LAND USE SERVICES DEPARTMENT
PLANNING COMMISSION STAFF REPORT

HEARING DATE: August 6, 2015 **AGENDA ITEM #2**

Project Description

APN:	0446-011-04, 0446-011-05, 0446-011-06, 0446-021-11, and 0446-021-35
Applicant:	Omya Inc.
Community:	Lucerne Valley/3rd Supervisorial District
Location:	Approximately six (6) miles south of Highway 18 and five (5) miles west of Crystal Creek Road
Project No:	AP20080046
Staff:	Reuben J. Arceo
Applicant Rep:	Shelby Olsen, Omya Inc.
Proposal:	Revision to a Mining Conditional Use Permit and amendment to a Reclamation Plan for an existing limestone quarry to: increase the operational life of the quarry by 24 years from 2031 to 2055; incorporate 40 additional acres on BLM land for access and drainage; and increase the disturbance limits of the project by 190.1 acres to 355.1 acres. With the 40 acres of BLM land, the project total acreage is 375.1 acres.

Vicinity Map

11 Hearing Notices Sent On: July 23, 2015 Report Prepared By: Reuben J. Arceo

SITE INFORMATION

Project Size: 375.1 Acres

Terrain: Rugged steep north slope of San Bernardino Mountains with existing quarry benches and overburden stockpile, access road and sedimentation basins; incised drainages running south to north.

Vegetation: Chaparral community in lower elevation and road areas and pinyon pine/juniper/yucca transitional zone on slopes.

SURROUNDING LAND DESCRIPTION:

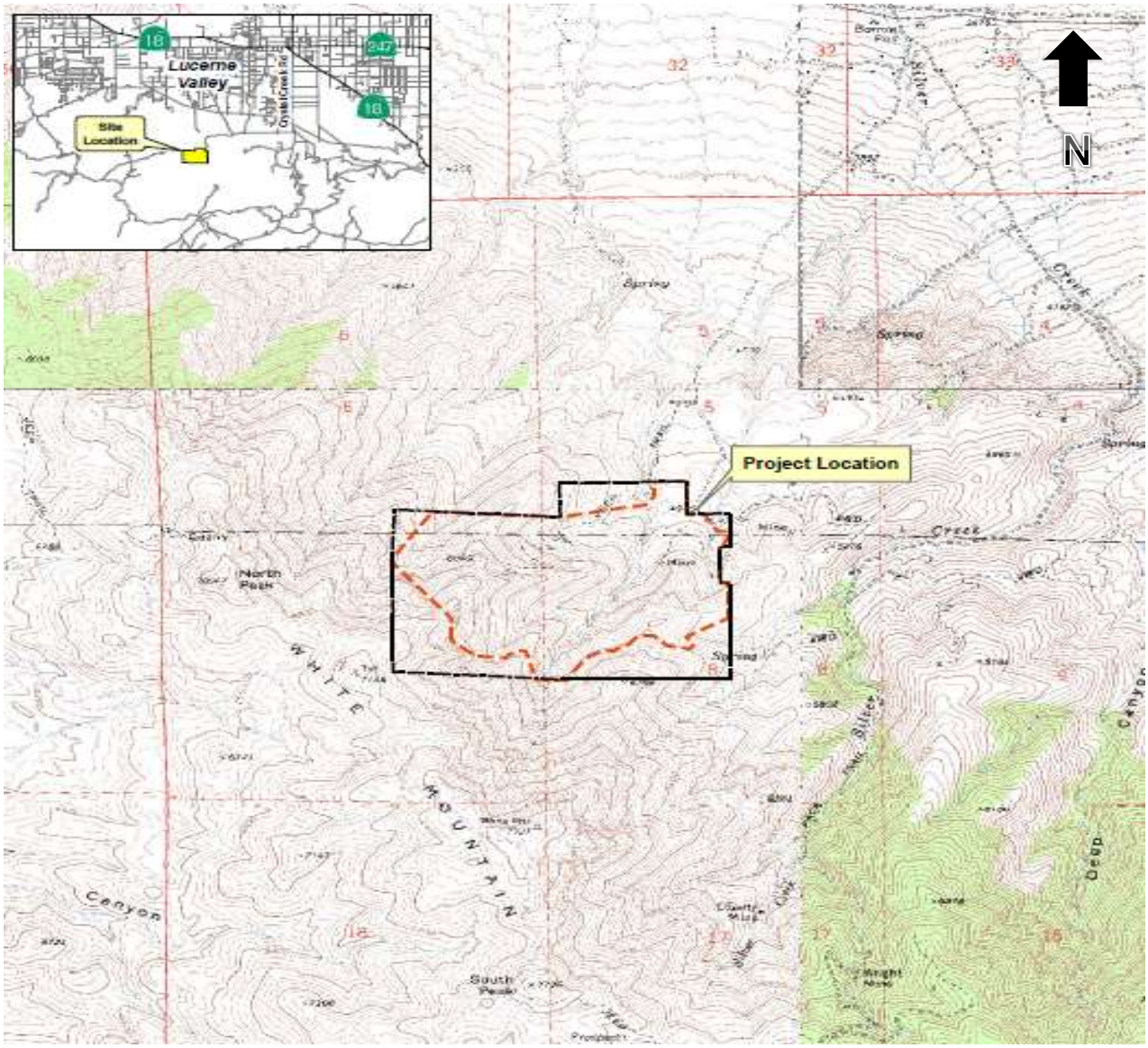
AREA	EXISTING LAND USE	LAND USE ZONING DISTRICT
Site	Existing Quarry	Resource Conservation (RC)
North	Vacant/Undeveloped/BLM land	Resource Conservation (RC)
South	Other limestone quarries/US Forest Service land	Resource Conservation (RC)
East	Vacant/Undeveloped/US Forest Service land	Resource Conservation (RC)
West	Vacant/Undeveloped/US Forest Service Land	Resource Conservation (RC)

	AGENCY
City Sphere of Influence:	None
Water Service:	Bottled water for employees, dust control water trucked in from processing plant
Sewer Service:	Portable Toilets

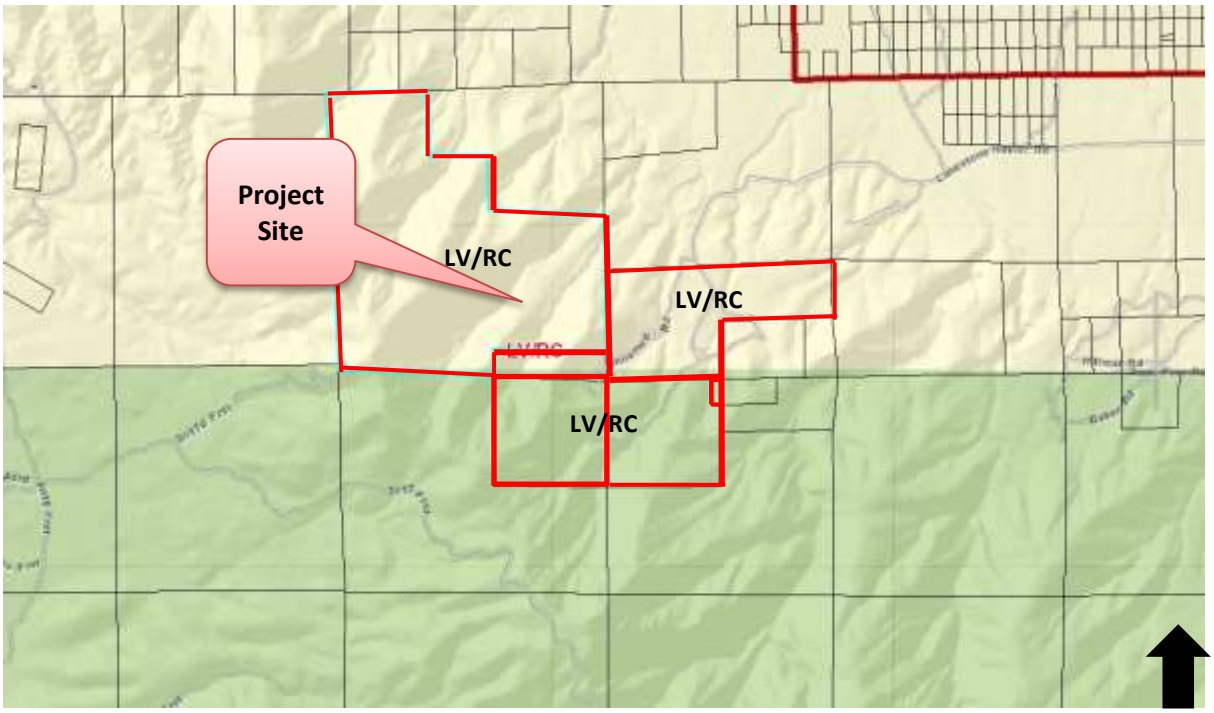
STAFF RECOMMENDATION: That the Planning Commission CERTIFY the Environmental Impact Report, ADOPT the proposed Findings and Statement of Overriding Considerations, APPROVE the Revision to the existing Mining CUP/Reclamation Plan subject to the attached Conditions of Approval and incorporated Mitigation Measures, and FILE the Notice of Determination.

In accordance with Section 86.08.010 of the Development Code, the action taken by the Planning Commission may be appealed to the Board of Supervisors within ten (10) calendar days after the Planning Commission hearing.

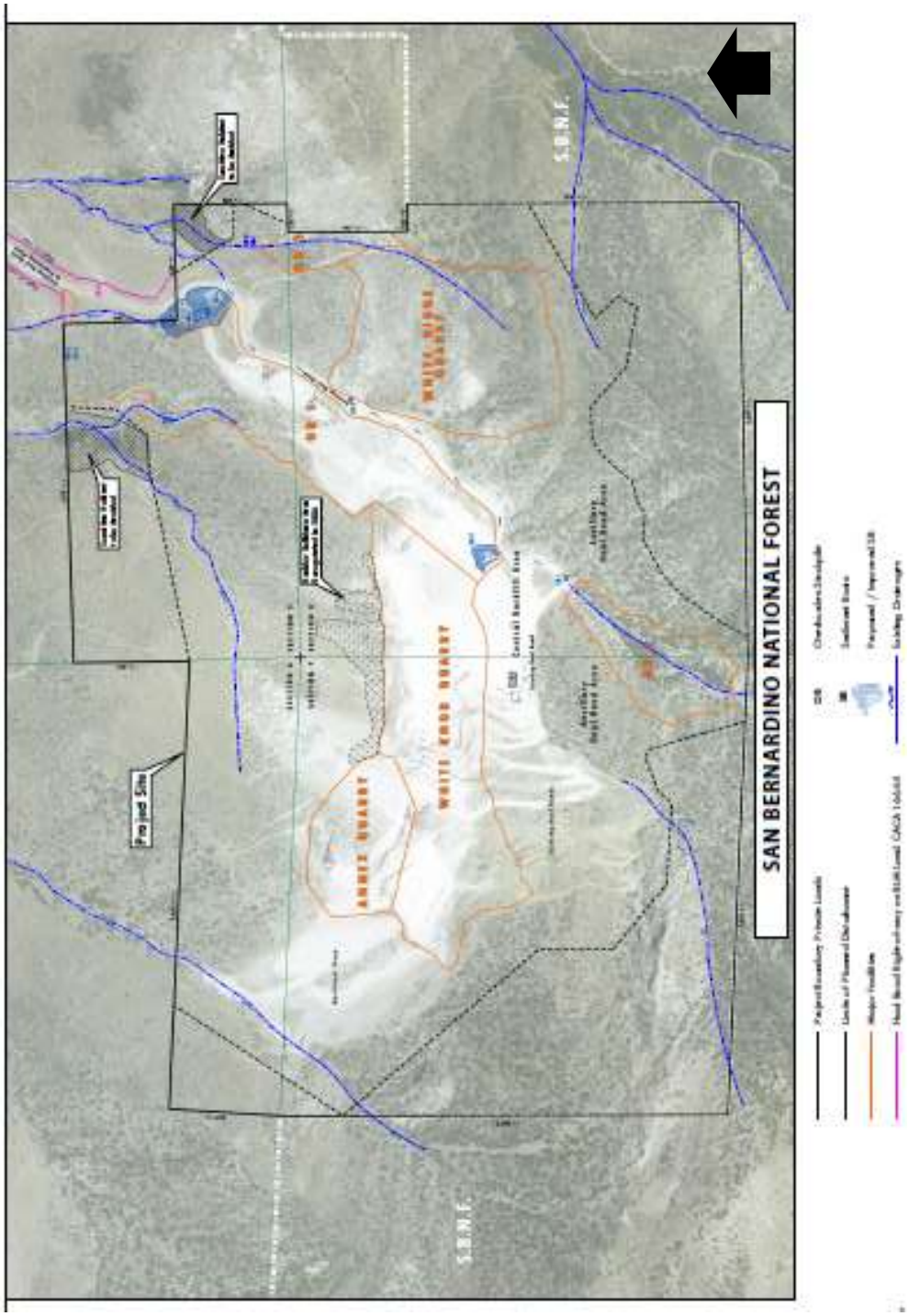
VICINITY MAP
White Knob/White Ridge Quarry



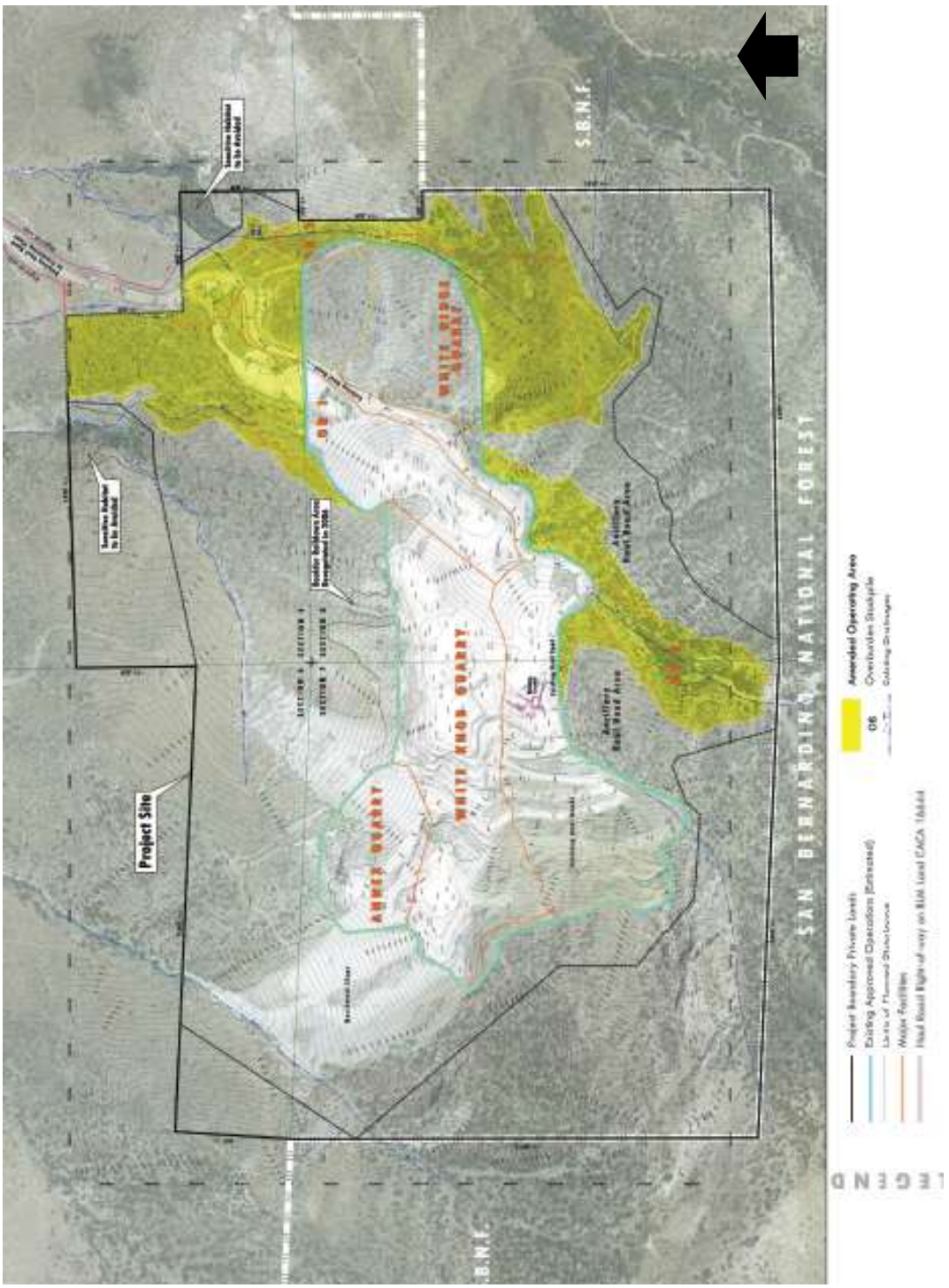
OFFICIAL LAND USE DISTRICT MAP
ZONING DESIGNATION
Resource Conservation (RC)



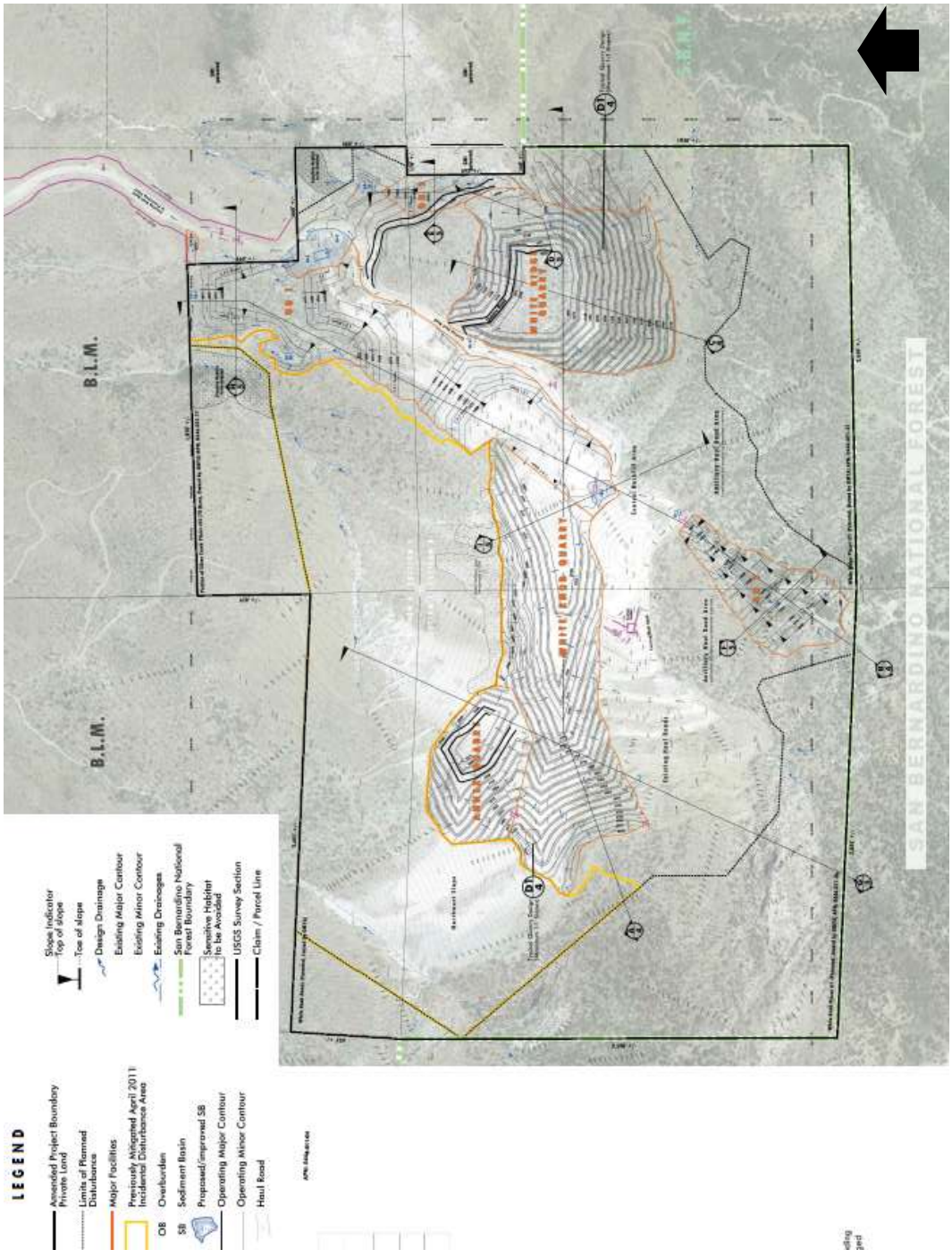
White Knob/White Ridge Quarry
Project Components



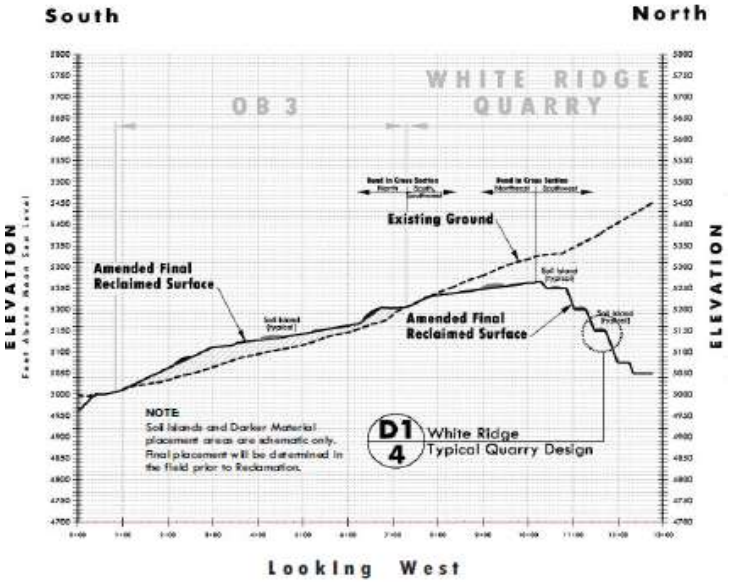
Amended Area

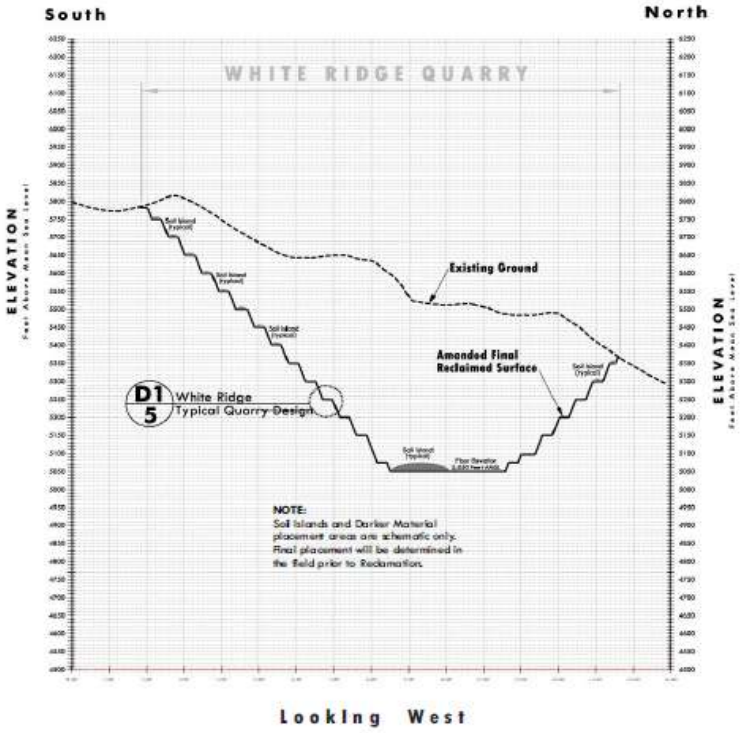


Mine Plan

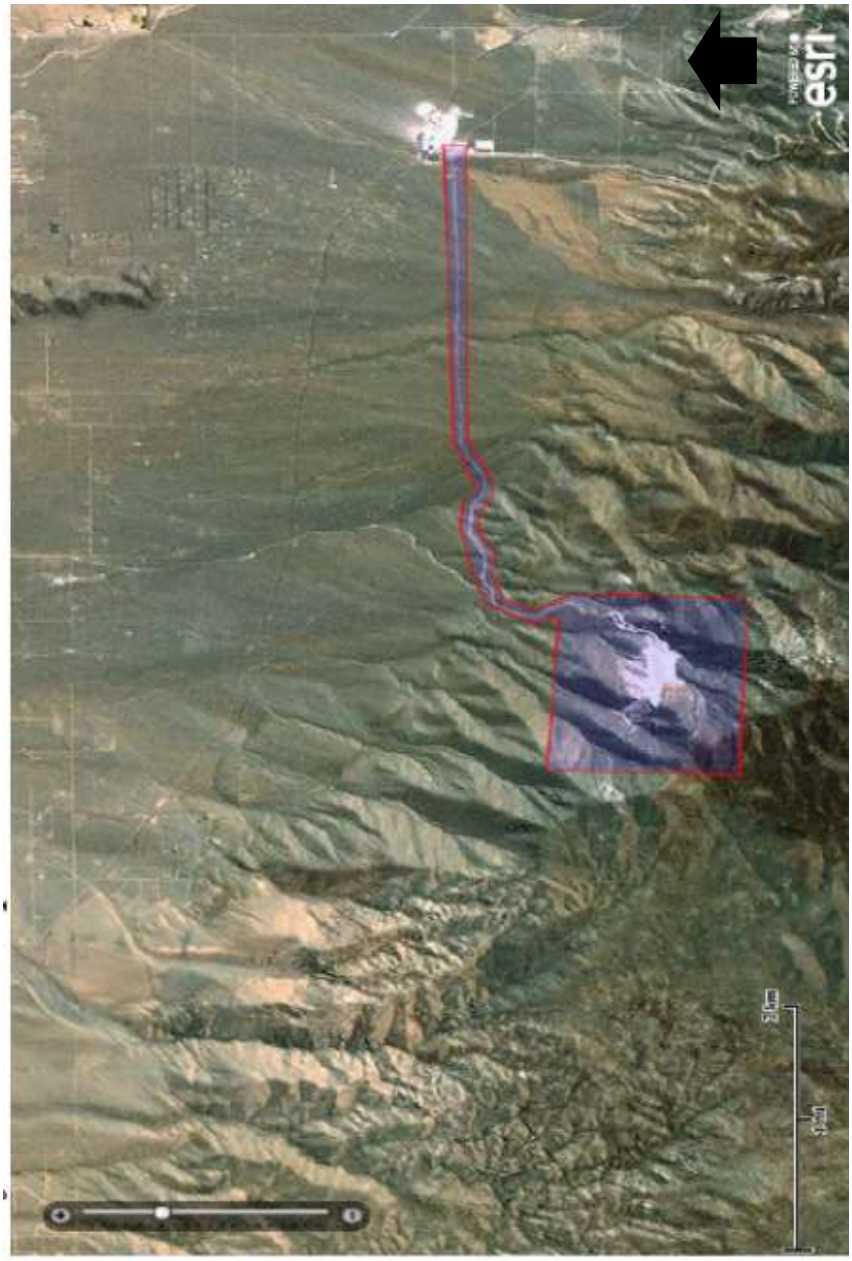

B.L.M.
B.L.M.
SAN BERNARDINO NATIONAL FOREST
LEGEND
Amended Project Boundary Private Land
Limits of Planned Disturbance
Major Facilities
Previously Mitigated April 2011 Incidental Disturbance Area
OB Overburden
SB Sediment Basin
Proposed/improved SB
Operating Major Contour
Operating Minor Contour
Haul Road
Slope Indicator Top of slope
Toe of slope
Design Drainage
Existing Major Contour
Existing Minor Contour
Existing Drainages
San Bernardino National Forest Boundary
Sensitive Habitat To be Avoided
USGS Survey Section
Claim / Parcel Line

Reclamation Plan





SITE PHOTOS
Overview of Haul Road



Aerial Oblique looking South with OB-1 in front

Looking Southeast at OB-1 and White Knob

Typical Rough Benches

Post-Reclamation View Simulation

Looking Northwest from State Route 18/Custer Road (Lucerne Valley Market)

Figure 3.1-4a
Existing Conditions

Figure 3.1-4b
Year 2065 Conditions (All Mining and Concurrent Reclamation Plus 10 Years of Final Reclamation Completed)

PROJECT DESCRIPTION AND BACKGROUND:

Project: The Project consists of a proposed revision to the existing Mining Conditional Use Permit (CUP) and Reclamation Plan for expansion of the existing White Knob/White Ridge Limestone Quarries, a limestone mine operated by Omya Inc. (Omya), located on the north slope of the San Bernardino Mountains south of the community of Lucerne Valley. The Amended Mine and Reclamation Plan (Amended Plan or proposed Project) would increase the operational years of the quarry by 24 years from the existing permit expiration date of 2031 to the year 2055.

The Amended Plan includes an increase in mine area of approximately 190.1 acres over the existing approved quarry area of 145 acres as noted in Table 1. This increase results in a total quarry area of approximately 355.1 acres of existing or planned surface mining operation-related disturbance. The Amended Plan would not result in the increase of mining equipment used at the quarry or an increase in the quantity of daily quarried material. Approximately 40 acres of the existing 83.5-acre Bureau of Land Management (BLM) haul road right-of-way on federal public land must be reclaimed and is added to the proposed Project reclamation total. This 375.1-acre area comprises the total Project site.

The primary areas to be reclaimed will be the existing White Knob Quarry and White Knob Annex, the approved White Ridge Quarry, the existing Overburden Site #1 and proposed Overburden Sites #2 and #3 for a total of approximately 134.6 acres. In addition, there will be approximately 200 acres of ancillary disturbance areas, which include haul/access roads, sediment basins, storage pads, crusher location, west slope impact area, and boulder roll-down area. The acreage for each component is shown in Table 1. Material is hauled approximately 5 miles to the Crystal Creek Road processing plant, which is not a part of the Mining CUP or Reclamation Plan.

The proposed Project is designed to make the reclaimed lands suitable for future open space uses and wildlife habitat. It includes site-specific activities to satisfy the reclamation requirements of the Surface Mining and Reclamation Act of 1975, as amended, and its implementing regulations (collectively, SMARA), as well as the County's surface mining and land reclamation ordinance (San Bernardino County Code Chapter 88.03). A lead-agency-approved reclamation plan is required for all surface mining operations in the state that are subject to SMARA. The County has primary discretionary authority over the proposed Project and serves as the lead agency responsible under the California Environmental Quality Act (CEQA) and SMARA. If approved, the proposed Project would not preclude future permitting of extraction and reclamation activities within or beyond the Project site. Any such future proposal would require authorization from the County and compliance with CEQA.

Project Objectives: The Amended Plan was developed with several objectives in mind. The key objective is the continued mining and recovery of the unique high calcium limestone at the site. Other objectives include limiting the area of disturbance by expanding contiguous quarries and placing overburden within completed areas. Finally, providing open space habitat is achieved through design of slopes that can accommodate wildlife movement, revegetation of slopes, erosion control, and compliance with the Carbonate Habitat Management Strategy for endangered plants.

Location: The Project site is located approximately 6 miles southwest of the community of Lucerne Valley and 8 miles northwest of Big Bear Lake just north of the San Bernardino National Forest. The Project site is located entirely on private lands, with the exception of the haul road, which is within an approved right-of-way on BLM-managed lands. The existing mine and planned expansions are bounded on the south by mountainous undeveloped National Forest lands, on the west, north, and east by unpatented placer mining claims on public lands managed by the BLM, and on the northeast by patented open space.

Site History: The White Knob/White Ridge Quarries produce high purity limestone (calcium carbonate) suitable for pharmaceutical and food additives, as well as many other uses. Limestone deposits that are considered both regionally and nationally important have been quarried in the north-slope area above Lucerne Valley since the 1950's. Lucerne Valley's local economy is highly dependent upon the mining industry, with three different companies refining various products from large quarry operations. The White Knob site was discovered in the 1950's by the Fife family, and was originally permitted in 1987 by a Swiss firm, Pluess-Staufer, which became Omya Inc. The original permit was for 145 acres of disturbed area to be reclaimed, with operations to cease in 2031.

Application Timeline: The Revision application was originally submitted in 2004, at which time staff required the submission of technical reports regarding slope stability, drainage, and biological resources. Through 2008, the Project was refined and re-submitted to the County. The preparation of an Environmental Impact Report (EIR) was required, and through the County's Request for Proposals (RFP) process, PMC was selected in 2009 to prepare the EIR. However, further delays were encountered as Omya negotiated agreements with the BLM for the haul road right of way, and with California Department of Fish and Wildlife (CDFW) for impacts to local drainages, particularly Ruby Springs. Until those issues were resolved, the preparation of the EIR was placed on hold, as the Project description could have changed as a result of the agreements. In February 2013, with the agreements completed, Omya submitted an updated version of the Amended Plan. In June 2013 the Notice of Preparation for the EIR was published. The Draft EIR was released in October 2014 and the Final EIR was prepared in May 2015 and published on July 1, 2015.

TABLE 1: Amended Plan Components

Quarry or Area	Existing Approved Areas (acres)	Proposed New Areas (acres)	Total Amended Project Areas (acres)	Percent Change
White Knob Quarry	35	6.1	41.1	17.4%
White Knob Annex Quarry	7	5.5	12.5	78.6%
White Ridge Quarry	18	15.1	33.1	83.9%
Overburden Site #1	15	16.9	31.9	11.2%
Overburden Site #2	0	13.0	13.0	N/A
Overburden Site #3	0	3.0	3.0	N/A
Ancillary Disturbance Limits (outside of above, incl. haul road, sedimentation basins, crusher location, boulder roll-down)	70	130.5	200.5	186.4%
Totals	**145**	**190.1**	**355.1**	131.1%

Mine Operation: Overburden removal and quarry development may occur throughout the year, but usually occurs for about four (4) months per year. The White Knob Quarry currently produces an average of 512,000 tons per year of excavated material, which includes 324,000 tons per year of ore to the crusher and 188,000 tons per year of overburden or non-spec rock. Of the crushed ore material, 275,400 tons per year are sent to the processing plant for production and 48,600 tons per year of crusher fines are sent to the overburden stockpile. None of the material sent to the processing plant including waste material after processing is returned to the quarry site.

The quarrying procedure, which uses standard open pit and benching practices, generally includes the following steps: (1) the area of planned surface disturbance is cleared of vegetation cover; (2) topsoil is removed and stockpiled for future use during reclamation activities; (3) access roads are developed into the planned upper benches; (4) blast holes are drilled with rotary blast hole drills, then controlled blasting loosens the rock at a benching interval of 25–30 feet; and (5) front-end loaders load the broken rock into 40- to 100-ton off-highway haul trucks to be transported to the primary mobile crusher located adjacent to the mining area. The material is separated into ore for processing and overburden material at the crusher site. Crushed ore is trucked to the processing plant located at Crystal Creek Road. Estimated ore reserves are approximately 4.8 million tons, with approximately 7.7 million tons of waste rock.

While the White Ridge quarry was permitted in 1987, it has not yet been developed. This area and continuation of the White Knob and White Knob Annex will be mined until 2055 when operations cease. Portions of the White Knob Quarry will be backfilled starting in 2035, to reduce the visibility of the overburden stockpiles as viewed from the valley.

Two new overburden stockpile areas are proposed to manage the waste rock over the mine lifespan. Overburden and waste rock at the White Knob/White Ridge Quarries are composed of gray impure limestone and granite intrusive rock. Overburden and waste rock are nontoxic, naturally occurring rock material, but which is of insufficient quality (purity and brightness) to process for ore. The Amended Plan proposes to expand the existing overburden site OB-1 and create two additional overburden sites (OB-2 and OB-3) to accommodate overburden and waste rock as noted in Table 2.

Table 2: Overburden Sites

Storage Area	Existing Areas (approx. acres)	Planned Additional Areas (acres)	Total Area (acres)
OB-1	15	16.9	31.9
OB-2	0	13.0	13.0
OB-3	0	3.0	3.0
Total OB Stockpiles	15	32.9	47.9
White Knob Quarry Backfill	Within planned quarry	(15)	15
Central Area Backfill	To be disturbed by crusher site and quarry haul roads	(11)	11

The Project site is situated on steep rocky slopes at a high elevation (4,000 to 6,300 feet above mean sea level) as compared to a location in the central area of Lucerne Valley, on State Highway 18 (2,960 feet amsl). This difference in elevation results in the Project site being visible from several miles. The limestone deposits are essentially pure white in color as the overburden is removed. These two factors resulted in the original (1987) EIR conclusion that there would be significant environmental effects to the visual quality of the area that could not be mitigated to below a level of significance. Mitigation measures were incorporated but the visual impacts after mitigation would remain significant. Overriding considerations were adopted as part of the original approval. The proposed Project adds 145 acres to the site.

Reclamation: The Reclamation Plan details the methods and procedures and sequences to be employed to reclaim the existing disturbed areas and proposed expansion area and will establish a monitoring program and financial assurances as required by SMARA to ensure that reclamation is completed in accordance with the approved Reclamation Plan.

On July 2, 2015, in conformance with SMARA Section 2774 (d)(2), the County informed the state Office of Mine Reclamation (OMR) of the Project's scheduled August 6, 2015 Planning Commission hearing. In conjunction with the required hearing notice, the County included responses to OMR comments raised in their December 15, 2014 letter, attached as Letter D in the Final EIR. The Amended Plan will require minor revisions to address OMR comments regarding slope stability and revegetation. This requirement is included in the Conditions of Approval. After incorporating the changes suggested by OMR, the Project's Mining/Reclamation Plan will meet the County's SMARA requirements.

ANALYSIS:

Land Use Compatibility: The site is located within the Resource Conservation (RC) land use zoning district, which allows mineral resource development (mining) subject to a CUP. The properties surrounding the site are also zoned RC. The Project would not physically divide an established community, and is consistent with all applicable land use policies and regulations of the County's General Plan and Development Code.

CEQA. As described earlier under the application timeline, an EIR was prepared for the Project. The key issues that required mitigation were as follows:

- Aesthetics: To reduce views of mining activities, material shall be kept back from the north-facing slopes as much as possible, darker material or colorant shall be used on north-facing slopes, and revegetation shall be implemented as soon as an area is completed.
- Air Quality: Dust control measures were included for operations and reclamation activities.
- Biological Resources: Mitigation is included for carbonate plant species, desert tortoise, raptors, burrowing owls, pallid San Diego pocket mouse, coast horned lizard, bats, and riparian habitats including oak woodlands.
- Cultural Resources: If any resources are found during activities, a qualified archaeologist shall examine the find and determine the course of action. If fossil-bearing limestone is encountered, a qualified paleontologist shall examine the find and curate any specimens.
- Geologic/Soils: Monitoring of the Ruby Springs drainage shall be performed and reported to the permitting agencies. If remedial work is necessary, all applicable permits shall be obtained first.
- Hydrology and Water Quality: The sediment control basins shall be improved per the 2011 technical report and shall be inspected regularly and maintained.

All issues can be mitigated below a level of significant impact, with the exception of impacts to a scenic vista and the existing visual character of the Project vicinity. As the scenic visual impacts cannot be mitigated below a level of significance, a Statement of Overriding Considerations, attached as Exhibit B, must be adopted in order to approve the Project. Several requirements are included in the EIR, and Conditions of Approval, attached as Exhibit C, to minimize views of white material, including the use of native soil as final layers on the overburden stockpiles, use of colorant to stain the visible manufactured slopes, and revegetation.

Project Alternatives: The EIR analyzed three (3) alternatives to the Project, (1) the No Project Alternative, (2) Elimination of Overburden Stockpile No. 2, and (3) Backfill of Central White Knob and Annex Quarries. These alternative were chosen as visual impacts remain significant even after mitigation. However these alternatives did not meet all of the Project objectives, most importantly Objective 1: Continue the mining and recovery of a unique high calcium limestone resource to supply the Lucerne Valley processing plant for the production of a wide range of calcium carbonate products.

Comment letters were received from OMR, Mojave Desert AQMD, the Morongo Band of Mission Indians, CDFW, and the Center for Biological Diversity. The Final EIR, attached as Exhibit D, contains each letter and the response to each comment. Mitigation measures regarding the requirements for the Carbonate Habitat Management Strategy (CHMS) and raptor conservation were clarified, and a mitigation measure regarding oak woodlands was added and these were included in the Mitigation Monitoring Reporting Program, attached as Exhibit E. The response to comments did not trigger the need for substantial revisions or re-circulation of the EIR.

Reclamation Plan – The goal of the Project's reclamation plan is to return the site to privately-owned vacant open space consistent with the Resource Conservation Land Use District as shown in the Reclamation Plan, while not obstructing the potential for future mining. Reclamation of disturbed areas will commence immediately after mining is completed. Final reclamation should be completed within five (5) years of the termination of mining activities. Complete reclamation of the site will include:

- Removal of all equipment.
- Remedial grading of fill slopes where necessary.
- Mitigation of any potential hazards.
- Revegetation with indigenous species.

RECOMMENDATION: That the Planning Commission:

1) **CERTIFY** the Environmental Impact Report, **ADOPT** the Statement of Overriding Considerations and the CEQA Findings;
2) **ADOPT** the Conditional Use Permit Findings contained in the staff report;
3) **APPROVE** Mining/Reclamation Plan 86M-06 as revised by the Amended Plan;
4) **FILE** the Notice of Determination.

ATTACHMENTS:

Exhibit A: Conditional Use Permit Findings
Exhibit B: CEQA Findings and Statement of Overriding Considerations
Exhibit C: Conditions of Approval (Conditional Use Permit)
Exhibit D: Draft and Final Environmental Impact Report
Exhibit E: Mitigation Monitoring and Reporting Program

EXHIBIT A

Conditional Use Permit Findings

EXHIBIT A

FINDINGS for Omya Inc. White Knob/White Ridge Quarry: Revision to the existing Mine and Reclamation Plan to: increase the operational life of the quarry by 24 years from 2031 to 2055; add 2 additional overburden sites on 16 acres; incorporate 40 additional acres on BLM land for access and drainage; and increase the disturbance limits of the project by 190.1 acres for a total of 355.1 acres. With the 40 acres of BLM land, the project total acreage is 375.1 acres. (APNs: 0446-011-04, 0446-011-05, 0446-011-06, 0446-021-11, and 0446-021-35)

Pursuant to Development Code Section 88.03.060(k)(2), the following findings must be made in the affirmative in order to approve the Project's mining Reclamation Plan:

1. The Reclamation Plan No. 86M-06 as conditioned complies with the California Surface Mining and Reclamation Act (SMARA, Public Resources Code Sections 2772-2773) and any other applicable provisions.

2. The Reclamation Plan, as conditioned, complies with applicable requirements of State mining regulations (California Code of Regulations Sections 3500-3505 and 3700-3713).

3. The Reclamation Plan and the potential end use of the Project site as reclaimed, as conditioned, is in compliance with the Reclamation Plan and are consistent with the Development Code, General Plan and any applicable resource plan or element.

4. The Reclamation Plan has been reviewed in compliance with the California Environmental Quality Act (CEQA) and the County's environmental review guidelines, and all significant adverse impacts from reclamation of the surface mining operations are mitigated below a level of significance or to the maximum extent feasible.

5. The Project site and/or resources will be reclaimed to a condition that is reasonably compatible with the surrounding natural environment, topography, and other open space resources.

6. The Reclamation Plan, as conditioned, will reclaim the mined lands to a usable condition which is readily adaptable for alternative land uses consistent with the General Plan and applicable resource plan; with regard to this Project, the post-mining condition will be open space.

7. The County has responded to comments and recommendations raised by the Office of Mine Reclamation (OMR), a division of the State Department of Conservation, in its review of the Project's Mine/Reclamation Plan. In a letter dated December 15, 2014, OMR provided comments on the Project's Mine/Reclamation Plan. On July 6, 2015, the County provided comment responses to OMR and notified OMR Planning Commission hearing scheduled for August 6, 2015, at which time approval of the Project was to be considered. Pursuant to the County's responses, and Conditions of Approval required for this Project, the concerns expressed by OMR have been addressed.

8. The Project will not have a significant adverse impact on the environment, subject to implementation of the proposed Conditions of Approval and mitigation measures. An Environmental Impact Report (EIR) was prepared in compliance with CEQA, and CEQA findings have been reviewed and considered prior to its adoption and prior to approval of the Project. The EIR reflects the independent judgment of the County of San Bernardino.

EXHIBIT B

CEQA Findings and Statement of Overriding Considerations

California Environmental Quality Act Findings

Planning Commission

San Bernardino County, California

Facts, Findings and Statement of Overriding Considerations

Related to the White Knob/White Ridge Limestone Quarry Expansion Project

FACTS, FINDINGS AND STATEMENT OF OVERRIDING CONSIDERATIONS FOR THE WHITE KNOB/WHITE RIDGE LIMESTONE QUARRY EXPANSION PROJECT COUNTY OF SAN BERNARDINO (SCH # 2013061020)

I. Introduction

San Bernardino County (County) prepared a Final Environmental Impact Report (Final EIR) for the proposed Revision to a Mining Conditional Use Permit (CUP) and Reclamation Plan as described in the Amended Mine and Reclamation Plan (Amended Plan or project) for the existing White Knob/White Ridge Limestone Quarries. The Final EIR addresses the potential environmental effects associated with project implementation, which entails a Revision to a Mining Conditional Use Permit (CUP) and Reclamation Plan for a proposed expansion of the existing White Knob/White Ridge Limestone Quarries, a limestone mining operation located in the San Bernardino Mountains in southwestern San Bernardino County and operated by Omya, Inc. The Amended Plan would increase the operational years of the quarry by 24 years from the existing permit expiration date of 2031 to the year 2055. The Amended Plan includes approximately 375.1 acres, consisting of approximately 335.1 acres of existing or planned surface mining operation–related disturbance and approximately 40 acres of existing BLM haul road right-of-way. The proposed project is designed to make the reclaimed lands suitable for future open space uses and wildlife habitat. It includes site-specific activities to satisfy the reclamation requirements of the Surface Mining and Reclamation Act of 1975, as amended, and its implementing regulations (collectively, SMARA), as well as the County's surface mining and land reclamation ordinance (San Bernardino County Code Section 88.03.000).

A lead agency-approved reclamation plan is required for all surface mining operations in the state that are subject to SMARA. The County has primary discretionary authority over the proposed project and serves as the lead agency under California Environmental Quality Act (CEQA) and SMARA. If approved, the proposed project would not preclude future permitting of extraction and reclamation activities within or beyond the project site. Any such future proposal would require authorization from the County and compliance with CEQA and SMARA.

The Findings and Statement of Overriding Considerations set forth below (Findings) are presented for adoption by the San Bernardino Planning Commission (Planning Commission), as the County's findings under the California Environmental Quality Act (CEQA) (Public Resources Code Section 21000 et seq.) and the CEQA Guidelines (California Code of Regulations, Title 14, Section 15000 et seq.) relating to the project. The Findings provide the written analysis and conclusions of this Planning Commission regarding the project's environmental impacts, mitigation measures, alternatives to the project, and the overriding considerations, which in this Planning Commission's view, justify approval of the White Knob/White Ridge Limestone Quarry Expansion project, despite environmental effects that cannot be mitigated below a level of significance.

II. General Findings and Project Overview

A. Surface Mining and Reclamation Act (SMARA)

SMARA was signed into law in 1975, went into effect in 1976, and has been amended 24 times since its effective date. The intent of SMARA is to assure reclamation of mined lands, encourage production and conservation of minerals, and create and maintain surface mining and

reclamation policy (regulations). One of the principal requirements of SMARA is the preparation and implementation of reclamation plans. A reclamation plan must be prepared by a mining applicant prior to initiation of mining activities. Reclamation plans must be approved by the SMARA lead agency (usually a county or city) and the California Department of Conservation, Office of Mine Reclamation (OMR). Reclamation plans are subject to environmental review under CEQA. The Amended Plan was prepared in accordance with SMARA and its implementing regulations (reclamation performance standards) set forth in the Title 14 of the California Code of Regulations, Sections 3700 through 3711.

B. Procedural Background

The Planning Commission approved the existing White Knob/White Ridge Limestone Mine Site Approval and Reclamation Plan in 1986 (RP# 86M-04) with an expiration date of December 31, 2031. RP# 86M-04 permits mining operations on 145 acres of the mine operator's 357.5 total acres of land holdings. Omya Inc., has proposed the Amended Plan for expansion of the existing White Knob/White Ridge Limestone Quarries. Approval of the Amended Plan by the Planning Commission is a discretionary project, as defined by CEQA Guidelines Section 15357, and therefore requires environmental review.

The County prepared a Notice of Preparation (NOP) on June 12, 2013, stating that an EIR for the project would be prepared. This notice was circulated to the public, local, state, and federal agencies and other interested parties to solicit comments on the project. Concerns raised in response to the NOP were considered during preparation of the Draft Environmental Impact Report (referred to as the Draft EIR or the DEIR). The Notice of Availability for the DEIR was published on October 27, 2014. The DEIR was published for public review and comment on October 27, 2014, and was filed with the California Office of Planning and Research under State Clearinghouse No. 2013061020. The review period for the DEIR ended on December 15, 2014.

The County prepared written responses to the comments received during the comment period and included these responses in the Final EIR. The Final EIR provides a list of those who commented on the DEIR, copies of written comments (coded for reference), written responses to comments regarding the environmental review, and errata with minor text changes made to the DEIR as a result of comments on the DEIR. The Final EIR was made available for public review on July 1, 2015.

C. Project Characteristics

Omya Inc.'s (Omya) proposed Amended Plan includes approximately 375.1 acres, which comprise the "project site" for this EIR. The primary areas to be reclaimed are the existing White Knob Quarry and White Knob Annex Quarry, the approved White Ridge Quarry, the existing Overburden Site #1 and proposed Overburden Sites #2 and #3, and the ancillary disturbance areas, which include haul/access roads, sediment basins, storage pads, crusher location, west slope impact area, and boulder roll-down area.

The proposed project is designed to make the reclaimed lands suitable for future open space uses and wildlife habitat and includes site-specific activities to satisfy the reclamation requirements of SMARA, as well as the County's surface mining and land reclamation ordinance (San Bernardino County Code Section 88.03.000).

Site History

Mining began on the property now controlled by Omya during the late 1950s and has been more or less continuous since 1958. The White Knob and White Ridge claims were staked in the

1950s by the Fife family and later patented. Small-scale mining, road building, and core drilling occurred during the 1960s and -70s. During the early 1980s, the White Knob deposit was leased by Omya and the deposit was explored by core drilling and detailed geologic investigations. In 1985, the decision to open and permit the White Knob/White Ridge deposit was made. Mining at the White Knob Quarry started in 1987 after San Bernardino County permitting was completed. For logistical reasons, mining started between the elevations of 5,500 and 5,900 feet above mean sea level (amsl). Ore from those levels met production requirements for 10 years, while a haul road was being constructed to the top of the knob at 6,200 feet amsl. Topography in the area of the quarry is extremely steep and rugged. Several 100-foot-high cliffs were originally present before mining began, and the deposit forms a steep cliff-sided ridge trending east to west and about 1,500 feet long.

The Planning Commission approved the existing White Knob/White Ridge Limestone Mine Site Approval and Reclamation Plan in 1986 (RP# 86M-06) with an expiration date of December 31, 2031. RP# 86M-06 permits mining operations on 145 acres of the mine operator's 357.5 total acres of land holdings. The site is designated as CA mine ID# 91-36-0067.

On April 20, 2011, a Settlement Agreement was entered into by and between the BLM, the California Department of Fish and Game (now the Department of Fish and Wildlife [CDFW]), and Omya relating to activities at the White Knob Quarry. There are six separate components (Parts A through F) in the Agreement. Part B of the Agreement is entitled "Repair, Remediate, and Monitor Improvements to the White Knob Quarry Right-of-Way Access Road and Associated Facilities to Protect Drainages." These conditions are included in the Amended Plan.

The components (Parts A through F) of the Agreement consist of the following:

- Part A – Omya has agreed to study and monitor Ruby Springs, located to the northwest of the quarry. Ongoing monitoring through 2014 was undertaken and reported to the BLM.
- Part B – Requires Omya to repair, remediate, and monitor measures to control runoff and sedimentation along the 4.4 miles of haul road on BLM-managed land.
- Part C – Requires that the former explosives storage facility located on BLM land be removed and reclaimed. The facility has been removed. The area is part of the 70-acre area to be purchased by Omya (see Part E, below), and its future use and reclamation are part of the Amended Plan.
- Part D – Requires haul road improvements and reclamation to be incorporated into the overall reclamation plan.
- Part E – Requires Omya to apply to the BLM for the purchase of 70 acres on which overburden material is proposed to be placed in the future.
- Part F – Recovery of costs for the BLM.

In August 2011, the consulting engineering firm Stantec prepared the *White Knob Quarry Haul Road Drainage Report and Plan of Development* to analyze the existing drainage conditions at the quarry and along the haul road, and to provide recommendations for facilities to control stormwater and sediment runoff and provide protection to surrounding drainages. Omya subsequently submitted an amended right-of-way application to the BLM to make improvements to the haul road and drainages as recommended in the Plan of Development. As part of the Settlement Agreement and in order to accommodate the improvements required to adequately repair and remediate the right-of-way access road and drainage facilities, the existing right-of-way was expanded from 67 acres to its present 83.5 acres.

Project Objectives

The Amended Plan was developed with the following objectives:

- Continue the mining and recovery of a unique high calcium limestone resource to supply the Lucerne Valley processing plant for the production of a wide range of calcium carbonate products.
- Minimize additional land disturbance through the expansion of contiguous existing and previously approved quarries and minimal expansion of existing overburden stockpiles and haul roads.
- Place overburden within completed portions of Overburden Site #1 (OB-1) to limit the area of disturbance.
- Meet the requirements of SMARA and the County surface mining ordinance.
- Minimize impacts to sensitive plants and wildlife through quarry design and ongoing bighorn sheep programs.
- Reclaim the site for post-mining uses which would include open space habitat.
- Reduce the slopes on overburden fill areas to an overall maximum slope of 2H:1V and revegetate disturbed areas to minimize aesthetic and erosion impacts
- Mitigate for lost, threatened, and endangered species habitat in accordance with the Carbonate Habitat Management Strategy, April 2003 (CHMS) requirements by relinquishing unpatented mining claims or transfer of private property as determined adequate by the CHMS and regulatory agencies.
- Reclaim and maintain the site to eliminate hazards to public safety.

D. Record of Proceedings and Custodian of Record

For purposes of CEQA and the findings set forth herein, the record of proceedings for San Bernardino County findings and determinations consists of the following documents and testimony, at a minimum:

- The NOP, comments received on the NOP, and all other public notices issued by the County in relation to the White Knob/White Ridge Limestone Quarry Expansion EIR (e.g., Notice of Availability).
- 1986 EIR for the original development of the quarries (SCH No. 86050516)
- The White Knob/White Ridge Limestone Quarry Expansion Draft EIR, associated appendices to the Draft EIR, and technical materials cited in the Draft EIR.
- The White Knob/White Ridge Limestone Quarry Expansion Final EIR, including comment letters, and technical materials cited in the Final EIR.
- All non-draft and/or non-confidential reports and memoranda prepared by the County and consultants related to the project or any of the above-associated environmental documents.
- Minutes and transcripts of the discussions regarding the project and/or project components at public hearings held by San Bernardino County.
- Staff reports associated with Planning Commission meetings on the project.

- Those categories of materials identified in Public Resources Code Section 21167.6.

The County Clerk of the Board is the custodian of the administrative record. The documents and materials that constitute the administrative record are available for review at the San Bernardino County offices located at 385 N. Arrowhead Avenue, San Bernardino, CA 92415-0182.

E. Consideration of the Environmental Impact Report

In adopting these Findings, the Planning Commission finds that the Final EIR was presented to this Planning Commission, the decision-making body of the lead agency, which reviewed and considered the information in the Final EIR prior to approving the White Knob/White Ridge Limestone Quarry Expansion. By these findings, the Planning Commission ratifies, adopts, and incorporates the analysis, explanations, findings, responses to comments, and conclusions of the Final EIR. The Planning Commission finds that the Final EIR was completed in compliance with CEQA and represents the independent judgment of the County.

F. Severability

If any term, provision, or portion of these Findings or the application of these Findings to a particular situation is held by a court to be invalid, void, or unenforceable, the remaining provisions of these Findings, or their application to other actions related to White Knob/White Ridge Limestone Quarry Expansion plan, shall continue in full force and effect unless amended or modified by the County.

G. Summary of Environmental Findings

The Planning Commission determines that based on all of the evidence presented, including, but not limited to, the EIR, written and oral testimony given at meetings and hearings, and submission of comments from the public, organizations, and regulatory agencies, and the responses prepared to the public comments, the following environmental impacts associated with the project are:

1. Potentially Significant and Cannot Be Avoided or Reduced to a Less Than Significant Level

Project Specific

- Alteration of a Scenic Vista/existing Visual Character

Cumulative

- The Proposed Project would Contribute to Cumulative Impacts on Visual Character

2. Potentially Significant Impacts That Can Be Avoided or Reduced to a Less Than Significant Level Through Implementation of Mitigation Measures

Project Specific

- Emissions of Air Pollutants Resulting in Violation of Air Quality Standards or Contributing to Existing Violations

- Exposure of Sensitive Receptors to Localized Criteria Pollutants

- Adverse Impacts on Candidate, Sensitive, or Special-Status Species
- Adverse Impacts on Special-Status Plant Species
- Adverse Impacts on the Desert Tortoise
- Adverse Impacts on Coast Horned Lizard
- Adverse Impacts on Burrowing Owl
- Adverse Impacts to Le Conte's Thrasher and other Migratory Birds
- Adverse Impacts to Golden Eagle and Other Raptors
- Adverse Impacts to Special-Status Bats
- Adverse Impacts to Pallid San Diego Pocket Mouse
- Adverse Impacts on Riparian Habitat or Sensitive Natural Communities
- Substantial Adverse Impact on an Archaeological or Historical Resource
- Destroy a Unique Paleontological Resource or Geologic Feature
- Adverse impact on Rock and Soil Talus Erosion
- Substantially Alter Drainage Patterns

Cumulative

- Contribution to Cumulative Impacts on Biological Resources

3. Less Than Significant and No Impacts That Do Not Require Mitigation

Project Specific

- Conflict with MDAQMD Air Quality Management Plans
- Conflict with Federal Land Managers' Air Quality Related Values
- Exposure of Sensitive Receptors to Toxic Air Contaminant Pollutant Concentrations
- Impacts to Mule Deer and Bighorn Sheep
- Impacts on Federally Protected Wetlands
- Impacts on Wildlife Movement
- Conflict with Local Policies and Ordinances
- Conflict with Conservation Plans
- Disturbance of Human Remains
- Exposure of People or Structures to Potential Substantial Adverse Seismic Effects
- Impacts related to Slope Stability

- Erosion and Soil Loss
- Impacts Due to Construction of New Stormwater Drainage Infrastructure
- Impacts Related to Adequate Water Supply

Cumulative

- Cumulative impacts on Air Quality
- Cumulative impacts on Cultural Resources
- Cumulative impacts on Geology and Soils
- Cumulative impacts on the Environment due to Greenhouse Gas Emissions
- Conflict with an Applicable Plan, Policy, or Regulation Adopted for the Purpose of Reducing the Emissions of Greenhouse Gases
- Cumulative Impacts on Hydrology and Water Quality
- Cumulative Impacts on Public Services and Utilities

III. Findings and Recommendations Regarding Significant and Unavoidable and Cumulatively Considerable Impacts

A. Aesthetics

1. Change in Existing Visual Character (EIR Impact 3.1.1)

(a) Potential Impact. The proposed Amended Plan would incrementally add mine development primarily in the center and eastern portions of the project site, but will not increase the overall width of the mine along the background of the mountain ridge. The changes will cause physical alterations to form, line, and, in particular, color as compared to the existing and permitted project. The overall scenic integrity of the site will not substantially decrease from that of the existing and permitted project, as no new uses are being added to the overall viewshed. However, the overall visual impacts are still considered unavoidable significant impacts consistent with the 1986 EIR findings. See DEIR pages 3.1-10 through 3.1-22.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.1.1 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. Implementation of the mitigation measure would require that the project include design features and reclamation activities that would reduce visual impacts. Measures include, but are not limited to, minimization of boulder roll-down visual impacts, implementation of reclamation and revegetation on completed equipment-accessible

quarry benches, and limiting the surface disturbance area. The mitigation measure would help limit project impacts on scenic vistas.

(2) Remaining Impacts. Implementation of the mitigation measures would reduce the project's impacts on scenic vistas; however, these impacts cannot be fully mitigated and would remain significant and unavoidable.

(3) Overriding Considerations. The environmental, economic, social, and other benefits of the project override any remaining significant adverse impact of the project related to alteration of scenic vistas in the project area, as more fully stated in the Statement of Overriding Considerations in Section VIII, below.

2. Cumulative Change in Visual Character (EIR Impact 4.0.1)

(a) Potential Impact. Implementation of the proposed project, in combination with other reasonably foreseeable mining projects in the County, would contribute to the alteration of the visual character of the San Bernardino Mountains. Large-scale mining operations on the north slope of the San Bernardino Mountains have resulted in surface disturbances that are visible from much of Lucerne Valley. These disturbances are highly evident on the mountain slopes due to the generally light color of the limestone deposits in contrast to other mostly undisturbed steep slopes. The extent of the landscape alteration in the viewshed and the contrast between the linear-appearing mine features and the non-linear nature of the undisturbed areas also contribute to the landscape alteration. Limestone mines contribute a greater share of this impact due to the greater color contrast between mined and unmined areas and because of their position on the mountain slopes overlooking the valley. Due to their lower elevation and lesser color contrast, the aggregate mines are generally less visible to surrounding areas. Most of the existing mining operations are active, and final reclamation has been implemented on relatively small portions of the permitted mining areas. The mines are anticipated to operate for decades, and final reclamation will not be complete until several years after the completion of the last mining. While the existing disturbance is part of the environmental setting or baseline, additional surface disturbance is expected to occur as existing mining operations continue and as proposed new mines and mine expansions are approved and developed. This additional disturbance would have a cumulatively considerable impact on the visual resources in the region. This is considered a cumulatively considerable and significant and unavoidable impact. See DEIR pages 4.0-2 to 4.0-1.

(b) Mitigation Measures. The only true mitigation to remove this impact would be the ceasing of all development. This, however, is not realistic. Feasible mitigation to lessen this impact is not possible.

(c) Findings. Based on the DEIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Remaining Impacts. The project's contribution to the impact cannot be fully mitigated and would be cumulatively considerable and significant and unavoidable.

(3) Overriding Considerations. The environmental, economic, social, and other benefits of the project override any remaining significant adverse impact of the project resulting in a cumulative contribution to alteration of scenic vistas of the project area, as more fully stated in the Statement of Overriding Considerations in Section VIII, below.

IV. Findings and Recommendations Regarding Significant Impacts Which Are Avoided or Mitigated to a Less Than Significant Level

A. Air Quality

1. Emissions of Air Pollutants Resulting in Violation of Air Quality Standards or Contributing to Existing Violations (EIR Impact 3.2.1)

(a) Potential Impact. Implementation of the project would result in long-term operational emissions of criteria air pollutants and ozone precursors (i.e., ROG and NOx). The project does not propose to construct any structures other than excavations and piles, which are created from mining operations, and thus only project operations are assessed. The incremental increase of air pollutant emissions over baseline conditions as a result of the proposed project is compared to the mass-based thresholds from the MDAQMD CEQA Handbook as shown in Table 3.2-9 of the DEIR (DEIR page 3.2-18). As shown in Table 3.2-9, the increment in pollutant emissions would occur below levels that will significantly affect regional air quality emissions, with the exception of PM_{10}, which is predicted to exceed the mass-based MDAQMD thresholds for PM_{10}, which would be a potentially significant impact. See pages 3.2-17 to 3.2-21.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.2.1 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to operation emissions related to PM_{10} will be mitigated to a less than significant level by requiring that maximum speed on unpaved road be 25 miles per hour; that all unpaved roads be watered at least twice per day or more if needed, to control dust emissions by 80% or a dust palliative, such as magnesium chloride, may be used to treat the unpaved roads; and all areas to be graded and areas where bulldozers operate shall be watered at least twice per day, more if needed. Implementation of mitigation measure MM 3.2.1 would result in PM_{10} emissions that are 3.9 tons less than current operations. This is because in addition to the mitigation, the project would allow up to the maximum production rate to be extracted exclusively from the White Knob/White Ridge Quarries, resulting in no material being quarried at the Butterfield/Sentinel Quarries. The lack of any material being quarried at the Butterfield/Sentinel Quarries as a result of the project would result in a reduction of PM_{10} emissions.

(2) Remaining Impacts. Any remaining impacts related to PM_{10} emissions would be less than significant.

2. Exposure of Sensitive Receptors to Localized Criteria Pollutants (EIR Impact 3.2.4)

(a) Potential Impact. Project emissions have the potential to create localized "hot spots" if, when summed with existing ambient concentrations, they result in concentrations greater than the applicable ambient air quality standard. Emissions of the criteria pollutants of concern for the project (i.e., PM_{10}, $PM_{2.5}$) were modeled to predict concentrations at the off-site point of maximum impact (PMI). DEIR Table 3.2-11 (DEIR page 3.2-26) shows impact assessment results for the particulate matter air dispersion model that was prepared. Results of criteria pollutant modeling show that the project would not exceed the ambient air quality standards but may increase pollutant concentrations above the significant impact levels. This would be a potentially significant impact. See DEIR pages 3.2-25 to 3.2-26.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.2.1 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to operation emissions related to PM_{10} will be mitigated to a less than significant level by requiring that maximum speed on unpaved road be 25 miles per hour; that all unpaved roads be watered at least twice per day or more if needed, to control dust emissions by 80% or a dust palliative, such as magnesium chloride, may be used to treat the unpaved roads; and all areas to be graded and areas where bulldozers operate shall be watered at least twice per day, more if needed. Implementation of mitigation measure MM 3.2.1 would result in PM_{10} emissions that are 3.9 tons less than current operations. This is because in addition to the mitigation, the project would allow up to the maximum production rate to be extracted exclusively from the White Knob/White Ridge Quarries, resulting in no material being quarried at the Butterfield/Sentinel Quarries. The lack of any material being quarried at the Butterfield/Sentinel Quarries as a result of the project would result in a reduction of PM_{10} emissions.

(2) Remaining Impacts. Any remaining impacts related to PM_{10} emissions would be less than significant.

3. **Result in a Cumulatively Considerable Net Increase in Nonattainment Criteria Pollutant (EIR Impact 3.2.6)**

(a) **Potential Impact.** Implementation of the proposed project, in combination with cumulative development in the Mojave Desert Air Basin, would result in a cumulatively considerable net increase of criteria air pollutants for which the MDAB is designated nonattainment. This is considered a potentially cumulatively considerable impact. See DEIR pages 3.2-28.

(b) **Mitigation Measures**. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.2.1 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) **Findings**. Based on the DEIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) **Effects of Mitigation**. The project's contribution to cumulative operation criteria air pollutant emissions will be mitigated to a less than cumulatively considerable level by requiring that maximum speed on unpaved roads be 25 miles per hour; that all unpaved roads be watered at least twice per day or more if needed, to control dust emissions by 80% or a dust palliative, such as magnesium chloride, may be used to treat the unpaved roads; and all areas to be graded and areas where bulldozers operate shall be watered at least twice per day, more if needed. Implementation of mitigation measure MM 3.2.1 would result in PM_{10} emissions that are 3.9 tons less than current operations. This is because in addition to the mitigation, the project would allow up to the maximum production rate to be extracted exclusively from the White Knob/White Ridge Quarries, resulting in no material being quarried at the Butterfield/Sentinel Quarries. The lack of any material being quarried at the Butterfield/Sentinel Quarries as a result of the project would result in a reduction of PM_{10} emissions.

(2) **Remaining Impacts.** Any remaining impacts related to criteria air pollutant emissions would be less than cumulatively considerable.

C. Biological Resources

1. Impacts to Special-Status Species (EIR Impact 3.3.1)

(a) Potential Impact. General mine operation and construction activities could result in substantial adverse effects, either directly or through habitat modifications, to special-status species, which would be considered a potentially significant impact. See DEIR pages 3.3-57 through 3.3-59.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.3.1a through MM3.3.1i is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and Final EIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to special-status species would be mitigated to a less than significant level by requiring a mandatory contractor/worker awareness training for project personnel; designating a field contact representative for overseeing compliance with protections to special-status species; a 25 mile per hour speed limit in all project areas except County roads and State and Federal highways; checking vehicles before moving to ensure no wildlife is present; inspecting equipment left over night for the presence of wildlife; reporting and recording of special-status wildlife encounters; disposing of food-related items in secure trash cans; fueling vehicles and equipment outside of the 100 feet buffer zone for riparian/riverine areas; and prohibiting rodenticide usage.

(2) Remaining Impacts. Any remaining impacts related to special-status species would be less than significant.

2. Impacts to Special-Status Plant Species (EIR Impact 3.3.2)

(a) Potential Impact. Implementation of project-related activities could result in substantial adverse effects, either directly or through habitat modification, to special-status plant species, which would be considered a potentially significant impact. See DEIR pages 3.3-59 through 3.3-60 and FEIR pages 3.0-9 through 3.0-11.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.3.2 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and Final EIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to special-status plant species would be mitigated to a less than significant level through implementation of the CHMS, which requires land dedication or claim relinquishments to offset project impacts on listed threatened or endangered plants at a 3:1 ratio. The 3:1 ratio applies to the total number of conservation units (CUs) (calculated by San Bernardino County National Forest [SBNF] staff according to the provisions of the CHMS) and total occupied habitat, in acres or fractions of acres, for each listed species. The mitigation measure consists of four parts: (1) field surveys to determine conservation value of proposed disturbance areas; (2) comparable field surveys to verify conservation value of mining claims to be relinquished; (3) administrative requirements to complete the land dedication or claim relinquishments (which may include mineral withdrawal); and (4) protection measures for special-status plants located adjacent to project disturbance areas that are not planned to be removed.

(2) Remaining Impacts. Any remaining impacts related to special-status plant species would be less than significant.

3. Impacts to Desert Tortoise (EIR Impact 3.3.3)

(a) Potential Impact. Implementation of project-related activities could result in substantial adverse effects, either directly or through habitat modification, to desert tortoise. These effects would be considered a potentially significant impact. See DEIR pages 3.3-60 through 3.3-62 and FEIR page 3.0-12.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measures MM 3.3.3a and 3.3.3b hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and Final EIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to Desert Tortoise would be mitigated to a less than significant level by requiring a USFWS-authorized desert tortoise biologist to conduct pre-project surveys in accordance with the USFWS pre-project field survey protocol (2010) prior to activities in undisturbed portions of the site. If individuals or their sign are identified during pre-project surveys, mitigation measure MM 3.3.3b shall be implemented. It requires development of a habitat mitigation and monitoring plan and raven control plan and would implement avoidance, minimization and mitigation measures, such as avoiding tortoise burrows to the extent feasible and temporary exclusionary fencing at the limits of disturbance prior to initiation of project activities. Other measures include surveys by the authorized biologist prior to declaring an area free of tortoises; if excavating a tortoise is necessary it must be done with hand tools only to remove it from harm's way; monitoring the moved desert tortoise; measures for handling desert tortoise movement if necessary; and mitigation for impacts on desert tortoise habitat at a 1:1 minimum ratio.

(2) Remaining Impacts. Any remaining impacts related to desert tortoise would be less than significant.

4. Impacts to Coast Horned Lizard (EIR Impact 3.3.4)

(a) Potential Impact. Implementation of project-related activities could result in substantial adverse effects, either directly or through habitat modifications, to coast horned lizards, which would be considered a potentially significant impact. See DEIR page 3.3-62.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.3.4 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and Final EIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to coast horned lizard would be mitigated to a less than significant level by requiring coast horned lizard surveys. Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine whether suitable habitat for coast horned lizard occurs within 250 feet of the proposed impact area. If suitable habitat exists, preconstruction surveys must be performed by a qualified biologist in a manner to maximize detection of coast horned lizards (i.e., during warm weather, walking slowly). If any lizards are discovered within the work areas, they shall be actively moved or passively encouraged to leave the work area.

(2) Remaining Impacts. Any remaining impacts related to coast horned lizard would be less than significant.

5. Impacts to Burrowing Owl (EIR Impact 3.3.5)

(a) Potential Impact. Implementation of project-related activities could result in substantial adverse effects, either directly or through habitat modifications, to burrowing owl. These effects would be considered a potentially significant impact. See DEIR page 3.3-63.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.3.5 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and Final EIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to burrowing owl would be mitigated to a less than significant level by requiring burrowing owl surveys if clearing and construction activities will occur in undisturbed portions of the site during the nesting period for burrowing owls (February 1–August 31). If suitable habitat exists, focused surveys must be performed by a qualified biologist in accordance with the CDFW's Staff Report on Burrowing Owl Mitigation, published March 7, 2012. Surveys shall be repeated if project activities are suspended or delayed for more than 15 days during nesting season. If no burrowing owls are detected, no further mitigation is required. If active burrowing owl nest sites are detected, the mine operator shall implement the avoidance, minimization, and mitigation methodologies outlined in the CDFW's Staff Report on Burrowing Owl Mitigation prior to initiating project-related activities that may impact burrowing owls.

(2) Remaining Impacts. Any remaining impacts related to burrowing owl would be less than significant.

6. Impacts to Le Conte's Thrasher and other Migratory Birds (EIR Impact 3.3.6)

(a) Potential Impact. Implementation of project-related activities could result loss of populations or essential habitat for Le Conte's thrasher and other special-status avian species, including raptors. This would be considered a potentially significant impact. See DEIR page 3.3-63 through 3.3-64 and FEIR page 3.0-12.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.3.6 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and Final EIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to Le Conte's thrasher and other migratory birds would be mitigated to a less than significant level by requiring a qualified biologist to conduct pre construction surveys to identify active migratory birds nest; if project activities will occur in undisturbed portions of the site during the migratory bird nesting season (March 15–August 15). Focused surveys must be performed by a qualified biologist for the purposes of determining the presence/absence of active

nest sites within the proposed impact area and a 200-foot buffer (if feasible). Surveys shall be repeated if project activities are delayed or postponed for more than 30 days. If active nest sites are identified within 200 feet of project activities, the mine operator shall impose a limited operating period (LOP) for all active nest sites prior to commencement of any project activities to avoid construction or project-related disturbances to migratory bird nesting activities. An LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, and construction) will not occur and will be imposed within 100 feet of any active nest sites until the nest is deemed inactive. Activities permitted within and the size (i.e., 100 feet) of LOPs may be adjusted through consultation with the CDFW and/or the County.

When an active nest is located within 200 feet of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to the County until the nest(s) are deemed inactive.

(2) Remaining Impacts. Any remaining impacts related to Le Conte's thrasher and other migratory birds would be less than significant.

7. Impacts to Golden Eagle and Other Raptors (EIR Impact 3.3.7)

(a) Potential Impact. Implementation of project-related activities could result in substantial adverse effects, either directly or through habitat modifications, to golden eagles and other protected raptors. These impacts would be considered potentially significant. See DEIR page 3.3-64 through 3.3-67 and FEIR pages 3.0-14 through 3.0-15.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.3.7 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and Final EIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to golden eagles and other protected raptors would be mitigated to a less than significant level by requiring that the applicant participate in and implement the Raptor Conservation Strategy (RCS). Omya and three other mining companies are actively participating in the development of the RCS and have agreed to follow the guidelines outlined in the final document (Eliason 2013). The RCS is intended to be a living document that may be updated over time as new information becomes available and includes monitoring objectives, schedules, and protocols, as well as measures to avoid, minimize, rectify, and reduce effects to nesting raptors along the North Slope.

If, during the raptor nesting season (January 15–August 15), clearing and/or construction activities would occur in undisturbed portions of the site, or blasting activities will occur in any portion of the project site, preconstruction surveys to identify active raptor nests shall be conducted by a qualified biologist within 14 days of construction initiation. If active golden eagle or other raptor nest sites are identified within a half mile of project activities, the applicant shall impose a 500-foot LOP for all active nest sites prior to commencement of any project activities to avoid construction- or project-related disturbances to nesting raptors.

When an active nest is located within a half mile of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to the County until the nest(s) are deemed inactive.

(2) Remaining Impacts. Any remaining impacts related to golden eagle and other special-status raptors would be less than significant.

8. Impacts to Special Status Bats (EIR Impact 3.3.9)

(a) Potential Impact. Implementation of project-related activities could result in the loss of populations or essential habitat for special-status bat species, which would be considered a potentially significant impact. See DEIR pages 3.3-68 through 3.3-69 and FEIR pages 3.0-14 through 3.0-15.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.3.9 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and Final EIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to special-status bats would be mitigated to a less than significant level by requiring a qualified biologist to conducted preconstruction surveys prior to implementation of project-related activities in undisturbed portions of the site. If potential roost sites are identified, a preconstruction survey by a qualified biologist shall be conducted between March 1 and July 31 to determine the presence or absence of roosting bats. If the survey does not identify the presence of occupied roosts, no further mitigation is required. If non-breeding roosts occupied by special-status bat species are documented within construction areas, the bats shall be safely flushed from the sites where roosting habitat is planned to be removed prior to May of each construction phase and prior to the onset of construction activities. The removal of the roosting sites shall occur during the time of day when the roost is unoccupied.

If a maternity colony is detected, a 100-foot construction-free buffer shall be established around the roost site and remain in place until it has been determined by a qualified biologist that the nursery is no longer active. Removal of maternity roosts shall be restricted to between March 1 and April 15 or August 15 and October 15 to avoid interfering with an active nursery.

The loss of each roost will be compensated for by the construction and installation of two bat boxes suitable to the bat species and colony size excluded from the original roosting site. The bat boxes shall be installed in the vicinity prior to removal of the original day/maternity roost sites. A detailed program for bat flushing, roosting site removal, and installation of bat boxes shall be developed in consultation with a qualified biologist.

(2) Remaining Impacts. Any remaining impacts related to special-status bats would be less than significant.

9. Impacts to Pallid San Diego Pocket Mouse (EIR Impact 3.3.10)

(a) Potential Impact. Implementation of project-related activities could result in substantial adverse effects, either directly or through habitat modification, to the pallid San Diego pocket mouse. These effects would be considered a potentially significant impact. See DEIR pages 3.3-69 to 3.3-70.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.3.10 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and Final EIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to pallid San Diego pocket mouse would be mitigated to a less than significant level by requiring a qualified biologist to determine if suitable habitat for this species occurs within 250 feet of the proposed impact area. If suitable habitat exists, preconstruction surveys must be performed by a qualified biologist in a manner to maximize detection of pallid San Diego pocket mice. If any mice are discovered within the work areas, they shall be actively moved or passively encouraged to leave the work area.

(2) Remaining Impacts. Any remaining impacts related to pallid San Diego pocket mouse would be less than significant.

10. Impacts to on Riparian Habitat or Sensitive Natural Communities (EIR Impact 3.3.11)

(a) Potential Impact. Implementation of project activities could result in the loss of riparian vegetation and/or sensitive natural communities, which would be considered a potentially significant impact. See DEIR pages 3.3-70 to 3.3-71 and FEIR pages 3.0-15 to 3.0-16.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.3.11a and MM 3.3.11b is hereby adopted and will

be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and Final EIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to riparian habitat or sensitive natural communities would be mitigated to a less than significant level by requiring that the mine operator shall ensure there is no net loss of riparian vegetation. Mitigation can include on-site restoration or purchase of mitigation credits at a USACE-approved mitigation bank, placing a conservation easement over a riparian area, or quit claiming mineral claims over a riparian area. Mitigation, as required in regulatory permits issued through the CDFW, the USACE, or the RWQCB, may be applied to satisfy this measure.

The measure also requires that the mine operator ensure there is no net loss of oak woodland habitat. This can be achieved by preservation of existing oak woodlands by recording a conservation easement(s) in favor of the County or an approved organization or agency; replacement or restoration of former oak woodlands; contribution of in-lieu mitigation fees to the Oak Woodlands Conservation Fund; or performing other mitigation measures as may be required by the County.

(2) Remaining Impacts. Any remaining impacts related to riparian habitat or sensitive natural communities would be less than significant.

11. Contribution to Cumulative Biological Resources Impacts (EIR Impact 4.0.3)

(a) Potential Impact. The proposed project in combination with other reasonably foreseeable projects could result in mortality and loss of habitat for special-status species, as well as biologically sensitive habitats. Therefore, this impact is considered cumulatively considerable. See DEIR pages 4.0-4 and 4.0-5

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measures MM 3.3.1a through MM 3.3.1i, MM 3.3.2, MM 3.3.3a and MM 3.3.3b, MM 3.3.4, MM 3.3.5, MM 3.3.6, MM 3.3.7, MM 3.3.9, and MM 3.3.10 are hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and Final EIR and the entire record before this Planning Commission, this Planning Commission finds that:

1. **Effects of Mitigation.** The project's contribution to cumulative impacts related to biological resources will be mitigated to a less than cumulatively considerable level by mitigating the project's individual impacts to special-status animal species, special-status plant species, desert tortoise, coast horned lizard, burrowing owl, Le Conte's thrasher and other migratory birds, golden eagles and other raptors, special-status bats, and pallid San Diego pocket mouse.

a. Special-Status Animal Species. The impacts related to special-status plant species would be mitigated to a less than significant level by requiring a

mandatory contractor/worker awareness training for project personnel; designating a field contact representative for overseeing compliance with protections to special-status species; a 25 mile per hour speed limit in all project areas except County roads and State and Federal highways; checking vehicles before moving to ensure no wildlife is present; inspecting equipment left over night for the presence of wildlife; reporting and recording of special-status wildlife encounters; disposing of food-related items in secure trash cans; fueling vehicles and equipment outside of the 100 feet buffer zone for riparian/riverine areas; and prohibiting rodenticide usage.

b. Special-Status Plant Species. The impacts related to special-status plant species would be mitigated to a less than significant level through implementation of the Carbonate Habitat Management Plan, which requires land dedication or claim relinquishments to offset project impacts on listed threatened or endangered plants at a 3:1 ratio. The 3:1 ratio applies to the total number of conservation units (CUs) (calculated by San Bernardino County National Forest [SBNF] staff according to the provisions of the CHMS) and total occupied habitat, in acres or fractions of acres, for each listed species. The mitigation measure consists of four parts: (1) field surveys to determine conservation value of proposed disturbance areas; (2) comparable field surveys to verify conservation value of mining claims to be relinquished; (3) administrative requirements to complete the land dedication or claim relinquishments (which may include mineral withdrawal); and (4) protection measures for special-status plants located adjacent to project disturbance areas that are not planned to be removed.

c. Desert Tortoise. The impacts related to Desert Tortoise would be mitigated to a less than significant level by requiring a USFWS-authorized desert tortoise biologist to conduct pre-project surveys in accordance with the USFWS pre-project field survey protocol (2010) prior to activities in undisturbed portions of the site. If individuals or their sign are identified during pre-project surveys, mitigation measure MM 3.3.3b shall be implemented. It requires development of a habitat mitigation and monitoring plan and raven control plan and would implement avoidance, minimization and mitigation measures, such as avoiding tortoise burrows to the extent feasible and temporary exclusionary fencing at the limits of disturbance prior to initiation of project activities. Other measure include surveys by the authorized biologist prior to declaring an area free of tortoises; if excavating a tortoise is necessary it must be done with hand tools only to remove it from harm's way; monitoring the moved desert tortoise; measures for handling desert tortoise movement if necessary; and mitigation for impacts on desert tortoise habitat at a 1:1 minimum ratio.

d. Coast Horned Lizard. The impacts related to coast horned lizard would be mitigated to a less than significant level by requiring coast horned lizard surveys. Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine whether suitable habitat for coast horned lizard occurs within 250 feet of the proposed impact area. If suitable habitat exists,

preconstruction surveys must be performed by a qualified biologist in a manner to maximize detection of coast horned lizards (i.e., during warm weather, walking slowly). If any lizards are discovered within the work areas, they shall be actively moved or passively encouraged to leave the work area.

e. Burrowing Owl. The impacts related to burrowing owl would be mitigated to a less than significant level by requiring burrowing owl surveys if clearing and construction activities will occur in undisturbed portions of the site during the nesting period for burrowing owls (February 1–August 31). If suitable habitat exists, focused surveys must be performed by a qualified biologist in accordance with the CDFW's Staff Report on Burrowing Owl Mitigation, published March 7, 2012. Surveys shall be repeated if project activities are suspended or delayed for more than 15 days during nesting season. If no burrowing owls are detected, no further mitigation is required. If active burrowing owl nest sites are detected, the mine operator shall implement the avoidance, minimization, and mitigation methodologies outlined in the CDFW's Staff Report on Burrowing Owl Mitigation prior to initiating project-related activities that may impact burrowing owls.

f. Le Conte's Thrasher and Other Migratory Birds. The impacts related to Le Conte's thrasher and other migratory birds would be mitigated to a less than significant level by requiring a qualified biologist to conduct pre construction surveys to identify active migratory birds nest; if project activities will occur in undisturbed portions of the site during the migratory bird nesting season (March 15–August 15). Focused surveys must be performed by a qualified biologist for the purposes of determining the presence/absence of active nest sites within the proposed impact area and a 200-foot buffer (if feasible). Surveys shall be repeated if project activities are delayed or postponed for more than 30 days. If active nest sites are identified within 200 feet of project activities, the mine operator shall impose a limited operating period (LOP) for all active nest sites prior to commencement of any project activities to avoid construction or project-related disturbances to migratory bird nesting activities. An LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, and construction) will not occur and will be imposed within 100 feet of any active nest sites until the nest is deemed inactive. Activities permitted within and the size (i.e., 100 feet) of LOPs may be adjusted through consultation with the CDFW and/or the County.

When an active nest is located within 200 feet of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to the County until the nest(s) are deemed inactive.

g. Golden Eagles and other Protected Raptors. The impacts related to golden eagles and other protected raptors would be mitigated to a less than significant level by requiring that the applicant participate in and implement the Raptor Conservation Strategy (RCS). Omya and three other mining companies are actively participating in the development of the RCS and have agreed to follow the guidelines outlined in the final document (Eliason 2013). The RCS is intended to be a living document that may be updated over time as new information becomes available and includes monitoring objectives, schedules, and protocols, as well as measures to avoid, minimize, rectify, and reduce effects to nesting raptors along the North Slope.

   If, during the raptor nesting season (January 15–August 15), clearing and/or construction activities would occur in undisturbed portions of the site, or blasting activities will occur in any portion of the project site, preconstruction surveys to identify active raptor nests shall be conducted by a qualified biologist within 14 days of construction initiation. If active golden eagle or other raptor nest sites are identified within a half mile of project activities, the applicant shall impose a 500-foot LOP for all active nest sites prior to commencement of any project activities to avoid construction- or project-related disturbances to nesting raptors.

   When an active nest is located within a half mile of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to the County until the nest(s) are deemed inactive.

h. Special-Status Bats. The impacts related to special-status bats would be mitigated to a less than significant level by requiring a qualified biologist to conduct preconstruction surveys prior to implementation of project-related activities in undisturbed portions of the site. If potential roost sites are identified, a preconstruction survey by a qualified biologist shall be conducted between March 1 and July 31 to determine the presence or absence of roosting bats. If the survey does not identify the presence of occupied roosts, no further mitigation is required. If non-breeding roosts occupied by special-status bat species are documented within construction areas, the bats shall be safety flushed from the sites where roosting habitat is planned to be removed prior to May of each construction phase and prior to the onset of construction activities. The removal of the roosting sites shall occur during the time of day when the roost is unoccupied.

   If a maternity colony is detected, a 100-foot construction-free buffer shall be established around the roost site and remain in place until it has been determined by a qualified biologist that the nursery is no longer active. Removal of maternity roosts shall be restricted to between March 1 and

April 15 or August 15 and October 15 to avoid interfering with an active nursery.

The loss of each roost will be compensated for by the construction and installation of two bat boxes suitable to the bat species and colony size excluded from the original roosting site. The bat boxes shall be installed in the vicinity prior to removal of the original day/maternity roost sites. A detailed program for bat flushing, roosting site removal, and installation of bat boxes shall be developed in consultation with a qualified biologist.

i. Pallid San Diego Pocket Mouse. The impacts related to pallid San Diego pocket mouse would be mitigated to a less than significant level by requiring a qualified biologist to determine if suitable habitat for this species occurs within 250 feet of the proposed impact area. If suitable habitat exists, preconstruction surveys must be performed by a qualified biologist in a manner to maximize detection of pallid San Diego pocket mice. If any mice are discovered within the work areas, they shall be actively moved or passively encouraged to leave the work area.

2. Remaining Impacts. Any remaining cumulative impacts related to biological resources would be less than cumulatively considerable.

D. Cultural Resources

1. Substantial Adverse Impact on an Archaeological or Historical Resource (EIR Impact 3.4.1)

(a) Potential Impact. While no evidence of significant historical or archaeological resources has been identified for the project site, project-related earth-moving activities could uncover previously unknown historical or archaeological resources. This impact would be potentially significant. See DEIR pages 3.4-18 to 3.4-19.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.4.1 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to archeological or historical resources would be mitigated to a less than significant level by halting work if cultural resources are encountered. The mitigation requires that work be halted immediately within 50 feet of the discovery if, during the course of construction, mining, or reclamation activities, previously unknown cultural resources (i.e., prehistoric or historic sites) are discovered. The mitigation requires the mine operator to notify the San Bernardino County Land Use Services Department, and retain a professional archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards in prehistoric or historical archaeology to determine the significance of the discovery. Determination of impacts, significance, and mitigation that protects the discovered resource shall be made by a qualified archaeologist in

consultation with recognized local Native American groups, if appropriate. The San Bernardino County Museum shall also be contacted for review of the archaeological find(s). To ensure construction workers are aware of the potential for encountering cultural resources, prior to the commencement of project excavations, all construction and mining personnel shall be informed of the potential to inadvertently uncover cultural resources and the procedures to follow subsequent to an inadvertent discovery of cultural resources.

(2) Remaining Impacts. Any remaining impacts related to archeological and historical resources would be less than significant.

2. Destroy a Unique Paleontological Resource or Geologic Feature (EIR Impact 3.4.3)

(a) Potential Impact. Implementation of the proposed project could result in the destruction of previously unknown unique paleontological resources or geologic features. This impact would be potentially significant. See DEIR pages 3.4-19 to 3.4-20.

(b) Mitigation Measures White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.4.3 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to unique paleontological resources or geologic features would be mitigated to a less than significant level by requiring the removal of non-metamorphosed fossiliferous limestone, if encountered during mining activities, and they shall be removed and retained for examination by a qualified paleontologist. If any fossil-bearing materials are encountered, a program to protect and preserve such resources that might be exposed or unearthed shall be developed in cooperation with the project applicant and San Bernardino County. The program shall be developed in accordance with the proposed guidelines of the Society of Vertebrate Paleontology and shall include, but not be limited to, the following:

- All non-metamorphosed fossiliferous limestone encountered during mining shall be stockpiled for examination by a qualified paleontologist.

- Collected samples of sediments shall be processed to recover small invertebrate and vertebrate fossils. Recovered specimens shall be prepared so that they can be identified and permanently preserved.

- Any specimens shall be identified, curated, and placed into a repository with permanent retrievable storage.

- A report of findings, including an itemized inventory of recovered specimens, shall be prepared on completion of the steps outlined above. The report shall include a discussion of the significance of all recovered specimens. The report and inventory, when submitted to San Bernardino

County, will signify completion of the program to mitigate impacts on paleontological resources.

(2) Remaining Impacts. Any remaining impacts related to unique paleontological resources or geologic would be less than significant.

3. Contribution to Cumulative Cultural and Paleontological Resources Impacts (EIR Impact 4.0.4)

(a) Potential Impact. Implementation of the proposed project could result in the inadvertent disturbance of previously unknown cultural and/or paleontological resources, contributing to a cumulative impact on such resources in the region. This impact would be less than cumulatively considerable. See DEIR pages 4.0-5 and 4.0-6

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measures MM 3.4.1 and MM 3.4.3 are hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The projects contribution to cumulative impacts related to cultural and paleontological resources will be mitigated to a less than cumulatively considerable level by mitigating the projects individual impacts to cultural and paleontological resources.

a. Archeological or Historical Resources. The impacts related to archeological or historical resources would be mitigated to a less than significant level by halting work if cultural resources are encountered. The mitigation requires that work be halted immediately within 50 feet of the discovery if, during the course of construction, mining, or reclamation activities, previously unknown cultural resources (i.e., prehistoric or historic sites) are discovered. The mitigation requires the mine operator to notify the San Bernardino County Land Use Services Department, and retain a professional archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards in prehistoric or historical archaeology to determine the significance of the discovery. Determination of impacts, significance, and mitigation that protects the discovered resource shall be made by a qualified archaeologist in consultation with recognized local Native American groups, if appropriate. The San Bernardino County Museum shall also be contacted for review of the archaeological find(s). To ensure construction workers are aware of the potential for encountering cultural resources, prior to the commencement of project excavations, all construction and mining personnel shall be informed of the potential to inadvertently uncover cultural resources and the procedures to follow subsequent to an inadvertent discovery of cultural resources.

b. Paleontological Resources. The impacts related to unique paleontological resources or geologic features would be mitigated to a less than significant level by requiring the removal of non-metamorphosed

fossiliferous limestone, if encountered during mining activities, and they shall be removed and retained for examination by a qualified paleontologist. If any fossil-bearing materials are encountered, a program to protect and preserve such resources that might be exposed or unearthed shall be developed in cooperation with the project applicant and San Bernardino County. The program shall be developed in accordance with the proposed guidelines of the Society of Vertebrate Paleontology and shall include, but not be limited to, the following:

- All non-metamorphosed fossiliferous limestone encountered during mining shall be stockpiled for examination by a qualified paleontologist.

- Collected samples of sediments shall be processed to recover small invertebrate and vertebrate fossils. Recovered specimens shall be prepared so that they can be identified and permanently preserved.

- Any specimens shall be identified, curated, and placed into a repository with permanent retrievable storage.

- A report of findings, including an itemized inventory of recovered specimens, shall be prepared on completion of the steps outlined above. The report shall include a discussion of the significance of all recovered specimens. The report and inventory, when submitted to San Bernardino County, will signify completion of the program to mitigate impacts on paleontological resources.

2. Remaining Impacts. Any remaining cumulative impacts related to cultural and paleontological resources would be less than cumulatively considerable.

C. Geology and Soils

1. Rock and Soil Talus Erosion (EIR Impact 3.5.3)

(a) Potential Impact. Rock and soil talus on the northwest slope and within the Western Drainage could impact the Ruby Springs area. This is a potentially significant impact. See DEIR pages 3.5-65 through 3.5-66.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.5.3 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to rock and soil talus erosion will be mitigated to a less than significant level by requiring that Omya prepare and submit periodic monitoring of the Western Drainage and Ruby Springs area to the County of San Bernardino. If the results of periodic monitoring of the Western Drainage and Ruby Springs area finds that sediments from the White Knob Quarry operation have caused a measurable impact to Ruby Springs, Omya shall prepare and submit for

approval additional sediment control measures that may include (1) revision of the 2008 Sedimentation and Erosion Monitoring Technical Work Plan, and/or (2) remediation of the Western Drainage and/or Ruby Springs area. Any remediation efforts in the Western Drainage and/or Ruby Springs area will occur prior to proceeding with work on the ground. Omya shall obtain all necessary permits and pay all required fees and financial assurances, including, but not limited to, County of San Bernardino permits, BLM permits, California Department of Fish and Wildlife permits, and US Fish and Wildlife Service permits. Reporting of monitoring results shall be done at least once every two years and following any significant rain event that is equal to or exceeds the 10-year return period rainfall for the project site. Reports of monitoring activities, data, and findings shall be provided to the County at least once every two years prior to the annual SMARA inspection. The first report shall be submitted within the year following the approval of the Amended Reclamation Plan. The monitoring shall be done in accordance with the 2008 Sedimentation and Erosion Monitoring Technical Work Plan (dated May 31, 2008) and any subsequent approved amendments.

(2) Remaining Impacts. Any remaining impacts related to rock and soil talus erosion would be less than significant.

D. Hydrology and Water Quality

1. Substantially Alter Drainage Pattern (EIR Impact 3.7.1)

(a) Potential Impact. The project will substantially alter the existing drainage pattern in the quarry area, while maintaining the existing haul road drainage. Quarrying will remove existing vegetation and soils and expose bedrock, thereby potentially increasing the amount of runoff. Overburden and mine waste materials will be placed into existing drainages, creating three sloped fills, and will backfill the lower portion of the White Knob Quarry, thereby increasing the potential for sedimentation and erosion. This would result in a potentially significant impact. See DEIR pages 3.7-35 through 3.7-40.

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.7.1 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The impacts related to drainage patterns will be mitigated to a less than significant level by requiring the following measures in addition to requirements contained in the project's Stormwater Pollution Prevention Plan (SWPPP) and Spill Prevention, Control, and Countermeasure Plann (SPCC) and incorporated into the final Amended Mine and Reclamation Plan.

a. Implement the recommendations for modifications of the project's haul road drainage and sediment control structures given in the September 12, 2013, Stantec technical memorandum and August 2011 Stantec report, *White Knob Haul Road Drainage Study and Plan Development*, to

implement Sections 15, 16, and 17 of the April 20, 2011, Settlement Agreement between Omya and the Bureau of Land Management in sections:

- 2.3 Culvert Flow Calculations (EIR Appendix G, Stantec 2013, p.6);
- 2.4 Culvert Riprap Calculations (EIR Appendix G, Stantec 2013, p. 7);
- 3.1.2, Roadway Grading and Ditch Recommendations (EIR Appendix G, Stantec 2011, p. 3.3);
- 3.2.2, Sediment Catchment Basins Recommendations(EIR Appendix G, Stantec 2011, p. 3.6); and
- 4.0, Right-of-Way Recommendations (EIR Appendix G, Stantec 2011, p. 4.1).

These improvements would ensure no flow increases to downstream flows during flood events.

b. All quarry areas, overburden fills, and haul roads shall be maintained to minimize erosion and sedimentation.

c. Sedimentation basins shall be inspected regularly, at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. Sediment shall be removed and basin function restored as needed.

d. Any sediment removed from basins shall be deposited on the overburden areas or into the White Knob Quarry sedimentation pond. Sediment placed on the overburden areas shall utilize temporary stormwater best management practices (BMPs) to prevent further sediment discharge and shall be revegetated in accordance with the 2013 Amended Reclamation Plan.

e. Basin spillways shall remain in good working condition and repaired as necessary.

f. Areas in haul roads that experience erosion shall be backfilled and rocked to minimize future erosion.

g. Overburden fill slopes and benches shall be inspected regularly, at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. If erosion or sedimentation is observed, temporary BMPs shall be utilized on overburden slopes and benches as soon as possible to minimize future erosion.

h. Areas of erosion or sediment deposition in overburden areas shall be permanently remediated as soon as possible, preferably before the next precipitation event. Remediated overburden slopes and benches shall be revegetated and/or armored in accordance with the 2013 Amended Reclamation Plan.

i. Haul road culverts and Arizona crossings shall be inspected regularly at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. Culverts and crossing shall be repaired and maintained to allow for proper passage of floodwaters.

j. If any of the haul road culverts are damaged or washed out, they shall be replaced with a culvert that provides a minimal capacity to pass a 20-year storm event without overtopping or excess erosion.

k. The seven procedures that were implemented to minimize boulder roll-down shall continue for the life of the project. These procedures are identified in mitigation measure **MM 3.1.1**. Procedures shall be modified and/or additional measure put in place, as necessary, to achieve minimal boulder roll-down.

(2) Remaining Impacts. Any remaining impacts related to drainage patterns would be less than significant.

2. Cumulative Hydrology and Water Quality (DEIR Impact 4.0.7)

(a) Potential Impact. Implementation of the proposed project, as well as other projects in the area, could result in a cumulative impact on hydrology and water quality through alteration of the existing drainage pattern, increasing the potential for erosion and sedimentation. This impact would be less than cumulatively considerable. See DEIR page 4.0-9

(b) Mitigation Measures. White Knob/White Ridge Limestone Quarry Expansion EIR mitigation measure MM 3.7.1 is hereby adopted and will be implemented as provided by the Mitigation Monitoring and Reporting Program.

(c) Findings. Based on the DEIR and the entire record before this Planning Commission, this Planning Commission finds that:

(1) Effects of Mitigation. The projects contribution to cumulative impacts related to drainage patterns will be mitigated to a less than cumulatively considerable level by requiring the following measures in addition to requirements contained in the project's SWPPP and SPCC and incorporated into the final Amended Mine and Reclamation Plan.

a. Implement the recommendations for modifications of the project's haul road drainage and sediment control structures given in the September 12, 2013, Stantec technical memorandum and August 2011 Stantec report, *White Knob Haul Road Drainage Study and Plan Development*, to implement Sections 15, 16, and 17 of the April 20, 2011, Settlement Agreement between Omya and the Bureau of Land Management in sections:

- 2.3 Culvert Flow Calculations (EIR Appendix G, Stantec 2013, p.6);
- 2.4 Culvert Riprap Calculations (EIR Appendix G, Stantec 2013, p. 7);
- 3.1.2, Roadway Grading and Ditch Recommendations (EIR Appendix G, Stantec 2011, p. 3.3);

- 3.2.2, Sediment Catchment Basins Recommendations(EIR Appendix G, Stantec 2011, p. 3.6); and
- 4.0, Right-of-Way Recommendations (EIR Appendix G, Stantec 2011, p. 4.1).

These improvements would ensure no flow increases to downstream flows during flood events.

b. All quarry areas, overburden fills, and haul roads shall be maintained to minimize erosion and sedimentation.

c. Sedimentation basins shall be inspected regularly, at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. Sediment shall be removed and basin function restored as needed.

d. Any sediment removed from basins shall be deposited on the overburden areas or into the White Knob Quarry sedimentation pond. Sediment placed on the overburden areas shall utilize temporary stormwater BMPs to prevent further sediment discharge and shall be revegetated in accordance with the 2013 Amended Reclamation Plan.

e. Basin spillways shall remain in good working condition and repaired as necessary.

f. Areas in haul roads that experience erosion shall be backfilled and rocked to minimize future erosion.

g. Overburden fill slopes and benches shall be inspected regularly, at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. If erosion or sedimentation is observed, temporary BMPs shall be utilized on overburden slopes and benches as soon as possible to minimize future erosion.

h. Areas of erosion or sediment deposition in overburden areas shall be permanently remediated as soon as possible, preferably before the next precipitation event. Remediated overburden slopes and benches shall be revegetated and/or armored in accordance with the 2013 Amended Reclamation Plan.

i. Haul road culverts and Arizona crossings shall be inspected regularly at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. Culverts and crossing shall be repaired and maintained to allow for proper passage of floodwaters.

j. If any of the haul road culverts are damaged or washed out, they shall be replaced with a culvert that provides a minimal capacity to pass a 20-year storm event without overtopping or excess erosion.

k. The seven procedures that were implemented to minimize boulder roll-down shall continue for the life of the project. These procedures are

identified in mitigation measure **MM 3.1.1**. Procedures shall be modified and/or additional measure put in place, as necessary, to achieve minimal boulder roll-down.

Remaining Impacts. Any remaining cumulative impacts related to hydrology and water quality would be less than cumulatively considerable.

V. Other Impacts and Considerations

1. Growth-Inducing Impacts of the Proposed Project

CEQA Guidelines Section 15126.2(d) requires that an EIR evaluate the growth-inducing impacts of a proposed action.

(a) Findings. Based on the DEIR and the entire record before this Planning Commission, the project would not result in growth inducement.

(b) Explanation. The White Knob Quarry has been in operation since 1987. The proposed project is for the expansion of area and extension of time for the operation of the White Knob/White Ridge Quarries. This mine and reclamation plan does not include the development of any residential units or the extension of public utility services to serve the project. Implementation of the proposed project would not create a substantial amount of new employment resulting in a demand for new services or new housing units elsewhere. Therefore, adoption of the Amended White Knob/White Ridge Mine and Reclamation Plan would not result in any growth-inducing impacts. (DEIR page 4.0-11)

2. Significant Irreversible Environmental Changes Involved if the Project is Implemented

CEQA Sections 21100(b)(2) and 21100.1(a) require that EIRs prepared for the adoption of a plan, policy, or ordinance of a public agency must include a discussion of significant irreversible environmental changes of project implementation.

(a) Findings. Based on the DEIR and the entire record before this Planning Commission, the project would not result in any significant irreversible environmental changes.

(b) Explanation. As discussed on DEIR page 4.0-1, operation of the proposed project would require some nonrenewable resources, such as fuel for vehicles and equipment. The project currently uses nonrenewable resources for the operation of the site. Some of these nonrenewable resources, such as diesel fuel and gasoline, would represent an increase above baseline conditions for those operations that would mine the expanded quarry areas. However, these uses are not expected to result in substantial increases in the expenditure of a nonrenewable resource. At the conclusion of the proposed project, all existing buildings and other energy-consuming uses would be decommissioned, dismantled, and removed from the project area. No further energy demand would be generated in the project area.

Accidents, such as the release of hazardous materials, could trigger irreversible environmental damage. However, project operations that would result in the transport of hazardous materials off-site would be transported by an approved carrier in accordance with state and local regulations. Considering the types and minimal quantities of hazardous materials that are and would continue to be used at the site, and emergency response plans and procedures that are ongoing as part of the existing project, accidental

release of substantial quantities of hazardous materials is unlikely. State and federal regulations and safety requirements would ensure that public health and safety risks are maintained at acceptable levels, so significant irreversible changes from accidental releases are not expected.

3. Energy Usage

CEQA Guidelines Appendix F requires that EIRs contain an evaluation of the potential energy impacts of a project with an emphasis on reducing the wasteful, inefficient, or unnecessary consumption of energy.

(a) Findings. Based on the DEIR and the entire record before this Planning Commission, the project would not result in the need for new or altered energy producing facilities nor would it result in an inefficient use of energy.

(b) Explanation. The proposed project would result in fuel usage that equals 0.001 percent of the typical annual fuel usage in the state yearly until 2031. From 2031 to 2055, the project would result in fuel usage that equals 0.01 percent of the typical annual fuel usage in the state yearly. See DEIR pages 4.0-12 through 4.0-14.

VI. Project Alternatives

A. Background – Legal Requirements

CEQA requires that EIRs assess feasible alternatives or mitigation measures that may substantially lessen the significant effects of a project prior to approval (Public Resources Code Section 21002). With the exception of the "no project" alternative, the specific alternatives or types of alternatives that must be assessed are not specified. CEQA "establishes no categorical legal imperative as to the scope of alternatives to be analyzed in an EIR. Each case must be evaluated on its own facts, which in turn must be reviewed in light of the statutory purpose" (*Citizens of Goleta Valley v. Planning Commission*, 52 Cal.3d. 553, 556 [1990]). The legislative purpose of CEQA is to protect public health, welfare, and the environment from significant impacts associated with all types of development, by ensuring that agencies regulate activities so that major consideration is given to preventing environmental damage while providing a decent home and satisfying living environment for every Californian (Public Resources Code Section 21000). In short, the objective of CEQA is to avoid or mitigate environmental damage associated with development. This objective has been largely accomplished in the project through the inclusion of project modifications and mitigation measures that reduce the potentially significant impacts to an acceptable level. The courts have held that a public agency "may approve a developer's choice of a project once its significant adverse environment effects have been reduced to an acceptable level—that is, all avoidable significant damage to the environment has been eliminated and that which remains is otherwise acceptable" (*Laurel Hills Homeowners Assoc. v. City*, 83 Cal.App.3d 515, 521 [1978]).

B. Identification of Project Objectives

The CEQA Guidelines state that the "range of potential alternatives to the project shall include those that could feasibly accomplish most of the basic purposes of the project and could avoid or substantially lessen one of more of the significant effects" of the project (CEQA Guidelines Section 15126.6(c)). Thus, consideration of the project objectives is important to determining which alternatives should be assessed in the EIR.

The DEIR identified the following objectives for the White Knob/White Ridge Limestone Quarries Expansion:

- Continue the mining and recovery of a unique high calcium limestone resource to supply the Lucerne Valley processing plant for the production of a wide range of calcium carbonate products.
- Minimize additional land disturbance through the expansion of contiguous existing and previously approved quarries and minimal expansion of existing overburden stockpiles and haul roads.
- Place overburden within completed portions of Overburden Site #1 (OB-1) to limit the area of disturbance.
- Meet the requirements of SMARA and the County surface mining ordinance.
- Minimize impacts to sensitive plants and wildlife through quarry design and ongoing bighorn sheep programs.
- Reclaim the site for post-mining uses which would include open space habitat.
- Reduce the slopes on overburden fill areas to an overall maximum slope of 2H:1V and revegetate disturbed areas to minimize aesthetic and erosion impacts
- Mitigate for lost, threatened, and endangered plant species habitat in accordance with the CHMS requirements by relinquishing unpatented mining claims or transfer of private property as determined adequate by the CHMS and regulatory agencies.
- Reclaim and maintain the site to eliminate hazards to public safety.

VII. Alternatives Analysis in DEIR

1. Alternatives Considered But Rejected

A. Reduced Project Alternative

This alternative includes the reduction in size of the proposed project by removing the White Ridge Quarry from the project. The currently approved Mine and Reclamation Plan includes the White Ridge Quarry as part of Phase 4, which can be mined under current approvals.

Findings: This reduced project alternative would not reduce the project's environmental impacts to a less than significant level. Further, this alternative would not meet the project's objective of the mining and recovery of a unique high calcium limestone resource to supply the Lucerne Valley processing plant for the production of a wide range of calcium carbonate products. Therefore, this alternative has been rejected.

Explanation: Because much of the project's environmental impacts are due to the mining of the overall site and the placement of the overburden, including the significant and unavoidable impacts on aesthetics, this alternative would not reduce the project's environmental impacts. The exclusion of the White Ridge Quarry from the project would decrease the impacts on visual resources but not to an

insignificant level, as impacts caused by the remainder of the quarry areas would remain. This alternative would also reduce significant biological resource impacts identified in Section 3.3, Biological Resources, but would not completely avoid these impacts. (DEIR page 5.0-2)

B. Backfill All Quarries Alternative

This alternative includes backfilling the overburden materials stored in OB-1, OB-2, and OB-3 into the White Knob, Annex, and White Ridge quarry pits during mining operations.

Findings: Removal of overburden from OB-1, OB-2, and OB-3 and filling the quarries with overburden would increase the amount of air emissions, increase the amount of water quality impacts, as well as increase potential for biological resource impacts, as it would prolong the operation of the quarries and any earth moving activities. Additionally, these activities would interfere with concurrent reclamation activities. Because this alternative would not reduce impacts relative to the project, this alternative has been rejected from further analysis.

Explanation: Because of how the quarries operate, placing overburden materials in an operating quarry is not possible, as this will not allow for the removal of the limestone and there are no land areas available on the site to store the overburden while mining occurs. Generally, the overburden is placed in an area that would not be mined in order to prohibit it from interfering with ongoing mining operations. Backfilling all of the quarries—White Knob, Annex, and White Ridge—during operation is not logistically possible.

Operation of the mine would still require the placement of overburden material in OB-1, OB-2, and OB-3, thereby impacting these areas. Removal of this overburden from OB-1, OB-2, and OB-3 upon quarry closure would increase the impacts on these areas by re-introducing earth moving equipment to the area, which, over the years of operation, may have begun to stabilize.

C. Removal Of Overburden From Project Site

This alternative includes the removal of overburden that would have been placed in OB-2 and OB 3 from the project site to another location. This alternative would reduce the impacts related to those areas, as well as decrease the project size by 16 acres (13 acres for OB-2 and 3 acres for OB 3). However, this alternative would result in moving large amounts of overburden by truck to another site.

Findings: This alternative would result in a significant increase in air quality impacts due to transporting the overburden to another site and result in additional physical impacts due to placement of the overburden in the offsite area. Therefore, this alternative has been rejected from further analysis.

Explanation: This alternative would reduce the impacts related to those areas as well as decrease the project size by 16 acres (13 acres for OB-2 and 3 acres for OB 3). However, this alternative would result in moving large amounts of overburden by truck to another site, which would increase air emissions relative to the project. It would also result in potential impacts on aesthetics, biological resources, cultural resources, geologic and seismic hazards, hydrology and water quality, and possibly other impact areas to the area in which the overburden would be placed.

Additionally, this alternative would not allow for the backfilling of the project quarries, which will increase the post-closure impacts on the site by not allowing for the reclamation of the site, much of which depends on the backfilling of the quarries.

2. Alternatives Analyzed in the DEIR

A. Alternative 1: No Project

This alternative would retain the approved 1986 White Knob-White Ridge Limestone Mine Site Approval and Reclamation Plan. The 1986 Plan has an expiration date of December 31, 2031. The approved quarry site consists of 145 acres of mining facilities within 357.5 acres of patented fee land, portions of which are leased and owned by Omya. Additionally, as with the proposed project, Alternative 1 would include proposed changes to the existing haul road to the White Knob/White Ridge Quarries from the processing plant.

Findings. The No Project Alternative is rejected as a feasible alternative because it does not meet the project objectives. For example, this alternative does not meet the most recent SMARA reclamation requirements, and would result in geology and hydrology impacts that exceed those of the project, as discussed on pages 5.0-3 through 5.0-9 of the DEIR.

Explanation. Pages 5.0-3 through 5.0-9 of the DEIR provide an analysis of the No Project as compared to the proposed project. This alternative would retain the 1986 White Knob-White Ridge Limestone Mine Site Approval and Reclamation Plan. This alternative would result in impacts that exceed those of the project on geology and soil and hydrology and water quality resources, due to lack of SMARA requirements at the time of the original plan. Further, this alternative would not meet all project objectives.

B. Alternative 2: Elimination of OB-2

Under Alternative 2, overburden site 2 (OB-2) would be eliminated from the project. This alternative would not result in impacts on the wetland features in this area. The overburden that would have been placed in this 13-acre site would be placed in OB-1 or OB-3, increasing the size and height of these areas. The elimination of OB-2 would also result in the reduction in size of the project area from 335.1 acres to 322.1 acres. The proposed project lists the total size of OB-1 as 31.9 acres and OB-3 as 3.0 acres. Assuming the overburden from the OB-2 site would be absorbed into OB-1 and OB-3 using the same proportional size, OB-1 is approximately 10.6 times the size of OB-3, OB-1 would increase to 43.7 acres and OB-3 to 4.3 acres in size. Additional changes to these overburden sites would also have to be incorporated into this alternative, such as additional sedimentation basins or other drainage features and the re-contouring of OB 1 and OB-3 to accommodate the additional overburden, as well as the realignment of the on-site haul road to reach the White Ridge Quarry.

Findings. The Elimination of OB-2 is rejected as a feasible alternative because, although it meets the project objectives, it would result in some impacts that exceed those of the proposed project, as discussed on pages 5.0-9 through 5.0-13 of the DEIR.

Explanation. Pages 5.0-9 through 5.0-13 of the DEIR provide an analysis of the Elimination of OB-2 Alternative as compared to the project. This alternative would

overburden site 2 (OB-2) would be eliminated from the project. This alternative would result in worse impacts to biological resources – specifically special-status plants and sensitive habitat - due to the expansion of OB-1 which would encroach on the sensitive habitat west of OB-1. In addition, this alternative would result in greater impacts on hydrology and water quality, in comparison to impacts of the proposed project, because expansion of OB-1 has the potential to create the need for additional sedimentation basins and drainage improvements.

C. Alternative 3: Backfill Central White Knob and Annex Quarries

Alternative 3 would include the backfilling of the White Knob and Annex Quarries. This alternative would be similar to the proposed project except that upon reclamation the OB 1 overburden storage area and central portions of the White Knob and Annex Quarries would be much higher because material placed in the White Ridge Quarry would now be placed in the White Knob and Annex Quarries. This would require that the final backfill elevation of OB-1 and the White Knob and Annex Quarries be raised to accommodate the additional fill, depending on slope stability. Under the proposed project, design of overburden fill slopes in all three disposal areas was found to have adequate slope stability; however, Alternative 3 would remove the fill in OB-3, the upper portions of OB-2, and some portion of the toe of OB-1, thereby reducing the potential for the mining-related fill slopes to fail or otherwise become unstable, and reducing the area of disturbance in the central and eastern drainages. The amount of fill that can be placed in each quarry would be restricted by the stability of the final fill, i.e., the slope angle and height. Overburden that could not be placed in the White Knob and Annex Quarries would continue to be placed in OB-1.

Findings. The Backfill Central White Knob and Annex Quarries Alternative is rejected as a feasible alternative because, although it meets the project objectives, it would result in some impacts that exceed those of the proposed project, as discussed on pages 5.0-13 through 5.0-18 of the DEIR.

(a) Explanation. Pages 75.0-13 through 5.0-18 of the DEIR provide an analysis of the Backfill Central White Knob and Annex Quarries Alternative as compared to the proposed project. This alternative would include the backfilling of the White Knob and Annex Quarries. This alternative would result in worse impacts to aesthetics in comparison to impacts of the proposed project, because the OB-1 overburden storage area and central portions of the White Knob and Annex Quarries would be much higher than under the proposed project and a greater amount of quarry impacts could be observed from the surrounding area.

4. Environmentally Superior Alternative

Of the three presented alternatives, Alternative 3, the Backfill Central White Knob and Annex Quarries Alternative, is considered to be the environmentally superior alternative. Alternative 3 would have fewer adverse environmental impacts than the other two alternatives. However, Alternative 3 would have a greater impact to aesthetics due to the additional height requirements for OB-1 and the central portions of the White Knob and Annex Quarries, but fewer impacts to biological resources than the proposed project because less area would be disturbed in OB-3 and OB-2. As with the proposed project, impacts to biological resources could be reduced to less than significant by incorporating mitigation measures, but impacts to aesthetics would remain significant and unavoidable.

While Alternative 3 may technically meet most of the project's primary objectives, the backfilling of the White Knob and Annex Quarries presents logistical problems during operation of the quarries, as the backfilling of the White Knob and Annex Quarries could not occur until those quarries cease operation. This would require the placing of overburden material in areas temporarily until the material can be moved, which may, in itself, increase the potential for environmental impacts.

Based on the evaluation in the DEIR, the proposed project would be the environmentally superior alternative compared with the three proposed alternatives.

Table 1. Summary Comparison of Alternatives

Project Environmental Impacts	Alternative 1 No Project/ Existing Approval	Alternative 2 Elimination of OB-2	Alternative 3 Backfill Central White Knob and Annex Quarries
Aesthetics			
Substantial adverse effect on a scenic vista and the existing visual character	No increase in a significant and unavoidable impact	No increase in a significant and unavoidable impact	Potential increase in a significant and unavoidable impact
Cumulative impact on aesthetics and visual resources	No increase in a significant and unavoidable impact	No increase in a significant and unavoidable impact	No increase in a significant and unavoidable impact
Ranking	S	S	W
Air Quality			
Emissions of air pollutants resulting in violation of air quality standards or contributing to existing violations	No new or more severe significant impact	No new or more severe significant impact	No new or more severe significant impact
Exposure of sensitive receptors to localized criteria pollutants	No new or more severe significant impact	No new or more severe significant impact	No new or more severe significant impact
Ranking	L	S	S
Biological Resources			
Impacts on Candidate, Sensitive, or Special-Status Species	No new or more severe significant impact	Potentially more severe significant impact	No new or more severe significant impact
Impacts on Riparian Habitat or Sensitive Natural Communities	No new or more severe significant impact	Potentially more severe significant impact	No new or more severe significant impact
Cumulative impacts on biological resources	No new or more severe significant impact	Potentially more severe significant impact	No new or more severe significant impact
Ranking	S	W	L
Cultural Resources			

Project Environmental Impacts	Alternative 1 No Project/ Existing Approval	Alternative 2 Elimination of OB-2	Alternative 3 Backfill Central White Knob and Annex Quarries
Substantial adverse change in the significance of an archaeological or historical resource	No new or more severe significant impact	No new or more severe significant impact	No new or more severe significant impact
Destroy a unique paleontological resource or geologic feature	No new or more severe significant impact	No new or more severe significant impact	No new or more severe significant impact
Ranking	S	S	S
Geology and Soils			
Rock and soil talus erosion	Potentially more severe significant impact	No new or more severe significant impact	No new or more severe significant impact
Ranking	W	S	S
Hydrology and Water Quality			
Substantially alter drainage pattern	Potentially more severe significant impact	Potentially more severe significant impact	No new or more severe significant impact
Ranking	W	W	S

Source: PMC 2014

Notes:

L: Alternative would result fewer or less severe environmental impacts than the proposed project.
S: Alternative would result in similar impacts as the proposed project.
W: Alternative would result in greater or more severe environmental impacts than the proposed project.

VIII. Statements of Overriding Considerations

Pursuant to State CEQA Guidelines Section 15093, the County has balanced the benefits of the project against its potentially significant and unavoidable environmental impacts in determining whether to approve the project. Pursuant to the State CEQA Guidelines, if the benefits of the project outweigh the unavoidable adverse environmental impacts, those impacts may be considered "acceptable."

As described in Section III, above, and in Chapter 3 of the Draft EIR, the project would have significant and unavoidable adverse impacts on the environment. The project would significantly alter aesthetic resources, specifically impacting the visual character of the project area.

The Planning Commission hereby declares that it has made a reasonable and good faith effort to eliminate or substantially mitigate the potential impacts resulting from the project.

The Planning Commission further finds that except for the project, all other alternatives set forth in the EIR are infeasible because they would prohibit the realization of project objectives and/or specific economic, social, and other benefits that this Planning Commission finds outweigh any environmental benefits of the alternatives.

The Planning Commission declares that, having reduced the adverse significant environmental effects of the project to the fullest extent feasible by adopting the Mitigation Measures contained in the EIR, having considered the entire administrative record on the project, and having weighed the benefits of the project against its unavoidable adverse impacts after mitigation, the Planning Commission has determined that each of the economic, environmental, and other benefits of the project, including the continuation of operations and reclamation activities separately and individually outweigh the potential unavoidable adverse impacts and render those potential adverse environmental impacts acceptable upon the following overriding considerations:

A. Existing Use. Omya's Lucerne Valley plant operations require high-brightness, high-purity limestone ore (calcium carbonate) of specific quantities and qualities to produce fine ground calcium carbonate for numerous consumer and industrial products. To meet current and future product demand, Omya requires reliable and economic resources of high-quality limestone ore. Such high-quality limestone ore exists in the unique limestone deposits of the area, including those within the White Knob/White Ridge Quarries. The proposed Amended Mine and Reclamation Plan would assure Omya that its Lucerne Valley processing plant would have the raw limestone resources needed to continue producing existing products, and to respond to future product demand.

B. Employment Opportunities. The proposed project would continue to provide employment and continue providing jobs of regional importance. These jobs would continue to support the region and the County.

C. **Improve Existing Environment**: The project would improve operations at the existing quarry by implementing SMARA and County surface mining ordinances. Further, the project would reclaim the site for post-mining uses, which would include open space habitat and would mitigate for lost, threatened, and endangered species habitat in accordance with the CHMS requirements by relinquishing unpatented mining claims or transfer of private property as determined adequate by the CHMS and regulatory agencies. The project would also reclaim and maintain the site to eliminate hazards to public safety.

The Planning Commission hereby declares that the foregoing benefits provided to the public, through the approval and implementation of the project, outweigh the identified significant adverse environmental impacts of the project that cannot be mitigated. The Planning Commission finds that each of the project benefits separately and individually outweighs all of the unavoidable adverse environmental effects identified in the EIR and therefore finds those impacts to be acceptable.

EXHIBIT C

Conditions of Approval (Conditional Use Permit)

CONDITIONS OF APPROVAL
(MINING AND RECLAMATION PLAN
CONDITIONAL USE PERMIT)

Draft COA
August 6, 2015
Planning Commission

CONDITIONS OF APPROVAL

MINING AND RECLAMATION PLAN
CONDITIONAL USE PERMIT
White Knob/White Ridge Limestone Quarry

Conditions shown in italics are Mitigation Measures from the May 2015 Final Environmental Impact Report.

GENERAL REQUIREMENTS
Conditions of Operation and Procedures

LAND USE SERVICES – Planning (909) 387-8311

1. This conditional approval is for Mining CUP and Reclamation Plan No. 86M-06 for the White Knob/White Ridge Quarry, CA Mine ID# 91-36-0067 for a Revision to a Mining Conditional Use Permit (CUP) and amendment to a Reclamation Plan for an existing limestone quarry to: increase the operational life of the quarry by 24 years from 2031 to 2055; add 2 additional overburden sites on 16 acres; incorporate 40 additional acres on BLM land for access and drainage; and increase the disturbance limits of the project by 190.1 acres for a total of 355.1 acres. With the 40 acres of BLM land, the project total acreage is 375.1 acres.
   The White Knob/White Ridge Quarry is located approximately six (6) miles south of State Route 18, south of the community of Lucerne Valley, California.

2. Mine/Reclamation Documentation. Prior to authorization of the proposed expansion of the operations, the Amended Mine and Reclamation Plan text and maps, including the Revegetation Plan, shall be revised to reflect the project as approved by the Planning Commission and to address comments from the State Office of Mine Reclamation. The corrected plan, maps and any supporting technical reports shall be submitted within 120 days of the Planning Commission hearing date.

3. A copy of Mining CUP and Reclamation Plan No. 86M-06 shall be kept on site during active operations at all times. Any alteration or expansion of these facilities or increase in the developed area of the site from that shown on the final approved plot plans may require submission of an additional application for review and approval.

4. The authorization of the revised Mining CUP and Reclamation Plan No. 86M-06 shall be effective through 2055 for active mining and for an additional 5 years for reclamation. After the mining activities have been completed, the site shall be reclaimed to vacant open space and wildlife habitat to be managed by the legal owners.

5. The San Bernardino County Land Use Services Department shall be notified in writing, within 30 days, about any:

   a) Change in operating procedures, or inactive periods of operation for one (1) year or more.
   b) Changes of Company ownership, address, or telephone during the life of the Conditional Use Permit or Reclamation Plan.
   c) Any changes to provisions in lease agreements or real property that may affect the approved Mining CUP and Reclamation Plan.

6. The approved Mining CUP and Reclamation Plan shall be bound in a 3-ring notebook and shall incorporate the approved plan of operations, reclamation plan, revegetation plan, most recent slope stability analyses, most recent biological resources survey reports, and most recent Financial Assurances. The Mining CUP and Reclamation Plan shall be kept at the site at all times during operations and be presented to the inspector upon request.

7. The applicant/operator shall ascertain and comply with requirements of all Federal, State, County, and Local agencies as are applicable to the project areas. They include, but are not limited to: the San Bernardino County Departments of Planning, Environmental Health Services, Transportation/Flood Control, Fire Warden, Building and Safety, Bureau of Land Management, Mojave Desert Air Quality Management District, State Fire Marshall, Lahontan or Colorado Regional Water Quality Control Board, Caltrans District 8, California Department of Fish and Wildlife, State Mining and Geology Board, U.S. Fish and Wildlife Service, Mine Safety and Health Administration (MSHA), the California Occupational Safety and Health Administration (Cal-OSHA), and California Highway Patrol.

8. Indemnification. In compliance with the SBCC § 81.01.070, the applicant shall agree, to defend, indemnify, and hold harmless the County or its "indemnitees" (herein collectively the County's elected officials, appointed officials (including Planning Commissioners), Zoning Administrator, agents, officers, employees, volunteers, advisory agencies or committees, appeal boards or legislative body) from any claim, action, or proceeding against the County or its indemnitees to attack, set aside, void, or annul an approval of the County by an indemnitee concerning a map or permit or any other action relating to or arising out of County approval, including the acts, errors or omissions of any person and for any costs or expenses incurred by the indemnitees on account of any claim, except where such indemnification is prohibited by law. In the alternative, the applicant may agree to relinquish such approval.

   Any condition of approval imposed in compliance with the County Development Code or County General Plan shall include a requirement that the County acts reasonably to promptly notify the applicant of any claim, action, or proceeding and that the County cooperates fully in the defense. The applicant shall

reimburse the County and its indemnitees for all expenses resulting from such actions, including any court costs and attorney fees, which the County or its indemnitees may be required by a court to pay as a result of such action. The County may, at its sole discretion, participate at its own expense in the defense of any such action, but such participation shall not relieve the applicant of their obligations under this condition to reimburse the County or its indemnitees for all such expenses.

This indemnification provision shall apply regardless of the existence or degree of fault of indemnitees. The applicant's indemnification obligation applies to the indemnitees' "passive" negligence but does not apply to the indemnitees' "sole" or "active" negligence or "willful misconduct" within the meaning of Civil Code Section 2782.

9. Financial Assurances. The applicant/operator shall maintain an acceptable form of financial assurance for the reclamation plan and conditions of approval. The financial assurance shall identify the County of San Bernardino and the Department of Conservation as the beneficiaries. Any withdrawals made by the County for reclamation shall be re-deposited by the applicant/operator within 30 days of notification.

   The financial assurance shall be calculated based on a cost estimate submitted by the applicant/operator and approved by the County and the Department of Conservation, Office of Mine Reclamation for the approved reclamation procedures. Each year, following the annual mine site inspection, the assurance amount shall be reviewed and, if necessary, adjusted to account for new lands disturbed by surface mining operations, inflation and reclamation of lands accomplished in accordance with the approved Reclamation Plan.

   The financial assurance is not established to replace the applicant's/operator's responsibility for reclamation, but to assure adequate funding to complete reclamation per the Reclamation Plan and Conditions of Approval. Should the applicant/operator fail to perform or operate within all of the requirements of the approved Reclamation Plan, the County or Department of Conservation will follow the procedures outlined in Sections 2773.1 and 2774.1 of the Surface Mining and Reclamation Act (SMARA) regarding the encashment of the assurance and applicable administrative penalties, to bring the applicant/operator into compliance. The requirements for the assurance will terminate when reclamation of the site has been completed in compliance with the approved Reclamation Plan and accepted by the County and the Department of Conservation, Office of Mine Reclamation pursuant to California Code of Regulations, Section 3805.5.

10. Annual Reporting. The applicant/operator shall submit a report summarizing the past year's Mining CUP and Reclamation activity to the Department of Conservation, Office of Mine Reclamation and the Land Use Services

Department each year. Mine site inspections will occur in conjunction with the annual report or at other times as appropriate.

11. Funds. As determined necessary on a case by case basis, the applicant shall deposit funds with the County necessary to compensate staff time and expenses for review of compliance monitoring reports and site inspections.

12. Project Account. As determined necessary on a case by case basis, the applicant shall deposit funds with the County necessary to compensate staff time and expenses for review of compliance monitoring reports and site inspections.

13. Amendment. If the Mining CUP and Reclamation Plan procedures change from those outlined in the revised Mining CUP and Reclamation Plan No. 86M-006, the applicant/operator shall file an amendment and secure approval before such changes can be made effective.

14. Conditions. All conditions of this revised Mining CUP and Reclamation Plan are continuing conditions. Failure of the applicant/operator to comply with any or all of said conditions at any time could result in the revocation of the permit granted to use the property.

15. Clean Water Act. The US Army Corp of Engineers (COE) regulates discharge of dredged fill materials into Waters of the United States pursuant to Section 404 of the Clean Water Act. If the COE agrees that the delineated waters on the site are jurisdictional and the project will result in the discharge of materials into waters of the United States, a 404 permit may be require and will need to be obtained from the Los Angeles COE District Office. A pre-construction notification should be submitted to the COE District office early in the environmental process.

16. Regional Water Quality Control Board (RWQCB). The RWQCB regulates discharge to surface waters under the Clean Water Act (CLA) and the California Porter-Cologne Water Quality Act; therefore, a Section 401 permit may be required in conjunction with the 404 permit, if the COE concurs that the site supports waters of the United States. Effective July 1, 2010, all dischargers are required to obtain coverage under the Construction General Permit Order 2009-0009-DWQ adopted on September 2, 2009. A Section 401 water quality certification may be required as part of the approval by the COE if a 404 permit is deemed necessary by the COE.

17. Project Account. The Job Costing System (JCS) account number is AP20080046. This is an actual cost project with a deposit account to which hourly charges are assessed by various county agency staff (e.g. Land Use Services, Public Work and County Counsel). Upon notice, the “developer” shall deposit additional funds to maintain or return the account to a positive balance. The “developer” is responsible for all expenses charged to this account. Processing of the project shall cease if it is determined that the account has a

negative balance and that an additional deposit has not been made in a timely manner. A minimum balance of $1,200.00 shall be in the project account at the time of the project approval.

18. Fees. Prior to issuance of the approved Permits, all fees due under actual cost Job No. AP20080046 shall be paid in full.

19. Mitigation. Implementation of the mitigation measures required for this project shall be verified according to the methods identified in the Mitigation Monitoring and Compliance Program. Planning verification of compliance shall be requested through submittal of a Mitigation Monitoring and Compliance Application along with the required fee deposit. A qualified third party consultant with experience in mine operations shall do mitigation monitoring compliance verification to be funded by the applicant/operator. Annual reports shall be prepared by the operator that summarizes compliance with regulatory agency monitoring requirements and submitted to Land Use Services by October 1st of each year.

LAND USE SERVICES – Code Enforcement (909) 387-8311

20. Enforcement. If any County agency is required to enforce compliance with the conditions of approval, the property owner and "developer" shall be charged for such enforcement activities in accordance with the County Code Schedule of Fees. Failure to comply with these conditions of approval or the approved site plan design required for this project approval shall be enforceable against the property owner and "developer" (by both criminal and civil procedures) as provided by the San Bernardino County Code, Title 8 - Development Code; Division 6 - Administration, Chapter 86.09 - Enforcement.

COUNTY FIRE – Community Safety (909) 386-8400

21. Fire Jurisdiction. The above referenced project is under the jurisdiction of the San Bernardino County Fire Department herein ("Fire Department"). Prior to any construction occurring on any parcel, the developer shall contact the Fire Department for verification of current fire protection requirements. All new construction shall comply with the current Uniform Fire Code requirements and all applicable statutes, codes, ordinances and standards of the Fire Department.

LAND USE SERVICES - Land Development – Drainage (909) 387-8311

22. Tributary Drainage. Adequate provisions should be made to intercept and conduct the tributary off site - on site drainage flows around and through the site in a manner, which will not adversely affect adjacent or downstream properties at the time the site is developed.

PRIOR TO OPERATION OR NEW DISTURBANCE, THE FOLLOWING CONDITIONS SHALL BE MET

LAND USE SERVICES - Planning (909) 387- 8311

23. Project Boundary Verification. Prior to new ground disturbance, a Licensed Land Surveyor shall be employed to determine and permanently monument the property corners and limits of each road right-of-way and project boundaries. For each corner, GPS coordinates (or other similar technology) shall be provided in a format acceptable to the County. A final report shall be provided to Land Use Services.

24. Haul Road Improvements.
a) The operator shall provide evidence of an Offer of Right of Way dedication from the U.S. Bureau of Land Management, consistent with the 2011 Settlement Agreement between Omya Inc. and the Bureau of Land Management.

b) The operator shall provide evidence of the completion of the off-site haul road improvements on the approximately 4.4 mile haul road from the project site to the processing plant, as described in the *White Knob Haul Road Drainage Study and Plan of Development*, Stantec, August 2011.

c) The operator shall provide evidence of their purchase of the land to be sold by the U. S. Bureau of Land Management as contemplated in the 2011 Settlement Agreement between Omya, Inc. and the Bureau of Land Management. The operator shall not disturb such land prior to the purchase.

25. ***Bio- 3.3.1a*** *The mine operator shall retain a qualified biologist to conduct mandatory contractor/worker awareness training for project personnel. The awareness training will be provided to all personnel to brief them on the identified location of sensitive biological resources, including how to identify species (visual and auditory) most likely to be present, the need to avoid impacts on biological resources (e.g., plants, wildlife, and jurisdictional waters), and to brief them on the penalties for not complying with biological mitigation requirements. If new personnel are added to the project, the mine operator will ensure that they receive the mandatory training before starting work.*

26. ***Bio- 3.3.1b*** *The mine operator shall designate a field contact representative (FCR) responsible for overseeing compliance with protections to special-status species. The FCR shall be on-site during all project activities that could potentially cause significant impacts on sensitive biological resources. The FCR shall have the authority to halt activities that are in violation of the committed measures and non-emergency project-related activities that may endanger special-status species. The FCR shall authorize re-initiation of project activities after the hazards are removed, the species is no longer at risk, or the individual(s) are moved out of harm's way by the qualified biologist.*

27. ***Greenhouse Gas Monitoring and Mitigation****. The developer shall implement the following as greenhouse gas (GHG) mitigation during the operation of the approved project:*

    a) *Waste Stream Reduction. The "developer" shall provide to all project employees County-approved informational materials about methods and need to reduce the solid waste stream and listing available recycling services.*

    b) *Vehicle Trip Reduction. The "developer" shall provide to all project employees County-approved informational materials about the need to reduce vehicle trips and the program elements this project is implementing. Such elements may include: participation in established ride-sharing programs, creating a new ride-share employee vanpool, designating preferred parking spaces for ride sharing vehicles, designating adequate passenger loading and unloading for ride sharing vehicles with benches in waiting areas, and/or providing a web site or message board for coordinating rides.*

    c) *Select construction equipment based on low-emissions factors and high-energy efficiency. All diesel/gasoline-powered construction equipment shall be replaced, where possible, with equivalent electric or CNG equipment.*

    d) *All construction equipment engines shall be properly tuned and maintained in accordance with the manufacturers specifications prior to arriving on site and throughout construction duration.*

28. If human remains are encountered on the property, the San Bernardino County Coroner's Office Must be contacted within 24 hours of the find, and all work halted until a clearance is given by that office and any other involved agencies. Contact the County Coroner at 175 South Lena Road, San Bernardino, CA 92415-0037 or (909) 387-2543.

29. Stockpiling and Growth Medium. The operator shall stockpile all available growth medium and vegetation from areas to be disturbed and maintain the stockpiled material with temporary erosion control methods. At the time of reclamation, areas being reclaimed shall have the stockpiled growth medium and vegetation spread over them. Re-vegetation areas shall be ripped and decompacted and shall be supplemented by broadcast seeding with native and locally adapted seed per the approved reclamation plan. Stockpiled growth medium shall be stored separately from silt and overburden material stockpiles and shall be stabilized through establishment of temporary vegetative cover or other acceptable means of surface treatment for prolonged storage periods.

30. NPDES. The applicant/operator shall obtain a National Pollutant Discharge Elimination System (NPDES) Permit for storm water discharges associated with operation activities. The NPDES permit shall be submitted to the Colorado or

Lahontan Regional Water Quality Control Board (RWQCB) and a copy shall be submitted to Planning, or provide evidence from the RWQCB that the NPDES permit is not needed. For information, call RWQCB at (760) 241-7305.

31. Streambed Alteration Agreement. Prior to any disturbance that could disturb or alter any drainage course, the applicant/operator shall enter into a California Department of Fish and Wildlife 1603 Streambed Alteration Agreement or provide evidence that one is not required. Streambed alteration and/or discharge of fill material to a surface water may further require a CWA, section 401 water quality certification for impacts to federal waters or dredge and fill waste discharge requirements for impacts to non-federal waters, both issued by the Colorado Regional Water Quality Control Board or State Water Board. Early consultation with the Water Board Staff is encouraged. Information regarding these permits, including application forms can be downloaded from the following website:

    http://www.waterboards.ca.gov

32. Storm Water Pollution Prevention Program (SWPPP). The operator shall prepare a SWPPP outlining how storm water shall be conveyed or directed on and off-site during operations to avoid impacts to groundwater and surface water quality. Within the SWPPP, the operator shall list Best Management Practices (BMPs) to be employee on site to avoid water quality impacts. The SWPPP shall be submitted to the Regional Water Quality Control Board and a copy submitted to Planning or provide evidence from RWQCB that the SWPPP is not needed.

33. On-Site Lighting and Illumination. The area of illumination from any lighting shall be confined to be within the site boundaries and to minimize impacts to night sky views from surrounding properties. The glare from any luminous source, including on-site lighting shall not exceed one-half (0.5) foot-candle at property line. On-site lighting shall be fully shielded, diffused, or directed in a manner to avoid glare directed at adjacent properties, roadways or any light spill into any wildland areas surrounding the site that might affect nocturnal animals. No light shall project onto adjacent roadways in a manner that interferes with on-coming traffic. All lighting shall be limited to that necessary for maintenance activities, security and safety purposes. All signs proposed by this project shall only be lit by steady, stationary, shielded light directed at the sign.

34. Permit Maintenance. The applicant/operator shall maintain and annually renew existing permits to operate any applicable equipment from the Mojave Desert Air Quality Management District (MDAQMD) and be in compliance with said permits.

35. Exhaust Control Measures. Operation of all off-road and on-road diesel vehicles/equipment shall comply with the County Diesel Exhaust Control

Measures (Development Code, Section 83.01.040 (c)) including but not limited to:

a) Equipment/vehicles shall not be left idling for period in excess of five minutes;
b) Engines shall be maintained in good working order to reduce emissions;
c) Onsite electrical power connections shall be made available where feasible;
d) Ultra low-sulfur diesel fuel shall be utilized;
e) Electric and gasoline powered equipment shall substituted for diesel powered equipment where feasible;
f) Signs shall be posted requiring all vehicle drivers and equipment operators to turn off engines when not in use;
g) In addition, all on-road diesel trucks shall not idle more than five minutes per truck trip or per day on the project site.

36. Monumentation. If any activity on this project will disturb any land survey monumentation, including but not limited to vertical control points (benchmarks), said monumentation shall be located and referenced by or under the direction of a licensed land surveyor or registered civil engineer authorized to practice land surveying prior to commencement of any activity with the potential to disturb said monumentation, and a corner record or record or survey of the references shall be filed with the County Surveyor (Section 8771(b) Business and Professions Code).

37. The following conditions are for the occasion where the monuments of record cannot be located and the boundary must be determined for construction purposes.

A Record of Survey/Corner Record shall be filed in the following instances:
a) Legal descriptions or construction staking based upon a field survey of the boundary or building setbacks.
b) Monuments set to mark the property lines.
c) Pursuant to applicable sections of the Business and Professions Code.

ON-GOING OPERATIONAL CONDITIONS
General Requirements

PUBLIC HEALTH – Environmental Health Services (DEHS) (800) 442-2283

38. Noise Operations. The Noise level shall be maintained at or below County Standards, Development Code Section 83.01.080

39. Refuse. All refuse generated at the premises shall at all times be stored in approved containers and shall be placed in a manner so that visual or other impacts, and environmental public health nuisances are minimized and complies with the Development Code, Section 33.0830 et seq. For information, please call DEHS/Local Enforcement Agency (LEA) at: 909-387-4655.

40. Solid Waste Removal. All refuse containing garbage shall be removed from the premises at least one time per week to an approved solid waste facility in conformance with San Bernardino County Code Chapter 8, Section 33.0830 et seq. For information, please call DEHS/LEA at: 909-387-4655.

COUNTY FIRE – Community Safety (909) 386-8400

41. Access. The primary access route shall comply with the minimum requirements for fire protection and/or emergency response with applicable local ordinances, codes, and/or fire protection standards.

LAND USE SERVICES – Planning (909) 387-8311

42. Stockpiling. On-site materials shall not be stockpiled adjacent to an active drainage unless adequate protective measures are implemented. Adequate measures shall consider the most adverse conditions the stockpile will likely experience.

43. Soil Contamination. In the event of any soil contamination on-site, the applicant/operator shall remove to a County approved disposal site, any soils that become chemically contaminated so as to preclude any chemical leaching into the local ground water supply over time.

44. Overburden. The removal of vegetation and overburden, if any, in advance of surface mining shall be kept to the minimum. The following practices shall be undertaken during the performance of surface mining operations:

    a) Erosion control facilities such as retarding basins, ditches, stream bank stabilization, and diking shall be constructed and maintained where necessary to control water erosion.
    b) Erosion and Drainage. Grading and revegetation shall be designed to minimize erosion and to convey surface runoff to; natural drainage courses or interior basins designed for water storage.
    c) Resoiling. When the reclamation plan calls for resoiling, course hard mine waste shall be leveled and covered with a layer of finer material or weathered waste. The use of soil conditioners, mulches, or imported topsoil shall be considered where revegetation is part of the reclamation plan and where such measures are necessary.

45. Mining Operation. The mining operation shall be conducted in a manner to facilitate implementing site reclamation. The final site shall be graded and revegetated as per the approved Reclamation Plan Plot Plan. Any changes to the approved plans shall require a Revision Application.

46. Slope monitoring. Slope monitoring shall be implemented to assure that unnecessary hazards are not created with the active or final reclaimed slopes. The monitoring shall include the following items:
    a) Slope Stability Analysis: A qualified independent California Certified Professional Civil Engineer OR Engineering Geologist shall complete, on an annual basis or deemed necessary by County inspector, a stability assessment of existing and new quarry development areas. The analysis shall identify and discuss significant structural features or indications of potential instability encountered.

    b) Review of Slope Stability Considerations: Using the information from the investigation and monitoring, the assumptions and results of the stability analysis shall be evaluated for continued approved design applicability.

47. Interim Management Plan. The applicant shall implement measures to stabilize and secure the site during periods of inactivity as per the approved Reclamation Plan. An Interim Management Plan (IMP) as required by SMARA, Section 2770(h) shall be submitted to Planning for review and approval within 90 days of the mining operation becoming idle.

48. Site Maintenance. The applicant/operator shall maintain the premises in a neat and orderly manner at all times. No refuse shall be retained at any time in the work areas. All refuse shall be disposed of at an approved licensed disposal facility. Refuse storage shall be maintained in closed containers.

49. Reclamation. Reclamation shall be initiated at the earliest possible time on those portions of the mined lands that will not be subject to further disturbance by the surface mining operation.

50. Signage. Clearly legible signs denoting limits shall be posted along with fencing, berms, or rock barriers, as necessary, to protect against accidental entry to the site. Lettering shall be a minimum four (4) inches in height. As feasible, signs shall be placed every 300 feet around the perimeter of the project plan area where undisturbed ground adjoins the permit area. All signs shall be in place prior to the commencement of extraction activities.

51. Sign Maintenance. The applicant/operator should regularly review the adequacy of the signs. Care should be taken to ensure that signs do not become blocked by vegetation or become illegible from dirt or deterioration. Pay special attention to any areas where public roads intersect project roads. Other drivers may not be familiar with the operation of mining equipment, the mine's traffic patterns, and equipment blind spots. Ensure that the traffic and warning signs that are provided in these areas are adequate.

52. Advertisement. Any advertising or identifying sign shall be constructed in compliance with the designated Official Land Use District for this site.

53. Plots. Test plots shall be indicated on the Mine Reclamation Plan and required to determine the suitability of growth media for revegetation purposes. Test plots shall be conducted simultaneously with mining to determine the most appropriate planting procedures to be followed to ensure successful implementation of the Re-vegetation Plan.

54. Re-vegetation Monitoring. For each phase, monitoring will continue annually for at least five (5) years after reclamation has been completed. Following the first two years of qualitative monitoring, quantitative monitoring will be conducted. Monitoring will utilize methods appropriate to the areas under study. Beginning with the adoption of the final revision of the Reclamation Plan that encompasses all the needed changes to be consistent with the final conditions of project approval, and continuing until reclamation is completed, the applicant/operator will submit to Planning annual monitoring reports. The reports will:

a) Describe re-vegetation actions undertaken in the reporting period;
b) Identify areas that have been disturbed;
c) Identify areas and acreage for which re-vegetation has been started;
d) Present results of investigations on species diversity and other measures of re-vegetation success in test and control or reference plots;
e) Describe successes and problems in the re-vegetation efforts for that year;
f) Describe steps taken to resolve problems or achieve re-vegetation success;
g) Describe disturbance and re-vegetation efforts planned for the next two years.

55. Revegetation Renewal. If, in any phase, re-vegetation is not successful, the applicant/operator shall undertake the following actions:

a) If, during the first two years of qualitative monitoring, revegetation is clearly not successful, the applicant/operator will re-evaluate the revegetation methods and will discuss changes to these methods with the County representatives. The applicant/operator will revise the Re-vegetation Plan, secure concurrence from Planning for the changes, and begin implementing the new measures.
b) If the test plots do not meet the specified success criteria of the control plots after three years, the applicant/operator will make an assessment of the re-vegetation methods to identify any deficiencies contributing to planting failures. Corrective action shall be incorporated in follow-up testing.
c) If after five years, the re-vegetated areas (as measured by the results of the test plots) have not achieved these success criteria, the applicant/operator will immediately begin to implement the measures identified in a contingency plan.

56. Financial Assurances. Re-vegetation in arid areas is tenuous at best and, therefore, the applicant shall provide in the Financial Assurance Cost Estimate the costs to monitor and report on revegetation, incidental disturbance and erosion control for a time period of five (5) years following the termination date of operation in each phase.

57. Pursuant to SMARA, Section 2772.7, Planning will prepare a "Notice of Reclamation Plan Approval" on a form to be approved by the County Recorder's Office. The operator shall pay any and all review and recording fees.

58. ***AES 3.1.1*** *Operator shall maintain design features and reclamation activities that would reduce visual impacts. These measures are outlined in the Amended Plan and include the following:*

- *Implement measures to minimize boulder roll-down visual impacts including:*
  - *Precision drilling and buffer blasting when the outside edge is approached.*
  - *Drilling lifters on the edge to undercut the remaining slope and let it fall into the pit (like directional falling of a tree).*
  - *Excavator to pull down and pull in toward the pit blasted rock away from the edge.*
  - *Use of alternatives to blasting along the outside such as rock breakers, surface miners, cutting heads, and excavators.*
  - *Loader to pull back material from the edge.*
  - *Loader to dig at an angle to the edge or parallel to the edge when possible.*
  - *Manually scaling boulders from the high walls where they may be above a haulage road.*
- *Maintain the existing crusher site at the White Knob Quarry or use a portable plant within an active quarry to reduce its visibility from Lucerne Valley.*
- *Deposit waste rock within the White Knob Quarry footprint, as described in the Amended Plan, to reduce the area of disturbance for overburden stockpiles and visual impact outside the quarry.*
- *Design and phase mining of the White Ridge Quarry, which allows for concurrent reclamation and leaves an approximately 300-foot-high ridge of undisturbed hillside facing Lucerne Valley to minimize visual impacts.*
- *Implement reclamation and revegetation on completed equipment-accessible quarry benches and on overburden stockpiles concurrent with mining where feasible.*
- *Utilize color-staining product to darken the visible quarry and roll-down slopes where not subject to raveling to reduce visual impacts.*
- *Deposit darker waste rock on overburden sites where available to reduce color contrast.*
- *Design adequate erosion control features along the haul and access roads and quarry to control and limit erosion and sediment transport for a 20-year, one-hour duration storm event.*
- *Where feasible, construct catchment berms at the foot of stockpiles to reduce rock roll-down and sediment flow.*
- *Limit surface disturbances to areas identified in the Amended Plan.*

- *Implement appropriate dust controls to reduce visible dust.*

59. ***AQ 3.2.1*** *It shall be required in the final Amended Mine and Reclamation Plan that the following PM10 reduction measures be implemented as part of quarry operations and reclamation.*
    a) *Limit maximum speed on unpaved roads to 25 miles per hour.*
    b) *Water unpaved roads at least twice per day, more if needed to control dust emissions by at least 80 percent. Alternatively, a dust palliative, such as magnesium chloride, may be used to treat the unpaved roads.*
    c) *Water all areas to be graded and areas where bulldozers operate at least twice per day, more if needed, to control dust emissions.*

60. ***Bio- 3.3.1c*** *Project-related vehicles will stay on roads and observe a 25 mile per hour speed limit in all project areas, except on county roads and state and federal highways.*

61. ***Bio- 3.3.1d*** *Project-related vehicles shall be checked before moving for wildlife, as wildlife may seek shade and shelter under parked vehicles and construction equipment.*

62. ***Bio- 3.3.1e*** *All construction pipes, culverts, or similar structures that are stored on the project site for one or more nights shall be inspected thoroughly for the presence of wildlife before they are used or moved. If wildlife is present, they shall be allowed to move out of the area on their own or moved out of harm's way by a qualified biologist.*

63. ***Bio-3.3.1f*** *Encounters with a special-status wildlife species shall be reported to the Field Contact Representative (FCR) and qualified biologist. The qualified biologist shall maintain records of all encounters during the project, the species' condition, location found, and location released.*

64. ***Bio- 3.3.1g*** *All food-related trash items such as food wrappers, cans, bottles, and food scraps shall be disposed of in secured, closed containers and removed regularly from the project site.*

65. ***Bio- 3.3.1h*** *Fueling of vehicles and equipment shall be prohibited within 100 feet of riparian/riverine areas.*

66. ***Bio- 3.3.1i*** *No rodenticides shall be used on the project site.*

67. ***Bio- 3.3.2 Carbonate Habitat Management Strategy (CHMS) Consistency.*** *Prior to initiating project-related activities in undisturbed portions of the site, the*

mine operator shall complete land dedication or claim relinquishments to offset project impacts on listed threatened or endangered plants at a 3:1 ratio, consistent with the requirements of the CHMS, and provide documentation of the completed transaction to the County. The 3:1 ratio will apply to total number of conservation units (CUs) (calculated by San Bernardino County National Forest [SBNF] staff according to the provisions of the CHMS) and total occupied habitat, in acres or fractions of acres, for each listed species. This mitigation measure consists of four parts: (1) field surveys to determine conservation value of proposed disturbance areas; (2) comparable field surveys to verify conservation value of mining claims to be relinquished; (3) administrative requirements to complete the land dedication or claim relinquishments (which may include mineral withdrawal); and (4) protection measures for special-status plants located adjacent to project disturbance areas that are not planned to be removed.

a) *Project Area Field Surveys and Conservation Value Calculation. The mine operator shall retain a qualified biologist to perform focused surveys to determine the presence/ or absence of special-status plant species identified in Table 3.3-1 and within 100 feet of the proposed impact area. For listed threatened or endangered plants, the extent of occupied habitat shall be mapped and quantified. For any other special-status plants located in the project area, the biologist shall collect global positioning system (GPS) coordinates of occurrences and qualitative estimates of their abundance.*

   These surveys shall be conducted in accordance with the CDFW (2009) Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. These guidelines require that rare plant surveys be "floristic in nature," conducted by field botanists familiar with the regional flora, and conducted at the proper time of year when rare or endangered species are both evident and identifiable. Field surveys shall be scheduled to coincide with known flowering periods and/or during appropriate developmental periods that are necessary to identify the plant species of concern.

   Field survey results and mapping data shall be provided to the County and the SBNF for inclusion in the CHMS GIS data and calculation of total CHMS conservation value of the proposed project area.

b) *Mitigation Lands Field Surveys and Conservation Value Calculation. The mine operator shall identify one or more parcels of land or mining claims suitable for relinquishment and shall retain a qualified biologist to perform focused botanical surveys of those lands. Survey methods and data collection shall be as described above for project site field surveys. Field survey results and mapping data shall be provided to the San Bernardino National Forest for inclusion in the CHMS GIS data and calculation of total CHMS conservation value of the proposed project area.*

c) *Land Dedication or Claim Relinquishment. The mining operator shall specify lands or mining claims whose conservation values and habitat area occupied by listed species total no less than three times the total conservation value of the project area and roughly three times the occupied habitat for each affected listed species. The mining operator shall dedicate the lands or*

relinquish those claims according to the terms of the CHMS and the MOU. The operator shall provide written documentation of the land dedication or claim relinquishment to the County upon completion.

d) *Protect Special-Status Plant Locations Adjacent to Project Site. Any special-status plant species that are identified within 100 feet of the proposed impact area, but not proposed to be disturbed by the project, shall be protected by barrier fencing to ensure that construction activities and material stockpiles do not impact any special-status plant species. These avoidance areas shall be identified on project plans.*

68. ***Bio- 3.3.3a Desert Tortoise Surveys****. Prior to implementation of project-related activities, the mine operator shall retain a USFWS-authorized desert tortoise biologist to conduct pre-project surveys in accordance with the USFWS pre-project field survey protocol (2010). If no desert tortoises are identified during pre-project surveys, no further mitigation is required. If individuals or their sign are identified during pre-project surveys, mitigation measure* ***MM 3.3.3b*** *shall be implemented.*

69. ***Bio- 3.3.3b Desert Tortoise Avoidance, Minimization, and Mitigation.*** *Should occupied desert tortoise habitat be identified during the pre-project surveys, a habitat mitigation and monitoring plan and raven control plan shall be developed in consultation with the USFWS and the CDFW. This plan shall describe all measures to be implemented prior to, during, and after construction, including, but not limited to, the following:*

a) All tortoise burrows shall be avoided to the greatest extent feasible, and temporary exclusionary tortoise fencing (1x2-inch mesh hardware cloth) shall be installed at the limits of disturbance prior to initiation of construction activities. Fence installation and ongoing oversight of the need for maintenance shall be monitored by a USFWS-authorized desert tortoise biologist.

b) Upon completion of fence installation, the authorized biologist shall conduct a clearance survey of the fenced area prior to declaring the construction area free of tortoises.

c) If it is necessary to excavate a desert tortoise from its burrow to move it out of harm's way, excavation shall be done with hand tools, either by or under the direct supervision of the authorized biologist.

d) Desert tortoises removed from burrows shall be placed in an unoccupied burrow of approximately the same size as the one from which they were removed. If an existing burrow is not available, the authorized biologist shall construct one.

e) Desert tortoises moved during inactive periods will be monitored for at least two days after relocation or the end of construction, whichever occurs first.

f) If desert tortoises need to be moved at a time of day when ambient temperatures could harm them (less than 40 degrees and over 90 degrees Fahrenheit), they shall be held overnight in a clean cardboard box and released the following day during more favorable temperatures. Cardboard boxes used to hold tortoises shall only be used once.

g) All handling of desert tortoises shall be performed consistent with the Guidelines for Handling Desert Tortoises During Construction Projects (Desert Tortoise Council 1994).

h) The mine operator shall mitigate for impacts on occupied desert tortoise habitat at a 1:1 minimum ratio through the purchase of credits from an approved desert tortoise mitigation bank. The amount of credits purchased and the location of the mitigation bank used are subject to approval by the USFWS and the CDFW. The mine operator shall provide the County with evidence that the permit and/or other requirements established by either agency have been satisfactorily met.

70. ***Bio- 3.3.4 Coast Horned Lizard Surveys.*** *Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine if suitable habitat for this species occurs within 250 feet of the proposed impact area. If suitable habitat exists, preconstruction surveys must be performed by a qualified biologist in a manner to maximize detection of coast horned lizards (i.e., during warm weather, walking slowly). If any lizards are discovered within the work areas, they shall be actively moved or passively encouraged to leave the work area.*

71. ***Bio- 3.3.5 Burrowing Owl Surveys.*** *If clearing and construction activities will occur during the nesting period for burrowing owls (February 1–August 31), the mine operator shall retain a qualified biologist to determine if suitable nesting habitat occurs within 500 feet of the proposed impact area. If suitable habitat exists, focused surveys must be performed by a qualified biologist in accordance with the CDFW's Staff Report on Burrowing Owl Mitigation, published March 7, 2012. Surveys shall be repeated if project activities are suspended or delayed for more than 15 days during nesting season.*

If no burrowing owls are detected, no further mitigation is required. If active burrowing owl nest sites are detected, the mine operator shall implement the avoidance, minimization, and mitigation methodologies outlined in the CDFW's Staff Report on Burrowing Owl Mitigation prior to initiating project-related activities that may impact burrowing owls.

72. ***Bio-3.3.6 Migratory Bird Surveys.*** *If clearing and/or construction activities will occur in undisturbed portions of the site, or blasting activities will occur in any portion of the project site, during the migratory bird nesting season (March 15–August 15), preconstruction surveys to identify active migratory bird nests shall be conducted by a qualified biologist within 14 days of initiation of project activities. Focused surveys must be performed by a qualified biologist for the purposes of determining the presence/absence of active nest sites within the proposed impact area and a 200-foot buffer (if feasible). Surveys shall be repeated if project activities are delayed or postponed for more than 30 days.*

If active nest sites are identified within 200 feet of project activities, the mine operator shall impose a limited operating period (LOP) for all active nest sites prior to commencement of any project activities to avoid construction or project-related disturbances to migratory bird nesting activities. An LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, blasting, and construction) will not occur and will be imposed within 100 feet of any active nest sites until the nest is deemed inactive. Activities permitted within and the size (i.e., 100 feet) of LOPs may be adjusted through consultation with the CDFW and~~/or~~ the County.

When an active nest is located within 200 feet of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to CDWF and the County until the nest(s) are deemed inactive.

73. ***Bio-3.3.7a Raptor Conservation Strategy.*** *The applicant shall participate in and implement the Raptor Conservation Strategy.*

74. ***Bio- 3.3.7b Raptor Surveys****. If clearing and/or construction activities would occur in undisturbed portions of the site, or blasting activities will occur in any portion of the project site, during the raptor nesting season (January 15–August 15), preconstruction surveys to identify active raptor nests shall be conducted by a qualified biologist within 14 days of construction initiation. Focused surveys must be performed by a qualified biologist for the purposes of determining presence/absence of active nest sites within the proposed impact area. If no active nests are found, no further mitigation is required. Surveys shall be repeated if project activities are delayed or postponed for more than 30 days.*

If active golden eagle or other raptor nest sites are identified within a half mile of project activities, the applicant shall impose a limited operating period (LOP) for

all active nest sites prior to commencement of any project activities to avoid construction- or project-related disturbances to nesting raptors. A LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, blasting, and construction) will not occur and shall be imposed within 500 feet of any active nest sites until the nest is deemed inactive. Activities permitted within LOPs and the size (i.e., 500 feet) of LOPs may be adjusted through consultation with the CDFW and the County.

When an active nest is located within a half mile of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to the County until the nest(s) are deemed inactive.

75. ***Bio-3.3.9 Bat Surveys.*** *Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine whether potential roosting sites for special-status bats may be affected. If potential roost sites are identified, a preconstruction survey by a qualified biologist shall be conducted between March 1 and July 31 to determine the presence or absence of roosting bats. If the survey does not identify the presence of occupied roosts, no further mitigation is required.*

a) If non-breeding roosts occupied by special-status bat species are documented within construction areas, the bats shall be safely flushed from the sites where roosting habitat is planned to be removed prior to May of each construction phase and prior to the onset of construction activities. The removal of the roosting sites shall occur during the time of day when the roost is unoccupied.

b) If a maternity colony is detected, a 100-foot construction-free buffer shall be established around the roost site and remain in place until it has been determined by a qualified biologist that the nursery is no longer active. Removal of maternity roosts shall be restricted to between March 1 and April 15 or August 15 and October 15 to avoid interfering with an active nursery.

c) The loss of each roost will be compensated for by the construction and installation of two bat boxes suitable to the bat species and colony size excluded from the original roosting site. The bat boxes shall be installed in the vicinity prior to removal of the original non-breeding/maternity roost sites. A detailed program for bat flushing, roosting site removal, and installation of bat boxes shall be developed in consultation with a qualified biologist.

76. ***Bio-3.3.10 Pallid San Diego Pocket Mouse Surveys.*** *Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine if suitable habitat for this species occurs within 250 feet of the proposed impact area. If suitable habitat exists, preconstruction surveys must be performed by a qualified biologist in a manner to maximize detection of pallid San Diego pocket mice. If any mice are discovered within the work areas, they shall be actively moved or passively encouraged to leave the work area.*

77. ***Bio-3.3.11a No Net Loss of Riparian Vegetation.*** *The mine operator shall ensure there is no net loss of riparian vegetation. Mitigation can include on-site restoration or purchase of mitigation credits at a USACE-approved mitigation bank, placing a conservation easement over a riparian area, or quit claiming mineral claims over a riparian area. Mitigation, as required in regulatory permits issued through the CDFW, the USACE, or the RWQCB, may be applied to satisfy this measure. Evidence of compliance with this mitigation measure shall be provided prior to construction and grading activities for the proposed project.*

78. ***Bio-3.3.11b Oak Woodlands.*** *The mine operator shall ensure there is no net loss of oak woodland habitat. Mitigation can include any one or combination of the following:*

    a) *Preservation of existing oak woodlands by recording a conservation easement(s) in favor of the County or an approved organization or agency.*

    b) *Replacement or restoration of former oak woodlands. The County may require the planting and maintenance of replacement trees, including replacing dead or diseased trees. The replacement ratio and tree sizes shall be based on the recommendation of an Oak Reforestation Program prepared by a registered professional forester. The requirement to maintain trees in compliance with this paragraph shall terminate seven years after the trees are planted.*

    c) *Contribution of in-lieu mitigation fees to the Oak Woodlands Conservation Fund, established under Fish and Game Code Section 1363 for the purpose of purchasing oak woodlands conservation easements. A project applicant who contributes funds in compliance with this subsection shall not receive or use a grant from the Oak Woodlands Conservation Fund as part of the mitigation for the project. The in-lieu fee for replacement trees shall be calculated based on their equivalent value as established by the International Society of Arboriculture's current edition of the Guide for Plant Appraisal.*

    d) *Performing other mitigation measures as may be required by the County (e.g., inch-for-inch off-site replacement planting, transfer of development rights, enrollment of project with offset provider for carbon credits in greenhouse gas emission registry, carbon reduction, and carbon trading system).*

79. ***Cultural-3.4.1*** *It shall be required in the final Amended Mine and Reclamation Plan, that if, during the course of construction, mining, or reclamation activities previously unknown cultural resources (i.e., prehistoric or historic sites) are discovered, work shall be halted immediately within 50 feet of the discovery, the San Bernardino County Land Use Services Department shall be notified, and a professional archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards in prehistoric or historical archaeology shall be retained to determine the significance of the discovery. Determination of impacts, significance, and mitigation that protects the discovered resource shall be made by a qualified archaeologist in consultation with recognized local Native American groups, if appropriate. The San Bernardino County Museum shall also be contacted for review of the archaeological find(s). In addition, prior to the commencement of project excavations, all construction and mining personnel shall be informed of the potential to inadvertently uncover cultural resources and the procedures to follow subsequent to an inadvertent discovery of cultural resources.*

80. ***Cultural-3.4.3*** *If non-metamorphosed fossiliferous limestones are encountered during mining activities, they shall be removed and retained for examination by a qualified paleontologist. If any fossil-bearing materials are encountered, a program to protect and preserve such resources that might be exposed or unearthed shall be developed in cooperation with the project applicant and San Bernardino County. The program shall be developed in accordance with the proposed guidelines of the Society of Vertebrate Paleontology and shall include, but not be limited to, the following:*

a) All non-metamorphosed fossiliferous limestones that are encountered during mining shall be stockpiled for examination by a qualified paleontologist. The monitor shall be prepared to quickly salvage any fossils that might be present. The monitor should also remove samples of sediments that are likely to contain the remains of small fossil vertebrates and invertebrates.

b) Collected samples of sediments shall be processed to recover small invertebrate and vertebrate fossils. Recovered specimens shall be prepared so that they can be identified and permanently preserved.

c) Any specimens shall be identified, curated, and placed into a repository with permanent retrievable storage.

A report of findings, including an itemized inventory of recovered specimens, shall be prepared on completion of the steps outlined above. The report shall include a discussion of the significance of all recovered specimens. The report and inventory, when submitted to San Bernardino County, will signify completion of the program to mitigate impacts on paleontological resources.

81. In the event that Native American cultural resources are discovered during project development/construction, all work in the immediate vicinity of the discovery shall cease, and a qualified archaeologist who meets Secretary of the Interior standards shall assess the discovery. Work on the overall project may continue during this assessment period.

82. If significant Native American cultural resources are discovered for which a Treatment Plan must be prepared, contact Land Use Services for a list of Native

American tribes to be contacted. As of this date, the Morongo Band of Mission Indians and the San Manuel Band of Mission Indians shall be contacted. Additional tribes may be added to the list.

83. ***Geol-3.5.3*** *Omya shall prepare and submit periodic monitoring of the Western Drainage and Ruby Springs area to the County of San Bernardino. If the results of periodic monitoring of the Western Drainage and Ruby Springs area finds that sediments from the White Knob Quarry operation have caused a measurable impact on Ruby Springs, Omya shall prepare and submit for approval additional mitigation measures that may include (1) revision of the 2008 Sedimentation and Erosion Monitoring Technical Work Plan, and/or (2) remediation of the Western Drainage and/or Ruby Springs area. Any remediation efforts in the Western Drainage and/or Ruby Springs area will occur prior to proceeding with work on the ground. Omya shall obtain all necessary permits and pay all required fees and financial assurances, including, but not limited to, County of San Bernardino permits, BLM permits, California Department of Fish and Wildlife permits, and US Fish and Wildlife Service permits.*

Reporting of monitoring results shall be done at least once every two years and following any significant rain event that is equal to or exceeds the 10-year return period rainfall for the project site. Reports of monitoring activities, data, and findings shall be provided to the County of San Bernardino at least once every two years prior to the annual SMARA inspection. The first report shall be submitted within the year following the approval of the Amended Reclamation Plan. The monitoring shall be done in accordance with the 2008 Sedimentation and Erosion Monitoring Technical Work Plan (dated May 31, 2008) and any subsequent approved amendments.

84. ***Hydrol-3.7.1*** *The following mitigation measures shall be implemented in addition to requirements contained in the project's SWPPP and SPCC. All measures shall be subject to County of San Bernardino approval prior to implementation.*

a) Implement the recommendations for modifications of the project's haul road drainage and sediment control structures given in the September 12, 2013, Stantec technical memorandum and August 2011 Stantec report, White Knob Haul Road Drainage Study and Plan Development, to implement Sections 15, 16, and 17 of the April 20, 2011, Settlement Agreement between Omya and the Bureau of Land Management in sections:

- *2.3 Culvert Flow Calculations (EIR Appendix G, Stantec 2013, p.6);*
- *2.4 Culvert Riprap Calculations (EIR Appendix G, Stantec 2013, p. 7);*
- *3.1.2, Roadway Grading and Ditch Recommendations (EIR Appendix G, Stantec 2011, p. 3.3);*
- *3.2.2, Sediment Catchment Basins Recommendations(EIR Appendix G, Stantec 2011, p. 3.6); and*
- *4.0, Right-of-Way Recommendations (EIR Appendix G, Stantec 2011, p. 4.1).*

Inclusion of these improvements would ensure that no flow increases to

downstream flows during flood events.

b) All quarry areas, overburden fills, and haul roads shall be maintained to minimize erosion and sedimentation.

c) Sedimentation basins shall be inspected regularly, at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. Sediment shall be removed and basin function restored as needed.

d) Any sediment removed from basins shall be deposited on the overburden areas or into the White Knob Quarry sedimentation pond. Sediment placed on the overburden areas shall utilize temporary stormwater BMPs to prevent further sediment discharge and shall be revegetated in accordance with the 2013 Amended Reclamation Plan.

e) Basin spillways shall remain in good working condition and repaired as necessary.

f) Areas in haul roads that experience erosion shall be backfilled and rocked to minimize future erosion.

g) Overburden fill slopes and benches shall be inspected regularly, at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. If erosion or sedimentation is observed, temporary BMPs shall be utilized on overburden slopes and benches as soon as possible to minimize future erosion.

h) Areas of erosion or sediment deposition in overburden areas shall be permanently remediated as soon as possible, preferably before the next precipitation event. Remediated overburden slopes and benches shall be revegetated and/or armored in accordance with the 2013 Amended Reclamation Plan.

i) Haul road culverts and Arizona crossings shall be inspected regularly at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. Culverts and crossing shall be repaired and maintained to allow for proper passage of floodwaters.

j) If any of the haul road culverts are damaged or washed out, they shall be replaced with a culvert that provides a minimal capacity to pass a 20-year storm event without overtopping or excess erosion.

*k) The seven procedures that were implemented to minimize boulder roll-down shall continue for the life of the project. These procedures are identified in mitigation measure **AES 3.1.1**. Procedures shall be modified and/or additional measure put in place, as necessary, to achieve minimal boulder roll-down.*

PRIOR TO FINAL CLOSURE
The Following Conditions Shall Be Met

LAND USE SERVICES – Planning (909) 387-8311

85. Tributary Drainage Flows. Upon final reclamation, provisions shall be implemented to intercept and conduct off site tributary drainage flows around or through the site to minimize erosion in a manner which will not adversely affect adjacent or downstream properties and shall be maintained five (5) years following the termination date of operation.

86. Equipment. At the time of termination of the operation for any reason, all equipment associated with the operation shall be removed from the site, all hazards mitigated, and reclamation initiated within 90 days, as per the approved Reclamation Plan.

87. Exploratory Drilling. Any well, exploratory hole or test hole which is abandoned, out of service, or otherwise left unattended shall have a temporary cover over the well or opening which prevents the introduction of undesirable material into the well or hole, and ensures public and wildlife safety pursuant to California Health & Safety Code, Section 115700.

88. Access Roads. All access roads on site, which will not be retained for post-operation uses, shall be reclaimed at the conclusion of mining/hauling activities.

89. Site Re-Contour. The applicant/operator shall re-contour the site at the conclusion of operations. The site should resemble natural landforms where possible.

90. Reclamation Verification. Each area reclaimed shall be identified on a final map and labeled for identification. The final map shall be provided to Planning for review and approval.

CONCLUSION OF CONDITIONS

EXHIBIT D

Draft and Final Environmental Impact Report

COUNTY OF SAN BERNARDINO
WHITE KNOB/WHITE RIDGE LIMESTONE QUARRY EXPANSION
DRAFT ENVIRONMENTAL IMPACT REPORT

SCH No. 2013061020

Prepared for:

COUNTY OF SAN BERNARDINO
385 N ARROWHEAD AVE
SAN BERNARDINO, CA 92415

Prepared by:

6020 CORNERSTONE COURT WEST, SUITE 260
SAN DIEGO, CA 92121

OCTOBER 2014

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WHITE KNOB/WHITE RIDGE
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INTRODUCTION

The Draft Environmental Impact Report (DEIR) has been prepared in accordance with the California Environmental Quality Act (CEQA Statutes) (Public Resources Code Section 21000, et seq.) and the State Guidelines for implementation of CEQA (CEQA Guidelines) (Title 14, Chapter 3 of the California Code of Regulations (CCR), Section 15000, et seq.). The DEIR will be used by the County of San Bernardino (County) in its consideration of the potential environmental impacts associated with the implementation of the proposed Amended White Knob–White Ridge Mine and Reclamation Plan. The County is the lead agency and has the primary responsibility for preparing this Draft EIR.

This Draft EIR evaluates the potential impacts of the project in relation to the following categories:

- Aesthetics
- Air Quality
- Biological Resources
- Cultural and Paleontological Resources
- Geology and Soils
- Greenhouse Gas Emissions
- Hydrology and Water Quality
- Utilities and Service Systems

ES.1 PURPOSE AND SCOPE OF THE DRAFT EIR

CEQA requires the preparation of an EIR prior to approving any project that may have a significant effect on the environment. The County has determined that the proposed White Knob/White Ridge Limestone Quarries Expansion is a project under CEQA based on CEQA Guidelines Section 15378(a)(3) as follows:

> (a) "Project" means the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment, and that is any of the following:
>
> (3) An activity involving the issuance to a person of a lease, permit, license, certificate, or other entitlement for use by one or more public agencies.

The County of San Bernardino has determined that preparation of an EIR is the appropriate CEQA-required documentation due to the potential for significant environmental impacts that could result from implementation of the proposed project. This Draft EIR evaluates the existing environmental resources in the vicinity of the project site, analyzes potential impacts on those resources due to implementation of the proposed project, and if necessary, identifies mitigation measures that could avoid or reduce the magnitude of those impacts. This Draft EIR also evaluates reasonable alternatives to the proposed project.

ES.2 PROJECT CHARACTERISTICS

Omya Inc., proposed an Amended Mine and Reclamation Plan (Amended Plan or proposed project) for expansion of the existing White Knob/White Ridge Limestone Quarries, a limestone mining operation located in the San Bernardino Mountains in southwestern San Bernardino County. The Amended Plan would increase the operational years of the quarry by 24 years from the existing permit expiration date of 2031 to the year 2055.

The Amended Plan includes approximately 375.1 acres, consisting of approximately 335.1 acres of existing or planned surface mining operation–related disturbance and approximately 40 acres of existing BLM haul road right-of-way. This 375.1-acre area comprises the "project site" for this EIR. The primary areas to be reclaimed are the existing White Knob Quarry and White Knob Annex Quarry, the approved White Ridge Quarry, the existing Overburden Site #1 and proposed Overburden Sites #2 and #3, and the ancillary disturbance areas, which include haul/access roads, sediment basins, storage pads, crusher location, west slope impact area, and boulder roll-down area.

The proposed project is designed to make the reclaimed lands suitable for future open space uses and wildlife habitat. It includes site-specific activities to satisfy the reclamation requirements of the Surface Mining and Reclamation Act of 1975, as amended, and its implementing regulations (collectively, SMARA) as well as the County's surface mining and land reclamation ordinance (San Bernardino County Code Section 88.03.000). A lead-agency-approved reclamation plan is required for all surface mining operations in the state that are subject to SMARA. The County has primary discretionary authority over the proposed project and serves as the lead agency responsible under CEQA and SMARA. If approved, the proposed project would not preclude future permitting of extraction and reclamation activities within or beyond the project site. Any such future proposal would require authorization from the County and compliance with CEQA.

ES.3 KNOWN TRUSTEE AND RESPONSIBLE AGENCIES

For the purpose of CEQA, the term "trustee agency" means a state agency having jurisdiction by law over natural resources affected by a project which are held in trust for the people of the State of California. Specifically, the following trustee agencies may have an interest in the proposed White Knob/White Ridge Limestone Quarries Expansion project:

- California Department of Fish and Wildlife
- California Department of Forestry and Fire Protection (Cal Fire)

In CEQA, the term "responsible agency" includes all public agencies other than the lead agency that may have discretionary actions associated with the implementation of the proposed White Knob/White Ridge Limestone Quarries Expansion project. The following agencies have been identified as responsible agencies for the proposed project:

- California Office of Mine Reclamation
- California Department of Fish and Wildlife
- U.S. Bureau of Land Management
- Mojave Desert Air Quality Management District
- Colorado River Water Quality Control Board
- U.S. Army Corp of Engineers

ES.4 PROJECT ALTERNATIVES SUMMARY

California Environmental Quality Act (CEQA) Guidelines Section 15126.6(a) states that an environmental impact report (EIR) shall describe and analyze a range of reasonable alternatives to a project. These alternatives should feasibly attain most of the basic objectives of the project, while avoiding or substantially lessening one or more of the significant environmental impacts of the project. An EIR need not consider every conceivable alternative to a project, nor is it required to consider alternatives that are infeasible. The discussion of alternatives shall focus on those which are capable of avoiding or substantially lessening any significant effects of the project, even if they impede the attainment of the project objectives to some degree or would be more costly [CEQA Guidelines Section 15126.6(b)]. The Draft EIR considers the following alternatives:

- **Alternative 1 – No Project Alternative:** This alternative would retain the approved 1986 White Knob-White Ridge Limestone Mine Site Approval and Reclamation Plan. The 1986 Plan has an expiration date of December 31, 2031. The approved quarry site consists of 145 acres of mining facilities within 357.5 acres of patented fee land, portions of which are leased and owned by Omya.

  Additionally, as with the proposed project, Alternative 1 would include proposed changes to the existing haul road to the White Knob/White Ridge Quarries from the processing plant. This road is approximately 5.1 miles long; the first 4.4 miles of the haul road crosses land managed by the BLM. Use of the haul road on 67 acres was authorized under a Federal Land Policy Management Act (FLPMA) right-of-way (CACA 16644) approved by the BLM Barstow Resource Office in July 1988.

- **Alternative 2 – Elimination of OB-2:** Under Alternative 2, Overburden Site 2 (OB-2) would be eliminated from the project. This alternative would remove the impacts on the wetland features in this area. The overburden that would have been placed in this 13-acre site would be placed in OB-1 or OB-3, increasing the size and height of these areas. The elimination of OB-2 would also result in the reduction in size of the project area from 335.1 acres to 322.1 acres. The proposed project lists a total size of OB-1 as 31.9 acres and OB-3 of 3.0 acres. Assuming the overburden from OB-2 would be absorbed into OB-1 and OB-3 using the same proportional size, OB-1 is approximately 10.6 times the size of OB-3, OB-1 would increase to 43.7 acres and OB-3 to 4.3 acres in size. Additionally, changes to these overburden sites would also have to be incorporated in the proposed project, such as additional sedimentation basins or other drainage features and the re-contouring of OB-1 and OB-3 to accommodate the additional overburden, as well as the realignment of the on-site haul road to reach the White Ridge Quarry.

- **Alternative 3 – Backfill Central White Knob and Annex Quarries Alternative:** Alternative 3 would include the backfilling of the White Knob and Annex Quarries. This would be similar to the proposed project except that upon reclamation, the OB-1 overburden storage area and central portions of the White Knob and Annex Quarries would be much higher because material placed in the White Ridge Quarry would now be placed in the White Knob and Annex Quarries. This would require that the final backfill elevation of OB-1 and the White Knob and Annex Quarries be raised to accommodate the additional fill, depending on slope stability. Under the proposed project, design of overburden fill slopes in all three disposal areas was found to have adequate slope stability; however, Alternative 3 would remove the fill in OB-3, the upper portions of OB-2, and some portion of the toe of OB-1, thereby reducing the potential for the mining-related fill slopes to fail or otherwise become unstable and reducing the area of disturbance in the central and eastern

drainages. The amount of fill that can be placed in each quarry would be restricted by the stability of the final fill, i.e., the slope angle and height. Overburden that could not be placed in the White Knob and Annex Quarries would continue to be placed in OB-1.

The height of the backfill at OB-2 would be reduced, leaving more of the drainage in a natural condition. However, additional drainage control structures would likely be needed to collect and control the additional runoff because the project's White Knob sedimentation basin would not be constructed and the Annex Quarry would no longer capture quarry rainfall. The drainage east of the White Ridge Quarry would not be filled with OB-3, and the need for drainage control structures in that area would be decreased or eliminated.

ES.5 ENVIRONMENTAL EFFECTS DETERMINED NOT TO BE SIGNIFICANT

CEQA Guidelines Section 15128 requires an EIR to briefly describe any possible significant effects that were determined not to be significant and were therefore not discussed in detail in the EIR. The Initial Study (**EIR Appendix A**) indicated that the following resource areas would experience less than significant impacts or would experience no impact as a result of the proposed project. Section 3.9 of this Draft EIR includes all impact areas that were determined to have no impact or a less than significant impact in the Initial Study. The following subject areas will not be addressed further in this EIR:

- Agricultural and Forestry Resources
- Hazards and Hazardous Materials
- Land Use and Planning
- Mineral Resources
- Noise
- Population and Housing
- Public Services
- Recreation
- Transportation and Traffic

While the Draft EIR discusses impacts related to eight subject areas, the Initial Study also determined that some of the standards of significance for those areas resulted in no impact or a less than significant impact. These standards of significance will not be discussed further in this Draft EIR and are listed below:

Aesthetics: damage scenic resources within a state scenic highway; create light and glare

Air Quality: create objectionable odors affecting a substantial number of people

Geology and Soils: expansive soils; soils incapable of adequately supporting septic tanks or wastewater disposal systems

Hydrology and Water Quality: violate water quality standards or waste discharge requirements; deplete groundwater supplies and interfere with recharge; place housing within a flood hazard area or impede or redirect flood flows; create a public hazard related to flooding from dam or levee failure; create a public hazard related to inundation by seiche, tsunami, or mudflow

Utilities and Service Systems: exceed wastewater treatment requirements; require new or expanded water or wastewater treatment facilities; exceed capacity of wastewater treatment provider; exceed permitted capacity of landfill or conflict with solid waste regulations

ES.6 UNAVOIDABLE SIGNIFICANT IMPACTS AND CUMULATIVELY CONSIDERABLE IMPACTS

The Draft EIR addresses all potentially significant environmental impacts that the County identified during preparation of the NOP/IS and the scoping process. After further study and environmental review, as presented in the Draft EIR, the following environmental impacts were determined to be significant and unavoidable impacts and/or cumulatively considerable impacts:

Aesthetics: substantial adverse effect on a scenic vista and the existing visual character; cumulative impacts on aesthetics and visual resources

ES.7 ISSUES TO BE RESOLVED AND AREAS OF CONTROVERSY

Section 1.7 of Chapter 1.0, Introduction, provides a list of comments from agencies and/or persons responding to the Notice of Preparation. Comments received included requirements regarding Incidental Take Permits and Notification of Lake or Streambed Alternation as well as the EIR's responsibility in identifying biological resources on the project site. Other comments received included mitigation of recovered artifacts and the potential inadvertent boulder roll-down. The Draft EIR addresses these comments, as well as others, as a part of the individual section analysis. See Section 1.7 for a complete list of comments and commenters regarding the proposed project.

ES.8 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Table ES-1 provides a summary of project impacts and mitigation measures identified in the Draft EIR.

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TABLE ES-1
EXECUTIVE SUMMARY

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
Aesthetics			
Impact 3.1.1 Substantial Adverse Effect on a Scenic Vista and the Existing Visual Character	Significant and unavoidable	**MM 3.1.1** The Amended Plan includes design features and reclamation activities that would reduce visual impacts. These measures are incorporated into this DEIR in order to ensure compliance. These measures include the following: • Implement measures to minimize boulder roll-down visual impacts including: o Precision drilling and buffer blasting when the outside edge is approached. o Drilling lifters on the edge to undercut the remaining slope and let it fall into the pit (like directional falling of a tree). o Excavator to pull down and pull in toward the pit blasted rock away from the edge. o Use of alternatives to blasting along the outside such as rock breakers, surface miners, cutting heads, and excavators. o Loader to pull back material from the edge. o Loader to dig at an angle to the edge or parallel to the edge when possible. o Manually scaling boulders from the high walls where they may be above a haulage road. • Maintain the existing crusher site at the White Knob Quarry or use a portable plant within an active quarry to reduce its visibility from Lucerne Valley. • Deposit waste rock within the White Knob Quarry footprint, as described in the Amended Plan, to reduce the area of disturbance for overburden stockpiles and visual impact outside the quarry. • Design and phase mining of the White Ridge Quarry, which allows for concurrent reclamation and leaves an approximately	Significant and unavoidable

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		300-foot-high ridge of undisturbed hillside facing Lucerne Valley to minimize visual impacts. • Implement reclamation and revegetation on completed equipment-accessible quarry benches and on overburden stockpiles concurrent with mining where feasible. • Utilize color-staining product to darken the visible quarry and roll-down slopes where not subject to raveling to reduce visual impacts. • Deposit darker waste rock on overburden sites where available to reduce color contrast. • Design adequate erosion control features along the haul and access roads and quarry to control and limit erosion and sediment transport for a 20-year, one-hour duration storm event. • Where feasible, construct catchment berms at the foot of stockpiles to reduce rock roll-down and sediment flow. • Limit surface disturbances to areas identified in the Amended Plan. • Implement appropriate dust controls to reduce visible dust.	
Impact 4.0.1 Cumulative Impacts on Aesthetics and Visual Resources	Cumulatively considerable and significant and unavoidable	None available	Cumulatively considerable and significant and unavoidable
Air Quality			
Impact 3.2.1 Emissions of Air Pollutants Resulting in Violation of Air Quality Standards or Contributing to Existing Violations	Potentially sigificant	**MM 3.2.1** It shall be required in the final Amended Mine and Reclamation Plan that the following PM10 reduction measures be implemented as part of quarry operations and reclamation. • Limit maximum speed on unpaved roads to 25 miles per hour. • Water unpaved roads at least twice per day, more if needed to control dust emissions by at least 80 percent. Alternatively, a dust palliative, such as magnesium chloride, may be used to treat the unpaved roads. • Water all areas to be graded and areas where bulldozers operate at least twice per day, more if needed, to control dust emissions.	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
Impact 3.2.2 Conflict with MDAQMD Air Quality Management Plans	Less than significant	None required	Less than significant
Impact 3.2.3 Conflict with Federal Land Managers' Air Quality Related Values	Less than significant	None required	Less than significant
Impact 3.2.4 Exposure of Sensitive Receptors to Localized Criteria Pollutants	Potentially significant	Implement mitigation measure **MM 3.2.1.**	Less than significant
Impact 3.2.5 Exposure of Sensitive Receptors to Toxic Air Contaminant Pollutant Concentrations	Less than significant	None required	Less than significant
Impact 4.0.2 Cumulative Impacts on Air Quality	Less than cumulatively considerable	None required	Less than cumulatively considerable
Biological Resources			
Impact 3.3.1 through **Impact 3.3.10** Impacts on Candidate, Sensitive, or Special-Status Species	Potentially significant	**MM 3.3.1a** The mine operator shall retain a qualified biologist to conduct mandatory contractor/worker awareness training for project personnel. The awareness training will be provided to all personnel to brief them on the identified location of sensitive biological resources, including how to identify species (visual and auditory) most likely to be present, the need to avoid impacts on biological resources (e.g., plants, wildlife, and jurisdictional waters), and to brief them on the penalties for not complying with biological mitigation requirements. If new personnel are added to the project, the mine operator will ensure that they receive the mandatory training before starting work. **MM 3.3.1b** The mine operator shall designate a field contact representative (FCR) responsible for overseeing compliance with protections to special-status species. The FCR shall be on-site during all project activities that could potentially cause significant impacts on sensitive biological resources. The FCR shall have the authority to halt activities that are in violation of the committed measures and non-emergency project-related activities that may endanger special-status species. The FCR shall authorize re-initiation of project activities after the hazards are removed, the species is no longer at risk, or the individual(s) are moved out of harm's way by the qualified biologist.	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		MM 3.3.1c Project-related vehicles will stay on roads and observe a 25 mile per hour speed limit in all project areas, except on county roads and state and federal highways. **MM 3.3.1d** Project-related vehicles shall be checked before moving for wildlife, as wildlife may seek shade and shelter under parked vehicles and construction equipment. **MM 3.3.1e** All construction pipes, culverts, or similar structures that are stored on the project site for one or more nights shall be inspected thoroughly for the presence of wildlife before they are used or moved. If wildlife is present, they shall be allowed to move out of the area on their own or moved out of harm's way by a qualified biologist. **MM 3.3.1f** Encounters with a special-status wildlife species shall be reported to the FCR and qualified biologist. The qualified biologist shall maintain records of all encounters during the project, the species' condition, location found, and location released. **MM 3.3.1g** All food-related trash items such as food wrappers, cans, bottles, and food scraps shall be disposed of in secured, closed containers and removed regularly from the project site. **MM 3.3.1h** Fueling of vehicles and equipment shall be prohibited within 100 feet of riparian/riverine areas. **MM 3.3.1i** No rodenticides shall be used on the project site.	
Impact 3.3.2 Special-Status Plant Species	Potentially significant	**MM 3.3.2 Rare Plant Surveys.** Prior to initiating project-related activities in the undisturbed portions of the site, the mine operator shall retain a qualified biologist to perform focused surveys to determine the presence/absence of special-status plant species with potential to occur in and adjacent to (within 25 feet, where appropriate) the proposed impact area. Species intended to be addressed by this mitigation measure include all species not covered by the CHMS and for which a "may affect" determination was made in Table 3.3-1. These surveys shall be conducted in accordance with the CDFW *Guidelines for Assessing Effects of Proposed Developments on Rare Plants and Plant Communities* (Nelson 1994). These guidelines require that rare plant surveys be conducted at the proper time of	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		year when rare or endangered species are both evident and identifiable. Field surveys shall be scheduled to coincide with known flowering periods and/or during appropriate developmental periods that are necessary to identify the plant species of concern. If any state- or federally listed, CNPS List 1, or CNPS List 2 plant species are found in or adjacent to (within 25 feet) the proposed impact area during the surveys, these plant species shall be avoided to the extent possible and the following mitigation measures shall be implemented: (1) In some cases involving state-listed plants, it may be necessary to obtain an incidental take permit under Section 2081 of the Fish and Game Code (2081 permit). The mine operator shall consult with the CDFW to determine whether a 2081 permit is required and obtain all required authorizations prior to initiation of ground-breaking activities. (2) Before the approval of grading plans or any ground-breaking activity within the PSA, the mine operator shall submit a mitigation plan concurrently to the CDFW and the USFWS (if appropriate) for review and comment. The plan shall include mitigation measures for the population(s) to be directly affected. Possible mitigation for impacts on special-status plant species can include implementation of a program to transplant, salvage, cultivate, or re-establish the species at suitable sites (if feasible) or through the purchase of credits from an approved mitigation bank, if available. The actual level of mitigation may vary depending on the sensitivity of the species, its prevalence in the area, and the current state of knowledge about overall population trends and threats to its survival. The final mitigation strategy for directly impacted plant species shall be determined by the CDFW and the USFWS (if appropriate) through the mitigation plan approval process. (3) Any special-status plant species that are identified 25-feet of the proposed impact area, but not proposed to be disturbed by the project, shall be protected by barrier fencing to ensure that construction activities and material stockpiles do not impact any special-status plant species. These avoidance areas shall be identified on project plans.	

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
Impact 3.3.3 Desert Tortoise	Potentially significant	**MM 3.3.3a Desert Tortoise Surveys**. Prior to implementation of project-related activities, the mine operator shall retain a USFWS-authorized desert tortoise biologist to conduct pre-project surveys in accordance with the USFWS pre-project field survey protocol (2010). If no desert tortoises are identified during pre-project surveys, no further mitigation is required. If individuals or their sign are identified during pre-project surveys, mitigation measure **MM 3.3.3b** shall be implemented. **MM 3.3.3b Desert Tortoise Avoidance, Minimization, and Mitigation.** Should occupied desert tortoise habitat be identified during the pre-project surveys, a biological mitigation and monitoring plan shall be developed in consultation with the USFWS and the CDFW. This plan shall describe all measures to be implemented prior to, during, and after construction, including, but not limited to, the following. (1) All tortoise burrows shall be avoided to the greatest extent feasible, and temporary exclusionary tortoise fencing (1x2-inch mesh hardware cloth) shall be installed at the limits of disturbance prior to initiation of construction activities. Fence installation and ongoing oversight of the need for maintenance shall be monitored by a USFWS-authorized desert tortoise biologist. (2) Upon completion of fence installation, the authorized biologist shall conduct a clearance survey of the fenced area prior to declaring the construction area free of tortoises. (3) If it is necessary to excavate a desert tortoise from its burrow to move it out of harm's way, excavation shall be done with hand tools, either by or under the direct supervision of the authorized biologist. (4) Desert tortoises removed from burrows shall be placed in an unoccupied burrow of approximately the same size as the one from which they were removed. If an existing burrow is not available, the authorized biologist shall construct one. (5) Desert tortoises moved during inactive periods will be monitored for at least two days after relocation or the end of construction, whichever occurs first.	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		(6) If desert tortoises need to be moved at a time of day when ambient temperatures could harm them (less than 40 degrees and over 90 degrees Fahrenheit), they shall be held overnight in a clean cardboard box and released the following day during more favorable temperatures. Cardboard boxes used to hold tortoises shall only be used once. (7) All handling of desert tortoises shall be performed consistent with the *Guidelines for Handling Desert Tortoises During Construction Project* (Desert Tortoise Council 1994). (8) The mine operator shall mitigate for impacts on occupied desert tortoise habitat through the purchase of credits from a mitigation bank. The amount of credits purchased and the location of the mitigation bank used shall be established through consultation with and approval by the USFWS and the CDFW. The mine operator shall provide the County with evidence that the permit and/or other requirements established by either agency have been satisfactorily met.	
Impact 3.3.4 Coast Horned Lizard	Potentially significant	**MM 3.3.4 Coast Horned Lizard Surveys.** Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine if suitable habitat for this species occurs within 250 feet of the proposed impact area. If suitable habitat exists, preconstruction surveys must be performed by a qualified biologist in a manner to maximize detection of coast horned lizards (i.e., during warm weather, walking slowly). If any lizards are discovered within the work areas, they shall be actively moved or passively encouraged to leave the work area.	Less than significant
Impact 3.3.5 Burrowing Owl	Potentially significant	**MM 3.3.5 Burrowing Owl Surveys.** If clearing and construction activities will occur during the nesting period for burrowing owls (February 1–August 31), the mine operator shall retain a qualified biologist to determine if suitable nesting habitat occurs within 500 feet of the proposed impact area. If suitable habitat exists, focused surveys must be performed by a qualified biologist in accordance with the CDFW's *Staff Report on Burrowing Owl Mitigation,* published March 7, 2012. Surveys shall be repeated if project activities are suspended or delayed for more than 15 days during	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		nesting season. If no burrowing owls are detected, no further mitigation is required. If active burrowing owl nest sites are detected, the mine operator shall implement the avoidance, minimization, and mitigation methodologies outlined in the CDFW's *Staff Report on Burrowing Owl Mitigation* prior to initiating project-related activities that may impact burrowing owls.	
Impact 3.3.6 Le Conte's Thrasher and other Migratory Birds	Potentially significant	**MM 3.3.6 Migratory Bird Surveys.** If clearing and/or construction activities will occur during the migratory bird nesting season (March 15–August 15), preconstruction surveys to identify active migratory bird nests shall be conducted by a qualified biologist within 14 days of construction initiation. Focused surveys must be performed by a qualified biologist for the purposes of determining the presence/absence of active nest sites within the proposed impact area and a 200-foot buffer (if feasible). If active nest sites are identified within 200 feet of project activities, the mine operator shall impose a limited operating period (LOP) for all active nest sites prior to commencement of any project construction activities to avoid construction or access-related disturbances to migratory bird nesting activities. An LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, and construction) will not occur and will be imposed within 100 feet of any active nest sites until the nest is deemed inactive. Activities permitted within and the size (i.e., 100 feet) of LOPs may be adjusted through consultation with the CDFW and/or the County.	Less than significant
Impact 3.3.7 Golden Eagle and Other Raptors	Potentially significant	**MM 3.3.7 Raptor Conservation Strategy.** The applicant shall participate in and implement the Raptor Conservation Strategy.	Less than significant
Impact 3.3.8 Mule Deer and Bighorn Sheep	Less than significant	None required	Less than significant
Impact 3.3.9 Special-Status Bats	Potentially significant	**MM 3.3.9 Bat Surveys.** Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine whether potential roosting sites for special-status bats may be affected. If potential roost sites are	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		identified, a preconstruction survey by a qualified biologist shall be conducted prior to the end of April to determine the presence or absence of roosting bats. If the survey does not identify the present of occupied roosts, no further mitigation is required. If day roosts or maternity roosts occupied by special-status bat species are documented within construction areas, the bats shall be safely flushed from the sites where roosting habitat is planned to be removed prior to May of each construction phase (maternity roosts are generally occupied from May to August) and prior to the onset of construction activities. The removal of the roosting sites shall occur during the time of day when the roost is unoccupied. The loss of each roost will be compensated for by the construction and installation of two bat boxes suitable to the bat species and colony size excluded from the original roosting site. The bat boxes shall be installed in the vicinity prior to removal of the original day/maternity roost sites. A detailed program for bat flushing, roosting site removal, and installation of bat boxes shall be developed in consultation with a qualified biologist.	
Impact 3.3.10 Pallid San Diego Pocket Mouse	Potentially significant	**MM 3.3.10 Pallid San Diego Pocket Mouse Surveys.** Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine if suitable habitat for this species occurs within 250 feet of the proposed impact area. If suitable habitat exists, preconstruction surveys must be performed by a qualified biologist in a manner to maximize detection of pallid San Diego pocket mice. If any mice are discovered within the work areas, they shall be actively moved or passively encouraged to leave the work area.	Less than significant
Impact 3.3.11 Impacts on Riparian Habitat or Sensitive Natural Communities	Potentially significant	**MM 3.3.11 No Net Loss of Riparian Vegetation.** The mine operator shall ensure that there is no net loss of riparian vegetation. Mitigation can include on-site restoration or purchase of mitigation credits at a USACE-approved mitigation bank, placing a conservation easement over a riparian area, or quit claiming mineral claims over a riparian area. Mitigation as required in regulatory permits issued through the CDFW, the USACE, or the RWQCB shall be applied to satisfy this measure. Evidence of compliance with this mitigation measure shall be	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		provided prior to construction and grading activities for the proposed project that will affect riparian habitat.	
Impact 3.3.12 Impacts on Federally Protected Wetlands	No impact	None required	No impact
Impact 3.3.13 Impacts on Wildlife Movement	Less than significant	None required	Less than significant
Impact 3.3.14 Conflict with Local Policies and Ordinances	No impact	None required	No impact
Impact 3.3.15 Conflict with Conservation Plans	Less than significant	None required	Less than significant
Impact 4.0.3 Cumulative Impacts on Biological Resources	Cumulatively considerable	Implement mitigation measures **MM 3.3.1a** through **MM 3.3.1i, MM 3.3.2, MM 3.3.3a** and **MM 3.3.3b, MM 3.3.4, MM 3.3.5, MM 3.3.6, MM 3.3.9,** and **MM 3.3.10**.	Less than cumulatively considerable
Cultural and Paleontological Resources			
Impact 3.4.1 Substantial Adverse Impact on an Archaeological or Historical Resource	Potentially significant	**MM 3.4.1** It shall be required in the final Amended Mine and Reclamation Plan, that if, during the course of construction, mining, or reclamation activities previously unknown cultural resources (i.e., prehistoric or historic sites) are discovered, work shall be halted immediately within 50 feet of the discovery, the San Bernardino County Land Use Services Department shall be notified, and a professional archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards in prehistoric or historical archaeology shall be retained to determine the significance of the discovery. Determination of impacts, significance, and mitigation that protects the discovered resource shall be made by a qualified archaeologist in consultation with recognized local Native American groups, if appropriate. The San Bernardino County Museum shall also be contacted for review of the archaeological find(s). In addition, prior to the commencement of project excavations, all construction and mining personnel shall be informed of the potential to inadvertently uncover cultural resources and the procedures to follow subsequent to an inadvertent discovery of cultural resources.	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
Impact 3.4.2 Disturb Human Remains	Less than significant	None required	Less than sigificant
Impact 3.4.3 Destroy a Unique Paleontological Resource or Geologic Feature	Potentially significant	**MM 3.4.3** If non-metamorphosed fossiliferous limestones are encountered during mining activities, they shall be removed and retained for examination by a qualified paleontologist. If any fossil-bearing materials are encountered, a program to protect and preserve such resources that might be exposed or unearthed shall be developed in cooperation with the project applicant and San Bernardino County. The program shall be developed in accordance with the proposed guidelines of the Society of Vertebrate Paleontology and shall include, but not be limited to, the following: • All non-metamorphosed fossiliferous limestones that are encountered during mining shall be stockpiled for examination by a qualified paleontologist. The monitor shall be prepared to quickly salvage any fossils that might be present. The monitor should also remove samples of sediments that are likely to contain the remains of small fossil vertebrates and invertebrates. • Collected samples of sediments shall be processed to recover small invertebrate and vertebrate fossils. Recovered specimens shall be prepared so that they can be identified and permanently preserved. • Any specimens shall be identified, curated, and placed into a repository with permanent retrievable storage. • A report of findings, including an itemized inventory of recovered specimens, shall be prepared on completion of the steps outlined above. The report shall include a discussion of the significance of all recovered specimens. The report and inventory, when submitted to San Bernardino County, will signify completion of the program to mitigate impacts on paleontological resources.	Less than sigificant
Impact 4.0.4 Cumulative Impacts on Cultural Resources	Less than cumulatively considerable	None required	Less than cumulatively considerable

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
Geology and Soils			
Impact 3.5.1 Exposure of People or Structures to Potential Substantial Adverse Seismic Effects	Less than significant	None required	Less than significant
Impact 3.5.2 Slope Stability	Less than significant	None required	Less than significant
Impact 3.5.3 Rock and Soil Talus Erosion	Potentially significant	**MM 3.5.3** Omya shall prepare and submit periodic monitoring of the Western Drainage and Ruby Springs area to the County of San Bernardino. If the results of periodic monitoring of the Western Drainage and Ruby Springs area finds that sediments from the White Knob Quarry operation have caused a measurable impact on Ruby Springs, Omya shall prepare and submit for approval additional mitigation measures that may include (1) revision of the 2008 Sedimentation and Erosion Monitoring Technical Work Plan, and/or (2) remediation of the Western Drainage and/or Ruby Springs area. Any remediation efforts in the Western Drainage and/or Ruby Springs area will occur prior to proceeding with work on the ground. Omya shall obtain all necessary permits and pay all required fees and financial assurances, including, but not limited to, County of San Bernardino permits, BLM permits, California Department of Fish and Wildlife permits, and US Fish and Wildlife Service permits. Reporting of monitoring results shall be done at least once every two years and following any significant rain event that is equal to or exceeds the 10-year return period rainfall for the project site. Reports of monitoring activities, data, and findings shall be provided to the County of San Bernardino at least once every two years prior to the annual SMARA inspection. The first report shall be submitted within the year following the approval of the Amended Reclamation Plan. The monitoring shall be done in accordance with the 2008 Sedimentation and Erosion Monitoring Technical Work Plan (dated May 31, 2008) and any subsequent approved amendments.	Less than significant
Impact 3.5.4 Erosion and Soil Loss	Less than significant	None required	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
Impact 4.0.5 Cumulative Impacts on Geology and Soils	Less than cumulatively considerable	None required	Less than cumulatively considerable
Greenhouse Gas Emissions			
Impact 3.6.1 Impact on the Environment	Less than cumulatively considerable	None required	Less than significant
Impact 3.6.2 and **Impact 4.0.6** Conflict with an Applicable Plan, Policy, or Regulation Adopted for the Purpose of Reducing the Emissions of Greenhouse Gases	Less than cumulatively considerable	None required	Less than cumulatively considerable
Hydrology and Water Quality			
Impact 3.7.1 Substantially Alter Drainage Pattern	Potentially significant	**MM 3.7.1** The following mitigation measures shall be implemented in addition to requirements contained in the project's SWPPP and SPCC. All measures shall be subject to County of San Bernardino approval prior to implementation. a. Implement the recommendations for modifications of the project's haul road drainage and sediment control structures given in the September 12, 2013, Stantec technical memorandum and August 2011 Stantec report, White Knob Haul Road Drainage Study and Plan Development, to implement Sections 15, 16, and 17 of the April 20, 2011, Settlement Agreement between Omya and the Bureau of Land Management in sections: o 2.3 Culvert Flow Calculations (EIR Appendix G, Stantec 2013, p.6); o 2.4 Culvert Riprap Calculations (EIR Appendix G, Stantec 2013, p. 7); o 3.1.2, Roadway Grading and Ditch Recommendations (EIR Appendix G, Stantec 2011, p. 3.3); o 3.2.2, Sediment Catchment Basins Recommendations(EIR Appendix G, Stantec 2011, p. 3.6); and	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		o 4.0, Right-of-Way Recommendations (EIR Appendix G, Stantec 2011, p. 4.1). Inclusion of these improvements would ensure that no flow increases to downstream flows during flood events. b. All quarry areas, overburden fills, and haul roads shall be maintained to minimize erosion and sedimentation. c. Sedimentation basins shall be inspected regularly, at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. Sediment shall be removed and basin function restored as needed. d. Any sediment removed from basins shall be deposited on the overburden areas or into the White Knob Quarry sedimentation pond. Sediment placed on the overburden areas shall utilize temporary stormwater BMPs to prevent further sediment discharge and shall be revegetated in accordance with the 2013 Amended Reclamation Plan. e. Basin spillways shall remain in good working condition and repaired as necessary. f. Areas in haul roads that experience erosion shall be backfilled and rocked to minimize future erosion. g. Overburden fill slopes and benches shall be inspected regularly, at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. If erosion or sedimentation is observed, temporary BMPs shall be utilized on overburden slopes and benches as soon as possible to minimize future erosion. h. Areas of erosion or sediment deposition in overburden areas shall be permanently remediated as soon as possible, preferably before the next precipitation event. Remediated overburden slopes and benches shall be revegetated and/or armored in accordance with the 2013 Amended Reclamation Plan. i. Haul road culverts and Arizona crossings shall be inspected regularly at least once every 30 days during the rainy season,	

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. Culverts and crossing shall be repaired and maintained to allow for proper passage of floodwaters. j. If any of the haul road culverts are damaged or washed out, they shall be replaced with a culvert that provides a minimal capacity to pass a 20-year storm event without overtopping or excess erosion. k. The seven procedures that were implemented to minimize boulder roll-down shall continue for the life of the project. These procedures are identified in mitigation measure **MM 3.1.1**. Procedures shall be modified and/or additional measure put in place, as necessary, to achieve minimal boulder roll-down.	
Impact 4.0.7 Cumulative Impacts on Hydrology and Water Quality	Less than cumulatively considerable	None required	Less than cumulatively considerable
Utilities and Service Systems			
Impact 3.8.1.1 Construction of New Stormwater Drainage Infrastructure	Less than significant	None required	Less than significant
Impact 3.8.2.1 Adequate Water Supply	Less than significant	None required	Less than significant
Impact 4.0.8 Cumulative Impacts on Public Services and Utilities	Less than cumulatively considerable	None required	Less than cumulatively considerable

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This Draft Environmental Impact Report (Draft EIR or DEIR) was prepared in accordance with and in fulfillment of the California Environmental Quality Act (CEQA; Public Resources Code Sections 21000 et seq.) and the CEQA Guidelines (California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000 et seq.). As described in the CEQA Guidelines Section 15121(a), an environmental impact report (EIR) is a public informational document that assesses the potentially significant environmental impacts of a project. CEQA requires that an EIR be prepared by the agency with primary responsibility over the approval of a project (the lead agency). The County of San Bernardino (County) is the lead agency for the proposed White Knob/White Ridge Limestone Quarries Expansion project. Public agencies are charged with the duty to consider and minimize environmental impacts of proposed development where feasible and have the obligation to balance economic, environmental, and social factors.

1.1 PURPOSE OF THE EIR

CEQA requires the preparation of an EIR prior to approving any project that may have a significant effect on the environment. The County has determined that the proposed White Knob/White Ridge Limestone Quarries Expansion is a project under CEQA based on CEQA Guidelines Section 15378(a)(3) as follows:

> (a) "Project" means the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment, and that is any of the following:
>
> (3) An activity involving the issuance to a person of a lease, permit, license, certificate, or other entitlement for use by one or more public agencies.

The County of San Bernardino has determined that preparation of an EIR is the appropriate CEQA-required documentation due to the potential for significant environmental impacts that could result from implementation of the proposed project. This Draft EIR evaluates the existing environmental resources in the vicinity of the project site, analyzes potential impacts on those resources due to implementation of the proposed project, and if necessary, identifies mitigation measures that could avoid or reduce the magnitude of those impacts. This Draft EIR also evaluates reasonable alternatives to the proposed project.

1.2 KNOWN TRUSTEE AND RESPONSIBLE AGENCIES

For the purpose of CEQA, the term "trustee agency" means a state agency having jurisdiction by law over natural resources affected by a project which are held in trust for the people of the State of California. Specifically, the following trustee agencies may have an interest in the proposed White Knob/White Ridge Limestone Quarries Expansion project:

- California Department of Fish and Wildlife
- California Department of Forestry and Fire Protection (Cal Fire)

In CEQA, the term "responsible agency" includes all public agencies other than the lead agency that may have discretionary actions associated with the implementation of the proposed White Knob/White Ridge Limestone Quarries Expansion project. The following agencies have been identified as responsible agencies for the proposed project:

- California Department of Conservation, Office of Mine Reclamation
- California Department of Fish and Wildlife

- U.S. Bureau of Land Management
- Mojave Desert Air Quality Management District
- Colorado River Basin Regional Water Quality Control Board
- U.S. Army Corp of Engineers
- U.S. Fish and Wildlife Service

1.3 TYPE OF DOCUMENT

The CEQA Guidelines identify several types of EIRs, each applicable to different project circumstances. This EIR serves as a "project EIR." According to the CEQA Guidelines (Section 15161), a project EIR is "the most common type of EIR" that "examines the environmental impacts of a specific development project. This type of EIR should focus primarily on the changes in the environment that would result from the development project." This type of EIR "shall examine all phases of the project including planning, construction, and operation."

1.4 ORGANIZATION AND SCOPE

Sections 15122 through 15132 of the CEQA Guidelines identify content requirements for Draft and Final EIRs. An EIR must include a description of the environmental setting, an environmental impact analysis, mitigation measures, alternatives, significant irreversible environmental changes, growth-inducing impacts, and cumulative impacts. The environmental issues addressed in this Draft EIR were established through review of environmental documentation developed for the project, environmental documentation for nearby projects, and public agency responses to the Notice of Preparation (NOP). This Draft EIR is organized in the following sections:

CHAPTER ES – EXECUTIVE SUMMARY

This section provides a project narrative and identifies environmental impacts and mitigation measures through a summary matrix consistent with CEQA Guidelines Section 15123.

CHAPTER1.0 – INTRODUCTION

This section provides an overview that describes the intended use of the EIR, as well as the review and certification process.

CHAPTER 2.0 – PROJECT DESCRIPTION

This section provides a detailed description of the proposed project and project objectives, along with background information and physical characteristics consistent with CEQA Guidelines Section 15124.

CHAPTER 3.0 – ENVIRONMENTAL SETTING, IMPACTS, AND MITIGATION MEASURES

This section contains technical analyses relative to each environmental topic. Included in this section is a comprehensive analysis related to impacts and mitigations that correspond to project implementation. Each subsection contains a description of the existing setting of the project site. The environmental topics are summarized as follows:

- Aesthetics

- Air Quality
- Biological Resources
- Cultural and Paleontological Resources
- Geology and Soils
- Greenhouse Gas Emissions
- Hydrology and Water Quality
- Utilities and Service Systems
- Environmental Effects Determined Not to Be Significant

CHAPTER 4.0 – OTHER CEQA ANALYSIS

This section discusses the cumulative impacts associated with the proposed project that, when combined with past, present, and reasonably anticipated future events, may have a cumulative impact.

This section also contains discussions of growth-inducing effects that would be involved in the proposed action should it be implemented, as well as unavoidable significant environmental effects, including those that can be mitigated but not reduced to a level of insignificance.

CHAPTER 5.0 – PROJECT ALTERNATIVES

This section discusses alternatives to the proposed project, including the CEQA mandatory "No Project" alternative, that are intended to avoid or reduce significant environmental impacts of the proposed project. CEQA Guidelines Section 15126.6(e)(2) specifies that:

> "If the environmentally superior alternative is the "no project" alternative, the EIR shall also identify an environmentally superior alternative among the other alternatives."

CHAPTER 6.0 – REFERENCES

This section lists all reference material used in the EIR.

CHAPTER 7.0 – REPORT PREPARERS

This section lists all authors and agencies that assisted in the preparation of the report by name, title, and company or agency affiliation.

TECHNICAL APPENDICES

This volume includes all notices and other procedural documents pertinent to the EIR, as well as all technical material prepared to support the analysis.

1.5 ENVIRONMENTAL REVIEW PROCESS

The review and certification process for the EIR will involve the following general procedural steps:

NOTICE OF PREPARATION

In accordance with Section 15082 of the CEQA Guidelines, the County prepared a Notice of Preparation (NOP) of an EIR for the project on June 10, 2013. The County was identified as the lead agency for the proposed project. The notice was circulated to the public, local, state, and federal agencies, and other interested parties to solicit comments on the proposed project. Concerns raised in response to the NOP were considered during preparation of the Draft EIR. The NOP and responses by interested parties are presented in **EIR Appendix A.**

DRAFT EIR

This document constitutes the Draft EIR. The Draft EIR contains a description of the project, description of the environmental setting, identification of project impacts, and mitigation measures for impacts found to be significant, as well as an analysis of project alternatives. Upon completion of the Draft EIR, the County will file the Notice of Completion (NOC) with the Governor's Office of Planning and Research to begin the public review period (Public Resources Code Section 21161).

PUBLIC NOTICE/PUBLIC REVIEW

Concurrent with the Notice of Completion (NOC), the County will provide public notice of the availability of the Draft EIR for public review and invite comment from the general public, agencies, organizations, and other interested parties. The public review and comment period is forty-five (45) days. Public comment on the Draft EIR will be accepted both in written form and orally at public hearings. Notice of the time and location of the hearing will be published prior to the hearing. All comments or questions regarding the Draft EIR should be addressed to:

County of San Bernardino
Land Use Services Department
Mining Section
385 N. Arrowhead Avenue
San Bernardino, CA 92415-0182
Attention: Carrie Hyke, District Planner

RESPONSE TO COMMENTS/FINAL EIR

Following the public review period, a Final EIR (FEIR) will be prepared. The FEIR will respond to written comments received during the public review period and to oral comments made at any public hearing.

CERTIFICATION OF THE EIR/PROJECT CONSIDERATION

The County will review and consider the FEIR. If the County finds that the FEIR is "adequate and complete," the County may certify the FEIR. Upon review and consideration of the FEIR, the County may act on the proposed project. A decision to approve the project would be accompanied by written findings in accordance with CEQA Guidelines Section 15091 regarding

findings and, if applicable, Section 15093 regarding statements of overriding considerations. The County would also adopt a Mitigation Monitoring and Reporting Program, as described below, for mitigation measures that have been incorporated into or imposed on the project to reduce or avoid significant effects on the environment.

MITIGATION MONITORING

CEQA requires lead agencies to adopt a Mitigation Monitoring and Reporting Program (MMRP) to describe measures that have been adopted or made a condition of project approval in order to mitigate or avoid significant effects on the environment (California Public Resources Code Section 21081.6(a)). The specific "reporting or monitoring" program required by CEQA is not required to be included in the EIR; however, it will be presented to County decision-makers for adoption along with the EIR. Throughout the EIR, however, mitigation measures have been clearly identified and presented in language that will facilitate establishment of a Mitigation Monitoring and Reporting Program. Any mitigation measures adopted by the Board of Supervisors as conditions for approval of the project will be included in the MMRP to ensure and verify compliance. The MMRP will be prepared as a separate document and will be part of the project documentation to be considered for adoption by the County planning Commission.

1.6 COMMENTS RECEIVED ON THE NOTICE OF PREPARATION

The County received four comment letters on the Notice of Preparation for the White Knob/White Ridge Limestone Quarries Expansion project DEIR. A copy of each letter is provided in **EIR Appendix A**. The County received letters from the following state and local agencies.

- Mojave Desert Air Quality Management District (MDAQMD)
- California Department of Fish and Wildlife (CDFW)
- Native American Heritage Commission (NAHC)
- California Department of Conservation – Office of Mine Reclamation (OMR)

The following summarizes issues raised in the comment letters as well as the author of the letter.

MDAQMD

- The district states that they are in agreement with the NOP's assessment of the proposed project's air quality impacts.

CDFW

- The CDFW states that the CEQA document should contain sufficient, specific, and current biological information on the existing habitat and species at the project site, including all documents used to determine impacts.
- The CEQA document should not defer impact analysis and mitigation measures to future regulatory discretionary actions, such as a Lake or Streambed Agreement.
- Sensitive species have been identified on the project site, and species-specific surveys should be conducted and all identified sensitive species should be assessed in the DEIR.

- Compliance with approved habitat plans, such as the Carbonate Habitat Management Strategy (CHMS), should be discussed in the DEIR.

- A California Endangered Species Act (CESA) Incidental Take Permit must be obtained if the project has the potential to result in take of species of plants or animals listed under the CESA.

- A Notification of Lake or Streambed Alteration is required by the CDFW, which recommends that the entirety of the project site be assessed for the potential presence of CDFW jurisdictional areas.

- The CEQA document should summarize the Ruby Springs monitoring reports and provide complete copies of the reports to CDFW staff to assist in the Jurisdictional Determination.

- The phased nature of the proposed project may lead to significant temporal impacts and direct impacts to species such as bighorn sheep, raptors, and plants associated with carbonate soils. A thorough discussion of impacts associated with project activities and the phased approach to development and reclamation should be included in the EIR.

- A cumulative effects analysis should include project-related impacts to riparian areas, wetlands, vernal pools, alluvial fan habitats, wildlife corridors or movement areas, aquatic habitats, sensitive species, and other sensitive habitats, open lands, and adjacent natural habitats.

- The alternative analysis should include a range of alternatives that avoid or minimize impacts to biological resources. All Rare Natural Communities should be fully avoided and protected from project-related impacts. The EIR should include an evaluation of specific alternative locations with lower resource sensitivity. Off-site compensation for unavoidable impacts through acquisition and protection of high-quality habitat should be addressed.

- Bighorn sheep, mule deer, and other native animals use the project site for movement between habitats, bedding, escape terrain, and other important activities. Actions to prevent and mitigate impacts to these important forage resources and habitats should be addressed.

- Disturbance to bighorn sheep should be addressed, as well as the potential loss of individuals to mortality related to blasting, vehicle collision, or other mining activities or as a consequence of decreased access to forage. Consequences of loss of individuals should address population-level impacts to the persistence of this small population.

- Barriers to movement of bighorn sheep both for within-range movement and for immigration and emigration, and the consequences, should be evaluated. The topography of the quarries (slopes, bench height) should be assessed relative to the permeability for movement of bighorn sheep, deer, fox, bobcat, etc. Design of highwalls should address the ability of bighorn sheep and other species to traverse slopes, such as by planning for non-vertical slopes and benches with ramps between levels.

- In addition to impacts to habitat and wildlife, limits to access by recreational hunters to the project areas should be addressed.

- The DEIR should quantify impacts to habitats and species per the informational requirements of CEQA. An accompanying map showing the areas of impact should also be included.

- The DEIR should include current (completed within the 12-month period prior to circulation of the CEQA document) biological surveys for fauna and flora. If sensitive species may occur within the project area, species-specific surveys, conducted at the appropriate time of year and time of day, should be included with the CEQA document.

- The CEQA document should provide an analysis of the project's effects on the CHMS. The CEQA document should include a discussion of how the project will affect plan assembly, how the project will affect the goals and objectives of the CHMS, the applicable policies and procedures that pertain to the project, a discussion of survey requirements, and a list of proposed mitigation measures required. A copy of any documents required by the CHMS should be included with the CEQA document.

- A CESA Incidental Take Permit must be obtained if the project has the potential to result in "take" (California Fish and Game Code Section 86 defines "take" as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill") of State-listed CESA species, either through construction or over the life of the project.

- The DEIR should provide a thorough analysis of direct, indirect, and cumulative impacts and identify specific measures to offset such impacts.

- To avoid confusion between the mine site "reclamation" required by the Forest Service Mineral Regulations and the California Surface Mining and Reclamation Act (SMARA) and "mitigation" required under CEQA and other programs, the CDFW requests that the DEIR include a thorough analysis and comparison of the reclamation for the mining and the mitigation for the environmental impacts. The CDFW also recommends updating the revegetation plan within the approved SMARA reclamation plan.

NAHC

- Contact the appropriate Information Center for a record search to determine if a part or all of the area of project effect has been previously surveyed for cultural places. The NAHC recommends that known traditional cultural resources recorded on or adjacent to the project site be listed in the DEIR.

- Lead agencies should include in the mitigation plan provisions for the identification and evaluation of accidentally discovered archeological resources. In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American, with knowledge of cultural resources, should monitor all ground-disturbing activities.

- Lead agencies should include in the mitigation plan provisions for the disposition of recovered artifacts, in consultation with culturally affiliated Native Americans.

- Lead agencies should include in the mitigation plan provisions for discovery of Native American human remains. Health and Safety Code Section 5097.98 mandates the process to be followed.

OMR

- The OMR has no specific comments on the Initial Study at this time.
- It is recommended that the reclamation plan not be finalized or approved until mitigation is determined.
- The amended reclamation plan includes a number of maps and cross sections that must bear the signature of the licensed professional in responsible charge who prepared them.
- The reclamation plan does not address stabilization and reclamation of the Northwest Slope of the Annex Quarry or the area of inadvertent boulder roll directly north of the White Knob Quarry. The reclamation plan should include measures to stabilize and reclaim these areas.
- Comments concerning the January 14, 2013, CHJ Consultants study entitled "Slope Stability Investigation, Proposed Amended Plan Operations, White Knob Quarry Mining and Reclamation Plan, Lucerne valley, California" were made by the OMR stating that the study needed to be revised to address issues raised by the OMR.
- The "White Knob Haul Road, Drainage Study and Plan of Development" report must be stamped by the professional in responsible charge of the study and resubmitted to the OMR. The OMR cannot review preliminary work.
- The applicant should consult with the California Department of Fish and Wildlife to determine if a Stream and Lake Bed Alteration Agreement will be required.
- The amended reclamation plan provides recommended success criteria for naturally occurring habitats in Table 12 on page 61. The table may need to be revised for accuracy, as the figures for density and species richness in the table may have been inadvertently reversed.
- The OMR recommends reevaluating the baseline data in order to have a quantifiable density figure for all native perennials.
- The reclamation plan must have a signed statement accepting responsibility for reclamation per the approved reclamation plan.
- The reclamation plan must include a financial assurance estimate.
- SMARA Section 2774 provides the requirements with respect to lead agency approvals of reclamation plans, plan amendments, and financial assurances.

This section provides the description of the proposed project, which consists of the Amended Mine and Reclamation Plan for expansion of the White Knob/White Ridge Limestone Quarries. The purpose of the project description is to describe the project in a way that will be meaningful to the public, reviewing agencies, and decision-makers. As described in Section 15124 of the California Environmental Quality Act (CEQA) Guidelines, a complete project description must contain the following information but is not required to supply extensive detail beyond that needed for evaluation and review of the potential environmental impacts: (1) the location and boundaries of the project on a regional and detail map; (2) a statement of objectives sought by the proposed project; (3) a general description of the project's economic and environmental characteristics; and (4) a statement briefly describing the intended uses of the Draft EIR.

The Surface Mining and Reclamation Act (SMARA) was signed into law in 1975 and went into effect in 1976; it has been amended 24 times since its effective date. The intent of the act is to assure reclamation of mined lands, encourage production and conservation of minerals, and create and maintain surface mining and reclamation policy (regulations). One of the principal requirements of SMARA is the preparation of reclamation plans. A reclamation plan must be prepared by a mining applicant prior to initiation of mining activities. Reclamation plans must be approved by the SMARA lead agency (usually counties or cities) and the California Department of Conservation, Office of Mine Reclamation (OMR). Reclamation plans are subject to environmental review under CEQA. The Amended Mine and Reclamation Plan was prepared in accordance with SMARA and its implementing regulations (reclamation performance standards) set forth in the Title 14 of the California Code of Regulations, Sections 3700 through 3711.

2.1 PROJECT OVERVIEW

Omya Inc., proposed an Amended Mine and Reclamation Plan (Amended Plan or proposed project) for expansion of the existing White Knob/White Ridge Limestone Quarries, a limestone mining operation located in the San Bernardino Mountains in southwestern San Bernardino County. The Amended Plan would increase the operational years of the quarry by 24 years from the existing permit expiration date of 2031 to the year 2055.

The Amended Plan includes an increase in mine area of approximately 190.1 acres over the existing approved quarry area of 145 acres. This increase results in a total quarry area of approximately 335.1 acres of existing or planned surface mining operation-related disturbance. The Amended Plan would not result in the increase of mining equipment used at the quarry or the increase of daily quarried material. Approximately 40 acres of the existing 83.5-acre Bureau of Land Management (BLM) haul road right-of-way on federal public land must be reclaimed and is added to the proposed project reclamation total. This 375.1-acre area comprises the "project site" for this EIR. The specific elements of the proposed project are described in Sections 2.7 through 2.11. The primary areas to be reclaimed are the existing White Knob Quarry and White Knob Annex Quarry, the approved White Ridge Quarry, the existing Overburden Site #1 and proposed Overburden Sites #2 and #3, and the ancillary disturbance areas, which include haul/access roads, sediment basins, storage pads, crusher location, west slope impact area, and boulder roll-down area. See **Figure 2.0-2** for the haul road and **Figure 2.0-3** for the quarry and ancillary disturbance areas.

The proposed project is designed to make the reclaimed lands suitable for future open space uses and wildlife habitat. It includes site-specific activities to satisfy the reclamation requirements of the Surface Mining and Reclamation Act of 1975, as amended, and its implementing regulations (collectively, SMARA), as well as the County's surface mining and land reclamation ordinance (San Bernardino County Code Chapter 88.03). A lead-agency-approved reclamation

plan is required for all surface mining operations in the state that are subject to SMARA. The County has primary discretionary authority over the proposed project and serves as the lead agency responsible under CEQA and SMARA. If approved, the proposed project would not preclude future permitting of extraction and reclamation activities within or beyond the project site. Any such future proposal would require authorization from the County and compliance with CEQA.

2.2 PROJECT LOCATION

REGIONAL

The project site is located in the San Bernardino Mountains southwest of Lucerne Valley in southwestern San Bernardino County, California (see **Figure 2.0-1**). Northwest of the site lies the Victor Valley metropolitan area, which includes the incorporated cities of Apple Valley, Victorville, Adelanto, and Hesperia, all over 13 miles from the project site. South of the site lies the San Bernardino National Forest (SBNF) and Big Bear Lake and Lake Arrowhead, approximately 11 miles from the project site, as well as the unincorporated communities of Crestline, Lake Arrowhead, Running Springs, Big Bear City, Forest Falls, and the City of Big Bear Lake. West of the project site, Interstate 15 (I-15) traverses north to south with additional SBNF land beyond. Farther south and southwest of the site is the San Bernardino Valley, which includes land in both San Bernardino and Riverside counties and the incorporated cities of Riverside, San Bernardino, Ontario, and Rancho Cucamonga, all more than 23 miles from the project site. The eastern desert area of the county is located east of the site and includes the City of Twentynine Palms, 57 miles from the site, and the Town of Yucca Valley, 37 miles from the site, as well as the Marine Corps Air Ground Combat Center in Twentynine Palms. The area is accessed by I-15 and State Routes (SR) 18 and 247.

PROJECT SITE

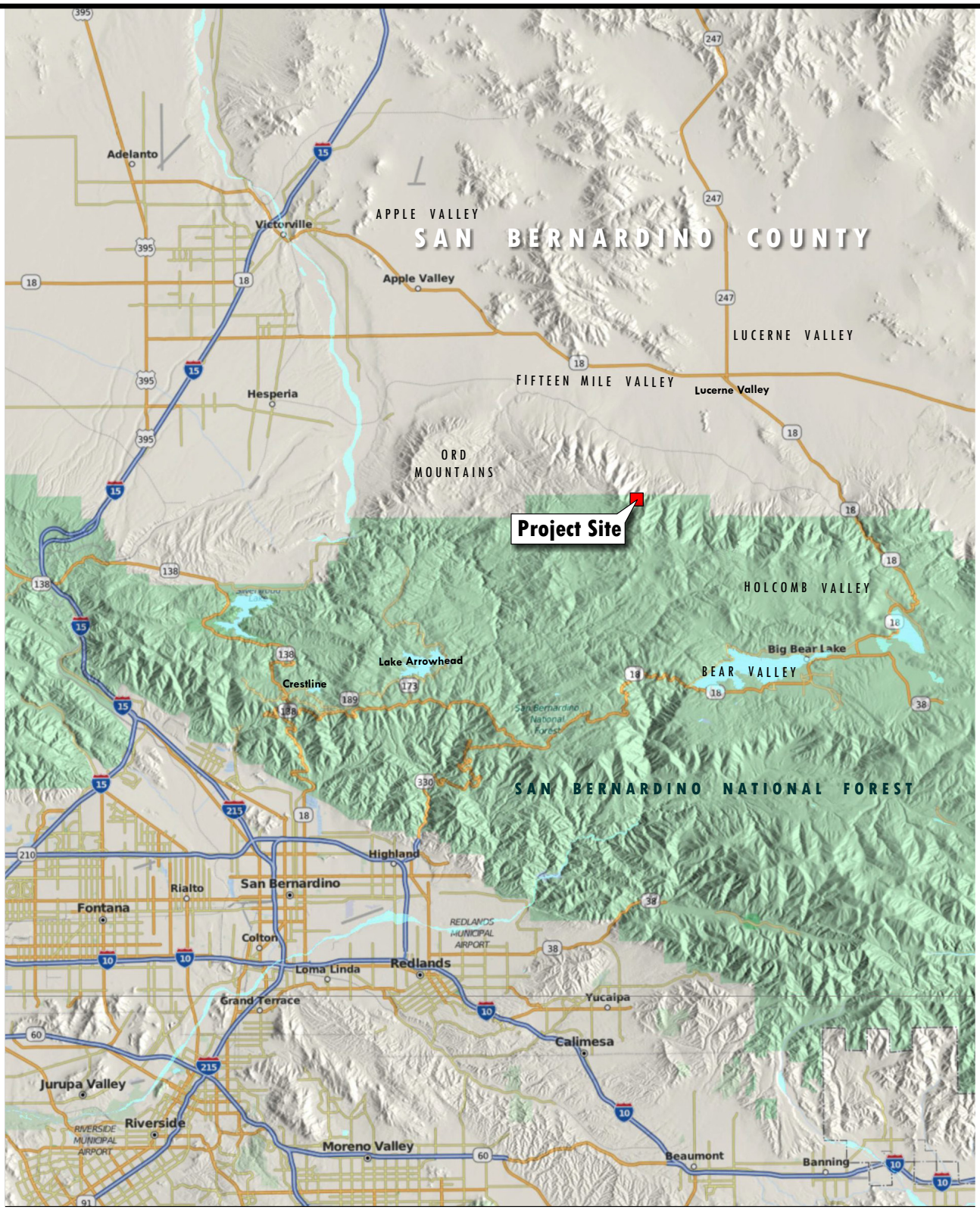
The White Knob/White Ridge Quarries are within the larger San Bernardino Mountains-Lucerne Valley Mining District, in which other large-scale limestone mines are present to the east along the north-facing slope of the mountains over a distance of approximately 10 miles. These other mining operations include:

- Omya – Sentinel/Butterfield
- Specialty Minerals, Inc. – Marble Canyon, Arctic Canyon, Cushenbury 21
- Mitsubishi Cement Co. – Cushenbury Mine

The project site is located entirely on private lands, with the exception of the haul road, which is within an approved right-of-way on BLM-managed lands. The existing mine and planned expansions are bounded on the south by mountainous undeveloped National Forest lands, on the west, north, and east by unpatented placer mining claims on public lands managed by the BLM, and on the northeast by patented open space.

The project site is located approximately 6 miles southwest of the community of Lucerne Valley and 8 miles northwest of Big Bear Lake just north of the San Bernardino National Forest (see **Figure 2.0-2**). The project site is within portions of Sections 5, 6, 7, and 8 of Township 3 North, Range 1 West, SBBM. The site is located on the north range front of the San Bernardino Mountains and includes local topographic relief of about 2,000 feet from approximately 4,900 to 6,900 feet above mean sea level (amsl). The site is accessed at its northeastern corner via a 5.1 mile-long haul road (4.4 miles of which is BLM haul road right-of way) from the Lucerne Valley processing plant at Crystal Creek Road.

T:_CS\Work\San Bernardino, County of\White Ridge Limestone Quarry\Figures



LEGEND

- **Project Site Location** (Geographic Location)
  California Zone 5 (FIPS 405): 6859727.90 1956210.48
  Lat/Lon: 34° 21' 49.3863" N, 117° 00' 44.3577" W

Source: Lilburn Corporation

0 2.265 5.25
MILES

N

Figure 2.0-1
Regional Location

PMC®

T:_CS\Work\San Bernardino County of\White Ridge Limestone Quarry\Figures

Project Boundary
Private Lands

Limits of Planned Disturbance

Haul Road Right-of-way
BLM Land CACA 16644

OB Overburden Stockpile

Proposed/Improved Basins

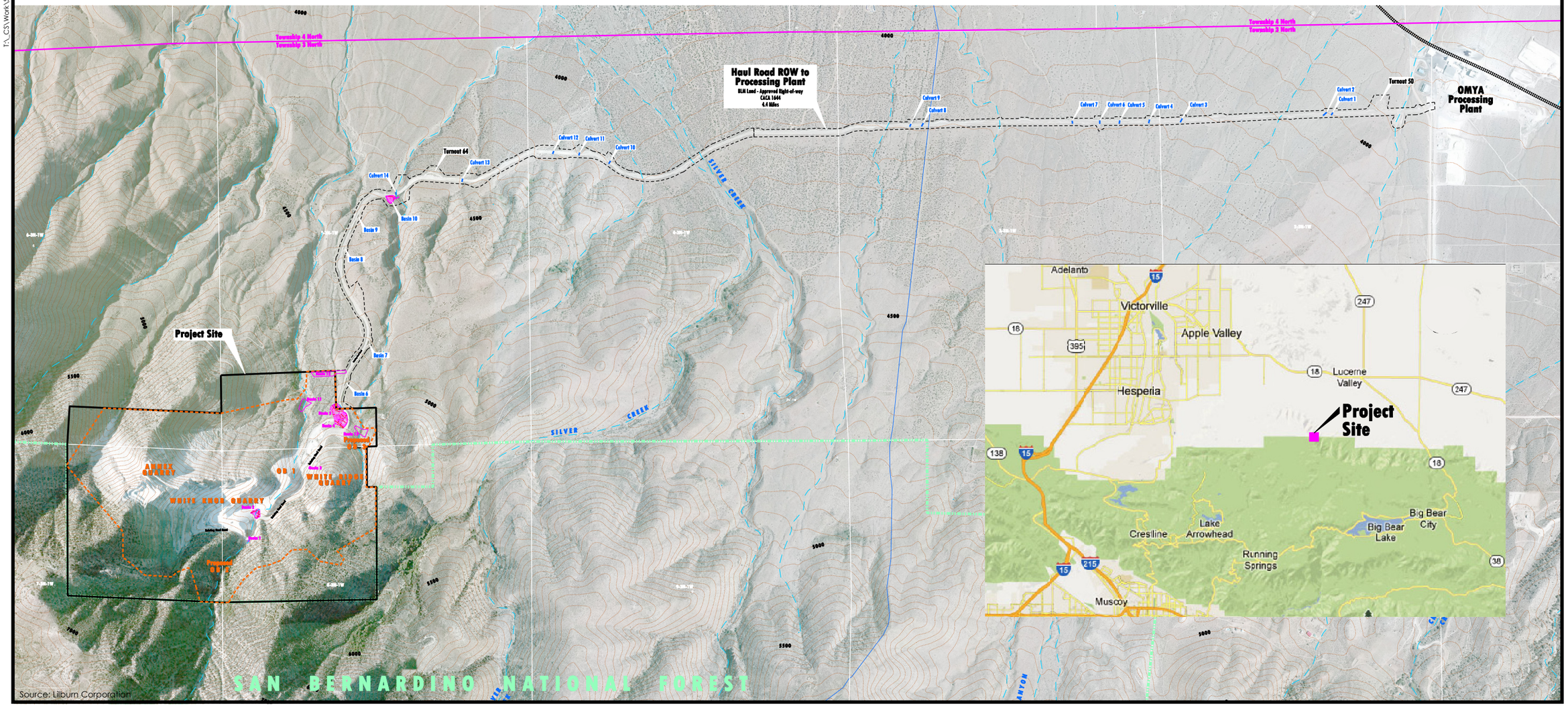
Existing Major Contour

Existing Minor Contour

Existing Drainages

San Bernardino National Forest Boundary

USGS Survey Township



Source: Lilburn Corporation

400 0 400 800
FEET

N

Figure 2.0-2
Project Vicinity

PMC®

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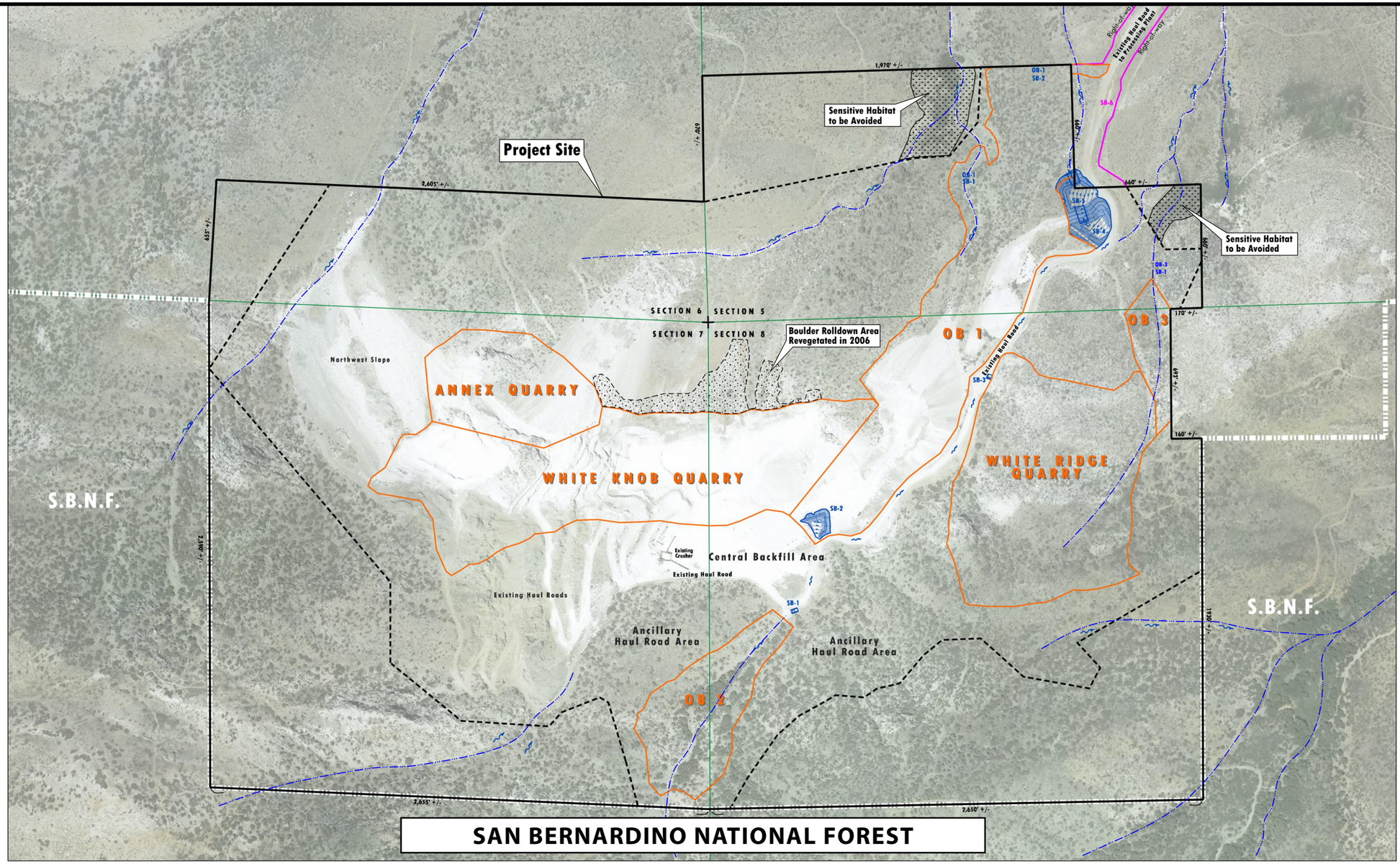

Project Boundary Private Lands

Limits of Planned Disturbance

Major Facilities

Haul Road Right-of-way on BLM Land CACA 16644

OB Overburden Stockpile

SB Sediment Basin

Proposed / Improved SB

Existing Drainages

Source: Lilburn Corporation

0 250 500

FEET

N

Figure 2.0-3

Existing Quarries and Planned Operations

PMC

At this time, Omya is in the process of acquiring the additional 70 acres of BLM land. As part of the 2011 Settlement Agreement, Omya expanded the right-of-way of the off-site haul road from 67 acres to its present 83.5 acres, which are also located on BLM land. The off-site haul road improvements and the sale of BLM land to Omya will be a part of the County's Conditions of Approval for the Amended Mine and Reclamation Plan. Thus, this EIR assumes that the federal actions associated with the improvements and land transfer are approved.

With the mandated purchase of 70 acres from BLM (see Section 2.3, Site History), the Omya land holdings, leased and owned, within the project boundary will consist of approximately 427.5 acres which is larger than the actual project disturbance area discussed in Section 2.1. **Table 2.0-1** identifies the land holdings and acreage.

TABLE 2.0-1
OMYA LAND HOLDINGS WITHIN PROJECT BOUNDARY

Claim Name and APN	Acreage	Owner
White Ridge Placer #1 APN 0446-021-35	157.5	Owned by Omya Inc.
White Knob Placer #1 APN 0446-011-06	160	Leased from Don Fife
White Knob Annex Placer Claim APN 0446-011-04	40	Leased from Don Fife
Silver Creek Placer #4 (portion) APN 0446-021-11	70	Owned by Omya Inc.

SURROUNDING LAND USE

The project site is located on the north side of the San Bernardino Mountains. All lands surrounding the project site are vacant, open space federal public lands managed by the Bureau of Land Management or by the U.S. Forest Service. The San Bernardino County land use designation for the site and the surrounding area is Resource Conservation (RC). Immediately south of the project site is the San Bernardino National Forest. The nearest private residence is approximately 2 miles north of the project site.

TABLE 2.0-2
SURROUNDING LAND USE

Area	Land Use	Land Use Designation
North	Vacant, BLM land	Resource Conservation
South	Vacant	Resource Conservation
East	Vacant	Resource Conservation
West	Vacant	Resource Conservation

2.3 SITE HISTORY

Mining began on the property now controlled by Omya during the late 1950s and has been more or less continuous since 1958. The White Knob and White Ridge claims were staked in the 1950s by the Fife family and later patented. Small-scale mining, road building, and core drilling occurred during the 1960s–1970s. During the early 1980s, the White Knob deposit was leased by Omya and the deposit was explored by core drilling and detailed geologic investigations. In 1985, the decision to open and permit the White Knob/White Ridge deposit was made. Mining at the White Knob Quarry started in 1987 after San Bernardino County permitting was completed. For logistical reasons, mining started between the elevations of 5,500 and 5,900 feet. Ore from those levels met production requirements for 10 years while a haul road was being constructed to the top of the knob at 6,200 feet. Topography in the area of the quarry is extremely steep and rugged. Several 100-foot-high cliffs were originally present before mining began, and the deposit forms a steep cliff-sided ridge trending east to west and about 1,500 feet long.

The San Bernardino County Planning Commission approved the existing White Knob/White Ridge Limestone Mine Site Approval and Reclamation Plan in 1986 (RP# 86M-04) with an expiration date of December 31, 2031. RP# 86M-04 permits mining operations on 145 acres of the mine operator's 357.5 total acres of land holdings. The site is designated as CA mine ID# 91-36-0067.

On April 20, 2011, a Settlement Agreement was entered into by and between the BLM, the California Department of Fish and Game (now the Department of Fish and Wildlife [CDFW]), and Omya relating to activities at the White Knob Quarry. There are six separate components (Parts A through F) in the Agreement. Part B of the Agreement is entitled "Repair, Remediate, and Monitor Improvements to the White Knob Quarry Right-of-Way Access Road and Associated Facilities to Protect Drainages." These conditions are included in the Amended Plan.

The components (Parts A through F) of the Agreement consist of the following:

- Part A – Omya has agreed to study and monitor Ruby Springs, located to the northwest of the quarry. Ongoing monitoring through 2014 is being undertaken and reported to the BLM.

- Part B – Requires Omya to repair, remediate, and monitor measures to control runoff and sedimentation along the 4.4 miles of haul road on BLM-managed land.

- Part C – Requires that the former explosives storage facility located on BLM land be removed and reclaimed. The facility has been removed. The area is part of the 70-acre area to be purchased by Omya (see Part E, below), and its future use and reclamation are part of the Amended Plan.

- Part D – Requires haul road improvements and reclamation to be incorporated into the overall reclamation plan.

- Part E – Requires Omya to apply to the BLM for the purchase of 70 acres on which overburden material is proposed to be placed in the future.

- Part F – Recovery of costs for the BLM.

In August 2011, Stantec prepared the *White Knob Quarry Haul Road Drainage Report and Plan of Development* to analyze the existing drainage conditions at the quarry and along the haul road, and to provide recommendations for facilities to control stormwater and sediment runoff and provide protection to surrounding drainages. Omya subsequently submitted an amended right-of-way application to the BLM to make improvements to the haul road and drainages as recommended in the Plan of Development. As part of the Settlement Agreement and in order to accommodate the improvements required to adequately repair and remediate the right-of-way access road and drainage facilities, the existing right-of-way was expanded from 67 acres to its present 83.5 acres.

2.4 EXISTING CONDITIONS

The White Knob/White Ridge Quarries are currently permitted to operate through the year 2031. Existing operations currently include mining at the White Knob Quarry site only (see **Figure 2.0-3**). At the present time, production comes from both the lower levels (5,500-foot level) and the upper levels (6,200-foot level). Two or three working levels are operated at any one time to supply the quota of ore needed to meet production demands.

Table 2.0-3 identifies the current uses by acreage for the White Knob and White Ridge Quarry area. As is shown, the White Knob Quarry currently consists of approximately 35 acres.

TABLE 2.0-3
QUARRY/AREA BY ACREAGE

Quarry or Area	Existing Approved Acres
White Knob Quarry	35
White Knob Annex Quarry	7
White Ridge Quarry	18
Overburden Site #1	15[1]
Overburden Site #2	–[1]
Overburden Site #3	–[1]
Ancillary Disturbance Limits[2] (outside of above)	70
Total	145

Note: Areas from 1986 Plan estimated to whole acres; proposed areas rounded to nearest tenth of an acre. Totals may be slightly different due to rounding.

1. *Combined waste areas; not individually estimated in 1986 Plan.*
2. *Ancillary disturbance limits include haul/access roads to quarries and overburden sites, sediment basins and other erosion control features, storage pads, crusher location, west slope impacts, and incidental impacts from boulder roll-down.*

The White Knob Quarry operates year-round. Mining of ore grade limestone may occur throughout the year, but usually occurs for about eight months a year. The excavated material has two main components: ore and overburden.[1]

Overburden removal and quarry development may occur throughout the year, but usually occur for about four months per year. The White Knob Quarry currently produces, based on production level from 2004 through 2006[2], an average of 512,000 tons per year of excavated material, which includes 324,000 tons per year of ore to the crusher and 188,000 tons per year of overburden or non-spec rock[3]. Of the crushed ore material, 275,400 tons per year are sent to the processing plant for production and 48,600 tons per year of crusher fines are sent to the overburden stockpile. None of the material sent to the processing plant including that considered "waste material" after processing is returned to the quarry site.

The quarrying procedure, which uses standard open pit and benching[4] practices, generally includes the following steps: (1) the area of planned surface disturbance is cleared of vegetation cover; (2) topsoil is removed and stockpiled for future use during reclamation activities; (3) access roads are developed into the planned upper benches; (4) blast holes are drilled with rotary blast hole drills, then controlled blasting loosens the rock at a benching interval of 25–30 feet; and (5) front-end loaders load the broken rock into 40- to 100-ton off-highway haul trucks to be transported to the primary mobile crusher located adjacent to the mining area. The material is separated into ore for processing and overburden material at the crusher site. Crushed ore is trucked to the Lucerne Valley processing plant located at the beginning of the haul road at its intersection with Crystal Creek Road. Overburden material that is screened out (including non-spec rock) is sent to the on-site overburden stockpile (OB-1). The site includes sediment control basins at key locations to control runoff from rain events.

The existing quarry deposit occurs in an area of extremely rugged topography along narrow ridges with cliffs up to 100 feet on three sides. Natural landslide and talus deposits composed of white and off-color marble are present on both the north and west slopes of the ridge. During mining of the rock in the deposit at the top of the ridge and along the crest, boulders of white limestone have rolled down the slope to the north and to the west into the West Canyon. The incidental boulder roll-down has partly covered the older natural talus and landslide deposits, and is visible from Lucerne Valley due to the contrast between the white limestone and the brown color of the hillside under the boulders.

For such mining-related visual impacts on the north-facing slope where mining has been completed, Permeon™ (permanent nontoxic dye) was applied in January 2006 to approximately 5 acres. The visual contrast has been reduced, as the brown-colored stain on the boulders blends with the natural hillside color. Revegetation of the upper slopes was also undertaken, utilizing native species, slow-release fertilizer, and commercial mycorrhizal inoculations. The area was irrigated for two years to allow a higher proportion of germination.

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[1] Ore is a type of rock can be extracted at a profit. For the proposed project, the "ore" is limestone. Overburden is the material that lies above an area of economic or scientific interest. In mining rock materials, it is most commonly the rock, soil, and vegetation that lie above the ore body.

[2] The three year 2004-2006 timeframe is used because it represents the highest production average for the quarry and therefore, characterizes the greatest impact.

[3] Non-spec rock is material that does not meet the quality and type specifications for the product, in this case limestone.

[4] In mining, a bench is a narrow, strip of land cut into the side of an open-pit mine. These step-like zones are created along the walls of an open-pit mine for access and mining

Although far less visible from a distance, the revegetation helps stabilize the upper slopes and reduce erosion and sediment transport.

The haul road to the White Knob/White Ridge Quarries from the processing plant is approximately 5.1 miles long, runs westerly from the processing plant for approximately 3.5 miles, then turns southerly to climb up a 14 percent grade to the quarry site (see **Figure 2.0-2**). The first 4.4 miles of the haul road cross land managed by the BLM. Use of the haul road on 67 acres was authorized under a Federal Land Policy Management Act (FLPMA) right-of-way (CACA 16644) approved by the BLM Barstow Resource Office in July 1988. As part of the 2011 BLM and Omya Settlement Agreement, the existing right-of-way was expanded from 67 acres to its present 83.5 acres in order to accommodate improvements and repairs to the access road and drainage facilities.

2.5 PROPOSED PROJECT PURPOSE AND NEED

Omya's Lucerne Valley plant operations require high-brightness, high-purity limestone ore (calcium carbonate) of specific quantities and qualities to produce fine ground calcium carbonate for numerous consumer and industrial products. To meet current and future product demand, Omya requires reliable and economic resources of high-quality limestone ore. Such high-quality limestone ore exists in the unique limestone deposits of the area, including those within the White Knob/White Ridge Quarries. The proposed Amended Mine and Reclamation Plan would assure Omya that its Lucerne Valley processing plant would have the raw limestone resources needed to continue producing existing products, and to respond to future product demand. .

2.6 PROJECT OBJECTIVES

The Amended Plan was developed with the following objectives:

- Continue the mining and recovery of a unique high calcium limestone resource to supply the Lucerne Valley processing plant for the production of a wide range of calcium carbonate products.
- Minimize additional land disturbance through the expansion of contiguous existing and previously approved quarries and minimal expansion of existing overburden stockpiles and haul roads.
- Place overburden within completed portions of Overburden Site #1 (OB-1) to limit the area of disturbance.
- Meet the requirements of SMARA and the County surface mining ordinance.
- Minimize impacts to sensitive plants and wildlife through quarry design and ongoing bighorn sheep programs.
- Reclaim the site for post-mining uses which would include open space habitat.
- Reduce the slopes on overburden fill areas to an overall maximum slope of 2H:1V and revegetate disturbed areas to minimize aesthetic and erosion impacts

- Mitigate for lost, threatened, and endangered species habitat in accordance with the CHMS [Carbonate Habitat Management Strategy, April 2003] requirements by relinquishing unpatented mining claims or transfer of private property as determined adequate by the CHMS and regulatory agencies.

- Reclaim and maintain the site to eliminate hazards to public safety.

2.7 PROPOSED PROJECT COMPONENTS

Existing and proposed facilities and areas included in the Amended Plan are identified in **Table 2.0-4**. As is shown, all quarries/areas will be expanded, increasing the total project area to 335.1 acres. This increase represents 131.1 percent change in the project size.

TABLE 2.0-4
AMENDED MINE AND RECLAMATION PLAN COMPONENTS

Quarry or Area	Existing Approved Areas (acres)	Proposed New Areas (acres)	Total Amended Project Areas (acres)	Percent Change
White Knob Quarry	35	6.1	41.1	17.4%
White Knob Annex Quarry	7	5.5	12.5	78.6%
White Ridge Quarry	18	15.1	33.1	83.9%
Overburden Site #1	15[1]	16.9	31.9	11.2%
Overburden Site #2	–[1]	13.0	13.0	N/A
Overburden Site #3	–[1]	3.0	3.0	N/A
Ancillary Disturbance Limits[2] (outside of above)	70	130.5	200.5	186.4%
Totals	**145**	**190.1**	**335.1**	131.1%

Note: Areas from 1986 Plan estimated to whole acres; proposed areas rounded to nearest tenth of an acre. Totals may be slightly different due to rounding.

1. Combined waste areas; not individually estimated in 1986 Plan.

2. Ancillary disturbance limits include haul/access roads to quarries and overburden sites, sediment basins and other erosion control features, storage pads, crusher location, west slope impacts, and incidental impacts from boulder roll-down.

The White Knob/White Ridge Quarries are currently permitted to operate through the year 2031. Known limestone resources would provide for an increase to approximately 8.9 million tons of ore to the Lucerne Valley processing plant for a proposed 40 years of operations (2016 through 2055). Depending on market demand, the White Knob/White Ridge Quarries' average ore-to-plant production rates may slightly decrease to approximately 222,500 tons per year compared to the 2004–2006 baseline average of 275,400 tons of ore to the plant per year (see **Table 2.0-5**). In order to ensure that the processing plant has sufficient limestone for production, a maximum amount of 680,000 of finished (crushed) ore tons per year is listed to show the White Knob/White Ridge Quarries solely supplying the Lucerne Valley processing plant in the event that production from the nearby Sentinel/Butterfield Quarries (not part of this project) is unavailable.

TABLE 2.0-5
WHITE KNOB/WHITE RIDGE QUARRIES THREE-YEAR AVERAGE AND AMENDED PLAN PROPOSED THROUGHPUTS (TONS PER YEAR)

	Material Excavated (Ore and Overburden)	Ore to Crusher	Overburden & Non-Spec Rock to On-Site Overburden Stockpile	Overburden & Non-Spec Rock for Aggregate (to Processing Plant)	Crushed Ore to Processing Plant (Production)	Crusher Fines to Stockpile (Est. 17% of Ore to Crusher)
3-Year Average[1] (Baseline) (2004–2006)	512,000	324,000	188,000	0	275,400	48,600
Proposed Amended Plan (Average)[1]	662,500	270,000[3]	392,500 (242,500)[4]	150,000[3]	222,500	47,500
Proposed Amended Plan (Maximum)[2]	1,950,000	800,000[3]	1,150,000 (850,000)[4]	Up to 300,000[3]	680,000[5]	120,000

Sources: Omya California 2013

Notes:

1. *The 2004-2006 average is used as a baseline as these years represent the highest productions years for the quarry. Three-year amounts are average actual production levels from 2004 through 2006, and the Amended Plan amounts are listed as both average and maximum proposed amounts. Percentages of ore, overburden and non-spec rock, and crusher waste (fines) vary with excavation phase and quality of limestone. The "material excavated" is the amount that includes the ore and overburden.*
2. *Maximum amounts are listed to show the White Knob/White Ridge Quarries solely supplying the Lucerne Valley processing plant in the event that production from the Sentinel/Butterfield Quarries is unavailable.*
3. *Per the Amended Plan, varying amounts of quarry overburden and non-spec rock would be crushed and transported to the processing plant (along with fines) for aggregate sales, depending on demand. Table lists potential overburden crushed and transported to the processing plant area.*
4. *Amounts of overburden including fines sold for aggregate would be subtracted from the amounts deposited on the overburden stockpiles.*
5. *Finished ore to the plant.*

2.8 PROPOSED PROJECT PHASING

Although mining is more or less continuous, the ultimate development of the quarry is phased. Four phases were previously identified for existing operations, and development of the middle benches during Phases 1 and 2 has been completed. Phase 3 is currently in progress and includes full development of the existing White Knob and White Knob Annex quarries, with mining expected to be completed around 2045. Phase 4 includes development of the White Ridge Quarry deposits to the east and is scheduled to begin around 2015 and last until 2055. Phase 5 is reclamation of the mine site, generally after completion of mining. The backfilling of portions of the White Knob Quarry and the Central Area would be initiated during the last 20 years of operations (approximately after year 2035).

Proposed phasing is described in **Table 2.0-6**. Phases 3 through 5 have been amended as a part of the proposed project. Note that mining operations may experience unscheduled phasing changes due to unforeseen market/economic demands and variation in material quality since the natural deposit is not of uniform quality. The County would be updated in the annual monitoring report on the status of operational phases.

TABLE 2.0-6
APPROVED AND AMENDED PHASED DEVELOPMENT – WHITE KNOB/WHITE RIDGE QUARRIES

Mining Phase	Duration Total Mine Life from 1988 to 2031 and Cumulative Years	Currently Permitted 1986 Plan and Location	Proposed Amendment Changes
1986 Approved Mine and Reclamation Plan			
Phase 1	Years 1–5, 5 years 1988–1993	Yes/completed White Knob development	No
Phase 2	Years 5–12, 7 years 1993–2000	Yes/completed White Knob development	No
Phase 3	Years 12–40, 28 years 2000–2031	Yes/in progress White Knob/Annex mining	Yes
Phase 4	Years 18–32, 14 years 2007–2020	Yes/not yet started White Ridge development	Yes
Phase 5	2032–2037	Yes/not yet started Final reclamation	Yes
2012 Proposed Amended Mine and Reclamation Plan ***Time spans below per the Amended Plan starting in year 2015 (year 1)***			
Phase	**Duration**	**Location/Description**	
Phase 3 Amended	Years 1–30, 30 years Ongoing 2015–2045	White Knob Annex mining; placement of waste rock into OB-1 & 2	
Phase 4 Amended	Years 1–40, 40 years 2015–2055	White Ridge mining; placement of waste rock into OB-1, 2 & 3	
Phase 5 Amended	Years 20–50, 30 years 2035–2065	Backfilling of White Knob Quarry and Central Area; final reclamation and revegetation	

Source: Omya California 2013

Notes: OB = overburden

2.9 MINING OPERATIONS

The following is a description of the Amended Plan mining operations proposed expansion at the White Knob/White Ridge Quarries. **Figure 2.0-4** identifies the various locations of proposed operations on the project site and should be referenced while reading this section.

PRE-MINING ACTIVITIES OF UNDISTURBED LANDS

The following activities would be conducted prior to mining and overburden[5] and waste rock stockpile development in order to limit disturbed areas to the mine plan boundaries and to facilitate ongoing and future reclamation and revegetation:

- Excavation and development limits would be located and marked in the field.
- Specified plants that can tolerate transplant would be salvaged and stored in a nursery and would be replanted on reclaimed land as areas become available for revegetation.

[5] Overburden is the term used in mining to describe material that lies above the area of economic interest, e.g., the rock and soil that lies above the ore seam.

- Seeds of specified plants would be collected and either used for revegetation or stored appropriately for maximum future viability.

- Salvageable soils and/or growth media would be placed in separate identified stockpiles for use as a seed bank and seedbed during reclamation. Soil stockpiles would be clearly marked and managed to limit wind and water erosion.

WHITE KNOB QUARRY MINING

The proposed White Knob Quarry expansion consists of approximately 6.1 acres, for a total disturbance area of approximately 41.1 acres. Estimated ore reserves are approximately 3.5 million tons, with approximately 5 million tons of waste rock. The haul road to the top of White Knob has been established, and mining would continue from the top down to the footwall of the deposit. Benches established previously would be pushed back to the south, west, and north as far as economic limits would allow.

The elongated quarry would be approximately 2,500 feet west to east and 600 feet wide and would reach a maximum elevation of 6,200 feet amsl on the west to a floor elevation of 5,300 feet daylighting on the east (see **Figure 2.0-5**). Typical slopes would be 45 to 50 feet vertical with a slope face angle averaging 70 degrees. Bench width would be typically 25 feet, but would be greater if wall height is over 50 feet. Generally, bench width is half-wall height. Pit ramps, the roadway that accesses the pit floor, would be 25 to 35 feet wide and grade would be 12 to 18 percent, depending on conditions.

WHITE KNOB ANNEX QUARRY MINING

The White Knob Annex Quarry area is a 12.5-acre area contiguous to the northwest of the White Knob Quarry. The Annex Quarry would be mined concurrently with the White Knob Quarry from the top down based on mining logistics and specific ore grades in demand. The oval-shaped quarry would be approximately 900 feet west to east and 550 feet wide and would reach a maximum elevation of 6,075 feet on the southwest to a floor elevation of 5,575 feet (see **Figure 2.0-6**). Estimated ore reserves are approximately 1.3 million tons, with approximately 2.7 million tons of waste rock.

WHITE RIDGE QUARRY MINING

The White Ridge Quarry area consists of about 33 acres on the east side of the site. Currently, the White Ridge Quarry area has not been mined. The White Ridge deposit is the eastward continuation of the White Knob ore body. The box-shaped quarry would be approximately 1,200 feet north to south and 900 feet west to east and would reach a maximum elevation of 5,750 feet on the south to a floor elevation of 5,050 feet (see **Figure 2.0-7**). Estimated ore reserves are approximately 6 million tons, with approximately 8 million tons of waste rock. Typical slopes would be 50 feet vertical with a slope face angle averaging 70 degrees. Bench width would typically 25 feet, but would be greater if wall height is over 50 feet. Generally, bench width is half-wall height. Pit ramps would be 25 to 35 feet wide and grade would be 12 to 18 percent, depending on conditions.

Access to the White Ridge deposit would be constructed from the existing crusher site south of White Knob Quarry and north of the existing access road eastward directly to the upper level of approximately 5,750 feet. After the existing crusher is decommissioned, the ore would be hauled to the the mobile crusher, which would be placed at various locations around the mine to be in close proximity to active mining areas and to reduce on-site hauling. Overburden and waste

rock would be deposited in the proposed Overburden Site #2 (OB-2) in the canyon to the west and at the existing OB-1. The new access roads would access the top of the deposit, and the site would be mined from the top down.

At an elevation of 5,350 to 5,050 feet, the White Ridge Quarry design leaves a 300-foot-high ridge of undisturbed hillside facing Lucerne Valley, behind which mining activities would occur. This would reduce views of a quarry face and reduce visual impacts of the lower southern portion of this quarry. A small 3-acre overburden site (OB-3) and an associated access road are planned on the southeast side of the White Ridge Quarry to handle waste rock for the northern portion of the quarry.

OVERBURDEN AND WASTE ROCK

Overburden and waste rock at the White Knob/White Ridge Quarries are composed of gray impure limestone and granite intrusive rock and granite dikes. Overburden and waste rock are nontoxic, naturally occurring rock material, but which is of insufficient quality (purity and brightness) to process for ore. The vast majority (60 percent) of the overburden and waste rock is impure calcium carbonate. Most of the remainder (40 percent) is granitic rock (monzonite). Limestone waste rock/overburden does not have the chemical composition to create acid mine drainage.[6]

Currently, overburden and fines that are not sold are deposited into the OB-1 stockpile. Material placed in this area includes both waste rock and material stockpiled for potential future use such as topsoil to be used during reclamation activities. Topsoil is kept segregated from rock material within the overburden storage areas. Material stockpiling would continue throughout the life of the operation. The Amended Plan proposes to expand the existing OB-1 and create two additional overburden sites (OB-2 and OB-3) to accommodate overburden and waste rock. The three overburden areas are described in more detail below. Waste rock is also planned to be backfilled into the White Knob Quarry and the area to its south defined as the Central Area.

The Amended Plan proposes the revisions shown in **Table 2.0-7** to handle the estimated overburden from the planned expansion of mining.

[6] Acid mine drainage (AMD) is caused when water flows over or through sulfur-bearing materials, forming solutions of net acidity. AMD comes mainly from abandoned coal mines and currently active coal mining. AMD is formed when pyrite, an iron sulfide, is exposed and reacts with air and water to form sulfuric acid and dissolved iron (EPA 2013, p. 1).

T:_CS\Work\San Bernardino, County of\White Ridge Limestone Quarry\Figures

Mine Plan Notes

1. Name: White Knob – White Ridge Quarries

2. Mineral Mined: Limestone

3. Mine Operator:
Omya California
7225 Crystal Creek Road
Lucerne Valley, CA 92356
Peter Sutherland, Plant Manager
(760) 248-5233

4. Land Owner:
Omya Inc.
7225 Crystal Creek Road
Lucerne Valley, CA 92356
Peter Sutherland, Plant Manager
(760) 248-5233

5. Applicant: Same as (3) Omya California

6. Representative:
Lilburn Corporation
1905 Business Center Drive
San Bernardino, CA 92408
(909) 890-1818

7. Owner of Mineral Rights:

Omya Land Holdings
White Knob – White Ridge Quarries

CLAIM NAME	ACREAGE LEASED OR OWNED BY OMYA & APN	LEGAL DESCRIPTION AND CAMC#	NAME AND ADDRESS
White Ridge Placer #1	157.5 acres Patented APN 0446-021-35	NW1/4 Sec 8, T3N, R1W SBBM Patent #1186488	**Owned by:** Omya Inc. 7225 Crystal Creek Road Lucerne Valley, CA
White Knob Placer #1	160 acres APN 0446-011-06	NE1/4 Sec 7, T3N, R1W, SBBM Patent #04-83-0104	**Leased from:** Don Fife P.O. Box 1054 Tustin CA 92681
White Knob Annex Placer Claim	40 acres APN 0446-011-04	SE ¼ Sec 6, S1/2, S1/2 T3N , R1W SBBM Patent #04-83-0104	**Leased from:** Don Fife P.O. Box 1054 Tustin CA 92681
Silver Creek Placer #4 (portion)	70 acres APN 0446-021-11	SW ¼ Sec 5, S1/2, T3N, R1W Land Sale with BLM	**Owned by:** Omya Inc. 7225 Crystal Creek Road Lucerne Valley, CA 92356

8. Geologists:
CHJ Consultants
1355 E. Cooley Drive, Suite C
Colton, CA 92324
(909) 824-7311

9. Map Preparers:
Omya California
Lilburn Corporation

10. Source of Existing Topography: Digital Mapping, Inc. & Aerial, 2009

11. Date of Map Preparation: January 2013

12. Assessor's Parcel Numbers: See No. 7 above.

13. Utilities:
Electricity: Onsite generated as needed
Gas: Not applicable
Water: Omya well system
Sewer: Portable sanitation stations
Telephone: Verizon

14. Area To Be Disturbed: 190.1 acres per this Amendment
Area To Be Reclaimed: 335.1 acres total with this Amendment and prior 1986 approval
BLM ROW – half road width or approx. 40 acres

15. Reclaimed End Uses: Open space habitat for native wildlife and plants

16. County Land Use District: Resource Conservation (RC)

17. Plant and Tree Protection:
No protected or endangered trees exist onsite. Specific plant and tree species including Joshua tree, Mojave yucca, pinyon pine, juniper, and canyon live oak will be managed per County Native Plant Protection policy.

18. Previously Mitigated / Incidental Disturbance Area defined on the map includes:

- Existing disturbance previously mitigated through either reclamation or the April 2011 Settlement Agreements. Previously mitigated disturbance areas are apparent on the photograph base map for Sheet 2.

Source: Lilburn Corporation

LEGEND

- Amended Project Boundary Private Land
- Limits of Planned Disturbance
- Major Facilities
- Previously Mitigated April 2011 Incidental Disturbance Area
- OB Overburden
- SB Sediment Basin
- Proposed/improved SB
- Operating Major Contour
- Operating Minor Contour
- Haul Road
- Slope Indicator: Top of slope; Toe of slope
- Design Drainage
- Existing Major Contour
- Existing Minor Contour
- Existing Drainages
- San Bernardino National Forest Boundary
- Sensitive Habitat to be Avoided
- USGS Survey Section
- Claim / Parcel Line

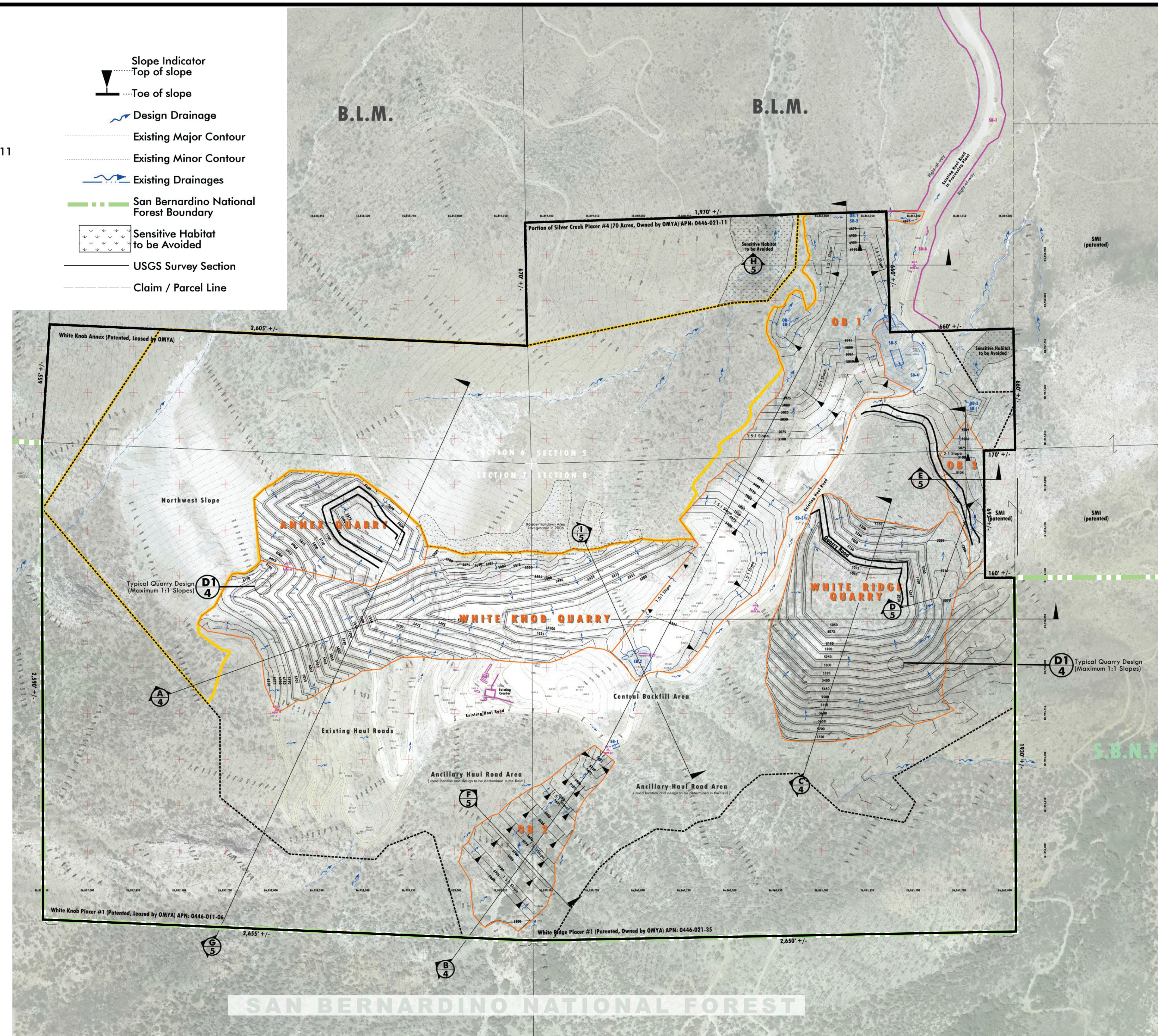

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Figure 2.0-4
Amended Mine Plan
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West

East

WHITE KNOB QUARRY

OB 1

WHITE RIDGE QUARRY

ELEVATION
Feet Above Mean Sea Level

Bend in Cross Section
Southwest | East

Amended Final Reclaimed Surface

Existing Ground

Soil Island (typical)

D1 4 White Knob Typical Quarry Design

Slope Stability
A-A'
See Figure 3.5-12

Slope 0.5 %

Amended Final Reclaimed Surface

Permanent Sediment Control Basin
(Finished Surface Approximately 5575')

White Knob Quarry Typical Haul Road (Reclaimed as Berm)

D2 4

Quarry Road to Remain

5,580' AMSL Toe of Slope

2:1

Floor Elevation 5,470 Feet AMSL

Central Backfill Area
Reclamation Phases 3 and 4

Floor Elevation 5,300 Feet AMSL

Quarry Surface

Haul Road and Drainage Operations

Existing Ground

Project Boundary

Amended Final Reclaimed Surface

White Ridge Typical Quarry Design

D1 5

Floor Elevation 5,050 Feet AMSL

NOTE:
Soil Islands and Darker Material placement areas are schematic only. Final placement will be determined in the field prior to Reclamation.

Looking North

Horizontal Scale: 1 inch = 200 feet
Vertical Scale: 1 inch = 200 feet

LEGEND

- Existing Ground Profile
- Amended Mine Plan Profile
- Amended Reclamation Plan Profile
- Overburden Backfill
- Soil Island
- Darker Material
- AMSL — Above Mean Sea Level

Source: Lilburn Corporation

0 200 400
FEET

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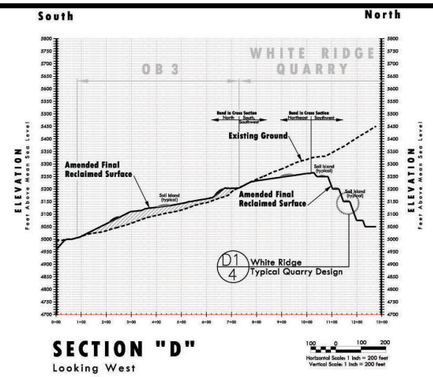
Figure 2.0-5
White Knob and White Ridge Quarries Cross Section – West to East

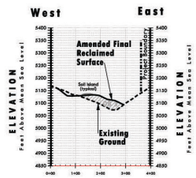
PMC

T:_CS\Work\San Bernardino, County of\White Ridge Limestone Quarry\Figures



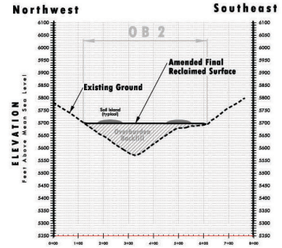
SECTION "D"
Looking West

Horizontal Scale: 1 Inch = 200 feet
Vertical Scale: 1 Inch = 200 feet



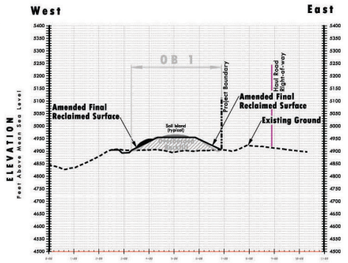
SECTION "E"
Looking North

Horizontal Scale: 1 Inch = 200 feet
Vertical Scale: 1 Inch = 200 feet



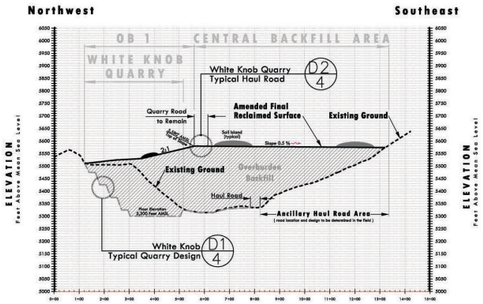
SECTION "F"
Looking Northeast

Horizontal Scale: 1 Inch = 200 feet
Vertical Scale: 1 Inch = 200 feet



SECTION "H"
Looking North

Horizontal Scale: 1 Inch = 200 feet
Vertical Scale: 1 Inch = 200 feet



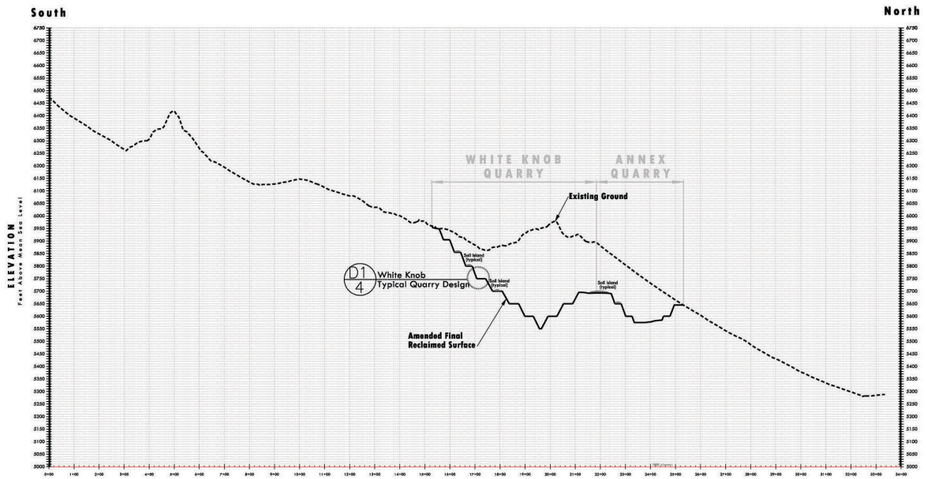
SECTION "I"
Looking Northeast

Horizontal Scale: 1 Inch = 200 feet
Vertical Scale: 1 Inch = 200 feet

LEGEND

- Existing Ground Profile
- Amended Mine Plan Profile
- Amended Reclamation Plan Profile
- Overburden Backfill
- Soil Island
- Darker Material
- AMSL Above Mean Sea Level

NOTE:
Soil Islands and Darker Material placement areas are schematic only. Final placement will be determined in the field prior to Reclamation.



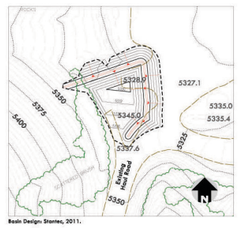
SECTION "G"
Looking Northwest

Horizontal Scale: 1 Inch = 200 feet
Vertical Scale: 1 Inch = 200 feet

Basin Design: Stantec, 2011.

Sediment Basin 1
Spillway Crest Elevation: 5,410'
Volume: 280 Cubic Yards

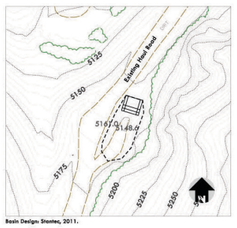
Scale: 1 Inch = 80 feet



Basin Design: Stantec, 2011.

Sediment Basin 2
Volume: 960 Cubic Yards

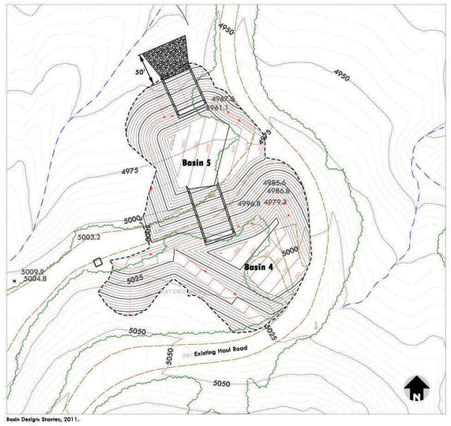
Scale: 1 Inch = 80 feet



Basin Design: Stantec, 2011.

Sediment Basin 3
Spillway Crest Elevation: 5,163'
Volume: 840 Cubic Yards

Scale: 1 Inch = 80 feet



Basin Design: Stantec, 2011.

Sediment Basins 4 and 5

Basin 4
Spillway Crest Elevation: 5,007.5'
Volume: 2,420 Cubic Yards

Basin 5
Spillway Crest Elevation: 4,974.5
Volume: 3,690 Cubic Yards

Scale: 1 Inch = 80 feet

Source: Lilburn Corporation

Figure 2.0-6
White Knob and Annex Quarries Cross Section – North to South

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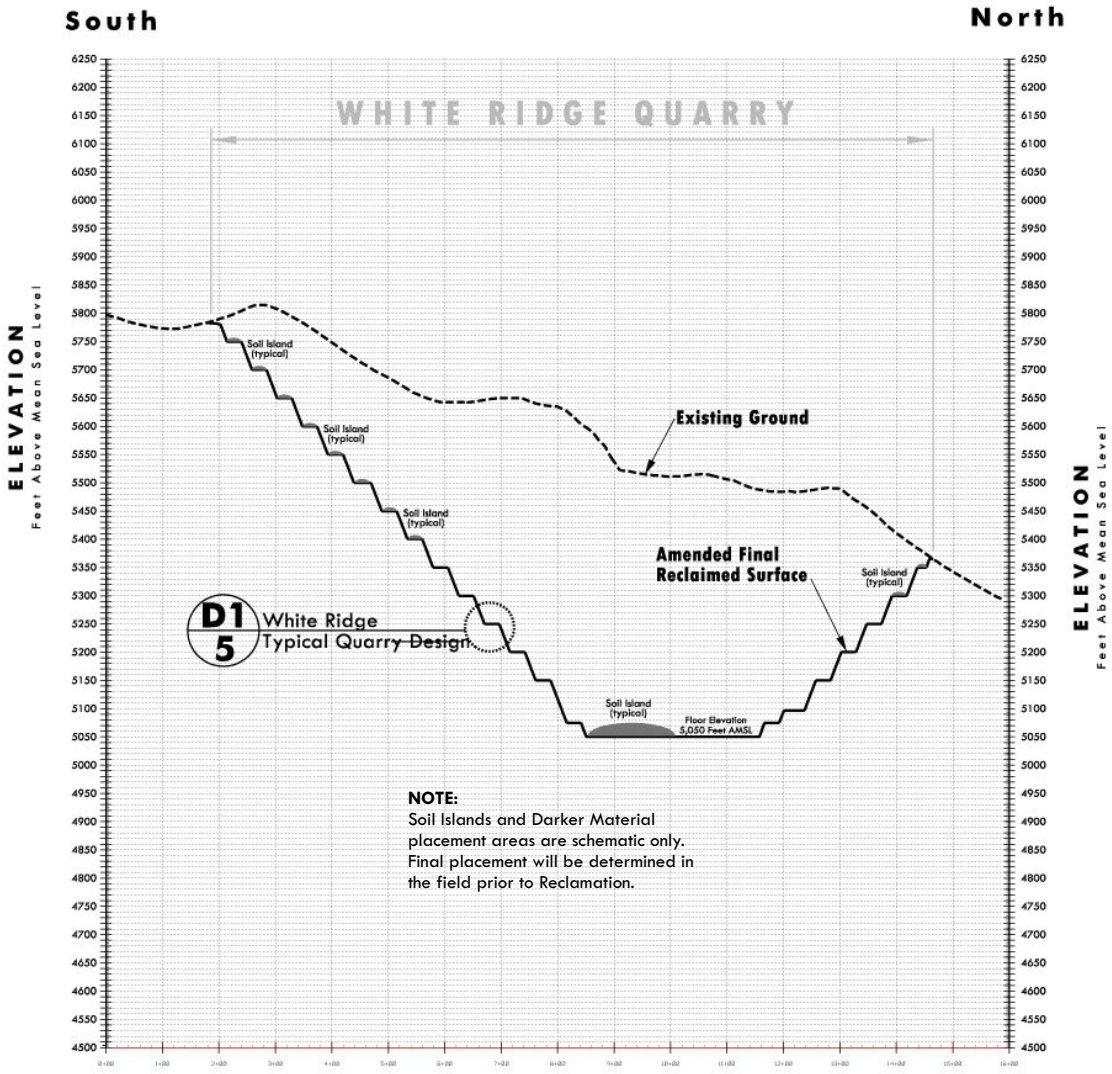

LEGEND

- Existing Ground Profile
- Amended Mine Plan Profile
- Amended Reclamation Plan Profile
- Overburden Backfill
- Soil Island
- Darker Material
- AMSL — Above Mean Sea Level

CROSS SECTION "C"

White Ridge Quarry - North to South

White Knob and White Ridge Quarries - OMYA California
Amended Mine and Reclamation Plan
County of San Bernardino, California

Source: Lilburn Corporation

0 200 400
FEET
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Figure 2.0-7
White Ridge Quarry Cross Section – North to South

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TABLE 2.0-7
PLANNED OVERBURDEN, WASTE ROCK, AND FINES STORAGE AREAS – WHITE KNOB/WHITE RIDGE QUARRIES

Storage Area	Existing Areas (approx. acres)	Planned Additional Areas (acres)	Total Area (acres)
OB-1	15	16.9	31.9
OB-2	0	13.0	13.0
OB-3	0	3.0	3.0
Total OB Stockpiles	15	32.9	47.9
White Knob Quarry Backfill	Within planned quarry	(15)[1]	15
Central Area Backfill	To be disturbed by crusher site and quarry haul roads	(11)[2]	11

Source: Omya California 2013
Notes:
Areas rounded to nearest tenth of an acre. Totals may be slightly different due to rounding.
1. White Knob Quarry to be partially backfilled by overburden to approximate elevation of 5,575 feet, reducing height of quarry face to 625 feet.
2. Central Area to be backfilled up to approximate elevation of 5,575 feet as feasible.

Overburden Stockpile 1 (OB-1)

The existing approved OB-1 stockpile of approximately 15 acres would be progressively extended to the south into the White Knob Quarry and north by about 1,300 feet onto an additional 70 acres into BLM land west of the haul road (see **Figures 2.0-4** and **2.0-8**). At this time, Omya is in the process of acquiring the additional 17 acres as part of its 70-acre purchase of BLM land. Sale of this land to Omya will be a part of the County's Conditions of Approval for the Amended Mine and Reclamation Plan. As overburden removal progresses, the pad would be incrementally built southward to a planned elevation of 5,325 feet. OB-1 would be developed as a series of three benches of varied widths per the existing grade reclaimed to 2H:1V.[7] Basins 4 and 5 would be improved per the updated sedimentation control plan, and secondary sediment basins 11 and 12 would be constructed to the stockpile's northwest and north to prevent sediment from leaving the site. Backfilling of the eastern portion of the White Knob Quarry during about the last 20 years of operations would occur to minimize OB-1 expansion and to minimize disturbance of new ground.

Overburden Stockpile 2 (OB-2)

OB-2 would be developed on approximately 13 acres in a canyon area south of the crusher and west of the White Ridge Quarry in Phase 4. Overburden from the White Ridge Quarry would be transported on haul roads along level alignments along the contour. Overburden and waste rock would be placed at OB-2 between the elevations of 5,800 feet and 5,425 feet (see **Figures 2.0-4** and **2.0-8**). Basin 1 located at OB-2's toe would be improved per the updated sedimentation control plan. OB-2 would be approximately 1,150 feet southwest to northeast and approximately 550 feet wide at its widest point and would be developed as a series of approximately six 50-foot-wide benches along interslopes of 1.5H:1V. The overall slope of OB-2 would be no greater than approximately 2H:1V from the amended final reclaimed surface beginning at 5,573.5 feet above mean sea level (AMSL) to the top of OB-2 at 5,800 feet AMSL.

[7] 2H:1V describes the slope. For every 2 feet in run (horizontal increase), the rise (vertical increase) is 1 foot, which equates to a 50 percent slope.

Overburden Stockpile 3 (OB-3)

OB-3 would be developed on approximately 3 acres to the northeast of the White Ridge Quarry in Phase 4. Overburden from the White Ridge Quarry would be placed at OB-3 between approximate elevations of 5,200 and 5,025 feet (see **Figures 2.0-4** and **2.0-9**). Basin 3 would be constructed at the toe to collect sediment from the stockpile. OB-3 would be approximately 750 feet north to south and approximately 200 feet wide at its widest point and developed as a series of benches.

NON-SPEC MATERIAL PRODUCTION

The Amended Plan includes an option of crushing varying amounts of overburden and non-spec rock and transporting this material to the processing plant (along with fines) for sale as aggregate, depending on demand. These amounts would be subtracted from the amounts deposited on the overburden stockpiles. **Table 2.0-5** lists potential overburden crushed and transported to the processing plant as an average of 150,000 tons per year with a maximum of 300,000 tons per year. The combination of all material transported to the processing plant would not exceed 680,000 tons of finished ore per year, which is the processing plant maximum capacity.

Depending on the amounts of non-spec material transported off-site, a portion of this material would be eliminated from being deposited in the overburden stockpiles. It is anticipated that some of the overburden stockpiles may be a level or two lower than shown on the reclamation plot plan, depending on the amount of non-spec material removed.

OPERATIONS

Hours of Operation and Employees

Mining of ore grade limestone would occur throughout the year, but would usually occur approximately eight months per year. Overburden removal and quarry development may occur throughout the year, but would usually occur for about four months per year. Ore production requirements are the major determining factor for scheduling of mining activities.

Mining activities vary throughout the year and may occur 24 hours per day, 7 days a week, depending on operational requirements. Blasting is currently restricted to daylight hours and would remain so with the proposed project.

The current mining operations employ approximately 10 equipment operators/haul truck drivers Monday through Thursday over two 10-hour shifts (6:00 a.m. to 4:00 p.m. and 4:00 p.m. to 2:00 a.m.). In addition, the site employs two managers and one geologist. During the summer months (June through September), four additional contractors work on-site to assist with crushing and screening operations. Several drilling and blasting contractors visit the site approximately once a week. The maximum number of employees at the site is anticipated to be 16 equipment operators/haul truck drivers, two managers, one geologist, and two contractors. All of these employees divide their time between the White Knob Quarry facility and Omya's other quarry in the county, the Sentinel/Butterfield Quarry.

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South

North

OB 2

CENTRAL BACKFILL AREA

OB 1

ELEVATION
Feet Above Mean Sea Level

Limits of Disturbance or Project Boundary

Floor Elevation 5,800 Feet AMSL

Soil Island (typical)

1.5:1

OB 2

Existing Ground

Amended Final Reclaimed Surface

Permanent Sediment Control Basin
(Finished Surface Approximately 5575' AMSL)

5575.5' AMSL Highest Surface

Slope 0.5 %

Central Backfill Area
Reclamation Phases 3 and 4

Haul Road

White Knob Quarry
Typical Haul Road
(Reclaimed as Berm)

D2
4

Quarry Road to Remain

5,580' AMSL Top of Slope

2:1

Floor Elevation 5,320 Feet AMSL

Slope Stability
B-B'
See Figure 3.5-13

Mine Phase 2

Mine Phase 1

Drainage Channel

Floor Elevation 4,955 Feet AMSL

NOTE:
Soil Islands and Darker Material placement areas are schematic only. Final placement will be determined in the field prior to Reclamation.

Looking Northwest

LEGEND

- Existing Ground Profile
- Amended Mine Plan Profile
- Amended Reclamation Plan Profile
- Overburden Backfill
- Soil Island
- Darker Material
- AMSL — Above Mean Sea Level

Source: Lilburn Corporation

0 200 400
FEET

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Figure 2.0-8
OB-1, OB-2 and Central Backfill Area Cross Section – North to South

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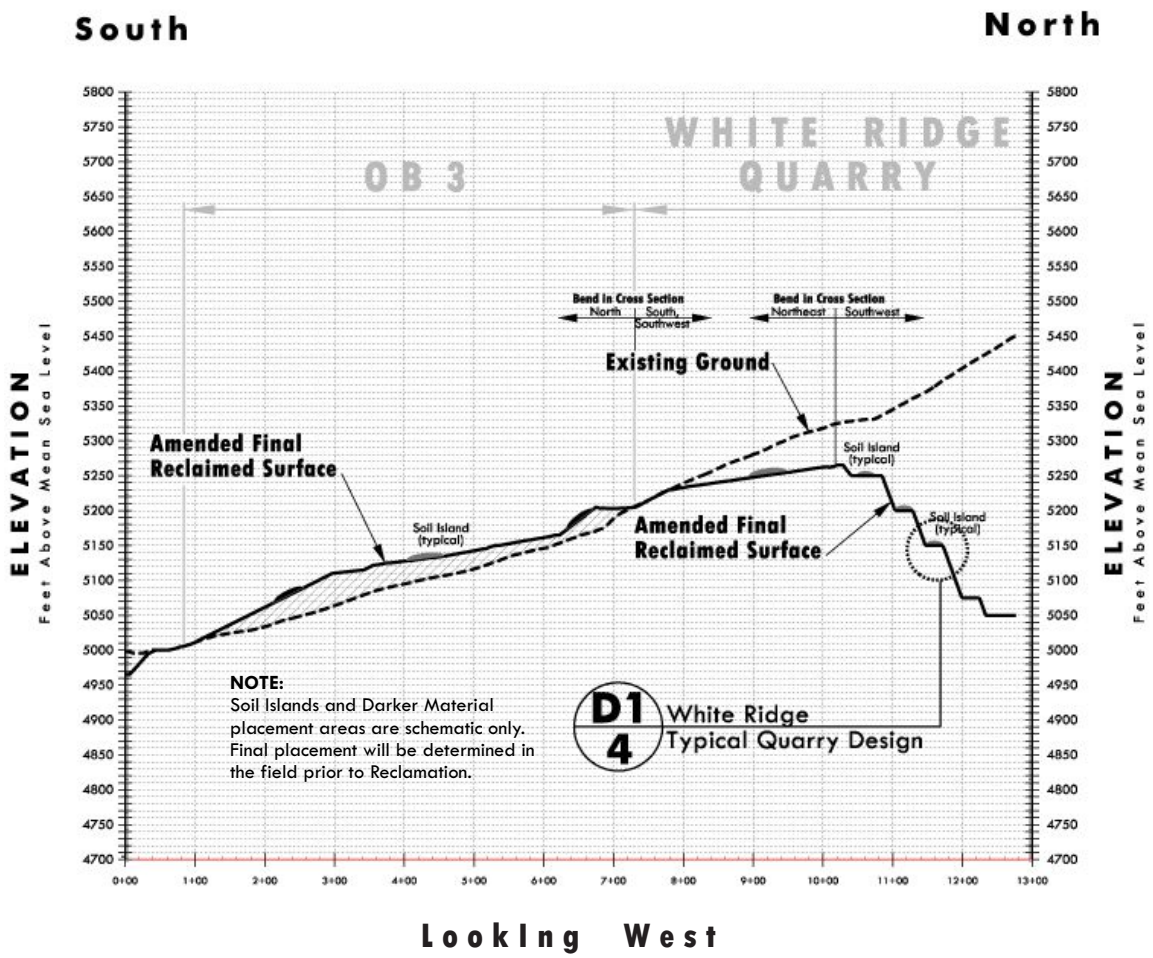

LEGEND

- Existing Ground Profile
- Amended Mine Plan Profile
- Amended Reclamation Plan Profile
- Overburden Backfill
- Soil Island
- Darker Material
- AMSL — Above Mean Sea Level

CROSS SECTION "D"

OB-3 - North to South

White Knob and White Ridge Quarries - OMYA California
Amended Mine and Reclamation Plan
County of San Bernardino, California

Source: Lilburn Corporation

0 200 400
FEET
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Figure 2.0-9
OB-3 Cross Section – North to South

PMC®

Equipment Used

The major equipment listed in **Table 2.0-8** is currently used in mining at the White Knob/White Ridge Quarries. No changes in equipment numbers are planned because processing operations would not increase. As operations progress, alternate equipment may be required to optimize operations; this equipment is also listed in the table. The alternative equipment would not substantively change the mining operations described in this section.

TABLE 2.0-8
TYPICAL QUARRY EQUIPMENT – WHITE KNOB/WHITE RIDGE QUARRIES

Equipment	Typical Number	Proposed Increase in Equipment	Purpose
Bobcat	3	0	Earthmoving
Crane	1	0	Lifting as needed
Dozer	2	0	Removal of topsoil and waste rock. Construction and maintenance of the haul road and quarry bench grading.
Off-Road Haul Trucks	11 (40- to 100-ton trucks)	0	Transportation of excavated material to the primary crusher and to overburden stockpiles onsite and transportation of crushed sized ore to the Lucerne Valley processing plant.
Front-End Loaders	8	0	Loading of excavated materials into haul trucks at quarry and at the primary crusher.
Excavator	1	0	Currently limited use for special projects and boulder breaking. Potential future replacement to be used in place of front-end loader.
Grader	1	0	Limited use for road development and maintenance.
Forklift	15	0	Equipment moving
Generator	1	0	Electrical power
Manlift	1	0	Various operations
Dump Truck	1	0	Ore moving
Grease Truck	1	0	Equipment maintenance
Fuel Truck	1	0	Fueling vehicle
Sweeper	3	0	Site maintenance
Lube Van	1	0	Equipment maintenance

Source: Omya California 2013

Ore Crushing Operations

The primary crushing area is currently centrally located at the 5,500-foot level immediately adjacent and to the south of the White Knob Quarry and north of the existing haul road **(see Figure 2.0-4)**. However, the permanent crusher is nearing the end of its operational use and will be decommissioned in the future. Once the permanent crusher is decommissioned, a mobile-type crusher would be relocated in proximity to active mining to reduce hauling from the quarry to the crusher. The following discussion applies to a stationary or mobile crusher at varied locations. No changes in the crushing process are planned, only moving the crusher to another disturbed site within the mining area.

Ore from the White Knob Quarry is hauled to the crusher and screened for size reduction and sorting of ore grades. The screen arrangement separates fines from the load. Stockpiles of ore, separated as to grade, are made by the conveyor at the crusher. From these stockpiles, haul trucks are loaded to transport the crushed ore to the processing plant using the main haul road.

The following is a list of the equipment and support facilities for the ore crushing system:

- Truck dump hopper and vibrating feeder
- Primary screen
- Jaw crusher
- Belt conveyors and radial stacker
- One 50-foot railroad boxcar containing spare parts, tools, and lunchroom
- Portable toilets
- One 10,000-gallon diesel fuel tank (double-walled) for mobile equipment
- One 10,000-gallon skid-mounted nonpotable water tank

Fuel for mobile equipment is stored at the quarry site in an approved double-walled tank with a spill control berm. Mine equipment is fueled at the fuel storage site. Scheduled equipment maintenance occurs at the Lucerne Valley processing site. Minor or emergency repairs may be conducted at the quarry. Any waste oil generated at the mine site is collected and transported for off-site disposal by approved methods and by properly trained and licensed personnel. As operations progress, alternate equipment may be required to optimize operations (see **Table 2.0-8**). These may include the utilization of a mobile crusher, which would be capable of being set up near the face of the quarry to reduce handling of the ore. A mobile crusher could also be moved within the quarry area as needed. The alternate equipment would not substantively change the process described previously.

Site Access and Circulation

Vehicular access to the mining area is provided only on restricted access/haul roads. **Figure 2.0-4** shows the location of all haul, access, and quarry roads on the site. As described previously, the site is accessed via a 5.1-mile-long haul road at its northeastern corner. From this point, an internal haul road runs south along the eastern side of OB-1 and Basins 4 and 5, winds southwest between the White Ridge and White Knob quarries, and continues south past Basin 2 and through the Central Backfill Area. The internal haul road then turns west and splits to access the White Knob Quarry to the north and the crusher site to the west. The haul road then continues west past the crusher site and winds through the western portion of the White Knob Quarry into the Annex Quarry.

A new haul/access road would be extended from the existing internal road near Basins 4 and 5 southeasterly to provide access to the proposed OB-3. As shown on **Figure 2.0-4**, the internal haul/access road would also be extended south to provide access to the proposed OB-2. The exact location and design would be determined in the field.

Off-Site Haul Road

The off-site haul road is within a recently amended BLM right-of-way (CACA 16644) incorporating the first 4.4 miles of the 5.1-mile haul road starting at the boundary of the Lucerne Valley processing plant and ending at the fee land boundary at the quarry site. The BLM and Omya Settlement Agreement has six separate remediation components (Parts A–F). In order to accommodate the improvements required to adequately repair and remediate the right-of-way access road and drainage facilities, the existing right-of-way was expanded from 67 acres to its present 83.5 acres. The BLM requires final reclamation on approximately 40 acres of the total 83.5 acres of federal public land. This is included in the Amended Plan.

Lighting

No lighting is currently used or would be used to operate the quarries during nighttime hours, with the exception of headlights on mobile equipment. No new sources of lighting are proposed as part of the project.

Water and Wastewater

The White Knob/White Ridge Quarries utilize groundwater during operations. Water is obtained from two permitted sources: a well located at the processing plant site and a well located in Crystal Creek Canyon near Turnout 5 on the Crystal Creek haul road. No surface water is used in the operation. Water is hauled in a water truck and sprayed on the haul roads and active mining and overburden areas to minimize fugitive dust. Water is also used for revegetation during the initial stages of reclamation. The project proposes to increase water usage by approximately 2.25 acre-feet per year in order to provide the needed water for quarry operations in the expanded areas. There are no planned additional diversions or storage for water supply, and no new or expanded treatment facilities are proposed.

Portable toilets with hand washing stations are supplied for use by employees and are located at the crusher site. No other wastewater is produced from the mining and crushing operations.

Solid Waste

Small amounts of solid waste are generated in the form of general refuse from on-site project personnel. This general refuse is collected and disposed of off-site at the Victorville Landfill located approximately 30 miles west of the project site. The Amended Plan would also require the need to remove solid waste from the project site. However, because solid waste removal currently occurs and is not expected to increase due to mine expansion, it is considered an existing condition for the purposes of this EIR.

Hazardous Materials and Waste

No processing chemicals are used or are proposed to be used during mining and crushing operations. The current blasting agent ammonium nitrate and fuel oil mixture (ANFO) is used during blasting operations at the site. All ANFO used at the site is currently stored separately in magazines located at designated locations at Omya's processing plant site per all federal, state, and local regulations. Magazine storage of ANFO would continue in this manner and no changes are proposed.

DRAINAGE AND EROSION/SEDIMENTATION CONTROL

Numerous erosion and sedimentation controls have been and are planned to be implemented in the quarries and stockpile areas to control, minimize, and prevent off-site sedimentation. Runoff is directed into the quarries, and many sediment basins, culverts, dips, or drains direct water off roads. A number of energy dissipaters, riprap, hay bales, catch basins, and/or silt fences trap sediment and prevent it from traveling off-site. Long-term stabilization, or reclamation, would generally involve grading or reshaping disturbed areas, establishing effective drainage, placement of plant growth media, and revegetation. Following reclamation, the majority of surface runoff from quarry areas would be retained in the quarry limits where it would either percolate to groundwater or evaporate. A brief description of project drainage facilities is included below. Section 3.7, Hydrology and Water Quality, provides a detailed discussion of these facilities.

On-Site Haul Road/Drainage

The on-site haul road within the quarry area from the crusher area to the northeast corner of the project site east of OB-1 carries stormwater from the southern areas northward. The area where the haul road is located does not have the width to place a separate drainage channel. The drainage report determined that the required 4-foot berms on each side (or a hillside slope or eventually the side slope of OB-1), as required for truck safety per the Mine Safety and Health Administration (MSHA), are adequate to contain the 10-year design flow and the 100-year flow within the roadway with over 2 feet of freeboard. The haul road would be graded with a 2 percent cross fall and berm openings to allow stormwater discharge to the existing sediment catchment basins on the site. Equipment and aggregate material is located on-site to make repairs to the roadway/drainage damaged during and after a storm.

Sediment Basins

There are currently four sediment catchment basins on the quarry site as well as two basins off-site. Sediment Basins 1, 3, 4, and 5 are located along the haul road and are illustrated on **Figure 2.0-6**. Basin 6 and Basin 7 are located just off-site. No modifications to the existing sediment basins are anticipated in order to implement the proposed project.

Quarries

The existing and future mining activities located on the site would create and deepen their pit floors. Future runoff down slopes, benches, roads, and ramps and any sediment would be directed into the mined-out portion of the quarry or into sediment basins. For the White Knob Quarry, the final backfill would be designed to act as a permanent sediment basin.

2.10 RECLAMATION

RECLAMATION PLAN

Reclamation of the proposed project pertains to the end use of the property. The approved 1986 reclamation plan includes a revegetation plan that was updated in 2008. No substantial changes to the approved reclamation and revegetation methods are proposed in the Amended Plan. However, the timing and some specific details of reclamation would be affected by the proposed expansion of quarries and overburden sites. Reclamation of disturbed lands is an integral part of ongoing mining operations. As a part of the proposed project,

reclamation of the site to meet SMARA standards is included in order to minimize impacts to the surrounding environments. Because of the phased nature of the mining development, reclamation concurrent with mining can only occur to a limited degree for safety and logistical reasons. Concurrent reclamation starts with the initiation of mining and includes the following:

- Salvaging and stockpiling of grubbed organics, soils, growth media, seeds, and relocatable plants and cuttings for propagation and direct deposition and/or replanting to available reclamation areas during clearing of areas to be developed.
- Ongoing seed collection on-site and/or adjacent to the site and propagation of seeds, salvaged plants, and cuttings at a local nursery by a contracted revegetation contractor.
- Backfilling of the eastern half of the White Knob Quarry to approximately the 5,575-foot level.
- Sloping and grading of completed quarry and stockpile slopes for safety, slope stability, and erosion control.
- Placement of darker materials, as available, on the outside of more visible slopes, and colorization if shown successful for slopes not susceptible to raveling to reduce color contrast.
- Ripping of compacted areas prior to revegetation.
- Covering approximately 30 percent of equipment-accessible horizontal areas with growth media, utilizing the island revegetation concept.
- Phasing reclamation of on-site roads to begin after reclamation of quarries and overburden sites is completed, as determined by the County, to allow access to reclamation areas.
- Reclamation of the White Knob Quarry access road to half width by ripping and seeding.
- Revegetation including hand seeding and direct seeding followed by imprinting, seedling planting, and hydroseeding on steep slopes impacted by roll-down as deemed most effective.
- Irrigation may be conducted on newly seeded and planted areas for two to three years to maximize establishment.
- Monitoring and remediation of revegetated areas until success criteria are achieved.

RECLAMATION PHASING

A summary of the general reclamation phasing is included in **Table 2.0-9**. The Amended Reclamation Plan is provided as **Figure 2.0-10**.

TABLE 2.0-9
GENERAL RECLAMATION PHASING WHITE KNOB-WHITE RIDGE QUARRIES

Phase	Years of Operations (estimated)	Planned Reclamation Activities
1	1–10	Newly developed areas – Salvage and stockpile plants and cuttings, organics, seeds, and soils. North-facing slopes – Concurrent colorization and revegetation below the quarry where mining has been completed and downhill migration of the material has sufficiently slowed.
2	11–20	Newly developed areas – Salvage and stockpile plants and cuttings, organics, seeds, and soil. North-facing slopes – Concurrent colorization and revegetation below the quarry where mining has been completed and downhill migration of the material has sufficiently slowed. White Knob – Annex Quarry – Initiate revegetation on completed upper benches as they become available.
3	21–30	White Knob – Annex Quarry – Complete slope contouring and initiate backfilling on eastern half developing final sediment basin; revegetation on completed areas. Central Area – Initiate backfilling and revegetation as areas become available.
4 (Final Mining Phase)	31–40	White Knob – Annex Quarry – Complete slope contouring and initiate backfilling on eastern half developing final sediment basin; revegetation on completed areas. White Ridge Quarry – Initiate revegetation on 30% of completed upper benches as they become available. Central Area – Initiate backfilling and revegetation as areas become available. OB-1 & 2 – Complete deposition and sloping of overburden, initiate revegetation on completed areas.
5 (Final Reclamation during the 10 years following the termination of mining)	41–50	Remove crusher and other plant equipment within one year after completion of mining. White Knob – Annex Quarry – Finish sloping of backfill; revegetate 30% of all areas not previously revegetated; maintain erosion control; monitor revegetation progress and conduct remediation as necessary until success criteria achieved. White Ridge Quarry – Finish sloping of quarry; revegetate 30% of benches; maintain erosion control; monitor revegetation progress and conduct remediation as necessary until success criteria achieved. Central Area – Finish sloping; revegetate 30% of area; maintain erosion control; monitor revegetation progress; and conduct remediation as necessary until success criteria achieved. OB-1, 2 & 3 – Finish sloping; maintain erosion control facilities; revegetate; monitoring and remediation as necessary until success criteria achieved. On-Site Roads – Reclaimed after reclamation of quarries and pads certified complete as determined by County in order to allow access to all reclamation areas.

Source: Omya California 2013

Final reclamation would take place within the 10 years after termination of mining. All remaining equipment, stockpiles, and internal roads not needed for site access, reclamation, and revegetation and general site monitoring would be reclaimed. Final sloping of quarry walls, backfilled areas, and overburden stockpiles; erosion control; and revegetation of any unreclaimed areas and waste rock stockpiles would be conducted. Some haul roads may be left on-site for use in the revegetation and monitoring activities and for overall site public safety.

T:_CS\Work\San Bernardino, County of\White Ridge Limestone Quarry\Figures

Reclamation Plan Notes

1. Name: White Knob – White Ridge Quarries

2. Mineral Mined: Limestone

3. Mine Operator:
Omya California
7225 Crystal Creek Road
Lucerne Valley, CA 92356
Peter Sutherland, Plant Manager
(760) 248-5233

4. Land Owner:
Omya Inc.
7225 Crystal Creek Road
Lucerne Valley, CA 92356
Peter Sutherland, Plant Manager
(760) 248-5233

5. Applicant: Same as (3)

6. Representative:
Lilburn Corporation
1905 Business Center Drive
San Bernardino, CA 92408
(909) 890-1818

7. Owner of Mineral Rights:

Omya Land Holdings
White Knob – White Ridge Quarries

CLAIM NAME	ACREAGE LEASED OR OWNED BY OMYA & APN	LEGAL DESCRIPTION AND CAMC#	NAME AND ADDRESS
White Ridge Placer #1	157.5 acres Patented APN 0446-021-35	NW1/4 Sec 8, T3N, R1W SBBM Patent #1186488	**Owned by:** Omya Inc. 7225 Crystal Creek Road Lucerne Valley, CA
White Knob Placer #1	160 acres APN 0446-011-06	NE1/4 Sec 7, T3N, R1W, SBBM Patent #04-83-0104	**Leased from:** Don Fife P.O. Box 1054 Tustin CA 92681
White Knob Annex Placer Claim	40 acres APN 0446-011-04	SE ¼ Sec 6, S1/2, S1/2 T3N , R1W SBBM Patent #04-83-0104	**Leased from:** Don Fife P.O. Box 1054 Tustin CA 92681
Silver Creek Placer #4 (portion)	70 acres APN 0446-021-11	SW ¼ Sec 5, S1/2, T3N, R1W Land Sale with BLM	**Owned by:** Omya Inc. 7225 Crystal Creek Road Lucerne Valley, CA 92356

8. Geologists:
CHJ Consultants
1355 E. Cooley Drive, Suite C
Colton, CA 92324
(909) 824-7311

9. Map Preparers:
Omya California
Lilburn Corporation

10. Source of Existing Topography:
Digital Mapping, Inc. & Aerial 2009

11. Date of Map Preparation: January 2013

12. Assessor's Parcel Numbers: See No. 7 above

13. Utilities:
Electricity – Onsite generated as needed
Gas – Not applicable
Water – Omya well system
Sewer – Portable sanitation stations
Telephone – Verizon

14. Area To Be Disturbed: 190.1 acres per this Amendment
Area To Be Reclaimed: 335.1 acres total with this Amendment and prior 1986 approval
BLM ROW – half road width or approx. 40 acres

15. Reclaimed End Uses: Open space habitat for native wildlife and plants

16. County Land Use District: Resource Conservation (RC)

17. Reclamation starts with the initiation of mining and includes the following:

- Salvaging and stockpiling of grubbed organics, soils, growth media, seeds, and re-locatable plants and cuttings for propagation and direct deposition and/or re-planting to available reclamation areas during clearing of areas to be developed;
- Ongoing seed collection onsite and/or adjacent to the site and propagation of seeds, salvaged plants and cuttings at local nursery by a revegetation contractor;
- Sloping and grading of completed quarry and stockpile slopes for safety, slope stability, and erosion control;
- Backfilling of the eastern half of the White Knob Quarry after about year 20;
- Placement of darker materials as available on outside of more visible slopes and colorization if shown successful for slopes not susceptible to raveling to reduce color contrast;
- Ripping of compacted areas prior to revegetation;
- Covering approximately 30% of equipment accessible horizontal areas with **growth media to begin utilizing the island concept;**
- **Reclamation of onsite roads after reclamation of quarries and overburden stockpiles certified complete as determined by the County in order to allow access to all reclamation areas; and**
- Reclamation of half width of the BLM ROW haul road (approx. 40 acres) including removal of road surface material as needed, ripping compacted areas and seeding.

18. Revegetation is summarized below: (See Amended Reclamation Plan text for details.)

- Ripping the surface to a depth of 2 feet for moisture and seed collection;
- Placement of available growth media in islands to cover approximately 30% of equipment accessible horizontal surfaces to 1.5' to 2 feet thick;
- Seeding with locally native species and revegetation per methods described in Reclamation Plan and table below;
- Staking or flagging reclaimed areas to eliminate additional disturbance;
- Irrigation maximum of 2 years as recommended;
- Monitoring and maintenance is required as access allows; and
- Application of remedial activities as necessary, including but not limited to additional seeding and planting, plant protection, irrigation, and change of seed and plant mix.

Source: Lilburn Corporation

Table 11
Recommended Plant Species for Revegetation

Perennial Grasses for application as seed and mycorrhizal nursery stock. **Bold species required.**

Common Name	Latin Name	Lbs/acre (PLS)
Indian ricegrass	***Achnalherwn hymenoides (Oryzpsis h,)***	**10**
Parish's needlegrass	***Achnalherum parishii (Stipa coronala depauperala)***	**10**
Desert needlegrass	***Stipa speciosa (<6,000 feet)***	**10**
Squirreltail	*Elymus elymoides (Sitanion hystrix)*	2
3-awn grass	*Aristida purpurea*	2
Nodding bluegrass	*Poa secunda*	2

Shrubs for application as potted nursery stock: greenhouse propagation by seed or cuttings; outplanted as "deep pot" stock.

Common Name	Latin Name	
Blackbrush	*Coleogyne ramosissima*	Approx. 100 per acre

Shrubs for application as seed. **Bold species required.** Remainder should be added depending on availability.

Common Name	Latin Name	Lbs/acre(PLS)
Bigberry manzanita	***Arctostaphylos glauca***	**2**
Great basin sagebrush	***Artemisia trideniala***	**5**
Cupleaf ceonothus	***Ceonothus greggii***	**2**
Curleaf mountain mahogany	***Cercocarpus Ledifolius (<6,000' – 2 lbs) (>6,000' – 10lbs)***	
Common rabbitbrush	***Chrysothamnus nauseosus***	**5**
Green ephedra	***Ephedra virklis***	**5**
California Fremintia	***Fremoniodendron californicum***	**5**
California buckwheat	***Eriogonum fasiculatum***	**5**
Curleaf rabbitbrush	*Chrysothamnus viscidiflorus*	2
Douglas rattleweed	*Astragalus douglassii*	2
Greenleaf manzanita	*Arctostaphylos patula*	2
San Bernardino Mtn buckwheat	*Eriogonum microthecum var. corymbosoides*	2
Snakeweed	*Guitierrizia sarothre*	2
Grinnells penstemon	*Penstemon grinneuii*	2
Purple mat	*Nemophila rothrockii*	2
Blazing star	*Mentzelia laevicaulis*	2

Trees for application as nursery stock: greenhouse propagation from seed, outplanted as "deep pot" stock. Densities determined by slope aspect and elevation.

Common Name	Latin Name	
Pinyon pine	*Pinus monophylla*	
Canyon live oak	*Quercus chysolepis*	

Source: "Revegetation Plan" Omya Mining Operations on USDA Forest Service Land San Bernardino National Forest, Tierra Madre Consultants 1996

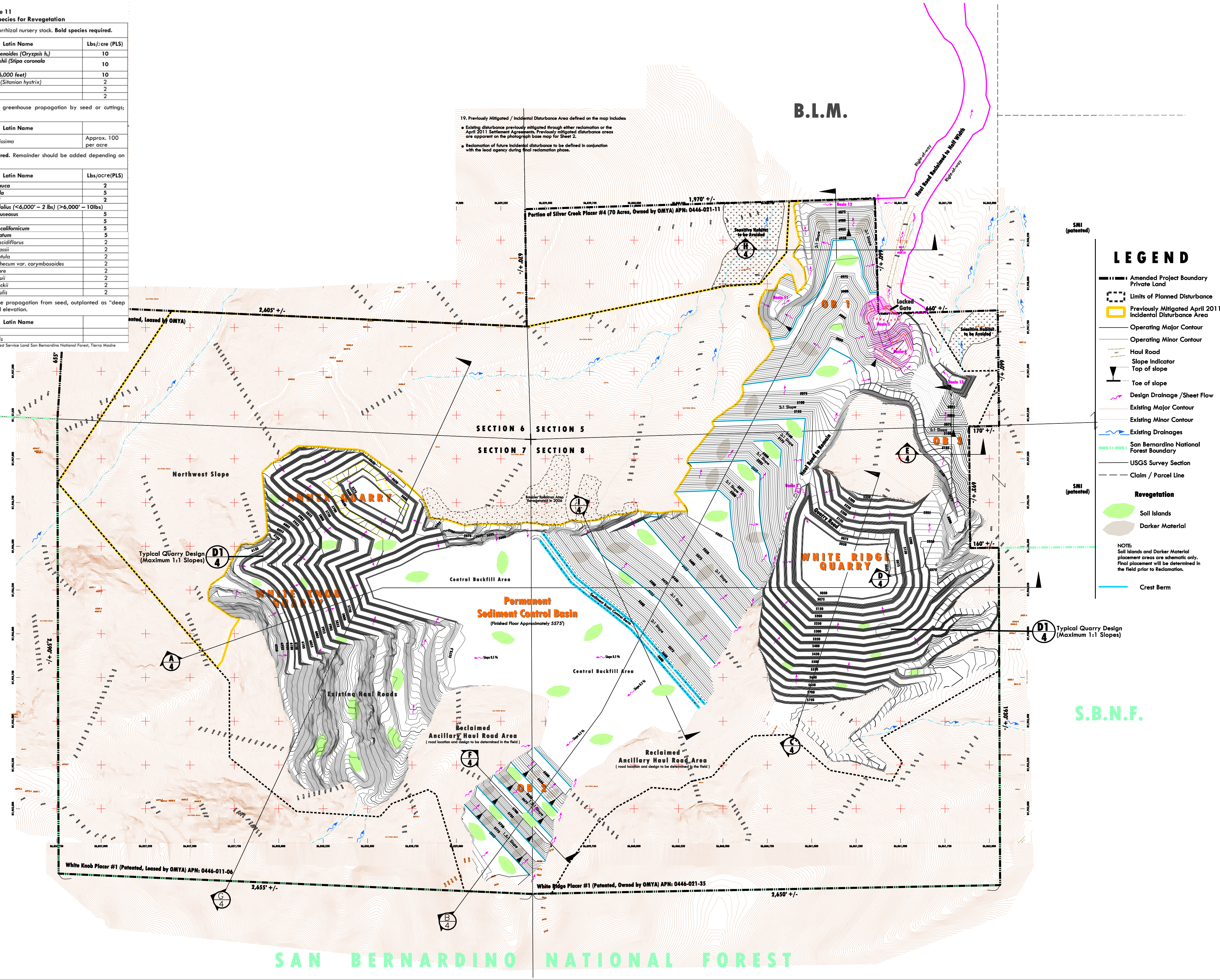

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Figure 2.0-10
Amended Reclamation Plan
PMC®

Ongoing maintenance of fencing, signs, and erosion control would be conducted. Roads not needed for site and quarry access would be ripped, covered with available growth media, and revegetated. Other on-site roads needed for quarry and pad access would be reclaimed after reclamation of quarries and pads is certified complete.

RECLAMATION AND BACKFILLING OF WHITE KNOB AND WHITE KNOB ANNEX QUARRIES

During mining of the White Knob and White Knob Annex quarries, concurrent reclamation of the completed slopes and upper haul roads would occur, but only after those portions of the pit have reached their final outer limit and the ore has been mined. During Phases 3 and 4, the White Knob Quarry would be mined from top to bottom from approximately 6,200 to 5,300 feet and the Annex Quarry from 6,075 to 5,575 feet. After completion of mining, likely during the last 20 years of operations, the eastern portion of the White Knob Quarry and the adjacent Central Area to its south would be partially backfilled with overburden to create a floor elevation at approximately the 5,575-foot level and graded to maintain a permanent sediment basin for future sediment control. The final backfilled floor would be graded to drain toward the highwall on the south and west and would have capacity to retain all quarry runoff for a 20-year/1-hour precipitation event. During and after completion of mining in the Annex Quarry, the quarry would be utilized for stormwater and sediment retention for precipitation that falls on this quarry area.

Concurrent and final reclamation would include final slope stabilization, placement of growth media, revegetation, colorization where needed and feasible, maintenance of erosion controls, monitoring of revegetation progress, and remediation as necessary until success criteria are achieved.

RECLAMATION OF WHITE RIDGE QUARRY

During and after completion of mining in this quarry, the quarry floor at approximately 5,050 feet would be utilized for stormwater and sediment retention for precipitation that falls on the quarry area and for a portion of the haul road drainage on the west. Final reclamation would include final slope stabilization, haul road removal, placement of growth media, revegetation, colorization where needed and feasible, maintenance of erosion controls, monitoring of revegetation progress, and remediation as necessary until established success criteria are achieved.

RECLAMATION OF OVERBURDEN SITES

The three overburden sites would be concurrently reclaimed, as possible. As the final buildout design and overburden placement for each site is completed, the stockpile surface and slopes can be reclaimed. Reclamation of the surface would include slope reduction, drainage controls, placement of growth media, revegetation with native species, irrigation, and monitoring and remediation as necessary until established success criteria are achieved. Reclamation of the slopes would include slope reduction to no steeper than an overall 2H:1V.

HAUL ROAD AND OFF-SITE ACCESS ROAD

The 2011 Settlement Agreement Part B requires Omya to repair, remediate, and monitor measures to control runoff and sedimentation along the 4.4 miles of haul road on BLM-managed land. In addition, the BLM requires final reclamation on approximately 40 acres of the total 83.5 acres of federal public land for haul road right-of-way. These measures are identified further in this section under subsection 2.12, Project-Proposed Environmental Mitigation Measures, Off-Site Haul Road.

The off-site White Knob Quarry access road is needed for access from Lucerne Valley to the quarries during the mining and reclamation phases. After receiving certification from the County that reclamation and revegetation of the quarries have achieved established success criteria, this road would be reclaimed to half width through ripping and revegetation.

CLEANUP

All cleanup operations are to be conducted within one year of the final termination of mining. Scrap material, refuse, residual equipment, and surplus materials would be removed, recycled, and/or disposed of at an appropriate landfill site. Excess material piles and disturbed areas would be regraded for positive drainage, scarified, and revegetated. Any spillage of fuel, oil, grease, or hazardous materials is to be cleaned up in a proper and legally acceptable manner.

SLOPE AND SLOPE TREATMENT

A slope stability investigation was prepared for the proposed project in January 2013 by CHJ Consultants. The investigation concluded that the proposed mine excavation and reclamation (backfilling) of the quarries would be suitably stable against gross failure for the anticipated long-term conditions, including the effects of seismic shaking, and meet the factor of safety criteria for status and seismic conditions. All recommended measures, as listed below, would be implemented as part of the proposed project during mining activities.

- Overall final cut slopes in the granite and limestone should be no steeper than approximately 1H:1V up to the maximum heights proposed in the mining and reclamation plans.
- If encountered during future mining, geologic structures that exhibit exceptional continuity and adverse geometry with regard to planned slope aspects or contain significant clay linings, water seepage, or other potentially deleterious conditions shall be evaluated for potential impacts to reclaimed slopes. Slope design may require adjustment of bench geometry to mitigate potential instability if such features are encountered.
- Large, unstable boulders on mine slopes shall be removed or stabilized prior to the end of reclamation.
- Final reclaimed fill slope composed of overburden materials and proposed as OB-1, OB-2, and OB-3 should be no steeper than 2H:1V overall to the maximum proposed heights.
- Slopes should be protected with berms and/or levees as necessary to prevent slope erosion in the areas where natural slopes drain onto the reclaimed slopes.

A final slope stability assessment report would be prepared for the County to assess the final slopes as part of the site closure, to comply with SMARA slope stability requirements, per California Code of Regulations (CCR) Section 3502(b)(13).

PONDS AND WASTE STOCKPILES

No operational ponds, reservoirs, or tailings are utilized or produced at the project site. Rock waste and overburden have been and would continue to be deposited in overburden placement sites. Overburden placement areas would be reclaimed with overall slopes no greater than 2H:1V and revegetated as discussed previously.

REVEGETATION

Implementation of the proposed project is intended to restore self-sustaining native vegetation communities and provide visual integration of reclaimed lands with surrounding open space areas to support future wildlife habitat and open space use of the project site. The Omya White Knob Quarry Revegetation Plan was prepared by Scott White Biological Consulting in 2008.

Revegetation of the disturbed areas would include ripping of the compacted soil, placement of growth media and organics (logs) to assist in plant growth, and revegetation of the area during the fall planting season. The island concept would be utilized and would cover approximately 30 percent of the equipment-accessible horizontal surface in a manner that would allow maximum visual enhancement and revegetation success. The islands would be constructed of 1.5 to 2 feet of soil and media growth cover and would trap windblown seeds and attract wildlife to aid in seed dispersal. Irrigation would occur for two years as needed, followed by monitoring for 10 years or until success criteria, as outlined in the revegetation plan, are met.

MONITORING AND MAINTENANCE

SMARA requires annual reporting of mining and reclamation activities. The reports are filed with the Department of Conservation (DOC) Office of Mine Reclamation (OMR) and the County. Revegetated areas would be monitored over a 10-year period or until success criteria are achieved following initial seeding and/or planting. Data on plant species diversity, cover, survival, and vigor would be collected on revegetated sites and compared to baseline data from undisturbed sites to evaluate project success.

Monitoring and maintenance of reclamation is an ongoing responsibility of Omya. The project site would be inspected as needed, at least annually by the County. As reclamation efforts increase through establishment of native species, the frequency of monitoring by Omya would increase commensurate with the activities being conducted. As required by the proposed project's reclamation plan, the individual monitor(s) would be qualified revegetation specialists approved by the County.

RECLAMATION ASSURANCE

Omya would post an updated reclamation assurance annually in an amount sufficient to pay for the cost of reclamation for existing disturbance as outlined in the Amended Plan and summarized here. The County would annually review the updated reclamation financial assurance cost estimate (FACE), as annual updates are required by SMARA. San Bernardino County is the lead agency for SMARA, which also requires the reclamation assurance to be reviewed and approved by the OMR, in compliance with Section 88.03.080 of the County Development Code.

Omya most recently submitted its annually updated FACE to the County in June 2013, which is pending approval. The current FACE, in the form of a letter of credit on file payable to the County and to the OMR, was approved in July 2012.

2.11 PUBLIC SAFETY

To reduce the risk of injury to the general public and employees, several safety measures have been incorporated and would be ongoing as part of mining and reclamation activities on the project site.

Vehicular access to the mining area is provided only on restricted access/haul roads. The roads have multiple highly visible warning signs directing the public away from the active mining area. In addition, the haul roads are watched by company personnel during operating hours. During non-operating times, locked steel gates are closed on all haul roads accessing both active and inactive quarries to restrict vehicle access. Safety berms are placed on jeep and off-road vehicle (ORV) trails to restrict ORV access and would be maintained as necessary.

Signs are located around the perimeter of the mining area directing vehicles or foot traffic away from the mining or reclamation areas.

Active mining areas comply with all federal (MSHA) and state (Cal/OSHA) mine safety regulations. Workers, including contractor labor, are trained in mine safety and first aid. Elevated roads have safety berms, quarries have safety benches with berms, and inactive ramps and roads in mining areas are blocked to prevent access.

Prior to blasting activities, employees working in the area are notified, and a visual search of the area is done prior to blasts to verify that no one is present in the area. Standard horn signals are used to notify personnel before and after blasts (all clear). "No Smoking" signs are placed on all storage containers that contain flammable materials. Storage containers are labeled indicating contents, and hazardous or poisonous materials are identified. Buildings or storage facilities are locked.

Once mining has been completed, the quarry rims would have a fence or other type of access restriction erected along dangerous highwalls with warning signs to prevent anyone from entering the quarry area. Upon completion of the reclamation of the mine, this fencing/access restriction will be removed.

2.12 POST-RECLAMATION AND FUTURE MINING

Because natural resources, particularly high-grade limestone resources, are finite and limited, an effort would be made in the reclamation to conserve remaining limestone resources that may have some conceivable future resource value. Limestone resources would be left in benches within the quarries. Reclamation on the patented land would not preclude future permitting of mining and reclamation of the potentially economic limestone resources that may remain after mining related to this proposed project is completed.

The planned land use subsequent to mining is open space and wildlife habitat compatible with surrounding BLM and U.S. Forest Service lands. The quarry excavation and reclamation would result in a series of reclaimed benches 25 to 30 feet wide and 50 feet high within the quarries. The eastern portion of the White Knob Quarry would be backfilled with waste rock to approximately the 5,575-foot elevation, graded to maintain a permanent sediment basin for future sediment control, and revegetated. The slopes of the reclaimed overburden sites would be no greater than 2H:1V overall and revegetated on up to 30 percent of the equipment-accessible horizontal surfaces.

The project area is bounded by SBNF lands to the south, by BLM lands on the west and north, and by privately held land to the east (patented claims). The area is known to have additional limestone resources, and mining could be undertaken in the vicinity of the site in the future with additional entitlements.

2.13 PROJECT-PROPOSED IMPACT REDUCTION MEASURES

Numerous project designs, conditions of approval, and mitigation measures from the existing approved 1986 Plan were incorporated into the existing White Knob/White Ridge Quarries operations. This Amended Plan includes the following avoidance/minimization and environmental protection measures to reduce potential environmental impacts:

1) Implement mining methods along ridges and cliffs to minimize future boulder roll-down.

2) Place future overburden into existing overburden areas and/or backfill into completed quarries as much as feasible to reduce requirement for additional land and visual impacts.

3) Design and implement drainage control improvements to comply with CDFW regulations, including a number of sediment basins within the project area for overburden stockpiles and along roads.

4) Maximize overburden and fines for off-site use, reducing volume of overburden stockpiles.

5) As areas become available, implement reclamation/revegetation of completed quarries and overburden stockpiles to reduce visual impacts through backfilling, recontouring and slope reduction, growth media placement, revegetation with native plant species, and colorization as applicable.

6) Salvage and relocate Joshua trees, Mojave yuccas, and specific cacti species suitable for transplanting.

7) Develop the quarry site consistent with the CHMS Plan and guidelines, and mitigate impacts to these listed species through permanent conservation easements on mining claims in consultation with the County and the Forest Service.

8) Design overburden sites to avoid known or potential carbonate habitat to the degree possible. As most of the overburden and waste rock is carbonate rock, additional habitat will be created during reclamation, minimizing the overall loss of plant habitat.

9) Continue support of CDFW bighorn sheep studies during the mining project.

10) Implement and monitor erosion control facilities along the access road on BLM-managed lands per the approved right-of-way conditions.

The Amended Plan includes a site-specific revegetation plan that identifies growth media and organics salvage and placement, seeding and revegetation, seed collection and propagation, irrigation, site cleanup, public safety, rock and fill slope stability, drainage and erosion controls, a monitoring and maintenance plan, and bond release criteria.

AIR QUALITY PERMITS

The existing crusher has approved air quality permits to operate, which are renewed annually by the Mojave Desert Air Quality Management District (MDAQMD). The permits outline specific conditions that must be met to maintain air quality standards and limits on daily and hourly production rates. The existing permits allow for a maximum of 4,000 tons per day and 400 tons

per hour of ore processed, which is sufficient to accommodate the increased excavation area proposed in the Amended Plan. Therefore, no change in the existing crusher air quality permits will be necessary. Existing dust control measures are in compliance with MDAQMD Rules 401 (limiting visible emissions from exhaust), 402 (avoid nuisance emissions to people or businesses or property), 403 (prohibits visible dust from crossing property lines), and 403.2 (requirements for controlling fugitive dust) and meet the required air quality regulations. The dust control measures are required to be in place and operative, and regular monitoring by agency personnel ensures that the regulatory standards are met. Haul trucks and diesel equipment must meet all requirements of the California Air Resources Board's diesel vehicle regulations to reduce diesel pollutants. Upon decommissioning of the stationary crusher, a mobile crusher would be used. A new air quality permit would be required for the mobile crusher.

EROSION AND SEDIMENTATION CONTROL

The objective of all drainage control measures is to limit runoff to minimize or prevent erosion and to promote settling of suspended solids before the runoff leaves the site. The Settlement Agreement, as discussed previously, includes as Part B a section entitled: "Repair, Remediate, and Monitor Improvements to the White Knob Quarry Right-of-Way Access Road and Associated Facilities to Protect Drainages." The *White Knob Quarry Haul Road Drainage Report and Plan of Development* was prepared to analyze the existing drainage conditions at the quarry and along the haul road and to provide recommendations for facilities to control stormwater and sediment runoff and provide protection to surrounding drainages. Recommendations from the Plan of Development are summarized below.

On-Site Haul Road

The on-site haul road within the quarry area from the crusher area to the northeast corner of the project site east of OB-1 carries stormwater from the southern areas northward. The area where the haul road is located does not have the width to place a separate drainage channel. The hydrology study determined that the required 4-foot berms on each side (or a hillside slope or eventually the side slope of OB-1), as required for truck safety per the Mine Safety and Health Administration (MSHA), are adequate to contain the 10-year design flow and the 100-year flow within the roadway with over 2 feet of freeboard. The haul road will be graded with a 2 percent cross fall and berm openings to allow stormwater discharge to the sediment catchment basins discussed below. Adequate on-site equipment and aggregate materials are available to make repairs to road damage that may occur during heavy storms.

Off-Site Haul Road

There are currently four sediment catchment basins on the quarry site [Basins 1, 3, 4, and 5] along the road (illustrated on **Figure 2.0-6**) and two just downstream off-site (Basin 6 and Basin 7). The sediment debris production calculations determined that the four on-site basins have a volume of less than half of the predicted volumes needed, and recommended improvements are discussed below. The two basins just off-site to the northeast have adequate capacity and spillway protection, and no additional improvements are required. Sediment basins will be monitored, maintained, and excavated as necessary and sediment removed from the sites to an overburden site at the quarry. The basins and captured sediment would be maintained for the life of the quarry. Each basin site requires access that will support loading and haulage equipment and would meet required MSHA safety standards. Access roads and the sedimentation basins would be reclaimed as part of the long-term reclamation plan for the mine site.

Stantec completed the *White Knob Quarry Haul Road Drainage Report and Plan of Development* in 2011. This report was intended to specifically comply with items 15 through 17 of Part B of the Settlement Agreement. The report made the following recommendations:

Roadway Grading and Ditch: The road should be graded with a 2 percent cross fall. Which side of the road would be the low side of the roadway would be predicated on which side the next downstream catchment basin is on. The road surface should be an aggregate base course, free of calcium carbonate materials. The 4-foot-high earthen berms should continue to be provided, with the addition of breaks in the berms at the sediment catchment basins to allow stormwater and debris to flow in to the basins.

Sediment Catchment Basins: The following recommendations were made for the on-site roadway catchment basins:

> Basin 1 is located at the base of the proposed OB-2 in a confined area with little room for expansion. A concrete spillway is recommended to allow overflow of the 10-year design storm without failure of the basin embankment.
>
> Basin 2 is a new basin located in the upper drainage area about 400 feet north of Basin 1 with a designed volume of 960 cubic yards. Note that Basin 1 and Basin 2 will eventually be covered over with overburden during the last 10 years of operations or so, and storm flow and sediment would be captured by the permanent sediment basin to be designed on the former White Knob Quarry floor.
>
> Basin 3 is an existing basin along the haul road near the northwest end of the planned White Ridge Quarry. This basin is not able to be expanded; however, a concrete spillway will be constructed following BLM approval of the improvement.
>
> Basins 4 and 5 are adjacent to each other and located to the east of the proposed OB-1 expansion area. These two basins will be combined into one basin with a concrete spillway from Basin 4 into Basin 5 and a concrete spillway and a 50-foot riprap apron from Basin 5 to the natural drainage to the north. The bottoms of the basins will have a maximum grade of 10 percent and a total debris and sediment volume capacity of 6,380 cubic yards.

Since existing Basins 6 through 9 along the off-site portion of the haul road have sufficient capacity as well as spillway protection, no changes to these basins are recommended. However, Stantec recommended that a new basin be constructed off-site at location 10.

On-site Basins 11 and 12 will be constructed on the northeast and north side of OB-1 to control potential runoff and sediment off of OB-1. Both will have riprap spillways discharging into the natural drainages. On-site Basin 13 will be constructed at the toe of OB-3 to handle potential runoff and sediment and will have a riprap spillway discharging into the natural drainage.

The overburden stockpiles will be constructed with berms near the crest of the fill benches to prevent runoff over the fill slope. Typically, due to the porosity of the overburden, little runoff occurs. Drainage will be directed away from the rims. Riprap, catchment basins, and various energy dissipaters will be placed along the toe of fills as needed to trap sediment and minimize the potential for off-site transport. These drainage controls will be periodically inspected and maintained as necessary.

Culvert Riprap: Stantec recommended that the length of protection downstream of the culvert outlet should be extended in all locations. The culverts at Stations 154+20, 170+50, and 182+00 should have the existing outlet riprap protection removed and replaced with the appropriate riprap class and apron dimension.

Quarries

Existing and future mining activities at the three on-site quarries area will create and deepen their pit floors. Future runoff down slopes, benches, roads, and ramps and any sediment will be directed into the mined-out portion of the quarry or into sediment sumps located down the road in the vicinity of OB-1. For the White Knob Quarry, the final backfill will be designed to act as a permanent sediment basin for future sediment control through sloping the drainage toward the west into the quarry walls with sufficient capacity to handle potential runoff for a 20-year/1-hour precipitation event. The drainage controls will minimize the potential for off-site transport and will eliminate any potential adverse effect on downstream property.

A large number of energy dissipaters, sediment capture basins, riprap, hay bales, and/or silt fences trap sediment and minimize the potential for off-site transport. Operations also limit surface disturbance to minimum areas, and concurrent reclamation and revegetation will stabilize disturbed pads and slopes.

INCIDENTAL BOULDER ROLL-DOWN MITIGATION

During mining of the rock in the deposit at the top of the ridge and along the crest, boulders of white limestone have rolled down the slope to the north and to the west into the West Canyon. The incidental boulder roll-down has partly covered the older natural talus and landslide deposits, and is visible from Lucerne Valley.

Precautions have been taken and new mining procedures have been implemented to minimize future roll-down. However, because of remaining cliffs, some roll-down would be unavoidable, as it is necessary to continue to mine the ridge down and daylight in order to safely recover the ore. The following procedures are to continue for the life of the project to minimize boulder roll-down:

1) Precision drilling and buffer blasting when the outside edge is approached.

2) Drilling lifters on the edge to undercut the remaining slope and let it fall into the pit (like directional falling of a tree).

3) Excavator to pull down and pull in toward the pit blasted rock away from the edge.

4) Use of alternatives to blasting along the outside such as rock breakers, surface miners, cutting heads, and excavators.

5) Loader to pull back material from the edge.

6) Loader to dig at an angle to the edge or parallel to the edge when possible.

7) Manually scaling boulders from the highwalls where they may be above a haulage road.

Additional measures to reduce the visual impacts include concurrent colorization and revegetation of the visible north-facing slopes below the quarry where mining has been completed and downhill migration of the material has sufficiently slowed.

Where mining-related visual impacts have been completed on the north-facing slope, Permeon™ (permanent nontoxic dye) was applied in January 2006 to approximately 5 acres. The visual contrast has been substantially reduced, as the brown-colored stain on the boulders blends with the natural hillside color. Revegetation of the upper slopes was also undertaken, utilizing native species, slow release fertilizer, and commercial mycorrhizal inoculations. Irrigation occurred for two years to allow a higher proportion of germination. Revegetation helps stabilize the upper slopes and reduce erosion and sediment transport.

Reclamation will be a concurrent effort in which colorization by the use of permanent nontoxic dye that colors the rocks brown to blend in with the natural colors of the mountainsides, and revegetation would occur on the benches where mining is completed. Concurrent and final reclamation would include colorization (if feasible due to surface material suitability) and revegetation to blend with the natural-colored slopes.

VISUAL IMPACT MITIGATION

The Amended Plan includes designs and reclamation activities to reduce existing and future visual impacts from the quarries, overburden sites, and roll-down areas. These measures include the following:

- Implement measures to minimize boulder roll-down visual impacts as discussed previously.
- Maintain the existing crusher site at the White Knob Quarry or use a portable plant within an active quarry to reduce its visibility from Lucerne Valley.
- Deposit waste rock within the White Knob Quarry footprint, as described in the Amended Plan, to reduce the area of disturbance for overburden stockpiles and visual impact outside the quarry.
- Design and phase mining of the White Ridge Quarry, which allows for concurrent reclamation and leaves an approximately 300-foot-high ridge of undisturbed hillside facing Lucerne Valley to minimize visual impacts.
- Implement reclamation and revegetation on completed equipment-accessible quarry benches and on overburden stockpiles concurrent with mining where feasible.
- Utilize color-staining product to darken the visible quarry and roll-down slopes where not subject to raveling to reduce visual impacts.
- Deposit darker waste rock on overburden sites where available to reduce color contrast.
- Design adequate erosion control features along the haul and access roads and quarry to control and limit erosion and sediment transport.
- Where feasible, construct catchment berms at the foot of stockpiles to reduce rock roll-down and sediment flow.
- Limit surface disturbances to areas identified in the Amended Plan.
- Implement appropriate dust controls to reduce visible dust.

BIOLOGICAL RESOURCES MITIGATION

Compliance with Carbonate Habitat Management Strategy Requirements

The carbonate soils located on the project site provide a unique habitat, and there are five federally listed threatened or endangered plant species endemic to carbonate soils. The proposed project site was previously determined by the US Fish and Wildlife Service to not be located within designated critical habitat for these carbonate-endemic plants. An intensive collaborative effort led to the development of the Carbonate Habitat Management Strategy (CHMS) in 2003. The strategy is designed to provide long-term protection for the carbonate-endemic plants and also provide for continued long-term mining in the San Bernardino Mountains. A portion of the carbonate habitats is protected from mining impacts in perpetuity within the carbonate habitat reserves dedicated and managed as described in the CHMS.

Omya intends to develop the quarry site consistent with the CHMS and guidelines. Omya will mitigate impacts to these listed species through permanent relinquishment of mining claims or transfer of private property in accordance with the CHMS requirements and consultation with the County and the US Forest Service.

Draft North Slope Raptor Conservation Strategy

Omya and three other mining companies are actively participating in the development of the Raptor Conservation Survey (RCS) and have agreed to follow the guidelines outlined in the final document (Eliason 2013). The RCS is intended to be a living document that may be updated over time as new information becomes available and includes monitoring objectives, schedules, and protocols, as well as measures to avoid, minimize, rectify, and reduce effects to nesting raptors along the North Slope. The following is a summary of the standard design features for mining and other projects on the North Slope, as outlined in the draft RCS.

2.14 REGULATORY REQUIREMENTS, PERMITS, AND APPROVALS

PROPOSED ACTION

The project proponent is requesting the following from the County of San Bernardino:

- Approval of a Mining Conditional Use Permit
- Approval of an amendment to an existing Reclamation Plan (RP# 86M-04)

REQUIRED PERMITS AND CONSULTATIONS

In addition to the approvals by the County listed above, the following permits may be required prior to the development and operation of the proposed project:

- California Department of Fish and Wildlife – Streambed Alteration Agreement
- Mojave Desert Air Quality Management District – Air Quality Permitting
- Office of Mine Reclamation – Approval of Amended Mine and Reclamation Plan
- Regional Water Quality Control Board – National Pollutant Discharge Elimination System Permit
- U.S. Fish and Wildlife Service – Section 7 Consultation with Forest Service through the Carbonate Habitat Management Strategy

The following is an introduction to the environmental analysis for the proposed White Knob/White Ridge Limestone Quarries Expansion, including a discussion of the cumulative analysis approach and general assumptions used in the environmental analysis. The reader is referred to the individual technical sections of the Draft Environmental Impact Report (Draft EIR or DEIR) (Sections 3.1 through 3.8) for further information on the specific assumptions and methodologies used in the analysis for each particular technical subject.

ANALYSIS ASSUMPTIONS USED TO EVALUATE THE IMPACTS OF THE PROPOSED WHITE KNOB/WHITE RIDGE LIMESTONE QUARRIES EXPANSION

BASELINE ENVIRONMENTAL CONDITIONS ASSUMED IN THE DRAFT EIR

This subsection identifies the actual existing physical conditions of the project site to provide a point of comparison of pre-proposed project conditions (the baseline, inclusive of the existing project) and post-proposed project conditions to ensure that changes caused by the proposed project are seen in context and significant effects can be identified accurately.

For purposes of assessing the environmental effects of a proposed project, CEQA Guidelines Section 15126.2 states, "the lead agency should normally limit its examination to changes in the existing physical conditions in the affected area as they exist at the time the notice of preparation is published." See also CEQA Guidelines Section 15125(a). However, there is no uniform, inflexible rule regarding establishment of this "baseline," and a lead agency has discretion to decide how the existing physical conditions without the project can most realistically be measured.

For the proposed project and in this EIR, the County of San Bernardino, as the lead agency, is evaluating changes in the existing physical conditions in the affected area as they existed when the County released the Notice of Preparation (NOP) for the proposed project in June 2013. The existing quarries are currently operating and have been in operation under the current reclamation plan (RP# 86M-04) since the initial project approval in 1986. Therefore, current mining operations are part of the baseline environmental conditions for the project. In addition, surface mining operations have continued on the project site since the release of the NOP and have resulted in further surface disturbance and other changes to the physical environment. This EIR evaluates whether changes in the baseline environmental conditions of the White Knob/White Ridge Limestone Quarries and current operations that are proposed by the Amended Plan would result in significant physical effects to the environment.

At this time, Omya is in the process of acquiring the additional 70 acres of BLM land. As part of the 2011 Settlement Agreement, Omya expanded the right-of-way of the off-site haul road from 67 acres to its present 83.5 acres, which are also located on BLM land. The off-site haul road improvements and the sale of BLM land to Omya will be a part of the County's Conditions of Approval for the Amended Mine and Reclamation Plan. Thus, this EIR assumes that the federal actions associated with the improvements and land transfer are approved.

Summary of Current Operations

Current mining operations on the project site include mining at the White Knob Quarry site and Annex Quarry only as well as stockpiling at the existing Overburden Site #1 (OB-1), operation of the on-site crusher, and use of all existing internal haul roads and the primary access road. Actual mining operations at the White Ridge Quarry have not occurred, and this area is currently in its vacant natural state. The existing (under the current Reclamation Plan) surface mining

operation-related disturbance area totals approximately 138 acres, including the approximately 38 acres of the 40-acre Bureau of Land Management (BLM) haul road right-of-way.

The White Knob Quarry currently produces an average of 512,000 tons per year of excavated material, which includes 324,000 tons per year of ore to the crusher and 188,000 tons per year of overburden or non-spec rock. Of crushed ore material, 275,400 tons per year are sent to the processing plant for production and 48,600 tons per year of crusher fines are sent to the overburden stockpile.[1]

At the present time, production comes from both lower levels (5,500 foot level) and upper levels (6,200 foot level) within the White Knob Quarry. The procedure generally includes clearing of vegetation, topsoil removal and stockpiling, access road development, blast hole drilling and controlled blasting, and crushing and screening with a portable crusher. Crushed ore is then trucked to the processing plant and overburden material is sent to OB-1. During mining of the rock in the deposit at the top of the ridge and along the crest, boulders of white limestone have inadvertently rolled down the slope to the north and to the west into the West Canyon.

The White Knob Quarry operates year-round. Mining of ore grade limestone may occur throughout the year, but usually occurs about eight months a year. Overburden removal and quarry development may occur throughout the year, but usually occur for about four months per year.

STRUCTURE OF THE ENVIRONMENTAL IMPACT ANALYSIS

Sections 3.1 through 3.8 of this DEIR contain a detailed description of current setting conditions (including applicable regulatory setting), an evaluation of the direct and indirect environmental effects resulting from the implementation of the proposed project, and existing regulations that mitigate environmental effects. Furthermore, DEIR Sections 3.1 through 3.8 contain additional feasible mitigation measures and identify whether significant environmental effects of the project would remain after application of mitigation.

Section 3.9 of this DEIR contains a summary of those environmental issue areas that were determined not to be significantly affected by project implementation in the Initial Study (**EIR Appendix A**). These issue areas include the following:

- Agriculture and Forest Resources
- Hazards and Hazardous Materials
- Land Use and Planning
- Mineral Resources
- Noise
- Population and Housing

[1] Based on a three-year baseline average. Three-year amounts are average actual production levels from 2004 to 2006.

- Public Services
- Recreation
- Transportation and Traffic

Existing Setting

This subsection includes a description of the physical setting associated with the technical area of discussion, consistent with CEQA Guidelines Section 15125. As previously identified, the existing setting is based on conditions as they existed when the NOP for the proposed project was released for circulation on June 12, 2013.

Regulatory Framework

This subsection identifies applicable federal, state, regional, and local plans, policies, laws, and regulations that apply to the technical area of discussion.

Standards of Significance

Standards of significance are identified and used to determine whether the environmental effects are considered "significant" and require the application of mitigation measures.

Methodology

The methodology of analysis for each impact area is defined in each analysis section. The various sections use methodologies specific to that impact area. For example, Air Quality uses project-specific air quality emission quantifications to determine the level of impact, while the Aesthetics methodology is subjective and is based, in part, on individual perception and visual photo simulations.

Project Impacts and Mitigation Measures

This subsection identifies direct and indirect environmental effects associated with implementation of the proposed project. Each environmental impact analysis is identified numerically (e.g., Impact 3.7.1 – Substantially Alter Drainage Pattern) and is supported by substantial evidence.

Mitigation measures for the proposed project were developed through a review of the environmental effects of the proposed project by consultants with technical expertise as well as by environmental professionals. The mitigation measures identified consist of "performance standards" that identify clear requirements that would avoid or minimize significant environmental effects (the use of performance standard mitigation is allowed under CEQA Guidelines Section 15126.4(a) and is supported by case law *Rio Vista Farm Bureau Center v. County of Solano* ([1st Dist. 1992] 5 Cal. App. 4th at pp. 371, 375–376 [7 Cal. Rptr. 2d 307]).

APPROACH TO THE CUMULATIVE IMPACT ANALYSIS

CEQA Guidelines Section 15130 requires that EIRs include an analysis of the cumulative impacts of a project when the project's effect is considered cumulatively considerable. Each technical section in the DEIR considers whether the project's effect on anticipated cumulative setting conditions is cumulatively considerable (i.e., a significant effect). "Cumulatively considerable"

means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (CEQA Guidelines Section 15065(a)(3)). The determination of whether the project's impact on cumulative conditions is considerable is based on a number of factors, including consideration of applicable public agency standards, consultation with public agencies, and expert opinion. The environmental effects of implementation of the proposed project are incorporated in the cumulative impact analysis contained in each technical section. In addition, Section 4.0, Other CEQA Analysis, provides a summary of the cumulative impacts associated with the proposed project.

Definition of Cumulative Setting

The general cumulative setting conditions considered in this Draft EIR are based on:

- **General Plans**. These are the existing land use plans that provide general growth patterns in the region, consisting of unincorporated San Bernardino County and the cities of San Bernardino, Victorville, Apple Valley, Hesperia, Big Bear Lake, Lake Arrowhead, Crestline, and Running Springs.

- **Large-Scale Surface Mining Projects**. This includes current large-scale proposed and approved surface mining projects in San Bernardino County Supervisorial District 1, which encompasses the project site (see **Table 3.0-1**). It should be noted that this list is not intended to be all-inclusive of surface mining activities in the county, but rather a general description of current surface mining activities.

Section 4.0 of the Draft EIR includes a description of the cumulative setting's geographic extent based on the characteristics of the environmental issue under consideration as set forth in Section 15130(b) of the CEQA Guidelines. The geographic scope of area and time horizon considered for each cumulative impact evaluated in the EIR is dictated by the specific type and nature of the impact being considered. For example, when considering a project's incremental contribution to cumulative air quality criteria pollutants, the geographic scope of area is the air basin in which the project is located. In contrast, geology impacts are generally site-specific and limited to the physical footprint of a project site, and water quality impacts are considered within the watershed in which the project is located. Cumulative effects are considered based on the specific geographic and temporal scopes identified on a resource-by-resource basis.

TABLE 3.0-1
PAST, PRESENT, AND FORESEEABLE PROJECTS

Project Name/ Number	Project Description	Project Location	Status of Project
Big Bear Disposal Office Addition (P201300365)	Revision to an approved action to modify the conditions of approval for an industrial park to allow the continued operation of a temporary construction demolition, debris recycling, and stockpiling operation on a portion of a 5.56-acre parcel	Big Bear City	Approved 12/22/11
Richard Woltil (P201300046)	Revision to an approved action at the Mitsubishi Cement Corporation Lucerne Valley Plant to add a 12-foot by 60-foot lime storage silo with pumps, mixing, and metering equipment to reduce emissions from kiln gases on a portion of 78 acres	Lucerne Valley	Conditionally Approved

Project Name/ Number	Project Description	Project Location	Status of Project
Miller, Linda A. Family Living Trust (P201200342)	Tentative parcel map (TPM 19413) to divide a 1-acre lot into four lots on northeast corner of Miller Lane and Mitchell Lane	Lake Erwin	Accepted
Munem Maida (P201300086)	Minor use permit to establish a 6,793-square-foot convenience store with grocery and type 21 off-site liquor sales and gas station on .89 acres	Lake Erwin	Accepted
LPA, Inc. (P201300366)	Revision to an approved action to add 10 new cabins, a new dining hall, a new maintenance shed, a new entrance gate, and a new bridge to the existing lake on portions of 130 acres	Big Bear City	Accepted
Dynamic Development (P201300122)	Minor use permit to establish a 9,026-square-foot general retail store on 1.75 acres	Lucerne Valley	Accepted
Martin, Johnny Ray (P200900099)	Parcel map exception to create four parcels and a remainder parcel on 640 acres	Rimrock	Accepted
Hadley, Paul (P201200240)	Tentative parcel map (19388) to create four parcels on 41.7 acres	Rimrock	Conditionally Approved
High Grade Materials Co. (P20120009)	Revision to a conditional use permit to expand the mining area of an existing 215-acre pit by 113 acres on a total of 328 acres	Lucerne Valley	Accepted
Twentynine Palms Mine Life Extension (AP20100087)	Revision to extend the life of an existing mining operation by 30 years to 6/30/2049	Twentynine Palms	Approved 1/8/2011
Robertson's Revision for Mine Life Extension (AP20110038)	Revision to extend the life of an existing mining operation by 30 years to 6/5/2053	Lucerne Valley	Approved
Mitsubishi Cement Corporation	A mining conditional use permit/reclamation plan to establish a new limestone quarry on 154 acres at 1.3 million tons per year production for a time frame of 120 years, south of the existing Cushenbury cement plant	State Highway 18, west side; Marble Canyon Road, approximately ¼ mile south of	EIR/EIS in process
Robertson's	Revision to extend the life of an existing mining operation by 30 years from 6/5/2023 to 6/5/2053 on 268 acres	Camp Rock Road, approximately ¼ mile west of; Highway 18, both sides	Application on hold
Searles Valley Minerals (AP20090011)	Re-establish mining reclamation plan until 1/15/2015 on 160-acre portion of 640 acres	6 miles east of Trona	Accepted
Daily Transit Mix, LLC (AP20130116)	Amendment to an existing mining and reclamation plan mine site (2001M-05) to extend the operating life by 30 years months and increase the facility from 12.2 acres to 14.5 acres	Paradise View Road and Powerline Road southeast corner .75 miles east of Fort Irwin Road	Accepted

Project Name/ Number	Project Description	Project Location	Status of Project
Hanson Aggregates, LLC (AP20120008)	Amendment to an approved mining and reclamation plan (conditional use permit) to expand by 11.72 acres an existing 365.94-acre mine site for a total of 377.66 acres within a total of 2,127.66 acres	National Trails Highway at Newberry Springs off-ramp	Approved 5/10/2012
Tetra Technologies Inc. (AP20120027)	Amendment change to an approved mining/ reclamation plan (2001M-03) to add five new production wells to increase the flow rate from 80 to 200 gallons and production to 10,000 to 12,000 liquid tons per year on a portion of 10,835 acres	Amboy Plant	Accepted
US Iron, LLC (AP20120012)	Conditional use permit for a mining and reclamation plan for the removal of iron ore tailings on 20 acres	I-15 and Cima Road, north of; Excelsior Road	Approved 8/9/2012
Dalton Trucking Inc. (AP20120002)	Mining and reclamation plan conditional use permit to establish a mine site on 160 acres; a portion of 640 acres to include a 8x30 portable scale house in section 5 18N 13 E; and 10 acres of mill sites for stock piling 80 feet in diameter and 10 feet high, to include an 8x30 office trailer on a portion of 160 acres in section 24 19N 12E for a period of 30 years	Mesquite Lake; 5 miles south of Sandy Valley, NV; northeast of Clark MTS; east of Kingston Road	Approved 2/20/2012
Sully-Miller Contracting Company (AP20110033)	Conditional use permit to revise a mining and reclamation plan based on previous mining, which expired in 2007; proposed plan proposes deletion of federal lands, changes from five phases to two phases, and increase in mining depth from 20 to 30 feet on 32 acres	National Trails Highway, north side; Goffs Road	Conditionally Approved 7/5/2012
Omya California	Revision to an approved action to add 15 acres of limestone rock storage to an existing mining operation on a portion of approximately 110 acres	Four parcels beginnings approximately 285 feet east of Crystal Creek Road, ending approximately 2,190 feet east of	Conditionally Approved
CalPortland Company (AP20120013)	Revision to an approved action for the CalPortland Cement Mining Reclamation Plan to backfill the quarry with cement kiln dust (CKD), plant waste material, and quarry waste rock upon completion of extraction operations, and identify alternative options for an end use	Slover Avenue, east of; extending between Rail Road, Access Road, and Cement Plant Road	Approved 8/1/2013
RMDG LLC (P201200293)	Certificate of land use compliance to recognize mineral resource development on 62 parcels of land in Red Mountain for a total of 705.19 acres; vested rights number: VR 2012-02 A, B & C	Approximately 23 miles north of Kramer Junction along US Route 395, Atolia and Red Mountain area	Approved
Pan American Minerals Inc. (P20120004)	Temporary use permit for 16 exploratory drilling holes	Calico Road, approximately 4,000 feet north of the turnoff	Approved 1/13/2012

Project Name/ Number	Project Description	Project Location	Status of Project
Bagdad Chase, Inc. (P201100214)	Temporary use permit for exploration for minerals at mining site	South of Highway 40, 3 miles past Ludlow	Approved 6/1/2011
Tetra Technologies (P201100481)	Temporary use permit for a salt mine to add a 1,344-square-foot office trailer on 587 acres	Saltus Road, both sides; National Trails Highway	Approved 12/9/2011
Specialties Minerals Inc. Quarries Plan of Operation (2003)	Three limestone mines	San Bernardino National Forest	US Forest Service jurisdiction
Baldwin Hard Rock Prospecting Permit	US Forest Service consent to the BLM issuing 29 permits for federal hard rock mineral prospecting will also propose to issue three special use permits needed for access and road construction	San Bernardino National Forest	US Forest Service Jurisdiction
Wildlands Conservancy	Revision to an approved action (Reclamation Plan CUP) by excluding 3.3 acres from the Cajon Pass Sand and Gravel Mine ("Cosy Dell") 51.10-acre reclamation area; areas to be excised from the boundaries of the Reclamation Plan and reclamation requirements include telecommunications equipment through long-term leases and easement, electrical power facilities through easement, access/easement roads to said facilities both on the east and west side of Interstate 15, and a historic stone wall	Interstate 15, both sides; Cleghorn Road	Approved 3/25/2013
Fig International Investment Corporation AP20140100/SMAR	Conditional Use Permit to establish a new mine operation affecting 30 acres within a 188 acre parcel area for purposes of excavating iron ore to a depth of 100 feet for a period of 15 years or until December 31, 2030. The mining operation will be conducted in two phases with the estimated completion of reclamation after the cessation of mining in December 2032.	Black Mine Rd, Johnson Valley	Accepted
Omya California AP20120022	Amended Plan of Operations and Reclamation Plan on total of 214.8 acres to extend operations until 2055.	Butterfield and Sentinel Quarries on Forest Service lands	Accepted

Source: County of San Bernardino 2014

COMMON TERMINOLOGY USED IN THE DRAFT EIR

This Draft EIR uses the following terminology to describe the environmental effects of the proposed project:

Less Than Significant Impact: A less than significant impact would cause no substantial change in the physical condition of the environment (no mitigation would be required for project effects found to be less than significant).

Significant Impact and Potentially Significant Impact: A significant impact would cause (or would potentially cause) a substantial adverse change in the physical conditions of the environment. Significant impacts are identified by the evaluation of project effects using

specified standards of significance provided in each technical section of the DEIR. Identified significant impacts are those where the project would result in an impact that can be measured or quantified, while identified potentially significant impacts are those impacts where an exact measurement of the project's effects cannot be made but substantial evidence indicates that the impact would exceed standards of significance. A potentially significant impact may also be an impact that may or may not occur and where a definite determination cannot be foreseen. Mitigation measures and/or project alternatives are identified to avoid or reduce project effects to the environment to a less than significant level.

Significant and Unavoidable Impact: A significant and unavoidable impact would result in a substantial negative change in the environment that cannot be avoided or mitigated to a less than significant level if the project is implemented. Pursuant to Section 15092(b) of the CEQA Guidelines, the County must issue a Statement of Overriding Considerations for these impacts prior to approving the project. Mitigation measures designed to minimize these impacts are described.

Less Than Cumulatively Considerable Impact: A less than cumulatively considerable impact would cause no substantial change in the physical condition of the environment under cumulative conditions.

Cumulatively Considerable Impact: A cumulatively considerable impact would result when the incremental effects of an individual project result in a significant adverse physical impact on the environment under cumulative conditions.

Standards of Significance: A set of significance criteria to determine at what level or "threshold" an impact would be considered significant. Significance criteria used in this EIR include the CEQA Guidelines; factual or scientific information; regulatory performance standards of local, state, and federal agencies; and County goals, objectives, and policies. Specified significance criteria used by the County of San Bernardino are identified at the beginning of the impact analyses in each technical section of the DEIR.

ENVIRONMENTAL IMPACT REPORTS UTILIZED IN THIS EIR

This Draft EIR utilizes technical information and analyses from previously prepared EIRs that are relevant to the consideration of environmental effects of the proposed project, which is supported by the CEQA Guidelines (see Sections 15148 [Citation] and 15150 [Incorporation by Reference]). In addition to materials cited, the following EIRs have been utilized in this Draft EIR and are incorporated by reference:

- *Final Environmental Impact Report for the Proposed White Knob-White Ridge Limestone Deposit Mining and Reclamation Plan* (State Clearinghouse No. 86050516)

- *Notice of Preparation for the Sentinel and Butterfield Quarries Expansion* (State Clearinghouse No. 2013021057)

By utilizing provisions of the CEQA Guidelines, the County, in preparing this DEIR, has been able to make maximum feasible and appropriate use of the technical information in these EIRs. These EIRs and other referenced materials are available for review on request at the County of San Bernardino Land Use Services Department at 385 N. Arrowhead Avenue, San Bernardino, CA 92415-0182.

This section describes the existing visual resources of the project site and describes the impacts associated with implementation of the proposed project. The analysis focuses on the anticipated alteration of long-range views from the surrounding low-lying areas. Information for this section comes from field observations and a review of aerial photographs and the Amended Plan.

The County published a Notice of Preparation and Initial Study (NOP/IS) for the proposed project on June 12, 2013. A copy of the NOP/IS, along with comments received during the public review period, is contained in **EIR Appendix A**. No comments regarding aesthetics were received during the public review period.

3.1.1 EXISTING SETTING

EXISTING CONDITIONS

Visual Character of Project Site and Surrounding Area

The project site is located in the Lucerne Valley area on the north slope of the San Bernardino Mountains. The project site elevation ranges from approximately 4,000 to 6,300 feet above mean sea level (amsl) and is topographically higher than valley floor, which is generally 2,960 feet amsl in the "downtown" area of Lucerne Valley near the intersection of Highways 18 and 247. The existing natural landscape character of the area surrounding the project site consists of steep mountain slopes, rock outcrops, ridges, vertical cliffs over 100 feet in height, and canyons. Vegetation is characterized as Mojave or open desert shrubland and semi-desert chaparral at lower elevations, transitioning to pinyon-juniper-mountain mahogany woodland at higher elevations. Vegetation tends to be denser on north slopes and gullies, and more open on south slopes and along ridges. Most of the project site and areas south and west of the site were burned in wildfires in 2007 and appear sparsely vegetated to barren from a distance. Mining features have been part of the landscape for over 50 years and are an integral part of the north slope of the mountains visible from Lucerne Valley.

Visible features of the site include an existing active quarry, overburden site, and boulder roll-down areas on the north- and west-facing slopes, which appear as altered disturbed slopes and stockpiles with a lighter color that contrasts with the existing natural areas. Access to the various levels within the quarries is via a series of switchback roads cut into the adjacent granite rock mountainside. **Figure 2.0-2** in Chapter 2.0, Project Description, shows the project site and vicinity.

Surrounding Land Uses and Views

The project site is bounded on the south by mountainous undeveloped National Forest lands, on the west, north, and east by unpatented placer mining claims on public lands managed by the Bureau of Land Management (BLM), and on the northeast by open space. There are several other large-scale limestone mines along the north slope of the San Bernardino Mountains over a distance of about 10 miles.

Public views of the area are primarily limited to State Routes (SR) 18 and 247, which are located approximately 5 to 6 miles northwest and east of the site and from other local roads and residences in the Lucerne Valley. Due to topography and the orientation of the quarry sites, views are limited to those from the northwest to east within Lucerne Valley. The project site is not visible from any developed/populated areas to the south within the San Bernardino National Forest (SBNF), including from the City of Big Bear Lake (and from the lake itself), Fawnskin, and Big Bear City, due to the intervening ridges located north of the lake and the relatively lower elevations of the lake itself.

Scenic Vistas and Scenic Highways

State Routes 18 and 247 are identified as eligible state scenic highways but are not designated as such by Caltrans. These highways are designated as scenic routes under the Lucerne Valley Community Plan by the County of San Bernardino.

VISUAL RESOURCES ASSESSMENT

A Visual Resources Assessment was conducted for the proposed project in accordance with the BLM's Visual Resource Management (VRM) Program guidelines, which has established a system for evaluating and estimating visual resources to determine appropriate protection or enhancement of the visual environment (EIR Appendix B, Lilburn Corporation 2013, p. 1). Following is a summary of the assessment of the existing conditions of the project site and surrounding area.

Scenic Quality

Scenic quality refers to the overall impression retained after walking or driving through the area or from living and working in the area.

In assessing the visual effects of a proposed project, rating scenic quality requires a description of the existing scenic values in the landscape both on the project site and surrounding the site. The following factors were considered in the assessment of scenic quality of the proposed project site and vicinity based on the guidelines of the VRM:

- Landform
- Vegetation
- Water
- Color
- Influence of adjacent scenery
- Cultural modification
- Scarcity (unique, rare, or unusually memorable)

The VRM system uses a points system to evaluate scenic quality. Each of the factors listed above is assigned points (0 to 5) based on whether scenic quality will be of great importance, some importance, or little importance. The lower the number of points, the less that factor influences the overall scenic quality of the site. The values are totaled for the area and a Scenic Quality Class is determined and assigned. These classes are:

- Class A – areas that combine the most outstanding characteristics of each rating factor (19 to 33 points)
- Class B – areas in which there is a combination of some outstanding features and some that are fairly common to the physiographic region (12 to 18 points)
- Class C – areas in which the features are fairly common to the physiographic region (0 to 11 points)

Table 3.1-1 summarizes the scenic quality ratings determined for the project site and surrounding area. Detailed descriptions of each factor and how the associated ratings were determined are provided in the Visual Resources Assessment in **EIR Appendix B**.

TABLE 3.1-1
ASSESSMENT OF EXISTING CONDITIONS – SCENIC QUALITY

Factor	Rating
Landform	3
Vegetation	3
Water	0
Color	1
Adjacent Scenery	3
Scarcity	3
Cultural Modifications	0

Source: EIR Appendix B, Lilburn Corporation 2013, p. 17

The overall rating for scenic quality is 13, which places the proposed project site in Scenic Quality Class B. Class B sites contain areas in which there is a combination of some outstanding features and some fairly common to the physiographic region.[1]

Sensitivity Levels

Landscapes have common elements that can be measured, but there is a subjective dimension to landscape aesthetics. This is because each viewer brings perceptions formed by individual influences (e.g., culture, familiarity with local geography, personal values). Sensitivity levels measure regional and individual public concern for scenic quality and are rated high, medium, or low by evaluating various indicators, as defined by the VRM. These are listed below and assessed in **Table 3.1-2**:

- Type of users – travelers on roads and residents (medium)
- Amount of use (or number of viewers) – travelers on roads and residents (medium)
- Public interest or concern – local residents' high to medium interest based on location in Lucerne Valley and when considering the other views of existing mine activities along the north slope
- Adjacent land uses (low)
- Special areas – national parks, wilderness areas (low)

Lucerne Valley has a long history of mining activities. Most of the mining operations along the north face of the San Bernardino Mountains, to the east of the site, have been permitted for

[1] A physiographic region is a landform region, which is an area delineated according to similar terrain that has been shaped by a common geologic history.

decades. Concurrent reclamation in the form of revegetation, covering of exposed areas with darker material, erosion control, and rock staining is required of most mining operations as a specific phase or area is completed. Despite these design features, existing and permitted mining on the north face of the San Bernardino Mountains has resulted in extensive surface disturbances that are highly visible from Lucerne Valley.

The project site has been actively mined for over 25 years and is currently permitted through 2031. The planned modifications would not create any new uses to the already altered site, but would add incrementally to the overall impact area by increasing the size and intensity of the White Ridge Quarry and to OB-1 and OB-2 in the central area of the site. **Figure 3.1-1** was prepared to schematically illustrate the existing approved mine areas as compared to the proposed Amended Plan. The combined results of the sensitivity levels create an overall sensitivity level of medium, according to the sensitivity level matrix in **Table 3.1-2**.

Distance Zones

Using the VRM system, the visual quality of a landscape is determined by the visibility of a site from major viewing routes or key observation points. The setting can be divided into three distance zones: foreground/middleground (f/m), less than 3 to 5 miles away; background (bg), 5 to 15 miles away; and seldom seen (ss), hidden from view by intervening topography or distance.

Figure 3.1-2 shows the locations of the three selected viewpoints that provide representative views of the existing site conditions and vicinity at different distances. The view from Viewpoint 1 at SR 18 is approximately 5.5 miles north of the project site. Viewpoint 2 is near the junction of State Routes 18 and 247, the most heavily traveled roads in the area. This view of the site is at a distance of approximately 6 miles to the northeast. Because of the distance and scenic quality, views of the site from these two viewpoints would be considered background views. Viewpoint 3 is from the residential area located approximately 4 miles to the northeast. Views of the site are considered foreground. As described previously, the area has a Scenic Quality Class B rating, which means a combination of outstanding features (dominant mountain ridge landscape) and some fairly common to the physiographic region. Because most of Lucerne Valley's scattered residential uses and businesses are generally 5 miles or more from the project site, the project would rate a distance zone classification of background.

TABLE 3.1-2
SENSITIVITY LEVEL MATRIX

Sensitivity Level Rating Unit	Type of Use	Amount of Use	Public Interest	Adjacent Land Uses	Special Areas	Overall Rating	Distance Zone	Explanation
VP 1 (north of site; SR 18)	M	M	M	L	L	M	bg	Visible from SH 18 and residences
VP 2 (northeast of site; SR 247)	M	M	M	L	L	M	bg	Visible from businesses and residences
VP 3 (northeast of site; local residential)	M	M	H	L	L	M	f/m	Visible from nearby residences

Source: EIR Appendix B, Lilburn Corporation 2013, p. 20
Key: H = High; M = Medium; L = Low
Distance zones: (f/m) foreground/middleground – less than 3 to 5 miles away; (bg) background 5 to 15 miles away; and (ss) seldom seen, hidden from view by intervening topography or distance

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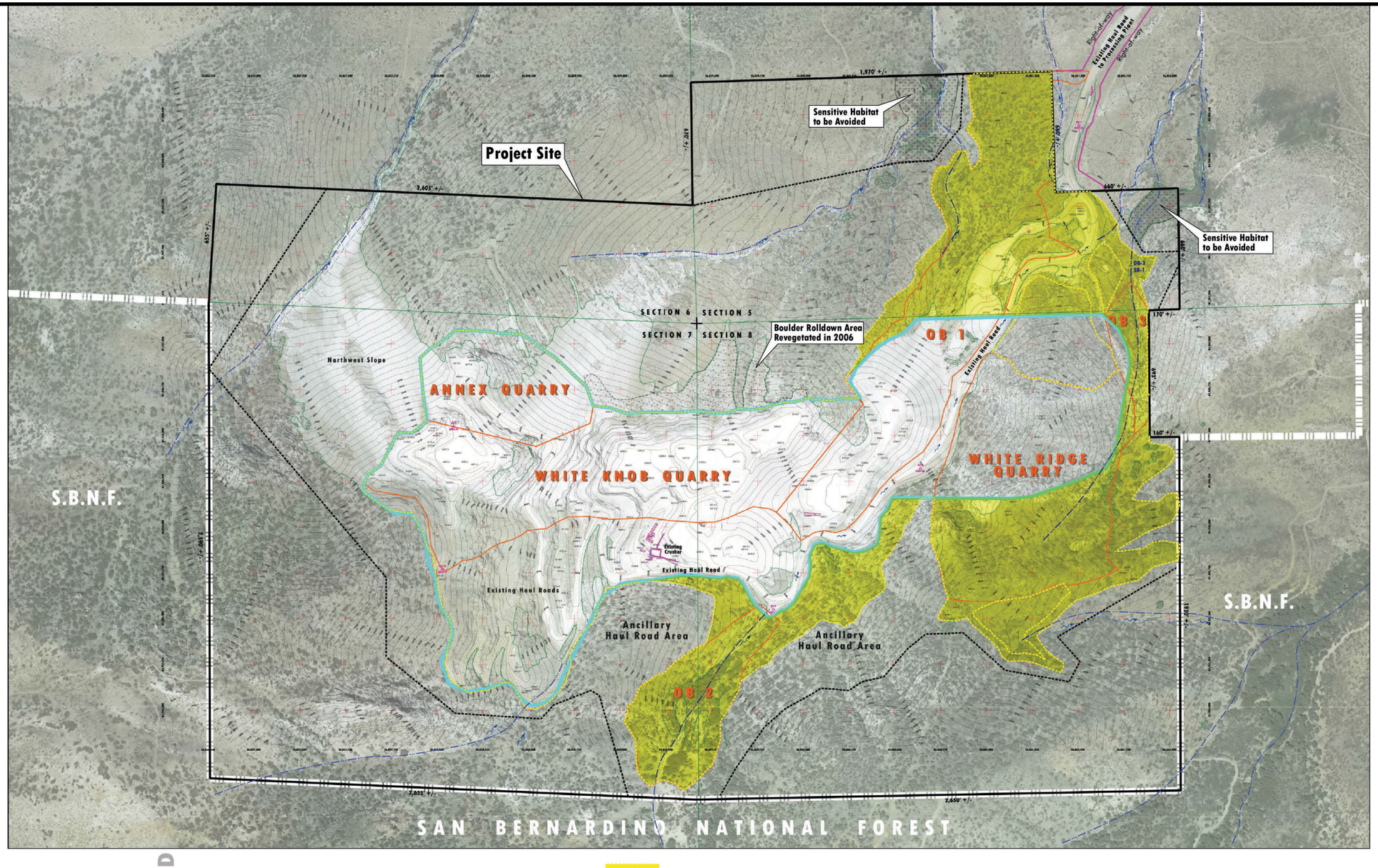

LEGEND

- Project Boundary Private Lands
- Existing Approved Operations (Estimated)
- Limits of Planned Disturbance
- Major Facilities
- Haul Road Right-of-way on BLM Land CACA 16644
- Amended Operating Area
- OB — Overburden Stockpile
- Existing Drainages

Source: Lilburn Corporation, 2012

0 250 500
FEET

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Figure 3.1-1
Schematic of Existing Approved and Amended Operations

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Visual Resource Classes and Objectives

Management classes of the VRM system are used to determine varying degrees of modification to basic elements of the landscape. The class rating is derived from an overlay technique that combines scenic quality, sensitivity levels, and distance zones which are used to identify areas with similar combinations of factors. These areas are assigned to one of five management classes according to the predetermined criteria. The class categories are defined as follows:

- Class I Objective – preserve the existing character of the landscape; generally applies to wilderness areas, wild and scenic rivers, and other similar situations
- Class II Objective – retain the existing character; the level of change should be low and should not attract the view of a casual observer
- Class III Objective – partially retain the existing character; the level of change should be moderate and should not dominate the view of a casual observer
- Class IV Objective – provide for activities that require major modification; the level of change can be high; however, impacts should be minimized as feasible

Table 3.1-3 combines the scenic quality, sensitivity level, and distance zones previously described. The class rating is then used to assess the impact of the proposed Amended Plan.

TABLE 3.1-3
VISUAL RESOURCE INVENTORY CLASSES

Visual Sensitivity		High			Medium			Low
Special Areas		I	I	I	I	I	I	I
Scenic Quality	A	II	II	II	II	II	II	II
	B	II	III	III* IV*	III	IV	IV	IV
	C	III	IV	IV	IV	IV	IV	IV
Distance Zones		f/m	bg	ss	f/m	bg	ss	ss

Source: EIR Appendix B, Lilburn Corporation 2013, p. 22
**If adjacent area is Class III or lower, assign Class III; if higher, assign Class IV*

The project site was determined to result in a medium use sensitivity level with a Scenic Quality Class B rating in the background distance zone and would fall into the Management Class IV Objectives described above.

3.1.2 REGULATORY FRAMEWORK

FEDERAL AND STATE

There are no federal or state regulations applicable to the proposed project.

LOCAL

San Bernardino County General Plan

The San Bernardino County General Plan defines scenic routes as roadways that have scenic vistas and other scenic and aesthetic qualities that over time have been found to add beauty to the county. General Plan Policy OS 5.3 provides a list of County-designated scenic routes for which the County desires to retain the scenic character. According to this list, State Routes (SR) 18 and 247, located north and east of the project site, are County-designated scenic routes. General Plan Policy OS 5.2 requires development along scenic corridors to demonstrate through visual analysis that proposed improvements are compatible with the scenic qualities present. The following General Plan policies and programs that pertain to the proposed project assist in the protection of scenic resources in the county:

Policy M/LU 1.20 Closely review development projects on private land adjacent to National Forest lands to ensure that development projects are capable of meeting all development requirements within the project boundaries or other non-federal land. Provide opportunities for the U.S. Forest Service to consult with the County on development of private land that may have an adverse effect on adjoining National Forest land.

Policy CO 7.3 Mining operators/owners will provide buffers between mineral resources (including access routes) and abutting incompatible land uses. New mineral and non-mineral development in these zones will be designed and reviewed according to the compatibility criteria specified in this policy.

Policy M/CO 1.2 Protect scenic vistas by minimizing ridgeline development that would substantially detract from the scenic quality of major ridgeline viewsheds.

Policy OS 5.3 The County desires to retain the scenic character of visually important roadways throughout the County. A "scenic route" is a roadway that has scenic vistas and other scenic and aesthetic qualities that over time have been found to add beauty to the County. Therefore, the County designates the following routes as scenic highways and applies all applicable policies to development on these routes (see Figures 2-4A through 2-4C of the Circulation and Infrastructure Background Report):

d. State Route 18 from San Bernardino northeast to the City of Big Bear Lake; from Big Bear Lake northwest to Apple Valley; within the Victorville sphere of influence; and from Victorville and Adelanto to the Los Angeles County line.

o. State Route 247 (Old Woman Springs Road/Barstow Road) from the Town of Yucca Valley north to Barstow.

3.1.3 IMPACTS AND MITIGATION MEASURES

STANDARDS OF SIGNIFICANCE

An aesthetic or visual resource impact is considered significant if implementation of the project would result in any of the following:

1) Have a substantial adverse effect on a scenic vista.

2) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway.

3) Substantially degrade the existing visual character or quality of the site and its surroundings including the scenic quality of the foothills.

4) Create a new source of substantial light or glare that would adversely affect day or nighttime views in the area.

The Initial Study prepared for the proposed project (see **EIR Appendix A**) determined that there would be no impact related to scenic resources within a state scenic highway or the creation of light or glare (standards of significance 2 and 4). The reader is referred to the NOP/IS for a complete analysis of these impact areas. A copy of the NOP/IS, along with comments received during the public review period, is contained in **EIR Appendix A**.

The 1986 EIR for the original development of the quarries (SCH No. 86050516) recognized that there would be significant visual impacts from development of the quarry. It was determined that the impacts, although visible, are consistent with the general visual character of the Lucerne Valley Limestone Mining area, which includes numerous quarries, overburden sites, haul roads, and limestone processing plants. A Statement of Overriding Considerations regarding this and the other environmental effects of the White Knob Quarry that could not be mitigated to a level below significance was prepared and accepted by the San Bernardino County Planning Commission. The County of San Bernardino Planning Commission found that the economic, social, and other benefits to the region as a result of the project outweighed the significance of the project impacts on visual resources.

METHODOLOGY

The following analysis is based on the Visual Resources Assessment prepared for the proposed project by Lilburn Corporation in July 2013 (see **EIR Appendix B**). The methodology used in this assessment is described below.

Data Collection

In order to determine areas from which the proposed operations could be seen by the public, a potential viewshed of the proposed expanded area was prepared based on United States Geological Survey (USGS) topographic mapping. **Figure 3.1-2** shows that the proposed expansions would be visible from the northwest through east (refer to shaded areas on **Figure 3.1-2**). The area was surveyed for representative viewpoints, and photographs were taken of the site from various vantage points. State Routes 18 and 247 are identified as eligible state scenic highways but are not designated as such by Caltrans. These highways are designated as scenic routes under the Lucerne Valley Community Plan by the County of San Bernardino.

Field surveys and the photographs were used to evaluate existing visual conditions, and three viewpoint locations were selected to provide the basis for computer-generated simulations showing the proposed amendment in relation to the surrounding environment. A land use survey was also conducted to identify existing land uses and their relevance to the proposed amendment. **Figure 3.1-2** also shows the locations of the three viewpoint locations:

- Viewpoint 1 – State Route 18 and Custer Avenue looking south from a distance of approximately 5.5 miles; residential and some business
- Viewpoint 2 – Lucerne Valley Market at Barstow Road and State Route 18 looking southwest from a distance of approximately 6 miles; business
- Viewpoint 3 – Onyx and Carnelian roads looking southwest from a distance of approximately 4 miles; residential

Model Methodology

The simulations were created using three-dimensional terrain models developed from the design plans and merged with the existing topography. The final terrain model is meshed, consisting of triangles or squares, and becomes a close representation of the physical environment. The model is registered to a three-dimensional coordinate system by using USGS topo quads or aerial imagery. The computer-rendered model is overlayed or matched to the existing site photography. The projection is colored to simulate color, textures, and shaping consistent with the surface and subsurface conditions. A photograph is then rendered that simulates future visual conditions. Proposed design elements are isolated and textured to more closely represent real-world coloring.

Preparation of Computer Simulations

Viewpoints 1 and 2 were chosen as representative views available to travelers along State Routes 18 and 247, respectively, and local businesses and residents in Lucerne Valley. The market area near the junctions of State Routes 18 and 247 is considered the "center" of town. Highway views were chosen because they represent the most common views of the area (i.e., the largest number of viewers either travel along the highway or live nearby). Viewpoint 3 was chosen to represent residential views in an area that is the closest residential area to the site not blocked by intervening hills. From this viewpoint, the site is highly visible. Rock staining conducted in the past years is evident in the center of the slope area.

Photographs taken from these viewpoints were used as a base to simulate the proposed amendments to the quarries and overburden stockpiles in the context of the existing visual conditions and setting.

PROJECT IMPACTS AND MITIGATION MEASURES

Substantial Adverse Effect on a Scenic Vista and the Existing Visual Character (Standards of Significance 1 and 3)

Impact 3.1.1 Implementation of the proposed project could have a substantial effect on a scenic vista. The project design and proposed reclamation activities would minimize this effect. However, the overall visual impacts are still considered unavoidable significant impacts consistent with the 1986 EIR findings. Therefore, this impact would be **significant and unavoidable**.

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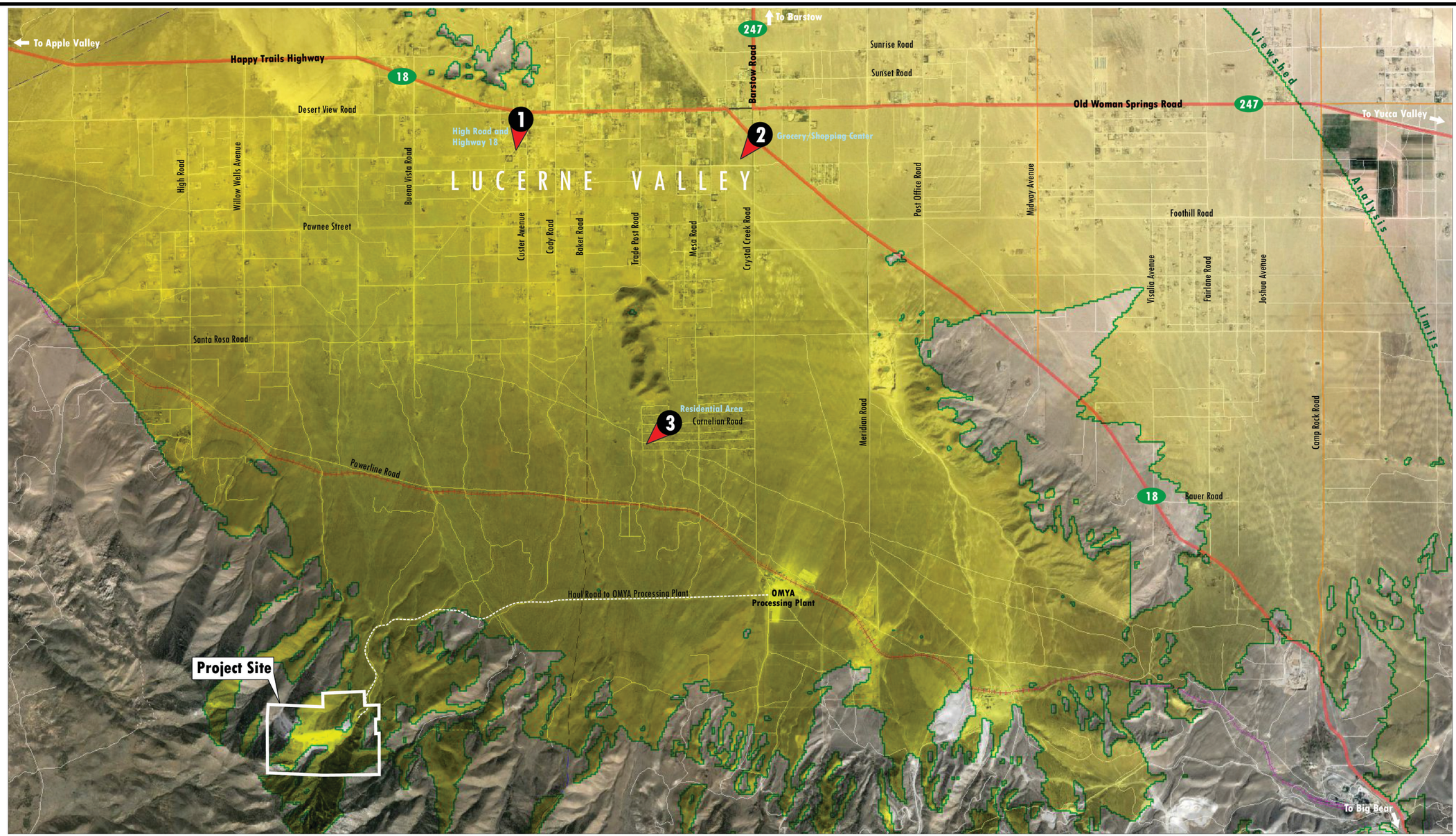

LEGEND

Areas of Potential Visibility
Note: The Viewshed Analysis data comprised of only USGS Digital Elevation Models. The data set did not account for trees, houses and other obstructions above ground elevation. Analysis covered a 10 mile radius.

2 Viewpoint Location and Direction of View (3 Total)

Source: Lilburn Corporation, 2012

0 0.625 1.25
MILES

N

Figure 3.1-2
Overall Viewshed Analysis and Simulation Viewpoint Locations

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The project site is located in an area that could be considered visually sensitive. According to the County of San Bernardino General Plan, the desert landscape and natural resources define the rural character of the area. In addition, the project site is visible from portions of SR 18 and SR 247 which have been designated by the County as scenic routes. However, mining has been part of the landscape for over 70 years and is an integral part of the north slope of the mountains visible from Lucerne Valley and these roadways.

The 1986 EIR for the original development of the quarries (SCH No. 86050516) recognized that there would be significant visual impacts from the quarry development and a Statement of Overriding Considerations was prepared and accepted by the County.

The principal changes in the Amended Plan with respect to visual resources are the increase in size of the overburden stockpiles, the increase in size of the approved undeveloped White Ridge Quarry, and the increase in the number of ancillary haul roads west and east of OB-2. These changes are shown on **Figure 3.1-1** and would be the incremental changes to visual impacts of the proposed Amended Plan as compared to the existing operations.

Figure 3.1-2 shows the three locations where views of the proposed project were simulated in the context of the existing conditions. Due to topography and the orientation of the quarry site, views are limited to those from the northwest to east. **Figures 3.1-3**, **3.1-4**, and **3.1-5** show existing and future views of the project site from each of the viewpoints. The top photographs in these figures show existing conditions, while the bottom photographs show simulated views of the site after mine closure and with concurrent and approximately 10 years of final reclamation completed (Year 2065). **Figure 3.1-5b** provides a simulated view of the site from Viewpoint 3 in Year 2030 with only concurrent reclamation completed. This figure provides a simulation with the site at its most disturbed and final reclamation not yet implemented, although some reclamation is implemented concurrent with quarry operations. As shown in these figures, the proposed project would expand the visible disturbance area along the north slope. Particularly visible (see **Figure 3.1-5b**), as compared to existing conditions, are OB-2 and the White Ridge Quarry. However, as shown in these figures, implementation of the proposed reclamation activities described above would reduce the exposed white areas to darker shades of white and tan over time. The project proponent tested colorization and revegetation methods on the north-facing slopes on approximately 5 acres. The visual contrast has been substantially reduced as the brown-colored stain on the boulders blends with the natural hillside color. Revegetation of the upper slopes was also undertaken utilizing native species. These positive effects are illustrated in the center of the disturbed project on all three existing photographs in **Figures 3.1-3** through **3.1-5**.

Following is a detailed discussion of the anticipated visual changes resulting from implementation of the proposed amendment as seen from each of the viewpoints.

Viewpoint 1 – SR 18 and Custer Avenue

The reader is referred to **Figure 3.1-3**. The project site is located approximately 5.5 miles to the south as viewed near the intersection of SR 18 and Custer Avenue, west of the town center. This area includes travelers on State Route 18, scattered rural residential, and businesses along the highway. The existing quarry is visible halfway up the north slope of the range (see **Figure 3.1-3a**). The main visible features are the white rock slopes to the west and north of the quarry and OB-1 on the lower east. These features have altered the color, form, and line of the natural slopes.

The simulation after project buildout with 10 years of final reclamation and time for reclamation to take effect shows the permitted expansion of the White Knob and Annex Quarries on the upper west as a series of benches that may be visible depending on shadowing and color (see **Figure**

3.1-3b). The White Ridge Quarry to the east is also shown as a series of benches that may be visible depending on shadowing and color. Note the gray hill in the foreground of the White Ridge Quarry, which blocks views of the lower half of this quarry. The expansion of OB-1 and OB-2 are seen as plateaus of white rock. OB-3 is seen to the lower left of the White Ridge Quarry. The quarries and overburden stockpiles would darken with reclamation and weathering over time.

The proposed Amended Plan would incrementally add mine development primarily in the center and eastern portions of the project site but will not increase the overall width of the mine along the background of the mountain ridge. The changes will cause physical alterations to form, line, and in particular color as compared to the existing and permitted project. The overall scenic integrity of the site will not substantially decrease from that of the existing and permitted project, as no new uses are being added to the overall viewshed. However, the overall visual impacts are still considered unavoidable significant impacts consistent with the 1986 EIR findings.

Viewpoint 2 – Lucerne Valley Market

The reader is referred to **Figure 3.1-4**. The project site is located approximately 6 miles to the southwest as viewed from the Lucerne Valley Market near the intersection of SR 18 and Barstow Road in the town center. This area includes travelers on State Route 18, scattered rural residential, and businesses along the highways. The existing quarry is visible halfway up the north slope of the range (see **Figure 3.1-4a**). The main visible features are the white rock slopes to the west and north of the quarry and OB-1 on the lower east. These features have altered the color, form, and line of the natural slopes.

The simulation after quarry buildout with 10 years of final reclamation and time for reclamation to take effect shows the permitted expansion of the White Knob and Annex Quarries on the upper west as a series of benches that may be visible depending on shadowing and color (see **Figure 3.4-4b**). The White Ridge Quarry to the east is also depicted as a series of benches that may be visible depending on shadowing and color. Note the gray hill in the foreground of the White Ridge Quarry, which blocks views of the lower half of this quarry. OB-1 is more visible from this angle of view looking up the canyon, with the "face" and benches of the stockpile seen as plateaus of white rock. OB-2 is seen at the top of OB-1 as another plateau. OB-3 is barely visible at the bottom of the White Ridge Quarry. The quarries and overburden stockpiles will darken with reclamation and weathering over time.

The proposed Amended Plan would incrementally add physical alterations to form, line, and in particular color as compared to the existing and permitted project. The overall scenic integrity of the site would not substantially decrease from that of the existing project, as no new uses are being added to the overall viewshed. However, the overall visual impacts are still considered unavoidable significant impacts consistent with the 1986 EIR findings.

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Figure 3.1-3a

Existing Conditions

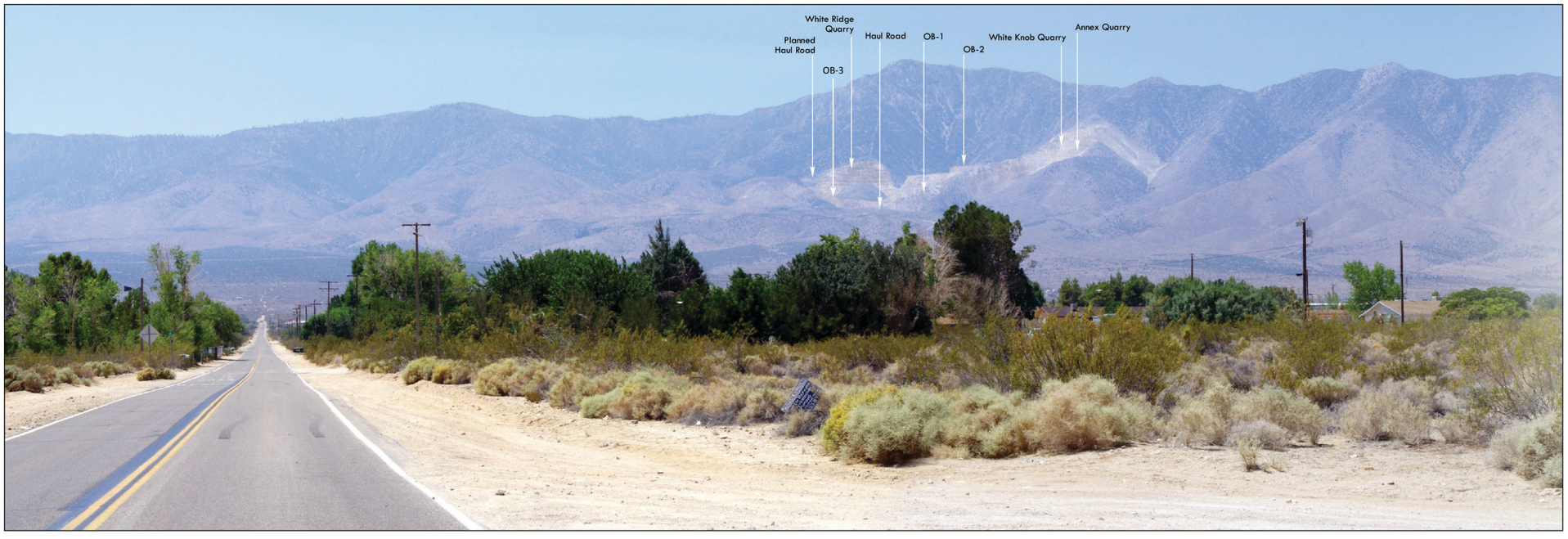

Figure 3.1-3b

Year 2065 Conditions (All Mining and Concurrent Reclamation Plus 10 Years of Final Reclamation Completed)

Source: Lilburn Corporation, 2012

Figure 3.1-3

Viewpoint 1 – Existing and Future (Year 2065) Conditions

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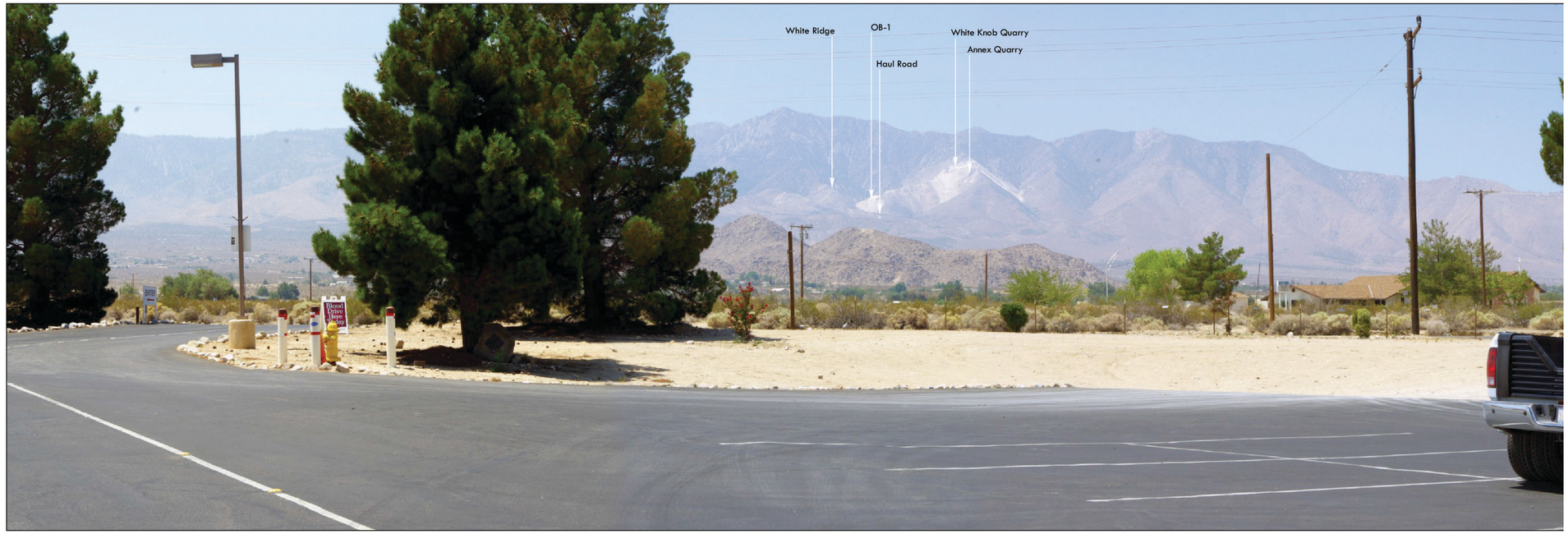

Figure 3.1-4a

Existing Conditions

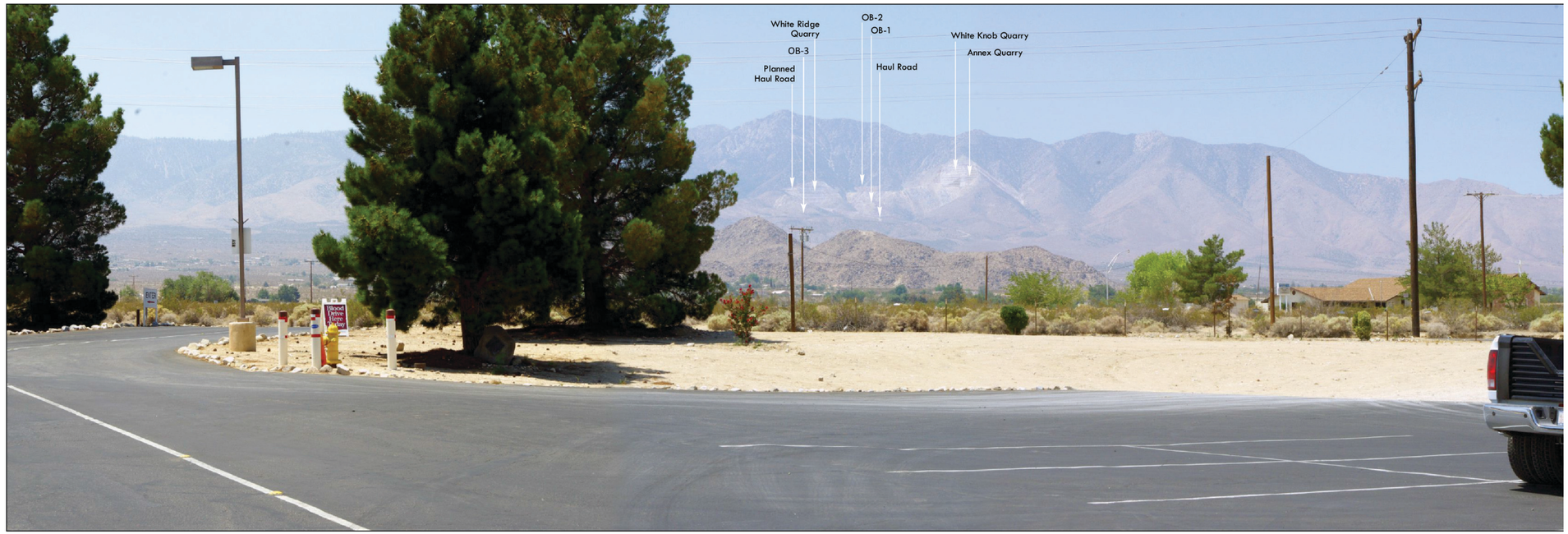

Figure 3.1-4b

Year 2065 Conditions (All Mining and Concurrent Reclamation Plus 10 Years of Final Reclamation Completed)

Source: Lilburn Corporation, 2012

Figure 3.1-4

Viewpoint 2 – Existing and Future (Year 2065) Conditions

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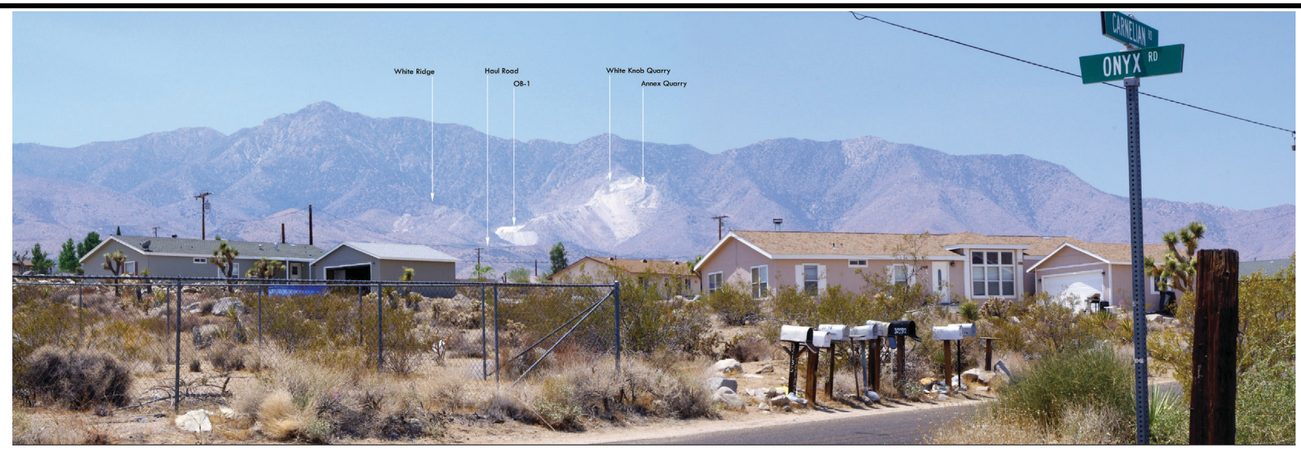

Figure 3.1-5a

Existing Conditions

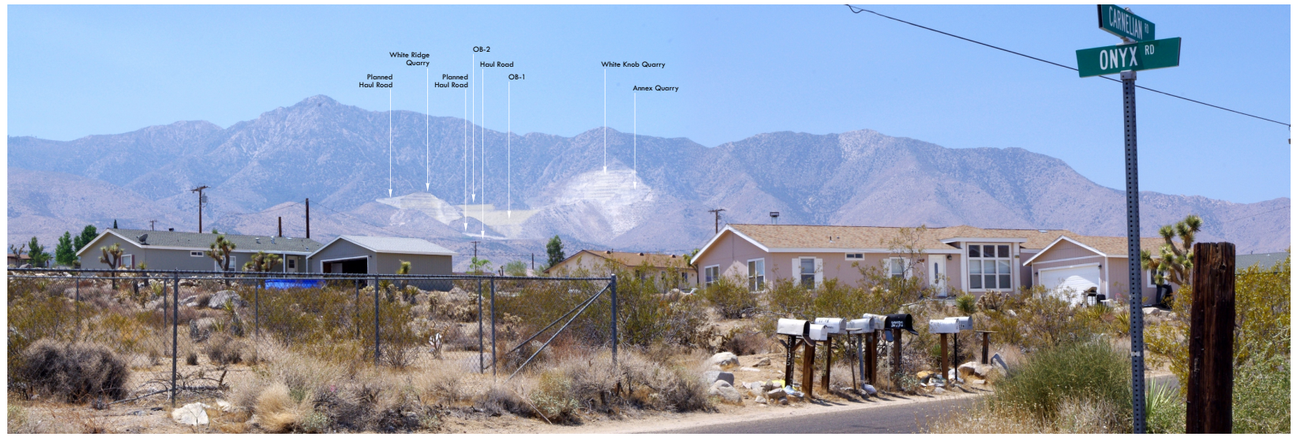

Figure 3.1-5b

Year 2030 Conditions (Mining and Concurrent Reclamation Ongoing, No Final Reclamation)

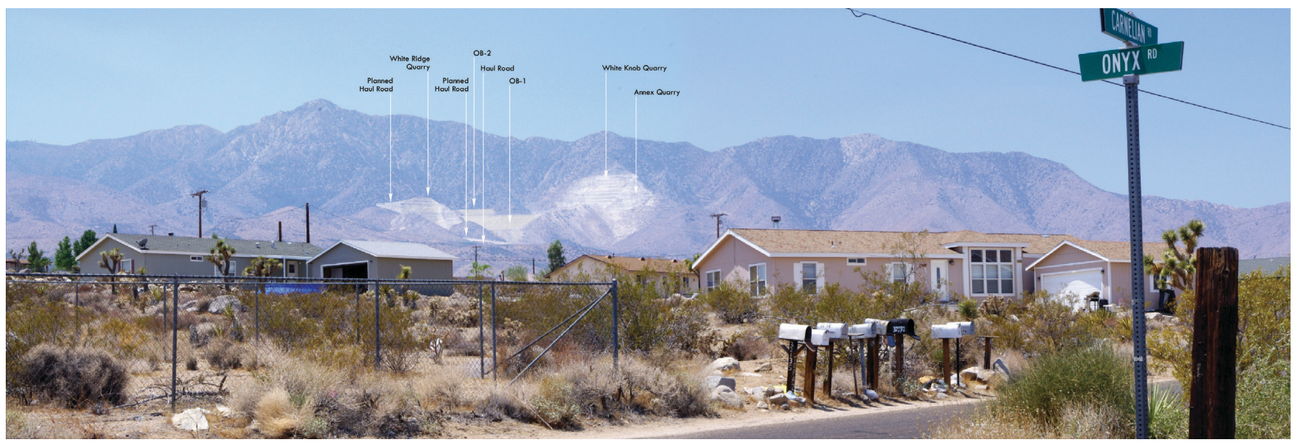

Figure 3.1-5c

Year 2065 Conditions (All Mining and Concurrent Reclamation Plus 10 Years of Final Reclamation Completed)

Source: Lilburn Corporation, 2012

Figure 3.1-5
Viewpoint 3 – Existing and Future (Year 2030 and Year 2065) Conditions

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Viewpoint 3 – Onyx and Carnelian Roads

The reader is referred to **Figure 3.1-5**. The project site is located approximately 4 miles to the southwest as viewed from the intersection of Onyx and Carnelian roads in a rural residential area. The existing quarry is visible along the north slope of the range (see **Figure 3.1-5a**). Due to its closer location, viewers in this area may be able to discern quarry benches and haul roads. The main visible features are the white rock slopes to the north of the quarry and OB-1 on the lower east. These features have altered the color, form, and line of the natural slopes.

Figure 3.1-5b provides a simulated view of conditions at Year 2030 from Viewpoint 3. At this point, all mining at the White Knob and Annex Quarries and placement of waste rock into OB-1 and OB-2 (Phase 3) would be complete, and mining of the White Ridge Quarry and placement of waste rock into OB-3 would be ongoing. Concurrent reclamation would have been implemented as proposed, but no final reclamation would have been completed. This simulation is intended to provide a view of the project site under "worst-case scenario" conditions with the site. As shown on this figure, without implementation of final reclamation, the exposed white areas are significantly brighter than under Year 2065 conditions (see **Figure 3.1-5c**).

The simulation after quarry buildout with 10 years of final reclamation and time for reclamation to take effect shows the permitted expansion of the White Knob and Annex Quarries on the upper west as a series of benches (see **Figure 3.1-5c**). The White Ridge Quarry to the east is also shown as a series of benches that may be visible depending on shadowing and color. Note the gray hill in the foreground of the White Ridge Quarry, which blocks views of the lower half of this quarry. OB-1 is more visible from this angle of view looking up the canyon, with the "face" and benches of the stockpile seen as plateaus of white rock. OB-2 is seen at the top of OB-1 as another plateau. OB-3 is located at the bottom of the White Ridge Quarry below the gray hill. The quarries and overburden stockpiles would darken with reclamation and weathering over time.

Mitigation Measures

MM 3.1.1 The Amended Plan includes design features and reclamation activities that would reduce visual impacts. These measures are incorporated into this DEIR in order to ensure compliance. These measures include the following:

- Implement measures to minimize boulder roll-down visual impacts including:
  - Precision drilling and buffer blasting when the outside edge is approached.
  - Drilling lifters on the edge to undercut the remaining slope and let it fall into the pit (like directional falling of a tree).
  - Excavator to pull down and pull in toward the pit blasted rock away from the edge.
  - Use of alternatives to blasting along the outside such as rock breakers, surface miners, cutting heads, and excavators.
  - Loader to pull back material from the edge.
  - Loader to dig at an angle to the edge or parallel to the edge when possible.

- Manually scaling boulders from the high walls where they may be above a haulage road.

- Maintain the existing crusher site at the White Knob Quarry or use a portable plant within an active quarry to reduce its visibility from Lucerne Valley.

- Deposit waste rock within the White Knob Quarry footprint, as described in the Amended Plan, to reduce the area of disturbance for overburden stockpiles and visual impact outside the quarry.

- Design and phase mining of the White Ridge Quarry, which allows for concurrent reclamation and leaves an approximately 300-foot-high ridge of undisturbed hillside facing Lucerne Valley to minimize visual impacts.

- Implement reclamation and revegetation on completed equipment-accessible quarry benches and on overburden stockpiles concurrent with mining where feasible.

- Utilize color-staining product to darken the visible quarry and roll-down slopes where not subject to raveling to reduce visual impacts.

- Deposit darker waste rock on overburden sites where available to reduce color contrast.

- Design adequate erosion control features along the haul and access roads and quarry to control and limit erosion and sediment transport for a 20-year, one-hour duration storm event.

- Where feasible, construct catchment berms at the foot of stockpiles to reduce rock roll-down and sediment flow.

- Limit surface disturbances to areas identified in the Amended Plan.

- Implement appropriate dust controls to reduce visible dust.

Timing/Implementation: Implemented during mining and reclamation activities

Enforcement/Monitoring: County of San Bernardino Land Services Department

The proposed Amended Plan will incrementally add physical alterations to form, line, and in particular color as compared to the existing project. The overall scenic integrity of the site will not substantially decrease from that of the existing project as no new uses are being added to the overall viewshed. However, the overall visual impacts are still considered unavoidable significant impacts consistent with the 1986 EIR. Therefore, this impact would be **significant and unavoidable**.

This section includes a description of existing air quality conditions, a summary of applicable regulations, a description of existing air quality conditions, and an analysis of potential air quality impacts associated with the proposed project. Mitigation measures are recommended, as necessary, to reduce significant air quality impacts. This air quality analysis and the associated modeling and health risk assessment were conducted by Sespe Consulting, Inc. (see **EIR Appendix C**).

The County published a Notice of Preparation and Initial Study (NOP/IS) for the proposed project on June 12, 2013. A copy of the NOP/IS, along with comments received during the public review period, is contained in **EIR Appendix A**. The Mojave Desert Air Quality Management District submitted comments indicating staff concurrence with the proposed assessment of potential impacts to be addressed in the EIR.

3.2.1 EXISTING SETTING

MOJAVE DESERT AIR BASIN

The Mojave Desert Air Basin (MDAB) is an assemblage of mountain ranges interspersed with long broad valleys that often contain dry lakes. Many of the lower mountains that dot the vast terrain rise from 1,000 to 4,000 feet above the valley floor. Prevailing winds in the MDAB are out of the west and southwest. These prevailing winds are due to the proximity of the MDAB to coastal and central regions and the blocking nature of the Sierra Nevada range to the north; air masses pushed onshore in Southern California by differential heating are channeled through the MDAB. The MDAB is separated from the Southern California coastal and central California valley regions by mountains (highest elevation approximately 10,000 feet), whose passes form the main channels for these air masses. The Antelope Valley is bordered in the northwest by the Tehachapi Mountains, separated from the Sierra Nevada in the north by the Tehachapi Pass (3,800-foot elevation). The Antelope Valley is bordered in the south by the San Gabriel Mountains, bisected by Soledad Canyon (3,300 feet). The Mojave Desert is bordered in the southwest by the San Bernardino Mountains, separated from the San Gabriel Mountains by the Cajon Pass (4,200 feet). A lesser channel lies between the San Bernardino Mountains and the Little San Bernardino Mountains (the Morongo Valley).

During the summer, the MDAB is generally influenced by a Pacific subtropical high cell that sits off the coast, inhibiting cloud formation and encouraging daytime solar heating. The MDAB is rarely influenced by cold air masses moving south from Canada and Alaska, as these frontal systems are weak and diffuse by the time the reach the desert. Most desert moisture arrives from infrequent warm, moist and unstable air masses from the south. The MDAB averages between 3 and 7 inches of precipitation per year (from 16 to 30 days with at least 0.01 inches of precipitation). The MDAB is classified as a dry-hot desert climate, with portions classified as dry-very hot desert, to indicate at least three months have maximum average temperatures over 100°F.

The Mojave Desert Air Quality Management District (MDAQMD) is the local agency for air quality planning with authority over air pollutant sources.

AIR POLLUTANTS OF CONCERN AND HEALTH EFFECTS

The air pollutants emitted into the ambient air by stationary and mobile sources are regulated by federal and state law. These regulated air pollutants are known as "criteria air pollutants" and are categorized into primary and secondary pollutants. Primary air pollutants are those that are emitted directly from sources. Carbon monoxide (CO), reactive organic gases (ROG), nitrogen oxides (NO_X), sulfur dioxide (SO_2), most particulate matter (PM_{10} and $PM_{2.5}$), lead, and fugitive

dust are primary air pollutants. Of these, CO, SO_2, PM_{10}, and $PM_{2.5}$ are criteria pollutants. ROG and NO_X are criteria pollutant precursors and go on to form secondary criteria pollutants through chemical and photochemical reactions in the atmosphere. Ozone (O_3) and nitrogen dioxide (NO_2) are the principal secondary pollutants. Presented below is a description of each of the primary and secondary criteria air pollutants and their known health effects.

Carbon monoxide (CO) is a colorless, odorless, toxic gas produced by incomplete combustion of carbon substances, such as gasoline or diesel fuel. The primary adverse health effect associated with CO is interference with normal oxygen transfer to the blood, which may result in tissue oxygen deprivation.

Reactive organic gases (ROG) are compounds comprising primarily atoms of hydrogen and carbon. Internal combustion associated with motor vehicle usage is the major source of hydrocarbons. Other sources of ROG include evaporative emissions associated with the use of paints and solvents, the application of asphalt paving, and the use of household consumer products such as aerosols. Adverse effects on human health are not caused directly by ROG, but rather by reactions of ROG to form secondary pollutants such as ozone.

Nitrogen oxides (NO_X) serve as integral participants in the process of photochemical smog production. The two major forms of NO_X are nitric oxide (NO) and nitrogen dioxide (NO_2). NO is a colorless, odorless gas formed from atmospheric nitrogen and oxygen when combustion takes place under high temperature and/or high pressure. NO_2 is a reddish-brown irritating gas formed by the combination of NO and oxygen. NO_X acts as an acute respiratory irritant and increases susceptibility to respiratory pathogens.

Nitrogen dioxide (NO_2) is a byproduct of fuel combustion, produced by combustion of NO and oxygen. NO_2 acts as an acute irritant and, in equal concentrations, is more injurious than NO. At atmospheric concentrations, however, NO_2 is only potentially irritating. There is some indication of a relationship between NO_2 and chronic pulmonary fibrosis. Some increase in bronchitis in children has also been observed at concentrations below 0.3 part per million (ppm). Nitrogen dioxide absorbs blue light; the result is a brownish-red cast to the atmosphere and reduced visibility. NO_2 also contributes to the formation of PM_{10} (particulates having an aerodynamic diameter of 10 microns—or 0.0004 inch—or less in diameter) and ozone.

Sulfur dioxide (SO_2) belongs to the family of sulfur oxide gases (SO_x). SO_2 is a colorless, pungent, irritating gas formed by the combustion of sulfurous fossil fuels. Fuel combustion is the primary source of SO_2. At sufficiently high concentrations, SO_2 may irritate the upper respiratory tract. At lower concentrations and when combined with particulates, SO_2 may do greater harm by injuring lung tissue. A primary source of SO_2 emissions is high sulfur content coal. Gasoline and natural gas have very low sulfur content and hence do not release significant quantities of SO_2. Sulfur dioxide is a precursor to sulfate (SO_4), which is a component of particulate matter. In addition, SO_2 and NO_2 can react with other substances in the air to form acids, which fall to the earth as rain, fog, snow, or dry particles.

Particulate matter (PM) is a mixture of pollutants in liquid and solid forms. Particulate matter may be classified as primary or secondary. Primary particulates are emitted directly by emission sources, whereas secondary particulates are formed through atmospheric reaction of gases. Particulates are usually classified according to size. The particle diameter can vary from approximately 0.005 micron to 100 microns. Particulate matter less than 10 microns in diameter is referred to as PM_{10} (coarse particulates) and less than 2.5 microns is referred to as $PM_{2.5}$ (fine particulates).

Ozone (O_3), or smog, is one of a number of substances called photochemical oxidants that are formed when ROG and NO_X (both byproducts of the internal combustion engine) react with sunlight. Ozone poses a health threat, especially to those who already suffer from respiratory diseases. Additionally, O_3 has been tied to crop damage, typically in the form of stunted growth and premature death. Ozone can also act as a corrosive, resulting in property damage such as the degradation of rubber products.

EXISTING AMBIENT AIR QUALITY

Ambient air quality in San Bernardino County can be inferred from ambient air quality measurements conducted at nearby air quality monitoring stations. The project is located near the Lucerne Valley monitoring station, which measures PM_{10}. Concentrations at this station were less than the federal standard in all but one year (2007) of the decade reviewed. Concentrations are estimated to have exceeded the California PM_{10} standard six or less days each year, except in 2007 when the estimate was 37 days exceeding.

The Hesperia monitoring station is the closest location where ozone is monitored. Ozone levels exceeded the 2008 federal 8-hour standard between 40 and 73 days per year between 2002 and 2011. The California 1-hour standard was exceeded between 15 and 46 days per year.

The Victorville monitoring station collects a full suite of pollutants and is the closest station to monitor CO and NO_2, which are both attainment pollutants.

The South Coast Air Quality Management District (SCAQMD) operates a $PM_{2.5}$ monitoring station in the City of Big Bear Lake. $PM_{2.5}$ concentrations at this station exceeded the federal standard on a handful of days in each year 2005 through 2009, while 2010 and 2011 did not have exceedances.

Table 3.2-1 summarizes the published data from 2009 to 2011 for each year that monitoring data is provided.

TABLE 3.2-1
SUMMARY OF AMBIENT AIR QUALITY DATA

Pollutant	Year		
	2009	2010	2011
Ozone (O_3)			
Maximum 1-Hour Concentration (ppm)	0.123	0.119	0.132
Maximum 8-Hour Concentration (ppm)	0.101	0.101	0.113
Carbon Monoxide (CO)[2]			
Maximum 1-Hour Concentration (ppm)	1.8	8.7	1.9
Maximum 8-Hour Concentration (ppm)	1.1	2.3	1.5
Nitrogen Dioxide (NO_2)			
Maximum 1-Hour Concentration (ppm)	0.059	0.065	0.060
Annual Arithmetic Mean Concentration (ppm)	0.015	0.015	0.015
Respirable Particulate Matter (PM_{10})			
Maximum 24-Hour Concentration ($\mu g/m^3$)	93	43	33
Annual Arithmetic Mean ($\mu g/m^3$)	17.3	14.6	13.8
Fine Particulate Matter ($PM_{2.5}$)			

Pollutant	Year		
	2009	2010	2011
Maximum 24-Hour Concentration ($\mu g/m^3$)	29.4	27.5	30.6
Annual Arithmetic Mean ($\mu g/m^3$)	9.9	8.4	8.4

Source: EIR Appendix C, Sespe 2013
Notes: $\mu g/m^3$ = micrograms per cubic meter; ppm = parts per million
Ozone is from Hesperia Monitoring Station operated by the MDAQMD.
NO_2 and CO concentrations are from Victorville Monitoring Station operated by the MDAQMD.
PM_{10} concentrations are from Lucerne Valley Middle School Monitoring Station operated by the MDAQMD.
$PM_{2.5}$ concentrations are from Big Bear City Monitoring Station operated by SCAQMD.

VISIBILITY

Concerns related to visibility are typically related to the aesthetic damage resulting from air pollution. The project is within 100 kilometers of several Class I Wilderness Areas, which are areas protected from impacts on visibility, ozone phytotoxicity, and deposition of nitrates and sulfates that can acidify water bodies under the Clean Air Act. Class I Wilderness Areas within 100 kilometers of the project include San Gorgonio (14 miles), Cucamonga (30 miles), San Jacinto (34 miles), Joshua Tree National Park (35 miles), and San Gabriel (45 miles).

Good visibility is essential to the enjoyment of national parks and scenic areas. Across the United States, regional haze has decreased the visual range in these pristine areas from 140 miles to 35–90 miles in the west and from 90 miles to 15–25 miles in the east. This haze is composed of small particles that absorb and scatter light, affecting the clarity and color of what humans see in a vista. The pollutants that create haze (also called haze species) are measurable as sulfates, nitrates, organic carbon, elemental carbon, fine soil, and coarse mass. Anthropogenic sources of haze include industry, motor vehicles, agricultural and forestry burning, and dust from soils disturbed by human activities. Pollutants from these sources, in concentrations much lower than those which affect public health, can impair visibility anywhere. Natural forest fires, biological emissions, and other natural events also contribute to haze species concentrations. Visibility-reducing particles can be transported long distances from where they are generated, thereby producing regional haze. When they are transported to and occur in national parks and wilderness areas, the reduced visibility impairs the quality and the value of the wilderness experience.

Conditions in the San Gorgonio Wilderness Area would be of primary concern for this project because it is closest, and other areas would experience less severe impacts. The environmental setting for each Class I Wilderness Area in California is found in the California Regional Haze Plan. The San Gorgonio Wilderness Area description from this plan is provided in **EIR Appendix C**.

TOXIC AIR CONTAMINANTS

Toxic air contaminants (TACs) are not considered criteria pollutants in that TACs are not addressed through the setting of federal or state ambient air quality standards. Instead, the U.S. Environmental Protection Agency (EPA) and the California Air Resources Board (CARB) regulate TACs with statutes and regulations that generally require the use of the maximum or best available control technology to limit emissions. At the state level, CARB has authority for the regulation of emissions from motor vehicles, fuels, and consumer products. In 1998, CARB added diesel-exhaust particulate matter (DPM) to the list of toxic air contaminants. DPM is the primary toxic air contaminant of concern for mobile sources. Of all controlled toxic air contaminants, emissions of DPM are estimated to be responsible for about 70 percent of the total ambient TAC

risk. CARB has made the reduction of the public's exposure to DPM one of its highest priorities, with an aggressive plan to require cleaner diesel fuel and cleaner diesel engines and vehicles.

The MDAQMD does not publish health risk estimates for areas within its jurisdiction. Because the project area is near the boundary of the Mojave Desert and South Coast air basins, the SCAQMD Multiple Air Toxics Exposure Study (MATES) III risk map that shows total cancer risk of approximately 85 excess cancer cases per one million people exposed in the Big Bear Lake area is considered representative of conditions in the area of the project (see Figure 3 of **EIR Appendix C**).

It should be noted that the SCAQMD's MATES study is based on ambient air quality monitoring data from several monitoring stations in the South Coast Air Basin. The MATES III study includes fixed monitoring sites (where data is collected over multiple years) and microscale or temporary sites where monitoring occurred for a limited time period (six to ten weeks). The nearest fixed air monitoring site to the project vicinity is the Inland Valley San Bernardino station located at 14360 Arrow Highway in Fontana, which is over 60 miles southwest of the project site. The MATES III study included a temporary site that appears to be located closer to the project, but no address is provided in the MATES III documentation. The MATES III study acknowledges, "Since the sampling periods for the microscale sites are limited, annual averages for measured substances cannot be calculated" (EIR Appendix C, Sespe 2013, p. 4). The ambient health risk identified in Figure 3 of **EIR Appendix C** includes projection of risk levels from locations that were monitored compared to those that were not. This discussion overlooks these details and considers the risk map published by the SCAQMD at face value such that it represents existing conditions at the project site.

As previously stated, DPM accounts for roughly 70 percent of the cancer risk from air pollution in urban areas where on-road sources dominate the inventory. Diesel engines are a ubiquitous source and thus it is not surprising that stationary source TAC effects "are generally much lower than region-wide risk levels; region-wide risks tend to overwhelm any potential local 'hot spots'" (EIR Appendix C, Sespe 2013, p. 4).

3.2.2 REGULATORY FRAMEWORK

Regulations that affect air quality consist primarily of those promulgated under the federal and state clean air acts. Other regulations that affect air quality include those related to federal conformity, impacts on Class I and Class II Wilderness Areas, and impacts on health risk.

AMBIENT AIR QUALITY STANDARDS

The federal Clean Air Act and the California Clean Air Act each contain comprehensive frameworks for air quality planning and regulation. Title 40 of the Code of Federal Regulations (CFR) and Title 17 of the California Code of Regulations (CCR) contain requirements that have been promulgated under authority granted to the EPA and CARB by the acts.

Criteria air pollutants include SO_X, NO_X, PM, CO, lead, and ground-level ozone. Ambient air quality standards (AAQS) are developed by the EPA and CARB for each of the criteria pollutants. Primary AAQS are designed to protect human health, with an adequate margin of safety, including sensitive populations such as children, the elderly, and individuals suffering from respiratory disease. Secondary AAQS are designed to protect public welfare from any known or anticipated adverse effects of a pollutant (e.g., building facade degradation, reduced visibility, and damage to crops and domestic animals).

Ambient air quality standards and related monitoring programs are among the many devices established by air quality regulations (40 CFR 50–51). Geographic areas called "attainment areas" are classified by the EPA and CARB based on whether the ambient air in the area meets the AAQSs. An attainment area is an area in which pollutant concentrations are less than or equal to the AAQS, while nonattainment areas have pollution levels above the AAQS. State and federal AAQS are shown in **Table 3.2-2**.

TABLE 3.2-2
AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	California Standards	National Standards
Ozone	8 Hour	0.070 ppm (137$\mu g/m^3$)	0.075 ppm
	1 Hour	0.09 ppm (180 $\mu g/m^3$)	–
Carbon Monoxide	8 Hour	9.0 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)
	1 Hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)
Nitrogen Dioxide	1 Hour	0.18 ppm (339 $\mu g/m^3$)	100 ppb
	Annual Arithmetic Mean	0.030 ppm (57 $\mu g/m^3$)	53 ppb (100 $\mu g/m^3$)
Sulfur Dioxide	24 Hour	0.04 ppm (105 $\mu g/m^3$)	N/A
	3 Hour	–	N/A
	1 Hour	0.25 ppm (665 $\mu g/m^3$)	75 ppb
Particulate Matter (PM_{10})	Annual Arithmetic Mean	20 $\mu g/m^3$	N/A
	24 Hour	50 $\mu g/m^3$	150 $\mu g/m^3$
Particulate Matter – Fine ($PM_{2.5}$)	Annual Arithmetic Mean	12 $\mu g/m^3$	15 $\mu g/m^3$
	24 Hour	N/A	35 $\mu g/m^3$
Sulfates	24 Hour	25 $\mu g/m^3$	N/A
Lead	Calendar Quarter	N/A	1.5 $\mu g/m^3$
	30 Day Average	1.5 $\mu g/m^3$)	N/A
Hydrogen Sulfide	1 Hour	0.03 ppm (42 $\mu g/m^3$)	N/A
Vinyl Chloride (chloroethene)	24 Hour	0.01 ppm (26 $\mu g/m^3$)	N/A
Visibility-Reducing Particles	8 Hour (10:00 to 18:00 PST)	–	N/A

Source: EIR Appendix C, Sespe 2013, p. 8

Notes: mg/m^3 = milligrams per cubic meter; ppm = parts per million; ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter

In order to make progress toward attainment with the AAQS, each state and air district containing federal nonattainment areas is required to develop a written plan for improving air quality in those areas. These plans are called State Implementation Plans (SIP) and Attainment Plans. California's SIP contains mobile source and consumer product emission control strategies proposed by CARB and a compilation of stationary and area source strategies that have been developed by local air districts under CARB supervision. Through these plans, the state and local air districts outline efforts that they will take to reduce air pollutant concentrations to levels below the standards. Federal and state attainment status designations assigned by the EPA and CARB for the project area are summarized in **Table 3.2-3**.

TABLE 3.2-3
FEDERAL AND STATE AMBIENT AIR QUALITY ATTAINMENT STATUS FOR THE MDAB

Pollutant	Federal	State
Ozone (O_3)	Nonattainment	Nonattainment
Coarse Particulate Matter (PM_{10})	Nonattainment	Nonattainment
Fine Particulate Matter ($PM_{2.5}$)	Unclassified/Attainment	Nonattainment
Carbon Monoxide (CO)	Attainment	Attainment
Nitrogen Dioxide (NO_2)	Unclassified/Attainment	Unclassified/Attainment
Sulfur Dioxide (SO_2)	Unclassified/Attainment	Unclassified/Attainment
Lead	Attainment	Attainment
Particulate Sulfate	N/A	Attainment
Hydrogen Sulfide	N/A	Attainment
Visibility Reducing Particles	N/A	Unclassified

Source: EIR Appendix C, Sespe 2013, p. 9

California ambient air quality standards (CAAQS) are more stringent than the national ambient air quality standard (NAAQS). Existing law requires district plans for attaining CAAQS to assess the cost-effectiveness of available and proposed emission control measures. Proposed emission control measures in the Attainment Plans are typically developed into air district rules.

Mojave Desert Air Quality Management District

The MDAQMD is the agency primarily responsible for ensuring that federal and state ambient air quality standards are not exceeded and that air quality conditions are maintained. Responsibilities of the MDAQMD include, but are not limited to, adopting and enforcing rules and regulations concerning sources of air pollution, issuing permits for stationary sources of air pollution, monitoring ambient air quality and meteorological conditions, and implementing programs and regulations required by the federal Clean Air Act and Clean Air Act Amendments. The MDAQMD also assists CARB in preparing the State Implementation Plan by preparing Attainment Plans that demonstrate how the ambient air quality standards will be achieved. The Attainment Plans describe the rules that will be developed and other means by which the MDAQMD will manage the emissions within its jurisdiction. MDAQMD Attainment Plans are listed in **Table 3.2-4**.

TABLE 3.2-4
MDAQMD AIR QUALITY ATTAINMENT PLANS

Name of Plan	Date of Adoption	Standard(s) Targeted	Applicable Area	Pollutant(s) Targeted	Attainment Date[1]
Federal 8-Hour Ozone Attainment Plan (Western Mojave Desert Nonattainment Area	June 2008	Federal 8-hour ozone (84 ppb)	Western Mojave Desert Nonattainment Area (MDAQMD portion)	NO_x and VOC/ROG	2021
2004 Ozone Attainment Plan (State and Federal)	April 2004	Federal 1-hour ozone	Entire district	NO_x and VOC/ROG	2007
Triennial Revision to the 1991 Air Quality Attainment Plan	January 1996	State 1-hour ozone	Entire district	NO_x and VOC/ROG	2005
Mojave Desert Planning Area Federal Particulate Matter Attainment Plan	July 1995	Federal daily and annual PM_{10}	Mojave Desert Planning Area	PM_{10}	2000
1991 Air Quality Attainment Plan	August 1991	State 1-hour ozone	San Bernardino County portion	NO_x and VOC/ROG	1994

Source: EIR Appendix C, Sespe 2013, p. 9

[1] A historical attainment date given in an attainment plan does not necessarily mean that the affected area has been re-designated to attainment.

The MDAQMD Attainment Plans contain the rules proposed for adoption. Current MDAQMD rules that apply to project sources include:

- **Rule 201 – Permits to Construct** applies to the construction of air emissions sources that are not otherwise exempt under Rule 219.
- **Rule 203 – Permit to Operate** requires air emissions sources that are not exempted by Rule 219 to obtain operating permit.
- **Rule 204 – Requirements** contains rule language describing New Source Review including Best Available Control Technology (BACT) and emissions offset requirements for stationary sources.
- **Rule 219 – Equipment Not Requiring a Permit** describes the type of equipment that does not require a permit pursuant to District Rules 201 and 203.
- **Rule 401 – Visible Emissions** limits visibility of fugitive dust to less than No. 1 on the Ringlemann Chart (i.e., 20 percent opacity).
- **Rule 402 – Nuisance** applies when complaints from the public are received by the district.
- **Rule 403 – Fugitive Dust** prohibits visible dust beyond the property line of the emission source, requires "every reasonable precaution" to minimize fugitive dust emissions and prevent trackout of materials onto public roadways, and prohibits greater than 100 $\mu g/m^3$ difference between upwind and downwind particulate concentrations.
- **Rule 403.2 – Fugitive Dust Control** for the Mojave Desert Planning Area contains the following requirements applicable to limestone processing facilities:

a. Stabilize industrial unpaved roads carrying more than ten vehicle trips per day with the majority of those vehicles weighing 30 tons or more.

b. Enclose exterior belt conveyors sufficiently to cover the top and sides of the bulk material being transferred, or employ an alternate dust suppression system sufficient to prevent visible fugitive dust.

c. Manage or treat bulk material open storage piles sufficiently to prevent visible fugitive dust emissions. For purposes of this rule, active watering during visible dusting episodes shall be sufficient to maintain compliance.

d. Cover loaded bulk material haul vehicles while traveling upon publicly maintained paved surfaces.

e. Employ a dust suppression system at bulk material transfer points sufficient to prevent visible fugitive dust.

f. Stabilize or eliminate bulk material open storage piles that have been or are expected to be inactive for at least one year.

g. Stabilize as much unpaved operations area as is feasible.

h. Vacuum sweep bulk material spills on paved surfaces weekly or more often, as needed.

i. Prevent facility-related bulk material trackout on publicly maintained paved surfaces.

j. Clean up facility-related bulk material trackout and spills on publicly maintained roads within 24 hours.

k. Employ belt cleaners and/or conveyor return scrapers to minimize conveyor spillage.

- **Rule 404 – Particulate Matter Concentration** sets concentration limits based on the flow rate of the discharge. The concentration limits would apply to discharge from a stack (e.g., baghouse).
- **Rule 405 – Solid Particulate Matter Weight** limits emissions based on the weight of material processed.
- **Rule 900 – New Source Performance Standards** incorporates federal regulation (40 CFR 60) that affects the construction of emissions units. Requirements may or may not apply depending on the size, construction, and manufacture date of equipment that will be used. Specifically, NSPS OOO (40 CFR 60.670) applies to equipment in nonmetallic mineral processing plants.
- **Regulation XIII – New Source Review** contains a number of rules that are applied to new and modified sources.
- **Rule 1520 – Control of Toxic Air Contaminants from Existing Sources** implements AB 2588 Air Toxics Hot Spots requirements.
- **Rule 2002 – General Federal Actions Conformity** requires federal actions to conform to the applicable implementation plan.

San Bernardino County General Plan

The General Plan includes policies and programs that are intended to protect air quality. The General Plan policies and programs that assist in the protection of air quality are listed below.

Policy CO 4.1 Because developments can add to the wind hazard (due to increased dust, the removal of wind breaks, and other factors), the County will require either as mitigation measures in the appropriate environmental analysis required by the County for the development proposal or as conditions of approval if no environmental document is required, that developments in areas identified as susceptible to wind hazards to address site-specific analysis of:

a. Grading restrictions and/or controls on the basis of soil types, topography or season.

b. Landscaping methods, plant varieties, and scheduling to maximize successful revegetation.

c. Dust-control measures during grading, heavy truck travel, and other dust generating activities.

Toxic Air Contaminant Regulations

TACs are pollutants listed by the State of California that pose acute, chronic, and/or cancer health risks to exposed individuals. Hazardous air pollutants (HAP) are pollutants listed by the EPA that pose acute, chronic, and/or cancer health risks to exposed individuals.

The California Office of Environmental Health Hazard Assessment (OEHHA) is responsible for developing the scientific basis for listing and evaluation of health risk from TACs. CARB is responsible for quantifying toxic air contaminant emissions and controlling TACs by promulgation and enforcement of air toxic control measures (ATCM). Assembly Bill (AB) 1807, passed in 1983, requires the State of California to identify and control TACs. TACs are formally identified through a detailed process that starts when a chemical's risk to human health and the environment is above certain criteria. Once TACs are identified, the emission sources, controls, technologies, and costs are reviewed to determine if regulation is needed to reduce emissions. In 1993, AB 1807 was amended by passage of AB 2728, which requires the State to list the 189 federal HAPs in the toxic air contaminants list.

In 1987, the AB 2588 air toxics "hot spots" program was established. This program requires subject facilities to report their air toxics emissions, determine localized health risks, and notify nearby residents for whom risk may exceed the notification level (CARB 2008). The program was amended in 1992 to require facilities to reduce high risks (e.g., greater than 100 in 1 million cancer risk, or 10 hazard index) through the development of a risk management plan. The Hotspots Analysis and Reporting Program is a software program that calculates TAC emission inventories and performs health risk assessments for use in the AB 2588 program.

The Off-Road Vehicle Regulation (13 CCR 2449) was adopted by CARB in 2007 to reduce diesel particulate matter (DPM) and NO_x emissions from in-use off-road heavy-duty diesel vehicles in California. The regulation was amended by CARB in December 2010. Prior to that time, the regulation phased in from 2010 to 2020, but the December 2010 rulemaking pushed the start date back to 2014 and the date of final implementation back to 2024. In addition, until CARB receives a waiver from the EPA to regulate in-use off-road engines, the provisions that require

further control are not enforceable. Registering fleets through the Diesel Off-Road Online Reporting System (DOORS), labeling equipment, idling limits, and sale notification are requirements of the Off-Road Regulation that are still in effect. Regulatory Advisory 10-414 describes the enforcement delay and was last updated in 2011.

The On-Road Heavy Duty Diesel Vehicle (In-Use) Regulation (13 CCR 2025) was adopted in 2010. The regulation requires diesel trucks and buses that operate in California to be upgraded to reduce emissions. Heavier trucks were required to be retrofitted with particulate matter filters beginning January 1, 2012, and older trucks must be replaced starting January 1, 2015. By January 1, 2023, nearly all trucks and buses will need to have 2010 model year engines or equivalent. The regulation applies to nearly all privately and federally owned diesel-fueled trucks and buses and to privately and publicly owned school buses with a gross vehicle weight rating greater than 14,000 pounds.

Portable engines are regulated by an air toxic control measure (17 CCR 93116) that limits DPM and may also be regulated by the Portable Equipment Registration Program or a local air district permit. In-use portable engines regulated by the ATCM begin phasing in controls to meet emissions reductions criteria on January 1 of 2013, 2017, and 2020. By 2020, in-use portable engines will have Tier 4 particulate emissions characteristics. The Portable Equipment Registration Program requires applications for new registrations to be accepted only for engines that emit less than the interim Tier 4 standards.

3.2.3 IMPACTS AND MITIGATION MEASURES

STANDARDS OF SIGNIFICANCE

Consistent with Appendix G of the California Environmental Quality Act (CEQA) Guidelines and the MDAQMD guidelines, the project would have a significant impact if it would:

1) Violate any air quality standard or contribute substantially to an existing or projected air quality violation.

2) Conflict with or obstruct implementation of an applicable air quality plan.

3) Expose sensitive receptors to substantial pollutant concentrations.

4) Create objectionable odors affecting a substantial number of people.

5) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors).

The Initial Study prepared for the proposed project (see **EIR Appendix A**) determined that there would be no impact related to objectionable odors (standard of significance 4). Therefore, this standard of significance is not discussed further.

An air quality impact is considered significant if the proposed project would violate any ambient air quality standard, contribute substantially to an existing or projected air quality violation, or expose sensitive receptors to substantial pollutant concentrations. MDAQMD thresholds have also been used to determine air quality impacts in this analysis. To assist local jurisdictions in the evaluation of air quality impacts, the MDAQMD has published a guidance document for the

preparation of the air quality portions of environmental documents that includes thresholds of significance to be used in evaluating land use proposals. Thresholds of significance are based on a source's projected impacts and are a basis from which to apply mitigation measures. The MDAQMD-recommended thresholds are identified in **Table 3.2-5**.

TABLE 3.2-5
MDAQMD-RECOMMENDED SIGNIFICANCE THRESHOLDS

Significance Level	Project-Generated Emissions	
	Tons per Year	Pounds per Day
Carbon Monoxide (CO)	100	548
Nitrogen Oxide (NO_x)	25	137
Reactive Organic Gas (ROG)	25	137
Sulfur Oxide (SO_x)	25	137
Course Particulate Matter (PM_{10})	15	82
Fine Particulate Matter ($PM_{2.5}$)	15	82
Hydrogen Sulfide	10	54
Lead	0.6	3

Source: EIR Appendix C, Sespe 2013, p.17

The MDAQMD guidelines state, "Note that the emissions thresholds are given as a daily value and an annual value, so that multi-phased projects (such as project with a construction phase and a separate operational phase) with phases shorter than one year can be compared to the daily values." The project proposes actions lasting longer than one year; therefore, for the purposes of this analysis, the MDAQMD daily thresholds do not apply and the project is evaluated in comparison to MDAQMD annual thresholds.

Localized Significant Impact Thresholds

In addition to overall regional air pollutant emission impacts, there is the potential for localized air pollutant impacts from land use projects. Localized adverse air quality impacts from stationary sources are not addressed by the values in **Table 3.2-5**. Local significance thresholds represent the maximum emissions at a project site that are not expected to cause or contribute to an exceedance of the most stringent national or state ambient air quality standards. To fall within local significance thresholds, the project's modeled concentration of pollutants may not exceed the increment between the ambient air quality standards and background concentrations.

In the absence of MDAQMD localized significant impact thresholds, significant impact levels (SILs) published by the San Joaquin Air Pollution Control District (SJVAPCD) to the Dispersion and Risk Assessment Modelers Group list server (August 12, 2013) are used to evaluate potential localized adverse air quality impacts. SJVAPCD guidance contains separate SILs for point and fugitive sources of PM_{10} and $PM_{2.5}$. The SJVAPCD significant impact levels are considered appropriate for the purpose of this analysis, as they closely reflect the rural nature of the Mojave Desert Air Basin. In addition, the SILs draw a distinction between point and fugitive sources and provide corresponding annual concentrations.

Table 3.2-6 shows the hourly and annual SIL thresholds with sensitive receptors located in the project vicinity.

TABLE 3.2-6
SIGNIFICANT IMPACT LEVEL (SIL) THRESHOLD – MICROGRAMS PER CUBIC METER ($\mu G/M^3$)

PM_{10} – 24-Hour	PM_{10} – Annual	$PM_{2.5}$ – 24-Hour	$PM_{2.5}$ – Annual
10.4	2.08	2.5	0.63

Source: EIR Appendix C, Sespe 2013, p. 37

Toxic Air Contaminant Thresholds

The MDAQMD regulates levels of air toxics through a permitting process that covers both construction and operation. The MDAQMD has adopted Regulation XIII for both new and modified sources that use materials classified as air toxics. The MDAQMD guidelines for permit processing consider any project involving the emission of a carcinogenic or toxic air contaminant identified in MDAQMD Regulation XIII that exceeds the maximum individual cancer risk of 10 in one million and/or a Hazard Index (HI) (non-cancerous) greater than or equal to 1 to be significant.

METHODOLOGY

As discussed in Chapter 3.0, Project Description, Omya operates two other quarries in the area. These two quarries, the Sentinel and Butterfield Quarries, are located approximately 3 miles south of the processing plant on Crystal Creek Road. (The Sentinel and Butterfield Quarries are currently undergoing a separate CEQA evaluation for proposed expansion.) The combined production from all the operating quarries (Butterfield, Sentinel, and White Knob) is limited by the processing plant maximum production rate. The project would allow up to 680,000 tons per year of finished ore to be extracted exclusively from the White Knob and White Ridge quarries. This would result in no material being quarried at Sentinel and Butterfield as 680,000 tons per year meets the maximum production capacity at the Lucerne Valley processing plant, which is an indirect effect of the project that necessitates calculation of Sentinel and Butterfield emissions in the air quality baseline (existing conditions). Moreover the available vehicular activity data does not distinguish which units operate in each quarry. Thus, the emissions from vehicles are calculated for the fleet and apportioned to quarries based on throughput amount and to units operating on roads by vehicle miles traveled (VMT).

Baseline Emissions

Under baseline (existing) conditions, the Lucerne Valley processing plant is receiving ore from the Butterfield, Sentinel and White Knob Quarries. Omya provided information on historical activity levels and equipment that was used to estimate baseline air pollutant emissions for the project. In general, the quarries and processing plant consist of operations and equipment that emit fugitive dust and diesel exhaust. Baseline emissions were estimated using methods and parameters from the Mineral Industry Emissions Inventory Guidance, emission factors from the EPA's AP-42 document, and the emissions modeling software EMFAC2011, OFFROAD2011, and CalEEMod. Baseline emission sources modeled include vehicles, dust from equipment travel over dirt roads, dust generated during mining and processing activities, and combustion during mining and processing (see Tables 11 through 15 located on pages 26-28 of **EIR Appendix C**).

Project Emissions

As previously stated, the project would allow up to the maximum production rate of 680,000 tons per year of finished ore to be extracted exclusively from the White Knob and White Ridge quarries. Realization of this maximum production rate would result in no material being quarried at Sentinel and Butterfield as the combined production from all the operating quarries (Butterfield, Sentinel, and White Knob) is limited by the processing plant 680,000-ton maximum production rate. Therefore, the project emission impact analysis assumes the maximum production rate of 680,000 tons per year of finished ore to be extracted exclusively from the White Knob and White Ridge quarries. The project emission impact analysis also accounts for the required reclamation activities that would occur after closure of the quarry. Reclamation activities would not result in air pollutant emissions greater than that emitted during quarry operations.

Project emissions (see **Tables 3.2-9** and **3.2-10** below) were also estimated using methods and parameters from the Mineral Industry Emissions Inventory Guidance, emission factors from the EPA's AP-42 document, and the emissions modeling software EMFAC2011, OFFROAD2011, and CalEEMod. Emission sources modeled include vehicles, dust from equipment travel over dirt roads, dust generated during mining and processing activities, and combustion during mining and processing (see **EIR Appendix C**).

Air dispersion/deposition modeling and a health risk assessment were then performed to determine the potential for the project to result in significant localized impacts.

Several models were run with a consistent set of volume sources and a varying list of receptors (i.e., discrete, boundary, and grid). The discrete receptor model includes the receptors shown in **Table 3.2-7** and **Figure 3.2-1**.

TABLE 3.2-7
PROJECT VICINITY RECEPTORS

Receptor Number	UTM, Easting (meters)	UTM, Northing (meters)	Type – Location
R1	493,520	3,801,220	Horse Springs Campground
R2	497,885	3,805,925	Residence – 2 miles north of White Knob Quarry
R3	500,757	3,805,056	Residence – 1.75 miles northeast of White Knob Quarry
R4	503,805	3,802,145	Residence – 2.66 miles east of White Knob Quarry
R5	504,720	3,804,980	Residence – 0.25 mile northwest of processing plant
R6	509,570	3,795,820	Holcomb Valley Campground
R7	498,780	3,797,730	Big Pine Flat Campground

Source: EIR Appendix C, Sespe 2013, p. 32

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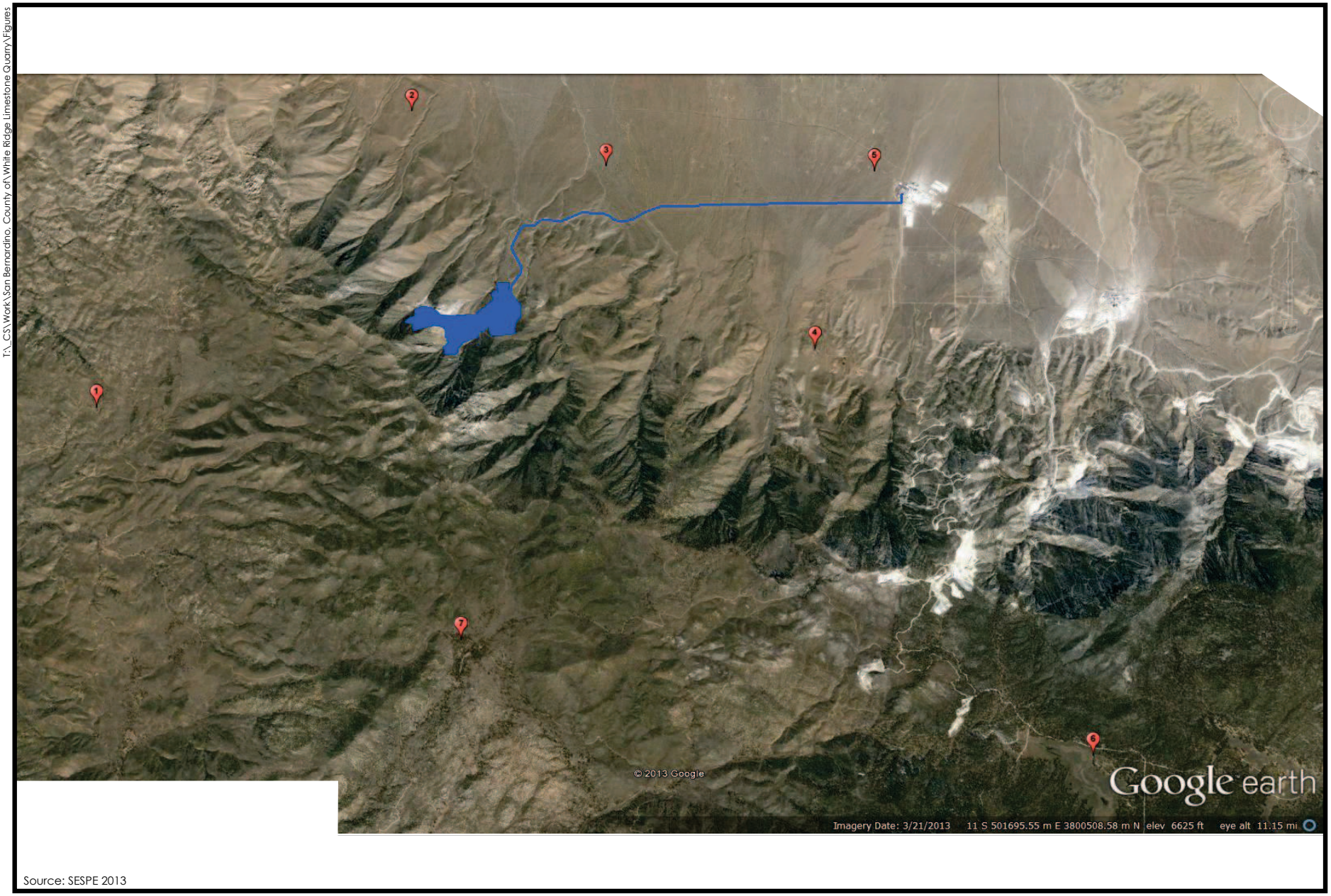

Source: SESPE 2013

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Figure 3.2-1
Receptors in Project Vicinity

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The boundary receptor run includes only receptors along a boundary around the quarry area (**Figure 3.2-2**). The boundary receptor run is used to estimate concentrations of PM_{10} and $PM_{2.5}$ at the point of maximum impact for comparison to primary ambient air quality standards (i.e., to protect human health). The boundary on the north was chosen to coincide with the east–west-trending foothills. The boundaries on the south and west were chosen to reflect the concentration that may be experienced by an individual on the nearest roadway. The boundary on the east was chosen to exclude residences located in the foothills along Crystal Creek Road (i.e., since the residences are outside the project boundary, the boundary concentrations are closer to the sources and conservatively represent concentrations at the residences).

Grid receptor runs were used in the health risk assessment and the deposition model. The health risk assessment grid uses 200-meter spacing. The deposition model grid uses 500-meter spacing.

The deposition model is the only model run prepared for the project that assumes the plume is depleted by deposition. The deposition model considers three sizes of particulates. Total suspended particulates (TSP) (i.e., PM_{30}), PM_{10}, and $PM_{2.5}$ are calculated for each source, and the amount of each size varies based on the source accordingly. For instance, the dominant source of dust emissions is the roads, which emit a combination of dust and diesel particulate matter. When dust and DPM emissions are combined, the resulting fractionation for unpaved roadway particulates is 3.34 percent $PM_{2.5}$, 25.5 percent $PM_{10-2.5}$, and 71.2 percent PM_{30-10}. The combination of sources operating at the processing plant results in fractionation of 4.5 percent $PM_{2.5}$, 14.0 percent $PM_{10-2.5}$, and 81.5 percent PM_{30-10}. Other source fractionations were varied according to the calculated amounts of dust and DPM.

The weight of particles presented in **Table 3.2-8** is most appropriate for dust particles, which constitute the majority of particulate matter emitted by project sources. Because the diesel particulates are emitted in smaller quantities, the dust densities are applied to all particulates regardless of their origin.

TABLE 3.2-8
DEPOSITION PARAMETERS

Particle Size Bin (μg)	Assumed Density (grams/cubic centimeter)
2.5	1.0
2.5–10	1.75
10–30	2.5

Source: EIR Appendix C, Sespe 2013, p. 32

PROJECT IMPACTS AND MITIGATION MEASURES

Emissions of Air Pollutants Resulting in Violation of Air Quality Standards or Contributing to Existing Violations (Standard of Significance 1)

Impact 3.2.1 Project-generated operational emissions would exceed applicable significance thresholds and could contribute to regional nonattainment conditions. As a result, this impact is considered **potentially significant.**

Implementation of the project would result in long-term operational emissions of criteria air pollutants and ozone precursors (i.e., ROG and NOx). The project does not propose to construct

any structures other than excavations and piles, which are created from mining operations, and thus only project operations are assessed. As previously stated, baseline (current) emissions and project emissions were estimated from vehicle sources, equipment traveling over dirt roads, mining and processing activities, and combustion sources. The incremental increase of air pollutant emissions over baseline conditions as a result of the proposed project, is compared to the mass-based thresholds from the MDAQMD CEQA Handbook in **Table 3.2-9**.

TABLE 3.2-9
LONG-TERM OPERATIONAL EMISSIONS (UNMITIGATED)

Source	Emissions (tons/year)						
	ROG	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	Lead
Proposed Project (contribution beyond current baseline conditions)*	1.0	12.5	3.4	0.0	**37.1**	11.7	0.0
MDAQMD Potentially Significant Impact Threshold	25 tons/year	25 tons/year	100 tons/year	25 tons/year	15 tons/year	15 tons/year	0.6 tons/year
Exceed MDAQMD Threshold?	**No**	**No**	**No**	**No**	**Yes**	**No**	**No**

Source: EIR Appendix C, Sespe 2013, p. 34

*Notes: * These emissions are based on a total of 680,000 tons of crushed ore to the processing plant per year all coming from the proposed project and used as a worst-case scenario, if the Butterfield/Sentinel quarries are no longer producing ore. A total of 680,000 tons is used as this is the maximum production capacity at the processing plant. However, the crushed ore to the processing plant for the proposed project is expected to average 222,500 tons per year and therefore, the emissions would be much less than the worst case scenario shown here.*

As shown in **Table 3.2-9**, the increment in pollutant emissions would occur below levels that will significantly affect regional air quality emissions, with the exception of PM_{10}, which is predicted to exceed the mass-based MDAQMD thresholds for PM_{10}, which would be a **potentially significant impact**. Therefore, the following mitigation is required.

Mitigation Measures

MM 3.2.1 It shall be required in the final Amended Mine and Reclamation Plan that the following PM_{10} reduction measures be implemented as part of quarry operations and reclamation.

- Limit maximum speed on unpaved roads to 25 miles per hour.
- Water all unpaved roads at least twice per day, more if needed, to control dust emissions by at least 80 percent. Alternatively, a dust palliative, such as magnesium chloride may be used to treat the unpaved roads.
- Water all areas to be graded and areas where bulldozers operate at least twice per day, more if needed.

Timing/Implementation: *Required to be placed in the final version of the Amended Plan and implemented during mining and reclamation activities*

Enforcement/Monitoring: *County of San Bernardino Land Services Department*

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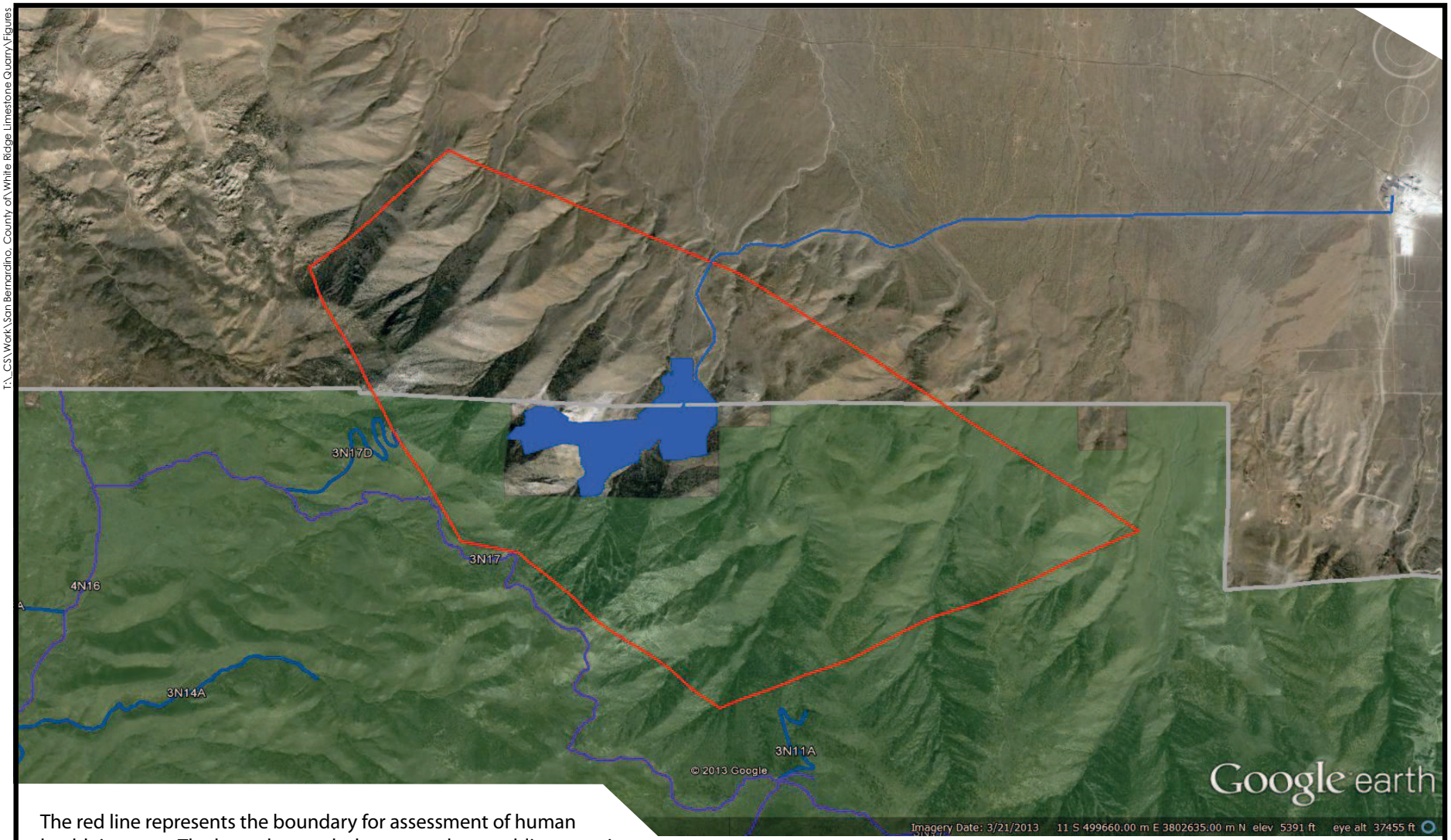

The red line represents the boundary for assessment of human health impacts. The boundary excludes areas where public access is possible (e.g. roads, residences) and does not correspond with the legal boundary of the property.

Source: SESPE 2013

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Figure 3.2-2
Boundary Run - Particulate Matter

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TABLE 3.2-10
LONG-TERM OPERATIONAL EMISSIONS (MITIGATED)

Source	Emissions (tons/year)*						
	ROG	NO_x	CO	SO_2	PM_{10}	$PM_{2.5}$	Lead
Proposed Project (contribution beyond current baseline conditions)	1.0	12.5	3.4	0.0	-3.9	1.7	0.0
MDAQMD Potentially Significant Impact Threshold	25 tons/year	25 tons/year	100 tons/year	25 tons/year	15 tons/year	15 tons/year	0.6 tons/year
Exceed MDAQMD Threshold?	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Source: EIR Appendix C, Sespe 2013, p. 34
*Notes: *These emissions are based on a total of 680,000 tons of crushed ore to the processing plant per year all coming from the proposed project and used as a worst-case scenario, if the Butterfield/Sentinel quarries are no longer producing ore. A total of 680,000 tons is used as this is the maximum production capacity at the processing plant. However, the crushed ore to the processing plant for the proposed project is expected to average 222,500 tons per year. Mitigation measures presented in MM 3.2.1 reduce emissions below the MDAQMD thresholds as determined using methods discussed under the Methodology section above.*

As shown, implementation of mitigation measure **MM 3.2.1** would reduce PM_{10} emissions by 3.9 tons less than current operations. This is because in addition to the mitigation, the project would allow up to the maximum production rate to be extracted exclusively from the White Knob/White Ridge Quarries, resulting in no material being quarried at the Butterfield/Sentinel Quarries. The lack of any material being quarried at the Butterfield/Sentinel Quarries as a result of the project would result in a reduction of PM_{10} emissions. PM_{10} emissions would be reduced to levels below the significance threshold, and this impact is **less than significant**.

As identified in **Table 3.2-3**, the Basin is listed as federal nonattainment for ozone and PM_{10} and state nonattainment for ozone, PM_{10}, and $PM_{2.5}$. Ozone is a health threat to persons who already suffer from respiratory diseases and can cause severe ear, nose and throat irritation and increases susceptibility to respiratory infections. Particulate matter can adversely affect the human respiratory system. As shown in **Table 3.2-10**, the proposed project would result in increased emissions of ozone and $PM_{2.5}$, however, the correlation between a project's emissions and increases in nonattainment days, or frequency or severity of related illnesses, cannot be accurately quantified.

The overall strategy for reducing air pollution and related health effects in the Air District is contained in the MDAQMD Air Quality Management Plans (AQMPs). The AQMPs provides control measures that reduce emissions to attain federal ambient air quality standards by their applicable deadlines such as the application of available cleaner technologies, best management practices, incentive programs, as well as development and implementation of zero- and near-zero technologies and control methods. The CEQA thresholds of significance established by the air district are designed to meet the objectives of the AQMPs and in doing so achieve attainment status with state and federal standards. As noted above, the project would increase the emission of these pollutants, but would not exceed the thresholds of significance established by the air district for purposes of reducing air pollution and its deleterious health effects. Therefore, this impact would be considered **less than significant**.

Conflict with MDAQMD Air Quality Management Plans (Standard of Significance 2)

Impact 3.2.2 Implementation of the proposed project would not conflict with or obstruct implementation of MDAQMD air quality attainment plans. This impact is considered to be **less than significant**.

As part of its enforcement responsibilities, the EPA requires each state with nonattainment areas to prepare and submit a State Implementation Plan that demonstrates the means to attain the federal standards. The SIP must integrate federal, state, and local plan components and regulations to identify specific measures to reduce pollution in nonattainment areas, using a combination of performance standards and market-based programs. Similarly, under state law, the California Clean Air Act requires an air quality attainment plan to be prepared for areas designated as nonattainment with regard to the federal and state ambient air quality standards. Air quality attainment plans outline emissions limits and control measures to achieve and maintain these standards by the earliest practical date.

As previously mentioned, the project site is located within the Mojave Desert Air Basin, which is under the jurisdiction of the MDAQMD. The MDAQMD is required, pursuant to the federal Clean Air Act, to reduce emissions of criteria pollutants for which the air basin is in nonattainment. In order to reduce such emissions, the MDAQMD adopts and enforces rules and regulations concerning sources of air pollution, issues permits for stationary sources of air pollution, monitors ambient air quality and meteorological conditions, and implements programs and regulations required by the federal Clean Air Act and Clean Air Act Amendments. The MDAQMD also assists CARB in preparing the State Implementation Plan by preparing Attainment Plans that demonstrate how the ambient air quality standards will be achieved. The Attainment Plans describe the rules that will be developed and other means by which the MDAQMD will manage the emissions within its jurisdiction.

A project is conforming with the MDAQMD Attainment Plans if it complies with all applicable district rules and regulations, complies with all proposed control measures that are not yet adopted from the applicable plan(s), and is consistent with the growth forecasts in the applicable plan(s) (or is directly included in the applicable plan). A project is nonconforming if it conflicts with or delays implementation of any applicable attainment or maintenance plan. Conformity with growth forecasts can be established by demonstrating that the project is consistent with the land use plan that was used to generate the growth forecast. An example of a nonconforming project would be one that increases the gross number of dwelling units, increases the number of trips, and/or increases the overall vehicle miles traveled in an affected area (relative to the applicable land use plan).

As shown in **Table 3.2-3**, the western area of the MDAB where the project is located is designated as nonattainment for federal and state ozone standards as well as for federal and state PM_{10} standards. On the basis of those attainment designations, the project would screen out of conformity analysis if:

- Ozone precursor pollutants, NOx and ROG emissions, are less than 25 tons per year each;
- PM_{10} emissions are less than 100 tons per year; and
- Emissions are less than 10 percent of the nonattainment area emissions inventory.

As shown in **Table 3.2-9**, the project emits 1.0 tons per year of ROG and 12.5 tons per year of NO_x, which are each less than the threshold of 25 tons per year. PM_{10} emissions are 37.1 tons per year, which is less than the federal conformity screening threshold of 100 tons per year.

In 2010, sources within the San Bernardino portion of the Mojave Desert Air Basin emitted NO_x and PM_{10} in the amounts of 55,125 tons per year and 43,646 tons per year, respectively. The project increment represents 0.023 percent of the NO_x emissions and 0.085 percent of the PM_{10} emissions in the region (an inventory of ROG and other pollutant emissions is not available).

Since the project would generate less than 25 tons of the ozone precursor pollutants NO_x and ROG annually and less than 100 tons of PM_{10} emissions annually, and project emissions would not exceed 10 percent of the emissions inventory within the San Bernardino portion of the MDAB, this impact is **less than significant**.

Mitigation Measures

None required.

Conflict with Federal Land Managers' Air Quality Related Values (Standard of Significance 2)

Impact 3.2.3 Implementation of the proposed project would not conflict with or obstruct Federal Land Managers' Air Quality Related Values. This impact is considered to be **less than significant**.

The federal land manager (FLM) and the federal official with direct responsibility for management of Federal Class I parks and wilderness areas (i.e., park superintendent, refuge manager, forest supervisor) have an affirmative responsibility to protect the air quality–related values (AQRVs) (including visibility) of such lands and to consider whether a proposed project with emissions exceeding the "major" source thresholds will have an adverse impact on such values. The FLM's decision regarding whether there is an adverse impact is then conveyed to the permitting authority for consideration in its determinations regarding the permit. The permitting authority's determinations generally consider a wide range of factors, including the potential impact of the new source or major modification on the AQRVs of Class I areas, if applicable.

At the request of both state permitting agencies and permit applicants, the FLMs formed the Federal Land Managers' Air Quality Related Values Work Group (FLAG) to provide better consistency pertaining to their role in the review of new source permit applications near federal Class I areas. The purpose of FLAG is twofold: (1) to develop a more consistent and objective approach for the FLMs to evaluate air pollution effects on public AQRVs in Class I areas, including a process to identify those resources and any potential adverse impacts, and (2) to provide state permitting authorities and potential permit applicants consistency on how to assess the impacts of new and existing sources on AQRVs in Class I areas.

The FLMs are also concerned about resources in Class II parks and wilderness areas because they have other mandates to protect those areas as well. The information and procedures outlined in the FLAG report are generally applicable to evaluating the effect of new or modified sources on the AQRVs in both Class I and Class II areas.

The FLAG 2010 Phase I Report update recommends how to evaluate visibility, ozone phytotoxicity, and deposition impacts from new or modified sources. The FLAG Phase I Report recommends that an applicant apply the "Q/D test" for sources greater than 50 kilometers from

a Class I area to determine whether or not any further analysis is necessary. The Q/D test sums emissions of SO_2, NOx, PM_{10}, and sulfuric acid (H_2SO_4) (i.e., Q in tons per year) and then divides that total by the distance between the source and receptor (D in kilometers). Results equal to or less than 10 do not require further assessment (i.e., Q/D ≤10).

The FLM AQRVs apply to new or modified major sources and are generally used for Prevention Significant Deterioration (PSD) permitting under the Clean Air Act. The project does not propose a new stationary major source or a modified stationary major source that would require a permit under the Clean Air Act. Fugitive area source emissions and vehicular emissions are excluded from determining whether the quarry is a major source. The Omya facility is not considered a major source as evidenced by the fact that it holds local district operating permits rather than a federal operating permit under Title V (40 CFR Part 70). Thus, none of the sources operated by Omya are capable of producing effects that would trigger concerns with the AQRVs.

The incremental change in emissions from all of the sources combined would slightly exceed major source criteria, but the effects are dispersed along roads and within pits. Thus, it is unlikely that the change in emissions will cause or contribute to effects addressed by the AQRVs. Using the FLAG report equation (Quantity/Distance <10, or Q/D <10), projects can screen out of detailed analyses of AQRVs. Application of the equation is limited in the FLAG report to projects greater than 50 kilometers from a Class I Wilderness Area. The project is within 23 kilometers of San Gorgonio, but the Q/D test is applied here for disclosure purposes and to acknowledge the scale of emissions from the project as compared to the screening threshold. Presumably sufficient buffer between the project Q/D and the screening threshold would be evidence indicating less than significant effects on AQRVs regardless of the distance.

Using the Q/D test to sum SO_2, NOx, PM_{10}, and H_2SO_4 emissions, It was determined that the project emits 53.2 tons per year of these pollutants. Dividing this by 23 kilometers (the distance to San Gorgonio) the Q/D for the project is 2.3, which is a quarter of the screening threshold. Given the fact that there is no single major source and that the emissions are distributed over a large area, the project will result in **less than significant** impacts on AQRVs at Class I Wilderness Areas.

Moreover, monitoring performed in the San Gorgonio Wilderness Area indicates that nitrates, organic matter, and sulfates have the strongest contributions to degrading visibility on the worst days (EIR Appendix C, Sespe 2013, p. 35). Concentrations of these pollutants result from regional sources and particularly emissions from the South Coast Air Basin (SCAB). The project emits NO_x, some of which may become nitrates, but the relative amount as compared to the SCAB is negligible. The project also emits particulate matter, but the worst days are relatively unaffected by particulates. Thus, the project would not emit pollutants in amounts that would affect visibility in the San Gorgonio and other nearby Class I Wilderness Areas. The project's impact on visibility and regional haze is considered to be **less than significant**.

Phytotoxic ozone concentrations may result where the plume from a large combustion source travels relatively intact a sufficient distance for the photochemical reaction between NO_x and ROG to have occurred and produce ozone. The ozone would then be concentrated at a hot spot where vegetation could be affected. The project sources of NO_x are small and distributed over a large area. Therefore, the project would not cause phytotoxic ozone concentrations, and the project impact for this AQRV is considered **less than significant**.

The deposition AQRV is concerned with the acidification of water bodies. Specifically, sulfur and nitrogen compounds cause sensitive freshwater lakes and streams to lose acid-neutralizing capacity and sensitive soils to become acidified. Other ecosystems, including the forest, may exhibit fertilization and other effects from excess nitrogen deposition. The project sources of

nitrogen and sulfur are small and distributed over a large area. Therefore, the project would not cause acidification, and the project impact for this AQRV is considered **less than significant**.

Mitigation Measures

None required.

Exposure of Sensitive Receptors to Localized Criteria Pollutants (Standard of Significance 3)

Impact 3.2.4 Implementation of the proposed project would exceed applicable localized criteria pollutant significance thresholds and potentially increase the exposure of existing sensitive land uses to pollutant concentrations. As a result, this impact is considered **potentially significant**.

Project emissions have the potential to create localized "hot spots" if, when summed with existing ambient concentrations, they result in concentrations greater than the applicable ambient air quality standard. The main criteria pollutants of concern for the project are total suspended particulates (used for deposition modeling), PM_{10}, and $PM_{2.5}$. Ambient air quality standards for pollutants that are less of a concern are discussed first, followed by modeling results for the criteria pollutants of concern.

Carbon monoxide AAQS exceedance is generally a concern at high volume vehicular intersections in urban areas that operate at level of service (LOS) D or worse and where CO is emitted into partially or completely enclosed spaces such as parking structures and garages. CO modeling is not warranted for the project, and the impact on carbon monoxide ambient air quality standards is considered **less than significant**.

Sulfur dioxide AAQS exceedances are normally a concern for facilities that burn coal or refine petroleum. Diesel fuel used by the project would meet CARB specifications for sulfur content. SO_2 modeling is not warranted for the project, and the impact on sulfur dioxide ambient air quality standards is considered **less than significant**.

Nitrogen dioxide AAQS exceedances are normally a concern for facilities with a large combustion source. The quarrying and transportation of materials is performed by diesel engines, which are a source of NO_2. However, the diesel vehicles are comparatively small emitters of NO_2, and they move in order to perform job tasks. Movement reduces the likelihood of a hot spot. NO_2 has annual and hourly ambient air quality standards. On an annual basis, the project NO_x emissions are less than the CEQA significance threshold. Therefore, modeling to determine annual NO_2 concentration for comparison to the AAQS is not warranted. On an hourly basis, the project does not propose to change the equipment list compared with existing conditions. The potential for the project to cause or contribute to an exceedance of the hourly nitrogen dioxide AAQS is unlikely given the size of the operational area (335.1 acres), the distance from the quarries where activity is expected to be most intense to the boundary at which human health impacts are evaluated, and the limited potential increase in hourly activity at any one location on-site. Therefore, modeling hourly NO_2 concentrations is not warranted for the project, and the impact on nitrogen dioxide ambient air quality standards is considered **less than significant**.

Emissions of the criteria pollutants of concern for the project (i.e., PM_{10}, $PM_{2.5}$) are modeled to predict concentrations at the off-site point of maximum impact (PMI). **Table 3.2-11** shows impact assessment results for the particulate matter air dispersion model that was prepared. Ambient air quality standards are applied when background is less than the AAQS, and significant impact levels are applied when background already exceeds the AAQS. A significant impact is when

the project exceeds the AAQS. A cumulatively considerable impact occurs when the cumulative concentration exceeds the AAQS or the project concentration exceeds the SIL in an area where the ambient air quality standards are exceeded by background concentrations.

TABLE 3.2-11
INCREMENT IN CONCENTRATION AT POINT OF MAXIMUM IMPACT (UNMITIGATED)

	PM_{10} – 24-Hour	PM_{10} – Annual	$PM_{2.5}$ – 24-Hour	$PM_{2.5}$ – Annual
10-Year Maximum Background	93 μg	25 μg	30.6 μg	10.6 μg
Cumulative Concentration	106.1 μg	28.5 μg	34.3 μg	11.1 μg
5-Year Maximum Project Concentration	13.1 μg	3.54 μg	3.7 μg	0.48 μg
Most Stringent AAQS/ SIL	50 μg / 10.4 μg	20 μg / 2.08 μg	35 μg / 2.5 μg	12 μg / 0.63 μg
Exceed AAQS?	No	No	No	No
Exceed SIL?	Yes	Yes	Yes	No

Source: EIR Appendix C, Sespe 2013, p. 37

Note: Annual average PMI occurs where the haul road crosses the project boundary (UTM 499604.71, 3803971.15), which is omitted from consideration in favor of the higher of the two adjacent boundary receptors (UTM 499559.62, 3803991.54). Daily PMI occurs on the southwest property boundary (UTM 4980909, 3801590).

Results of criteria pollutant modeling show that the project would not exceed the AAQS but may increase pollutant concentrations above the significant impact levels (SIL). The SILs represent the amount that is cumulatively considerable and are applied as the significance thresholds. An exception is the $PM_{2.5}$ annual SIL, which is not exceeded by the project. The exceedances are because of bulldozing and grading.

Mitigation Measures

Implementation of mitigation measure **MM 3.2.1** would reduce PM_{10} emissions as shown in **Table 3.2-12** below significance thresholds resulting in a **less than significant** impact.

TABLE 3.2-12
INCREMENT IN CONCENTRATION AT POINT OF MAXIMUM IMPACT (MITIGATED – MM 3.2.1)

	PM_{10} – 24-Hour	PM_{10} – Annual	$PM_{2.5}$ – 24-Hour	$PM_{2.5}$ – Annual
10-Year Maximum Background	93 μg	25 μg	30.6 μg	10.6 μg
Cumulative Concentration	100.7 μg	26.7 μg	32.73 μg	10.9 μg
5-Year Maximum Project Concentration	7.7 μg	1.72 μg	2.14 μg	0.31 μg
Most Stringent AAQS/SIL	50 μg / 10.4 μg	20 μg / 2.08 μg	35 μg / 2.5 μg	12 μg / 0.63 μg
Exceed AAQS?	No	No	No	No
Exceed SIL?	No	No	No	No

Source: EIR Appendix C, Sespe 2013, p. 38

Note: Annual average PMI occurs where the haul road crosses the project boundary (UTM 499604.71, 3803971.15), which is omitted from consideration in favor of the higher of the two adjacent boundary receptors (UTM 499559.62, 3803991.54). Daily PMI occurs on the southwest property boundary (UTM 4980909, 3801590).

Exposure of Sensitive Receptors to Toxic Air Contaminant Pollutant Concentrations (Standard of Significance 3)

Impact 3.2.5 Implementation of the proposed project would not result in increased exposure of existing sensitive land uses to TACs that would exceed applicable standards. As a result, this impact is considered **less than significant**.

Sensitive land uses are defined as facilities or land uses that include members of the population which are particularly sensitive to the effects of air pollutants, such as children, the elderly, and people with illnesses. Examples of these sensitive receptors are residences, schools, hospitals, and daycare centers. CARB has identified the following groups of individuals as the most likely to be affected by air pollution: the elderly over 65, children under 14, and persons with cardiovascular and chronic respiratory diseases such as asthma, emphysema, and bronchitis. The proposed project is not considered a sensitive land use and would not be staffed by or service the population groups most likely to be affected by air toxics.

However, the proposed project would involve many heavy-duty truck trips on-site daily and thus diesel PM emissions, described as a TAC above, and therefore could adversely affect sensitive land uses in the vicinity of the project.

Constituents in diesel exhaust and dust emissions were speciated into toxic components using the following CARB speciation profiles:

- Particulate matter from unpaved roads (PM Profile #470)
- Particulate matter from paved roads (PM Profile #471)
- Particulate matter from aggregate processing (PM Profile #90013)
- Diesel particulate matter (PM Profile #6139 for the 2013 fleet)
- Diesel total organic gases (Organic Profile #818)

TACs emitted from project operations consist mainly of those found in vehicle exhaust and, to a lesser extent, trace amounts of metals and silica found in fugitive dust. **Table 3.2-13** presents the health risk predicted at nearby receptors.

TABLE 3.2-13
POTENTIAL HEALTH RISK IMPACTS

Receptor Number	Cancer Risk[1]	Chronic Non-Cancer Risk (H.I.)	Acute Non-Cancer Risk (H.I.)	Significant?
R1	0.54	0.05	0.09	No
R2	1.49	0.12	0.17	No
R3	3.08	0.17	0.24	No
R4	-0.47	0.02	0.05	No
R5	1.71	0.08	0.09	No
R6	-0.14	0.003	0.01	No
R7	0.54	0.05	0.11	No

Source: EIR Appendix C, Sespe 2013, p. 37
Notes: [1] Excess cancer cases per million people exposed and hazard index (H.I.).

As shown in **Table 3.2-13**, health risk impacts from the project are **less than significant**. (See Figure 6 through Figure 7 of **EIR Appendix C** for contoured plots of health risk for the project.)

Mitigation Measures

None required.

Result in a Cumulatively Considerable Net Increase in Nonattainment Criteria Pollutant (Standard of Significance 5)

Impact 3.2.6 Implementation of the proposed project and mitigation measure **MM 3.2.1**, in combination with cumulative development in the Mojave Desert Air Basin, would result in a cumulatively considerable net increase of criteria air pollutants for which the MDAB is designated nonattainment. This is considered a **less than cumulatively considerable** impact.

The MDAQMD's approach to assessing cumulative impacts is based on whether a proposed project will result in an increase in the frequency or severity of existing air quality violations or cause or contribute to new violations. As evaluated under Impact 3.2.1, the project would not exceed long-term operational standards with implementation of mitigation measure MM 3.2.1 and therefore would not violate air quality standards. Thus, the project would result in **less than cumulatively considerable** impacts.

Mitigation Measures

None required.

This section describes the existing biological resources, including special-status species and sensitive habitat known to occur and/or have the potential to occur in the project study area (PSA). The PSA was defined by the proposed quarry boundary, plus the haul road with a 200-foot buffer.[1] A summary of the regulations and programs that provide protective measures to special-status species, an analysis of impacts on biological resources that could result from project implementation, and a discussion of mitigation measures necessary to reduce impacts to a less than significant level, where feasible, are provided in this section.

The County published a Notice of Preparation and Initial Study (NOP/IS) for the proposed project on June 12, 2013. A copy of the NOP/IS, along with comments received during the public review period, is contained in EIR Appendix A. The California Department of Fish and Wildlife (CDFW) submitted comments on the NOP, and those comments were considered in the preparation of this section. In addition, the EIR preparers met with CDFW staff at the project site to discuss specific comments.

3.3.1 EXISTING SETTING

Several steps were taken to characterize the environmental setting in the project vicinity. First, project-related documentation was reviewed to collect site-specific data regarding habitat suitability for special-status species, as well as the identification of potentially jurisdictional waters. Additional information was obtained from a variety of outside data sources and can be found in the reference list. Lastly, preliminary database searches were performed on the following websites to identify special-status species with the potential to occur in the area:

- U.S. Fish and Wildlife Service's (USFWS) Information Planning and Conservation (IPaC) System (2013a)
- USFWS Critical Habitat Portal (2013b)
- California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB) (2013a)
- California Native Plant Society (CNPS) Inventory of Rare, Threatened, and Endangered Plants of California (2013)

The USFWS IPaC System was queried to identify special-status species within USFWS jurisdiction that have the potential to occur within the PSA. In addition, the USFWS Critical Habitat Portal was queried to identify designated critical habitat within 1 mile of the PSA. A query of the CNDDB database provided a list of known occurrences for special-status species within a 1-, 5-, and 10-mile radius of the PSA. Lastly, the CNPS database was queried to identify special-status plant species with the potential to occur within the Butler Peak, Fifteenmile, Fawnskin, and Lucerne Valley, California, U.S. Geological Survey (USGS) 7.5-minute quadrangles. Raw data from the database queries are provided in **EIR Appendix D**. Please see the Special-Status Species subsection below for a summary of the database search results and conclusions regarding the potential for each species to be impacted by project-related activities.

[1] Total area of PSA is 659.5 acres. This includes 239.4 acres of haul road area and 420.1 acres of quarry boundary area as is shown in Figures 3.3-1a and 3.3-1b. The PSA extends beyond the boundary of the 375.1-acre area that comprises the project site (see Chapter 2.0, Project Description).

REGIONAL SETTING

The PSA is located within the Mojave Desert ecological section of the American Semidesert and Desert ecological province (McNab et al. 2007). This province is characterized by long, hot summers and mild winters with a small amount of precipitation. The landscape consists of plains from below sea level to low mountain ranges with sparse vegetation of dwarf-shrubland, along with scattered occurrences of shrubland and woodland at higher elevations (McNab et al. 2007). Within the Mojave Desert section, the terrain consists of plains, low mountain ranges, playas, basins, and dunes. Soils are derived from sedimentary and granitic rocks as well as alluvial deposits. The vegetation is characterized by desert shrub, pinyon-juniper, and at higher elevations fir-spruce cover types (McNab et al. 2007). The Mojave Desert section is further subdivided into 16 subsections.

PHYSICAL SETTING

The PSA is associated with the Lucerne-Johnson Valleys and Hills subsection of the Mojave ecological section, comprising the mountains, hills, pediments, and alluvial plain north of the San Bernardino Mountains, Bighorn Mountains, and Pinto Mountain Fault from the Mojave River east to a linear depression that stretches from Troy Lake southeast to Cadiz Lake (Goudey and Miles 1998). Soils are predominantly well drained, with the exception of poorly drained playas that lack vascular plants. Vegetation is largely characterized by creosote bush series and big galleta series, with Joshua tree series common in pediments and fans, and Indian ricegrass series common on eolian sands (Goudey and Miles 1998). The mixed saltbush series is common on the basin floor, with iodine bush series and saltgrass series on wet basin-fill and lacustrine deposits (Goudey and Miles 1998). At higher elevations, California juniper series dominates over 3,000 feet (909 meters) above mean sea level (amsl), and black bush series occurs on the higher mountains (Goudey and Miles 1998). The climate is hot and arid with mean annual temperatures between 50° and 68° Fahrenheit, and 4–8 inches of precipitation that falls mostly as rain annually (Goudey and Miles 1998). Watersheds in this subsection are closed, and streams are dry most of the year with temporary ponding in playas and dry lake beds (Goudey and Miles 1998). Surface water runoff is rapid from the mountains and alluvial fans, but slow from basin-fill (Goudey and Miles 1998).

BIOLOGICAL SETTING

The PSA comprises a mix of barren and urban land uses along with natural community types. Uses associated with the barren/urban areas include roads and areas associated with the active mining operation. The remainder of the PSA consists of a mix of desert scrub, juniper, mixed chaparral, montane chaparral, pinyon-juniper, desert wash, and desert riparian community types. The upland community designations were assigned utilizing the U.S. Forest Service (USFS) Pacific Southwest Region CALVEG Vegetation Classification and Mapping data (2013). The PSA overlaps two CALVEG zones: the South Coast (Zone 9) and the South Interior (Zone 8). ESRI ArcView geodatabase files for CALVEG mapping tiles that overlap the PSA were downloaded and utilized to generate **Figure 3.3-1a** and **Figure 3.3-1b**. Aquatic features (e.g., ephemeral dry wash and desert riparian habitat) within the "proposed White Knob quarry boundary" were mapped using the results of the jurisdictional delineation conducted by Tetra Tech, while the aquatic features associated with the haul road were mapped using the CDFW California Streams (CA_Streams) data layer (Tetra Tech 2013). Each cover type is described below based on the data presented in the CDFW's *A Guide to Wildlife Habitats of California* (2013b).

Urban/Barren (145.9 Acres)

The urban land use encompasses a small portion of the existing Omya processing plant, which is located at the beginning of the haul road and terminus of Crystal Creek Road. The barren habitat type is associated with lands impacted by mining within the PSA, including haul roads, boulder roll-down areas, overburden placement, and extraction. Barren habitat is characterized by the absence of vegetation with less than 2 percent total vegetative cover by herbaceous species and less than 10 percent cover by tree or shrub species.

Although barren habitat provides little to no vegetative support, several species may still utilize these areas, including bighorn sheep (*Ovis canadensis*), bobcat (*Lynx rufus*), coyote (*Canis latrans*), raptors, raven (*Corvus corax*), rattlesnakes (*Crotalus* spp.), and other common associates of disturbed uses.

Desert Scrub (141.9 Acres)

Desert scrub is considered to be the most widespread habitat in California deserts and is generally found below 4,000 feet (1.212 meters) amsl. This community type typically has a low species diversity; however, common associates include catclaw acacia (*Acacia greggii*), desert agave (*Agave deserti*), coastal bladderpod (*Isomeris arborea*), white brittlebush (*Encelia farinose*), burrobush (*Ambrosia dumosa*), barrel cactus (*Ferocactus viridescens*), hedgehog cactus (*Echinocereus* spp.), branched pencil cholla (*Opuntia ramosissima*), teddybear cholla (*O. bigelovii*), Palmer's coldenia (*Tiquilia palmeri*), Wiggins croton (*Croton wigginsii*), desert globemallow (*Sphaeralcea ambigua*), jojoba (*Simmondsia chinensis*), littleleaf krameria (*Krameria erecta*), ocotillo (*Fouquieria splendens* ssp. *splendens*), beavertail pricklypear (*Opuntia basilaris*), rabbitbrush (*Chrysothamnus* spp.), desert sand verbena (*Abronia villosa*), desert senna (*Senna armata*), squaw waterweed (*Baccharis sergiloides*), Anderson's woldberry (*Lycium andersonii*), and Mojave yucca (*Yucca schidigera*). In addition, triangle evening primrose (*Oenothera elata*), galleta (*Pleuraphis jamesii*), big galleta (*Pleuraphis rigida*), and Spanish needle (*Palafoxia arida*) can be found in the herbaceous layer.

Standing water in winter and herbaceous growth in spring provide foraging opportunities for a variety of wildlife species. Reptiles and rodents are the more common taxa associated with this community; however, various other taxa also utilize desert scrub. Common associates include Couch's spadefoot toad (*Scaphiopus couchii*), desert tortoise (*Gopherus agasizzii*), desert iguana (*Dipsosaurus dorsalis*), common kingsnake (*Lampropeltis getula*), black-throated sparrow (*Amphispiza billineata*), pocket mice, kangaroo rats (*Dipodomys merriami*), kit fox (*Vulpes macrotis*), coyote, and bobcat.

Mixed Chaparral (15.5 Acres)

Mixed chaparral occurs as a mosaic on low- to mid-elevation (<5,000 feet/1,515 meters amsl) steep slopes and ridges with thin, well-drained soils. This is typically a structurally homogenous brushland community dominated by shrubs with thick, stiff, waxy evergreen leaves. The shrub height and percent crown cover within the mixed chaparral community is dictated by the amount of time since the last burn, precipitation regime, aspect, and soil type. The post-fire early-successional stages of mixed chaparral are characterized by subshrubs, annuals, and perennial herbs. However, at maturity, this community is characterized by a dense, nearly impenetrable thicket with greater than 80 percent shrub cover.

Common associates include scrub oak (*Quercus berberidifolia*), chaparral oak (*Q. durata*), and several species of ceanothus (*Ceanothus* spp.) and manzanita (*Arctostaphylos* spp.). Shrub

species typically found within mixed chaparral include chamise (*Adenostoma fasciculatum*), birch leaf mountain mahogany (*Cercocarpus betuloides*), silk-tassel (*Garrya* spp.), toyon (*Heteromeles arbutifolia*), yerba santa (*Eriodictyon* spp.), California buckeye (*Aesculus californica*), poison oak (*Toxicodendron diversilobum*), sumac (*Rhus* spp.), California buckthorn (*Rhamnus californica*), holly leaf cherry (*Prunus ilicifolia*), Montana chaparral pea (*Pickeringia montana*), and California fremontia (*Fremontodendron californicum*).

There are no wildlife species that are strictly restricted to mixed chaparral. Most species are associated with other shrub-dominated vegetative communities, including chamise-redshank chaparral, montane chaparral, coastal scrub, and sagebrush.

Montane Chaparral (47.3 Acres)

Montane chaparral varies in species composition with elevational, geographical, soil, and aspect changes. Most species associated with this community are fire adapted; therefore, chaparral is a secondary successional sequence following disturbance (e.g., logging, fire, erosion) in a variety of coniferous habitats. This community adjoins a variety of other habitat types, including montane riparian, mixed chaparral, and perennial grassland. One or more of the following species usually characterize montane chaparral communities: whitethorn ceanothus (*Ceanothus cordulatus*), snowbrush ceanothus (*C. velutinus*), greenleaf manzanita (*Arctostaphylos patula*), pinemat manzanita (*A. nevadensis*), hoary manzanita (*A. canescens*), bitter cherry (*Prunus emarginata*), huckleberry oak (*Quercus vacciniifolia*), sierra chinquapin (*Castanopsis sempervirens*), juneberry (*Amelanchier* sp.), Fremont silktassel (*Garrya fremontii*), Greene goldenweed (*Ericameria greenei*), mountain mahogany, toyon, sumac, and California buckthorn.

Numerous rodents, deer and other herbivores, and birds utilize montane chaparral habitats. This community provides foraging opportunities for small herbivores in the fall and winter when grasses are not abundant. In addition, rabbits and hares forage on twigs, evergreen leaves, and bark from chaparral plant species. Shrubs provide an important source of shade during hot weather, and moderate protection from high velocity wind events for many small mammal species. Lastly, this community provides seeds, fruits, insects, and protection from predators and climate, along with singing, roosting, and nesting sites for several bird species.

Montane Hardwood (0.1 Acre)

This community is characterized by a pronounced hardwood canopy, with a poorly developed shrub stratum and sparse herbaceous layer. In the Transverse and Peninsular ranges of Southern California, Jeffrey pine (*Pinus jeffreyi*), ponderosa pine (*Pinus ponderosa*), sugar pine (*Pinus lambertiana*), incense-cedar (*Calocedrus decurrens*), California white fir (*Abies concolor*), bigcone Douglas fir (*Pseudotsuga macrocarpa*), California black oak (*Quercus kelloggii*), and Coulter pine (*Pinus coulteri*) are common in the overstory at middle to high elevations. At lower elevations, white alder (*Alnus rhombifolia*), coast live oak (*Quercus agrifolia*), bigleaf maple (*Acer macrophyllum*), California laurel (*Umbellularia californica*), bigcone Douglas fir, valley oak (*Quercus lobata*), foothill pine (*Pinus sabiniana*), and blue oak (*Quercus douglasii*) are common overstory species. Typical understory shrub species include manzanita (*Arctostaphylos* spp.), poison oak, coffeeberry (*Rhamnus californica*), currant (*Ribes viburnifolium*), and ceanothus.

Species that utilize acorns as a major food source such as western scrub jay (*Aphelocoma californica*) and Steller's jay (*Cyanocitta stelleri*), wild turkey (*Meleagris gallopavo*), mountain quail (*Oreortyx pictus*), band-tailed pigeon (*Patagioenas fasciata*), California ground squirrel

Document Path: T:_GIS\San_Bernardino_County\MXD\White_Knob\Figure 3.3-1a Vegetation Within Quarry.mxd

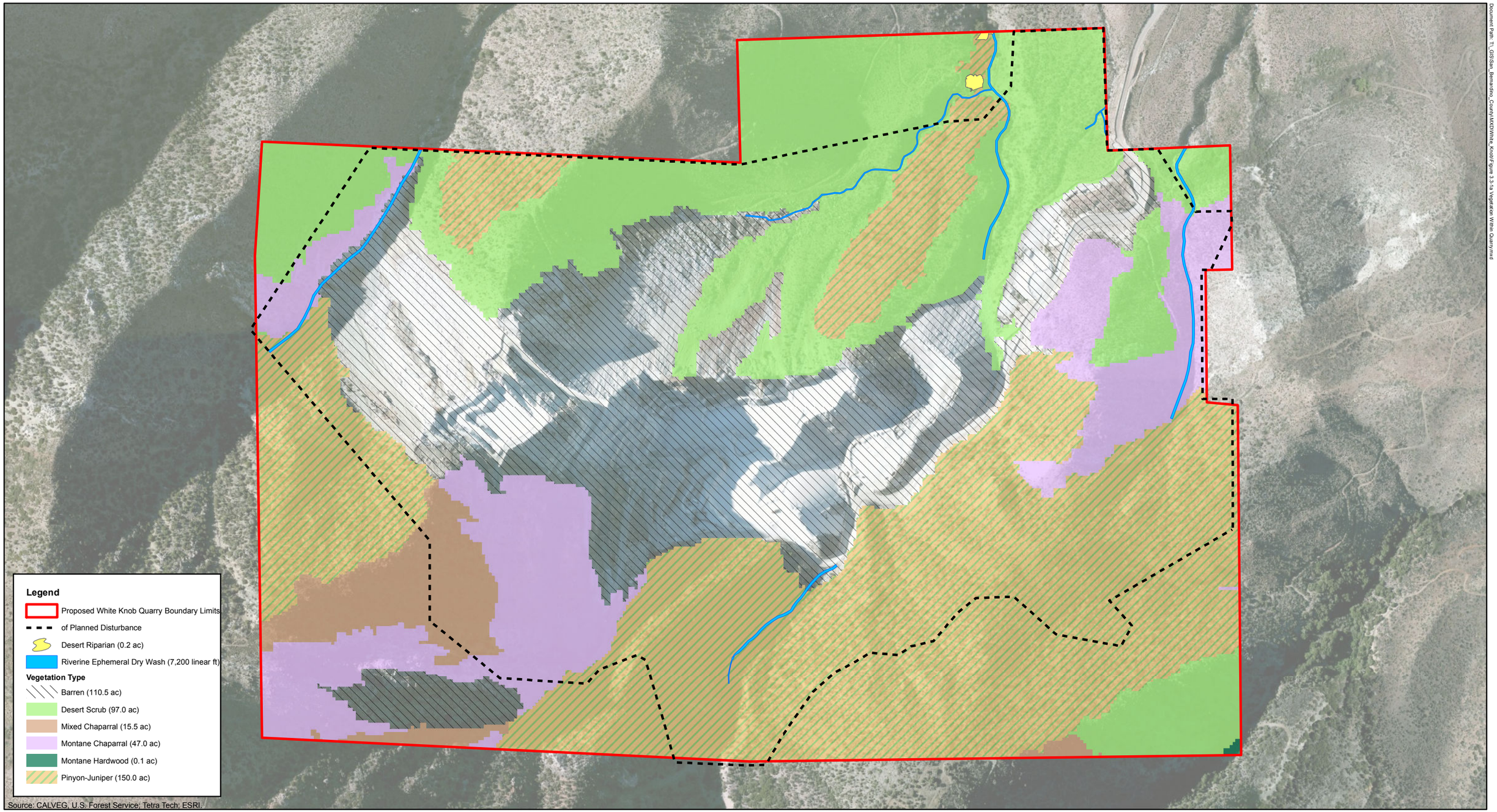


Figure 3.3-1a

Vegetative Communities within the Proposed White Knob Quarry

PMC

Document Path: T:_GIS\San_Bernardino_County\MXD\White_Knob\Figure 3.3-1b Vegetation Along Haul Road.mxd

Silver Creek

Source: CALVEG, U.S. Forest Service; California Streams, CA Dept of Fish & Wildlife; ESRI.

Legend

- Proposed White Knob Quarry Boundary
- Processing Plant
- Riverine Ephemeral Dry Wash
- Existing Haul Road

Vegetation Type

- Barren (35.0 ac)
- Desert Scrub (45.0 ac)
- Juniper (159.0 ac)
- Urban (0.4 ac)

N

0 0.5 1

MILES

Figure 3.3-1b

Vegetative Communities within 200 feet of the Haul Road

PMC®

(*Otospermophilus beecheyi*), dusky-footed woodrat (*Neotoma fuscipes*), black bear (*Ursus americanus*), and mule deer (*Odocoileus hemionus*) are commonly associated with montane hardwood habitats. In addition, several amphibians and reptiles can be found under woody debris and leaf litter including Mount Lyell salamander (*Hydromantes platycephalus*), ensatina (*Ensatina eschscoltzii*), relictual slender salamander (*Batrachoseps relictus*), western fence lizard (*Sceloporus occidentalis*), sagebrush lizard (*Sceloporus graciosus*), rubber boa (*Charina umbratica*), western rattlesnake (*Crotalus viridis*), California mountain kingsnake (*Lampropeltis zonata*), and sharp-tailed snake (*Contina tenuis*).

Pinyon-Juniper (150.0 Acres)

This habitat type occurs at middle elevations (4,000–8,000 feet/1,212–2,424 meters) and consists of open woodland of low, round-crowned, bushy trees that are needle-leaved, evergreen, and range from 30 feet to 50 feet in height. Pinyon-juniper habitats intergrade with a variety of other wildlife habitats including Joshua tree and desert scrub at lower elevations; eastside pine, perennial grass, and Jeffery pine at higher elevations; and sagebrush, mixed chaparral, and chamise-redshank chaparral along similar elevations. At mid to low elevations, the overstory typically comprises pure stands of either singleleaf (*Pinus monophylla*) or Parry (*Pinus quadrifolia*) pinyon pine, or pinyon mixed with juniper (*Juniperus* spp.), oaks (*Quercus* spp.), or Mojave yucca (*Yucca schidigera*). The understory is typically composed of immature California juniper (*Juniperus californica*) along with sagebrush (*Artemisia* spp.), blackbrush (*Coleogyne ramosissima*), common snakeweed (*Gutierrezia sarothrae*), narrowleaf goldenbush (*Ericameria linearifolia*), Parry nolina (*Nolina parryi*), curl-leaf mountain mahogany (*Cercocarpus ledifolius*), antelope bitterbrush (*Purshia tridentate*), Parry rabbitbrush (*Ericameria parryi*), chamise (*Adenostoma fasciculatum*), and redshank (*Adenostoma sparsifolium*). Common herbaceous associates include western wheatgrass (*Elymus spicatus*), blue grama (*Bouteloua gracilis*), and Indian ricegrass (*Achnatherum hymenoides*).

The pinyon mouse (*Peromyscus truei*), bushy-tailed woodrat (*Neotoma cinerea*), pinyon jay (*Gymnorhinus cyanocephalus*), plain titmouse (*Baeolophus inornatus*), and bushtit (*Psaltriparus minimus*) are characteristic of this community type. In addition, pinyon nuts and juniper berries are an important forage source for many wildlife species, which in turn act as dispersal agents for these plants.

Juniper (159.0 Acres)

This community is typically characterized by open to dense aggregations of California, Utah, or western junipers in the form of arborescent shrubs or small trees. Juniper habitats typically occur at middle elevations between Jeffrey pine and eastside pine communities at higher elevations, and sagebrush at lower elevations. Canopy species commonly associated with juniper habitats include white fir, Jeffrey pine, ponderosa pine, whitebark pine (*Pinus albicaulis*), and singleleaf pinyon pine. Shrub associates include antelope bitterbrush, California buckwheat (*Erigonum fasciculatum*), wax currant (*Ribes cereum*), gray horsebrush (*Tetradymia canescens*), green Mormon-tea (*Ephedra viridis*), curlleaf mountain mahogany, big sagebrush (*Artemisia tridentata*), and black sagebrush (*Artemisia nova*). Common forbs and grasses include Sandberg's bluegrass (*Poa secunda*), bighead clover (*Trifolium macrocephalum*), Idaho fescue (*Festuca idahoensis*), one-spike oatgrass (*Danthonia unispicata*), bottlebrush (*Callistemon* spp.), squirreltail (*Elymus elymoides*), and bluebunch wheatgrass (*Pseudoroegneria spicata*).

No species specifically rely on juniper habitats. However, juniper berries are an important food source for wintering birds, while the foliage is consumed by several mammal species.

Riverine-Ephemeral Dry Wash (7,200 Linear Feet)

Riverine habitats are characterized by intermittent to continually flowing water. Streams typically originate at some elevated source, such as a spring or lake, and flow downhill at a rate relative to the slope or gradient and the volume of surface water runoff or discharge. Flow velocities generally decline as the stream descends in elevation, and the volume of water increases until the stream flattens out at lower elevations. The transition from a high-gradient, high-flow stream to a low-gradient, low-flow river results in increases in water temperature and turbidity, while dissolved oxygen decreases and the bed material transitions from rock to mud.

Ephemeral dry washes move water, nutrients, and sediment throughout the watershed. When functioning properly, they provide landscape-level hydrologic connections; stream energy dissipation during high flow events to reduce erosion and improve water quality; surface and subsurface water storage and exchange; groundwater recharge and discharge; sediment transport, storage, and deposition to aid in floodplain maintenance and development; nutrient storage and cycling; support for vegetative communities to stabilize stream banks; and water supply and water-quality filtering (Levick et al. 2008). In addition, these features provide a variety of ecological services for wildlife, including migration corridors, forage, cover, and nesting. Due to the higher moisture content, wildlife abundance and diversity in and/or near them is typically higher than in surrounding uplands (Levick et al. 2008).

Desert Riparian (0.2 Acre)

This community is characterized by dense groves of low, shrublike trees or tall shrubs, to woodlands of small to medium-sized trees. These habitats are found adjacent to permanent water (e.g., streams, springs) or in naturally subirrigated areas. Dominant canopy species within this community vary but may include tamarisk (*Tamarix parviflora*), velvet ash (*Fraxinus velutina*), mesquite (*Prosopis glandulosa* var. *torreyana*), screwbean mesquite (*Prosopis pubescens*), Fremont cottonwood (*Populus fremontii* ssp. *fremontii*), and willows (*Salix* spp.). The subcanopy comprises smaller individuals of canopy species as well as quailbush (*Atriplex lentiformis* ssp. *breweri*), Mojave seablite (*Suaeda moquinii*), desert lavender (*Hyptis emoryi*), seep willow (*Baccharis salicifolia*), and arroweed (*Pluchea sericea*).

This habitat within the PSA covers 0.2 acre along the northern boundary and is characterized by common rush (*Juncus effuses*), arroyo willow (*Salix laevigata*), red willow (*Salix lasiolepis*), mule fat (*Baccharis salicifolia*), interior live oak (*Quercus wislizeni*), Parish's umbrellawort (*Taushia parishii*), pinyon pine (*Pinus monophylla*), and penstemon (*Penstemon* sp.).

Desert riparian communities play an important role in desert wildlife populations and support more bird species than any other desert habitat, with the exception of some palm oasis habitats. The dense shrubs and permanent water provide food, cover, and water for additional wildlife species.

SENSITIVE HABITATS

Sensitive habitats included are those that are of special concern to resource agencies or those that are protected under the California Environmental Quality Act (CEQA), Section 1600 of the California Fish and Game Code (FGC), Sections 401 and 404 of the Clean Water Act (CWA), and/or were identified in the *Carbonate Habitat Management Strategy* (Olson 2003).

Waters of the United States and/or State

Jurisdictional waters of the State and United States along with isolated wetlands provide a variety of functions for plants and wildlife. Wetlands and other water features provide habitat, foraging, cover, and migration and movement corridors for both special-status and common species. In addition to habitat functions, these features provide physical conveyance of surface water flows capable of handling large stormwater events. Large storms can produce extreme flows that cause bank cutting and sedimentation of open waters and streams. Jurisdictional waters can slow these flows and lessen the effects of these large storm events, protecting habitat and other resources. A jurisdictional delineation was performed by Tetra Tech (2013) within the proposed White Knob quarry boundary (**EIR Appendix D**). Based on the data presented in this report, approximately 7,200 linear feet of ephemeral dry wash and 0.2 acre of desert riparian habitats occur within the PSA (**Figure 3.3-2**). The amount and location of jurisdictional features that have the potential to be affected by the proposed haul road improvements have not been formally delineated to date; however, data obtained from the CDFW indicates that at least 10 ephemeral dry washes intersect the haul road.

Waters of the United States

The U.S. Army Corps of Engineers (USACE) continues to assert jurisdiction over all waters that are in use, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which may be subject to the ebb and flow of the tide and are defined as traditional navigable waters (USACE 2007). Field observations and review of relevant aerial photographs and topographic maps confirm that the unnamed drainages within the PSA terminate in Rabbit Lake (dry) found to the north of the PSA. No connection to the Mojave River for the drainages associated with the PSA was observed. A recent approved jurisdictional determination (AJD) dated April 30, 2013, has been issued by the USACE for the Marathon Solar Project located southeast of the PSA, on the west side of Camp Rock Road, north of State Route 247 (USACE 2013). The drainages associated with this project terminate in Lucerne Lake (dry), which is east of Rabbit Lake. The AJD for the Marathon Solar Project concluded that the on-site drainages are isolated and are not subject to USACE regulation under Section 404. The Marathon Solar Project AJD indicates that Rabbit Lake and Lucerne Lake are part of the same depositional environment and are both located in the Lucerne Valley Groundwater Basin Este Subarea. Based on the AJD issued for the solar project, which shares the same watershed as the PSA drainages, it is likely that jurisdictional drainages within the PSA are isolated and not subject to USACE jurisdiction, however no specific determination has been made at this time by USACE.

Waters of the State

Under Section 401 of the Clean Water Act (CWA) and the Porter-Cologne Water Quality Act, the Colorado River Regional Water Quality Control Board (RWQCB) asserts jurisdiction over jurisdictional wetlands and those non-isolated waters associated with traditional navigable waters. As the on-site drainages do not connect to the Mojave River, they are not subject to regulatory authority by the Colorado River RWQCB under Clean Water Act Section 401. The desert riparian wetland associated with Drainage C (**Figure 3.3-2**) meets the three-point federal criteria as a wetland and therefore may be subject to regulatory authority by the Colorado River RWQCB under the Porter-Cologne Act.

Under Section 1600 et seq. of the California Fish and Game Code, the CDFW regulates all diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake that supports fish or wildlife. The ephemeral dry washes within the PSA that have

definable bed-and-bank features or ordinary high water mark (OHWM) indicators would be subject to regulatory authority by the CDFW.

WILDLIFE MOVEMENT CORRIDORS

Wildlife corridors refer to established migration routes commonly used by resident and migratory species for passage from one geographic location to another. Corridors are present in a variety of habitats and link otherwise fragmented acres of undisturbed area. Maintaining the continuity of established wildlife corridors is important to (a) sustain species with specific foraging requirements, (b) preserve a species' distribution potential, and (c) retain diversity among many wildlife populations. Therefore, resource agencies consider wildlife corridors to be a sensitive resource.

Portions of the PSA have been disturbed by previous and ongoing mining operations; however, the undisturbed portions around the perimeter and off-site could facilitate regional wildlife movement. Available data on movement corridors and linkages was accessed via the CDFW BIOS 5 Viewer (2013c). Data reviewed included the Essential Connectivity Areas [ds623] layer and the Missing Linkages in California [ds420] layer. The PSA is located north of an Essential Connectivity Area and approximately 2.5 miles east of a linkage for bighorn sheep in the Missing Linkages layer. Omya reported no individuals have been documented on-site; however, there is the potential for this species to occur in the vicinity of the PSA.

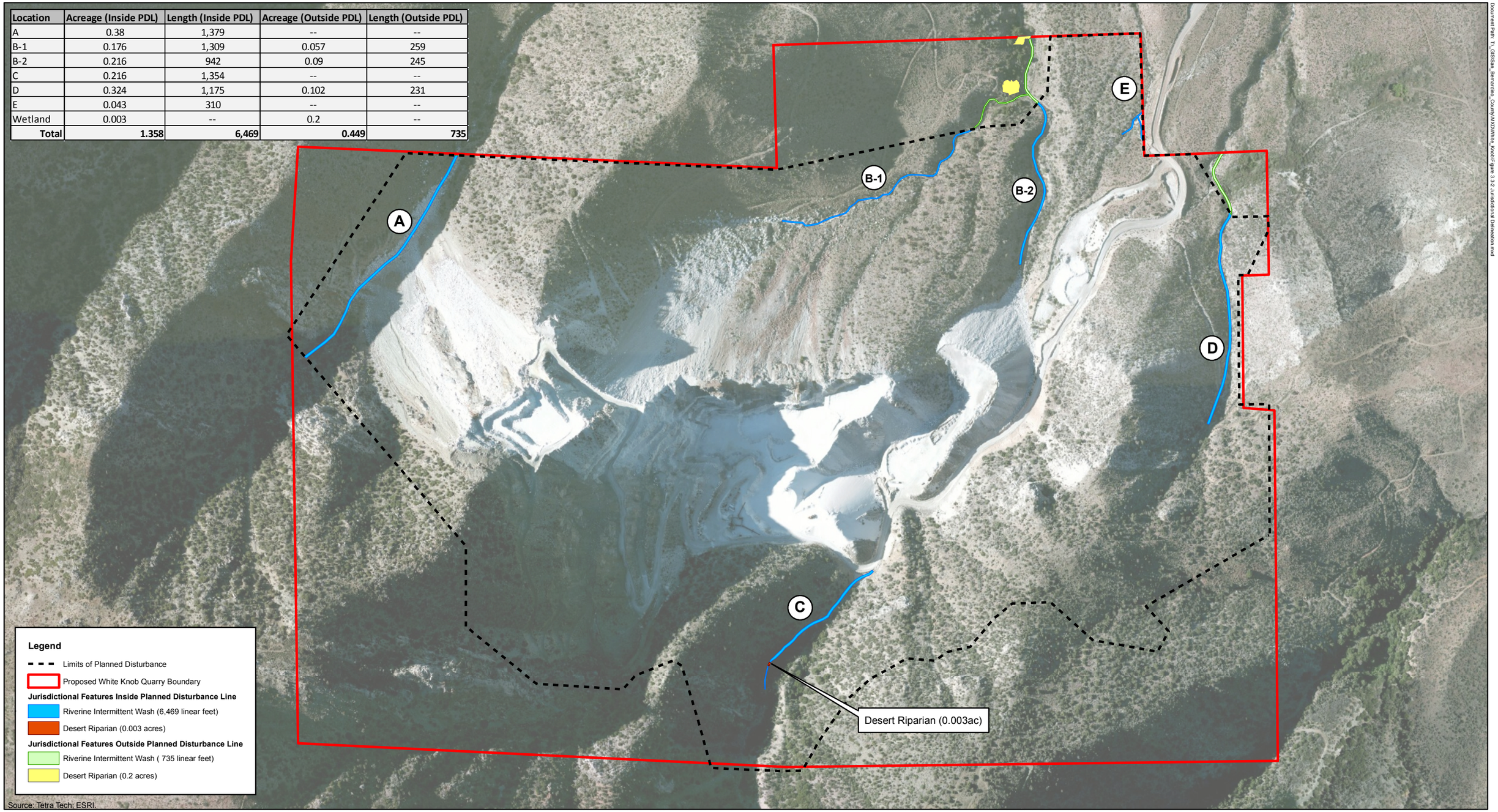
In addition, the San Bernardino County General Plan Open Space Overlay Map was reviewed to determine whether the PSA was located in an identified wildlife corridor. The PSA is not located in an identified corridor; however, it is located east of the Deep Creek wildlife corridor, north of the Bear Creek corridor, and west of the Grapevine Creek corridor.

SPECIAL-STATUS SPECIES

Candidate, sensitive, or special-status species are commonly characterized as species that are at potential risk or actual risk to their persistence in a given area, or across their native habitat. These species have been identified and assigned a status ranking by governmental agencies such as the CDFW, the USFWS, and private organizations such as the CNPS. The degree to which a species is at risk of extinction is the determining factor in the assignment of a status ranking. Some common threats to a species' or population's persistence include habitat loss, degradation, and fragmentation, as well as human conflict and intrusion. For the purposes of this biological review, special-status species are defined by the following codes:

- Listed, proposed, or candidates for listing under the federal Endangered Species Act (ESA) (50 Code of Federal Regulations [CFR] 17.11 – listed; 61 Federal Register [FR] 7591, February 28, 1996 candidates)
- Listed or proposed for listing under the California Endangered Species Act (CESA) (FGC 1992 Section 2050 et seq.; 14 California Code of Regulations [CCR] Section 670.1 et seq.)
- Designated as Species of Special Concern by the CDFW
- Designated as Fully Protected by the CDFW (FGC Sections 3511, 4700, 5050, 5515)
- Species that meet the definition of rare or endangered under CEQA (14 CCR Section 15380) including CNPS List Rank 1b and 2

Location	Acreage (Inside PDL)	Length (Inside PDL)	Acreage (Outside PDL)	Length (Outside PDL)
A	0.38	1,379	--	--
B-1	0.176	1,309	0.057	259
B-2	0.216	942	0.09	245
C	0.216	1,354	--	--
D	0.324	1,175	0.102	231
E	0.043	310	--	--
Wetland	0.003	--	0.2	--
Total	**1.358**	**6,469**	**0.449**	**735**



Document Path: T:_GIS\San_Bernardino_County\MXD\White_Knob\Figure 3.3-2 Jurisdictional Delineation.mxd

Figure 3.3-2
Jurisdictional Delineation

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The results of the USFWS, CDFW, and CNPS database queries identified several special-status species with the potential to be impacted by project-related activities. **Table 3.3-1** provides a summary of all special-status species identified in the database results. All special-status plant species returned from the CNPS and USFWS IPaC query, as well as those returned from the 5-mile CNDDB query, are analyzed in **Table 3.3-1**, as well as special-status wildlife species returned from the USFWS IPaC query and 10-mile CNDDB query. **Table 3.3-1** also provides a description of the habitat requirements for each species and conclusions regarding the potential for each species to be impacted by project components. The CNDDB results within 1 mile of the project are depicted on **Figure 3.3-3**. In addition, the query of the USFWS Critical Habitat Portal revealed that the PSA is not within any designated critical habitat; however, designated critical habitat for Cushenbury buckwheat (*Eriogonum ovalifolium* var. *vineum*) and Cushenbury oxytheca (*Oxytheca parishii* var. *goodmaniana*) does occur in proximity to the PSA (**Figure 3.3-4**).

The PSA is located on the north slope of the San Bernardino Mountains, which is characterized by steep slopes, rocky pinnacles, outcrops, rock crevices, rock ledges, cliff potholes, and cliffs. These habitat characteristics provide excellent nest sites for several cliff-nesting raptors, including owls, golden eagles, California condors, peregrine falcons, prairie falcons, and red-tailed hawks. In order to provide consistent objectives, management actions, processes, and management tools across the North Slope, the San Bernardino National Forest (SBNF) is in the process of developing a Raptor Conservation Strategy (RCS). A draft version of the RCS is provided in **EIR Appendix D**.

Special-Status Plant Species

Special-status plants that are state and/or federally listed or are found on CNPS List 1A (believed to be extinct); List 1B (rare, threatened, or endangered in California and elsewhere); or List 2 (rare, threatened, or endangered in California, but are more numerous elsewhere) are considered in this impact analysis. Based on these criteria and the database search results, 37 special-status plant species have the potential to occur in the PSA. Each special-status plant species that is considered in the impact analysis is described below based on the data obtained from the CNPS *Inventory of Rare, Threatened, and Endangered Plants of California* (2013).

Cushenbury Oxytheca (*Acanthoscyphus parishii* var. *goodmaniana*)

Cushenbury oxytheca is a San Bernardino County endemic, is federally listed as endangered, and has a CNPS rare plant rank of 1B.1. This species is an annual herb that blooms from May through October. It is typically found in pinyon and juniper woodlands at elevations ranging from 3,999 to 7,799 feet (1,219–2,377 meters) above mean sea level (amsl). Cushenbury oxytheca has a strong affinity for carbonate soils and is often found growing on either sand or talus. This species is threatened by carbonate mining, non-native plants, power line maintenance, and vehicles.

According to the CNDDB, there are three occurrences of Cushenbury oxytheca within 1 mile of the PSA and nine records within 5 miles. In addition, this species was documented on-site by Scott White Biological Consulting (SWBC) in 2006; however, subsequent surveys conducted by Lilburn Corporation in 2012 did not document this species. Due to the presence of suitable habitat and previous occurrences on and in the immediate vicinity of the PSA, this species may occur within the PSA.

Cushenbury Milk-Vetch (*Astragalus albens*)

Cushenbury milk-vetch is endemic to San Bernardino County, is federally listed as endangered, and has a CNPS rare plant rank of 1B.1. This species is a perennial herb that blooms from March

to June. It is typically found in Joshua tree woodlands, Mojavean desert scrub, and pinyon and juniper woodlands at elevations ranging from 3,593 to 6,562 feet (1,095–2,000 meters) amsl. It is usually found growing on carbonate and rarely on granitic substrate. This species is threatened by carbonate mining, energy development, grazing, road construction, and vehicles.

There are no records of Cushenbury milk-vetch within 1 mile of the PSA; however, there are three previous occurrences within 5 miles. Although this species was not observed during previous plant surveys, the presence of potential suitable habitat results in the potential for this species to occur within the PSA.

Big Bear Valley Milk-Vetch (*Astragalus lentiginosus* var. *sierrae*)

Big Bear Valley milk-vetch is a California endemic with a CNPS rare plant rank of 1B.2. It is not federally or state listed. This species is a perennial herb that blooms from April through August. It is typically found growing on gravelly or rocky soils in habitats such as Mojavean desert scrub, meadows and seeps, pinyon and juniper woodland, and upper montane coniferous forest. This species ranges from 5,905 to 8,530 feet (1,800–2,500 meters) amsl. Big Bear Valley milk-vetch is threatened by urbanization, illegal dumping, mining, road construction, vegetation and fuel management activities, road maintenance, and recreational activities.

There are two records of Big Bear Valley milk-vetch within 1 mile of the PSA and a total of ten occurrences within a 5-mile radius of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Big Bear Valley Woollypod (*Astragalus leucolobus*)

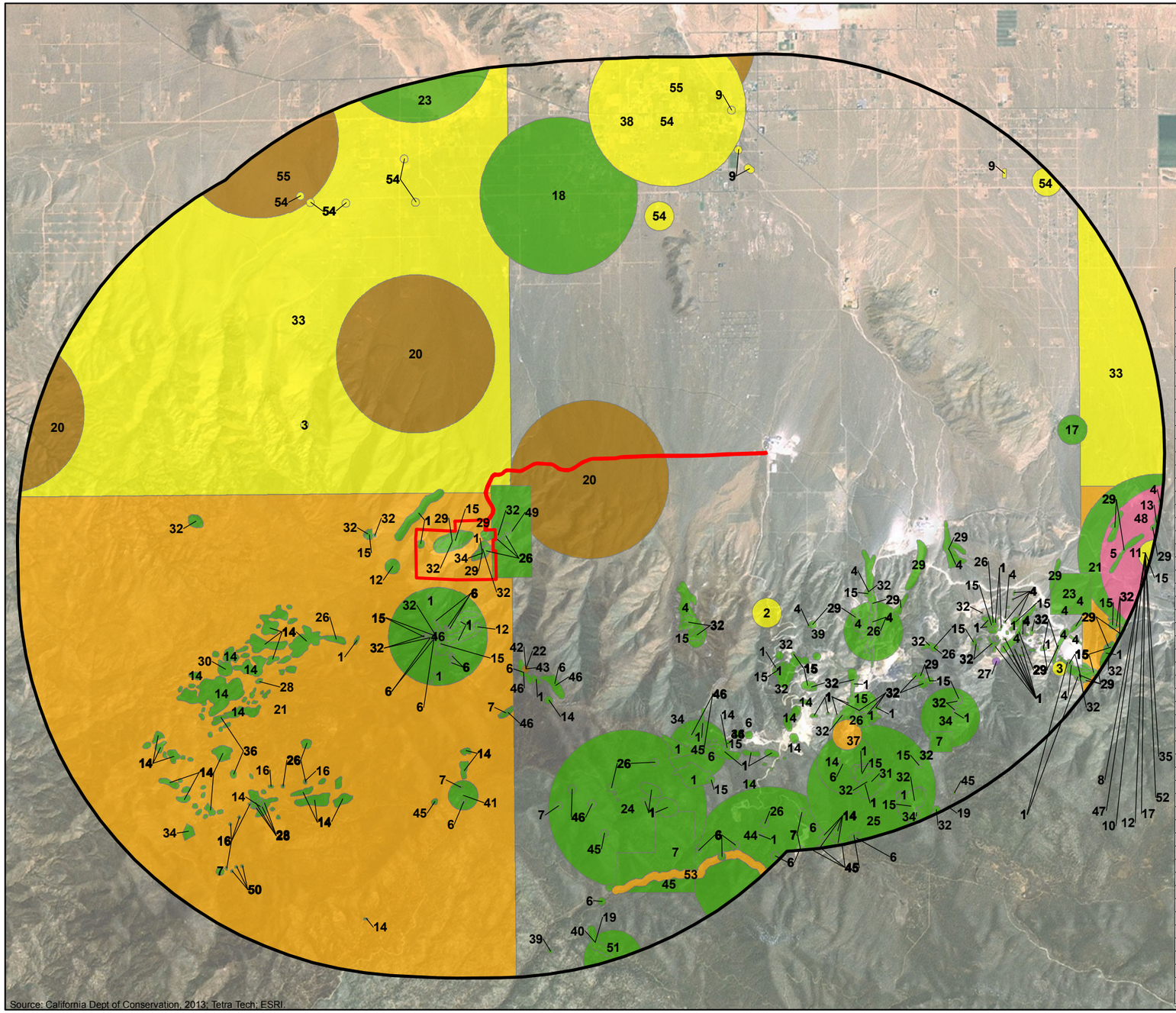
Big Bear Valley woollypod is a California endemic and has a CNPS rare plant rank of 1B.2. This species has no federal or state listing. Big Bear Valley woollypod is a perennial herb that blooms between May and July. It typically grows on rocky substrates in pinyon and juniper woodlands, pebble plains, and upper and lower montane coniferous forests. This species ranges from 5,741 to 9,465 feet (1,750–2,885 meters) amsl and is threatened by development, recreational activities, and vehicles.

There are no records of Big Bear Valley woollypod within 1 mile of the PSA; however, there are six occurrences within 5 miles. This species was not observed during previous plant surveys; however, this species may occur within the PSA due to presence of potential suitable habitat.

Tidestrom's Milk-Vetch (*Astragalus tidestromii*)

Tidestrom's milk-vetch is a perennial herb that can be found in both California and Nevada. In California, its distribution is limited to Inyo and San Bernardino counties. It has a CNPS rare plant rank of 2.2 and has no federal or state listing. This species blooms from April through July and ranges in elevation from 1,969 to 5,200 feet (600–1,585 meters) amsl. It is typically found growing on gravelly or sandy, carbonate substrate in Mojavean desert scrub. Tidestrom's milk-vetch is threatened by mining and solar energy development, and possibly by vehicles, road maintenance, and non-native plants.

There is no record of Tidestrom's milk-vetch within 1 mile of the PSA, but there is one occurrence within 5 miles of the PSA. This species was not observed during previous plant surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.



Map ID	Scientific Name	Common Name	Federal Listing	State Listing	Rare Plant Rank
1	*Acanthoscyphus parishii var. goodmaniana*	Cushenbury oxytheca	Endangered	None	1B.1
2	*Accipiter cooperii*	Cooper's hawk	None	None	
3	*Aquila chrysaetos*	golden eagle	None	None	
4	*Astragalus albens*	Cushenbury milk-vetch	Endangered	None	1B.1
5	*Astragalus bernardinus*	San Bernardino milk-vetch	None	None	1B.2
6	*Astragalus lentiginosus var. sierrae*	Big Bear Valley milk-vetch	None	None	1B.2
7	*Astragalus leucolobus*	Big Bear Valley woollypod	None	None	1B.2
8	*Astragalus tidestromii*	Tidestrom's milk-vetch	None	None	2B.2
9	*Athene cunicularia*	burrowing owl	None	None	
10	*Atriplex parishii*	Parish's brittlescale	None	None	1B.1
11	*Berberis fremontii*	Fremont barberry	None	None	3
12	*Boechera dispar*	pinyon rockcress	None	None	2B.3
13	*Boechera lincolnensis*	Lincoln rockcress	None	None	2B.3
14	*Boechera parishii*	Parish's rockcress	None	None	1B.2
15	*Boechera shockleyi*	Shockley's rockcress	None	None	2B.2
16	*Calochortus palmeri var. palmeri*	Palmer's mariposa-lily	None	None	1B.2
17	*Calochortus striatus*	alkali mariposa-lily	None	None	1B.2
18	*Canbya candida*	white pygmy-poppy	None	None	4.2
19	*Castilleja lasiorhyncha*	San Bernardino Mountains owl's-clover	None	None	1B.2
20	*Chaetodipus fallax pallidus*	pallid San Diego pocket mouse	None	None	
21	*Charina umbratica*	southern rubber boa	None	Threatened	
22	*Corynorhinus townsendii*	Townsend's big-eared bat	None	None	
23	*Cymopterus multinervatus*	purple-nerve cymopterus	None	None	2B.2
24	*Drymocallis cuneifolia var. cuneifolia*	wedgeleaf woodbeauty	None	None	1B.1
25	*Dryopteris filix-mas*	male fern	None	None	2B.3
26	*Dudleya abramsii ssp. affinis*	San Bernardino Mountains dudleya	None	None	1B.2
27	*Ensatina klauberi*	large-blotched salamander	None	None	
28	*Eremogone ursina*	Big Bear Valley sandwort	Threatened	None	1B.2
29	*Erigeron parishii*	Parish's daisy	Threatened	None	1B.1
30	*Eriogonum kennedyi var. austromontanum*	southern mountain buckwheat	Threatened	None	1B.2
31	*Eriogonum microthecum var. johnstonii*	Johnston's buckwheat	None	None	1B.3
32	*Eriogonum ovalifolium var. vineum*	Cushenbury buckwheat	Endangered	None	1B.1
33	*Falco mexicanus*	prairie falcon	None	None	
34	*Heuchera parishii*	Parish's alumroot	None	None	1B.3
35	*Icteria virens*	yellow-breasted chat	None	None	
36	*Ivesia argyrocoma var. argyrocoma*	silver-haired ivesia	None	None	1B.2
37	*Lampropeltis zonata (parvirubra)*	California mountain kingsnake (San Bernardino population)	None	None	
38	*Lasionycteris noctivagans*	silver-haired bat	None	None	
39	*Lilium parryi*	lemon lily	None	None	1B.2
40	*Mimulus exiguus*	San Bernardino Mountains monkeyflower	None	None	1B.2
41	*Mimulus purpureus*	little purple monkeyflower	None	None	1B.2
42	*Myotis evotis*	long-eared myotis	None	None	
43	*Myotis volans*	long-legged myotis	None	None	
44	*Navarretia peninsularis*	Baja navarretia	None	None	1B.2
45	*Packera bernardina*	San Bernardino ragwort	None	None	1B.2
46	*Phlox dolichantha*	Big Bear Valley phlox	None	None	1B.2
47	*Piranga rubra*	summer tanager	None	None	
48	*Psychomastax deserticola*	desert monkey grasshopper	None	None	
49	*Saltugilia latimeri*	Latimer's woodland-gilia	None	None	1B.2
50	*Sidalcea hickmanii ssp. parishii*	Parish's checkerbloom	None	Rare	1B.2
51	*Streptanthus bernardinus*	Laguna Mountains jewel-flower	None	None	4.3
52	*Symphyotrichum defoliatum*	San Bernardino aster	None	None	1B.2
53	*Thamnophis hammondii*	two-striped garter snake	None	None	
54	*Toxostoma lecontei*	Le Conte's thrasher	None	None	
55	*Xerospermophilus mohavensis*	Mohave ground squirrel	None	Threatened	

Figure 3.3-3
CNDDB Occurrences of Special-status Species within 5 Miles of the PSA

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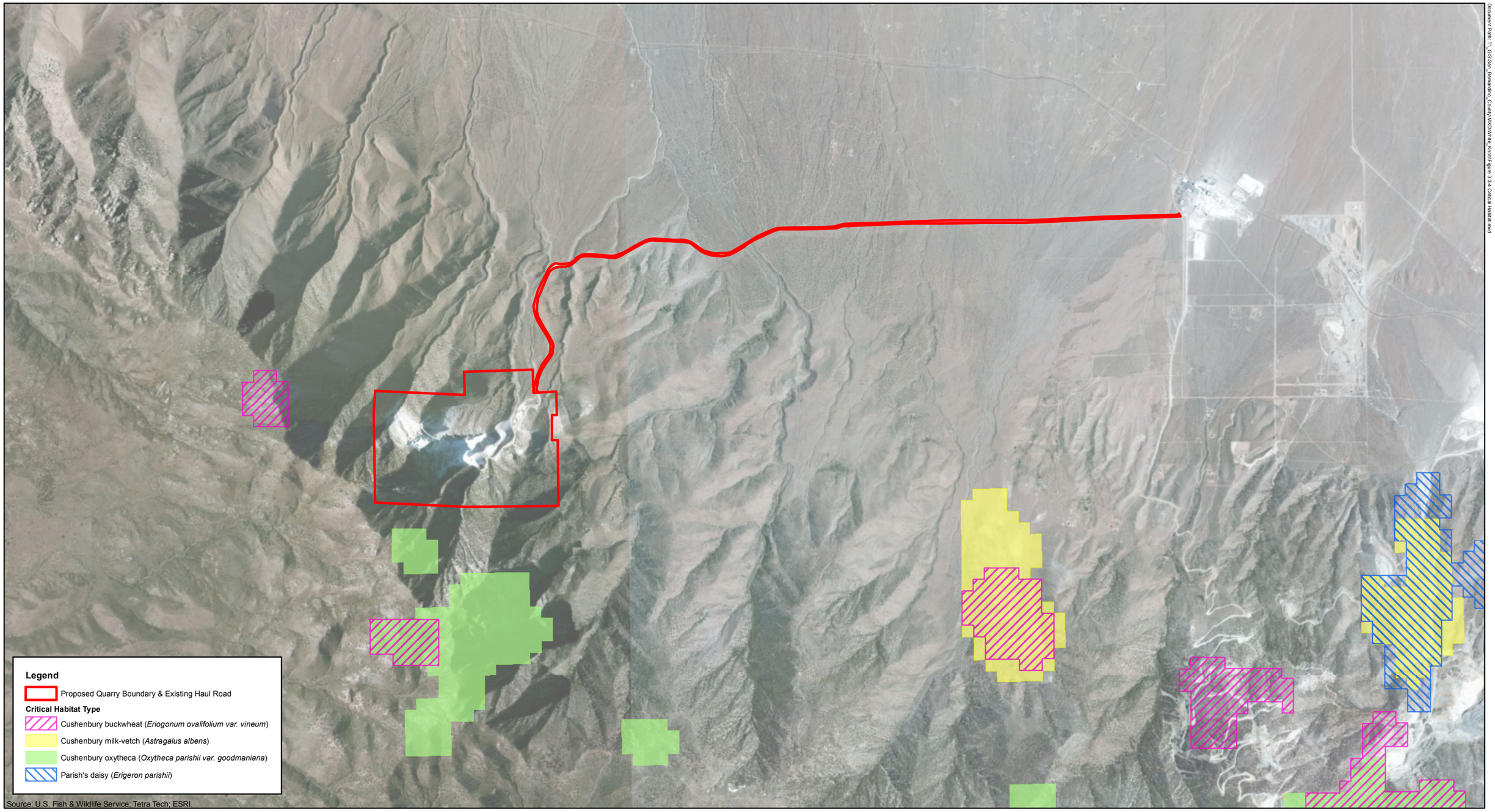

Figure 3.3-4

Critical Habitat in the Vicinity of the PSA

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TABLE 3.3-1
SPECIAL-STATUS SPECIES OCCURRENCE DATA

Scientific Name	Common Name	Federal Status	State Status	CNPS Rare Plant Rank	General Habitat Characteristics	Habitat Present/ Absent	Rationale
Plants							
Acanthoscyphus parishii var. *goodmaniana*	Cushenbury oxytheca	FE	–	1B.1	Grows on carbonate, sand, or tallus in pinyon and juniper woodland. Elev: 4,022–7,844 feet (1,219–2,377 m). Blooms: May–Oct (CNPS 2013).	P	May affect. Suitable habitat present and documented during previous surveys of the project area (SWBC 2007).
Astragalus albens	Cushenbury milk-vetch	FE	–	1B.1	Usually grows on carbonate, rarely granitic, in Joshua tree woodland, Mojavean desert scrub, and pinyon and juniper woodland. Elev: 3,613–6,600 feet (1,095–2,000 m). Blooms: Mar–June (CNPS 2013).	P	May affect. Suitable habitat present.
Astragalus lentiginosus var. *sierrae*	Big Bear Valley milk-vetch	–	–	1B.2	Gravelly or rocky areas in Mojavean desert scrub, meadows and seeps, pinyon and juniper woodlands, and upper montane coniferous forest. Elev: 5,940–8,580 feet (1,800–2,600 m). Blooms: Apr–Aug (CNPS 2013).	P	May affect. Suitable habitat present.
Astragalus leucolobus	Big Bear Valley woollypod	–	–	1B.2	Rocky areas in pebble (pavement) plains, pinyon and juniper woodland, and upper and lower montane coniferous forests. Elev: 5,775–9,520 feet (1,750–2,885 m). Blooms: May–July (CNPS 2013).	P	May affect. Suitable habitat present.
Astragalus tidestromii	Tidestrom's milk-vetch	–	–	2.2	Sandy or gravelly carbonate substrates in Mojavean desert scrub. Elev: 1,980–5,230 feet (600–1,585 m). Blooms: April–July (CNPS 2013).	P	May affect. Suitable habitat present.
Atriplex parishii	Parish's brittlescale	–	–	1B.1	Alkaline areas in chenopod scrub, playas and vernal pools. Elev: 82–6,270 feet (25–1,900 m). Blooms: June–Oct (CNPS 2013).	A	No effect. Suitable habitat not present.
Boechera dispar	pinyon rockcress	–	–	2.3	Granitic and gravelly areas in Joshua tree woodland, Mojavean desert scrub, and pinyon and juniper woodland. Elev: 3,960–8,382 feet (1,200–2,540 m). Blooms: Mar–June (CNPS 2013).	P	May affect. Suitable habitat present.

Scientific Name	Common Name	Federal Status	State Status	CNPS Rare Plant Rank	General Habitat Characteristics	Habitat Present/ Absent	Rationale
Boechera lincolnensis	Lincoln rockcress	–	–	2.3	Carbonate soil in chenopod scrub and Mojavean desert scrub. Elev: 3,630–8,926 feet (1,100–2,705 m). Blooms: Mar–May (CNPS 2013).	P	May affect. Suitable habitat present.
Boechera parishii	Parish's rockcress	–	–	1B.2	Rocky areas, quartzite on clay, or sometimes carbonate, in pebble (pavement) plains, upper montane coniferous forests, and pinyon and juniper woodlands. Elev: 5,841–9,867 feet (1,770–2,990 m). Blooms: Apr–May (CNPS 2013).	P	May affect. Suitable habitat present.
Boechera shockleyi	Shockley's rockcress	–	–	2.2	Rocky or gravelly, carbonate or quartzite, in pinyon and juniper woodland. Elev: 2,887–7,623 feet (875–2,310 m). Blooms: May–June (CNPS 2013).	P	May affect. Suitable habitat present.
Calochortus palmeri var. *palmeri*	Palmer's mariposa lily	–	–	1B.2	Mesic areas in chaparral, lower montane coniferous forests, and meadows and seeps. Elev: 3,300–7,887 feet (1,000–2,390 m). Blooms: Apr–Jul (CNPS 2013).	P	May affect. Suitable habitat present.
Calochortus striatus	alkali mariposa lily	–	–	1B.2	Alkaline, mesic areas in chaparral, chenopod scrub, Mojavean desert scrub, and meadows and seeps. Elev: 231–5,263 feet (70–1,595 m). Blooms: Apr–June (CNPS 2013).	P	May affect. Suitable habitat present.
Castilleja cinerea	ash-gray paintbrush	FT	–	1B.2	Mojavean desert scrub, meadows and seeps, pebble (pavement) plain, pinyon and juniper woodland, and clay openings in upper montane coniferous forest. Elev: 5,940–9,768 feet (1,800–2,960 m). Blooms: June–Aug (CNPS 2013).	P	May affect. Suitable habitat present.
Castilleja lasiorhyncha	San Bernardino Mountains owl's-clover	–	–	1B.2	Mesic areas in chaparral, meadows and seeps, pebble (pavement) plains, riparian woodland, and upper montane coniferous forest. Elev: 5,280–7,887 feet (1,300–2,390 m). Blooms: May–Aug (CNPS 2013).	P	May affect. Suitable habitat present.
Cymopterus multinervatus	purple-nerve cymopterus	–	–	2.2	Sandy or gravelly areas in Mojavean desert scrub, and pinyon and juniper woodland. Elev: 2,607–5,940 feet (790–1,800 m). Blooms: Mar–Apr (CNPS 2013).	P	May affect. Suitable habitat present.

Scientific Name	Common Name	Federal Status	State Status	CNPS Rare Plant Rank	General Habitat Characteristics	Habitat Present/ Absent	Rationale
Drymocallis cuneifolia var. *cuneifolia*	wedgeleaf woodbeauty	–	–	1B.1	Sometimes on carbonate in riparian scrub and upper montane coniferous forests. Elev: 5,940–7,309 feet (1,800–2,215 m). Blooms: June–Aug (CNPS 2013).	A	No effect. Suitable habitat not present.
Dryopteris filix-mas	male fern	–	–	2.3	Rocky granitic areas in upper montane coniferous forest. Elev: 7,920–10,230 feet (2,400–3,100 m). Blooms: Jul–Sep (CNPS 2013).	A	No effect. Suitable habitat not present. Project is below 6,500 feet (1,969 m) in elevation.
Dudleya abramsii ssp. *affinis*	San Bernardino Mountains dudleya	–	–	2.2	Granitic, quartzite or carbonate soils in pebble (pavement) plains, pinyon and juniper woodlands, and upper montane coniferous forests. Elev: 4,125–8,580 feet (1,250–2,600 m). Blooms: Apr–Jul (CNPS 2013).	P	May affect. Suitable habitat present and documented during previous surveys of the project area (SWBC 2007; Lilburn 2013).
Elymus salina	Salina Pass wild-rye	–	–	2.3	Rocky pinyon and juniper woodland. Elev: 4,455–7,045 feet (1,350–2,135 m). Blooms: May–Jun (CNPS 2013).	P	May affect. Suitable habitat present.
Eremogone ursina	Big Bear Valley sandwort	FT	–	1B.2	Mesic, rocky areas in meadows and seeps, pebble (pavement) plains, and pinyon and juniper woodland. Elev: 5,940–9,570 feet (1,800–2,900 m). Blooms: May–Aug (CNPS 2013).	P	May affect. Suitable habitat present.
Erigeron parishii	Parish's daisy	FT	–	1B.1	Usually carbonate, sometimes granitic soils in Mojavean desert scrub, and pinyon and juniper woodland. Elev: 2,640–6,600 feet (800–2,000 m). Blooms: May–Aug (CNPS 2013).	P	May affect. Suitable habitat present and documented during previous surveys of the project area (SWBC 2007; Lilburn 2013).
Eriogonum evanidum	vanishing wild buckwheat	–	–	1B.1	Sandy or gravelly substrate in chaparral, cismontane woodland, lower montane coniferous forest, and pinyon and juniper woodland. Elev: 3,630–7,342 feet (1,100–2,225 m). Blooms: Jul–Oct (CNPS 2013).	P	May affect. Suitable habitat present.
Eriogonum kennedyi var. *austromontanum*	southern mountain buckwheat	FT	–	1B.2	Pebble (pavement) plains and gravelly lower montane coniferous forest. Elev: 5,841–9,537 feet (1,770–2,890 m). Blooms: June–Sep (CNPS 2013).	A	No effect. Suitable habitat not present.

Scientific Name	Common Name	Federal Status	State Status	CNPS Rare Plant Rank	General Habitat Characteristics	Habitat Present/ Absent	Rationale
Eriogonum microthecum var. *johnstonii*	Johnston's buckwheat	–	–	1B.3	Rocky areas in subalpine coniferous forest and upper montane coniferous forest. Elev: 6,035–9,622 feet (1,829–2,926 m). Blooms: Jul–Sep (CNPS 2013).	A	No effect. Suitable habitat not present.
Eriogonum ovalifolium var. *vineum*	Cushenbury buckwheat	FE	–	1B.1	Carbonate soil in Joshua tree woodland, Mojavean desert scrub, and pinyon and juniper woodland. Elev: 4,620–8,052 feet (1,400–2,440 m). Blooms: May–Aug (CNPS 2013).	P	May affect. Suitable habitat present and documented during previous surveys of the project area (SWBC 2007; Lilburn 2013).
Heuchera parishii	Parish's alumroot	–	–	1B.3	Rocky areas, sometimes on carbonate, in alpine boulder and rock fields, subalpine coniferous forests, and upper and lower montane coniferous forests. Elev: 4,950–12,540 feet (1,500–3,800 m). Blooms: Jun–Aug (CNPS 2013).	P	May affect. Suitable habitat present and documented during previous surveys of the project area (SWBC 2007).
Ivesia argyrocoma var. *argyrocoma*	silver-haired ivesia	–	–	1B.2	Alkaline meadows and seeps, pebble (pavement plains, and upper montane coniferous forests. Elev: 4,827–9,768 feet (1,463–2,960 m). Blooms: Jun–Aug (CNPS 2013).	A	No effect. Suitable habitat not present.
Lilium parryi	lemon lily	–	–	1B.2	Mesic areas in meadows and seeps, riparian forests, and upper and lower montane coniferous forests. Elev: 4,026–9,058 feet (1,220–2,745 m). Blooms: Jul–Aug (CNPS 2013).	P	May affect. Suitable habitat present.
Lewisia brachycalax	short-sepaled lewisia	–	–	2.2	Mesic areas in lower montane coniferous forests, and meadows and seeps. Elev: 4,521–7,590 feet (1,370–2,300 m). Blooms: Feb–Jul (CNPS 2013).	P	May affect. Suitable habitat present.
Mimulus exiguus	San Bernardino Mountains monkeyflower	–	–	1B.2	Mesic, clay soils in meadows and seeps, pebble (pavement) plains, and upper montane coniferous forests. Elev: 5,940–7,639 feet (1,800–2,315 m). Blooms: May–July (CNPS 2013).	P	May affect. Suitable habitat present.
Mimulus mohavensis	Mojave monkeyflower	–	–	1B.2	Sandy or gravelly areas, often in washes, in Joshua tree woodland and Mojavean desert scrub. Elev: 1,980–3,960 feet (600–1,200 m). Blooms: Apr–June (CNPS 2013).	P	May affect. Suitable habitat present. Project at or above 3,894 feet (1,180 m) elevation.

Scientific Name	Common Name	Federal Status	State Status	CNPS Rare Plant Rank	General Habitat Characteristics	Habitat Present/ Absent	Rationale
Mimulus purpureus	little purple monkeyflower	–	–	1B.2	Meadows and seeps, pebble (pavement) plains, and upper montane coniferous forests. Elev: 6,270–7,590 feet (1,900–2,300 m). Blooms: May–June (CNPS 2013).	P	May affect. Suitable habitat present.
Navarretia peninsularis	Baja navarretia	–	–	1B.2	Mesic areas in chaparral openings, lower montane coniferous forests, meadows and seeps, and pinyon and juniper woodlands. Elev: 4,950–7,590 feet (1,500–2,300 m). Blooms: June–Aug (CNPS 2013).	P	May affect. Suitable habitat present.
Packera bernardina	San Bernardino ragwort	–	–	1B.2	Pebble (pavement) plains, upper montane coniferous forests, and mesic, sometimes alkaline meadows and seeps. Elev: 5,940–7,590 feet (1,800–2,300 m). Blooms: May–July (CNPS 2013).	A	No effect. Suitable habitat not present.
Perideridia parishii ssp. *Parishii*	Parish's yampah	–	–	2.2	Meadows and seeps, and upper and lower montane coniferous forests. Elev: 4,834–9,900 feet (1,465–3,000 m). Blooms: Jun–Aug (CNPS 2013).	P	May affect. Suitable habitat present.
Phacelia parishii	Parish's phacelia	–	–	1B.1	Clay or alkaline areas in Mojavean desert scrub and playas. Elev: 1,782–3,960 feet (540–1,200 m). Blooms: Apr–July (CNPS 2013).	A	No effect. Suitable soils not present.
Phlox dolichantha	Big Bear Valley phlox	–	–	1B.2	Pebble (pavement) plain and upper montane coniferous forests. Elev: 6,039–9,801 feet (1,830–2,970 m). Blooms: May–July (CNPS 2013).	A	No effect. Suitable habitat not present.
Physaria kingii ssp. *bernardina*	San Bernardino Mountain bladderpod	FE	–	1B.1	Usually on carbonate in pinyon and juniper woodland, lower montane coniferous forests, and subalpine coniferous forests. Elev: 6,105–8,910 feet (1,850–2,700 m). Blooms: May–June (CNPS 2013).	P	May affect. Suitable habitat present.
Plagiobothrys parishii	Parish's popcorn-flower	–	–	1B.1	Alkaline and mesic areas in Great Basin scrub and Joshua tree woodland. Elev: 2,475–4,620 feet (750–1,400 m). Blooms: Mar–Nov (CNPS 2013).	A	No effect. Suitable habitat not present.
Poa atropurpurea	San Bernardino bluegrass	FE	–	1B.2	Mesic meadows and seeps. Elev: 4,488–8,101 feet (1,360–2,455 m). Blooms: Apr–Aug (CNPS 2013).	p	May affect. Potential suitable habitat present.

Scientific Name	Common Name	Federal Status	State Status	CNPS Rare Plant Rank	General Habitat Characteristics	Habitat Present/ Absent	Rationale
Puccinellia parishii	Parish's alkali grass	–	–	1B.1	Alkaline springs and seeps in meadows and seeps. Elev: 2,310–3,300 feet (700–1,000 m). Blooms: Apr–May (CNPS 2013).	A	May affect. Suitable habitat present. Project at or above 1,180 m elevation.
Pyrrocoma uniflora var. *gossypina*	Bear Valley pyrrocoma	–	–	1B.2	Meadows and seeps, and pebble (pavement) plain. Elev: 5,280–7,590 feet (1,600–2,300 m). Blooms: Jul–Sep (CNPS 2013).	P	May affect. Suitable habitat present.
Saltugilia latimeri	Latimer's woodland gilia	–	–	1B.2	Rocky or sandy, often granitic soils, sometimes in washes, in chaparral, Mojavean desert scrub, and pinyon and juniper woodland. Elev: 1,320–6,270 feet (400–1,900 m). Blooms: Mar–June (CNPS 2013).	P	May affect. Suitable habitat present.
Sidalcea hickmanii ssp. *parishii*	Parish's checkerbloom	–	–	1B.2	Chaparral, cismontane woodland, and lower montane coniferous forest. Elev: 3,300–8,246 feet (1,000–2,499 m). Blooms: Jun–Aug (CNPS 2013).	A	No effect. Suitable habitat not present.
Sidalcea malviflora ssp. *dolosa*	Bear Valley checkerbloom	–	–	1B.2	Meadows and seeps, riparian woodland, and meadows and seeps in upper and lower montane coniferous forests. Elev: 4,933–8,860 feet (1,495–2,685 m). Blooms: May–Aug (CNPS 2013).	P	May affect. Suitable habitat present.
Sidalcea neomexicana	salt spring checkerbloom	–	–	2.2	Alkaline and mesic areas in chaparral, coastal scrub, lower montane coniferous forest, Mojavean desert scrub, and playas. Elev: 49–5,049 feet (15–1,530 m). Blooms: Mar–June (CNPS 2013).	A	No effect. Suitable habitat not present.
Sidalcea pedata	bird-foot checkerbloom	FE	SE	1B.1	Mesic meadows and seeps, and pebble (pavement) plains. Elev: 5,280–8,250 feet (1,600–2,500 m). Blooms: May–Aug (CNPS 2013).	P	May affect. Suitable habitat present.
Streptanthus campestris	southern jewel-flower	–	–	1B.3	Rocky areas in chaparral, lower montane coniferous forests, and pinyon and juniper woodland. Elev: 2,970–7,590 feet (900–2,300 m). Blooms: Apr–Jul (CNPS 2013).	P	May affect. Suitable habitat present.

Scientific Name	Common Name	Federal Status	State Status	CNPS Rare Plant Rank	General Habitat Characteristics	Habitat Present/ Absent	Rationale
Symphyotrichum defoliatum	San Bernardino aster	–	–	1B.2	Near ditches, streams and springs, in cismontane woodland, coastal scrub, lower montane coniferous forests, meadows and seeps, marshes and swamps, and valley and foothill grasslands. Elev: 6–6,732 feet (2–2,040 m). Blooms: Jul–Nov (CNPS 2013).	P	May affect. Suitable habitat present.
Taraxacum californicum	California dandelion	FE	–	1B.1	Mesic meadows and seeps. Elev: 5,346–9,240 feet (1,620–2,800m). Blooms: May–Aug (CNPS 2013).	P	May affect. Suitable habitat present.
Thelypodium stenopetalum	slender-petaled thelypodium	FE	SE	1B.1	Mesic and alkaline meadows and seeps. Elev: 5,280–8,250 feet (1,600–2,500 m). Blooms: May–Sep (CNPS 2013).	A	No effect. Suitable habitat not present.
Fish							
Gila orcuttii	arroyo chub	–	SSC		Native to Los Angeles, San Gabriel, San Luis Rey, Santa Ana, and Santa Margarita rivers, as well as Malibu and San Juan creeks. Has been extirpated from much of the native range, but introduced to streams along the coast and the Mojave River system, where they have eliminated the Mohave tui chub (UC Davis 2013).	A	No effect. Project outside species range.
Siphateles bicolor mohavensis	Mohave tui chub	FE	SE		Endemic to the Mojave River, but currently only exists at Soda Springs, China Lake Naval Air Weapons Station, Lark Seep, and Camp Cady (USFWS 2009a).	A	No effect. Project outside species range.
Amphibians							
Anaxyrus californicus	arroyo toad	FE	SSC		Breeding habitat = slow moving streams with shallow pools, nearby sandbars and adjacent stream terraces. Often breed in shallow, sandy pools bordered by sand/gravel flood terraces. Inhabit upland habitats when not breeding, such as sycamore-cottonwood woodlands, oak woodlands, coastal sage scrub, chaparral and grassland (USFWS 2009b).	A	No effect. Suitable habitat not present.

Scientific Name	Common Name	Federal Status	State Status	CNPS Rare Plant Rank	General Habitat Characteristics	Habitat Present/ Absent	Rationale
Ensatina klauberi	large-blotched salamander	–	SSC		Oak woodland, pine woodland, coniferous forests, and shrublands from 1,700 to 5,400 feet (515–1,636 m). Woody debris is a key habitat component (Jennings and Hayes 1994).	A	No effect. Suitable habitat not present.
Rana draytoniii	California red-legged frog	FT	SSC		Requires aquatic habitat to breed, either natural or artificial, such as stock ponds (USFWS 2002a). Ponds/streams in humid forests, woodlands, grasslands, coastal scrub, and streamsides with plant cover in lowlands or foothills. Breeding habitat = permanent or ephemeral water sources; lakes, ponds, reservoirs, slow streams, marshes, bogs, and swamps. Ephemeral wetland habitats require animal burrows or other moist refuges for aestivation when the wetlands are dry. From sea level to 5,003 feet (0–1,516 m) (Nafis 2013).	A	No effect. Suitable habitat not present.
Rana muscosa	Sierra Madre yellow-legged frog	FE	SCE		Streams in ponderosa pine, montane hardwood-conifer, and montane riparian habitats (CDFW 2013d).	A	No effect. Suitable habitat not present.
Reptiles							
Charina umbratica	southern rubber boa	–	ST		Inhabit oak-conifer and mixed-conifer forests from 5,000 to 8,200 feet (1,515–2,484 m) where rocks and logs or other debris provide shelter (Nafis 2013).	A	No effect. Suitable habitat not present.
Gopherus agassizii	desert tortoise	FT	ST		Occur most commonly on gently sloping terrain with sandy-gravel soils and where there is sparse cover of low-growing shrubs, which allows establishment of herbaceous plants. Use burrows, caves, rock and caliche crevices, or overhangs for cover during winter (USFWS 2011).	P	May affect. Suitable habitat present.
Lampropeltis zonata (parvirubra)	California mountain kingsnake (San Bernadino population)	–	SSC		Found in diverse habitats including coniferous forest, oak-pine woodlands, riparian woodland, chaparral, manzanita, and coastal sage scrub between 804 and 9,022 feet (243–2,733 m) (Nafis 2013).	A	No effect. Suitable habitat not present.

Scientific Name	Common Name	Federal Status	State Status	CNPS Rare Plant Rank	General Habitat Characteristics	Habitat Present/ Absent	Rationale
Phrynosoma blainvillii	coast horned lizard	–	SSC		Occurs in valley-foothill hardwood, conifer and riparian habitats, as well as in pine-cypress, juniper and annual grassland habitats. Inhabits open country such as sandy areas, washes, floodplains, and wind-blown deposits. Found mainly below 3,000 feet (909 m) in Southern California mountains, but can range up to 6,000 feet (1,818 m) (CDFW 2013d).	P	May affect. Suitable habitat present.
Thamnophis hammondii	two-striped garter snake	–	SSC		Found in wet forests, oak forests, chaparral and rolling grasslands. In Southern California, drier chaparral, oak woodland, and grassland are used (Nafis 2013).	A	No effect. Suitable habitat not present.
Birds							
Aquila chrysaetos	golden eagle	–	FP		Rolling hills and mountain terrain, desert, sage-juniper flats, wide arid plateaus deeply cut by streams and canyons, open mountain slopes and cliffs and rock outcrops. Nests on cliffs of all heights and in large trees in open areas. Ranges from sea level to 12,575 feet (3,810 m) (CDFW 2013d).	P	May affect. Suitable habitat present.
Athene cunicularia	burrowing owl	–	SSC		Open areas with mammal burrows. Habitats include dry open rolling hills, grasslands, fallow fields, sparsely vegetated desert scrub with gullies, washes, arroyos, and edges of human disturbed lands. Inhabit golf courses, airports, cemeteries, vacant lots, and road embankments, with friable soils (Bates 2006).	P	May affect. Suitable habitat present.

Scientific Name	Common Name	Federal Status	State Status	CNPS Rare Plant Rank	General Habitat Characteristics	Habitat Present/ Absent	Rationale
Empidonax traillii extimus	Southwestern willow flycatcher	FE	SE		Breeds in relatively dense riparian tree and shrub communities associated with rivers, swamps, and other wetlands, including lakes (e.g., reservoirs). Most of these habitats are classified as forested wetlands or scrub-shrub wetlands. Habitat requirements for wintering are not well known, but include brushy savanna edges, second growth, shrubby clearings and pastures, and woodlands near water (USFWS 2002b).	A	No effect. Suitable habitat not present.
Haliaeetus leucocephalus	bald eagle	FD	FP		Nests in large, old-growth, or dominant live tree with open branchwork, especially ponderosa pine. Requires large bodies of water or rivers with abundant fish, and adjacent snags (CDFW 2013d).	A	No effect. Suitable habitat not present.
Icteria virens	yellow-breasted chat	–	SSC		Nest in early-successional riparian habitats with a well-developed shrub layer and an open canopy. Restricted to narrow border of streams, creeks, sloughs and rivers. Often nest in dense thicket plants such as blackberry and willow (Shuford and Gardali 2008).	A	No effect. Suitable habitat not present.
Piranga rubra	summer tanager	–	SSC		Breed primarily in mature riparian woodland with extensive cottonwood canopy, some records of orchard nesting. Need tall, shady trees (Shuford 2008).	A	No effect. Suitable habitat not present.
Toxostoma lecontei	Le Conte's thrasher	–	SSC		Occurs primarily in open desert wash, desert scrub, alkali scrub, and desert succulent shrub habitats, also in Joshua tree habitat with scattered shrubs. Commonly nests in dense, spiny shrubs or cacti (CDFW 2013d).	P	May affect. Suitable habitat present.
Vireo bellii pusillus	least Bell's vireo	FE	SE		Obligate riparian breeder, preferring structurally diverse riparian woodlands with a dense understory. Community structures typically utilized include cottonwood-willow woodlands, oak woodlands, and mule fat scrub (Kus 2002).	A	No effect. Suitable habitat not present.

Scientific Name	Common Name	Federal Status	State Status	CNPS Rare Plant Rank	General Habitat Characteristics	Habitat Present/ Absent	Rationale
Mammals							
Chaetodipus fallax pallidus	pallid San Diego pocket mouse	–	SSC		Sandy herbaceous areas, usually in association with rocks or course gravel. Elev: 0–5,906 feet (0–1,789 m) (CDFW 2013d).	P	May affect. Potential suitable habitat present.
Corynorhinus townsendii	Townsend's big-eared bat	–	SSC		Cave-dwelling, also roosts in old mine-workings, occasionally found in buildings. Population concentrations in areas with cavity-forming rock and in old mining districts (Bolster 1998).	P	May affect. Potential suitable habitat present.
Eumops perotis californicus	western mastiff bat	–	SSC		Open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, annual and perennial grasslands, palm oases, chaparral, desert scrub, and urban areas. Roosts in crevices on vertical cliff faces, high buildings, trees, and tunnels (CDFW 2013d).	P	May affect. Potential suitable habitat present.
Glaucomys sabrinus californicus	San Bernardino flying squirrel	–	SSC		Variety of coniferous and deciduous forests, including riparian forest. Found between 3,960 and 8,250 feet (1,200–2,500 m). Distribution fragmented by natural variation in vegetative cover, a preference for high elevation habitats, and barriers such as forest cover loss (Bolster 1998).	A	No effect. Suitable habitat not present.
Xerospermophilus mohavensis	Mohave ground squirrel	–	ST		Optimal habitats are open desert scrub, alkali desert scrub, and Joshua tree. Prefers sandy to gravelly soils, avoids rocky areas. Elev: 1,657–5,003 feet (502–1,516 m) (CDFW 2013d).	A	No effect. Outside species range **(Figure 3.3-6).**

Key	
Federal & State Status	**CNPS Rare Plant Rank**
(FE) Federal Endangered	*Rareness Ranks*
(FT) Federal Threatened	(1A) Presumed Extinct in California
(FC) Federal Candidate	(1B) Rare, Threatened, or Endangered in California and Elsewhere
(FD) Federally Delisted	(2) Rare, Threatened, or Endangered in California, but More Common Elsewhere
(SE) State Endangered	(3) More Species Information Needed
(ST) State Threatened	(4) Limited Distribution
(SSC) State Species of Special Concern	*Threat Ranks*
(SCT) State Candidate Threatened	(0.1) Seriously threatened in California
(FP) Fully Protected	(0.2) Fairly threatened in California
	(0.3) Not very threatened in California

Pinyon Rockcress (*Boechera dispar*)

Pinyon rockcress is a perennial herb that can be found in both California and Nevada. It has a CNPS rare plant rank of 2.3 and has no federal or state listing. This species blooms from March to June and ranges in elevation from 3,937 to 8,333 feet (1,200–2,540 meters) amsl. It is typically found growing on granitic, gravelly substrate in habitats such as Joshua tree woodland, Mojavean desert scrub, and pinyon and juniper woodland. Pinyon rockcress is threatened by mining, non-native plants, recreational activities, road construction, and vehicles.

There are two records of pinyon rockcress within 1 mile of the PSA, and no additional occurrences when the radius is increased to 5 miles. This species was not observed during previous plant surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Lincoln Rockcress (*Boechera lincolnensis*)

Lincoln rockcress is a perennial herb that can be found in California, Nevada, and Utah. In California, its distribution is limited to Inyo, Los Angeles, Riverside, and San Bernardino counties. It has a CNPS rare plant rank of 2.3 and has no federal or state listing. This species blooms from March to May and ranges in elevation from 3,609 to 8,875 feet (1,100–2,705 meters) amsl. It is typically found growing on carbonate substrate in Mojavean desert scrub and chenopod scrub. Lincoln rockcress hybridizes with perennial rockcress (*B. perennans*) and reflexed rockcress (*B. retrofracta*).

In California, this species is known from less than 20 occurrences, many of them dating more than 20 years ago. There is no record of Lincoln rockcress within 1 mile of the PSA, but there is one occurrence within 5 miles of the PSA. This species was not observed during previous plant surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Parish's Rockcress (*Boechera parishii*)

Parish's rockcress is a San Bernardino County endemic and has a CNPS rare plant rank of 1B.2. This species has no federal or state listing. Parish's rockcress is a perennial herb that blooms between April and May. It is often associated with rocky substrates consisting of quartzite on clay or sometimes carbonate. This species in known only from the San Bernardino Mountains and grows at elevations ranging from 5,807 to 9,810 feet (1,770–2,990 meters) amsl. It can be found growing in pinyon and juniper woodlands, pebble plains, and upper montane coniferous forests. Parish's rockcress is threatened by vehicles, carbonate mining, development, grazing, trampling, non-native plants, road construction, and possibly by illegal dumping.

There are no records of Parish's rockcress within 1 mile of the PSA; however, there are eight previous occurrences within 5 miles of the PSA. This species was not observed during previous plant surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Shockley's Rockcress (*Boechera shockleyi*)

Shockley's rockcress is a perennial herb that can be found in pinyon and juniper woodland habitats in California, Nevada, and Utah. It has a CNPS rare plant rank of 2.2 and has no federal or state listing. This species blooms from May through June and is found at elevations ranging from 2,871 to 7,579 feet (875–2,310 meters) amsl. Shockley's rockcress is associated with

carbonate and quartzite substrates in rocky and gravelly areas. This species is threatened by mining and vehicles.

There are three records of Shockley's rockcress within 1 mile of the PSA and nine total occurrences within a 5-mile radius of the PSA. This species was not observed during previous plant surveys; however, this species may occur within the PSA due to the presence of potential suitable soils and habitat.

Palmer's Mariposa Lily (*Calochortus palmeri* var. *palmeri*)

Palmer's mariposa lily is a California endemic with a CNPS rare plant rank of 1B.2. It is not federally or state listed. This species is a perennial bulbiferous herb that blooms from April through July. It is typically found growing in mesic areas in habitats such as chaparral, lower montane coniferous forests, and meadows and seeps. This species ranges from 3,281 to 7,841 feet (1,000–2,390 meters) amsl. Palmer's mariposa lily is threatened by development, grazing, non-native plants, recreational activities, and vehicles.

There is no record of Palmer's mariposa lily within 1 mile of the PSA, but there are four occurrences within a 5-mile radius of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Alkali Mariposa Lily (*Calochortus striatus*)

Alkali mariposa lily is not state or federally listed, but it does have a CNPS 1B.2 rare plant rank. This species is a perennial bulbiferous herb that blooms from April to June and occurs between 231 and 5,260 feet (70–1595 meters) amsl. Alkali mariposa lily is typically associated with mesic, alkaline soils of chaparral, chenopod scrub, Mojavean desert scrub, and meadows and seeps. This species is threatened by urbanization, grazing, trampling, road construction, hydrological alterations, and water diversions that cause dewatering.

There are no records of this species within 1 mile of the PSA; however, two records were identified within the 5-mile CNDDB query. This species was not observed during previous surveys; however, due to the presence of potentially suitable habitat, this species may occur within the PSA.

Ash-Gray Paintbrush (*Castilleja cinerea*)

Ash-gray paintbrush is a federally threatened San Bernardino County endemic species. It has no state listing, but has a CNPS rare plant rank of 1B.2. Ash-gray paintbrush is a hemiparasitic perennial herb. Host plant species parasitized by ash-gray paintbrush include buckwheat (*Eriogonum sp.*) and sagebrush (*Artemisia sp.*) (USDA 2013). Ash-gray paintbrush blooms from June through August and is found at elevations ranging from 5,906 to 9,711 feet (1,800–2,960 meters) amsl. Ash-gray paintbrush can be found in a variety of habitats, including Mojavean desert scrub, meadows and seeps, pebble plains, pinyon and juniper woodlands, and clay openings in upper montane coniferous forests. This species is threatened by vehicles, development, logging, non-native plants, vegetation and fuels management, mining, recreational activities, road maintenance, and grazing.

There are no records of this species within a 5-mile radius of the PSA, nor was this species observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

San Bernardino Mountains Owl's-Clover (*Castilleja lasiorhyncha*)

San Bernardino Mountains owl's-clover is a California endemic with a CNPS rare plant rank of 1B.2. It is not federally or state listed. This species is a hemiparisitic annual herb that blooms from May through August. It is typically found growing in mesic areas in a variety of habitats, including chaparral, meadows and seeps, pebble plains, riparian woodlands, and upper montane coniferous forest. This species ranges from 4,265 to 7,841 feet (1,300–2,390 meters) amsl. This owl's-clover is threatened by urbanization, illegal dumping, mining, road construction, vegetation and fuel management activities, road maintenance, and recreational activities.

There are no records of San Bernardino Mountains owl's-clover within 1 mile of the PSA; however, there is one occurrence within a 5-mile radius of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Purple-Nerve Cymopterus (*Cymopterus multinervatus*)

Purple-nerve cymopterus is a perennial herb that can be found in many states throughout the southwest United States and into Baja California. It has a CNPS rare plant rank of 2.2 and no federal or state listing. This species bloom from March to April and can be found at elevations ranging from 2,592 to 5,906 feet (790–1,800 meters) amsl. Purple-nerve cymopterus grows on sandy or gravelly substrates in Mojavean desert scrub and pinyon and juniper woodland. This species is threatened by vehicles and possibly threatened by solar energy development and non-native plants.

There are no records of this species within a 5-mile radius of the PSA, nor was this species observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

San Bernardino Mountains Dudleya (*Dudleya abramsii* ssp. *affinis*)

San Bernardino Mountains dudleya is endemic to San Bernardino County. It has a CNPS rare plant rank of 1B.2 and no state or federal listing. This species is a perennial herb that blooms from April to July. It is typically found in upper montane coniferous forests, pebble plains, and pinyon and juniper woodlands at elevation ranging from 4,101 to 8,530 feet (1,250–2,600 meters) amsl. It is usually found growing on carbonate, granitic, or quartzite substrates. This species is threatened by development, foot traffic, limestone mining, and vehicles, and possibly threatened by non-native plants and illegal dumping.

There is one record of San Bernardino Mountains dudleya within 1 mile of the PSA. In addition, there are nine occurrences within 5 miles of the PSA. In addition, this species was previously documented by SWBC in 2006 and again by Lilburn Corporation in 2012; therefore, this species is likely to occur within the PSA.

Salina Pass Wild-Rye (*Elymus salina*)

Salina Pass wild-rye is a perennial rhizomatous herb that can be found in California, Arizona, Idaho, and Wyoming. In California, it is only known to occur in Inyo and San Bernardino counties. This species has a CNPS rare plant rank of 2.3 and has no federal or state listing. It blooms from May to June and ranges in elevation from 4,429 to 7,005 feet (1,350–2,135 meters). It is typically found growing on rocky areas in pinyon and juniper woodland.

There are no records of this species within a 5-mile radius of the PSA, nor was this species observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Big Bear Valley Sandwort (*Eremogone ursine*)

Big Bear Valley sandwort is a federally threatened San Bernardino County endemic species. It has no state listing, but has a CNPS rare plant rank of 1B.2. Big Bear Valley sandwort is a perennial herb that blooms from May through August and is found at elevations ranging from 5,906 to 9,514 feet (1,800–2,900 meters) amsl. San Bernardino Valley sandwort is known only from the vicinity of Big Bear and Baldwin lakes. This species can be found growing in mesic, rocky areas in a variety of habitats, including meadows and seeps, pebble plains, and pinyon and juniper woodlands. This species is threatened by vehicles, development, grazing, foot traffic, road maintenance, mining, illegal dumping, recreational activities, fire suppression activities, and trampling.

There are no records of Big Bear Valley sandwort within 1 mile of the PSA; however, there are two occurrences within a 5-mile radius of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Parish's Daisy (*Erigeron parishii*)

Parish's daisy is a federally threatened California endemic that can be found in Riverside and San Bernardino counties. It has no state listing, but has a CNPS rare plant rank of 1B.1. This species is a perennial herb that blooms from May through August and is found at elevations ranging from 2,625 to 6,562 feet (800–2,000 meters) amsl. This species is associated with carbonate and sometimes granitic substrates. It can be found in Mojavean desert scrub and pinyon and juniper woodlands. This species is threatened by carbonate mining, vehicles, road construction, and residential development.

There is one record of Parish's daisy within 1 mile of the PSA and three occurrences within a 5-mile radius of the PSA. In addition, this species was previously documented on the project site by SWBC in 2006 and again by Lilburn Corporation in 2012.

Vanishing Wild Buckwheat (*Eriogonum evanidum*)

Vanishing wild buckwheat is an annual herb found in California and Baja California. This species has a CNPS rare plant rank of 1B.1, but has no federal or state listing. It blooms from July to October and ranges in elevation from 3,609 to 7,300 feet (1,100–2,225 meters). It is typically found growing on sandy or gravelly substrates in a variety of habitats, including chaparral, cismontane woodland, lower montane coniferous forest, and pinyon and juniper woodland. This species is threatened by development, foot traffic, grazing, recreational activities, and vehicles, and possibly by alteration of fire regimes and non-native plants.

There are no records of this species within a 5-mile radius of the PSA, nor was this species observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Cushenbury Buckwheat (*Eriogonum ovalifolium* var. *vineum*)

Cushenbury buckwheat is a federally endangered San Bernardino County endemic species. It has not state listed, but has a CNPS rare plant rank of 1B.1. This species is a perennial herb that

blooms from May through August and is found at elevations ranging from 4,593 to 8,005 feet (1,400–2,440 meters) amsl. This species is associated with carbonate substrate and can be found in Mojavean desert scrub, Joshua tree woodland, and pinyon and juniper woodlands. This species is threatened by mining, vehicles, and road construction.

There are three records of Cushenbury buckwheat within 1 mile of the PSA and eight occurrences within a 5-mile radius of the PSA. In addition, this species was previously documented by SWBC in 2006 and again by Lilburn Corporation in 2012.

Parish's Alumroot (*Heuchera parishii*)

Parish's alumroot is a California endemic with a CNPS rare plant rank of 1B.3. It is not federally or state listed. This species is a perennial rhizomatous herb that blooms from June through August. It is typically found growing rocky, sometimes carbonate, substrate. Parish's alumroot grows in a variety of habitats, including alpine boulder and rock fields, subalpine coniferous forests, and upper and lower montane coniferous forests. This species ranges from 4,921 to 12,467 feet (1,500–3,800 meters) amsl. Parish's alumroot is possibly threatened by recreational activities and mining.

There is one record of Parish's alumroot within 1 mile of the PSA and four occurrences within a 5-mile radius of the PSA. In addition, this species was documented on-site by SWBC in 2006; however, subsequent surveys conducted by Lilburn Corporation in 2012 did not document this species. Due to the presence of suitable habitat and previous occurrences on and in the immediate vicinity of the PSA, this species may occur within the PSA.

Lemon Lily (*Lilium parryi*)

Lemon lily is a perennial bulbiferous herb found in California, Arizona, and Sonora, Mexico. This species has a CNPS rare plant rank of 1B.2, but has no federal or state listing. It blooms from July to August and ranges in elevation from 4,003 to 9,006 feet (1,220–2,745 meters) amsl. It is typically found growing in mesic areas in habitats such as meadows and seeps, riparian forests, and upper and lower montane coniferous forests. This species is threatened by horticultural collecting, water diversion, recreational activities, and grazing.

There are no records of lemon lily within 1 mile of the PSA; however, there are two occurrences within a 5-mile radius of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Short-Sepaled Lewisia (*Lewisia brachycalyx*)

Short-sepaled lewisia is a perennial herb that can be found in many states throughout the southwest United States and into Baja California. In California, its distribution is limited to San Bernardino and San Diego counties. Short-sepaled lewisia has a CNPS rare plant rank of 2.2 and no federal or state listing. This species blooms from February through July and can be found at elevations ranging from 4,495 to 7,546 feet (1,370–2,300 meters) amsl. Short-sepaled lewisia grows in mesic areas in lower montane coniferous forest and in meadows and seeps. This species is threatened by vehicles and recreational activities.

There are no records of this species within a 5-mile radius of the PSA, nor was this species observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

San Bernardino Mountains Monkeyflower (*Mimulus exiguus*)

San Bernardino Mountains monkeyflower is an annual herb that can be found in California and Baja California. In California, its distribution is limited to San Bernardino County. It has a CNPS rare plant rank of 1B.2 and no federal or state listing. This species blooms from May through July and can be found at elevations ranging from 5,906 to 7,595 feet (1,800–2,315 meters) amsl. This species grows in clay soils in mesic areas in upper montane coniferous forest, pebble plains, and meadows and seeps. This species is threatened by development, mining, recreational activities, and vehicles.

There is no record of this species within 1 mile of the PSA, but there is one occurrence within 5 miles of the PSA. This species was not observed during previous plant surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Mojave Monkeyflower (*Mimulus mohavensis*)

Mojave monkeyflower is an annual herb endemic to San Bernardino County. It has a CNPS rare plant rank of 1B.2 and no federal or state listing. This species blooms from April to June and can be found at elevations ranging from 1,969 to 3,937 feet (600–1,200 meters) amsl. Mojave monkeyflower grows on sandy or gravelly substrates, often in washes. It can be found in Joshua tree woodland and Mojavean desert scrub. This species is threatened by development, mining, non-native plants, solar and wind energy projects, and vehicles.

There are no records of this species within a 5-mile radius of the PSA; however, this species was returned in the CNPS query, and suitable habitat is present within the PSA.

Little Purple Monkeyflower (*Mimulus purpureus*)

Little purple monkeyflower is an annual herb found in California and Baja California. In California, its distribution is limited to San Bernardino and Riverside counties. Little purple monkeyflower has a CNPS rare plant rank of 1B.2 and no federal or state listing. This species blooms from May to June and can be found at elevations ranging from 6,234 to 7,546 feet (1,900–2,300 meters) amsl. Little purple monkeyflower can be found growing in meadows and seeps, pebble plains, and upper montane coniferous forests. This species is threatened by development, mining, recreational activities, vegetation and fuel management, and vehicles.

Little purple monkeyflower is known in California from approximately 20 occurrences; one of these is within a 5-mile radius of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Baja Navarretia (*Navarretia peninsularis*)

Baja naverretia is an annual herb found in California and Baja California. It has a CNPS rare plant rank of 1B.2 and no federal or state listing. This species blooms from June to August and can be found at elevations ranging from 4,921 to 7,546 feet (1,500–2,300 meters) amsl. Baja navarretia can be found growing in mesic areas in meadows and seeps, openings in chaparral, lower montane coniferous forests, and pinyon and juniper woodlands. This species is threatened by gold panning and vehicles.

There is one record of Baja navarretia within a 5-mile radius of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Parish's Yampah (*Perideridia parishsii* ssp. *parishii*)

Parish's yampah has a CNPS rare plant rank of 2.B.2. This is a perennial herb that blooms from June to August and can be found at elevations ranging from 4,834 to 9,900 feet (1,465–3,000 meters) amsl. Parish's yampah is typically associated with lower montane coniferous forests, meadows, seeps, and upper montane coniferous forests. This species is threatened by development, fire suppression, foot traffic, hydrological alterations, non-native plants, road maintenance, vehicles, and water diversions.

There is one record of Parish's yampah within a 5-mile radius of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

San Bernardino Mountain Bladderpod (*Physaria kingii* ssp. *bernardina*)

San Bernardino Mountains bladderpod is a federally endangered San Bernardino County endemic species. It is not state listed, but has a CNPS rare plant rank of 1B.1. This species is a perennial herb that blooms from May through June and is found at elevations ranging from 6,070 to 8,858 feet (1,850–2,700 meters) amsl. This species is associated with carbonate substrate and can be found in lower montane coniferous forests, subalpine coniferous forests, and pinyon and juniper woodlands. This species is threatened by development, mining, recreational activities, vegetation and fuel management, and vehicles.

This species is known from less than ten occurrences in the Big Bear Valley area. There are no records of San Bernardino Mountain bladderpod within 5 miles of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

San Bernardino Bluegrass (*Poa atropurpurea*)

San Bernardino bluegrass is a federally endangered California endemic species. In California, its distribution is limited to San Bernardino and San Diego counties. It is not state listed, but has a CNPS rare plant rank of 1B.2. This species is a perennial rhizomatous herb that blooms from April to August and is found at elevations ranging from 4,462 to 8,055 feet (1,360–2,455 meters) amsl. This species is associated with mesic meadows and seeps. San Bernardino bluegrass is threatened by development, grazing, hydrological alterations, mining, recreational activities, and vehicles. Another potential threat is hybridization with non-native Kentucky bluegrass (*Poa pratensis*).

There are no records of San Bernardino bluegrass within 5 miles of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Parish's Alkali Grass (*Puccinellia parishii*)

Parish's alkali grass is not state or federally listed; however, it does have a CNPS 1B.1 rare plant rank. This species blooms from April to May and can be found at elevations ranging from 2,310 to 3,330 feet (700–1,000 meters) amsl. Parish's alkali grass is found growing in meadows, seeps, and alkaline springs and is known in California from one occurrence at Rabbit Spring confirmed in 1992. This species is threatened by groundwater pumping, flood control, and trampling.

No records of this species were returned in the CNDDB query; however, it was identified in the CNPS query. In addition, Parish's alkali grass was not identified during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Bear Valley Pyrrocoma (*Pyrrocoma uniflora* var. *gossypina*)

Bear Valley pyrrocoma is a perennial herb endemic to San Bernardino County. It has a CNPS rare plant rank of 1B.2 and no federal or state listing. This species blooms from July to September and can be found at elevations ranging from 5,249 to 7,546 feet (1,600–2,300 meters) amsl. Bear Valley pyrrocoma is found growing in meadows and seeps and pebble plains. This species is threatened by grazing, development, non-native plants, recreational activities, trampling, and vehicles.

Bear Valley pyrrocoma is known from fewer than 20 occurrences. There are no records of this species within 5 miles of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Latimer's Woodland Gilia (*Saltugilia latimeri*)

Latimer's woodland gilia is an annual herb endemic to California. Its distribution is limited to Inyo, Kern, Riverside, and San Bernardino counties. Latimer's woodland gilia has a CNPS rare plant rank of 1B.2 and no federal or state listing. This species blooms from March to June and can be found at elevations ranging from 1,312 to 6,234 feet (400–1,900 meters) amsl. It is associated with rocky or sandy areas, often in washes and often on granitic substrates. Latimer's woodland gilia is found growing in chaparral, Mojavean desert scrub, and pinyon and juniper woodland.

Latimer's woodland gilia is known from fewer than 20 occurrences and there have been very few recent collections. There is one record of this species within 1 mile of the PSA and no additional occurrences within 5 miles. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Bear Valley Checkerbloom (*Sidalcea malviflora* ssp. *dolosa*)

Bear Valley checkerbloom is a perennial herb endemic to San Bernardino County. It has a CNPS rare plant rank of 1B.2 and no federal or state listing. This species blooms from May to August and can be found at elevations ranging from 4,905 to 8,809 feet (1,495–2,685 meters) amsl. It can be found in a variety of habitats, including meadows and seeps, riparian woodlands, and meadows and seeps in upper and lower montane coniferous forests. Bear Valley checkerbloom is threatened by hydrological alterations, water diversions, and vehicles. In addition, it is possibly threatened by development, recreational activities, and foot traffic.

Bear Valley checkerbloom is known from fewer than 20 occurrences, all within the San Bernardino Mountains. There are no records of this species within 5 miles of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Bird-Foot Checkerbloom (*Sidalcea pedata*)

Bird-foot checkerbloom is a federally and state endangered species endemic to San Bernardino County. This species is a perennial rhizomatous herb with a CNPS rank of 1B.1. It blooms from May to August and is found at elevations ranging from 5,249 to 8,202 feet (1,600–2,500 meters) amsl. This species is associated with pebble plains and mesic meadows and seeps. Bird-foot checkerbloom is threatened by development, erosion, foot traffic, grazing, illegal dumping, non-native plants, and vehicles.

There are no records of this species within 5 miles of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Southern Jewel-Flower (*Streptanthus campestris*)

Southern jewel-flower is a perennial herb found in California and Baja California. It has a CNPS rare plant rank of 1B.3 and no federal or state listing. This species blooms from April through July and can be found at elevations ranging from 2,953 to 7,546 feet (900–2,300 meters) amsl. It can be found on rocky substrate in chaparral, lower montane coniferous forests, and pinyon and juniper woodlands.

There are no records of this species within 5 miles of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

San Bernardino Aster (*Symphyotrichum defoliatum*)

San Bernardino aster is a perennial rhizomatous herb found in endemic to California. It has a CNPS rare plant rank of 1B.2 and no federal or state listing. This species blooms from July to November and can be found at elevations ranging from 7 to 6,693 feet (2–2,040 meters) amsl. It can be found near ditches, streams, and springs, in a variety of habitats, including cismontane woodland, coastal scrub, lower montane coniferous forest, meadows and seeps, marshes and swamps, and vernally mesic valley and foothill grasslands.

There is no record of this species within 1 mile of the PSA; however, there is one occurrence within 5 miles of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

California Dandelion (*Taraxacum californicum*)

California dandelion is a federally endangered species endemic to San Bernardino County. This species is a perennial herb with a CNPS rank of 1B.1 and no state listing. It blooms from May to August and is found at elevations ranging from 5,315 to 9,186 feet (1,620–2,800 meters) amsl. This species is associated with mesic meadows and seeps. California dandelion is seriously threatened by development, grazing and trampling, hydrological alterations, mining, vehicles, recreation, and hybridization with non-native common dandelion (*T. officinale*).

There are no records of this species within 5 miles of the PSA. This species was not observed during previous surveys; however, this species may occur within the PSA due to the presence of potential suitable habitat.

Special-Status Wildlife Species

Based on database search results, eight special-status wildlife species have the potential to occur in the PSA. Mule deer and bighorn sheep were also included the analysis because of known occurrences in the vicinity of the PSA. Each species considered in the impact analysis is described below based on the data obtained from various published data sources.

Desert Tortoise (*Gopherus agassizii*)

Desert tortoises are federally and state listed as a threatened species. In California, this species occurs in the Mojave and Sonoran deserts. They are found in a variety of desert habitats and terrains. At lower elevations, they are most common on flats and slopes characterized by creosote bush scrub, and at higher elevations, on rocky slopes characterized by blackbrush scrub or juniper woodlands. Desert tortoises are most often found in areas where there is sparse cover of low-growing shrubs; this allows establishment of an herbaceous layer for food. In

addition, desert tortoises need friable, sandy-gravel soils for burrowing. This species has been found between sea level and 7,300 feet (0–2,225 meters) amsl (USFWS 2011).

Previous focused surveys for desert tortoise did not identify any individuals or their sign (scat, burrows, carcasses, etc.) on or adjacent to the PSA. There are no records of this species within 5 miles of the PSA; however, there are three CNDDB records for this species within 10 miles of the PSA (CDFW 2013a). Due to the presence of suitable habitat for this species in portions of the PSA, there is the potential for this species to be affected by project-related activities.

Coast Horned Lizard (*Phyrnosoma blainvillii*)

The coast horned lizard is a California species of special concern. Typical vegetative associations include valley-foothill hardwood, conifer, and riparian habitat as well as pine-cypress, juniper, and annual grassland. The current known distribution is in the Sierra Nevada foothills from Butte County south to Kern County and throughout the Central and Southern California coast. This species is typically found below 2,000 feet (606 meters) amsl in the north and 3,000 feet amsl in the south; however, the range may extend up to 4,000 feet (1,212 meters) amsl in the Sierra Nevada foothills and 6,000 feet (1,818 meters) in the Southern California mountain ranges.

There are no CNDDB records of this species in proximity to the PSA; however, there are three records within 10 miles. This species was not observed during previous surveys for other species or biological evaluations; however, focused surveys for this species have not been conducted to date. Due to the presence of suitable habitat for this species in portions of the PSA, there is the potential for this species to be affected by project-related activities.

Golden Eagle (*Aquila chrysaetos*)

The golden eagle is a California fully protected species and is federally protected under the Bald and Golden Eagle Protection Act, the Migratory Bird Treaty Act, and the Lacey Act. Golden eagles typically inhabit rolling foothills, mountain areas, sage-juniper flats, and desert habitats from sea level up to 11,500 feet (0–3,484 meters) amsl (CDFW 2013d). Nest sites are typically on cliffs and in large trees in open areas. Although this species is unlikely to use the habitat within the PSA for nesting, it may nest on adjacent lands and use the PSA for foraging.

Focused surveys for this species have not been conducted to date; however, the presence of suitable habitat, the observation of an individual fly-over, and the presence of two CNDDB records within 5 miles and 13 within 10 miles of the project result in the potential for this species to be impacted by project-related activities.

Burrowing Owl (*Athene cunicularia*)

The burrowing owl is a California species of special concern and is federally protected under the Migratory Bird and Treaty Act and as a bird of prey under the Raptor Recovery Act. Burrowing owls prefer nesting in mammal burrows in open areas of dry, open, rolling hills, grasslands, fallow fields, sparsely vegetated desert scrub with gullies, washes, arroyos, and along the edges of human disturbed lands. This species can also be found inhabiting golf courses, airports, cemeteries, vacant lots, and road embankments with friable soils for nesting. The elevation range for this species extends from 200 feet (60 meters) below mean sea level (bmsl) to 12,000 feet (3,636 meters) amsl at the Dana Plateau in Yosemite (Bates 2006).

Focused surveys for this species have not been conducted to date; however, the presence of suitable habitat and the presence of four CNDDB records within 5 miles of the project results in the potential for this species to be impacted by project-related activities.

Le Conte's Thrasher (*Toxostoma lecontei*)

The Le Conte's thrasher is a California species of special concern. This species is a nonmigratory bird this is endemic to California, Nevada, Arizona, Utah, and Mexico. Le Conte's thrashers prefer to nest in thorny shrubs and small desert trees such as prickly pear (*Opuntia* spp.), saltbush (*Atriplex* spp.), and yuccas (including small Joshua trees and mesquites (*Prosopis* spp.). The elevation range for this species extends from 267 feet (81 meters) bmsl in Inyo County to 4,950 feet (1,500 meters) amsl or higher in the Mojave Desert (Weigand and Fitton 2008).

Focused surveys for this species have not been conducted to date. The presence of suitable habitat, along with the presence of eight CNDDB records within 5 miles and 18 within 10 miles of the project result in the potential for this species to be impacted by project-related activities.

Pallid San Diego Pocket Mouse (*Chaetodipus fallax pallidus*)

The pallid San Diego pocket mouse is a California species of special concern. Habitats typically associated with this species include coastal scrub, chamise-redshank chaparral, mixed chaparral, sagebrush, desert wash, desert scrub, desert succulent shrub, pinyon-juniper, and annual grassland. The elevation range for this species is from sea level up to 4,500 feet (1,350 meters) amsl in the Santa Rosa Mountains and Riverside County, and 6,000 feet (1,800 meters) amsl at Cactus Flat on the north slope of the San Bernardino Mountains (CDFW 2013d).

Focused surveys for this species have not been conducted to date. The presence of suitable habitat and the presence of three CNDDB records within 5 miles of the project result in the potential for this species to be impacted by project-related activities.

Townsend's Big-Eared Bat (*Corynorhinus townsendii*)

The Townsend's big-eared bat is a California species of special concern. This species is broadly distributed across California in subalpine and alpine habitats. Caves, mines, tunnels, buildings, or other human-made structures are required for roosting, and separate sites for night, day, hibernation, or maternity roosts may be used. Hibernation sites are cold, but not below freezing, while maternity roosts are warm. This species is extremely sensitive to disturbance of roosting sites, and all known nursery colonies in limestone caves in California have apparently been abandoned (CDFW 2013d).

Focused surveys for this species have not been conducted to date. The presence of suitable habitat and the presence of one CNDDB record within 5 miles of the project result in the potential for this species to be impacted by project-related activities.

Western Mastiff Bat (*Eumops perotis californicus*)

The western mastiff bat is a California species of special concern and an uncommon resident in the southeastern San Joaquin Valley, in the Coastal Ranges from Monterey County south to Southern California, and from the coast east to the Colorado Desert. This species is typically associated with semi-arid habitats, including conifer and deciduous woodlands, coastal scrub, annual and perennial grasslands, palm oases, chaparral, desert scrub, and urban habitats. Western mastiff bats prefer crevices in cliff faces, high buildings, trees, and tunnels for roosting; and when roosting in rock crevices, vertical faces are required to drop off and take flight (CDFW 2013d).

Focused surveys for this species have not been conducted to date. The presence of suitable habitat and the presence of one CNDDB record within 10 miles of the project result in the potential for this species to be impacted by project-related activities.

Mule Deer (*Odocoileus hemionus*)

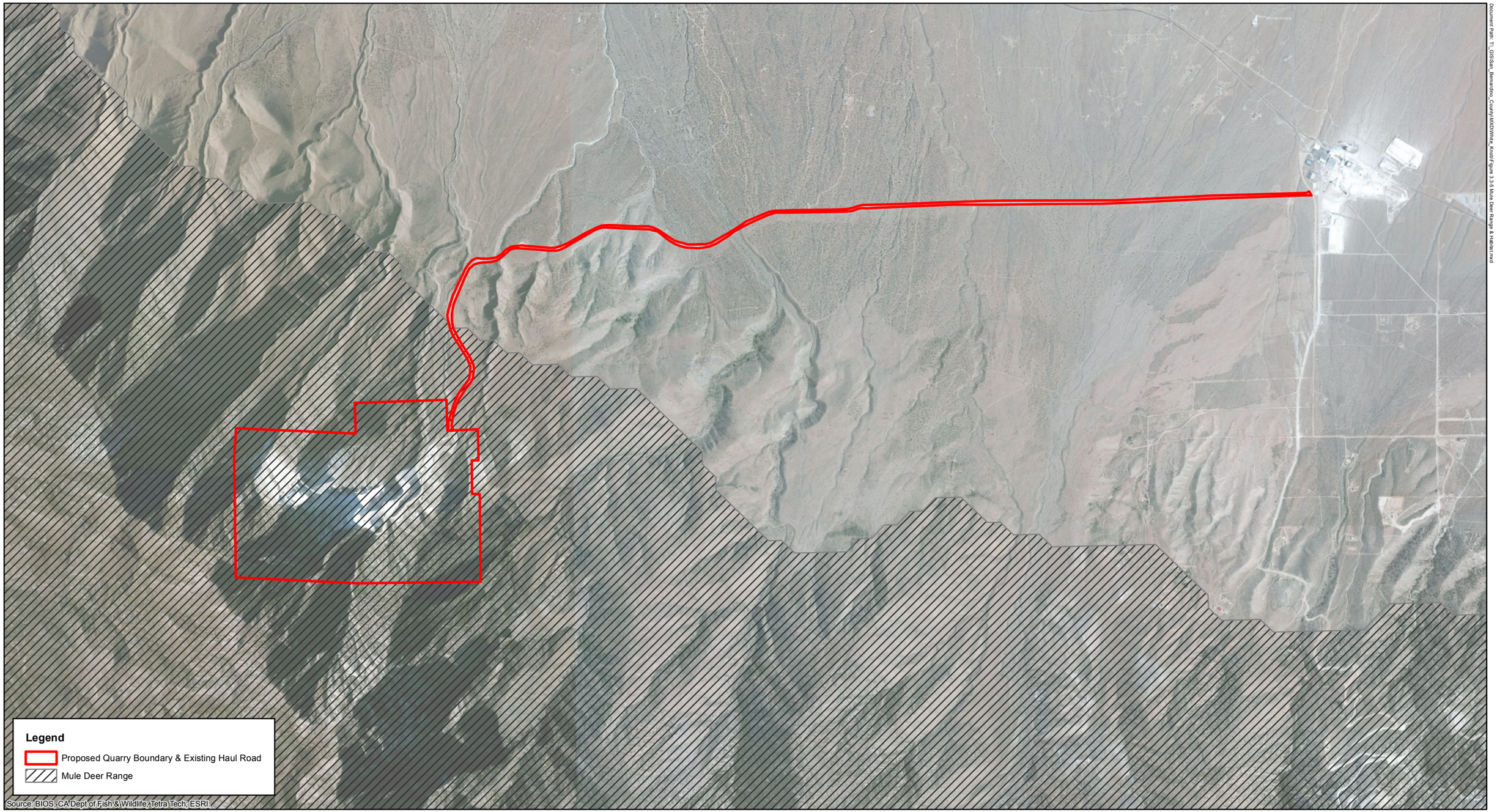
Mule deer are common, yearlong residents or elevational migrants with a widespread distribution in California, except in deserts and intensively farmed areas without cover. This species occurs along major river corridors in the Central Valley and in scattered desert mountain areas. Mule deer prefer a mosaic of early to intermediate successional stages of forest, woodland, and brush habitats that provide woody cover, meadow and shrubby openings, and water sources. Fawning occurs in moderately dense shrublands and forests, dense herbaceous areas, and high-elevation riparian and mountain shrub habitats that contain adequate forage and water. Fawning occurs from early April to midsummer and varies based on snowpack conditions (CDFW 2013d).

The PSA is located on the edge of the range for this species (**Figure 3.3-5**), and no individuals have been documented on-site; however, the connectivity model developed in *A Linkage Network for the California Deserts* (Penrod et al. 2012) identifies the undisturbed lands surrounding the PSA as "core" habitat for mule deer. This data is available via the Mule Deer Connectivity Modeling for the California Desert Linkage Network [ds829] layer on the CDFW BIOS 5 Viewer (2013c). As a result, there is the potential for this species to occur in the vicinity of the PSA.

Bighorn Sheep (*Ovis canadensis*)

Bighorn sheep are mostly uncommon in California and use alpine dwarf-shrub, low sage, sagebrush, bitterbrush, pinyon-juniper, palm oasis, desert riparian, desert succulent shrub, desert scrub, subalpine conifer, perennial grassland, montane chaparral, and montane riparian habitats. This species grazes all year on a wide variety of plant species but prefers green, succulent grasses and forbs in open habitats such as rocky barrens, meadows, and low sparse brushlands. Steep, rocky terrain is use as escape habitat and for bedding. In addition, steep, rugged slopes and canyons are used by this species as lambing areas (CDFW 2013d).

The PSA is located within the range for this species, and the connectivity model identifies the PSA and surrounding habitats as patch habitat (Pernod et al. 2012). These data are available via the Bighorn Sheep Connectivity Modeling for the California Desert Linkage Network [ds828] layer on the CDFW BIOS 5 Viewer (CDFW 2013c) The PSA may be used by bighorn sheep rarely during exploratory/breeding movements; however, it falls outside the known home range of bighorn sheep on the north slope of the San Bernardino Mountains (Jeff Villepique, pers. comm.)

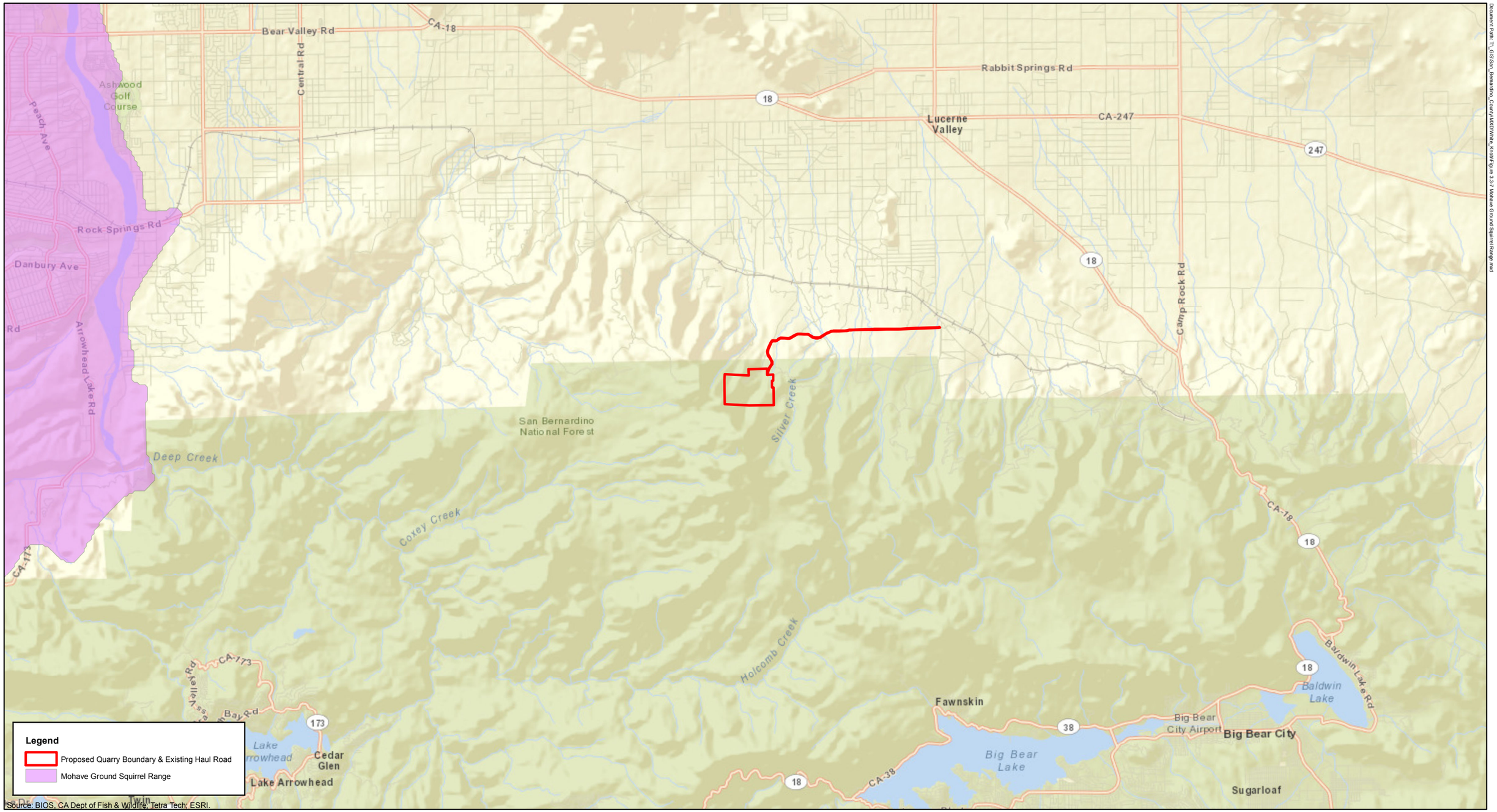


Document Path: T:_GIS\San_Bernardino_County\MXD\White_Knob\Figure 3.3-5 Mule Deer Range & Habitat.mxd

Figure 3.3-5

Mule Deer Range

PMC



Document Path: T:_GIS\San_Bernardino_County\MXD\White_Knob\Figure 3.3-7 Mohave Ground Squirrel Range.mxd

Figure 3.3-6

Mohave Ground Squirrel Range

3.3.2 REGULATORY FRAMEWORK

This section identifies environmental review and consultation requirements, as well as permits and approvals that must be obtained from local, state, and federal agencies before implementation of the project.

FEDERAL

Endangered Species Act

The Endangered Species Act of 1973 (ESA), as amended, provides protective measures for federally listed threatened and endangered species, including their habitats, from unlawful take (16 United States Code (USC) Sections 1531–1544). The ESA defines "take" to mean "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Title 50, Part 222, of the Code of Federal Regulations (50 CFR Section 222) further defined "harm" to include "an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including feeding, spawning, rearing, migrating, feeding, or sheltering."

ESA Section 7(a)(1) requires federal agencies to utilize their authority to further the conservation of listed species. ESA Section 7(a)(2) requires consultation with the USFWS or the National Marine Fisheries Service (NMFS) if a federal agency undertakes, funds, permits, or authorizes (termed the federal nexus) any action that may affect endangered or threatened species, or designated critical habitat. For projects that may result in the incidental "take" of threatened or endangered species, or critical habitat, and that lack a federal nexus; a Section 10(a)(1)(b) incidental take permit can be obtained from the USFWS and/or the NMFS.

Clean Water Act

The basis of the Clean Water Act (CWA) was established in 1948; however, it was referred to as the Federal Water Pollution Control Act. The act was reorganized and expanded in 1972 (33 USC Section 1251), and at this time the Clean Water Act became the act's commonly used name. The basis of the CWA is the regulation of pollutant discharges into waters of the United States, as well as the establishment of surface water quality standards.

Section 404

CWA Section 404 (33 USC Section 1344) established the program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Under this regulation, certain activities proposed within waters of the United States require the obtainment of a permit prior to initiation. These activities include, but are not limited to, placement of fill for the purposes of development, water resource projects (e.g., dams and levees), infrastructure development (e.g., highways and bridges), and mining operations.

The primary objective of this program is to ensure that the discharge of dredged or fill material is not permitted if a practicable alternative to the proposed activities exists that results in less waters of the United States or the proposed activity would result in significant adverse impacts on these waters. To comply with these objectives, a permittee must document the measures taken to avoid and minimize impacts on waters of the United States and provide compensatory mitigation for any unavoidable impacts.

The U.S. Environmental Protection Agency (EPA) and the USFWS are assigned roles and responsibilities in the administration of this program; however, the USACE is the lead agency in the administration of day-to-day activities, including issuance of permits. The agencies will typically assert jurisdiction over the following waters: (1) traditional navigable waters (TNW); (2) wetlands adjacent to TNWs; (3) relatively permanent waters (RPW) that are non-navigable tributaries to TNWs and have relatively permanent flow or seasonally continuous flow (typically three months); and (4) wetlands that directly abut RPWs. Case-by-case investigations are usually conducted by the agencies to ascertain their jurisdiction over waters that are non-navigable tributaries and do not contain relatively permanent or seasonal flow, wetlands adjacent to the aforementioned features, and wetlands adjacent to but not directly abutting RPWs (USACE 2007). Jurisdiction is not generally asserted over swales or erosional features (e.g., gullies or small washes characterized by low-volume/short-duration flow events) or ditches constructed wholly within and draining only uplands that do not have relatively permanent flows.

The extent of jurisdiction within waters of the United States, which lack adjacent wetlands, is determined by the ordinary high water mark (OHWM). The OHWM is defined in 33 CFR Section 328.3(e) as the "line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas." Wetlands are further defined under 33 CFR Section 328.3 and 40 CFR Section 230.3 as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions"; and typically include "swamps, marshes, bogs, and similar areas." The 1987 *Corps of Engineers Wetland Delineation Manual* (1987 Manual) sets forth a standardized methodology for delineating the extent of wetlands under federal jurisdiction (USACE 1987).

The 1987 Manual outlines three parameters that all wetlands, under normal circumstances, must contain positive indicators for to be considered jurisdictional. These parameters include (1) wetland hydrology, (2) hydrophytic vegetation, and (3) hydric soils (USACE 1987). In 2006, the USACE issued a series of Regional Supplements to address regional differences that are important to the functioning and identification of wetlands. The supplements present "wetland indicators, delineation guidance, and other information" that is specific to the region. The USACE requires that wetland delineations submitted after June 5, 2007, be conducted in accordance with both the 1987 Manual and the applicable supplement.

Section 401

Under CWA Section 401 (33 USC Section 1341), federal agencies are not authorized to issue a permit and/or license for any activity that may result in discharges to waters of the United States, unless a state or tribe where the discharge originates either grants or waives CWA Section 401 certification. CWA Section 401 provides states or tribes with the ability to grant, grant with conditions, deny, or waive certification. Granting certification, with or without conditions, allows the federal permit/license to be issued and remain consistent with any conditions set forth in the CWA Section 401 certification. Denial of the certification prohibits the issuance of the federal license or permit, and waiver allows the permit/license to be issued without state or tribal comment. Decisions made by states or tribes are based on the proposed project's compliance with EPA water quality standards as well as applicable effluent limitations guidelines, new source performance standards, toxic pollutant restrictions, and any other appropriate requirements of state or tribal law. In California, the State Water Resources Control Board is the primary regulatory authority for CWA Section 401 requirements (additional details below).

Migratory Bird Treaty Act

Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) of 1918 (16 USC Sections 703–711). The MBTA makes it unlawful to take, possess, buy, sell, purchase, or barter any migratory bird listed in 50 CFR Section 10, including feathers or other parts, nests, eggs, or products, except as allowed by implementing regulations (50 CFR Section 21). The majority of birds found in the project vicinity would be protected under the MBTA.

Bald and Golden Eagle Protection Act

The bald eagle and golden eagle are federally protected under the Bald and Golden Eagle Protection Act (16 USC Sections 668–668c). Under the act, it is illegal to take, possess, sell, purchase, barter, offer to sell or purchase or barter, transport, export, or import at any time or in any manner a bald or golden eagle, alive or dead; or any part, nest or egg of these eagles unless authorized by the Secretary of the Interior. Violations are subject to fines and/or imprisonment for up to one year. Active nest sites are also protected from disturbance during the breeding season.

Executive Order 13112 – Invasive Species

This executive order directs all federal agencies to refrain from authorizing, funding, or carrying out actions or projects that may spread invasive species. The order further directs federal agencies to prevent the introduction of invasive species, control and monitor existing invasive species populations, restore native species to invaded ecosystems, research and develop prevention and control methods for invasive species, and promote public education on invasive species. As part of the proposed action, the USFWS and the USACE would issue permits and therefore would be responsible for ensuring that the proposed action complies with Executive Order 13112 and does not contribute to the spread of invasive species.

Fish and Wildlife Coordination Act of 1958 (16 USC 661 et seq.)

The Fish and Wildlife Coordination Act requires that whenever any body of water is proposed or authorized to be impounded, diverted, or otherwise controlled or modified, the lead federal agency must consult with the USFWS, the state agency responsible for fish and wildlife management, and the National Marine Fisheries Service. Section 662(b) of the act requires the lead federal agency to consider the recommendations of the USFWS and other agencies. The recommendations may include proposed measures to mitigate or compensate for potential damages to wildlife and fisheries associated with a modification of a waterway.

Executive Order 11990 Protection of Wetlands (42 FR 26961, May 25, 1977)

Executive Order 11990 requires federal agencies to provide leadership and take action to minimize destruction, loss, or degradation of wetlands and to preserve and enhance the natural qualities of these lands. Federal agencies are required to avoid undertaking or providing support for new construction located in wetlands unless (1) no practicable alternative exists and (2) all practical measures have been taken to minimize harm to wetlands.

STATE

California Endangered Species Act

Under the California Endangered Species Act (CESA), the CDFW has the responsibility for maintaining a list of endangered and threatened species (FGC Section 2070). The CDFW also maintains a list of "candidate species," which are species formally noticed as being under review for potential addition to the list of endangered or threatened species, and a list of "species of special concern," which serve as a species "watch lists."

Pursuant to the requirements of the CESA, an agency reviewing a proposed project within its jurisdiction must determine whether any state-listed endangered or threatened species may be present and determine whether the proposed project will have a potentially significant impact on such species. In addition, the CDFW encourages informal consultation on any proposed project that may impact a candidate species.

Project-related impacts on species on the CESA endangered or threatened list would be considered significant. State-listed species are fully protected under the mandates of the CESA. "Take" of protected species incidental to otherwise lawful management activities may be authorized under FGC Section 206.591. Authorization from the CDFW would be in the form of an incidental take permit.

California Fish and Game Code

Streambed Alteration Agreement (FGC Sections 1600–1607)

State and local public agencies are subject to FGC Section 1602, which governs construction activities that will substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake designated as waters of the state by the CDFW. Under FGC Section 1602, a discretionary Streambed Alteration Agreement must be issued by the CDFW to the project proponent prior to the initiation of construction activities within lands under CDFW jurisdiction. As a general rule, this requirement applies to any work undertaken within the 100-year floodplain of a stream or river containing fish or wildlife resources.

Native Plant Protection Act

The Native Plant Protection Act (FGC Sections 1900–1913) prohibits the taking, possessing, or sale within the state of any plants with a state designation of rare, threatened, or endangered (as defined by the CDFW). An exception in the act allows landowners, under specified circumstances, to take listed plant species, provided that the owners first notify the CDFW and give that state agency at least 10 days to retrieve the plants before they are plowed under or otherwise destroyed (FGC Section 1913). Project impacts on these species are not considered significant unless the species are known to have a high potential to occur within the area of disturbance associated with construction of the proposed project.

Birds of Prey

Under FGC Section 3503.5, it is unlawful to take, possess, or destroy any birds in the orders Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto.

"Fully Protected" Species

California statutes also afford "fully protected" status to a number of specifically identified birds, mammals, reptiles, and amphibians. These species cannot be "taken," even with an incidental take permit. FGC Section 3505 makes it unlawful to take "any aigrette or egret, osprey, bird of paradise, goura, numidi, or any part of such a bird. FGC Section 3511 protects from take the following fully protected birds: ((a) golden eagle and (b) southern bald eagle (*Haliaeetus leucocephalus leucocephalus*); . FGC Section 4700 identifies the following fully protected mammals that cannot be taken: (a) bighorn sheep (*Ovis canadensis*), except Nelson bighorn sheep (subspecies *Ovis canadensis nelsoni*); and (b) ring-tailed cat (genus *Bassariscus*);.

California Wetlands and Other Waters Policies

The California Resources Agency and its various departments do not authorize or approve projects that fill or otherwise harm or destroy coastal, estuarine, or inland wetlands. Exceptions may be granted if all of the following conditions are met:

- The project is water-dependent.
- No other feasible alternative is available.
- The public trust is not adversely affected.
- Adequate compensation is proposed as part of the project.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act of 1966 (California Water Code Section 13000 et seq.; CCR Title 23, Chapter 3, Subchapter 15) is the primary state regulation that addresses water quality. The requirements of the act are implemented by the State Water Resources Control Board at the state level and at the local level by the Regional Water Quality Control Board (RWQCB). The RWQCB carries out planning, permitting, and enforcement activities related to water quality in California. The act provides for waste discharge requirements and a permitting system for discharges to land or water. Certification is required by the RWQCB for activities that can affect water quality.

Clean Water Act, Section 401 Water Quality Certification

CWA Section 401 (33 USC Section 1341) requires that any applicant for a federal license or permit, which may result in a pollutant discharge to waters of the United States, obtain a certification that the discharge will comply with EPA water quality standards. The state or tribal agency responsible for issuance of the Section 401 certification may also require compliance with additional effluent limitations and water quality standards set forth in state/tribal laws. In California, the RWQCB is the primary regulatory authority for CWA Section 401 requirements.

The Colorado River RWQCB is responsible for enforcing water quality criteria and protecting water resources in the project area. In addition, the RWQCB is responsible for controlling discharges to surface waters of the state by issuing waste discharge requirements (WDR) or commonly by issuing conditional waivers to WDRs. The RWQCB requires that a project proponent obtain a CWA Section 401 water quality certification for CWA Section 404 permits issued by the USACE. A request for water quality certification (including WDRs) by the RWQCB and an application for a General Permit for Storm Water Discharges Associated with Construction

Activities are prepared and submitted following completion of the CEQA environmental document and submittal of the wetland delineation to the USACE.

Delegated Permit Authority

California has been delegated permit authority for the National Pollutant Discharge Elimination System (NPDES) permit program, including stormwater permits for all areas except tribal lands. Issuance of CWA Section 404 dredge and fill permits remains the responsibility of the USACE; however, the state actively uses its CWA Section 401 certification authority to ensure CWA Section 404 permits are in compliance with state water quality standards.

State Definition of Covered Waters

Under California state law, waters of the state means "any surface water or groundwater, including saline waters, within the boundaries of the state." Therefore, water quality laws apply to both surface water and groundwater. After the U.S. Supreme Court decision in *Solid Waste Agency of Northern Cook County v. US Army Corps of Engineers*, the Office of Chief Counsel of the State Water Resources Control Board released a legal memorandum confirming the state's jurisdiction over isolated wetlands. The memorandum stated that under the California Porter-Cologne Water Quality Control Act (Porter-Cologne), discharges to wetlands and other waters of the state are subject to state regulation, and this includes isolated wetlands. In general, the Board regulates discharges to isolated waters in much the same way as they do for waters of the United States, using Porter-Cologne rather than Clean Water Act authority.

NONGOVERNMENTAL AGENCY

California Native Plant Society

The California Native Plant Society (CNPS) is a nongovernmental agency that classifies native plant species according to current population distribution and threat level in regard to extinction. These data are utilized by the CNPS to create/maintain a list of native California plants that have low numbers, limited distribution, or are otherwise threatened with extinction. This information is published in the *Inventory of Rare and Endangered Vascular Plants of California* (CNPS 2013). Potential impacts on populations of CNPS-listed plants receive consideration under CEQA review.

The following identifies the definitions of the CNPS listings:

List 1A: Plants believed to be extinct

List 1B: Plants that are rare, threatened, or endangered in California and elsewhere

List 2: Plants that are rare, threatened, or endangered in California, but are more numerous elsewhere

All of the plant species on List 1 and 2 meet the requirements of the Native Plant Protection Act Section 1901, Chapter 10, or FGC Section 2062 and Section 2067 and are eligible for state listing. Plants appearing on List 1 or 2 are considered to meet the criteria of CEQA Section 15380, and effects on these species are considered "significant." Classifications for plants on List 3 (plants about which we need more information and/or List 4 (plants of limited distribution), as defined by the CNPS, are not currently protected under state or federal law. Therefore, no detailed descriptions or impact analysis was performed on species with these classifications.

LOCAL

San Bernardino County General Plan

The General Plan includes policies and programs that are intended to guide future development in a way that reduces impacts on biological resources. For example, the General Plan states that in addition to conditions of approval that may be required for specific future development proposals, the County shall establish long-term comprehensive monitoring plans for its role in the protection of native species. In addition, the General Plan contains policy provisions that prohibit land conversion until adequate mitigation is provided to reduce impacts to less than significant in cases where a mitigated negative declaration is used for CEQA compliance. The following is a list of the applicable policies and programs that address biological resources in the county and pertain to the proposed project. These policies are designed to guide future development in a way that lessens impacts on these features. These provisions are discussed in more detail in the impact discussions below.

Policy CO 2.1 The County will coordinate with state and federal agencies and departments to ensure that their programs to preserve rare and endangered species and protect areas of special habitat value, as well as conserve populations and habitats of commonly occurring species, are reflected in reviews and approvals of development programs.

Programs

2. The County shall require the conditions of approval of any land use application to incorporate the County's identified mitigation measures in addition to those that may be required by state or federal agencies to protect and preserve the habitats of the identified species. This measure is implemented through the land use regulations of the County Development Code and compliance with the CEQA, CESA, ESA and related environmental laws and regulations.

Policy CO 2.4 All discretionary approvals requiring mitigation measures for impacts to biological resources will include the condition that the mitigation measures be monitored and modified, if necessary, unless a finding is made that such monitoring is not feasible.

Programs

1. The monitoring program will be designed to determine whether the mitigation measures were implemented and effective.

2. The monitoring program will be funded by the project applicant to ensure compliance with and effectiveness of conditions of approval.

San Bernardino Development Code

Division 2, Land Use Zoning Districts and Allowed Land Uses

Chapter 82.11 (Biotic Resources Overlay) of the Development Code implements General Plan policies regarding the protection and conservation of beneficial rare and endangered plants and animal resources and their habitats, which have been identified within unincorporated

areas of the county. Biotic Resources Overlays are applied to areas that have been identified by a county, state, or federal agency as habitat for species of unique, rare, threatened, or endangered plants or animals or their habitats as listed in the General Plan. When a land use is proposed, or an existing land use is increased by more than 25 percent of disturbed area within a Biotic Resources Overlay, the land use application must include a biotic resources report, which identifies all biotic resources located on the site and those on adjacent parcels that could be impacted by the proposed development. The biotic resources report is also required to identify mitigation measures designed to reduce or eliminate impacts on the identified resources.

Division 8, Resource Management and Conservation

Chapter 88.01 (Plant Protection and Management) provides regulations and guidelines for the management of plant resources in the unincorporated areas of the county on property or combinations of property under private or public ownership. The intent of Chapter 88.01 is to promote plant life within the county through appropriate management techniques, conserve the native plant life heritage, regulate native plant and tree removal activity, protect and maintain local watersheds, and preserve habitats for rare, endangered, or threatened plants and to protect animals with limited or specialized habitats. Chapter 88.01 requires the issuance of a permit prior to the removal of regulated trees and plants.

Carbonate Habitat Management Strategy

The Carbonate Habitat Management Strategy (CHMS) was developed to facilitate limestone mining activity while conserving four federally listed plant species that occur in the northeastern San Bernardino Mountains, almost exclusively on carbonate soils (Olson 2003). The plants covered under the CHMS include Cushenbury buckwheat, Cushenbury milk-vetch, Cushenbury oxytheca, and Parish's daisy. The goal of the CHMS is to streamline compliance with the federal Endangered Species Act for mining activities while building a reserve for carbonate plants that is designed to provide for their long-term survival and recovery. The Carbonate Habitat Management Area (CHMA), for which the CHMS was developed, covers approximately 160,000 acres in the northeast San Bernardino Mountains, including the PSA. A Memorandum of Understanding and Agreement was signed by Omya, the USFS, the BLM, San Bernardino County, Specialty Minerals, Mitsubishi Cement Company, the CNPS, and the Cushenbury Mine Trust to implement the CHMS. A copy of the agreement is included in **EIR Appendix D**.

3.3.3 IMPACTS AND MITIGATION MEASURES

STANDARDS OF SIGNIFICANCE

The impact analysis provided below is based on the following State CEQA Guidelines Appendix G thresholds of significance:

1) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW or the USFWS.

2) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations or by the CDFW or the USFWS.

3) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.

4) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

5) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

6) Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan.

7) Reduce the number or restrict the range of an endangered, rare, or threatened plant or animal species or biotic community, thereby causing the species or community to drop below self-sustaining levels.

METHODOLOGY

The impact assessment below discusses impacts from implementation of project activities. The impact assessment was based on the project description (Chapter 2.0), information described in the environmental setting, and the standards of significance described above. In addition, the impact analysis is organized by the significance criteria noted above: special-status plant and wildlife species, sensitive vegetation communities, federally protected wetlands, wildlife movement corridors, and compliance with local plans and policies, or existing habitat conservation plans. Each impact category includes a description of the specific potential impacts as well as avoidance, minimization, and mitigation measures that can potentially reduce and mitigate potentially significant impacts. The reader is referred to Chapter 2.0, Project Description, for specific details on the project. The impact analysis factors the existing quarry operations with how implementation of the proposed Amended Mine and Reclamation Plan associated with future mining and reclamation.

IMPACTS AND MITIGATION MEASURES

Impacts on Candidate, Sensitive, or Special-Status Species (Standards of Significance 1 and 7)

The species or species groups identified below were determined to have the potential to be significantly impacted by project-related activities, either directly or through habitat modification. Impacts on these species would be considered a **potentially significant** impact.

Special-Status Species

Impact 3.3.1 General mine operation and construction activities could result in substantial adverse effects, either directly or through habitat modifications, to special-status species, which would be considered a **potentially significant** impact.

The day-to-day operations of the project, in addition to the expansion of the mine into undisturbed habitat, have the potential to result in adverse impacts on special-status species through mortality and/or habitat loss. This would be a **potentially significant impact**.

Mitigation Measures

The following mitigation measures are applicable to all project-related activities:

MM 3.3.1a The mine operator shall retain a qualified biologist to conduct mandatory contractor/worker awareness training for project personnel. The awareness training will be provided to all personnel to brief them on the identified location of sensitive biological resources, including how to identify species (visual and auditory) most likely to be present, the need to avoid impacts on biological resources (e.g., plants, wildlife, and jurisdictional waters), and to brief them on the penalties for not complying with biological mitigation requirements. If new personnel are added to the project, the mine operator will ensure that they receive the mandatory training before starting work.

MM 3.3.1b The mine operator shall designate a field contact representative (FCR) responsible for overseeing compliance with protections to special-status species. The FCR shall be on-site during all project activities that could potentially cause significant impacts on sensitive biological resources. The FCR shall have the authority to halt activities that are in violation of the committed measures and non-emergency project-related activities that may endanger special-status species. The FCR shall authorize re-initiation of project activities after the hazards are removed, the species is no longer at risk, or the individual(s) are moved out of harm's way by the qualified biologist.

MM 3.3.1c Project-related vehicles will stay on roads and observe a 25 mile per hour speed limit in all project areas, except on county roads and state and federal highways.

MM 3.3.1d Project-related vehicles shall be checked before moving for wildlife, as wildlife may seek shade and shelter under parked vehicles and construction equipment.

MM 3.3.1e All construction pipes, culverts, or similar structures that are stored on the project site for one or more nights shall be inspected thoroughly for the presence of wildlife before they are used or moved. If wildlife is present, they shall be allowed to move out of the area on their own or moved out of harm's way by a qualified biologist.

MM 3.3.1f Encounters with a special-status wildlife species shall be reported to the FCR and qualified biologist. The qualified biologist shall maintain records of all encounters during the project, the species' condition, location found, and location released.

MM 3.3.1g All food-related trash items such as food wrappers, cans, bottles, and food scraps shall be disposed of in secured, closed containers and removed regularly from the project site.

MM 3.3.1h Fueling of vehicles and equipment shall be prohibited within 100 feet of riparian/riverine areas.

MM 3.3.1i No rodenticides shall be used on the project site.

The following timing/implementation and enforcement/monitoring applies to all of the mitigation measures identified above.

Timing/Implementation: *Prior to and ongoing during quarry operation*

Enforcement/Monitoring: *San Bernardino County Planning Department*

Implementation of the mitigation measures above would reduce potential impacts to a **less than significant** level.

Special-Status Plant Species

Impact 3.3.2 Implementation of project-related activities could result in substantial adverse effects, either directly or through habitat modification, to special-status plant species, which would be considered a **potentially significant** impact.

Suitable habitat for 37 listed plant species occurs within the PSA. In addition, previous focused surveys have identified Cushenbury buckwheat, Cushenbury oxytheca, and Parish's daisy within the PSA; however, the CHMS is designed to mitigate for impacts on these species as well as Cushenbury milk-vetch. In 2003 Omya entered into a Memorandum of Understanding with the US Forest Service, Bureau of Land Management, San Bernardino County, and other private parties, whereby all parties agreed to implement the terms of the CHMS in regard to future mining proposals. Implementation of the CHMS will ensure that impacts on these species are mitigated to a less than significant level.

However, the remaining 33 special-status plant species are not covered by the CHMS and therefore may be adversely impacted by implementation of project-related activities should they be present in areas proposed for disturbance. This impact is considered **potentially significant.**

Mitigation Measures

MM 3.3.2 **Rare Plant Surveys.** Prior to initiating project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to perform focused surveys to determine the presence/absence of special-status plant species with potential to occur in and adjacent to (within 25 feet, where appropriate) the proposed impact area. Species intended to be addressed by this mitigation measure include all species not covered by the CHMS and for which a "may affect" determination was made in **Table 3.3-1**.

These surveys shall be conducted in accordance with the CDFW *Guidelines for Assessing Effects of Proposed Developments on Rare Plants and Plant Communities* (Nelson 1994). These guidelines require that rare plant surveys be conducted at the proper time of year when rare or endangered species are both evident and identifiable. Field surveys shall be scheduled to coincide with known flowering periods and/or during appropriate developmental periods that are necessary to identify the plant species of concern.

If any state- or federally listed, CNPS List 1, or CNPS List 2 plant species are found in or adjacent to (within 25 feet) the proposed impact area during the surveys, these plant species shall be avoided to the extent feasible and the following mitigation measures shall be implemented:

(1) In some cases involving state-listed plants, it may be necessary to obtain an incidental take permit under Section 2081 of the Fish and Game Code (2081 permit). The mine operator shall consult with the CDFW to determine whether a 2081 permit is required and obtain all required authorizations prior to initiation of ground-breaking activities.

(2) Before conducting any ground-breaking activity within the proposed impact area, the mine operator shall submit a mitigation plan concurrently to Land Use Services, the CDFW and the USFWS (if appropriate) for review and comment. The plan shall include mitigation measures for the population(s) to be directly affected. Possible mitigation for impacts on special-status plant species can include implementation of a program to transplant, salvage, cultivate, or re-establish the species at suitable sites (if feasible) or through the purchase of credits from an approved mitigation bank, if available. The actual level of mitigation may vary depending on the sensitivity of the species, its prevalence in the area, and the current state of knowledge about overall population trends and threats to its survival. The final mitigation strategy for directly impacted plant species shall be determined by the CDFW and the USFWS (if appropriate) through the mitigation plan approval process.

(3) Any special-status plant species that are identified within 25-feet of the proposed impact area, but not proposed to be disturbed by the project, shall be protected by barrier fencing to ensure that construction activities and material stockpiles do not impact any special-status plant species. These avoidance areas shall be identified on project plans.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Implementation of mitigation measure **MM 3.3.2** will reduce potential impacts to a **less than significant** level by ensuring that special-status plant species are fully mitigated.

Desert Tortoise

Impact 3.3.3 Implementation of project-related activities could result in substantial adverse effects, either directly or through habitat modification, to desert tortoise. These effects would be considered a **potentially significant** impact.

Previous surveys did not detect desert tortoises or tortoise sign (burrows, scat, carcasses, etc.) on or adjacent to the PSA. In addition, the closest documented occurrence in the region is approximately 7 miles north of the PSA. Nonetheless, suitable habitat exists for this species within the PSA; therefore, this species could potentially inhabit the site, which would result in adverse impacts on desert tortoises should they be present in areas proposed for disturbance. The impact is considered **potentially significant.**

Mitigation Measures

MM 3.3.3a **Desert Tortoise Surveys.** Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a USFWS-

authorized desert tortoise biologist to conduct pre-project surveys in accordance with the USFWS pre-project field survey protocol (2010). If no desert tortoises are identified during pre-project surveys, no further mitigation is required. If individuals or their sign are identified during pre-project surveys, mitigation measure **MM 3.3.3b** shall be implemented.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

MM 3.3.3b **Desert Tortoise Avoidance, Minimization, and Mitigation.** Should occupied desert tortoise habitat be identified during the pre-project surveys, a biological mitigation and monitoring plan shall be developed in consultation with the USFWS and the CDFW. This plan shall describe all measures to be implemented prior to, during, and after construction, including, but not limited to, the following:

(1) All tortoise burrows shall be avoided to the greatest extent feasible, and temporary exclusionary tortoise fencing (1x2-inch mesh hardware cloth) shall be installed at the limits of disturbance prior to initiation of construction activities. Fence installation and ongoing oversight of the need for maintenance shall be monitored by a USFWS-authorized desert tortoise biologist.

(2) Upon completion of fence installation, the authorized biologist shall conduct a clearance survey of the fenced area prior to declaring the construction area free of tortoises.

(3) If it is necessary to excavate a desert tortoise from its burrow to move it out of harm's way, excavation shall be done with hand tools, either by or under the direct supervision of the authorized biologist.

(4) Desert tortoises removed from burrows shall be placed in an unoccupied burrow of approximately the same size as the one from which they were removed. If an existing burrow is not available, the authorized biologist shall construct one.

(5) Desert tortoises moved during inactive periods will be monitored for at least two days after relocation or the end of construction, whichever occurs first.

(6) If desert tortoises need to be moved at a time of day when ambient temperatures could harm them (less than 40 degrees and over 90 degrees Fahrenheit), they shall be held overnight in a clean cardboard box and released the following day during more favorable temperatures. Cardboard boxes used to hold tortoises shall only be used once.

(7) All handling of desert tortoises shall be performed consistent with the *Guidelines for Handling Desert Tortoises During Construction Projects* (Desert Tortoise Council 1994).

(8) The mine operator shall mitigate for impacts on occupied desert tortoise habitat through the purchase of credits from a mitigation bank. The amount of credits purchased and the location of the mitigation bank used shall be established through consultation with and approval by the USFWS and the CDFW. The mine operator shall provide the County with evidence that the permit and/or other requirements established by either agency have been satisfactorily met.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Implementation of mitigation measures **MM 3.3.3a** and **MM 3.3.3b** would reduce potential impacts to a less than significant level by ensuring that impacts on desert tortoise are fully mitigated.

Coast Horned Lizard

Impact 3.3.4 Implementation of project-related activities could result in substantial adverse effects, either directly or through habitat modifications, to coast horned lizards, which would be considered a **potentially significant** impact.

Suitable habitat for the coast horned lizard occurs within the PSA. In addition, three CNDDB records have been documented within 10 miles of the PSA (CDFW 2013a). The presence of suitable habitat and documented occurrences result in the determination that implementation of project-related activities may result in adverse impacts on this species, should it be present in areas proposed for disturbance. This would be a **potentially significant** impact.

Mitigation Measures

MM 3.3.4 **Coast Horned Lizard Surveys.** Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine whether suitable habitat for coast horned lizard occurs within 250 feet of the proposed impact area. If suitable habitat exists, preconstruction surveys must be performed by a qualified biologist in a manner to maximize detection of coast horned lizards (i.e., during warm weather, walking slowly). If any lizards are discovered within the work areas, they shall be actively moved or passively encouraged to leave the work area.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Implementation of the above mitigation measure would reduce potential impacts to a **less than significant** level by ensuring that impacts on coast horned lizard are fully mitigated.

Burrowing Owl

Impact 3.3.5 Implementation of project-related activities could result in substantial adverse effects, either directly or through habitat modifications, to burrowing owl. These effects would be considered a **potentially significant** impact.

Focused surveys for this species have not been conducted to date. The presence of potentially suitable habitat and the presence of four CNDDB records within 5 miles of the project result in the potential for this species to be impacted by project-related activities. This would be a **potentially significant** impact.

Mitigation Measures

MM 3.3.5 **Burrowing Owl Surveys.** If clearing and construction activities will occur in undisturbed portions of the site during the nesting period for burrowing owls (February 1–August 31), the mine operator shall retain a qualified biologist to determine if suitable nesting habitat occurs within 500 feet of the proposed impact area. If suitable habitat exists, focused surveys must be performed by a qualified biologist in accordance with the CDFW's *Staff Report on Burrowing Owl Mitigation*, published March 7, 2012. Surveys shall be repeated if project activities are suspended or delayed for more than 15 days during nesting season.

If no burrowing owls are detected, no further mitigation is required. If active burrowing owl nest sites are detected, the mine operator shall implement the avoidance, minimization, and mitigation methodologies outlined in the CDFW's *Staff Report on Burrowing Owl Mitigation* prior to initiating project-related activities that may impact burrowing owls.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Implementation of mitigation measure **MM 3.3.5** would reduce potential impacts to a **less than significant** level by ensuring that impacts on burrowing owl are fully mitigated.

Le Conte's Thrasher and other Migratory Birds

Impact 3.3.6 Implementation of project-related activities could result loss of populations or essential habitat for Le Conte's thrasher and other special-status avian species, including raptors. This would be considered a **potentially significant** impact.

The PSA may provide nesting and/or foraging habitat for Le Conte's thrashers and other migratory birds not identified in **Table 3.3-1**. All native breeding birds (except game birds during the hunting season), regardless of their listing status, are protected under the MBTA. Vegetation clearing during the nesting season could result in direct impacts on nesting birds should they be present. Furthermore, noise and other human activity may result in nest abandonment if nesting birds are present within 200 feet of a work site. Due to the presence of suitable habitat for these

species, implementation of project-related activities may result in adverse impacts should they be present in areas proposed for disturbance. This would be a **potentially significant** impact.

Mitigation Measures

MM 3.3.6 **Migratory Bird Surveys.** If clearing and/or construction activities will occur in undisturbed portions of the site during the migratory bird nesting season (March 15–August 15), preconstruction surveys to identify active migratory bird nests shall be conducted by a qualified biologist within 14 days of construction initiation. Focused surveys must be performed by a qualified biologist for the purposes of determining the presence/absence of active nest sites within the proposed impact area and a 200-foot buffer (if feasible).

If active nest sites are identified within 200 feet of project activities, the mine operator shall impose a limited operating period (LOP) for all active nest sites prior to commencement of any project construction activities to avoid construction or access-related disturbances to migratory bird nesting activities. An LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, and construction) will not occur and will be imposed within 100 feet of any active nest sites until the nest is deemed inactive. Activities permitted within and the size (i.e., 100 feet) of LOPs may be adjusted through consultation with the CDFW and/or the County.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Implementation of mitigation measure **MM 3.3.6** would reduce potential impacts to a **less than significant** level by ensuring that impacts on migratory birds are fully mitigated.

Golden Eagle and Other Raptors

Impact 3.3.7 Implementation of project-related activities could result in substantial adverse effects, either directly or through habitat modifications, to golden eagles and other protected raptor species. These impacts would be considered **potentially significant**.

The PSA is located on the north slope of the San Bernardino Mountains, which is characterized by steep slopes, rocky pinnacles, outcrops, rock crevices, rock ledges, cliff potholes, and cliffs. These habitat characteristics provide excellent nest sites for several cliff-nesting raptors, including owls, golden eagles, California condors, peregrine falcons, prairie falcons, and red-tailed hawks. Project activities have the potential to directly or indirectly impact golden eagles and other protected raptor species. This would be a **potentially significant** impact.

Omya and three other mining companies are actively participating in the development of the RCS and have agreed to follow the guidelines outlined in the final document (Eliason 2013). The RCS is intended to be a living document that may be updated over time as new information becomes available and includes monitoring objectives, schedules, and protocols, as well as measures to avoid, minimize, rectify, and reduce effects to nesting raptors along the North

Slope. The following is a summary of the standard design features for mining and other projects on the North Slope, as outlined in the draft RCS.

General Design Features (DF)

DF-1. Participate in the North Slope Raptor Conservation Strategy.

DF-2. Disturbance footprints for mine operations and development of new quarries and roads shall be limited to the greatest extent possible to the goal of minimizing impacts on adjacent habitat and sensitive biological resources.

DF-3. Any soil bonding or weighting agents to be used on unpaved surfaces shall be non-toxic to wildlife and plants and non-attractants for wildlife.

DF-4. All vehicles and equipment shall be maintained in proper working condition to minimize the potential for spill of motor oil, antifreeze, hydraulic fluid, grease, or other hazardous materials; except as necessary to repair or remove disabled vehicles or equipment, vehicle servicing shall take place only at a designated area.

DF-5. Maintain facilities and grounds in a manner that minimizes any potential impacts to raptors, predators, and scavengers (e.g., minimize storage of equipment near active quarries that may attract prey, remove trash/garbage daily, etc.). All trash and food-related waste shall be secured in self-closing animal-proof containers and removed daily from the site.

DF-6. No recreational target shooting will occur on National Forest System lands.

DF-7. The mine operators shall conduct wildlife/plant awareness programs for employees (including new employee orientation and annual refresher trainings). The program will address raptor nest awareness. This will include the importance of avoiding harassment/ disturbance, adherence to speed limits, adherence to defined project boundaries, reporting guidelines, etc. The Forest Service will provide assistance in developing the training program.

DF-8. Avoid practices that attract/enhance prey populations and opportunities for raptor hunting or scavenging near active quarries, haul roads, and processing areas. This would also help discourage the spread of non-native birds; to discourage the spread of disease and pathogens, etc.

DF-9. Reduce vehicle collision risk to raptors and other scavengers by removing animal carcasses from haul and access roads immediately.

DF-10. New powerlines should be buried to reduce avian collisions and electrocution. Where it is not possible to bury lines, [mine operators will follow][2] the Avian Power Line Interaction Committee (APLIC) guidance on power line construction and design (APLIC 2006).

Reclamation (RE)

[2] A suggested modification to the text of DF-10 is shown to extend applicability of this requirement to mine operators.

The timing and planning of reclamation measures should consider improving or creating suitable foraging and nesting habitat for raptors. These measures may include:

RE-1. Phase reclamation where possible to re-establish suitable habitat for prey species in areas where mining activities have ceased.

RE-2. Where perch structures are lacking, consider construction/installation of artificial perches (e.g., poles, rock piles, etc.) for foraging.

RE-3. Restrict vehicle use and human activity to the extent possible in reclamation areas. Remove and reclaim roads where possible.

RE-4. Revegetate with local native plant species that are favorable for raptor prey species.

RE-5. During reclamation, create suitable cover for prey species by considering spatial features on the landscape. Planting in groupings and mosaics and construction of brush and rock piles should be considered.

RE-6. If natural water sources are lacking in reclamation areas, evaluate the feasibility of artificial water sources (wildlife drinkers, guzzlers, catchment structures, etc.) during the reclamation period.

The following additional protection measures are outlined in the RCS for implementation on an as-needed basis, as determined by SBNF monitoring results. These measures were developed on the premise that because the RCS is "viewed as a long-term management effort with the expectation that the mining operations may exist a century or more after approval, these measures are viewed as a tentative toolbox of possible approaches. Depending on site-specific conditions, one or more of these measures may be appropriate. Alternatively, development of new measures may be more appropriate, especially in response to changes in mining technology, changes in wildlife monitoring/management techniques, and based on a better understanding of the ecology of north slope raptors (Eliason 2013)."

PM-1. Where nest monitoring detects changes in behavior of nesting raptors associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds, etc.) would be used during the breeding season. In some cases, if a nest were extremely close (with ½-mile), noise attenuation devices or techniques should be considered without waiting for monitoring results.

PM-2. Where disturbance or mortality risk is determined to be very high due to close proximity (within ½-mile), a Limited Operating Period (LOP) should be considered with a restriction on blasting (or other activities likely to cause nest abandonment or failure) during the breeding season.

PM-3. If suitable nesting habitat is degraded to the point that suitable nest sites are a limiting factor, consider construction of artificial nest platforms at suitable sites away from disturbance sources.

Mitigation Measures

MM 3.3.7 **Raptor Conservation Strategy.** The applicant shall participate in and implement the Raptor Conservation Strategy.

Implementation of **MM 3.3.7** would effectively reduce project-related impacts on golden eagles and other raptors to a **less than significant** level.

Mule Deer and Bighorn Sheep

Impact 3.3.8 Implementation of project-related activities would not result in substantial adverse effects, either directly or through habitat modifications, to mule deer and bighorn sheep. These impacts would be considered **less than significant**.

The major issues and concerns regarding impacts on mule deer resulting from extraction and mineral development outlined in *Habitat Guidelines for Mule Deer* in the *Southwest Deserts Ecoregion* include direct loss of habitat, physiological stress, disturbance and displacement, habitat fragmentation and isolation, and secondary effects (Heffelfinger et al. 2006). The majority of the area within the project site has already been directly or indirectly affected by previous and ongoing mining activities; therefore, it is presumed that the majority of impacts on this species resulting from habitat loss were incurred as a result of previously authorized mining activities. In addition, the extent and characteristics of the ongoing mining operations (e.g., traffic, equipment and methods used, number of personnel) are not anticipated to change as a result of the proposed project. As a result, it is also presumed that any physiological stress, disturbance, displacement, and habitat fragmentation and isolation were also incurred as a result of previously authorized mining activities. Secondary effects are typically associated with the support and/or service industries (e.g., vehicular traffic and human presence) linked to project-related activities (Heffelfinger et al. 2006). As previously stated, project operations are not expected to expand as a result of the proposed project; therefore, these effects are also presumed to have been incurred as a result of the previously authorized activities.

The potential loss of individuals to mortality related to blasting, vehicle collision, or other mining activities, or as a consequence of decreased access to forage and the population-level impacts on the persistence of the small population of bighorn sheep as a result of loss of individuals are primary concerns regarding the proposed project. A review of available peer-reviewed published literature revealed that surface mining activities do not appear to have a significant adverse impact on bighorn sheep (Jansen et al. 2006, 2007, 2009; Bleich et al. 2008). The three articles published by Jansen et al. were the product of studies conducted on bighorn sheep inside and outside a copper mine in Arizona (2006, 2007, 2009). Landscape features selected by subadult male, adult male, and female bighorn sheep in the active mine site included desert islands (undisturbed areas within the mine site), while subadult males and females also selected highwalls (formed as a byproduct of mining activity) (Jansen et al. 2006). Sheep exhibited similar behavior on desert islands as similar habitats outside the mine site (Jansen et al. 2006). Subadult male and female bighorn sheep fed and were less alert on highwalls than outside the mine perimeter, but social interaction increased, likely due to higher visibility and decreased risk of ambush predation (Jansen et al. 2006, 2007).

In the Jansen et al. 2009 study, home ranges and core areas of bighorn sheep were compared during mine closure and operation. Adult male home ranges and core areas were generally larger or similar in size during both the non-breeding and breeding season during mine closure; however, during breeding season, adult males used the mine site more during operation (Jansen et al. 2009). Female home ranges and core areas were of similar size during both closure and operation; however, females used the mine more during operation than closure. Overall Jansen et al. (2006, 2007, 2009) concluded that bighorn sheep used the mine site more when it was active than when it was inactive and that bighorn sheep may be habituated to the human activities associated mining operations (e.g., traffic, human presence, sounds).

The study published by Bleich et al. (2009) studied mountain sheep in the vicinity of three highwall limestone mines in San Bernardino County. The purpose of the study was to evaluate factors that influenced habitat use and to investigate the influence of mining activity on sheep distribution. Bleich et al. (2009) concluded that sheep were associated with areas closer to the mine than they were with random points. The alterations to terrain and vegetation that result from mining operations can promote occupancy by bighorn sheep as a result of the reduction of vegetation density that can hide ambush predators, and the creation of steep slopes (≥27° and ≤85°) and rugged escape terrain (Bleich et al. 2009).

Although the PSA is located within the range for both mule deer and bighorn sheep, occurrences are anticipated to be rare and associated with explaratory/breeding movements (Jeff Villepique, pers. Comm..). In addition, portions of the PSA have already been disturbed due to previous/ongoing mining activities, and the level of activity (e.g., traffic, equipment use) is not anticipated to increase. In addition, typical slopes within the PSA would be characterized by 45 to 50 feet vertical bench faces, at an angle averaging around 70 degrees, which is consistent with escape terrain requirements. This information, combined with the data presented above, results in the determination that impacts on mule deer and bighorn will be **less than significant** as a result of project-related activities.

Mitigation Measures

None required.

Special-Status Bats

Impact 3.3.9 Implementation of project-related activities could result in the loss of populations or essential habitat for special-status bat species, which would be considered a **potentially significant** impact.

Bats roost in a wide variety of habitats, including buildings, mines, under bridges, rock crevices, caves, under tree bark, and in snags. The western mastiff bat and Townsend's big-eared bat are considered California species of special concern. These species may utilize a variety of habitats and structures throughout the PSA, as well as in adjoining off-site areas, for roosting and foraging. Suitable roosting habitat for these species includes in trees under bark, in snags, and in caves. The disturbance of active maternity roosts would affect the reproductive success of the species, as young do not fly from the maternity roost until they reach several months in age (CDFW 2013d). Construction of the proposed project could disturb roosting bats and thus eliminate future roosting opportunities.

Construction of the project would require the removal of habitat that could provide roosting for these special-status bat species. Removal of this habitat would be considered a direct and significant impact if special-status bat species were taken or deterred from roosting. Construction and operation of the project could also result in noise, dust, and other indirect disturbances to wildlife in the project vicinity. This would be a **potentially significant** impact.

Mitigation Measures

MM 3.3.9 **Bat Surveys.** Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine whether potential roosting sites for special-status bats may be affected. If potential roost sites are identified, a preconstruction survey by a qualified biologist shall be conducted prior to the end of April to determine

the presence or absence of roosting bats. If the survey does not identify the presence of occupied roosts, no further mitigation is required.

If day roosts or maternity roosts occupied by special-status bat species are documented within construction areas, the bats shall be safely flushed from the sites where roosting habitat is planned to be removed prior to May of each construction phase (maternity roosts are generally occupied from May to August) and prior to the onset of construction activities. The removal of the roosting sites shall occur during the time of day when the roost is unoccupied. The loss of each roost will be compensated for by the construction and installation of two bat boxes suitable to the bat species and colony size excluded from the original roosting site. The bat boxes shall be installed in the vicinity prior to removal of the original day/maternity roost sites. A detailed program for bat flushing, roosting site removal, and installation of bat boxes shall be developed in consultation with a qualified biologist.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Implementation of mitigation measure **MM 3.3.9** will reduce potential impacts to a **less than significant** level by ensuring that impacts on special-status bats are fully mitigated.

Pallid San Diego Pocket Mouse

Impact 3.3.10 Implementation of project-related activities could result in substantial adverse effects, either directly or through habitat modification, to the pallid San Diego pocket mouse. These effects would be considered a **potentially significant** impact.

The PSA may provide suitable habitat for the pallid San Diego pocket mouse, which is a California species of special concern. In addition, there are two CNDDB occurrence records within 1 mile of the PSA. Due to the presence of suitable habitat for this species, implementation of project-related activities may result in adverse impacts should individuals be present in areas proposed for disturbance, which would be a **potentially significant** impact.

Mitigation Measures

MM 3.3.10 **Pallid San Diego Pocket Mouse Surveys.** Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine if suitable habitat for this species occurs within 250 feet of the proposed impact area. If suitable habitat exists, preconstruction surveys must be performed by a qualified biologist in a manner to maximize detection of pallid San Diego pocket mice. If any mice are discovered within the work areas, they shall be actively moved or passively encouraged to leave the work area.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Implementation of mitigation measure **MM 3.3.10** will reduce potential impacts to a **less than significant** level by ensuring that impacts on pallid San Diego pocket mice are fully mitigated.

Impacts on Riparian Habitat or Sensitive Natural Communities (Standard of Significance 2)

Impact 3.3.11 Implementation of project activities could result in the loss of riparian vegetation and/or sensitive natural communities, which would be considered a **potentially significant** impact.

Sensitive habitats include those that are of special concern to resource agencies and those that are protected under CEQA, Section 1600 of the FGC, and Section 404 of the CWA. Project-related activities have the potential to substantially adversely affect riparian habitat or other sensitive natural communities identified in local or regional plans, policies, or regulations or by the CDFW or the USFWS. Impacts on these resources would be considered a **potentially significant** impact.

Implementation of project activities may result in adverse impacts on riparian and aquatic communities should they be present in areas proposed for disturbance. Based on the data provided in the jurisdictional delineation report provided by Tetra Tech (2013), 0.003 acre of wetland and 6,469 linear feet (1.355 acre) of jurisdictional drainage occur within the limits of planned disturbance and therefore have the potential to be impacted by project-related activities (**Figure 3.3-2**). In addition, 10 ephemeral dry washes (**Figure 3.3-1b**) were identified on the CDFW California Streams (CA_Streams) data layer as intersecting the haul road; however, this number may increase once a formal field delineation is completed. In any event, the repairs and remediation to control runoff and sedimentation along the haul road required in the BLM/CDFW 2011 Settlement Agreement have the potential to impact riparian habitat.

Mitigation Measures

MM 3.3.11 **No Net Loss of Riparian Vegetation.** The mine operator shall ensure there is no net loss of riparian vegetation. Mitigation can include on-site restoration or purchase of mitigation credits at a USACE-approved mitigation bank, placing a conservation easement over a riparian area, or quit claiming mineral claims over a riparian area. Mitigation, as required in regulatory permits issued through the CDFW, the USACE, or the RWQCB, may be applied to satisfy this measure.

Evidence of compliance with this mitigation measure shall be provided prior to construction and grading activities for the proposed project.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Implementation of mitigation measure **MM 3.3.11** will ensure that impacts on riparian or sensitive natural communities are **less than significant** by ensuring that impacts on these communities are fully mitigated.

Impacts on Federally Protected Wetlands (Standard of Significance 3)

Impact 3.3.12 Implementation of project activities would not result in the disturbance, degradation, and/or removal of federally protected wetlands. **No impact** would occur.

The PSA contains several ephemeral dry washes and three small desert riparian wetlands. The USACE asserts jurisdiction over all waters that are defined as traditional navigable waters (USACE 2007). Field observations and review of relevant aerial photographs and topographic maps confirm that the unnamed drainages within the PSA terminate in Rabbit Lake (dry) found to the north of the PSA. A recent approved jurisdictional determination (AJD) dated April 30, 2013, was issued by the USACE for the Marathon Solar Project located southeast of the PSA on the west side of Camp Rock Road, north of State Route 247 (USACE 2013). The drainages associated with this project terminate in Lucerne Lake (dry), which is east of Rabbit Lake. The AJD for the Marathon Solar Project concluded that the on-site drainages are isolated and are not subject to USACE regulation under Section 404 of the Clean Water Act. The Marathon Solar Project AJD indicates that Rabbit Lake and Lucerne Lake are part of the same depositional environment and are both located in the Lucerne Valley Groundwater Basin Este Subarea. Based on the approved jurisdictional determination issued for the solar project that shares the same watershed as the PSA drainages, it is likely that jurisdictional drainages within the PSA are isolated and not subject to USACE jurisdiction. As a result, the project is anticipated to have **no impact** on federally protected wetlands.

Mitigation Measures

None required.

Impacts on Wildlife Movement (Standard of Significance 4)

Impact 3.3.13 Implementation of the proposed project would not interfere with the movement of native resident or migratory wildlife species. This would be considered a **less than significant** impact.

Portions of the PSA have been disturbed by previous and ongoing mining operations; however, the undisturbed portions around the perimeter and off-site could facilitate regional wildlife movement. Available data on movement corridors and linkages was accessed via the CDFW BIOS Viewer. Data reviewed included the Essential Connectivity Areas [ds623] layer and the Missing Linkages in California [ds420] layer. The PSA is located north of an Essential Connectivity Area and approximately 2.5 miles east of a linkage for bighorn sheep in the Missing Linkages layer. In addition, the San Bernardino County General Plan Open Space Overlay Map was reviewed to determine whether the PSA was located within an identified wildlife corridor. The PSA is not located within an identified corridor; however, it is located east of the Deep Creek wildlife corridor, north of the Bear Creek corridor, and west of the Grapevine Creek corridor. In addition, as described under **Impact 3.3.8** above project-related activities are anticipated to have a less than significant impact on mule deer and bighorn sheep. As a result, impacts on the movement of native resident or migratory wildlife species will be **less than significant** as a result of project-related activities.

Mitigation Measures

None required.

Conflict with Local Policies and Ordinances (Standard of Significance 5)

Impact 3.3.14 Implementation of project activities would not conflict with local policies and ordinances. **No impact** would occur.

The County of San Bernardino Development Code includes Section 88.01.060 (Desert Native Plant Protection Ordinance) and Section 88.01.080 (Riparian Plant Conservation). The Desert Native Plant Protection ordinance provides regulations for the removal or harvesting of specified desert native plants in order to preserve and protect the plants and to provide for the conservation of desert resources. The provisions in this ordinance are intended to augment and coordinate with the Desert Native Plants Act (Food and Agricultural Code Section 80001 et seq.) and the efforts of the California Department of Food and Agriculture to implement and enforce the act. The Riparian Plant Conservation ordinance provides regulations for the removal of vegetation within 200 feet of the bank of a stream or in an area indicated as protected riparian habitat on an overlay map or specific plan. Development of the proposed project would be required to be consistent with all local policies and ordinances protecting biological resources. Therefore, **no impact** would occur with regard to consistency with local ordinances or policies protecting biological resources.

Mitigation Measures

None required.

Conflict with Conservation Plans (Standard of Significance 6)

Impact 3.3.15 Implementation of the proposed project would not conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan. This would be considered a **less than significant** impact.

The Carbonate Habitat Management Strategy (CHMS) is the only adopted conservation plan to which the proposed project would be subject. On April 29, 2003, the US Forest Service, Bureau of Land Management, San Bernardino County, and mining stakeholders, including Omya, executed a Memorandum of Understanding whereby all parties agreed to implement the terms of the CHMS in regard to future mining proposals (**EIR Appendix D**). In 2005, the USFWS issued a Programmatic Biological Opinion (BO) for the CHMS concluding that compliance with the terms of the CHMS would not result in jeopardy to the continued existence of plant species covered under the CHMS and would promote the recovery of the species.

The CHMS is a collaborative strategy to facilitate the preservation and recovery of carbonate plant species, while providing a method for mining projects to obtain Endangered Species Act compliance. The CHMS proposes multiple methods of permanent habitat conservation, including federal land use designations, federal purchases of private property, land exchanges, relinquishment of unpatented mining claims, and/or execution of a conservation easement or surface use restrictions coupled with a mineral withdrawal. Mining interests obtain ESA compliance under the Carbonate Habitat Management Strategy by contributing enough land to the habitat reserve to offset impacts on habitat on land to be mined. The CHMS assigns conservation values to each parcel of property or mining claim based on a series of criteria

including whether the habitat is occupied, suitable, revegetated, or provides other beneficial habitat, which is then assigned a multiplier based on the number of carbonate plant species present. To adequately mitigate for project impacts, mitigation lands must be permanently conserved at a compensation ratio of 3:1. Before any mining activity can be allowed under the CHMS, the mine operator must add land worth 3 units of conservation value to the habitat reserve for each unit of conservation value to be lost to the proposed mining activity.

Participation in and implementation of the CHMS will effectively reduce project-related impacts on carbonate plants to a **less than significant** level.

Mitigation Measures

None required.

This section evaluates the potential impacts of the proposed project on historical, cultural, and paleontological resources. Cultural resources are defined as prehistoric and historic sites, structures, and districts or any other physical evidence associated with human activity considered important to a culture, a subculture, or a community for scientific, traditional, or religious reasons. Paleontological resources include fossil remains, as well as fossil localities and formations that have produced fossil material.

This section is based on technical reports prepared for the proposed project. CRM TECH prepared a Class III Cultural Resources Survey in 2008 and a Paleontological Resources Assessment Report in 2009 for a 298-acre portion of the project site located on Bureau of Land Management (BLM)-managed federal lands and containing the project's primary access road. In addition, a Class III Cultural Resources Investigation was prepared by Jeanette A. McKenna in 2012 for the 70-acre portion of the project site that is on federal lands managed by BLM and being transferred to Omya ownership through a direct land sale. These documents are included in **EIR Appendix E**.

The County published a Notice of Preparation and Initial Study (NOP/IS) for the proposed project on June 12, 2013. A copy of the NOP/IS, along with comments received during the public review period, is contained in **EIR Appendix A**. The Native American Heritage Commission submitted comments on the NOP, and the agency's comments regarding a records search and reporting were considered during preparation of this section.

3.4.1 EXISTING SETTING

CULTURAL SETTING

Cultural resources contribute to an understanding of past human activities, including Native American history, local and regional European, African, and Asian settlement in North American urban development, historic engineering activities, cross-cultural influences, and human adaptations to the environment. Cultural resources, like many natural resources found on the planet, are nonrenewable. Once these resources have been destroyed, by whatever means, a fragment of history permanently disappears.

The archaeological sites of the Prehistoric period, the period before European arrival in the New World, may include the remains of Native American villages and campsites, food processing locations, areas for exploiting local floral and faunal resources, lithic resource procurement and stone tool production locations, and burial and cremation areas. They may also consist of trails, rock art and ground figures (geoglyphs), isolated artifacts, and sacred locations. Historic archaeological resources, on the other hand, derive from various periods after initial European contact, during which written European histories, to varying extents, occurred. Resources from this period include refuse deposits such as can and bottle dumps, filled-in privy pits and cisterns, melted adobe walls and foundations, collapsed structures and associated features, and roads and trails. They may be related to mission activities, travel and exploration, early settlement, homestead activities, cattle herding, lumbering, and mining, among other themes. In San Bernardino County, historic, archaeological resources date from the earliest Spanish mission activities (1770) to the mid twentieth century (1950). This class of resources, often related to a historic archaeological resource, includes structures of any type that are 50 years or more in age. This resource category, often referred to as the "built environment," comprises houses or other structures, irrigation works, bridges, dams, and other "built" historic engineering features (San Bernardino County 2006, p. IV-57).

Prehistoric Context

In order to understand Native American cultures prior to European contact, archaeologists have devised chronological frameworks on the basis of artifacts and site types that go back some 12,000 years. Currently, the chronology most frequently applied in the Mojave Desert divides the region's prehistory into five periods marked by changes in archaeological remains, reflecting different ways in which native peoples adapted to their surroundings. The five periods are as follows: the Lake Mohave Period, 12,000 years to 7,000 years ago; the Pinto Period, 7,000 years to 4,000 years ago; the Gypsum Period, 4,000 years to 1,500 years ago; the Saratoga Springs Period, 1,500 years to 800 years ago; and the Protohistoric Period, 800 years ago to European contact.

This time frame is based on general changes in artifactual remains, from large stone projectile points with few stones for grinding food products to smaller projectile points with an increase in the number of milling stone tools. The scheme also notes increases in population, changes in food procurement and resource exploitation, and more cultural complexity over time. During the Protohistoric Period, there is evidence of contact with the Colorado River tribes and the introduction of pottery across the Mojave Desert (EIR Appendix E, CRM TECH 2008, p. 4).

Ethnohistoric Context

The project site is located on the northern edge of the homeland of the Serrano Indians, whose traditional territory is centered at the San Bernardino Mountains but also includes the southern rim of the Mojave Desert, extending from Victorville eastward to Twentynine Palms. The name "Serrano" was derived from a Spanish term meaning "mountaineer" or "highlander." The basic written sources on Serrano culture are Kroeber, Strong, and Bean and Smith. The following ethnographic discussion of the Serrano people is based on these sources.

Prior to European contact, the Serranos were primarily gatherers and hunters, and occasional fishers, who settled mostly where flowing water emerged from the mountains. They were loosely organized into exogamous clans, led by hereditary heads, and the clans, in turn, were affiliated with one of two exogamous moieties. The exact nature of the clans, their structure, function, and number are not known, except that each clan was the largest autonomous political and landholding unit, the core of which was the patrilineage. There was no pan-tribal political union among the clans.

Although contact with Europeans may have occurred as early as 1771 or 1772, Spanish influence on Serrano lifeways was negligible until 1819, when a mission *assestencia* was established on the southern edge of Serrano territory. Between then and the end of the mission era in 1834, most of the Serranos in the San Bernardino Mountains were removed to the nearby missions. At present, most Serrano descendants are found on the San Manuel and the Morongo Indian reservations, where they participate in ceremonial and political affairs with other Native American groups on an inter-reservation basis (EIR Appendix E, CRM TECH 2008, p. 4).

Historic Context

Situated far from the coastline and any of the major desert trails, the Lucerne Valley area saw little change during the Spanish and Mexican periods, although sporadic mining activities reportedly took place in the vicinity. After the American annexation of Alta California in 1848, mining and prospecting in the area began in earnest, especially in the aftermath of gold discoveries in the San Bernardino Mountains in the early 1860s. As in the rest of the vast Mojave Desert, mining remained for a long time the dominant economic pursuit in the Lucerne Valley area. It has continued to the present time, yielding a diverse variety of mineral products ranging from gold to clay.

The mid-nineteenth century mining boom in the vicinity brought to the Lucerne Valley area its earliest Euro-American settlers. During the 1870s, "Uncle Pete" Davidson, a former prospector in the San Bernardino Mountains, established a homestead near Rabbit Springs and became the first permanent resident in the valley. In the meantime, the miniature gold rush in the San Bernardino Mountains and later the construction of the Big Bear dam in 1883–1884 brought a steady flow of traffic along a wagon road through the valley, so much so that Davidson's ranch came to be known as Davidson's Stage and Way Station. In 1897, James "Dad" Goulding, a silver miner from Colorado, acquired the Box S Ranch, which had been established in 1886 but later abandoned. In the late nineteenth and early twentieth century's, Goulding played a pivotal role in the growth of the small community that he named Lucerne Valley, after a type of alfalfa grown by the Mormons.

Around the turn of the century, more homesteaders started to filter into the valley, especially after Goulding's discovery of artesian water in 1905. Over the next few decades, the settlers attempted a number of money-making schemes, such as cultivating deciduous fruits and alfalfa, raising chickens, turkeys, and rabbits, and even luring Hollywood movie-makers, in most cases with only short-lived success. After World War II, guest ranches sprouted up throughout the valley, offering city dwellers a brief respite from the pressures of urban life. Throughout these various "fevers," however, growth remained relatively slow for the remote desert area, which has allowed it to retain much of its rural character to the present day (EIR Appendix E, CRM TECH 2008, p. 5).

CULTURAL RESOURCES RESEARCH METHODS AND RESULTS

Archaeological Records Search

On September 30, 2008, CRM TECH completed the records search at the Archaeological Information Center (AIC), San Bernardino County Museum, Redlands. During the records search, CRM TECH checked the AIC's electronic database for previously identified historical/ archaeological resources in or near the area of potential effect (APE) and existing cultural resources reports pertaining to the vicinity. Previously identified historical/archaeological resources include properties designated as California Historical Landmarks, Points of Historical Interest, or San Bernardino County Historical Landmarks, as well as those listed in the National Register of Historic Places, the California Register of Historical Resources, or the California Historical Resources Inventory (EIR Appendix E, CRM TECH 2008, p. 8).

According to AIC records, portions of the APE for the haul road were previously surveyed between 1985 and 1992, but no cultural resources had been recorded on or adjacent to the property. Outside the APE boundaries but within a 1-mile radius, AIC records show at least four other previous studies on various tracts of land and linear features. As a result of these and other similar studies in the vicinity, three archaeological sites were recorded within the scope of the records search, as listed in **Table 3.4-1**. One of these sites (36-005556) was found in the buffer area of the APE, and thus requires further consideration related to the proposed project (EIR Appendix E, McKenna 2012, p. v).

TABLE 3.4-1
PREVIOUSLY RECORDED CULTURAL RESOURCES

Site No.	Recorded by/Date	Description
36-005319	Lerch 1985	Prehistoric roasting pit/hearth
36-005556	Lerch 1986; McCarthy 1988	Scatter of lithic flakes
36-006142	McCarthy 1988	Bedrock milling feature (metate)
36-024514	Fife Mining Claim Road	Historic period resource

Source: EIR Appendix E, CRM TECH 2008, p. 9; EIR Appendix E, McKenna 2012, p. v

Historical Background Research

CRM TECH conducted the historical background research on the basis of published literature in local history and historic maps of the Lucerne Valley area. Among maps consulted for this study were the U.S. General Land Office's (GLO) land survey plat map dated 1896 and the U.S. Geological Survey's (USGS) topographic maps dated 1902, 1947, and 1956. These maps are collected at the Science Library of the University of California, Riverside, and the California Desert District of the U.S. Bureau of Land Management, located in Moreno Valley (EIR Appendix E, CRM TECH 2008, p. 8).

Situated in the foothills on the edge of the sparsely populated Mojave Desert country, the APE was determined by CRM TECH to have no evidence of any settlement or development activities throughout the historic period. Between the 1850s and the 1950s, the only man-made features noted in the vicinity of the APE were a few dirt roads across the barren landscape. Based on these historic maps, the APE appears to be relatively low in sensitivity for cultural resources from the historic period (EIR Appendix E, CRM TECH 2008, p. 9).

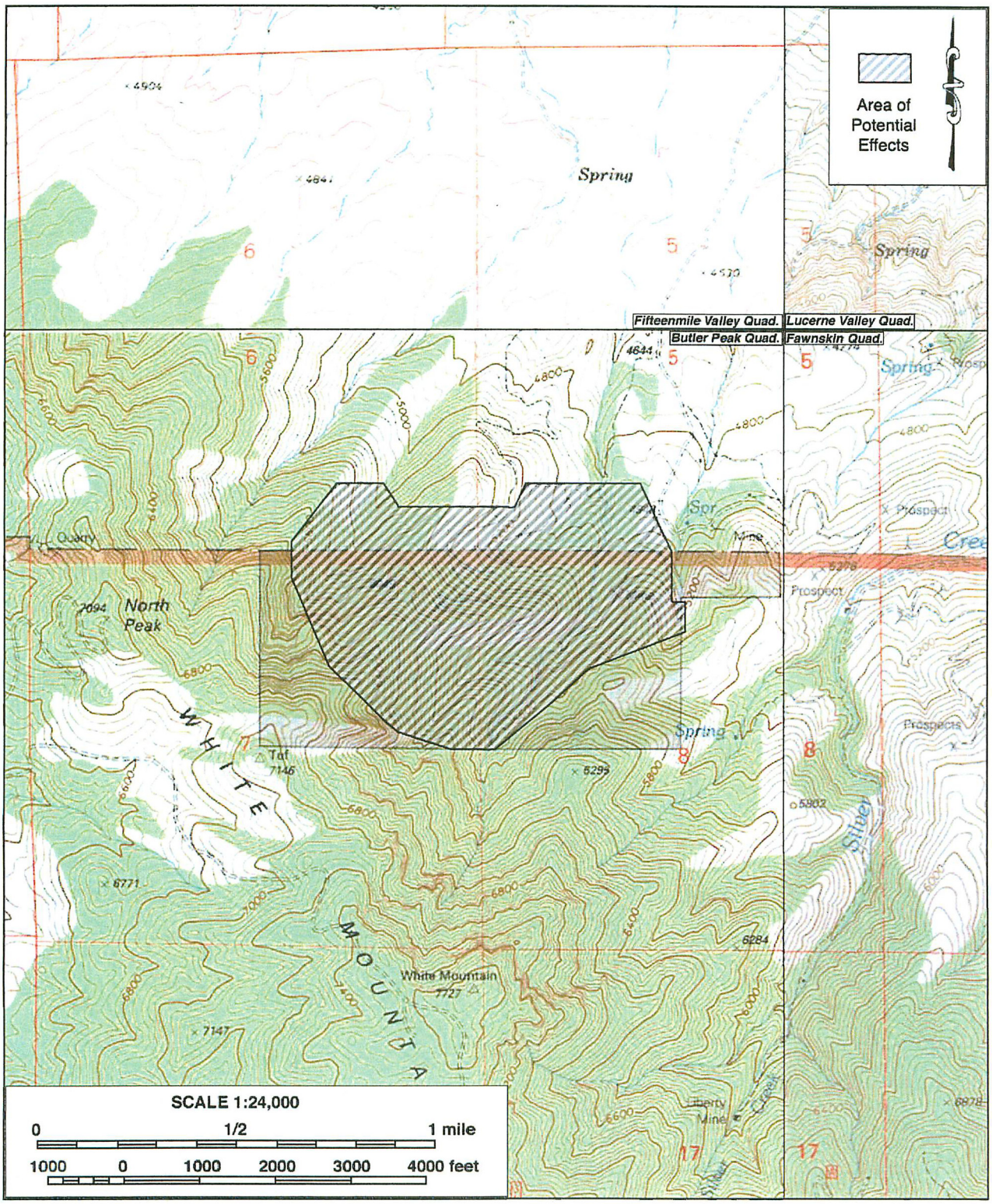
Native American Participation

As part of the research procedures, CRM TECH contacted the California Native American Heritage Commission (NAHC) on September 22, 2008, to request a records search in the commission's sacred lands file. Following NAHC's recommendations, CRM TECH further contacted a total of 11 Native American representatives in the region, both by mail and by telephone, between September 23 and October 29 to solicit local Native American input regarding any possible cultural resource concerns over the proposed undertaking. The correspondence between CRM TECH and the Native American representatives is located in Appendix 2 of the Class III Cultural Resources Survey, White Knob Quarry Revision Project.

In response to CRM TECH's inquiry, the NAHC reports that the sacred lands record search identified no Native American cultural resources in the immediate area of the project site. However, noting that "the absence of specific site information in the Sacred Lands File does not guarantee the absence of cultural resources in any project area," the NAHC recommends that local Native American representatives be contacted for further information and provided a list of potential contacts in the region.

Upon receiving the NAHC's response, CRM TECH initiated correspondence with all nine individuals on the referral list and the organizations they represent. In addition, John Gomez Jr., Cultural Resources Coordinator for the Ramona Band of Cahuilla Indians, and John Tommy Rosas, Tribal Administrator of the Tongva Ancestral Territorial Tribal Nation, were also contacted.

T:_CS\Work\San Bernardino, County of\White Ridge Limestone Quarry\Figures



Source: CRM TECH

Figure 3.4-1
Area of Potential Effect

PMC®

In a letter dated September 27, 2008, Charles Wood, Chairman of the Chemehuevi Indian Tribe, states that the area in and around the APE is sensitive for Native American cultural resources. The tribe is specifically concerned with any areas around Chimney Rock, which is approximately 6 miles to the north of the APE. The presence of village sites, petroglyphs, and geoglyphs in the area is also among the tribe's concerns. Primarily, the tribe is concerned with Native American artifacts, village sites, and human remains being discovered in the APE during the undertaking. In addition to requesting notification of any discovery of cultural resources in the APE, Mr. Wood requests that an aerial survey be conducted to identify any geoglyphs that may be present in the APE.

In e-mails dated October 1 and 24, 2008, John Tommy Rosas of the Tongva Ancestral Territorial Tribal Nation states that the APE is an old/current sacred site, in an area that is also sensitive for known Native American surface and below ground cultural items. He requested the area be studied and that there be tribal consultation under Section 106 of NHPA and Section 7 of NEPA. Michael Contreras, Cultural Heritage Program Manager for the Morongo Band of Mission Indians, replied by e-mail on October 15, 2008, stating that the tribe has no concerns at this time but wishes to be contacted regarding any archaeological discoveries. John Gomez Jr. of the Ramona Band responded by telephone on October 28 and expressed the tribe's intention to defer to other Native American groups located closer to the APE (EIR Appendix E, CRM TECH 2008, pp. 9–12).

Field Survey

On October 2 and 3, 2008, CRM TECH carried out the pedestrian field survey of the area. The relatively level areas of the APE were surveyed intensively by walking parallel north–south transects spaced 15 meters (approximately 50 feet) apart. Since such regular transects were impracticable on the steep slopes, the more rugged terrain in the APE was surveyed by inspecting all areas accessible or demonstrating the potential archaeological remains, such as the drainages and bedrock outcrops. Previously surveyed portions of the APE, where mining operations are currently ongoing, were given a cursory survey. In this way, the entire APE was examined systematically for any evidence of human activities dating to the prehistoric or historic periods (i.e., 50 years ago or older). Ground visibility ranged from poor (25 percent) to fair (70 percent), depending on the density of the vegetation (EIR Appendix E, CRM TECH 2008, pp. 8–9).

The intensive-level field survey produced negative results for potential cultural resources. The entire APE was closely inspected for any evidence of human activities dating to the prehistoric or historic periods, but none was found. Much of the APE has been disturbed by the ongoing mining activities and the construction of access roads, and large piles of quartz mining refuse are scattered throughout the area. No buildings, structures, objects, sites, features, or artifacts more than 50 years of age were encountered during the survey (EIR Appendix E, CRM TECH 2008, p. 12).

Expanded Mine Area

The following discussion pertains to the 70-acre portion of the project site that is located on BLM-managed federal lands and is in the process of being transferred to Omya ownership through a direct land purchase. This area is a part of the Amended Reclamation Plan. The APE includes this area and a surrounding buffer for a total area of 110 acres.

The Class III Cultural Resources Investigation for this portion of the project site consists of a records search and field investigation. The records search identified one prehistoric archaeological site and one historic period resource within the project area. The prehistoric archaeological site (36-005556), a lithic scatter, is located outside of the APE but within the buffer

area. This site was previously impacted by the development of the White Knob Haul Road, and little evidence of the site remains. It is not a significant resource but has a potential to yield additional data that may change this conclusion and is considered an area sensitive for additional cultural resources.

The historic period resource (36-024514; CA-SBR-15565H; the Fife Mining Claim Road) is not a significant resource. It has been impacted by prior construction, and no artifacts or other features were found in association with the segment of the road running through the APE (EIR Appendix E, McKenna 2012, p. vi).

PALEONTOLOGICAL SETTING

The following information was provided by the CRM TECH study Paleontological Resources Assessment Report, White Knob Quarry Revision Project. This study is located in **EIR Appendix E** of this DEIR.

Paleontological Resources Definition

Paleontological resources represent the remains of prehistoric life, exclusive of any human remains, and include the localities where fossils were collected as well as the sedimentary rock formations in which they were found. The defining character of fossils or fossil deposits is their geologic age, which is typically regarded as older than 10,000 years, the generally accepted temporal boundary marking the end of the last late Pleistocene glaciation and the beginning of the current Holocene epoch.

Common fossil remains include marine shells; the bones and teeth of fish, reptiles, and mammals; leaf assemblages; and petrified wood. Fossil traces, another type of paleontological resources, include internal and external molds (impressions) and casts created by these organisms. These items can serve as important guides to the age of the rocks and sediments in which they are contained, and may provide useful in determining the temporal relationships between rock deposits from one area and those from another as well as the timing of geologic events.

Fossil resources generally occur only in areas of sedimentary rock (e.g., sandstone, siltstone, mudstone, claystone, or shale). Because of the infrequency of fossil preservation, fossils, particularly vertebrate fossils, are considered to be nonrenewable paleontological resources. Occasionally fossils may be exposed at the surface through the process of natural erosion or as a result of human disturbances; however, they generally lay buried beneath the surficial soils. Thus, the absence of surface fossils does not preclude the possibility of their being present within subsurface deposits, while the presence of fossils at the surface is often a good indication that more remains may be found in the subsurface (CRM TECH 2009, p. 3).

Paleontological Sensitivity

The fossil record is unpredictable and the preservation of organic remains is rare, requiring a particular sequence of events involving physical and biological factors. Skeletal tissue with a high percentage of mineral matter is the most readily preserved within the fossil record; soft tissues not intimately connected with the skeletal parts, however, are the least likely to be preserved. For this reason, the fossil record contains a biased selection not only of the types of organisms preserved but also of certain parts of the organisms themselves. As a consequence, paleontologists are unable to know with certainty the quantity of fossils or the quality of their preservation that might be present within any given geologic unit.

Sedimentary units, which are paleontologically sensitive, are those geologic units (mappable rock formations) with a high potential to contain significant nonrenewable paleontological resources. More specifically, these are geologic units within which vertebrate fossils or significant invertebrate fossils have been determined by previous studies to be present or are likely to be present. These units include, but are not limited to, sedimentary formations that contain significant paleontological resources anywhere within their geographical extent as well as sedimentary rock units temporally or lithologically amenable to the preservation of fossils.

A geologic formation is defined as a stratigraphic unit identified by its lithic characteristics (e.g., grain size, texture, color, and mineral content) and stratigraphic position. There is a direct relationship between fossils and the geologic formations within which they are enclosed. With sufficient knowledge of the geology and stratigraphy of a particular area, it is possible for paleontologists to reasonably determine its potential to contain significant nonrenewable vertebrate, invertebrate, marine, or plant fossil remains.

The paleontological sensitivity for a geologic formation is determined by the potential for that formation to produce significant nonrenewable fossils. This determination is based on what fossil resources the particular geologic formation has produced in the past at other nearby locations. Determinations of paleontologic sensitivity must consider not only the potential for yielding vertebrate fossils but also the potential for a few significant fossils that may provide new and significant taxonomic, phylogenetic, and/or stratigraphic data.

The Society of Vertebrate Paleontology issued a set of standard guidelines intended to assist paleontologists to assess and mitigate any adverse effects/impacts on nonrenewable paleontological resources. The society defined three potential categories of paleontological sensitivity for geologic units that might be impacted by a proposed project. These categories are described below, along with the criteria used to establish their sensitivity.

- **High sensitivity:** Geologic units assigned to this category are considered to have a high potential for significant nonrenewable vertebrate, invertebrate, marine, or plant fossils. Sedimentary rock units in this category contain a relatively high density of recorded fossil localities, have produced fossil remains in the vicinity, and are very likely to yield additional fossil remains.

- **Low sensitivity:** Geologic units are assigned to this category when they have produced no or few recorded fossil localities and are not likely to yield any significant nonrenewable fossil remains.

- **Undetermined sensitivity:** Geologic units are assigned to this category when there is limited exposure of the rock units in the area and/or the rock units have been poorly studied (CRM TECH 2009, p. 5).

PALEONTOLOGICAL RESOURCES RESEARCH METHODS AND RESULTS

Records Search

CRM TECH utilized the records search service available through the Regional Paleontologic Locality Inventory located at the San Bernardino County Museum in Redlands and the Natural History Museum of Los Angeles County (NHMLAC) in Los Angeles. These institutions maintain files of regional paleontological localities, as well as supporting maps and documents for paleontological research.

The NHMLAC found no known paleontological localities within the area of potential effect or nearby from similar sediment lithologies to that occurring within the APE. A review of the Regional Paleontologic Locality Inventory by the San Bernardino County Museum (SBCM) indicates that no paleontological localities are recorded in the APE and no localities are recorded within several miles of the APE in any direction (CRM TECH 2009, p. 7).

According to the NHMLAC, in the lowest portion of the APE and along many of the drainages, there are surficial deposits of older Quaternary alluvium. These deposits, which are primarily fan deposits from the surrounding elevated terrain, will typically not contain significant vertebrate fossils, at least not in the uppermost layers. Geologic mapping indicates there are exposures of the Mississippian Furnace Limestone in the central portion of the APE. Despite this limestone being somewhat metamorphosed, it does contain recognizable invertebrate fossils and could potentially contain the remains of vertebrate fossils. The remainder of the APE contains Paleozoic metamorphic rocks and Mesozoic plutonic igneous rocks, both of which are considered to be devoid of fossils (CRM TECH 2009, p. 7).

The NHMLAC has determined that excavations that will penetrate into the Paleozoic metamorphic and Mesozoic igneous bedrock found throughout the majority of the APE will not encounter any vertebrate fossils. In addition, surface grading or shallow excavations into the older Quaternary alluvium found in the northeastern portion of the APE are also unlikely to uncover significant vertebrate fossils since this older alluvium is shallow and underlain by igneous bedrock exposed in the surrounding terrain (CRM TECH 2009, p. 8). Because of the APE's lithology, it is unlikely to yield any significant vertebrate fossils. However, the CRM TECH study notes that excavations within the Furnace Limestone Formation in the central portion of the APE have the potential to yield highly significant vertebrate fossils of late Paleozoic age which are otherwise poorly known in California.

The results of the records search conducted by the SBCM indicate that none of the geologic formations have the potential to contain significant nonrenewable fossil resources (CRM TECH 2009, p. 8). As a result, the SBCM has assigned all the geologic formations present within the APE a low sensitivity for yielding significant nonrenewable paleontological resources (CRM TECH 2009, p. 8).

Field Survey

The field survey conducted for the CRM TECH study did not produce any surface indications of paleontological resources within or adjacent to the APE. Surface soils were confirmed in the field as representing a gravelly, sandy loam matrix. Much of the APE has been disturbed by the ongoing mining activities and the construction of access roads, and large piles of quartz mining refuse are scattered throughout the area.

Omya California's geologist Howard Brown, who is intimately familiar with the White Knob Quarry, was interviewed as part of the CRM TECH study. He notes that "although rocks correlative with the Monte Cristo Limestone Formation are present in the APE, they have been metamorphosed by repeated regional and contact metamorphism to upper amphibolites grade and granulite grade (high temperature high pressure) and all of the limestone has been metamorphosed to marble, there is no remaining limestone that has not been metamorphosed. Based on 20 years of mining, it can be stated with certainty the potential for virtually any paleontological resources in igneous and metamorphosed rocks at the APE is nil." Brown also notes that rocks at the quarry are highly metamorphosed, coarse-grained calcite marble and—based on detailed field observations, sampling, drilling, and 20 years of mining—are not known to contain any fossils. He states that the possibility of finding non-metamorphosed fossiliferous limestones at the quarry is nonexistent.

However, according to CRM TECH, because there are pockets of non-metamorphosed limestone at the quarry, it is possible that some of these limestone pockets might contain remnant fossils, since fossils have been recovered from such limestone deposits in other portions of the metamorphic belt along the north flank of the San Bernardino Mountains (CRM TECH 2009, p. 12).

The primary ore being quarried at this location is a very coarse crystalline marble, with portions containing some very large calcite crystals. The Furnace Limestone, as mapped in the project area and now referred to as the Monte Cristo Limestone Formation, contains a significant amount of marble, which has a low potential for containing any paleontological resources. However, scattered small pockets of moderate to slightly metamorphosed limestone have been found within these large deposits of marble, and it is possible that this limestone may contain fossil remains, given that fossils have been recovered from limestone deposits found elsewhere in the area. These limestone pockets, though, appear to constitute a small percentage of the Monte Cristo Limestone.

The presence of the relatively small and infrequent pockets of potentially fossil-bearing limestone may account for the discrepancy in the sensitivity assessments between the SBCM and the NHMLAC. While the SBCM has assigned a low paleontological sensitivity for the Monte Cristo Limestone because "the Paleozoic and Mesozoic metamorphic and granitic rocks...do not preserve fossils," the NHMLAC notes that "excavations in the Furnace Limestone exposed in the central portion of the proposed project area could potentially recover highly significant vertebrate fossils of late Paleozoic age." The NHMLAC is presumably referring to the moderate to slightly metamorphosed limestone that appears to constitute a very small percentage of the Monte Cristo Limestone Formation (CRM TECH 2009, p. 12).

3.4.2 REGULATORY FRAMEWORK

FEDERAL

National Register of Historic Places

The National Register of Historic Places was established to recognize resources associated with the accomplishments of all peoples who have contributed to the country's history and heritage. Guidelines were designed for federal and state agencies in nominating cultural resources to the National Register. These guidelines are based on the integrity and significance of the resource. Quality of significance in American history, architecture, archaeology, engineering, and culture is present in resources that possess integrity of location, design, setting, materials, workmanship, feeling, and association.

The National Historic Preservation Act (NHPA) includes provisions that specifically address federal agencies' responsibilities when their activities involve National Historic Landmark (NHL) properties. Section 106 and its implementing regulations, "Protection of Historic Properties" (36 CFR Part 800), address federal agency responsibilities when an undertaking will affect properties eligible for or listed in the National Register of Historic Places.

Section 106 requires agencies, prior to approval of an undertaking, to "take into account" effects of an undertaking on historic properties. NHLs designated by the Secretary of Interior are included in this group. Section 110(f) of the act also outlines the specific actions that an agency must take when NHLs may be directly and adversely affected by an undertaking. Agencies must "to the maximum extent possible...minimize harm" to national Historic Landmarks affected by undertakings. Both Sections 106 and 110(f) also require agencies to afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking.

STATE

California Register of Historical Resources

The State Historical Resources Commission has designed the California Register of Historical Resources (CRHR) for use by state and local agencies, private groups, and citizens to identify, evaluate, register, and protect California's historical resources. The CRHR is the authoritative guide to the state's significant historical and archeological resources. This program encourages public recognition and protection of resources of architectural, historical, archeological, and cultural significance, identifies historical resources for state and local planning purposes, determines eligibility for state historic preservation grant funding, and affords certain protections under the California Environmental Quality Act (CEQA).

California Environmental Quality Act

Under CEQA, public agencies must consider the effects of their actions on both historical resources and unique archaeological resources. Pursuant to Public Resources Code (PRC) Section 21084.1, a "project that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment." Section 21083.2 requires agencies to determine whether proposed projects would have effects on unique archaeological resources.

Historical resource is a term with a defined statutory meaning (PRC Section 21084.1; determining significant impacts on historical and archaeological resources is described in CEQA Guidelines Section 15064.5 [a], [b]). Under CEQA Guidelines Section 15064.5(a), historical resources include the following:

> A resource listed in, or determined to be eligible by the State Historical Resources Commission, for listing in the California Register of Historical Resources (PRC Section 5024.1).
>
> A resource included in a local register of historical resources, as defined in Section 5020.1(k) of the Public Resources Code or identified as significant in a historical resource survey meeting the requirements of Section 5024.1(g) of the Public Resources Code, will be presumed to be historically or culturally significant. Public agencies must treat any such resource as significant unless the preponderance of evidence demonstrates that it is not historically or culturally significant.
>
> Any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California may be considered to be a historical resource, provided the lead agency's determination is supported by substantial evidence in light of the whole record. Generally, a resource will be considered by the lead agency to be "historically significant" if the resource meets the criteria for listing in the California Register of Historical Resources (PRC Section 5024.1), including the following:
>
> a) Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;
>
> b) Is associated with the lives of persons important in our past;

c) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or

d) Has yielded, or may be likely to yield, information important in prehistory or history.

The fact that a resource is not listed in, or determined to be eligible for listing in the California Register of Historical Resources, not included in a local register of historical resources (pursuant to Section 5020.1(k) of the Public Resources Code), or identified in a historical resources survey (meeting the criteria in PRC Section 5024.1(g)) does not preclude a lead agency from determining that the resource may be an historical resource as defined in PRC Section 5020.1(j) or 5024.1.

Historic resources are usually 45 years old or older and must meet at least one of the criteria for listing in the California Register of Historical Resources, described above (such as association with historical events, important people, or architectural significance), in addition to maintaining a sufficient level of physical integrity.

Properties of local significance that have been designated under a local preservation ordinance (local landmarks or landmark districts) or that have been identified in a local historical resources inventory may be eligible for listing in the CRHR and are presumed to be historical resources for purposes of CEQA unless a preponderance of evidence indicates otherwise (PRC Section 5024.1 and California Code of Regulations (CCR), Title 14, Section 4850). Unless a resource listed in a survey has been demolished, lost substantial integrity, or there is a preponderance of evidence indicating that it is otherwise not eligible for listing, a lead agency should consider the resource to be potentially eligible for the CRHR.

For historic structures, CEQA Guidelines Section 15064.5(b)(3) indicates that a project which follows the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings, or the Secretary of the Interior's Standards for Rehabilitation and Guidelines for Rehabilitating Historic Buildings (1995) will be considered as mitigating impacts to a less than significant level.

As noted above, CEQA also requires lead agencies to consider whether projects will impact unique archaeological resources. Public Resources Code Section 21083.2(g) states:

"Unique archaeological resource" means an archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria:

- *Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.*
- *Has a special and particular quality such as being the oldest of its type or the best available example of its type.*
- *Is directly associated with a scientifically recognized important prehistoric or historic event or person.*

Treatment options under Section 21083.2 include activities that preserve such resources in place in an undisturbed state. Other acceptable methods of mitigation under Section 21083.2 include

excavation and curation or study in place without excavation and curation (if the study finds that the artifacts would not meet one or more of the criteria for defining a unique archaeological resource).
Section 7050.5(b) of the California Health and Safety Code specifies protocol when human remains are discovered, as follows:

> *In the event of discovery or recognition of any human remains in any location other than a dedicated cemetery, there shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent remains until the coroner of the county in which the human remains are discovered has determined, in accordance with Chapter 10 (commencing with Section 27460) of Part 3 of Division 2 of Title 3 of the Government Code, that the remains are not subject to the provisions of Section 27492 of the Government Code or any other related provisions of law concerning investigation of the circumstances, manner and cause of death, and the recommendations concerning treatment and disposition of the human remains have been made to the person responsible for the excavation, or to his or her authorized representative, in the manner provided in Section 5097.98 of the Public Resources Code.*

CEQA Guidelines Section 15064.5(e) requires that excavation activities be stopped whenever human remains are uncovered and that the county coroner be called in to assess the remains. If the county coroner determines that the remains are those of Native Americans, the Native American Heritage Commission must be contacted within 24 hours. At that time, the lead agency must consult with the appropriate Native Americans, if any, as timely identified by the Native American Heritage Commission. Section 15064.5 directs the lead agency (or applicant), under certain circumstances, to develop an agreement with the Native Americans for the treatment and disposition of the remains.

In addition to the mitigation provisions pertaining to accidental discovery of human remains, the CEQA Guidelines also require that a lead agency make provisions for the accidental discovery of historical or archaeological resources, generally. Pursuant to Section 15064.5(f), these provisions should include "an immediate evaluation of the find by a qualified archaeologist. If the find is determined to be an historical or unique archaeological resource, contingency funding and a time allotment sufficient to allow for implementation of avoidance measures or appropriate mitigation should be available. Work could continue on other parts of the building site while historical or unique archaeological resource mitigation takes place."

Paleontological resources are classified as nonrenewable scientific resources. California Public Resources Code Section 5097.5 et seq. makes it a misdemeanor for anyone to knowingly disturb any archaeological, paleontological, or historical features situated on public lands. No state or local agencies have specific jurisdiction over paleontological resources. No state or local agency requires a paleontological collecting permit to allow for the recovery of fossil remains discovered as a result of construction-related earth-moving on state or private land in a project site.

LOCAL

San Bernardino County General Plan

The General Plan includes policies and programs that are intended to protect cultural and paleontological resources. The General Plan has identified Cultural Resource Overlay areas and requires new development proposed in these areas to perform a cultural resources field survey and evaluation. Furthermore, the General Plan requires that mitigation of impacts on important

cultural resources follow the standards established in Appendix G of the California Environmental Quality Act Guidelines.

The General Plan policies and programs that assist in the protection of cultural resources are listed below.

Policy CO 3.1 Identify and protect important archaeological and historic cultural resources in areas of the County that have been determined to have known cultural resource sensitivity.

Programs

1. Require a cultural resources field survey and evaluation prepared by a qualified professional for projects located within the mapped Cultural Resource Overlay area.

2. Mitigation of impacts to important cultural resources will follow the standards established in Appendix G of the California Environmental Quality Act Guidelines, as amended to date.

Policy CO 3.2 Identify and protect important archaeological and historic cultural resources in all lands that involves disturbance of previously undisturbed ground.

Programs

1. Require the Archaeological Information Center at the San Bernardino County Museum to conduct a preliminary cultural resource review prior to the County's application acceptance for all land use applications in planning regions lacking Cultural Resource Overlays and in lands located outside of planning regions.

2. Should the County's preliminary review indicate the presence of known cultural resources or moderate to high sensitivity for the potential presence of cultural resources, a field survey and evaluation prepared by a qualified professional will be required with project submittal. The format of the report and standards for evaluation will follow the "Guidelines for Cultural Resource Management Reports" on file with the San Bernardino County Land Use Services Department.

Policy CO 3.3 Establish programs to preserve the information and heritage value of cultural and historical resources.

Policy CO 3.5 Ensure that important cultural resources are avoided or minimized to protect Native American beliefs and traditions.

Programs

1. Consistent with SB 18, as well as possible mitigation measures identified through the CEQA process, the County will work and consult with local tribes to identify, protect and preserve "traditional cultural properties" (TCPs). TCPs include both manmade sites and resources as well as natural landscapes that contribute to the cultural significance of areas.

2. The County will protect confidential information concerning Native American cultural resources with internal procedures, per the requirements of SB 922, an addendum to SB 18. The purpose of SB 922 is to exempt cultural site information from public review as provided for in the Public Records Act. Information provided by tribes to the County shall be considered confidential or sacred.

3. The County will work in good faith with the local tribes, developers/applicants and other parties if the local affected tribes request the return of certain Native American artifacts from private development projects. The developer is expected to act in good faith when considering the local tribe's request for artifacts. Artifacts not desired by the local tribe will be placed in a qualified repository as established by the California State Historical Resources Commission. If no facility is available, then all artifacts will be donated to the local tribe.

4. [*Program 4 is not included in this list as it does not pertain to projects of this type]*

5. Because contemporary Native Americans have expressed concern over the handling of the remains of their ancestors, particularly with respect to archaeological sites containing human burials or cremations, artifacts of ceremonial or spiritual significance, and rock art, the following actions will be taken when decisions are made regarding the disposition of archaeological sites that are the result of prehistoric or historic Native American cultural activity:

    a. The Native American Heritage Commission and local reservation, museum, and other concerned Native American leaders will be notified in writing of any proposed evaluation or mitigation activities that involve excavation of Native American archaeological sites, and their comments and concerns solicited.

    b. The concerns of the Native American community will be fully considered in the planning process.

    c. If human remains are encountered during grading and other construction excavation, work in the immediate vicinity will cease and the County Coroner will be contacted pursuant to the state Health and Safety Code.

    d. In the event that Native American cultural resources are discovered during project development and/or construction, all work in the immediate vicinity of the find will cease and a qualified archaeologist meeting U.S. Secretary of Interior standards will be hired to assess the find. Work on the overall project may continue during this assessment period.

    e. If Native American cultural resources are discovered, the County will contact the local tribe. If requested by the tribe, the County will, in good faith, consult on the discovery and its disposition with the tribe.

San Bernardino Development Code

Division 2, Land Use Zoning Districts and Allowed Land Uses

Chapter 82.12 (Cultural Resource Preservation Overlay) of the Development Code is intended to provide for the identification and preservation of important archaeological and historical resources in the county. The application for a new development project proposed within a Cultural Resource Overlay is required to include a report prepared by a qualified professional that determines through appropriate investigation the presence or absence of archaeological and/or historical resources on the project site and within the project area, and recommends appropriate data recovery or protection measures. Currently, the County's Cultural Resources Sensitivity Overlay Map only covers the Oak Hills, Phelan, and Pinon Hills areas of the county. Therefore, the project site is not within a Cultural Resource Overlay.

Chapter 82.20 (Paleontological Resource Overlay) of the Development Code is intended to provide for the identification and preservation of important paleontological resources in the county. When a land use is proposed within a Paleontological Resource Overlay, the project is evaluated for compliance with the intent of the overlay. The overlay is applied to those areas where paleontologic resources are known to occur or are likely to be present. Specific identification of known fossil occurrences or potential paleontologic sensitivity is indicated by listing in the locality files of one or more of the following institutions: San Bernardino County Museum, University of California, and Los Angeles County Museum.

As described previously, the paleontological resources records search conducted for the proposed project utilized the records search services available through the San Bernardino County Museum and the Natural History Museum of Los Angeles County. According to these sources, no known paleontological localities occur within the APE or in the nearby area.

3.4.3 IMPACTS AND MITIGATION MEASURES

STANDARDS OF SIGNIFICANCE

Based on Appendix G of the CEQA Guidelines, a cultural or paleontological resources impact is considered significant if project implementation would result in any of the following:

1. Cause a substantial adverse change in the significance of a historical resource as defined in CEQA Guidelines Section 15064.5.

2. Cause a substantial adverse change in the significance of an archaeological resource as defined in CEQA Guidelines Section 15064.5.

3. Directly or indirectly destroy a unique paleontological resource or site or unique geological feature.

4. Disturb any human remains, including those interred outside of formal cemeteries.

The Notice of Preparation/Initial Study prepared for the proposed project (see **EIR Appendix A**) concluded that, based on the findings of cultural and paleontological resource assessments previously prepared for the project site, the presence of cultural and paleontological resources within the study area is highly unlikely, and no significant impacts are expected to occur. However, these previous assessments provided recommendations to address the discovery of previously unknown resources on the site that may be discovered during mining and

reclamation activities. Therefore, all of the significance thresholds listed above are addressed in the following impact analysis.

METHODOLOGY

The following impact analysis is based on the findings and conclusions of the cultural and paleontological technical studies prepared for the proposed project.

PROJECT IMPACTS AND MITIGATION MEASURES

Substantial Adverse Impact on an Archaeological or Historical Resource (Standards of Significance 1 and 2)

Impact 3.4.1 While no evidence of significant historical or archaeological resources has been identified for the project site, the proposed project through earth-moving activities may uncover a previously unknown historical or archaeological resource. This impact would be **potentially significant**.

As described previously, the archaeological records search, historical background research, and intensive-level field survey of the project site did not identify any significant archaeological or historical resources within the area of potential effect. However, archaeological resources were found in the buffer zone of the White Knob haul road APE. This resource was determined to not be of significance but has the potential to yield additional data that may change this conclusion. Additionally, consultation with concerned Native American tribes indicated that certain areas around the APE are highly sensitive for Native American cultural resources and that the APE lies within or in close proximity to a sacred site. Processing of the quarries may result in the unearthing of unknown historical or archaeological resources. This impact would be **potentially significant**.

Mitigation Measures

MM 3.4.1 It shall be required in the final Amended Mine and Reclamation Plan, that if, during the course of construction, mining, or reclamation activities previously unknown cultural resources (i.e., prehistoric or historic sites) are discovered, work shall be halted immediately within 50 feet of the discovery, the San Bernardino County Land Use Services Department shall be notified, and a professional archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards in prehistoric or historical archaeology shall be retained to determine the significance of the discovery. Determination of impacts, significance, and mitigation that protects the discovered resource shall be made by a qualified archaeologist in consultation with recognized local Native American groups, if appropriate. The San Bernardino County Museum shall also be contacted for review of the archaeological find(s). In addition, prior to the commencement of project excavations, all construction and mining personnel shall be informed of the potential to inadvertently uncover cultural resources and the procedures to follow subsequent to an inadvertent discovery of cultural resources.

Timing/Implementation: *Required to be placed in the final version of the Amended Plan and implemented during mining and reclamation activities*

Enforcement/Monitoring: *County of San Bernardino Planning Department*

Implementation of mitigation measure **MM 3.4.1** would ensure that any significant cultural resources inadvertently discovered during project implementation are protected and would reduce this impact to a level that is **less than significant**.

Disturb Human Remains (Standard of Significance 4)

Impact 3.4.2 No evidence of human remains has been identified for the project site. However, human remains could be encountered during construction, mining, or reclamation activities. This would be a **less than significant** impact.

Archaeological investigations completed for the project site did not identify any significant prehistoric or historic archaeological sites or human remains on those portions of the project site that were surveyed. The remainder of the project site has been heavily disturbed as a result of ongoing mining operations and is not likely to contain any human remains. However, construction, mining, and reclamation activities associated with the proposed project could result in the disturbance of previously unknown human remains.

Should human remains be discovered during any phase of the proposed project, the measures contained in Public Resources Code Section 5097.98 and Health and Safety Code Section 7050.5 would be followed, as required by state law. These measures include halting all work within a 200-foot radius of the discovery and notifying the County Coroner. If the remains are determined to be Native American, the coroner would notify the Native American Heritage Commission and the procedures outlined in CEQA Section 15064.5(d) and (e) would be followed. Compliance with these existing regulations would ensure that any human remains encountered during project implementation would be handled appropriately and no significant impacts would occur. Therefore, this impact would be **less than significant**.

Mitigation Measures

None required.

Destroy a Unique Paleontological Resource or Geologic Feature (Standard of Significance 3)

Impact 3.4.3 Implementation of the proposed project could result in the destruction of previously unknown unique paleontological resources or geologic features. This impact would be **potentially significant**.

Based on the research and field survey results of the paleontological resources assessment, the proposed project's potential to impact significant nonrenewable paleontological resources appears to range from low to indeterminate, depending on the type of rock encountered during mining operations. The surficial deposits of older Quaternary alluvium found within the drainages and in the lowest portion of the APE are unlikely to contain significant fossils, at least in the uppermost layers, and are considered to have a low potential. The Paleozoic metamorphic rocks and Mesozoic plutonic igneous rocks in the balance of the APE are also considered to have a low potential for significant fossil remains. Therefore, no paleontological monitoring of earth-moving activities is considered necessary within the alluvial soils, the highly metamorphosed rock, or the igneous rock.

However, there is the possibility that pockets of lesser metamorphosed limestones could be encountered in the areas of marble. Fossils have been found in similar formations in the area. Therefore, this limestone has to be assigned an undetermined potential for containing significant

nonrenewable paleontological remains, primarily invertebrate fossils. This impact would be **potentially significant**.

Mitigation Measures

MM 3.4.3 If non-metamorphosed fossiliferous limestones are encountered during mining activities, they shall be removed and retained for examination by a qualified paleontologist. If any fossil-bearing materials are encountered, a program to protect and preserve such resources that might be exposed or unearthed shall be developed in cooperation with the project applicant and San Bernardino County. The program shall be developed in accordance with the proposed guidelines of the Society of Vertebrate Paleontology and shall include, but not be limited to, the following:

- All non-metamorphosed fossiliferous limestones that are encountered during mining shall be stockpiled for examination by a qualified paleontologist. The monitor shall be prepared to quickly salvage any fossils that might be present. The monitor should also remove samples of sediments that are likely to contain the remains of small fossil vertebrates and invertebrates.

- Collected samples of sediments shall be processed to recover small invertebrate and vertebrate fossils. Recovered specimens shall be prepared so that they can be identified and permanently preserved.

- Any specimens shall be identified, curated, and placed into a repository with permanent retrievable storage.

- A report of findings, including an itemized inventory of recovered specimens, shall be prepared on completion of the steps outlined above. The report shall include a discussion of the significance of all recovered specimens. The report and inventory, when submitted to San Bernardino County, will signify completion of the program to mitigate impacts on paleontological resources.

Timing/Implementation: *Required to be placed in the final version of the Amended Plan and implemented during mining and reclamation activities*

Enforcement/Monitoring: *County of San Bernardino Planning Department*

Implementation of mitigation measure **MM 3.4.3** would ensure that any previously unknown unique paleontological resources or geologic features resources inadvertently discovered during project implementation are protected and would reduce this impact to a level that is **less than significant**.

This section discusses whether any element of the proposed project would result in increased exposure of people, structures, and/or the surrounding environment to geologic and seismic hazards such as ground shaking, slope failure, and accelerated erosion. Active surface mining and associated stockpiling and processing activities have been occurring in the project area since 1986. As a result, a substantial amount of information has been developed on the mineralogy, strength, and character of geologic units, the predominant orientation and abundance of geologic contacts and faults, and areas of existing slope instabilities. The conclusions in this section are based on project-specific geological data and on analyses and findings that have been developed by the project's geotechnical consultants and Omya's project geologist, Howard Brown (CHJ Consultants 2012, 2013 [EIR Appendix F]) and the results of annual sedimentation and erosion monitoring DCI 2012. These studies are the primary sources of information, conclusions, and recommendations presented in this section. The CHJ and DCI studies are part of the application materials for the proposed project included with the Amended Plan.

The County published a Notice of Preparation and Initial Study (NOP/IS) for the proposed project on June 12, 2013. A copy of the NOP/IS, along with comments received during the public review period, is contained in **EIR Appendix A**. The Office of Mine Reclamation (OMR) submitted comments on the NOP. OMR's comments were considered in the preparation of the analysis.

As required under the California Environmental Quality Act (CEQA), the effects of the project are analyzed in the existing environmental context, which is that of an active quarry whose pit highwalls have been generally stable, but localized rockfalls and landslides of side-cast overburden materials have occurred. One of the project's objectives is to correct the areas of instability in ongoing quarry excavations. This section evaluates the impacts of the project relative to baseline conditions, including whether its implementation would cause changes that would adversely affect off-site properties, the public, or the natural environment related to geologic and seismic hazards during and upon the completion of the proposed reclamation activities.

3.5.1 EXISTING SETTING

REGIONAL PROJECT GEOLOGY

The White Knob/White Ridge Limestone Quarries are located in the northern portion of the San Bernardino Mountains, which are part of California's Transverse Ranges Geomorphic Province, and south of Lucerne Valley (**Figure 3.5-1**). The Mojave Desert Geomorphic Province is located to the north of the site. The White Knob/White Ridge Limestone Quarries occupy an east–west-oriented resistant and rugged limestone ridge formed in the very steep north-sloping topography of the northern San Bernardino Mountains. Natural slopes descend to the north and northwest from the ridge of the quarries. A satellite ore deposit occurs to the east of the main White Knob Quarry on an adjacent north-trending White Ridge area that appears to be structurally related to the main quarry ridge. The area of the White Ridge deposit is not mined at this time, and adjacent slopes are in a natural state. The project includes future mining in this area.

A variety of rocks of Precambrian to recent age are exposed within the San Bernardino Mountains and the White Knob/White Ridge Limestone Quarries area. The Late Precambrian and Paleozoic metasedimentary rocks unconformably overlie earlier Precambrian basement (Figure 3.5-2). A major unconformity is present between Upper Cambrian and Devonian strata throughout the Mojave region. In the San Bernardino Mountains, Upper Precambrian and Lower Cambrian rocks are of miogeoclinal aspect; meaning sediments deposited at the edge of the continent or craton in shallow water and lacking sediments of volcanic origin. The middle Cambrian strata are of cratonal aspect, and upper Paleozoic rocks are identical to inner miogeoclinal facies of the

central and eastern Mojave region (Brown 1984). The general geologic structure and lithology of the site region are shown on Figure 3.5-3 adapted from Miller, Matti, and Brown (2000).

Several major tectonic events have been recognized in various parts of the San Bernardino Mountains, including complex Mesozoic age multiphase folding and thrust faulting, contact and regional metamorphism, and intrusive events. Cenozoic activity includes several generations of high- and low-angle faulting and mild folding. The San Bernardino Mountains area continues to be seismically active, as evidenced by the significant earthquakes in the area during the last 15 years (see subsection 3.5.2, Regional and Local Faulting and Seismicity).

The complex geologic history of the San Bernardino Mountains has allowed the formation of several large high brightness, high purity crystalline limestone deposits in the upper Paleozoic miogeoclinal limestone formations in the mountain range, with the White Knob/White Ridge Limestone Quarries among these deposits. Mississippian Monte Cristo limestone is mined for high brightness, high purity calcium carbonate, and the Pennsylvanian Bird Spring Formation is mined for cement grade limestone. At the quarries, Monte Cristo Limestone is mined. The White Knob Quarry deposit contains exceedingly coarse grained, very white translucent calcite marble. Individual calcite crystals are commonly over 1 inch across.

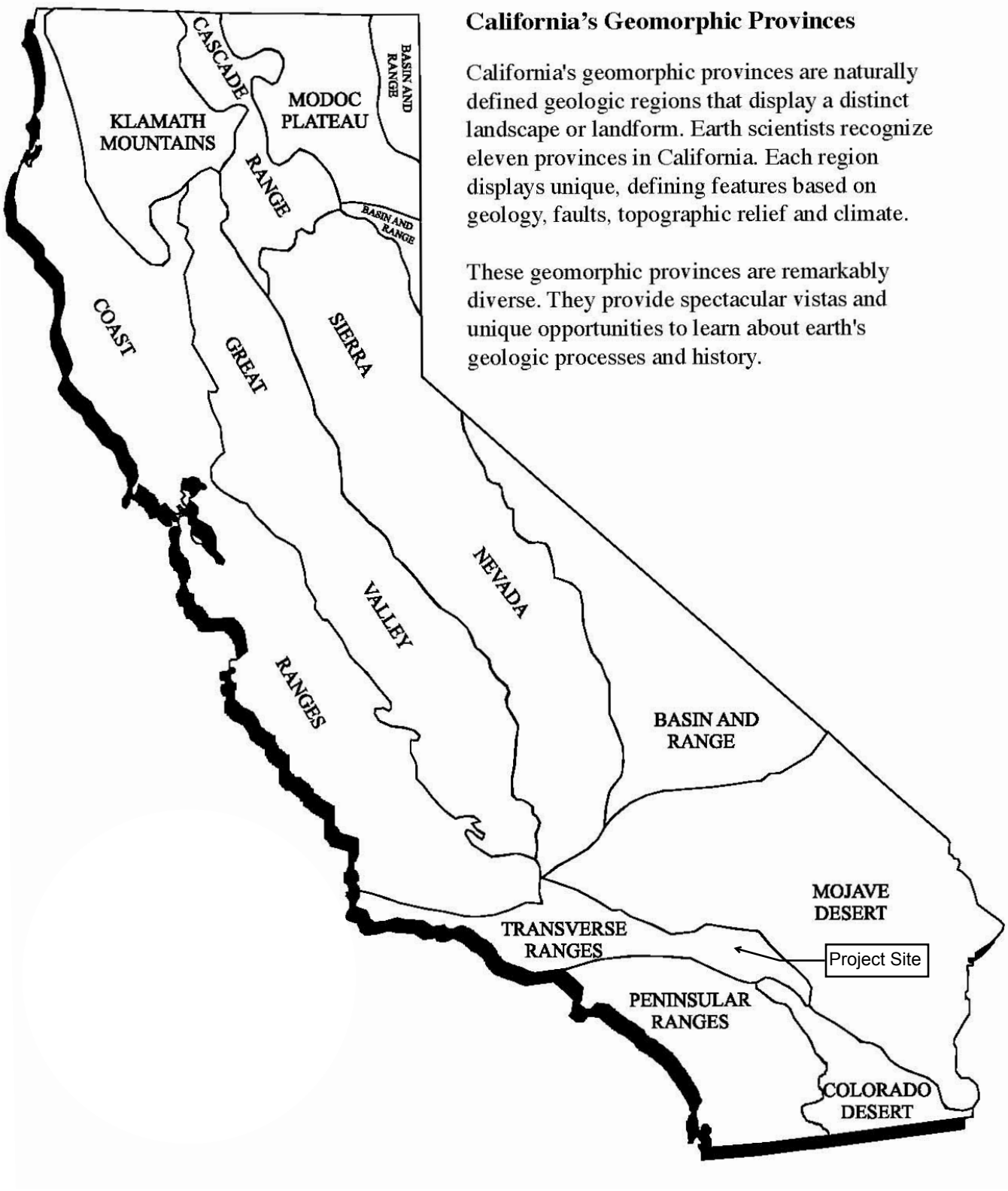
High purity white crystalline limestones have a large number of uses and are classified as white fillers and extenders with value added characteristics. The products are finely ground, high brightness, high purity limestone, and are the whitest, purest, and most valuable per ton of all limestone products. For most uses, white fillers and extenders require not only the most pure limestone but also the whitest color of all limestones.

Quaternary deposits mapped by Miller, Matti, and Brown (2000) along the northern flank of the San Bernardino Mountains include alluvial fan, axial valley, talus, colluvial, surficial, and landslide deposits ranging in age from very old (Pleistocene) to recent (Holocene) age. Sediments within the mining area primarily comprise colluvium and surficial sediments as thin slope mantling soils and in drainage channels as thin coarse-grained veneers in bedrock channels.

TOPOGRAPHY

The San Bernardino Mountains are one of the major ranges in the east–west-trending Transverse Ranges province of southern California. The north slope of the range rises abruptly from the desert floor in Lucerne Valley, with elevations along the north range crest reaching 8,400 feet above mean sea level (amsl). The access roadway for the White Knob/White Ridge Limestone Quarries mining operations begins east of the mine at an elevation of approximately 4,000 feet amsl near the Lucerne Valley processing plant facility. The roadway runs westerly across the desert for approximately 4.4 miles to an elevation of approximately 4,400 feet amsl where it turns southward toward the quarries. The mine roadway rises over the next 0.7 miles to an elevation of approximately 4,900 feet amsl where it enters the quarry operations area. The current quarry operations have excavated into the limestone from an elevation of approximately 5,465 to 6,250 feet amsl. Overburden materials currently in place in the main central drainage area range in elevation from approximately 5,330 to 5,050 feet amsl.

T:_GS\Work\San Bernardino, County of\White Ridge Limestone Quarry\Figures



Source: California Department of Conservation, California Geological Survey, 2002.

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Figure 3.5-1
California's Geomorphic Provinces

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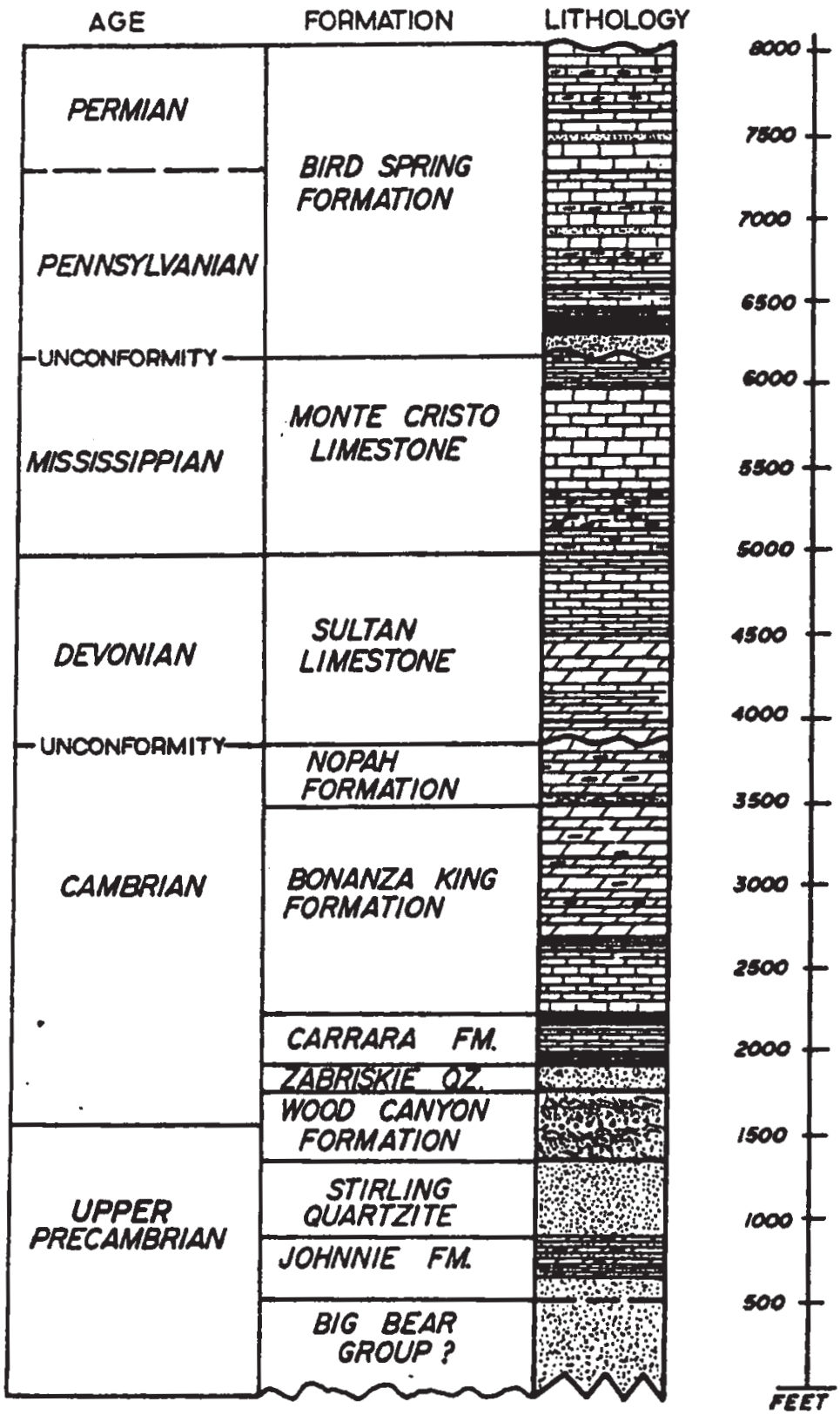

Source: AMENDED MINE AND RECLAMATION PLAN FOR OMYA CALIFORNIA WHITE KNOB - WHITE RIDGE LIMESTONE QUARRIES Figure 3.5-2

Figure 3.5-2

Stratigraphic Column of Paleozoic Rocks
Western San Bernardino Mountains

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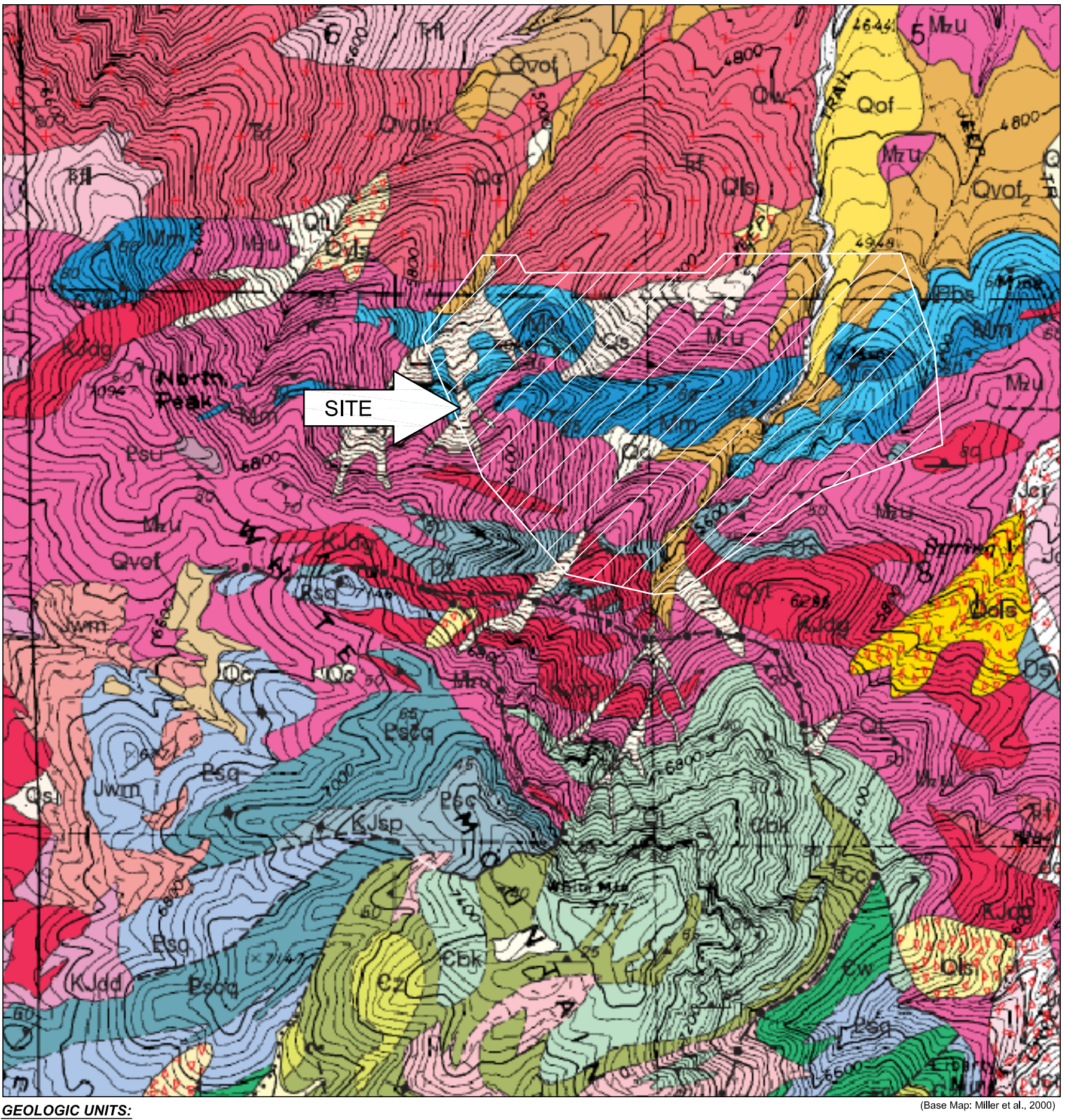

(Base Map: Miller et al., 2000)

GEOLOGIC UNITS:

Holocene sediments

Qc modern colluvial deposits

Qs undifferentiated surficial deposits

Qyt young talus deposits

$Qvof_2$ very old alluvial fan deposits

Crystalline Rocks

Mzu Mesozoic granitic rocks, undivided. Monzogranite to diorite, including small areas of monzonite. Includes heterogeneous, nondistinctive granitic rocks that cannot be assigned to larger granitic units in Butler Peak quadrangle. Fine- to coarse-grained; massive to foliate and lineate.

KJdg Mixed diorite and gabbro (Cretaceous and Jurassic). Biotite-hornblende diorite and quartz diorite, hornblende-biotite diorite and quartz diorite, pyroxenehornblende gabbro, and hornblende gabbro. Fine- to coarse-grained. Dioritic rocks appear to have possible spatial relation to Paleozoic carbonate rocks and intermediate composition Mesozoic plutons.

Pbs Bird Spring Formation (Pennsylvanian). Upper part of Furnace Limestone of Vaughan (1922) as mapped by Guillou (1953), Richmond (1960); correlated with Bird Spring Formation of southern Great Basin by Cameron (1981) and Brown (1991). Generally light-colored, medium- to thick-bedded, medium to coarsely crystalline calcite marble. Degree of recrystallization in quadrangle precludes confident subdivision of formation, but in Fawnskin quadrangle to east, typical lithologies include white, gray, or mottled marble and cherty, silicified marble. Some chert-bearing calcite marble contains lenses and thin layers of quartz silt and fine sand. Intermittent layers of minor brownweathering dolomite marble, siliceous marble horizons, and dark-gray calcite marble. In Butler Peak quadrangle, due to extreme recrystallization and deformation, layering in much of formation may or may not represent bedding.

Mm Monte Cristo Limestone (Mississippian). Upper part of Furnace Limestone of Vaughan (1922) as mapped by Richmond (1960). Correlated with the Monte Cristo Limestone of the southern Great Basin by Cameron (1981), and mapped by Brown (1984, 1987, and 1991) who recognized several formal stratigraphic members named originally by Hewitt (1931). Degree of recrystallization in quadrangle precludes recognition of detailed subdivisions, but includes heterogeneous, interlayered, light- and dark-gray, calcite and dolomite marble characteristic of Yellowpine Member, and thick-layered, light-gray to white, texturally massive, very pure calcite marble characteristic of Bullion Member.

Ds Sultan Limestone (Devonian). Middle part of Furnace Limestone of Vaughan (1922) as mapped by Richmond (1960); Brown (1991) correlated rocks in this interval with members of Sultan Limestone of Hewitt (1931) in southern Great Basin. Includes: (1) thin- to thick-layered, white calcite marble containing sparse thin layers of dark-gray calcite and dolomite marble characteristic of Crystal Pass Member; in part irregularly dolomitized. (2) Laminated to massive, light-gray, brown, and white, finely crystalline, locally chert-bearing metadolomite characteristic of Valentine Limestone Member.

geologic contact

Source: CHJ Consultants

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Figure 3.5-3

Regional Geologic Map of White Knob/White Ridge Quarries Area

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PROJECT GEOLOGY AND SOILS

Bedrock and Soils

Rocks at the White Knob/White Ridge Limestone Quarries include Paleozoic metamorphosed sedimentary rocks, Mesozoic granitic rocks, and younger landslide, talus, and coarse-grained alluvial deposits. The San Bernardino Mountains contain the largest high brightness, high purity limestone mining operations in North America.

Paleozoic Rocks and Limestone Deposit

Paleozoic rocks and ore grade limestone deposits at the quarries are mined from the Bullion Member of the upper Monte Cristo limestone of Mississippian Age. The stratigraphic section of Monte Cristo limestone at the White Knob/White Ridge Limestone Quarries is developed in an isoclinally folded (a fold with parallel limbs) and overturned section. The full thickness of the Bullion Member is up to 400 feet thick. The White Knob/White Ridge Limestone Quarries deposit occurs in the core of a tight fold and where the thickness of the Bullion Member has been increased. In the quarry area, the rocks strike nearly east–west and dip to the south. Dips range from about 45 degrees up to vertical.

The southern and northern margins of the White Knob/White Ridge Limestone Quarries ore deposit are formed by contact with steeply south-dipping intrusive rocks that include granitic and foliated schistose rocks. Foliation (bedding) measured within and along the ore body margin generally strikes east–west and dips southward at steep inclinations. Major contacts between the geologic mapping units include faults as mapped by Howard Brown, the Omya project geologist. High-angle faults are also mapped trending perpendicular to the east–west trend of the ore body (cross faults). The bedrock geologic materials observed in the quarry walls exhibit well-developed joint sets and systems, localized shear zones, and localized foliation that were measured with a geologic compass and recorded on a 100-scale topographic map (EIR Appendix F, CHJ 2013). These data are shown on the Geologic Map and Site Plan (**Figure 3.5-4**).

Mesozoic Rocks

Mesozoic rocks at the quarry include a variety of granitic rocks, which have intruded the deposit to the south, and younger thin granite dikes have intruded the deposit in several places. The rocks can be differentiated as to older plutonic rocks, which are non-fluorescent, and younger thin more siliceous dikes in which feldspars are highly fluorescent. The granitic rocks have created both regional and contact metamorphism of the adjacent carbonate rocks and have allowed coarse-grained marbles to form.

Other Metamorphic and Mineralized Rocks

Contact metamorphism in the general area of the quarries has formed several small skarn[1] zones, some of which contain small amounts of metallic minerals. In the surrounding area are several small zones that have been prospected in the past for a variety of metallic minerals, including gold, copper, and zinc. The known showings are small and non-economic. Within the

[1] A coarse-grained metamorphic rock, typically containing garnet, pyroxene, and wollastonite, formed by contact metamorphism of carbonate rocks.

quarry, a small contact sulfide zone has been encountered. This zone is up to 2 feet thick and is dominated by pyrite, pyrrotite, sphalerite, and magnetite. The material is volumetrically insignificant as an ore deposit, contaminates the adjacent limestone, and is waste rock. The sulfide-bearing rock, which is less than 0.005 percent of the waste rock, is placed in the overburden site where it is encapsulated by the carbonate-dominated waste rock, and thus no acid mine drainage can form from the material.

Younger Rocks and Alluvial Deposits

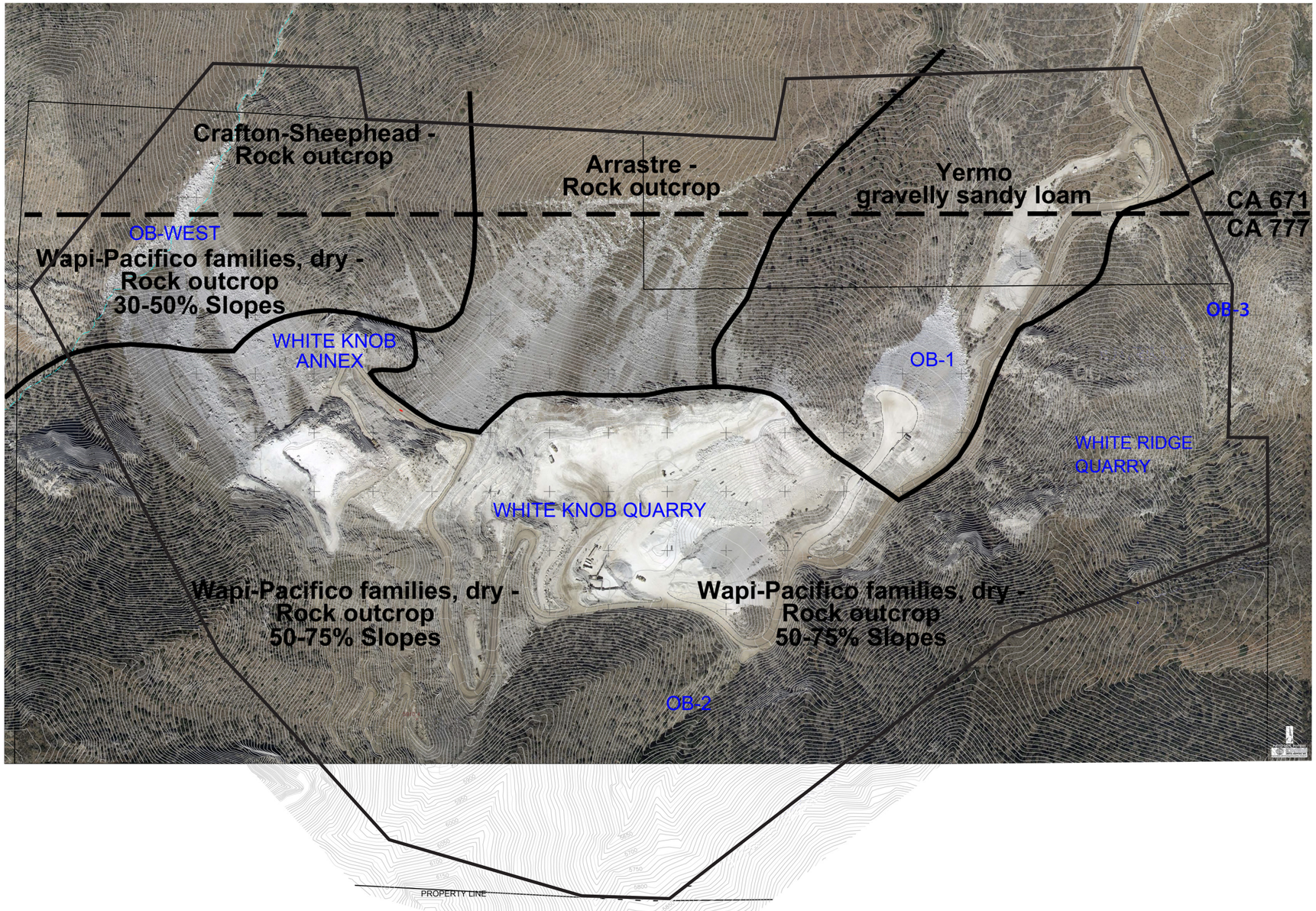
Younger rocks at the quarry area are derived from the older sedimentary, metamorphic, and igneous rocks and include landslide, talus, colluviums, and alluvial deposits. Landslide deposits are located along the north slope of the deposit and within a drainage to the south of the deposit. The landslide deposit to the north includes numerous very large boulders of white marble. Early attempts at mining at the deposit were in the landslide material, which tried to recover the white boulders.

Talus deposits are present along the east slope of the upper Western Drainage. Early road building in the 1970s constructed several roads in the talus deposit material. It is estimated that the natural talus material is up to 30 feet thick and forms a mantle on the steep slopes. The talus formed in Pleistocene and Holocene time by erosion of the very steep canyon slopes. Alluvial deposits include several generations of Pleistocene and Holocene and recent alluvium derived from exposed bedrock by fluvial processes.

Overburden Material

Overburden and waste rock at the White Knob/White Ridge Limestone Quarries are composed of grey impure limestone and granite intrusive rock and granite dikes. Overburden and waste rock are nontoxic, naturally occurring rock material, but are of insufficient quality (purity and brightness) to process for ore. The vast majority (60 percent) of the overburden and waste rock is dominantly impure calcium carbonate. Most of the remainder (40 percent) is granitic rock (monzonite). Limestone waste rock/overburden does not have the chemical composition to create acid mine drainage.

T:_CS\Work\San Bernardino County of\White Ridge Limestone Quarry\Figures



SITE INFORMATION

UTILITIES:

Water:	Imported	Gas:	N/A
Sewage:	Portable Toilets	Telephone:	Mobile Service
Electricity:	Generator	Cable TV:	N/A

LEGAL DESCRIPTION:

APN 0446-011-04:	S 1/2 S 1/2 SE 1/4 FRACTIONAL SEC 6 TP 3N R1W 40 AC M/L
APN 0446-011-05:	GOVT LOTS 4 5 6 7 8 11 12 13 14 15 16 17 18 19 20 AND 21 AND N 1/2 SE 1/4 AND N 1/2 S 1/2 SE 1/4 FRACTIONAL SEC 6 TP 3N R 1W
APN 0446-011-06:	NE 1/4 FRACTIONAL SEC 7 TP 3N R 1W 160 AC M/L
APN 0446-021-35:	PTN WHITE RIDGE PLACER CLAIM PAT NO 1186488 NW 1/4 SEC 8 TP 3N R 1W EX E 1/2 E 1/2 NE 1/4 NE 1/4 NW1/4 157.5 AC M/L
APN 0446-021-11:	S 1/2 FRACTIONAL SEC 5 TP 3N R 1W EX S 1/2 SE 1/4 319.20 AC M/L

PROJECT ACREAGE

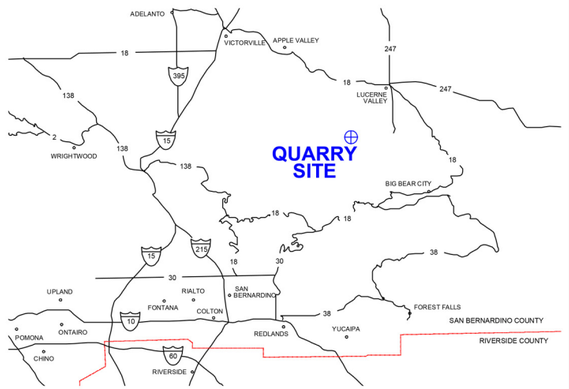
PRIVATE LAND:

Existing Area Disturbed:	145.00 Acres
Area to be Disturbed:	190.10 Acres

FEDERAL LAND:

Existing Area Disturbed:	9.20 Acres
Area to be Disturbed:	40.00 Acres

TOTAL AREA TO BE RECLAIMED: 335.10 Acres



LEGEND

SOIL UNIT BOUNDARIES

Source: AMENDED MINE AND RECLAMATION PLAN FOR OMYA CALIFORNIA WHITE KNOB - WHITE RIDGE LIMESTONE QUARRIES Figure 3.5-5

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Figure 3.5-4
Soil Resources at White Knob/White Ridge Quarries

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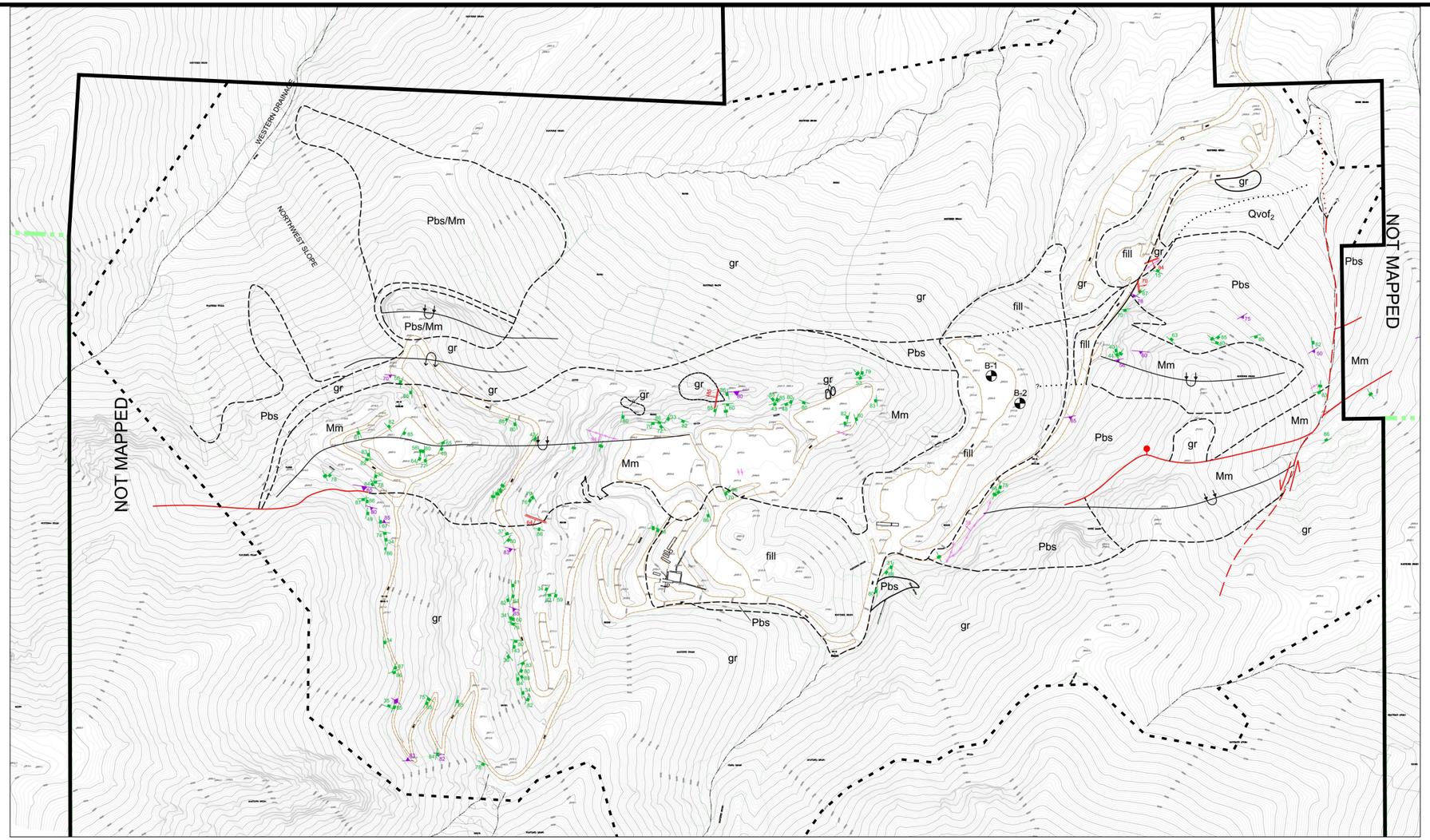

GEOLOGIC UNITS:

f - fill
Qvof - very old alluvial fan deposits (Holocene)
gr - undifferentiated granitic rocks (Mesozoic)
Pbs - Bird Spring Formation (Pennsylvanian)
Mm - Monte Cristo Limestone (Mississippian)

B-2 Location of exploratory boring

overturned synform/antiform

fault

approximate geologic contact - modified from Miller et al. (2000) based on field mapping

mafic dike

strike of vertical foliation

88 strike and dip of foliation

94 strike and dip of joint

strike and dip of vertical joint

85 strike and dip of shear zone

Source: AMENDED MINE AND RECLAMATION PLAN FOR OMYA CALIFORNIA WHITE KNOB - WHITE RIDGE LIMESTONE QUARRIES Figure 3.5-4

Figure 3.5-4
Geologic Map of White Knob/White Ridge Quarries

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Native Soils

The White Knob/White Ridge Limestone Quarries soil resources were assessed in the report entitled Soil Resources at White Knob Quarry by Paul Kielhold, dated October 2008. Published soil surveys were reviewed and site visits made to correlate mapping data to the Amended Reclamation Plan.

The soils at the White Knob/White Ridge Limestone Quarries have been the subject of two mapping efforts to date by the U.S. Department of Agriculture, Natural Resources Conservation Service. The results of the first effort were published in a survey entitled, Soil Survey of San Bernardino County, California, Mojave River Area (CA671), which was published in 1986 by what was then called the U.S.D.A. Soil Conservation Service in cooperation with the U.C. Agricultural Experiment Station. That survey covers only a small portion of the current mine site along the northern boundary.

A second survey was conducted of the San Bernardino National Forest Area (CA777), which extends from south of the quarry to a line north of Sections 7 and 8, Township 3 North, Range 1 West, San Bernardino Base and Meridian. The second survey covers the quarry area and most of the area within the currently proposed amendment to the mine reclamation plan. Data from both soil surveys was accessed via the Internet (NRCS). The mapping units and discussion that follow are taken primarily from the second, more recent survey with references made to the corresponding units from the first survey. The soil mapping units from published surveys have been transferred to the amended mine reclamation plan map (**Figure 3.5-5**).

There are three mapping units shown on most of the site, with the difference between two of them being the degree of slope (30–50 percent slopes versus 50–75 percent slopes). The soil-mapping units from the more recent survey (CA777) are:

- Wapi-Pacifico families, dry – Rock outcrop complex, 30 to 50 percent slopes
- Wapi-Pacifico families, dry – Rock outcrop complex, 50 to 75 percent slopes
- Yermo gravelly sandy loam, 30 to 50 percent slopes.

A "complex" mapping unit is one that consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. Some surveys include "miscellaneous areas," which have little or no soil material and support little or no vegetation. A rock outcrop is an example. Due to the rugged mountainous nature of the area and arid climate, limestone often forms rocky ridges devoid of soil or with only a thin rocky layer developed. Generally, soil or growth medium is rarely more than 6 to 12 inches thick. Tree roots may extend only several feet down into fractures in the bedrock. Soil may be 2 feet thick or more near or within ravines and may be up to 3 feet in the Yermo gravelly sandy loam in the northeast area along the haul road on-site.

The soils in White Knob/White Ridge Limestone Quarries area are mapped predominantly as Wapi-Pacifico complexes containing rock outcrop. As such, they contain areas that average about 0.8 feet of soil depth and essentially barren areas (rock outcrop) over as much as 25 percent of the area of the mapping unit. The soil north (downslope) from the north quarry wall (original mountain ridge) is more developed and averages about 3 feet deep. This includes the Crafton-Sheephead-Rock outcrop, the Arrastre-Rock outcrop, and the Yermo gravelly sandy loam units.

The Yermo gravelly sandy loam can be 60 inches deep. The Yermo unit as mapped on-site extends from the northeast corner (near the haul road) to the southwest, about as far as White Knob. As originally mapped, it covers alluvial and colluvial slopes at the lower elevations and extends to the steep mountainsides near White Knob, such as those now described as Wapi-Pacifico-Rock outcrop complexes.

Forest Service studies have determined that much of the soil found in the limestone mining area is classified as low to very low in productivity (Kielhold 2008). The soils are predominantly shallow, moderate to excessively drained and coarse textured with low moisture holding capacity. Bedrock outcroppings and substantial rock fragments are present throughout the soil. Vegetation response on these soils varies greatly due to low moisture conditions. The rugged mountainous steep terrain, rocky outcrops, and paucity of soil severely limit the amount of soil that may be recoverable through standard industry practices. This is particularly true at the project site, where virtually no soil is present on the limestone deposits and there is minimal vegetative material to be salvaged. Trees and vegetation that do exist will be grubbed and stored in growth media stockpiles on the overburden pads. Growth media salvaged will be composed of small amounts of topsoil, brown-colored fine-textured waste, and/or white-colored crusher fines and will be stored at the overburden site pads or distributed directly at active reclamation sites. Permanent and temporary material/growth media stockpiles will be stockpiled separately from overburden, fines, and waste rock, clearly identified, and covered with larger material to control erosion if needed.

The chemical composition of soils developed from Paleozoic limestone formations on the Omya California claims was analyzed by Burke (1981) and found to be pH neutral ranging from 7.2 to 7.8. Chemical analysis shown on **Table 3.5-1** is similar to the soils in the project area. Soil pH of less than 8.3 is not considered to represent an overly alkaline condition for most native plant species of the arid southwest, and the reclamation sites will not require chemical treatments to control pH.

TABLE 3.5-1
SOIL PROPERTIES FROM BURKE EXPERIMENTAL REVEGETATION PLOTS SAMPLES

Soil Property	Mean	Standard Deviation
pH	7.5	0.2
Electrical Conductance (x 1,000)	0.4	0.1
Nitrate Nitrogen	3.6	1.2
Sulfate Sulfur	< 5.0	–
Potassium	109.5	64.3
Phosphate Phosphorus	6.1	1.9
Iron	6.1	3.1
Zinc	4.4	1.2
Copper	1.4	0.4
Manganese	5.9	3.4
Sodium*	7.6	10.1
Calcium*	111.3	77.4
Magnesium	15.0	4.7

Source: Burke 1981
Mean = Nutrient values are in parts per million air dry soil or (*) saturation extract.

Mineral Resources

Omya has received Mineral Resource Zone 2 status (MRZ-2) for the limestone deposits on the White Knob/White Ridge Limestone Quarries area. Mineral resource zones are defined by the (California Department of Conservation (DOC) as follows:

- MRZ – 2: Areas underlain by mineral deposits where geologic data show that significant measured or indicated resources are present. MRZ-2 is divided on the basis of both degree of knowledge and economic factors.

  – MRZ-2a contain discovered mineral deposits that are either measured or indicated reserves as determined by such evidence as drilling records, sample analysis, surface exposure, and mine information. Land included in the MRZ- 2a category is of prime importance because it contains known economic mineral deposits. A typical MRZ-2a area would include an operating mine, or an area where extensive sampling indicates the presence of a significant mineral deposit.

  – MRZ-2b—Areas underlain by mineral deposits where geologic information indicates that significant inferred resources are present. Areas classified MRZ-2b contain discovered deposits that are either inferred reserves or deposits that are presently sub-economic as determined by limited sample analysis, exposure, and past mining history. Further exploration work and/or changes in technology or economics could result in upgrading areas classified MRZ-2b to MRZ-2a. A typical MRZ-2b area would include sites where there are good geologic reasons to believe that an extension of an operating mine exists or where there is an exposure of mineralization of economic importance (DOC No Date, p. 4).

Core drilling, detailed geologic mapping, and assay data prove the deposits are significant mineral resources (MRZ-2) and easily exceeded the criteria established by the California Department of Conservation Division of Mines and Geology. **Figure 3.5-6** shows the MRZ zoning of the White Knob/White Ridge claim area. The White Knob/White Ridge Limestone Quarries deposit is given MRZ-2 rating, which indicates it is recognized by the state as a valuable proven mineral resource with substantial reserves. MRZ-2 status is significant, as it recognizes the significance and importance of mineral resources and mining in land use planning.

REGIONAL AND LOCAL FAULTING AND SEISMICITY

Earthquake Terminology and Concepts

Earthquake Mechanisms and Fault Activity

A "fault" is defined as a fracture or zone of closely associated fractures along which rocks on one side have been displaced with respect to those on the other side. Most faults are the result of repeated displacement that may have taken place suddenly and/or by slow creep. A fault is distinguished from those fractures or shears caused by landsliding or other gravity-induced surficial failures. A "fault zone" is a zone of related faults that commonly are braided and subparallel, but may be branching and divergent. A fault zone has significant width (with respect to the scale at which the fault is being considered, portrayed, or investigated), ranging from a few feet to several miles.

An earthquake on a fault is produced when tectonic stress across the fault exceeds the strength of the earth's crust and the rock ruptures. The rupture causes seismic waves to propagate

through the earth's crust, producing the ground shaking effect known as an earthquake. The amount of rupture along a fault often varies, producing differing amounts of movement or slip along the fault. Fault rupture may or may not be visible at the earth's surface.

The Alquist-Priolo Earthquake Fault Zoning Act became part of California law on December 22, 1972, and went into effect March 7, 1973 (Bryant and Hart 2007). The law is codified in the California Public Resources Code (PRC) as Division 2, Chapter 7.5. This law initially was designated as the Alquist-Priolo Geologic Hazard Zones Act. The act was renamed the Alquist-Priolo Special Studies Zones Act effective May 4, 1975, and the Alquist-Priolo Earthquake Fault Zoning Act effective January 1, 1994. The original designation "Special Studies Zones" was changed to "Earthquake Fault Zones" when the act was last renamed.

For the purposes of the Alquist-Priolo Earthquake Fault Zoning Act, an "active fault" is defined by the State Mining and Geology Board in PRC Section 3601 as one which has had surface displacement within Holocene time (about the last 11,000 years). This definition does not, of course, mean that faults lacking evidence for surface displacement within Holocene time are necessarily inactive. A fault may be presumed to be inactive based on satisfactory geologic evidence; however, the evidence necessary to prove inactivity sometimes is difficult to obtain and locally may not exist.

An active fault can be identified if historic (last 200 years) displacement has occurred and is associated with one or more of the following: (a) a recorded earthquake with surface rupture, (b) fault creep slippage (slow ground displacement usually without accompanying earthquakes), and/or (c) displaced survey lines. Holocene fault displacement that occurred during the past 11,000 years without a historic record is identified by geomorphic evidence. Geomorphic evidence for Holocene faulting includes sag ponds, scarps showing little erosion, or the following features in Holocene age deposits: offset stream courses, linear scarps, shutter ridges, and triangular faceted spurs. The age of faulting offshore is based on the interpreted age of the youngest strata displaced by faulting.

Because the Alquist-Priolo Act requires the State Geologist to establish Earthquake Fault Zones to encompass all "potentially and recently active" traces of the San Andreas, Calaveras, Hayward, and San Jacinto faults, additional definitions were needed (PRC Section 2622). Initially, faults were defined as "potentially active" and were zoned if they showed evidence of surface displacement during Quaternary time (last 1.6 million years). Exceptions were made for certain Quaternary (i.e., Pleistocene) faults that were presumed to be inactive based on direct geologic evidence of inactivity during all of Holocene time or longer. The term "recently active" was not defined, as it was considered to be covered by the term "potentially active." Beginning in 1977, evidence of Quaternary surface displacement was no longer used as a criterion for zoning. However, the term "potentially active" continued to be used as a descriptive term on map explanations on Earthquake Fault Zone maps until 1988.

Earthquake Magnitude

When an earthquake occurs along a fault, its size can be determined by measuring the energy released during the event. A network of seismographs records the amplitude and frequency of the seismic waves that an earthquake generates. The Richter Magnitude (M) of an earthquake represents the highest amplitude measured by a seismograph at a distance of 100 kilometers from the epicenter. Richter magnitudes vary logarithmically, with each whole number step representing a ten-fold increase in the amplitude of the recorded seismic waves and 31.6 times the amount of energy released. While Richter Magnitude was historically the primary measure of earthquake magnitude, seismologists now use Moment Magnitude as the preferred way to

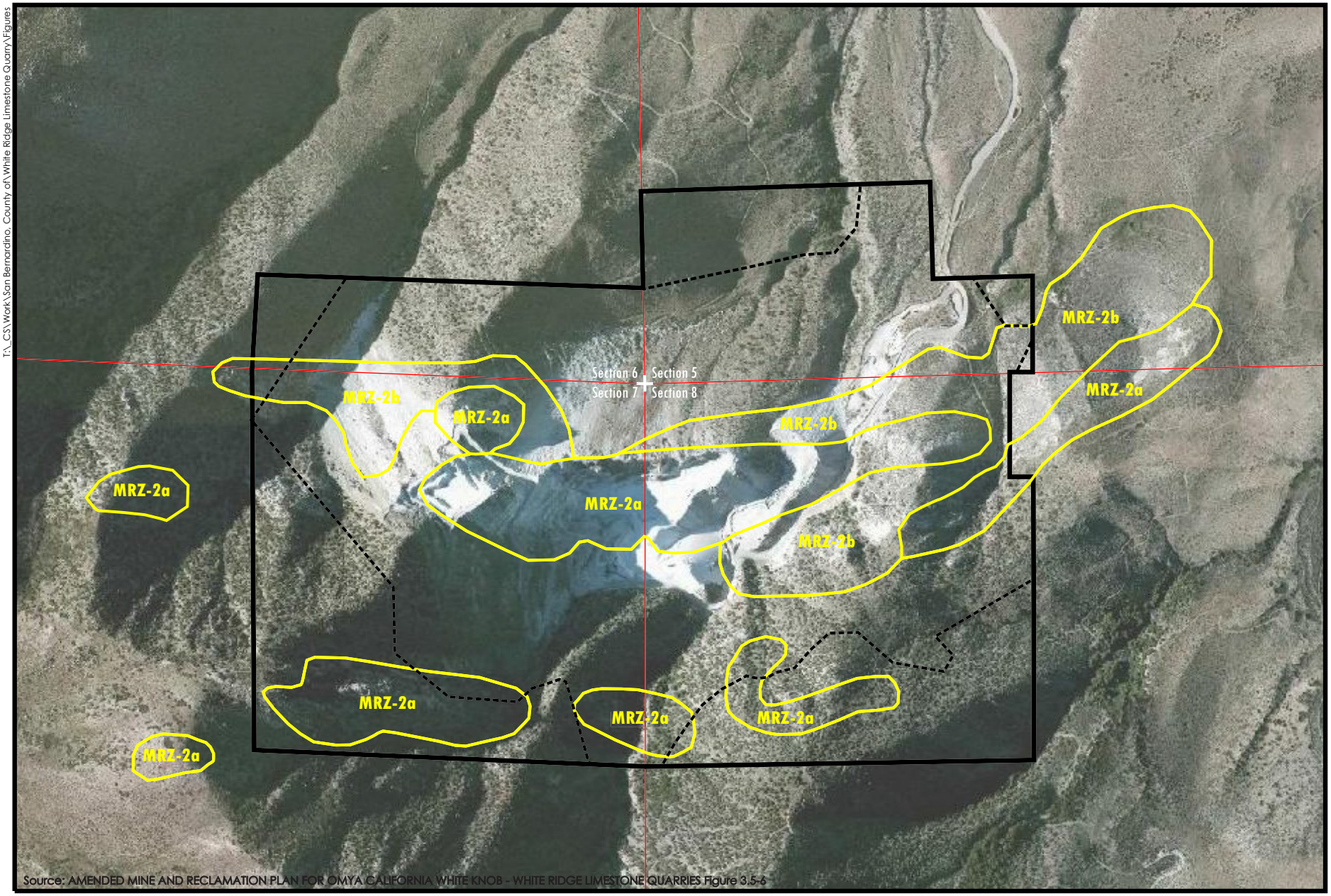

Figure 3.5-6

Mineral Land Classification at Map White Knob/White Ridge Quarries

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express the size of an earthquake. The Moment Magnitude scale (Mw) is based on the moment of the earthquake, which is equal to the rigidity of the earth times the average amount of slip on the fault, times the amount of fault area that slipped. Although the formulas of the scales are different, they both contain a similar continuum of magnitude values, except that Mw can reliably measure larger earthquakes and do so from greater distances.

Peak Ground Acceleration

A common measure of ground motion at any particular site during an earthquake is the peak ground acceleration (PGA). The PGA is the maximum acceleration experience by a particle of the earth during the course of the earthquake motion. Acceleration is chosen to describe earthquake motion because the building codes prescribe how much horizontal force building should be able to withstand during an earthquake. PGA is expressed as the percentage of the acceleration due to gravity (1.0 g), which is approximately 980 centimeters per second squared. Unlike measures of magnitude, which provide a single measure of earthquake energy, PGA varies from place to place and is dependent on the distance from the epicenter and the character of the underlying geology (e.g., hard bedrock, soft sediments, or artificial fills). For example, the maximum horizontal PGA value recorded in the San Fernando Valley of Southern California during the January 17, 1994, magnitude 6.7 (Mw) Northridge earthquake ranged from 0.39 g to 1.82 g (Yegian et al. 1995).

Modified Mercalli Intensity Scale

The Modified Mercalli Intensity Scale (**Table 3.5-2**) assigns an intensity value based on the observed effects of ground shaking produced by an earthquake. Unlike measures of earthquake magnitude and PGA, the Modified Mercalli (MM) intensity scale is qualitative in nature, which means it is based on actual observed effects rather than measured values. Similar to PGA, MM intensity values for an earthquake at any one place can vary depending on its magnitude, the distance from its epicenter, the focus of its energy, and the type of underlying geologic material. The MM values for intensity range from I (earthquake not felt) to XII (damage nearly total), and intensities ranging from IV to X could cause moderate to significant structural damage. Because the MM is a measure of ground shaking effects, intensity values can be related to a range of average PGA values, also shown in **Table 3.5-2.**

TABLE 3.5-2
MODIFIED MERCALLI SCALE

Modified Mercalli Scale	Effects of Intensity	Average Peak Ground Acceleration[a]
I	Not felt except by a very few under especially favorable conditions.	< 0.0017g
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.	0.0017–0.0014g
III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.	
IV	During the day, felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.	0.035–0.092 g
V (Light)	Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.	0.092–0.18 g

Modified Mercalli Scale	Effects of Intensity	Average Peak Ground Acceleration[a]
VI (Moderate)	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.	0.092–0.18 g
VII (Strong)	Everybody runs outdoors. Damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.	0.18–0.34 g
VIII (Very Strong)	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.	0.34–0.65 g
IX (Violent)	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.	0.65–1.24 g
X (Very Violent)	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.	>1.24 g
XI (Very Violent)	Few, if any, (masonry) structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.	>1.24 g
XII (Very Violent)	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.	>1.24 g

Source: University at Buffalo, State University of New York, 2013
Note: a. Value is expressed as a fraction of the acceleration due to gravity (g). Gravity (g) is 9.8 meters per second squared. 1.0 g of acceleration is a rate of increase in speed equivalent to a car traveling 328 feet from rest in 4.5 seconds.

Regional Faults

The tectonics of the Southern California area are dominated by the interaction of the North American and Pacific tectonic plates, which are sliding past each other in transform, or sideways, strike-slip motion. The San Andreas Fault Zone is a right-lateral strike-slip fault that is thought to represent the major surface expression of the tectonic boundary and to be accommodating most of the transform slip between the Pacific Plate and the North American Plate. Although some of the motion may be accommodated by rotation of crustal blocks such as the western Transverse Ranges (Dickinson 1996), some of the plate slip is accommodated by other northwest-trending strike-slip faults that are related to the San Andreas system, such as the San Jacinto fault and the Elsinore fault. Local compressional or extensional strain resulting from the transform motion along this boundary is also accommodated by left-lateral, reverse, and normal faults such as the Cucamonga fault and the nearby North Frontal Fault Zone (NFFZ).

The fault of most significance to the project from a ground-shaking standpoint is the NFFZ, exposed approximately 1 mile north of the site along the range front of the San Bernardino Mountains. This fault is a complex zone of left-lateral, thrust, and reverse faults and forms the boundary between the Mojave Desert Geomorphic Province on the north and the Transverse Ranges Geomorphic Province on the south. Since this fault dips at a moderate angle to the south (approximately 49 degrees, according to Petersen et al. 2008), the fault plane is about 1 mile beneath the project site.

The Eastern California Shear Zone (ECSZ) is a zone of regional deformation traversing the Mojave Desert that includes a system of predominantly northwest-trending strike-slip faults. The ECSZ accommodates strain along the Pacific/North American plate boundary across a zone approximately 65 miles wide and is thought to transfer as much as 15 percent of the total plate boundary shear into the Great Basin area (Shermer, Luyendyk, and Cisowski 1996). A number of faults of this system ruptured in combination during the 1992 Landers earthquake east of the site. Rupture of that event extended within approximately 25 miles of the mine area and included several faults (Hauksson 1993). An earthquake of magnitude 6.4, known as the Big Bear earthquake, occurred a few hours later. The Big Bear quake and its aftershocks occurred along a northeast-trending alignment located approximately 12 miles southeast of the project site. The Hector Mine earthquake of 1999 occurred on the Lavic Lake and Bullion faults of the ECSZ. The Helendale fault, Lenwood-Lockhart fault, and Johnson Valley fault of this system are located approximately 4.9 miles northeast, 15.5 miles northeast, and 19 miles east-northeast of the project site, respectively. These faults are major components of the ECSZ and are considered Holocene active.

The northwest-trending San Andreas fault is located approximately 18 miles southwest of the project site. The toe of the mountain front in the San Bernardino area roughly demarcates the presently active trace of the San Bernardino Mountains segment. Youthful fault scarps, vegetational lineaments, springs, and offset drainages characterize both segments. **Figure 3.5-7** depicts faults and their associated status of activity in the region of the site.

Local Faults

No evidence of active faulting traversing the mine quarry area was found during review of published and unpublished literature and maps, during the review of stereoscopic aerial photographs, or during prior field mapping. The quarry areas of the project site are not within an Alquist-Priolo Fault Rupture Hazard Zone (AP Zone), as designated by the California Alquist-Priolo Earthquake Fault Zoning Act (Bryant and Hart 2007) (see **Figure 3.5-8**). However, an AP Zone does run across the northern portion of the project and cross the unpaved access roadway (Bryant 1986a, 1986b). Ground rupture due to active faulting in the quarry area is not anticipated. Faults (localized shear zones) and folds were observed in existing quarry exposures. These faults and folds are typical of the rocks of the northern San Bernardino Mountains, and most or all of these structures are likely to predate or be associated with Cenozoic uplift of the San Bernardino Mountains or folding of the Paleozoic age rocks during Mesozoic time. Quaternary activity appears to be concentrated on faults along the south margin of the modern mountain range, and potential activity along locally mapped faults is considered very low. Various high-angle faults are mapped in the existing quarry area. These faults strike primarily north and south. It is anticipated that additional high-angle faults may be exposed/mapped during future quarry operations.

Regional Seismicity

Numerous small earthquakes have occurred in the region in the historic time period. **Figure 3.5-9** is a map of recorded earthquake epicenters (Epi Software 2000). The epicenters and magnitudes shown are based on data from recording instruments in a California Institute of Technology-Southern California Earthquake Data Center catalogue. This enclosure presents circles as epicenters of earthquakes with magnitude equal to or greater than 4.0 that were recorded from 1932 through 2011. The cluster of small earthquakes in the area of the project site may be partially attributable to quarry blasts.

As discussed previously, the most significant fault to the site from a ground-shaking standpoint is the NFFZ, mapped approximately 1 mile north of the site along the range front of the San Bernardino Mountains.

The regional structure of the Mojave Desert includes major northwest-trending, strike-slip fault zones. Jennings (1994) indicated several of these fault zones with evidence for Holocene fault displacement. Geomorphic evidence for Holocene fault displacement includes sag ponds, fresh fault scarps, or the following features in Holocene deposits: offset drainages, linear scarps, shutter ridges, and faceted spurs.

The Helendale fault is the closest of these Holocene active faults and is located approximately 8 miles northeast of the site. Jennings also indicates the Old Woman Springs, Lockhart, Harper, and Camp Rock faults, located at greater distances from the site, as having Holocene fault displacement. Surface rupture occurred on the southeastern end of the Camp Rock fault during the magnitude 7.3 Landers earthquake of June 28, 1992. An earthquake of magnitude 6.4, known as the Big Bear earthquake, occurred a few hours later.

The Working Group on California Earthquake Probabilities (1995) tentatively assigned a 28 percent (±13 percent) probability to a major earthquake occurring on the San Bernardino Mountains segment of the San Andreas fault between 1994 and 2024.

More recent 2009 probabilistic seismic hazard mapping using the U.S. Geological Survey's (USGS) Earthquake Hazard Program's interactive website finds the probability that the White Knob Quarry at latitude/longitude coordinates N34.3629, W117.012 will experience ground shaking from a magnitude 6.5 or greater earthquake ranges from 50 to 60 percent (see **Figure 3.5-10**).

Deterministic Seismic Hazard Analysis

A deterministic evaluation of seismic hazard was calculated for the NFFZ using the attenuation relations of Boore and Atkinson (2008), Campbell and Bozorgnia (2008), and Chiou and Youngs (2008) and magnitude 7.1 at a distance of 1 mile. A peak ground acceleration of 0.56g is estimated by the deterministic method (EIR Appendix F, CHJ 2013). Applying the 2010 California Building Code (CBC) Design Acceleration Parameters to the project site's latitude and longitude, the corresponding peak acceleration is 0.52g.

T:_CS\Work\San Bernardino, County of\White Ridge Limestone Quarry\Figures

SITE

CRYSTAL CREEK FAULT

S-29A

S-29

Geologic Time Scale			Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION	
						ON LAND	OFFSHORE
Quaternary	Late Quaternary	Historic				Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
		Holocene	200			Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
		Pleistocene	10,000			Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Pleistocene age.
	Early Quaternary		700,000			Undivided Quaternary faults – most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age.	Fault cuts strata of Quaternary age.
			1,600,000			Late Cenozoic faults within the Sierra Nevada, including parts of, but not restricted to, the Foothills fault system. These faults may have been active in Quaternary time.	
Pre-Quaternary						Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive. Pre-Quaternary faults not shown in Nevada and Oregon.	Fault cuts strata of Pliocene or older age.
			4.5 billion (Age of earth)				

Source: CHJ Consultants

N

Figure 3.5-7

Regional Fault Map for White Knob/White Ridge Quarries

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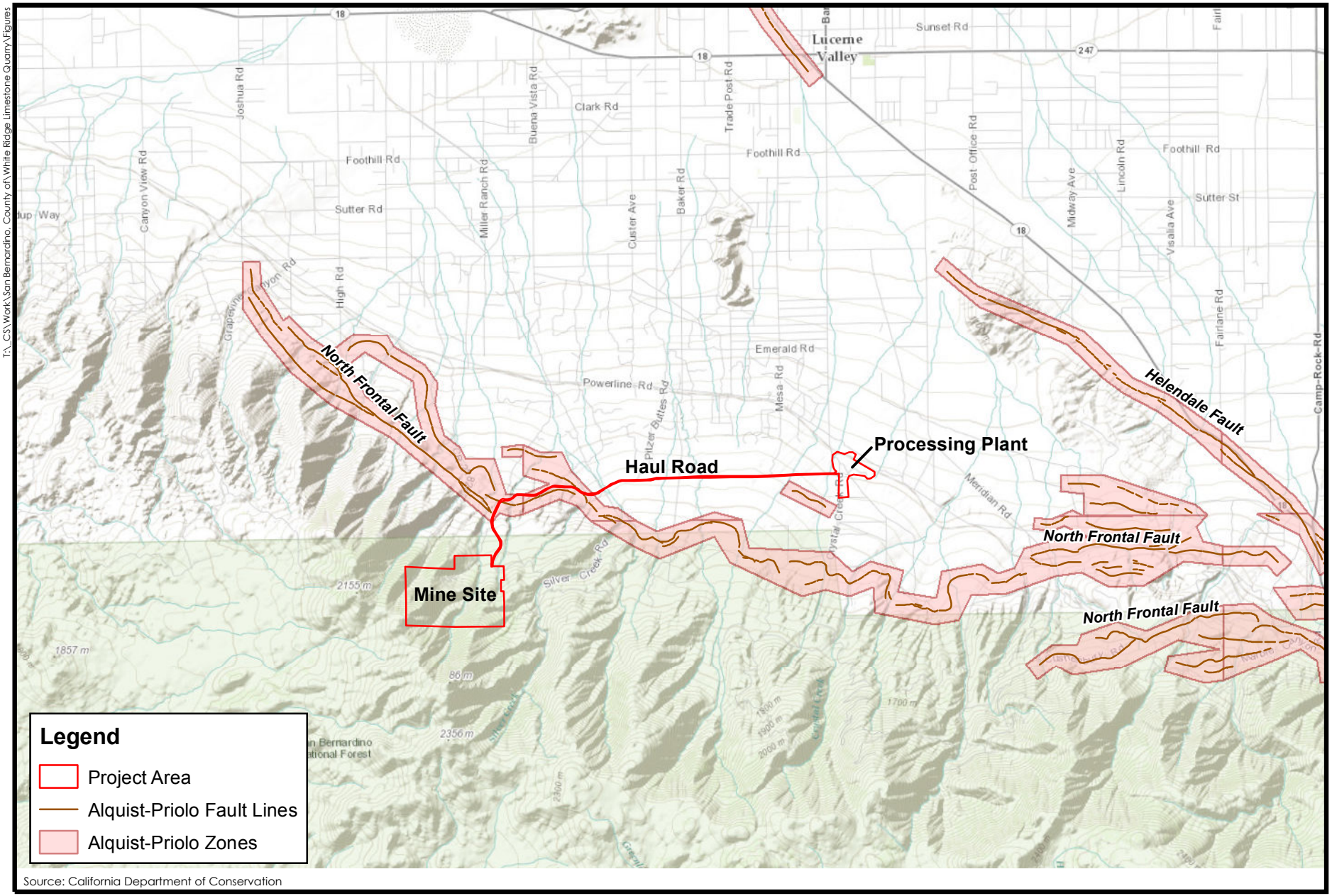

Figure 3.5-8
Alquist-Priolo Earthquake Fault Zone Map
for White Knob/White Ridge Quarries

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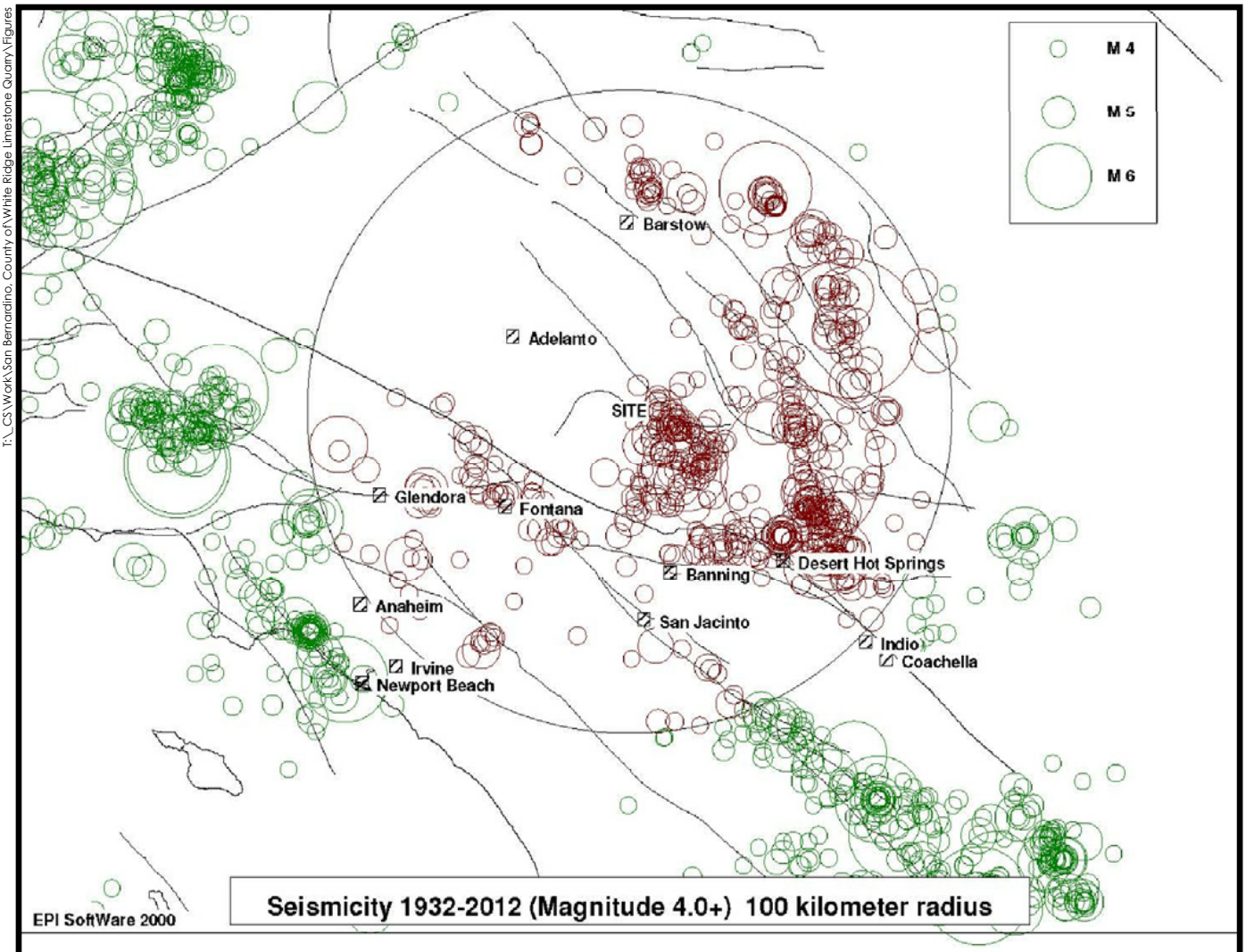
T:_GS Work\San Bernardino, County of\White Ridge Limestone Quarry\Figures



SITE LOCATION: 34.3629 LAT. -117.012 LONG.

MINIMUM LOCATION QUALITY: C

TOTAL # OF EVENTS ON PLOT: 1461

TOTAL # OF EVENTS WITHIN SEARCH RADIUS: 587

MAGNITUDE DISTRIBUTION OF SEARCH RADIUS EVENTS:

4.0- 4.9 : 529
5.0- 5.9 : 52
6.0- 6.9 : 4
7.0- 7.9 : 2
8.0- 8.9 : 0

CLOSEST EVENT: 4.0 ON FRIDAY, FEBRUARY 27, 1942 LOCATED APPROX. 3 KILOMETERS SOUTH OF THE SITE

LARGEST 5 EVENTS:

7.3 ON SUNDAY, JUNE 28, 1992 LOCATED APPROX. 55 KILOMETERS EAST OF THE SITE
7.1 ON SATURDAY, OCTOBER 16, 1999 LOCATED APPROX. 72 KILOMETERS NORTHEAST OF THE SITE
6.5 ON THURSDAY, APRIL 10, 1947 LOCATED APPROX. 80 KILOMETERS NORTHEAST OF THE SITE
6.4 ON SUNDAY, JUNE 28, 1992 LOCATED APPROX. 24 KILOMETERS SOUTHEAST OF THE SITE
6.1 ON THURSDAY, APRIL 23, 1992 LOCATED APPROX. 78 KILOMETERS SOUTHEAST OF THE SITE

Source: AMENDED MINE AND RECLAMATION PLAN FOR OMYA CALIFORNIA WHITE KNOB - WHITE RIDGE LIMESTONE QUARRIES Figure 3.5-9

0 50 100
FEET

N

Figure 3.5-9
Earthquake Epicenter Map
for White Knob/White Ridge Quarries

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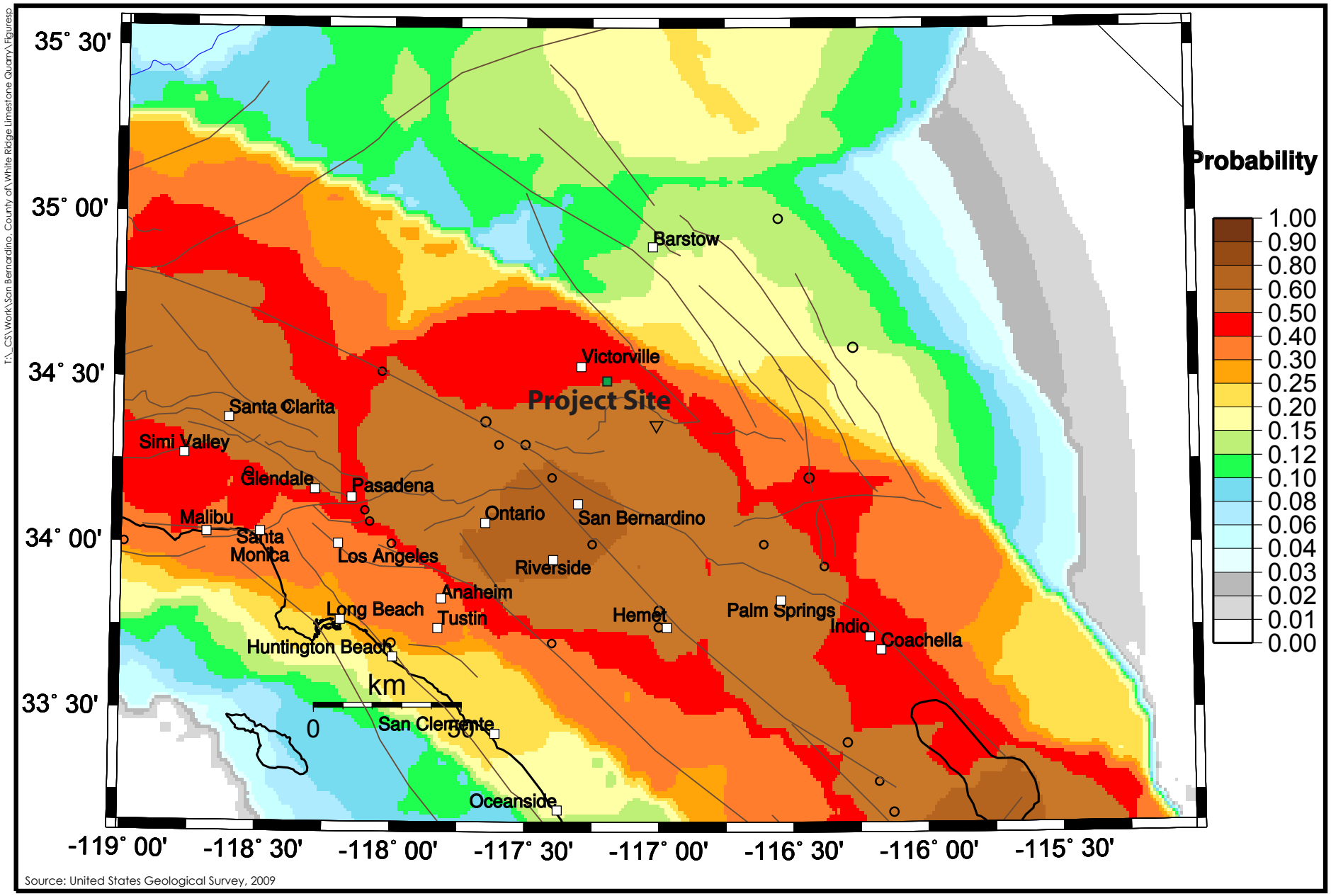

Figure 3.5-10

Earthquake Probabilistic Seismic Hazard Map

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3.5.3 GEOLOGIC HAZARDS

METHODS AND PARAMETERS OF SLOPE STABILITY ANALYSIS

This subsection discusses the various hazards and/or adverse conditions associated with the mine quarrying operation in the geologic setting of the project site. Slope failure occurs when a mass of rock, soil, or overburden fill moves downslope by sliding, flowing, falling, or as a complex combination. Slope instability occurs when the driving forces, forces causing the material to move, exceed resisting forces, forces holding the material in place. Natural factors that can affect the stability of a slope include the height and steepness of the slope; the strength and bulk density of the soil or bedrock; the degree of continuity, orientation, width, weathering, and density of bedrock discontinuities (e.g., fractures, faults, bedding planes); groundwater conditions; and the type and distribution of vegetation. While these natural features are important factors that determine the predisposition of a slope to fail, external processes such as exceptionally heavy rainfall, shaking from earthquakes, external surcharge loads (e.g., fills, buildings), or human disturbances (e.g., quarrying, road cuts, and large-scale vegetation removal) may trigger a new or reactivate an existing slope failure.

The stability of a slope is determined by analyzing the forces acting on a slope. The ratio of the forces resisting movement to those causing movement is expressed as the factor of safety (FOS). When a calculated FOS value is less than 1.0, forces that make a slope susceptible to failure have exceeded those that tend to hold it in place. In order to adequately calculate the FOS, geotechnical engineers and engineering geologists characterize the topography, underlying material types and material strengths, layering and orientation of each material type, and type, number, and orientation of discontinuities that may act as planes of weakness and form a surface of failure.

Geotechnical investigative methods include site-specific geologic and topographical mapping, drilling and logging, collecting samples, and laboratory testing. Based on the results of their investigation, professional judgment, and conservative assumptions, geotechnical engineers determine the potential types of failures and then use this information in engineering calculations of the forces acting on the slope. By this method, the resulting engineering calculations derive a factor of safety. The acceptable FOS analyzed under earthquake loading is less than that required under static conditions. The FOS that is considered acceptable varies based on the purpose of the slope, the adjacent structures, and the nature of the end land use. Methods for making slope stability engineering calculations vary from graphic nomograms (charts) to complex computer analyses.

A computer slope stability analysis can provide a more robust analysis because the program will conduct stability analyses along hundreds of failure surface geometries in a search to find the most "critical" failure surface that results in the lowest FOS. Engineering judgment is then needed to evaluate whether the computer-selected critical geometry is a valid potential failure surface. Slope stability analyses that have been conducted for various locations in the project area are further discussed below (EIR Appendix F, CHJ 2013).

White Knob/White Ridge Limestone Quarries Slope Stability

The project's geotechnical consultant, CHJ Consultants (2012, 2013), conducted a geotechnical study of the quarry and overburden slopes. The results of their technical analysis are summarized in subsection 3.5.5, Impacts and Mitigation Measures, below. In their evaluation of slope stability at White Knob/White Ridge Limestone Quarries, CHJ Consultants considered a landslide to be a deep-seated slope failure with a rupture surface at least 50 feet deep. As such, landslides are

typically related to the underlying structure of the parent material. CHJ used the term "surficial failures" to refer to shallow failures that affect the upper weathered or colluvial horizon of overlying material. Evidence for deep-seated landsliding was not observed in the White Knob/White Ridge Quarries walls or in natural exposures of the White Ridge area during CHJ's 2007 and 2008 evaluations or on their aerial photographs reviewed.

Groundwater in Slope Stability Analysis

No evidence of springs or perched groundwater conditions was observed at the project site during the geologic mapping or on the aerial photographs reviewed (CHJ 2012, 2013 [**EIR Appendix F**]). Depth-to-groundwater data is not available for the site vicinity from the California Department of Water Resources or the U.S. Geological Survey. The closest data available is from wells in the town of Lucerne Valley, located at significantly lower elevations in alluvial sediments north of the site. Field experience at the mine site by Omya's geologist, Howard Brown found that groundwater has not been encountered in exploratory borings drilled to at least 550 feet below ground surface (bgs). The current depth to groundwater at the site is not known, but is expected to be greater than 550 feet bgs. Based on the planned mining excavation depths, the anticipated depth of groundwater, and the presence of non-liquefiable bedrock, no potential for liquefaction and other shallow groundwater-related hazards is anticipated.

Quarry Highwalls

The coarse-grained calcite marble (limestone) ore at the site is relatively strong from a global slope stability standpoint, with no weak clay or schist interbeds observed in natural or mined exposures (EIR Appendix F, CHJ 2013). Natural cliffs formed in the calcite material stand vertically near the quarry site. Most joints are oriented favorably with respect to the planned quarry wall configurations and are typically discontinuous relative to global stability. The geologic structure was considered in planning the quarry slopes.

The granitic rocks on the margins of the ore body exhibit a similar orientation and spacing of joint sets as observed in the calcite marble. As described in the Amended Reclamation Plan, road cuts formed in the granitic rocks exhibit joint control of north–south striking faces at inclinations of approximately 57 degrees. Most joints dip at steep angles (between 70 and 90 degrees) as measured during geologic mapping of the existing road cuts in the granitic rock slopes and thus form stable slope configurations at existing slope angles.

Quarry Highwall Kinematic Slope Stability Analysis

CHJ (2013) (**EIR Appendix F**) utilized stereonet analysis of mapped geologic structures at the White Knob/White Ridge Limestone Quarries and then performed kinematic stability analyses to evaluate future slope performance. During field mapping, the orientation and relative continuity of joints, foliation, dikes, and shear zones were measured and recorded and are shown on in **Figure 3.5-4**. An example of the kinematic analysis is given in **Figure 3.5-11.** Kinematic data and stereonet analyses for the White Knob/White Ridge Quarries are given in Appendix B of the 2013 CHJ report, which is included in **EIR Appendix F** of this EIR.

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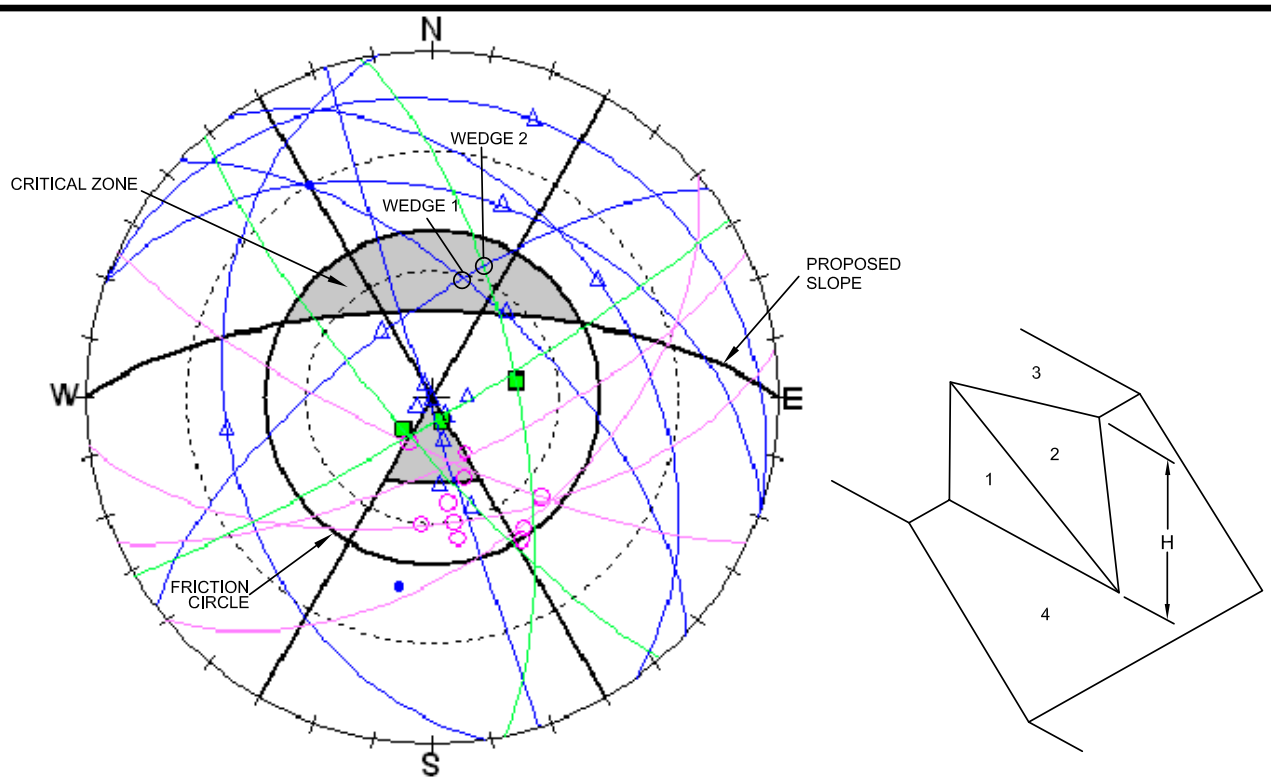

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 150 lb(f)/ft ³
(H) Height of Crest Above Intersection = 60 ft

Plane 1 : (D1) Dip Value = 70 °
(E1) Dip Direction = 323 °
Plane 2 : (D2) Dip Value = 63 °
(E2) Dip Direction = 40 °
Plane 3 : (D3) Dip Value = 1 °
(E3) Dip Direction = 0 °
Plane 4 : (D4) Dip Value = 70 °
(E4) Dip Direction = 0 °

Plane 1 : (C1) Cohesion = 800 lb(f)/ft ²
(P1) Friction Angle = 50 °
Plane 2 : (C2) Cohesion = 800 lb(f)/ft ²
(P2) Friction Angle = 50 °

Water Pressure : Cracks Completely Filled (Free Draining)

(GW) Density of Water = 62.4 lb(f)/ft ³

(HW) Overall Vertical Height of Wedge = 0 ft

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 3.06
Water Pressure on both planes = 0 lb(f)/ft ²

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 150 lb(f)/ft ³
(H) Height of Crest Above Intersection = 60 ft

Plane 1 : (D1) Dip Value = 70 °
(E1) Dip Direction = 323 °
Plane 2 : (D2) Dip Value = 70 °
(E2) Dip Direction = 78 °
Plane 3 : (D3) Dip Value = 1 °
(E3) Dip Direction = 0 °
Plane 4 : (D4) Dip Value = 70 °
(E4) Dip Direction = 0 °

Plane 1 : (C1) Cohesion = 800 lb(f)/ft ²
(P1) Friction Angle = 50 °
Plane 2 : (C2) Cohesion = 800 lb(f)/ft ²
(P2) Friction Angle = 50 °

Water Pressure : Cracks Completely Filled (Free Draining)

(GW) Density of Water = 62.4 lb(f)/ft ³

(HW) Overall Vertical Height of Wedge = 0 ft

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 3.53
Water Pressure on both planes = 0 lb(f)/ft ²

THERE IS CONTACT ON BOTH PLANES.

KEY:
△ 1-Small Joints
■ 2- Faults
○ 3- Follations
● 4- Dikes

Source: CHJ ConsultantsP

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Figure 3.5-11
Kinematic Slope Stability Analysis

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Based on stereonet analysis of the discontinuity orientations, joint, foliations, and shears, CHJ found that a small percentage of joints exhibit a potential to form surfaces that dip out of slope at angles between 35 and 40 degrees. Although factors of safety lower than 1.0 were calculated for planar failures along some joints, the limited continuity of joints in the ore body and wall rocks, relative roughness of surfaces formed in the coarse-grained calcite marble, and lack of empirical evidence for large failures on joints with this orientation indicate that the potential for large failures along such joint features is low.

The inclusion of catch benches in cut slope design provides mitigation of potential small, intra-bench scale rockfall debris, which is anticipated to be the primary mode of slope debris generation. In addition, subsequent to blasting of new walls, quarry operations include the use of a large scaling chain to assist in removal of loose or precarious blocks during removal of the ore. Therefore, CHJ concluded that the consideration of the geologic structure of the ore body and surrounding wall rocks in the planning and practice of quarry operations has resulted in formation of grossly stable slopes in the existing White Knob Quarry.

Field experience at the mine site by Omya's geologist Howard Brown found that groundwater has not been encountered in exploratory borings drilled to at least 550 feet below ground surface. Therefore, a condition of long-term saturated groundwater is not anticipated.

A few potentially unstable blocks/boulders were observed on the natural slopes above the existing and proposed slopes. These boulders could be mobilized during a major seismic event and roll downslope; however, this rockfall hazard is not affected by the proposed mining.

Given the steepness of natural slopes at the site and vicinity and the close proximity to the active NFFZ, the geologic materials at the site display a remarkably low susceptibility to deep-seated landsliding. Due to the purity of the calcite marble, no significant clay seams were observed in existing cut slopes nor are they expected to be exposed in the proposed cut slopes. In general, fracturing/jointing effectively reduces the strength of an overall rock mass by forming discontinuities between individual blocks of rock in the natural and cut slopes; however, the widely spaced and non-continuous joint density, joint roughness, moderate to total healing, and favorable joint orientations exhibited in the White Knob/White Ridge Limestone Quarries exposures also effectively limit the depth and areal extent of potential slope failures.

Global Slope Stability Analysis

White Knob/White Ridge Limestone Quarries Highwall Slope Stability

The global stability of the proposed final 1H:1V mine highwall slopes as depicted in the Amended Reclamation Plan documents (cross sections A-A', B-B', and C-C') were analyzed under both static and seismic conditions for rotational failures utilizing the SLIDE computer program, version 6.02 (Rocscience 2012). The Amended Reclamation Plan cross section A-A' is given in **Figure 2.0-5,** and the global stability analysis of one of the highwalls in cross section A-A' is given in **Figure 3.5-12**. The analysis considered the highest and steepest slope sections proposed for the mine. The seismic stability calculations were performed using a lateral pseudo-static coefficient "k" of 0.2g due to the proximity of the North Frontal Fault Zone. The factors of safety were calculated by Spencer's method.

The rock strength parameters listed in **Table 3.5-3** were obtained from testing of hand samples and large exposures of the existing quarry slopes. The Hoek-Brown criteria allow for estimation of rock mass properties based on field criteria such as how easily a specimen can be broken with a rock hammer and mining methods as well as other methods. The rock strengths used in the SLIDE

computer program were modeled utilizing the Generalized Hoek-Brown criteria (Hoek 2000; Hoek, Carranza-Torres, and Corkum 2002) and the program's built-in parameter calculator with the using estimated input values for both limestone and granite-type rocks given in **Table 3.5-4.**

The results of the global slope stability analyses are summarized in **Table 3.5-6**. Details of stability calculation results including material type boundaries, strength parameters, and the minimum factors of safety and critical slip surface are given in the 2013 CHJ report in Enclosures C-1 through C-6 for static and seismic conditions (**EIR Appendix F**).

As shown in Table 3.5-6, sufficient static FOS in excess of 1.5 and seismic FOS in excess of 1.1 were calculated for the reclamation slope configurations and satisfy San Bernardino County and State SMARA Guidelines. Based on the global stability analysis and observations of existing quarry slopes, it is anticipated that current mining practices will produce final mining and reclaimed quarry slopes that are suitably stable with regard to large-scale or deep-seated slope failure.

TABLE 3.5-3
MARBLE TYPE ROCK PROPERTIES

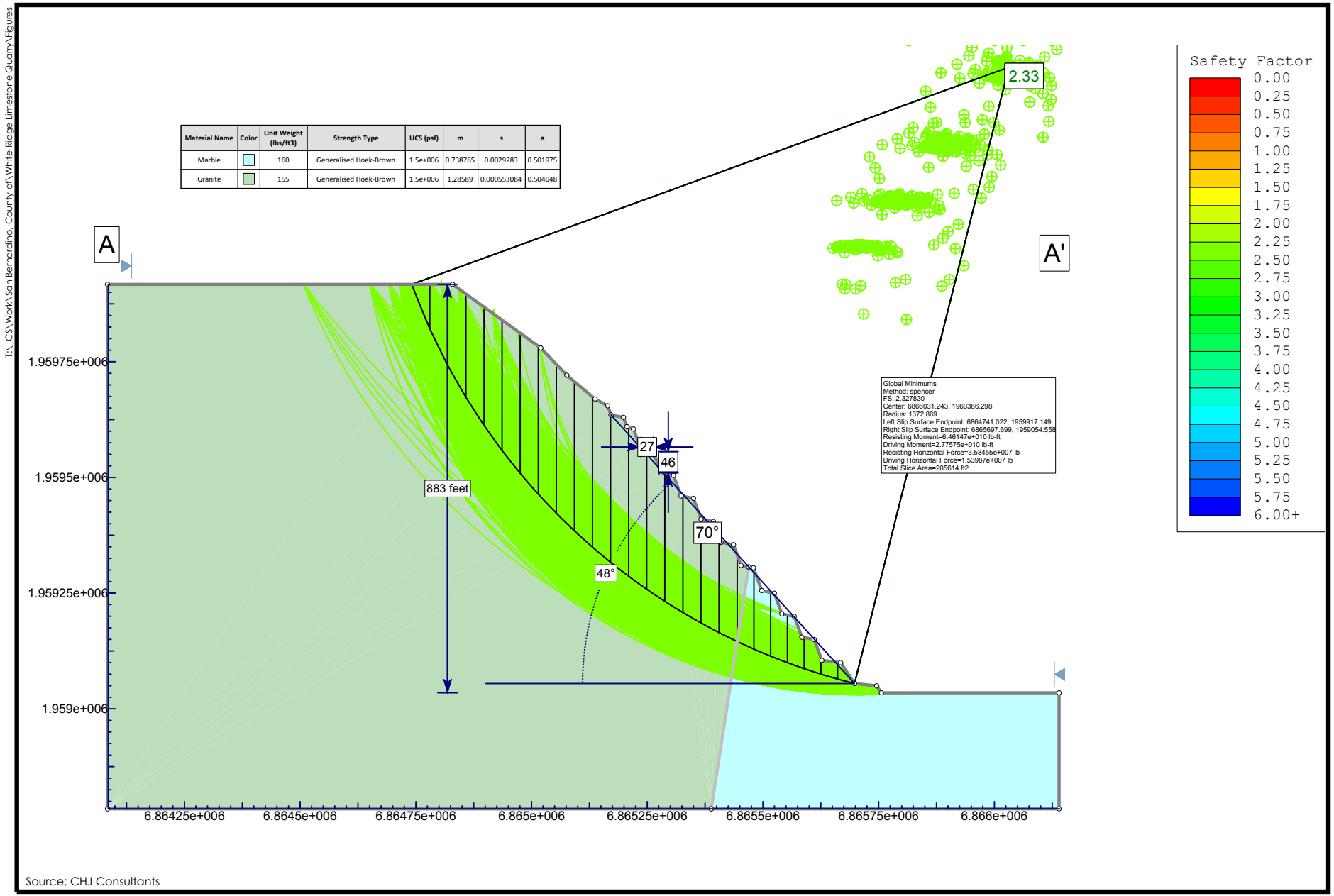
	Value	Description
Unit Weight (pcf*)	160	
Intact UCS[1] (psf**)	1,500,000	Specimen requires more than one blow of a geologic hammer to fracture it
Geologic Strength Index	65	Blocky with good surface conditions
Intact Rock Constant (mi***)	9	Marble
Disturbance Factor	1	Production blasting

Source: EIR Appendix F, CHJ 2013, Table 2
** pcf = pounds per cubic foot*
*** psf = pounds per square foot*
**** mi = unitless constant*
[1] = uniaxial compressive strength

TABLE 3.5-4
GRANITE TYPE ROCK PROPERTIES

	Value	Description
Unit Weight (pcf*)	155	
Intact UCS1 (psf**)	1,500,000	Specimen requires more than one blow of a geologic hammer to fracture it
Geologic Strength Index	55	Very blocky with good surface conditions
Intact Rock Constant (mi***)	32	Granite
Disturbance Factor	1	Production blasting

Source: EIR Appendix F, CHJ 2013, Table 3
** pcf = pounds per cubic foot*
***psf = pounds per square foot*
**** mi = unitless constant*
[1] = uniaxial compressive strength



Source: CHJ Consultants

Figure 3.5-12

Global Slope Stability Analysis Cross-Section A-A'

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White Knob/White Ridge Limestone Overburden Fill Slope Stability

As stated previously, overburden and waste rock at the White Knob/White Ridge Limestone Quarries are composed of grey impure limestone and granite intrusive rock and granite dikes. Overburden and waste rock are nontoxic, naturally occurring rock material, which are of insufficient quality (purity and brightness) to process for ore. The vast majority (60 percent) of the overburden and waste rock is dominantly impure calcium carbonate. Most of the remainder (40 percent) is granitic rock (monzonite).

The Amended Reclamation Plan proposes to expand the existing 15-acre overburden site (OB-1) by approximately 17 acres northward from its current site limits. Portions of the proposed expanded site include ground that is already disturbed by existing stockpiles. The final slope of OB-1 will have 2H:1V interslopes with benches placed at 100-foot vertical intervals with widths varying from approximately 25 to 75 feet. OB-1 fill will be placed from an elevation of approximately 5,580 to 4,850 feet amsl, creating a maximum fill slope height of 730 feet.

Two additional overburden fills, OB-2 and OB-3, will be created during Phase 4 of mining. OB-2 will fill 13 acres of a southern central canyon area by placing fill from an elevation of 5,815 to 5,425 feet amsl with an interslope angle of 1.5H:1V and an overall slope of no greater than 2H:1V. Benches in OB-2 will be places at approximately 50-foot vertical intervals with widths of approximately 25 to 50 feet. Backfilling of the White Knob Quarry will bury the toe of OB-2 to an elevation at the end of mining of approximately 5,575 feet amsl, creating a final maximum fill slope height of 240 feet. Overburden fill at OB-3 will cover approximately 3 acres and be placed northeast of the White Ridge Quarry between approximate elevations of 5,200 and 5,025 feet. The final slopes of 2H:1V will be have a maximum height of approximately 85 feet without a bench. Overburden backfilling of the White Knob Quarry will rise to a maximum elevation of 5,575 feet amsl and slope to the south and west at a 0.5 percent grade to create a large sedimentation basin.

The strength of overburden stockpile materials was estimated based on direct shear testing results performed on samples remolded to 85 percent relative compaction (**EIR Appendix F, CHJ 2013**). An internal frictional angle of φ=39 degrees, a cohesive strength of C=150 pounds per square foot (psf), and a unit weight of 125 pounds per cubic foot (pcf) were utilized in the SLIDE model to calculate the shear strength of overburden stockpile materials.

The global stability of the proposed benched final overburden slopes as depicted in the Amended Reclamation Plan documents (cross sections A-A', B-B', and C-C') were analyzed under both static and seismic conditions for rotational failures utilizing the SLIDE computer program, version 6.02 (Rocscience 2012). The Amended Reclamation Plan cross section B-B' is given in **Figure 2.0-8,** and the global stability analysis for overburden material along the northern portion of cross-section B-B' given in **Figure 3.5-13**. The analysis considered the highest and steepest fill slope sections proposed for the mine overburden fill. The seismic stability calculations were performed using a lateral pseudo-static coefficient "k" of 0.20 due to the proximity of the North Frontal Fault Zone. The factors of safety were calculated by Spencer's method.

As shown in **Table 3.5-5**, sufficient static factors of safety in excess of 1.5 and seismic factors of safety in excess of 1.1 were calculated for the reclamation fill slope configurations and satisfy San Bernardino County and State SMARA Guidelines. Based on the global stability analysis and observations of existing overburden stockpile slopes, it is anticipated that current and future mining practices will produce final mining and reclaimed overburden stockpile slopes that are suitably stable with regard to large-scale or deep-seated slope failure.

TABLE 3.5-5
SLOPE STABILITY SUMMARY

Cross Section	Material	Static FOS	Seismic FOS (k = 0.2)
A-A'	Rock slope	2.33	1.73
B-B'	Fill-over-rock slope	1.93	1.27
C-C'	Rock slope	2.37	1.83

Source: EIR Appendix F, CHJ 2013, Table 4

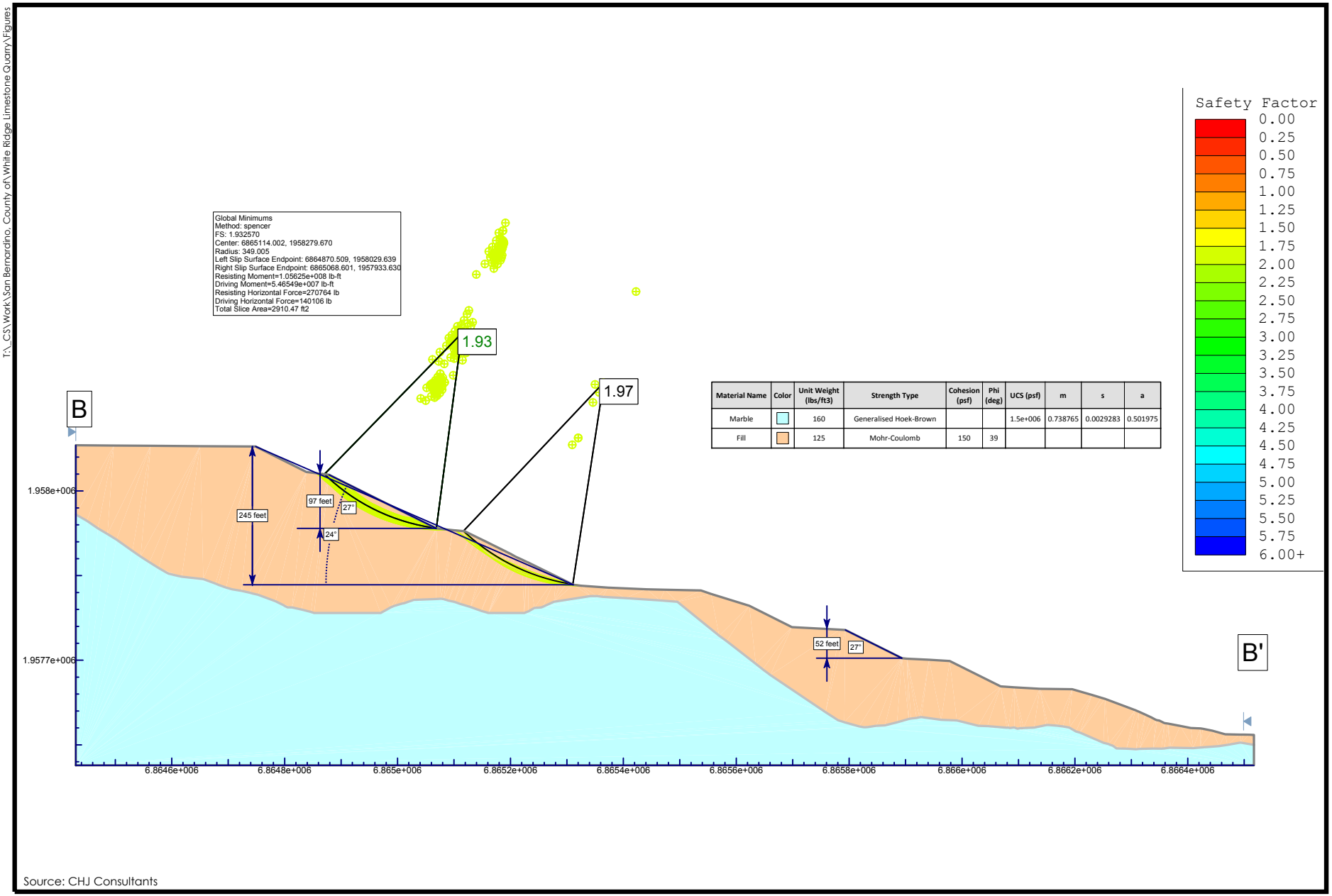
Shallow Landslides and Geologic Hazards

Shallow Landslide and Boulder Hazard

Quaternary talus, slope wash, stream terraces, landslides, and recent alluvium (Qal) occupy the topographic low areas in the vicinity of the White Knob/White Ridge Limestone Quarries (DCI 2012). Qal is mapped to extend upward from Lucerne Valley into the east Ruby drainage, locally called the Western Drainage, to an elevation of approximate 5,200 feet amsl. In addition, several landslides (Qls) were mapped in the quarry vicinity, prior to initiation of Omya mining operations (see **Figure 3.5-14**). One landslide extends northwest from the future quarry location down the east slope of the Western Drainage to the streambed, with a mapped base width of approximately 375 feet within the streambed. Another landslide located immediately adjacent to and upslope from the first landslide extends down the east side of the Western Drainage to the streambed, with a mapped base width of approximately 500 feet within the streambed. The bases of these two landslides are separated by a mapped distance of approximately 125 feet, with a combined mapped talus slope base length of approximately 1,000 feet (CDMG 1985).

Recent geotechnical studies by the project's consultant, CHJ, found no observable evidence for deep-seated landsliding in the White Knob/White Ridge Limestone Quarries highwalls or in natural exposures of the White Ridge area (CHJ 2012, 2013 [**EIR Appendix F**]). CHJ Consultants and Miller, Matti, and Brown (2000) identified remnant areas of very old alluvial fan deposits, Qvof. Small areas of Qvof deposits occur sporadically in the mining area, as shown in **Figure 3.5-3**.

Boulder rolling and surficial sliding of side-cast overburden material has occurred on the slopes northwest and north of the White Knob Quarry. In the past, the side-casted overburden material on the northwest slope has been transported downslope during high intensity rainfall events and deposited in the Western Drainage. CHJ (2012) analyzed the northwest slope for potential rockfalls and concluded that rockfall hazard from individual clasts is high compared to the adjacent natural slopes; CHJ made recommendations for mitigating the hazard, as discussed below. The Western Drainage eventually drains to Ruby Springs, one of several areas of natural springs that occur along the faulted flank of the San Bernardino Mountains. Studies and monitoring have been undertaken by DCI (2009, 2010, and 2011) to evaluate the extent that mine sediment has transported down the Western Drainage and the impacts to Ruby Springs. The most recent DCI (2012) sedimentation and erosion monitoring report is attached in Appendix C1 of the Amended Plan.



Source: CHJ Consultants

Figure 3.5-13

Global Slope Stability Analysis Cross-Section B-B'

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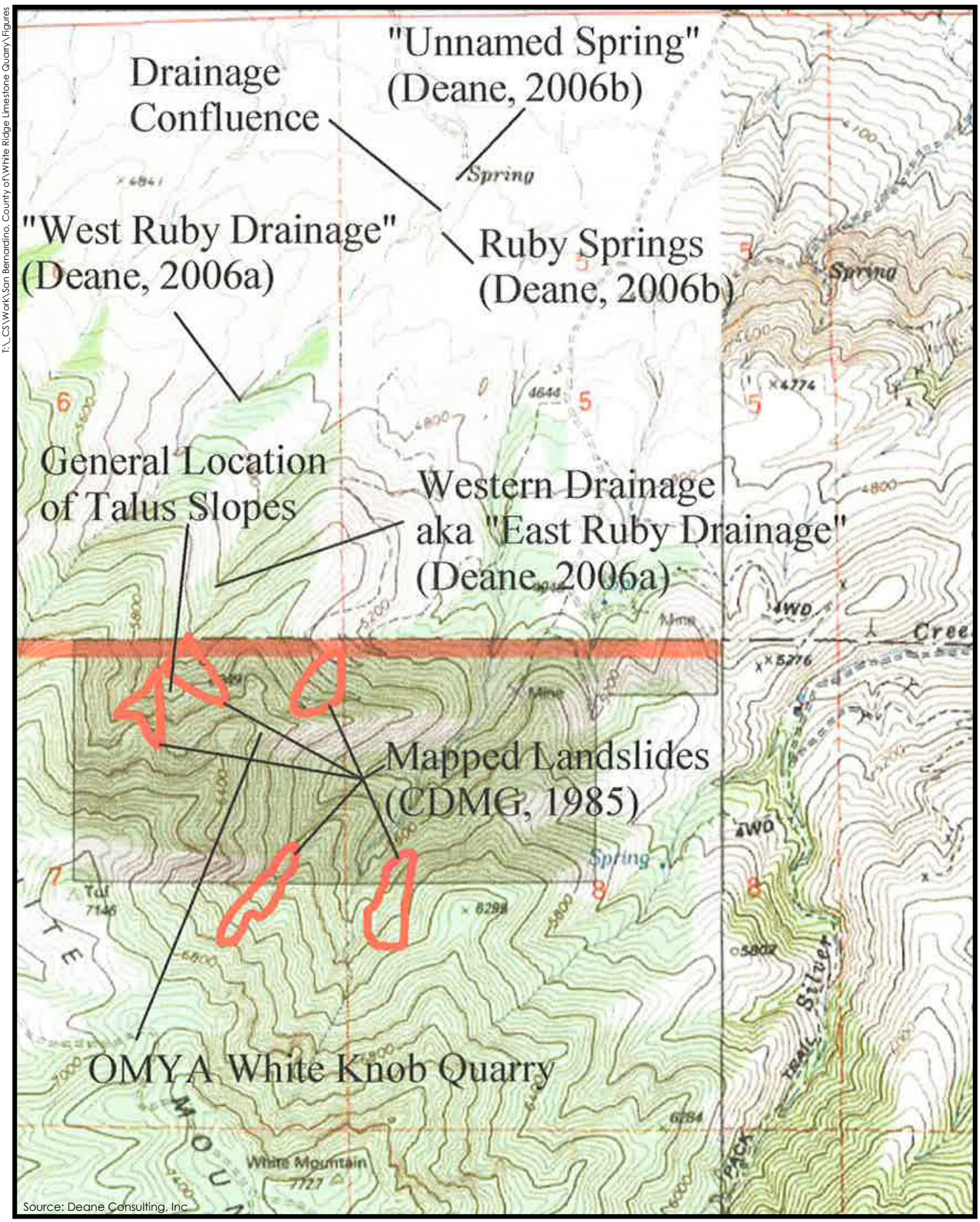

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Figure 3.5-14
Landslide Location Map Western Drainage

Northwest Talus Slope Stability and Rockfall Hazard

CHJ (2012) (**EIR Appendix F**) conducted a site investigation of the northwest slope and analyzed the stability of the talus materials and the potential for rockfalls. They found that the slope-forming bedrock units that underlie the northwest slope consist of strong and grossly stable crystalline rock types, which are shown by the overall angle of quarry slopes and calculations performed to be stable at gradients steeper than exhibited in the existing slope. Evidence of deep-seated landsliding in the northwest slope was not present in the existing terrain or on historic aerial imagery of the site. Therefore, CHJ did not evaluate the gross bedrock stability of the northwest slope, but focused on the surficial stability of overlying colluvium/talus materials and the rockfall potential.

The northwest slope is approximately 700 feet high and consists of two main areas/chutes of talus separated by a bedrock ridge that bisects the slope along the fall-line axis (see **Figure 3.5-15**). The toe of the slope forms the southern flank of the Western Drainage. Native slopes in the area of the northwest slope consist of granitic bedrock slopes mantled by a thin veneer of colluvium and locally small talus. Limestone/marble outcrops form cliffs and steep slopes at the top of the northwest slope. Native talus is typically light gray to gray-hued matrix-supported talus of small boulder to gravel size in a matrix of fine- to medium-grained silty sand. Talus generated by mining is typically white-colored small to large boulder size, clast-supported talus with a smaller fraction of gravel-to-cobble-size clasts. The mining talus is generally more angular than native talus and exhibits rounded to less common tabular forms.

The 2012 CHJ investigation found that the existing conditions of the northwest slope are:

1) Movement of individual boulders may occur where the underlying substrate is subject to downhill creep. Downhill creep is an ongoing natural process in colluvial slope environments and is expected to occur at natural rates in the northwest slope. Where boulders have come to rest on talus deposits, it is expected that the interlocking force of the angular materials is sufficient to result in retention of most clasts within the talus fields. Addition of boulders to the talus or undermining by headward erosion may perturb some clasts to induce rolling or sliding movement in the future.

2) Individual boulder roll-down by movement of an existing clast located on the slope face has occurred in the recent past (no material has been introduced to the northwest slope for several years). The most likely location (fall line) for long run-out roll-down is at the east flank of the slope where boulder-poor colluvium is exposed. The source area of this fall line is the slope on the west side of the White Knob Annex. The existing boulder fields act as a catchment area for large clasts.

3) Progressive down-gradient filling and movement of alluvium, generated by slope creep and debris flow into flat-lying accumulations between and upon boulders, were noted in the accumulation zone at the toe of the slope. This indicates the active and ongoing formation of a step pool system within the boulder accumulation zone that can act as a sediment/fines filtering area.

4) In the past, some boulders have traveled with sufficient momentum to carry partly up the toe of the opposing slope and generate flying debris from collision. The presence of a few boulders on the topographic terrace surface indicates that rock fall hazard is present in this area as well as at the toe of the northwest slope.

5) Natural slopes in the site area have been subjected to many more precipitation and seismic shaking events than the geologically young talus slope formed from recent mining of the White Knob area. It is expected that within a relatively short time, the northwest slope will achieve a state of stability that mimics the erosion/rock fall rate of surrounding natural slopes. The presence of a continuous trail traversing the slope indicates a relatively stable condition at this time. For undisturbed talus slopes, weathering and incremental gravity induced shifting of boulders to a more stable position will increase boulder stability with time.

CHJ analyzed the stability of the talus slope for static and seismic conditions for non-circular failures utilizing the SLIDE computer program, version 6.0 (Rocscience 2011). Based on the results of the slope stability calculations, observations of the existing slope conditions and observations of surrounding terrain and nearby natural slopes, CHJ concluded that the current northwest slope configuration is grossly stable and surficially stable compared with the expected natural conditions of slopes in the area.

CHJ used the Colorado Rockfall Simulation Program (CRSP) version 4.0 by Jones, Higgins, and Andrew (2000) to model the behavior of rolling boulders calibrated to the observed site conditions. The existing slope includes fall lines with different substrate properties. CHJ evaluated a combined talus and soft soil substrate to model rocks falling along the east side and a soft soil substrate and relatively smooth surface condition to model rocks falling along the west side of the northwest slope. Rock size was varied for each of the two fall lines and calibrated to existing conditions observed during field mapping. Analysis Points along the slope profile were selected in the program to coincide with accumulation features observed in the field.

CHJ found that for the existing materials on the northwest slope, there is evidence from individual shifted boulders and fresh-appearing bounce marks that rockfall hazard from existing individual clasts is high compared with natural rates on adjacent slopes in this area.

Northwest Slope, Western Drainage, and Ruby Springs Areas

The slope on the western side of the White Knob Quarry is called the northwest slope, and runoff generally flows into the Western Drainage (see **Figure 3.5-16**). The Western Drainage forms the eastern component of a pair of drainages that drain northeast and converge in the northwest corner of Section 5, Township 3 North, Range 1 West, San Bernardino Base and Meridian. These two drainages were named in the DCI monitoring reports as the east and west Ruby drainages, with the east Ruby drainage adjacent to the quarry and equivalent to the Western Drainage.

Past mining operations at White Knob Quarry inadvertently allowed white talus overburden material to fall onto the northwest slope. An intense rain storm event that occurred in early August 2003 was described as a relatively small isolated system that slowly moved northwestward along the northern front of the San Bernardino Mountains toward the White Knob Quarry. Rain that fell in the upper reaches of the east Ruby drainage, reportedly for 40 minutes was so intense that a mine worker could not see out his vehicle windshield with the wipers operating on their highest setting (Omya California 2005). No local rainfall data is available for this storm event because neither rain nor weather gauges were located in the vicinity of the quarry at the time of the storm.

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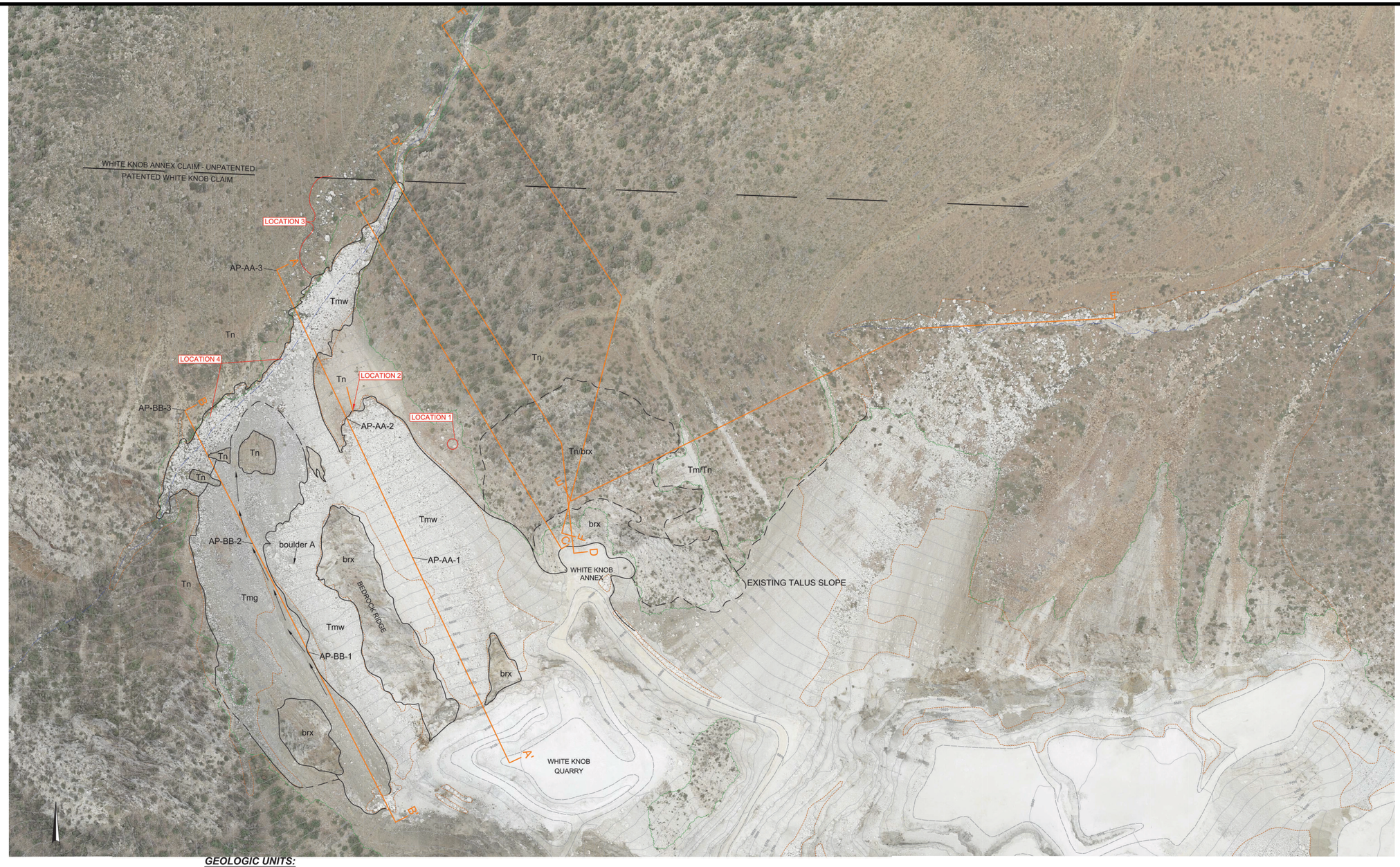

GEOLOGIC UNITS:

Tm - mining talus, w = whitish hue, g = grayish hue rock debris consisting of cobble to large boulder size clasts, fresh appearing surfaces, form clast-supported depris cone on native surfaces & boulder field at head of Western drainage

Tn - native talus/colluvium: silty gravelly sand underlies mining talus

brx - bedrock outcrop: limestone, marble, & granitic rocks of White Knob area

Tn/brx - mixed native talus/colluvium & bedrock

Tm/Tn - area of mining talus (whitish) as vaneere on native talus/colluvium

AP-AA-1 - Approximate location of analysis point used in CRSP rockfall evaluation

Approximate Claim Boundary

B B' Location of Geologic Cross Sectic

Source: CHJ Consultants

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Figure 3.5-15
Northwest Slope Map

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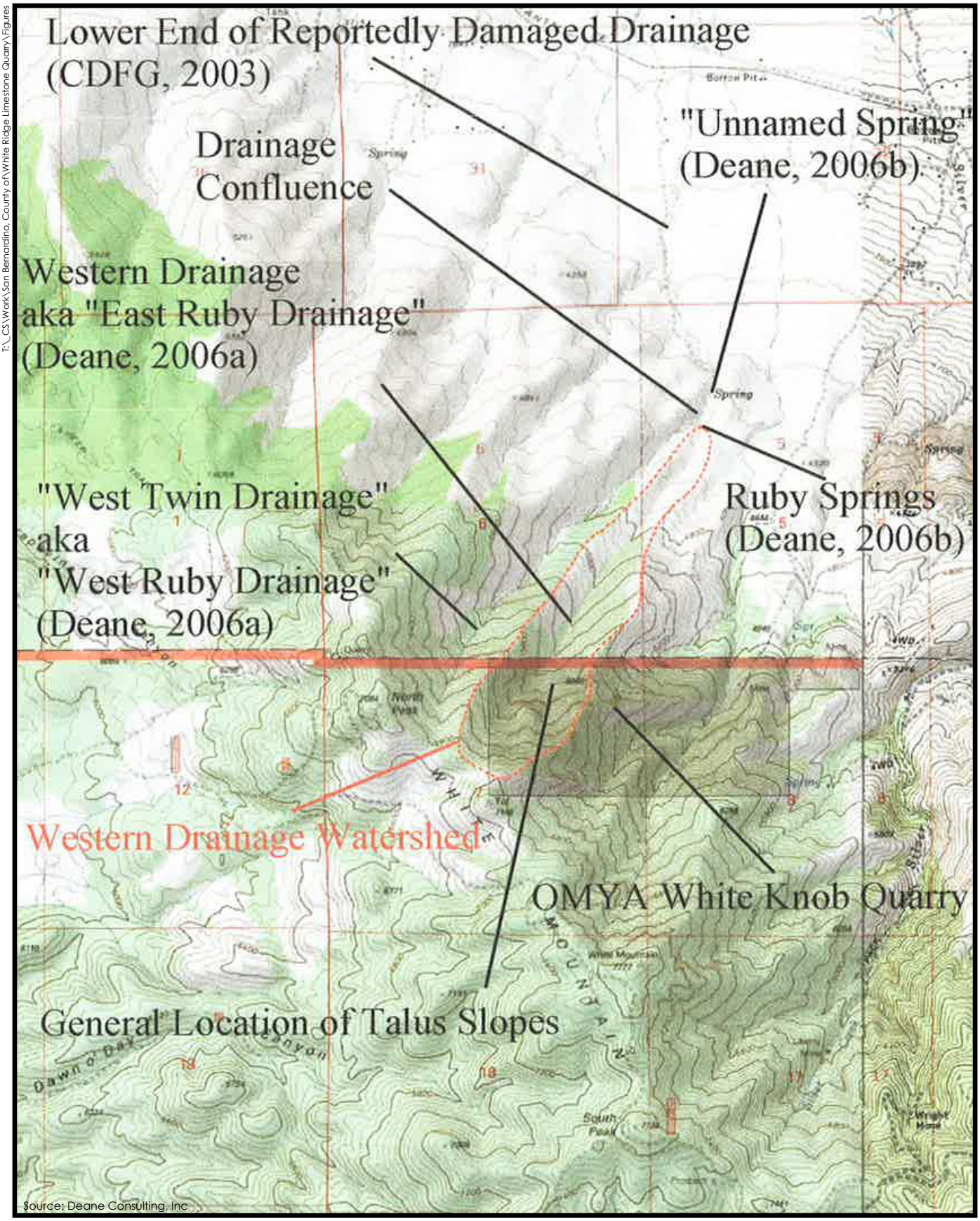


Figure 3.5-16
Western Drainage Watershed Map

On September 30, 2003, the California Department of Fish and Game (CDFG) (now the California Department of Fish and Wildlife [CDFW]) filed an investigation report summarizing its observations of the effects of erosion of the white talus material from the northwest slope on the streambed and vegetation of the Western Drainage, aka, east Ruby drainage. The report was based on reconnaissance surveys conducted by CDFG personnel on August 29, September 10, September 19, and September 22, 2003. The main conclusion of the CDFG investigation was that the white talus slope provided material that caused scouring of approximately 1.8 miles of the Western Drainage, resulting in streambed and vegetation damage, presumably in response to the August 2003 storm event.

DCI conducted a series of annual qualitative studies in the Western Drainage in 2005, 2006, 2007, 2008, and 2009 (DCI 2012) to provide a qualitative comparison of the Western Drainage via visual evaluation of observed changes in the noted sediments and vegetation, as well as surface water flow originating from Ruby Springs. Field data collected by DCI from 2005 to 2009 indicated that the damage from the August 2003 storm event was limited to the upper approximate 1.2 miles of streambed in the Western Drainage, essentially between the base of the white talus slope to the unnamed spring, Reaches +01 through +14 (see **Figure 3.5-17**). Thus, the lower approximate 0.6 miles of streambed in the study zone, extending from immediately below the unnamed spring to the end of the Western Drainage (Reaches +15 through +19), were not damaged in response to the August 2003 storm event.

Following a 2007 review letter by the California Office of Mine Reclamation (OMR) of Omya's 2006 initial Amended Reclamation Plan for White Knob Quarry, a more quantitative assessment was requested of impacts to the Western Drainage and Ruby Springs that included monitoring of the effects of sedimentation on the drainage and spring. A Sedimentation and Erosion Monitoring Technical Work Plan (dated May 31, 2008) was implemented to collect data for two reporting periods, June 2008–May 2009 and June 2009–May 2010. Additionally, in accordance with a settlement agreement between the Bureau of Land Management (BLM) and Omya, data collection was resumed during December 2011.

Following the collection of additional Ruby Springs discharge/surface water distance data during April through July 2011, Omya and DCI presented a conceptual model of the impact of the talus slope on Ruby Springs discharge rates to BLM personnel on August 3, 2011. The conceptual model was discussed, after which the BLM issued a letter summarizing the requirements of a report regarding the impact of the talus slope on Ruby Springs (see BLM 2011a and DCI 2012, Appendix A). A follow-up field investigation was conducted during early September 2011 by Thomas C. Deane, CHg (DCI) and, in part, Dr. Noel Ludwig, PhD (BLM California Desert District Hydrologist/Moreno Valley field office).

The "Talus Slope Impact on Ruby Springs – Western Drainage" report (DCI 2011), which summarized to-date data, presented a non-mathematical groundwater conceptual model for the Western Drainage from White Mountain to Ruby Springs and indicated that the talus slope has had a positive impact on Ruby Springs discharge rates, and was submitted to the BLM for review and comment. A November 22, 2011, comment letter by the BLM indicated agreement with the report's conclusions, but requested additional collection of data for the "foreseeable future" (BLM 2011b), presumably in accordance with the Sedimentation and Erosion Monitoring Technical Work Plan (DCI 2008). Due to the late timing of the BLM comment letter with respect to the assumed earlier beginning of Western Drainage precipitation, the period for data collection was shortened for the 2011–2012 reporting period. Results of the 2008–2009, 2009–2010, and 2011–2012 reporting periods (DCI 2009, 2010, 2012) found that the annual net changes in ground surface elevation and volume were similar in magnitude (see **Figure 3.5-17**).

2011–2012 Reporting Period

- Ground surface elevation for the streambed of the Western Drainage, per surveyed reach, ranged between approximately -0.024 feet per year (ft/yr) (-7 mm/yr, Reach +19, net erosion) and +0.014 ft/yr (+4 mm/yr, Reach +05, net sedimentation).

- Volume, per surveyed reach, ranged between approximately -4 cubic yards (Reach +14, net erosion) and +6 cubic yards (Reaches +05 and +11, net sedimentation).

- Native soil ground surface elevation for the 2011–2012 reporting period, per surveyed reach, ranged between approximately -0.026 ft/yr (-8 mm/yr, Reach +08, net erosion) and +0.010 ft/yr (+3 mm/yr, Reaches +01 and +13, net sedimentation).

2009–2010 Reporting Period

- Ground surface elevation approximately -0.053 ft/yr (-16 mm/yr, Reach +19, net erosion) and +0.043 ft/yr (+13 mm/yr, Reach +02, net sedimentation)

- Volume approximately -8 cubic yards (Reach +05, net erosion) and +14 cubic yards (Reach +11, net sedimentation).

- Native soil ground surface elevation for the 2009–2010 reporting period, which was approximately -0.026 ft/yr (-8 mm/yr, Reaches +11 and +19, net erosion) to +0.034 ft/yr (+10 mm/yr, Reach +06, net sedimentation).

2008–2009 Reporting Period

- Ground surface elevation approximately -0.031 ft/yr (-9 mm/yr, Reach +14, net erosion) to +0.105 ft/yr (+32 mm/yr, Reach +19, net sedimentation)

- Volume approximately -9 cubic yards (Reach +14, net erosion) to +40 cubic yards (Reach +11, net sedimentation).

- Native soil ground surface elevation for the 2008–2009 reporting period, which was approximately -0.027 ft/yr (-8 mm/yr, Reach +14, net erosion) to +0.058 ft/yr (+18 mm/yr, Reach +19, net sedimentation).

The cross-channel scores at CS-1 through CS-3 in the lower portion of the upper reaches of the Western Drainage (**Figure 3.5-17**) experienced an estimated peak ephemeral surface water flow discharge rate of approximately 101.1 gallons per minute (gpm) during a series of rain events that occurred during December 16–26, 2010 (2010–2011 rain year). In addition, observations at tracer clast location TCL-3 in the lower reaches and cross-channel scores CS-4 through CS-6 found no evidence of ephemeral surface water flow within the lower reaches of the Western Drainage in response to the series of December 2010 rain events. A 2011–2012 reporting period comparison of intact cross-channel scores, CS-1 through CS-6, and tracer clasts, TCL-1 through TCL-3, to the 2008–2009 and 2009-2010 reporting periods indicate there was no evidence of any measurable surface water flow or sediment/clast movement within the Western Drainage.

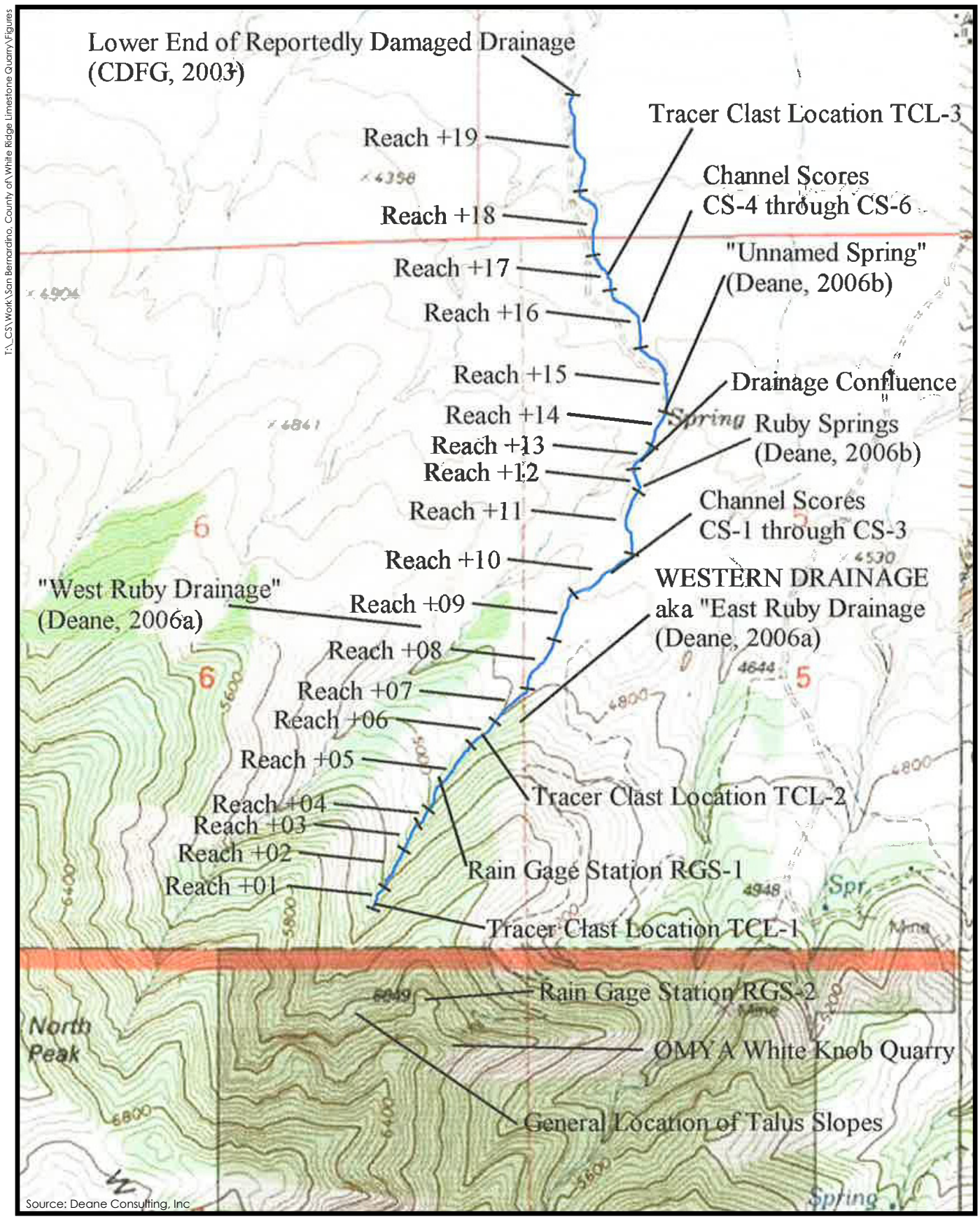


Figure 3.5-17
Western Drainage Data Collections
Locations Map

PMC®

Liquefaction

Liquefaction is a transformation of soil from a solid to a liquefied state during which saturated soil temporarily loses strength resulting from the buildup of excess pore water pressure, especially during earthquake-induced cyclic loading. Soils that are susceptible to liquefaction include loose to medium dense sand and gravel, low-plasticity silt, and some low-plasticity clay deposits. Ground failure can occur when liquefaction occurs in layers of sediment underlying a site. Soil liquefaction and associated ground failure can damage roads, pipelines, underground cables, and buildings with shallow foundations. Liquefaction can occur in areas characterized by water-saturated, cohesionless, granular materials at depths less than 40 feet. Soil that liquefies can manifest a number of failures, including lateral spreading, rapid settlement, and flow slides.

The only areas in the White Knob/White Ridge Limestone Quarries where high groundwater might cause a saturated condition in natural soils are in the bottoms of the main drainages. The soils in these drainages are typically too coarse grained to facilitate liquefaction. The overburden fill material that the mining operations will place in the drainages is a mixture of fines, angular rock, and boulders, and likewise is too coarse grained to be susceptible to liquefaction. The current depth to groundwater at the site is not known, but is expected to be greater than 550 feet bgs.

3.5.4 REGULATORY FRAMEWORK

The following section provides a brief summary of the federal, state, and local regulations, goals, and policies for quarry mining, mining safety, and protection of natural resources from open pit mining operations and reclamation activities.

FEDERAL

Mine Safety and Health Administration

The Mine Safety and Health Administration (MSHA), a division of the U.S. Department of Labor, administers the provisions of the Federal Mine Safety and Health Act of 1977. The MSHA develops and enforces mandatory safety and health regulations pursuant to the Code of Federal Regulations (CFR) that apply to all surface and underground mines located in the United States through inspections, rigorous training, and the provision of educational programs for employers and employees in the mining industry. The ultimate purpose is to eliminate fatal accidents, reduce the frequency and severity of nonfatal accidents, minimize health hazards, and promote improved safety and health conditions in mines. Project operations would be regulated by MSHA, and periodic inspections would be performed under MSHA regulations to ensure maximum worker safety during implementation of the Amended Plan. Mining operations are subject to periodic safety inspections by the MSHA.

STATE

Surface Mining and Reclamation Act

The Surface Mining and Reclamation Act (SMARA) (including the State Mining and Geology Board Reclamation Regulations) is flexible with respect to addressing geotechnical slope stability for both fill slopes and cut slopes. SMARA does not specify a minimum factor of safety (FOS) required for slope stability. However, Title 14, Chapter 8, California Code of Regulations [CCR] Section 3704(f) requires that: "Cut slopes, including final highwalls and quarry faces, shall have a

minimum slope stability factor of safety that is suitable for the proposed end use and conform with the surrounding topography and/or approved end use." For fill slopes, Section 3704(d) states "fill slopes shall be 2H:IV or flatter. Slopes steeper than 2H:IV must be supported by site-specific geologic and engineering analyses to indicate that the minimum FOS is suitable for the proposed end use."

A more general SMARA requirement of Section 3704(e) is that at closure, all fill slopes, including permanent piles or dumps of mine waste and overburden, must conform to the surrounding topography and/or approved end use. For the White Knob/White Ridge Limestone Quarries project, the proposed end use is undeveloped open space.

California Building Code

The California Building Code (CBC) has been codified in the California Code of Regulations as Title 24, Part 2. Title 24 is administered by the California Building Standards Commission, which, by law, is responsible for coordinating all building standards. Under state law, all building standards must be centralized in Title 24 or they are not enforceable. The purpose of the CBC is to establish minimum standards to safeguard the public health, safety, and general welfare through structural strength, means of egress facilities, and general stability by regulating and controlling the design, construction, quality of materials, use and occupancy, location, and maintenance of all buildings and structures within its jurisdiction. The 2010 edition of the CBC is based on the 2009 International Building Code published by the International Code Conference. The 2010 CBC contains California amendments based on the American Society of Civil Engineers (ASCE) Minimum Design Standards 7-05. ASCE 7-05 provides requirements for general structural design and includes means for determining earthquake loads as well as other loads (such as wind loads) for inclusion in building codes. The provisions of the CBC apply to the construction, alteration, movement, replacement, and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures throughout California. While the White Knob/White Ridge Limestone Quarries project does not include the construction of any buildings, the Amended Reclamation Plan requires the demolition, removal, and/or off-site transport of existing temporary structures, including any equipment maintenance facility, office spaces, conveyors, crushers, screens, wash plants, scales, explosive storage, and other miscellaneous structures.

LOCAL

County of San Bernardino Development Code

Geologic Hazards Overlay

The County's policies and standards pertaining to geologic hazards and associated investigation and mitigation standards are contained in Chapter 82.15.000, Geologic Hazards Overlay, of the San Bernardino County Development Code, 2007 edition. The County's policies and standards pertaining to mineral resources are contained in Chapter 82.17.000, Mineral Resources Overlay.

The Geologic Hazards Overlay (GHO) was created to provide greater public safety by establishing investigation requirements for areas that are subject to potential geologic problems, including active faulting, landsliding, debris flow/mud flow, rockfall, liquefaction, seiche, and adverse soil conditions. The GHO establishes minimum requirements for the geologic evaluation of land based on proposed land uses. The provisions of the GHO are also intended to ensure that the County fulfills its duties under state law regarding geologic hazards, including the

Alquist-Priolo Earthquake Fault Zoning Act (surface fault rupture) and the Seismic Hazards Mapping Act (earthquake-induced landslides and liquefaction ground failure). The County Planning Office and/or the County Geologist reviews land development applications, building permit applications, and land use proposals using maps showing the official County Geologic Hazard Zone maps and other maps and pertinent data, including but not limited to previous investigations of the subject property, to determine if a geologic investigation is required.

The northern portion of the project site intersects areas mapped by San Bernardino County as a surface fault rupture hazard zone (see **Figure 3.5-7**). No buildings or grading, other than for the access roadway, are proposed for the project. With respect to the Amended Plan, the County has required the project applicant to submit geologic hazard evaluations of the slopes subject to SMARA requirements. The stability of these mining slopes is discussed in the subsections 3.5.2, 3.5.3, and 3.5.5.

Surface Mining and Reclamation Overlay

The County of San Bernardino Surface Mining and Reclamation Overlay, Chapter 88.03.000 of the San Bernardino County Development Code, was adopted in order to comply with and implement the provisions of SMARA by adopting procedures for reviewing, approving, and/or permitting surface mining operations, reclamation plans, and financial assurances in the unincorporated areas of the county. The overlay sets forth the general procedural, operational, and reclamation requirements that must be complied with, where applicable, by surface mining and production operations in the county. The overlay contains requirements for the content of a reclamation plan, the review procedure, and mining standards. Applicability of the County's SMARA Overlay to State SMARA law and regulation is found in Section 88.03.090(a)(1) and (a)(2), which require reclamation plans to comply with Public Resources Code Sections 2777–2773 and California Code of Regulations Sections 3500–3505 and 3700–3713. In addition, performance standards in Division 3, Section 88.03.090(b), of the San Bernardino County Countywide Development Standards also apply to reclamation plans.

County of San Bernardino General Plan

The County of San Bernardino General Plan includes several policies with the goal of addressing natural geologic and seismic hazards to the general public. (Note that General Plan policies specifically associated with mining and resource extraction are described in Division 2, Chapter 82.17.000, Mineral Resources.)

The General Plan policies related to natural hazards focus on reducing the threat of natural hazards for the general public and therefore are focused primarily on controlling the location and type of land uses permitted in hazardous areas and ensuring proposals adequately consider the presence of geologic and seismic hazards. The project would be consistent with these plans and policies.

The General Plan includes the following project-related policies concerning geology, soils, and seismic hazards:

Policy S 4.2 Apply the provisions of the Revised Erosion and Sediment Control Ordinance countywide.

Policy S 4.3 Tailor grading, land clearance, and grazing to prevent unnatural erosion in erosion susceptible areas.

Policy S 6.1 Require development on hillsides to be sited in such a manner that minimizes the extent of topographic alteration required to minimize erosion, to maintain slope stability, and to reduce the potential for offsite sediment transport.

Policy S 7.1 Strive to mitigate the risks from geologic hazards through a combination of engineering, construction, land use, and development standards.

Policy S 7.4 Designate areas identified by the Alquist-Priolo Earthquake Fault Zoning Act (Public Resources Code, Division 2, Chapter 7.5) on the Hazard Overlay Maps to protect occupants and structures from high level of risk caused by ground rupture during earthquake.

Policy S 7.5 Minimize damage caused by liquefaction, which can cause devastating structural damage and a high potential for saturation exists when the groundwater level is within the upper 50 feet of alluvial material.

Policy S 7.6 Protect life and property from risks resulting from landslide, especially in San Bernardino and San Gabriel Mountains that have high landslide potential.

3.5.5 IMPACTS AND MITIGATION MEASURES

STANDARDS OF SIGNIFICANCE

Consistent with the County of San Bernardino Environmental Checklist and Appendix G of the CEQA Guidelines, the project would have a significant impact if it would result in:

1) Exposure of people or structures to potential substantial adverse effects, including the risk of loss, injury, or death, involving:

    i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault.

    ii. Strong seismic ground shaking.

    iii. Seismic-related ground failure, including liquefaction.

    iv. Landslides.

2) Substantial soil erosion or the loss of topsoil.

3) Location of development on a geologic unit or soil that is unstable, or that would become unstable as a result of development, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.

4) Location of development on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.

5) Location of development on soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems, where sewers are not available for the disposal of wastewater.

The Initial Study prepared for the proposed project (see **EIR Appendix A**) determined that there would be no impact related to expansive soil or soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems (standards of significance 4 and 5). The reader is referred to the NOP/IS for a complete analysis of these impact areas. A copy of the NOP/IS, along with comments received during the public review period, is contained in **EIR Appendix A**.

METHODOLOGY

The following impact analysis is based on independent review of project-specific geological data and on analyses and findings that have been developed by the project's geotechnical consultants (CHJ 2012, 2013; DCI 2012) and other literature cited in the section, with full bibliographic references provided in Chapter 6.0, References. The CHJ (EIR Appendix F) and DCI (Amended Reclamation Plan Appendix C1) studies are the primary sources of information presented in the impact analysis. The reports provide a comprehensive description of the methodologies used to evaluate existing conditions and conditions that would occur with project implementation.

PROJECT IMPACTS AND MITIGATION MEASURES

Exposure of People or Structures to Potential Substantial Adverse Seismic Effects (Standards of Significance 1 and 3)

Impact 3.5.1 The project site is located in an area with the potential for seismic activity. This is a **less than significant** impact.

No evidence of active faulting traversing the quarry area was found during a review of published and unpublished literature and maps, during the review of stereoscopic aerial photographs, or during prior field mapping. The quarry areas of the project site are not within an Alquist-Priolo Fault Rupture Hazard Zone (AP Zone), as designated by the California Alquist-Priolo Earthquake Fault Zoning Act (see **Figure 3.5-8**). However, an AP Zone of the North Frontal Fault Zone (NFFZ) crosses the off-site haul road north of the project site (Bryant 1986a, 1986b). Ground rupture due to active faulting in the quarry area is not anticipated. Ground rupture due to active faulting in the quarry area is not anticipated. The northern portion of the project site (haul road) intersects areas mapped by San Bernardino County as surface fault rupture hazard zones (see **Figure 3.5-7**).

The most significant fault to the project from a ground shaking standpoint is the NFFZ, exposed approximately 1 mile north of the site along the range front of the San Bernardino Mountains. This fault is a complex zone of left-lateral, thrust, and reverse faults and forms the boundary between the Mojave Desert Geomorphic Province on the north and the Transverse Ranges Geomorphic Province on the south. Since this fault dips at a moderate angle to the south (approximately 49 degrees according to Petersen et al. 2008), the fault plane is about 1 mile beneath the site.

More recent 2009 probabilistic seismic hazard mapping using the USGS Earthquake Hazard Program's interactive website finds the probability that the White Knob Quarry at latitude/longitude coordinates N34.3629, W117.0120 would experience ground shaking from a magnitude 6.5 or greater earthquake ranges from 50 to 60 percent (see **Figure 3.5-10**).

Based on an anticipated depth of groundwater greater than 550 feet below ground surface and the lack of liquefiable sediments, no potential for liquefaction and other shallow groundwater-related hazards is anticipated.

While no buildings or grading, other than for the haul road, are proposed for the project, the potential to result in the exposure of people to seismic hazards does exist on the project site. San Bernardino County has created the Geologic Hazards Overlay (GHO) to provide greater public safety by establishing investigation requirements for areas that are subject to potential geologic problems, including active faulting, landsliding, debris flow/mud flow, rockfall, liquefaction, seiche, and adverse soil conditions. The GHO establishes minimum requirements for the geologic evaluation of land based on proposed land uses. The County Planning Office and/or the County Geologist reviews land development applications, building permit applications, and land use proposals using maps showing the official County Geologic Hazard Zone maps and other maps and pertinent data, including but not limited to previous investigations of the subject property, to determine if a geologic investigation is required. The project is subject to these previsions and as such, has provided geologic hazard evaluations of the slopes subject to SMARA requirements, which are discussed further under Impact 3.5.2. As a result of the geologic hazards evaluations and the resultant procedures adopted by the project applicant, the potential to expose structures or people to seismic hazards is considered **less than significant**.

Mitigation Measures

None required.

Slope Stability (Standards of Significance 1 and 3)

Impact 3.5.2 Rock and soil slopes constructed as part of the proposed reclamation of the White Knob, Annex, and White Ridge Quarries could fail under static or seismic forces if not properly engineered and constructed. However, with implementation of existing procedures, this would result in a **less than significant** impact.

Slope stability analyses conducted by the project's geotechnical consultant CHJ (2012) on the northwest slope concluded that continued mining in the White Knob Quarry above the northwest slope and mining of the White Knob Annex is feasible, provided that suitable conditions can be established to limit addition of material or access to the existing and proposed slopes.

Based on prior gross slope stability analyses for limestone/marble mining and current surficial slope stability analysis, the existing talus/colluvium slopes are considered suitably stable to mass movement with respect to the stability of adjacent natural slopes and the anticipated final reclamation condition. It is anticipated that the talus slope would trend toward a more stable condition and achieve a natural state of stability with the passage of time. Additional evaluation of slopes above the Western Drainage may be warranted at the completion of mining and prior to final reclamation.

Reclamation activities within the White Knob Quarry pit would begin around year 2035 and would involve backfilling the pit to a depth of approximately 275 feet of overburden to a floor elevation of approximately 5,575 feet amsl. The remaining overburden would be placed in three areas (OB-1, OB-2, and OB-3) until the end of mining in 2055. Fill slopes would have an overall grade of 2H:1V or less with benches and crest berms to control and direct runoff.

At the end of mining, the White Knob Quarry highwalls would have an overall slope of 1 horizontal to 1 vertical (1H:1V), a maximum elevation of approximately 6,275 feet amsl, and a maximum mining depth of 5,300 feet amsl. At the end of mining, overburden would be placed in the White Knob Quarry up to an elevation of 5,575 feet amsl, leaving the maximum highwall

height of approximately 625 feet. The Annex Quarry 1H:1V highwalls would extend from a elevation of approximately 6,100 feet amsl to a depth of 5,575 feet amsl, a maximum highwall height of approximately 525 feet. The White Ridge Quarry 1H:1V highwalls would have a maximum elevation of approximately 5,800 feet amsl with the quarry floor at 5,050 feet amsl, a maximum highwall height of 750 feet.

Typical highwall slopes would be benched at 50-foot vertical intervals with an interslope face angle averaging 70 degrees. Bench width is typically 25 feet, but is greater if interslope wall height is over 50 feet. Generally, bench width is half of the interslope wall height. Pit ramps are 25 to 35 feet wide, and grade is 12 to 18 percent depending on conditions.

The 1H:1V highwalls in the White Knob Quarry would have a temporary maximum height of approximately 900 feet, but overburden backfilling the pit would create a final maximum height of approximately 625 feet. In the Annex Quarry, the highwalls would have a maximum height of 525 feet. For the White Ridge Quarry, the maximum highwall height would be 750 feet.

Future mining in the Annex and White Ridge areas is anticipated to provide mine slopes similar to those achieved in the White Knob area based on the continuity of the ore body and associated structural character between the existing and planned mine areas.

Adherence to the slope benching plan and consideration of newly exposed adverse structural features (if present) during future quarry excavation work can result in stable slopes during mining and after completion of quarry reclamation. The arid environment of the site precludes significant groundwater in the proposed slopes, except on a very sporadic basis where water may be concentrated along geologic structures such as faults following periods of precipitation.

Raveling processes during quarry operations would result in talus on the benches. This process has already occurred along older existing mine slopes. The talus would be left on the benches to facilitate revegetation and to give the reclaimed slopes a more natural appearance. It is anticipated that any resulting boulders would be angular and relatively resistant to rolling. Large, unstable, rounded blocks/boulders on slopes steeper than approximately 2H:1V within the active mining areas would be removed or stabilized.

Slope stability analyses conducted by the project's geotechnical consultant CHJ (2013) concluded that the final highwall slopes of the quarry pits have an acceptable FOS under static and earthquake conditions that are suitable for the open space end land use. The slope stability analyses were done using both the kinematic Markland Test and SLICE, a limit-equilibrium computer program.

The results of both the kinematic Markland Test and the SLICE program's static and pseudo-static limit-equilibrium analyses found that the stability of final quarry highwalls and overburden fill slopes would be adequate for the end land use. **Table 3.5-6** gives the results of the SLICE stability analyses, and Enclosures B-2.0 to B-9.0 in Appendix B of CHJ Consultants report (2013) provide the results of the kinematic analyses.

Slope stability analyses conducted by CHJ (2013) demonstrate that quarry and overburden fill slopes would remain stable. Therefore, the project would cause no adverse impact related to slope failure within the quarry pit. Based on the data and the results of CHJ's investigation, deep-seated landsliding is not anticipated in the proposed slopes. Additional analysis of the proposed quarry slopes is discussed previously in this section. Based on this information, it is anticipated that future mining practices would produce final mining and reclaimed quarry slopes which are suitably stable with regard to large-scale or deep-seated slope failure.

The 2012 CHJ northwest slope report also found that potential rockfall hazard is apparent in the western slope area. During mining of the rock in the deposit at the top of the ridge and along the crest, boulders of white limestone have inadvertently rolled down the slope to the north and to the west onto the northwest slope and into the Western Drainage. The incidental boulder roll-down has partly covered the older natural talus and landslide deposits, and is visible from Lucerne Valley. Precautions have been taken and procedures have been implemented to minimize future roll-down. However, because of remaining cliffs, some roll-down would be unavoidable, as it is necessary to continue to mine the ridge down and daylight in order to safely recover the ore. Once the limit of the ore is reached, no additional roll-down or visible changes would occur.

Procedures that were implemented in late 2003 and would continue for the life of the project to minimize boulder roll-down include:

1. Precision drilling and buffer blasting when the outside edge is approached.

2. Drilling lifters on the edge to undercut the remaining slope and let it fall into the pit (like directional falling of a tree).

3. Excavator to pull down and pull in toward the pit blasted rock away from the edge.

4. Use of alternatives to blasting along the outside such as rock breakers, surface miners, cutting heads, and excavators.

5. Loader to pull back material from the edge.

6. Loader to dig at an angle to the edge or parallel to the edge when possible.

7. Manually scaling boulders from the highwalls where they may be above a haulage road.

Additionally, revegetation of the upper slopes, undertaken mainly to reduce visual impacts, has also helped stabilize the upper slopes and reduce erosion and sediment transport.

CHJ recommended that personnel be precluded from occupying the northwest slope until such time as protective measures can be emplaced (by remote means) and/or the rate of rockfall from existing material is suitably lower. It should be noted that boulders bounding down the slope have been estimated to travel at maximum velocities up to approximately 115 feet per second, which gives a person at the toe of the 1,200-foot-long slope approximately 10 seconds to relocate from the path of a rolling boulder. CHJ also concluded that the likelihood of witnessing a rolling boulder under current slope conditions appears low. However, given the anticipated outcome of a human/boulder interaction, it would be prudent to exercise caution when performing tasks at the base of the western slope.

The 2012 CHJ report on the northwest slope concluded that continued mining in the White Knob Quarry above the northwest slope and mining of the White Knob Annex is feasible, provided that suitable conditions can be established to limit addition of material or access to the existing and proposed slopes. Based on the prior gross slope stability analyses for limestone/marble mining and the current surficial slope stability analysis, the existing talus/colluvium slopes are considered suitably stable to mass movement with respect to the stability of adjacent natural slopes and anticipated final reclamation condition. It is anticipated that the talus slope would trend toward a more stable condition and achieve a natural state of stability with the passage of time.

Additional evaluation of slopes above the Western Drainage may be warranted at the completion of mining and prior to final reclamation.

The 2012 CHJ report also found that potential rockfall hazard is apparent in the northwest slope area. Placement of conspicuous signs and/or barriers in the Western Drainage approach, warning of potential rockfall, is warranted based on observation of recent bounce marks and shifted boulders in the northwest slope. Mitigation of rockfall for individual clasts present on the slope by direct means is not considered practical with regard to human life safety at this time. Remote methods may be feasible; however, these may act to exacerbate movement of already stable clasts and contribute to sediment transport. There is a potential for debris flow activity during localized intense storm activity in the northwest slope area. Monitoring of sediment transport in the Western Drainage if future debris flow occurs may provide information with regard to sediment transport rates and potential effects on downstream features.

The continued implementation of the practices above during mine operations so as to avoid or minimize shallow slumps and boulder roll-out, signing in the Western Drainage approach warning of rockfalls, and the revegetation during reclamation of the disturbed areas would result in a **less than significant** impact.

Mitigation Measures

None required.

Rock and Soil Talus Erosion (Standard of Significance 3)

Impact 3.5.3 Rock and soil talus on the northwest slope and within the Western Drainage could impact the Ruby Springs area**.** This is a **potentially significant** impact.

Past mining operations at White Knob Quarry allowed white talus overburden material to fall onto the northwest slope. An intense rain storm in early August 2003 in the upper reaches of the Western Drainage caused some of this talus material to reach the Western Drainage.

Following a 2003 investigation report by the CDFG (2003), Omya's consultant, DCI Consultants, conducted a series of annual qualitative studies in the Western Drainage in 2005, 2006, 2007, 2008, and 2009 (DCI 2012) to provide a qualitative comparison of the Western Drainage via visual evaluation of observed changes in the noted sediments and vegetation, as well as surface water flow originating from Ruby Springs. Field data collected by DCI from 2005 to 2009 indicated that the damage from the August 2003 storm event was limited to the upper approximate 1.2 miles of streambed within the Western Drainage, essentially between the base of the white talus slope to the unnamed spring, Reaches +01 through +14 (see **Figure 3.5-17**).

In 2008, a Sedimentation and Erosion Monitoring Technical Work Plan (dated May 31, 2008) was implemented to collect more quantitative data of the effects of sedimentation on the drainage and spring for two reporting periods, June 2008–May 2009 and June 2009–May 2010. In accordance with the April 20, 2011, settlement agreement between the BLM and Omya**,** data collection was resumed during December 2011.

Following the collection of additional Ruby Springs discharge/surface water distance data during April through July 2011, Omya and DCI presented a conceptual model of the impact of the talus slope on Ruby Springs discharge rates to BLM personnel in August 2011. The conceptual model was discussed, after which the BLM issued a letter summarizing the requirements of a report regarding the impact of the talus slope on Ruby Springs (see BLM 2011a and DCI 2012,

Appendix A). A November 22, 2011, comment letter by the BLM indicated agreement with the report's conclusions, but requested additional collection of data for the "foreseeable future" (BLM 2011b), presumably in accordance with the Sedimentation and Erosion Monitoring Technical Work Plan (DCI 2008).

The April 20, 2011, Settlement Agreement between the BLM and Omya relating to activities at the White Knob Quarry included six separate components (Parts A–F). The Part A component deals with Ruby Springs and the Western Drainage and requires the following:

- Part A – Omya has agreed to study and monitor Ruby Springs, located to the northwest of the quarry. Ongoing monitoring through 2014 is being undertaken and reported to the BLM, and no substantial impacts to the drainage or springs have been observed (see Appendix C1 of Sedimentation and Erosion Monitoring 2010–2011 Reporting Period, Ruby Springs Area [DCI 2012]).

Mitigation Measures

MM 3.5.3 Omya shall prepare and submit periodic monitoring of the Western Drainage and Ruby Springs area to the County of San Bernardino. If the results of periodic monitoring of the Western Drainage and Ruby Springs area finds that sediments from the White Knob Quarry operation have caused a measurable impact to Ruby Springs, Omya shall prepare and submit for approval additional sediment control measures that may include (1) revision of the 2008 Sedimentation and Erosion Monitoring Technical Work Plan, and/or (2) remediation of the Western Drainage and/or Ruby Springs area. Any remediation efforts in the Western Drainage and/or Ruby Springs area will occur prior to proceeding with work on the ground. Omya shall obtain all necessary permits and pay all required fees and financial assurances, including, but not limited to, County of San Bernardino permits, BLM permits, California Department of Fish and Wildlife permits, and US Fish and Wildlife Service permits.

Reporting of monitoring results shall be done at least once every two years and following any significant rain event that is equal to or exceeds the 10-year return period rainfall for the project site. Reports of monitoring activities, data, and findings shall be provided to the County of San Bernardino at least once every two years prior to the annual SMARA inspection. The first report shall be submitted within the year following the approval of the Amended Reclamation Plan. The monitoring shall be done in accordance with the 2008 Sedimentation and Erosion Monitoring Technical Work Plan (dated May 31, 2008) and any subsequent approved amendments.

Timing/Implementation: *Ongoing as part of quarry operations*

Enforcement/Monitoring: *County of San Bernardino Planning Department*

This mitigation measure will ensure that the talus discharged into the Western Drainage will not impact Ruby Springs or the unnamed spring, and requires periodic monitoring and potentially additional sediment control measures of the outflow of Ruby Springs and the unnamed spring and measurement of sedimentation migration and deposition rates in the Western Drainage. The implementation of this mitigation measure during mine operations would avoid or minimize

impacts to the Western Drainage and Ruby Springs area. As a result, this impact would be mitigated to a **less than significant** level.

Erosion and Soil Loss (Standard of Significance 2)

Impact 3.5.4 Earthmoving and other ground disturbance associated with the phased reclamation of the site could temporarily promote accelerated erosion and soil loss. This is a **less than significant** impact.

The impact of the project on erosion and soil loss with respect to hydrologic conditions and water quality is discussed in Section 3.7, Hydrology and Water Quality. This impact focuses on the potential for accelerated erosion (such as sheet wash, rilling, rutting, and in more extreme cases, gullying, sloughing, or sliding of incised gully sidewalls) to undermine haul roads or cause damage to other structures. Accelerated erosion typically occurs on bare, unprotected slopes during the wet season, particularly in response to prolonged, intense storms.

As discussed previously, the susceptibility of a surface to erosion depends largely on the soil condition present. Coarse overburden material is unlikely to undergo significant erosion because of its ability to freely and rapidly drain excess water. However, stockpiles of washed fines, fill slopes along haul roads, or unprotected soil cover could potentially be subject to accelerated erosion. Following successful reclamation of the project area, erosion and soil loss would be approximately similar to natural pre-mining conditions. However, the interim phases of reclamation could leave certain surfaces temporarily subject to accelerated erosion.

As discussed in Chapter 2.0, Project Description, of this DEIR, temporary erosion control measures would be installed within the project site as described in the drainage report, the stormwater pollution prevention plan, and the revegetation plan. The drainage report concludes that the project would be designed consistent with State Water Resources Control Board requirements and the San Bernardino County Development Code, and would meet SMARA's reclamation standards for erosion and sediment control (14 CCR Section 3706). A monitoring program would be instituted to observe and classify the condition of surface soils in the project area, and remedial measures, such as reseeding, regrading, and installation of silt fences, would be implemented based on the severity and extent of erosional features observed.

Drainage ditches, swales, and sedimentation basins that would serve to capture excess sediment would be inspected, cleared, and maintained as needed and would be sufficient to convey the 10- and 20-year precipitation events and safely release 100-year flows. Standard procedures and implementation of the measures described above would prevent or remediate accelerated and damaging erosion within the project area. With respect to excessive sediment load being carried by stormwater flows, numerous controls, as described in Section 3.7, Hydrology and Water Quality, would be designed and implemented in a manner that reduces the potential impact to less than significant. As such, the impact with respect to erosion and soil loss would be **less than significant**.

Mitigation Measures

None required.

This section provides a discussion on the proposed White Knob/White Ridge Limestone Quarries Expansion Project and whether any element of the project would result in increased generation of greenhouse gas (GHG) emissions that could be considered cumulatively considerable. The discussion and conclusions in this section are based on an independent review of project-specific GHG emissions analysis and findings that have been developed by the applicant's air quality and GHG emissions consultant, Sespe Consulting, Inc. (*Air Quality and Greenhouse Gas Impact Assessment, Omya White Knob and White Ridge Quarries Expansion*, **EIR Appendix C**).

The County published a Notice of Preparation and Initial Study (NOP/IS) for the proposed project on June 12, 2013. A copy of the NOP/IS, along with comments received during the public review period, is contained in **EIR Appendix A**. There were no comments regarding greenhouse gas emissions/climate change.

3.6.1 ENVIRONMENTAL SETTING

EXISTING CLIMATE SETTING

To fully understand global climate change, it is important to recognize the naturally occurring "greenhouse effect" and to define the greenhouse gases that contribute to this phenomenon. Various gases in the earth's atmosphere, classified as atmospheric GHGs, play a critical role in determining the earth's surface temperature. Solar radiation enters the earth's atmosphere from space and a portion of the radiation is absorbed by the earth's surface. The earth emits this radiation back toward space, but the properties of the radiation change from high-frequency solar radiation to lower-frequency infrared radiation. GHGs, which are transparent to solar radiation, are effective in absorbing infrared radiation. As a result, this radiation that otherwise would have escaped back into space is now retained, resulting in a warming of the atmosphere. This phenomenon is known as the greenhouse effect. Among the prominent GHGs contributing to the greenhouse effect are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), nitrogen trifluoride (NF_3), and sulfur hexafluoride (SF_6).

For most nonindustrial development projects, motor vehicles make up the bulk of GHG emissions produced on an operational basis. The primary greenhouse gases emitted by motor vehicles include carbon dioxide, methane, nitrous oxide, and hydrofluorocarbons (CARB 2010). Following are descriptions of the primary greenhouse gases attributed to global climate change, including a description of their physical properties, primary sources, and contribution to the greenhouse effect.

Carbon Dioxide

Carbon dioxide (CO_2) is a colorless, odorless gas. CO_2 is emitted in a number of ways, both naturally and through human activities. The largest source of CO_2 emissions globally is the combustion of fossil fuels such as coal, oil, and gas in power plants, automobiles, industrial facilities, and other sources. A number of specialized industrial production processes and product uses such as mineral production, metal production, and the use of petroleum-based products can also lead to CO_2 emissions. The atmospheric lifetime of CO_2 is variable because it is so readily exchanged in the atmosphere (EPA 2008).

Methane

Methane (CH_4) is a colorless, odorless gas that is not flammable under most circumstances. CH_4 is the major component of natural gas, about 87 percent by volume. It is also formed and

released to the atmosphere by biological processes occurring in anaerobic environments. Methane is emitted from a variety of both human-related and natural sources. Human-related sources include fossil fuel production, animal husbandry (enteric fermentation in livestock and manure management), rice cultivation, biomass burning, and waste management. These activities release significant quantities of methane to the atmosphere. Natural sources of methane include wetlands, gas hydrates, permafrost, termites, oceans, freshwater bodies, non-wetland soils, and other sources such as wildfires. Methane's atmospheric lifetime is about 12 years (EPA 2011b).

Nitrous Oxide

Nitrous oxide (N_2O) is a clear, colorless gas with a slightly sweet odor. N_2O is produced by both natural and human-related sources. Primary human-related sources of N_2O are agricultural soil management, animal manure management, sewage treatment, mobile and stationary combustion of fossil fuels, adipic acid production, and nitric acid production. N_2O is also produced naturally from a wide variety of biological sources in soil and water, particularly microbial action in wet tropical forests. The atmospheric lifetime of N_2O is approximately 120 years (EPA 2010a).

Hydrofluorocarbons

Hydrofluorocarbons (HFCs) are man-made chemicals, many of which have been developed as alternatives to ozone-depleting substances for industrial, commercial, and consumer products. The only significant emissions of HFCs before 1990 were of the chemical HFC-23, which is generated as a byproduct of the production of HCFC-22 (or Freon 22, used in air conditioning applications). The atmospheric lifetime for HFCs varies from just over a year for HFC-152a to 260 years for HFC-23. Most of the commercially used HFCs have atmospheric lifetimes less than 15 years (e.g., HFC-134a, which is used in automobile air conditioning and refrigeration, which has an atmospheric life of 14 years) (EPA 2010a).

Perfluorocarbons

Perfluorocarbons (PFCs) are colorless, highly dense, chemically inert, and nontoxic. There are seven PFC gases: perfluoromethane (CF_4), perfluoroethane (C_2F_6), perfluoropropane (C_3F_8), perfluorobutane (C_4F_{10}), perfluorocyclobutane (C_4F_8), perfluoropentane (C_5F_{12}), perfluorohexane (C_6F1_4). Natural geological emissions have been responsible for the PFCs that have accumulated in the atmosphere in the past; however, the largest current source is aluminum production, which releases CF_4 and C_2F_6 as byproducts. The estimated atmospheric lifetimes for CF_4 and C_2F_6 are 50,000 and 10,000 years, respectively (EFCTC 2003).

Nitrogen Trifluoride

Nitrogen trifluoride (NF_3) is an inorganic, colorless, odorless, toxic, non-flammable gas used as an etchant (etching medium) in micro-electronics. Nitrogen trifluoride is predominantly employed in the cleaning of the plasma-enhanced chemical vapor deposition (PECVD) chambers in the production of liquid crystal displays and silicon-based thin film solar cells. It has a global warming potential of17,200 CO_2e. While NF_3 may have a lower global warming potential than other chemical etchants, it is still a potent GHG. In 2009, NF_3 was listed by California as a high global warming potential GHG to be listed and regulated under Assembly Bill (AB) 32 (Section 38505 Health and Safety Code)).

Sulfur Hexafluoride

Sulfur hexafluoride (SF_6) is an inorganic compound that is colorless, odorless, nontoxic, and generally nonflammable. SF_6 is primarily used as an electrical insulator in high voltage equipment. The electric power industry uses roughly 80 percent of all SF_6 produced worldwide. Significant leaks occur from aging equipment and during equipment maintenance and servicing. SF_6 has an atmospheric life of 3,200 years (EPA 2008).

Each GHG differs in its ability to absorb heat in the atmosphere based on the lifetime, or persistence, of the gas molecule in the atmosphere. Gases with high global warming potential, such as HFCs, PFCs, NT_3, and SF_6, are the most heat-absorbent. Methane traps over 21 times more heat per molecule than CO_2, and N_2O absorbs 310 times more heat per molecule than CO_2. Often, estimates of GHG emissions are presented in carbon dioxide equivalents (CO_2e), which weight each gas by its global warming potential (GWP). Expressing GHG emissions in carbon dioxide equivalents takes the contribution of all GHG emissions to the greenhouse effect and converts them to a single unit equivalent to the effect that would occur if only CO_2 were being emitted. **Table 3.6-1** shows the GWPs for different GHGs for a 100-year time horizon.

TABLE 3.6-1
GLOBAL WARMING POTENTIAL FOR GREENHOUSE GASES
(100-YEAR GIVEN TIME HORIZON)

Greenhouse Gas	Global Warming Potential
Carbon Dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Dioxide (N_2O)	310
Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs)	6,500
Nitrogen Trifluouride (NF_3)	17,200
Sulfur Hexafluoride (SF_6)	23,900

Sources: California Climate Action Registry 2009.

As the name implies, global climate change is a global problem. GHGs are global pollutants, unlike criteria air pollutants and toxic air contaminants, which are pollutants of regional and local concern, respectively. California is the twelfth to sixteenth largest emitter of CO_2 in the world and produced 492 million gross metric tons of carbon dioxide equivalents in 2004 (CEC 2006). Consumption of fossil fuels in the transportation sector was the single largest source of California's GHG emissions in 2004, accounting for 40.7 percent of total GHG emissions in the state (CEC 2006). This category was followed by the electric power sector (including both in-state and out-of-state sources) (22.2 percent) and the industrial sector (20.5 percent) (CEC 2006).

EFFECTS OF GLOBAL CLIMATE CHANGE

With more than a decade of concerted research, scientists have established that the early signs of climate change are already evident in the state—as shown, for example, in increased average temperatures, changes in temperature extremes, reduced snowpack in the Sierra Nevada, sea-level rise, and ecological shifts.

Many scientists believe that these changes are accelerating—locally, across the country, and around the globe. As a result of emissions already released into the atmosphere, California is

anticipated to face intensifying climate changes in coming decades (CNRA 2009). Generally, research indicates that California should expect overall hotter and drier conditions with a continued reduction in winter snow (with concurrent increases in winter rains), as well as increased average temperatures, and accelerating sea-level rise. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing (CNRA 2009).

Climate change temperature projections identified in the 2009 California Climate Adaptation Strategy suggest the following (CNRA 2009):

- Average temperature increase is expected to be more pronounced in the summer than in the winter season.
- Inland areas are likely to experience more pronounced warming than coastal regions.
- Heat waves are expected to increase in frequency, with individual heat waves also showing a tendency toward becoming longer, and extending over a larger area, thus more likely to encompass multiple population centers in California at the same time.
- As GHGs remain in the atmosphere for decades, temperature changes over the next 30 to 40 years are already largely determined by past emissions. By 2050, temperatures are projected to increase by an additional 1.8 to 5.4°F (an increase one to three times as large as that which occurred over the entire twentieth century).
- By 2100, the models project temperature increases between 3.6 to 9°F.

Precipitation levels are expected to change over the twenty-first century, though models differ in determining where and how much rain and snowfall patterns will change (CNRA 2009). Eleven out of 12 precipitation models run by the Scripps Institution of Oceanography suggest a small to significant (12–35 percent) overall decrease in precipitation levels by mid-century (CNRA 2009). In addition, higher temperatures hasten snowmelt and increase evaporation and make for a generally drier climate. Moreover, the 2009 California Climate Adaptation Strategy concludes that more precipitation will fall as rain rather than as snow, with important implications for water management in the state. California communities have largely depended on runoff from yearly established snowpack to provide the water supplies during the warmer, drier months of late spring, summer, and early autumn. With rainfall and meltwater running off earlier in the year, the state will face increasing challenges of storing the water for the dry season while protecting Californians downstream from floodwaters during the wet season.

There may be dramatic changes in average temperature and precipitation. In the next few decades, it is likely that the state will face a growing number of climate change–related extreme events such as heat waves, wildfires, droughts, and floods. Because communities, infrastructure, and other assets are at risk, such events can cause significant damages and are already responsible for a large fraction of near-term climate-related impacts every year (CNRA 2009).

Most climate projections developed to date produce gradual changes for a given climate variable. In the past, rapid climate changes have been observed, and scientists are increasingly concerned about additional abrupt changes that could push natural systems past thresholds beyond which they could not recover. Such events have been recorded in paleoclimatological records, but current global climate models cannot predict when they may occur again (CNRA 2009). Such abrupt changes have been shown to occur over very short periods of time (a few years to decades) and thus represent the most challenging situations to which society and

ecosystems would need to adapt (CNRA 2009). Short of being able to predict such abrupt changes, scientists are focusing their attention on aspects of the climate and earth system called "tipping elements" that can rapidly bring about abrupt changes.

Tipping elements refer to thresholds where increases in temperature cause a chain reaction of mutually reinforcing physical processes in the earth's dynamic cycles. The most dangerous of these include the following (CNRA 2009):

- A reduction in Arctic sea ice, which allows the (darker) polar oceans to absorb more sunlight, thereby increasing regional warming, accelerating sea ice melting even further, and enhancing Arctic warming over neighboring (currently frozen) land areas.

- The release of methane (a potent GHG), which is currently trapped in frozen ground (permafrost) in the Arctic tundra, will increase with regional warming and melting of the ground, leading to further and more rapid warming and resulting in increased permafrost melting.

- Continued warming in the Amazon could cause significant rainfall loss and large-scale dying of forest vegetation, which will further release CO2.

- The accelerated melting of Greenland and West Antarctic Ice Sheets observed in recent times, together with regional warming over land and in the oceans, involves mechanisms that can reinforce the loss of ice and increase the rate of global sea-level rise.

According to the 2009 California Climate Adaptation Strategy, the impacts of global warming in California have the potential to include, but are not limited to, the areas discussed in **Table 3.6-2**.

TABLE 3.6-2
POTENTIAL STATEWIDE IMPACTS FROM CLIMATE CHANGE

Potential Statewide Impact	Description
Public Health	Climate change is expected to lead to an increase in ambient (i.e., outdoor) average air temperature, with greater increases expected in summer than in winter months. Larger temperature increases are anticipated in inland communities as compared to the California coast. The potential health impacts from sustained and significantly higher than average temperatures include heat stroke, heat exhaustion, and the exacerbation of existing medical conditions such as cardiovascular and respiratory diseases, diabetes, nervous system disorders, emphysema, and epilepsy. Numerous studies have indicated that there are generally more deaths during periods of sustained higher temperatures, and these are due to cardiovascular causes and other chronic diseases. The elderly, infants, and socially isolated people with pre-existing illnesses who lack access to air conditioning or cooling spaces are among the most at risk during heat waves.
Floods and Droughts	The impacts of flooding can be significant. Results may include population displacement, severe psychosocial stress with resulting mental health impacts, exacerbation of pre-existing chronic conditions, and infectious disease. Additionally, impacts can range from a loss of personal belongings, and the emotional ramifications from such loss, to direct injury and/or mortality. Drinking water contamination outbreaks in the United States are associated with extreme precipitation events. Runoff from rainfall is also associated with coastal contamination that can lead to contamination of shellfish and contribute to food-borne illness. Floodwaters may contain household, industrial, and agricultural chemicals as well as sewage and animal waste. Flooding and heavy rainfall events can wash pathogens and chemicals from contaminated soils, farms, and streets into drinking water

Potential Statewide Impact	Description
	supplies. Flooding may also overload storm and wastewater systems, or flood septic systems, also leading to possible contamination of drinking water systems. Drought impacts develop more slowly over time. Risks to public health that Californians may face from drought include impacts on water supply and quality, food production (both agricultural and commercial fisheries), and risks of waterborne illness. As surface water supplies are reduced as a result of drought conditions, the amount of groundwater pumping is expected to increase to make up for the water shortfall. The increase in groundwater pumping has the potential to lower the water tables and cause land subsidence. Communities that utilize well water will be adversely affected by drops in water tables or through changes in water quality. Groundwater supplies have higher levels of total dissolved solids compared to surface waters. This introduces a set of effects for consumers, such as repair and maintenance costs associated with mineral deposits in water heaters and other plumbing fixtures, and on public water system infrastructure designed for lower salinity surface water supplies. Drought may also lead to increased concentration of contaminants in drinking water supplies.
Water Resources	The state's water supply system already faces challenges to provide water for California's growing population. Climate change is expected to exacerbate these challenges through increased temperatures and possible changes in precipitation patterns. The trends of the last century—especially increases in hydrologic variability—will likely intensify in this century. The state can expect to experience more frequent and larger floods and deeper droughts. Rising sea level will threaten the Delta water conveyance system and increase salinity in near-coastal groundwater supplies. Planning for and adapting to these simultaneous changes, particularly their impacts on public safety and long-term water supply reliability, will be among the most significant challenges facing water and flood managers this century.
Forests and Landscapes	Global climate change has the potential to intensify the current threat to forests and landscapes by increasing the risk of wildfire and altering the distribution and character of natural vegetation. If temperatures rise into the medium warming range, wildfire occurrence statewide could increase from 57 percent to 169 percent by 2085. However, since wildfire risk is determined by a combination of factors, including precipitation, winds, temperature, and landscape and vegetation conditions, future risks will not be uniform throughout the state.

Source: CNRA 2009

3.6.2 REGULATORY FRAMEWORK

FEDERAL

Federal Regulation and the Clean Air Act

In the past, the U.S. Environmental Protection Agency (EPA) has not regulated GHGs under the Clean Air Act because it asserted that the act did not authorize it to issue mandatory regulations to address global climate change and that such regulation would be unwise without an unequivocally established causal link between GHGs and the increase in global surface air temperatures. However, the U.S. Supreme Court held that the EPA must consider regulation of motor vehicle GHG emissions. In *Massachusetts v. Environmental Protection Agency et al.*, twelve states and cities, including California, together with several environmental organizations, sued to require the EPA to regulate GHGs as pollutants under the Clean Air Act (127 S. Ct. 1438 (2007)). The court ruled that greenhouse gases fit within the Clean Air Act's definition of a pollutant and that the EPA did not have a valid rationale for not regulating GHGs. In 2009, the EPA responded to this ruling and made an endangerment finding that GHGs pose a threat to the public health and welfare. That was the first step necessary for the establishment of federal GHG regulations under the Clean Air Act.

In April 2010, the EPA issued the final rule on new standards for GHG emissions and fuel economy for light-duty vehicles in model years 2017–2025. In November 2010, the EPA published the "PSD [Prevention of Significant Deterioration] and Title V Permitting Guidance for Greenhouse Gases," which provides the basic information that permit writers and applicants need to address GHG emissions regulated under the Clean Air Act. In that document, the EPA described the "Tailoring Rule" in the regulation of GHG emissions. With the Tailoring Rule, the EPA established a phased schedule in the regulation of stationary sources. The first phase of the "Tailoring Rule" began January 2, 2011, and focuses the GHG permitting programs on the largest sources, greater than 75,000 tons of CO_2e per year, already subject to the Clean Air Act permitting based on their non-GHG regulated air pollutants. Then, in step two beginning June 1, 2011, the rule expanded to cover large sources of GHGs that may not have been previously covered by the Clean Air Act for other pollutants, with new sources with the potential to emit 100,000 tons of CO_2e per year or existing sources that undertake modifications that increase emissions by at least 75,000 tons of CO_2e per year. The rule also describes the EPA's commitment to future rulemaking that will describe subsequent steps of the Tailoring Rule for GHG permitting (EPA 2010b).

FEDERAL HEAVY-DUTY NATIONAL PROGRAM

In August 2011, the EPA and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) announced the first-ever program to reduce greenhouse gas emissions and improve fuel efficiency of heavy-duty trucks and buses. The EPA and the NHTSA have each adopted complementary standards under their respective authorities covering model years 2014–2018, which together form a comprehensive Heavy-Duty National Program. The goal of the joint rulemakings is to present coordinated federal standards that help manufacturers to build a single fleet of vehicles and engines that are able to comply with both. The EPA and the NHTSA have adopted standards for CO_2 emissions and fuel consumption, respectively, tailored to each of three main regulatory categories: (1) combination tractors; (2) heavy-duty pickup trucks and vans; and (3) vocational vehicles. The EPA has additionally adopted standards to control HFC leakage from air conditioning systems in pickups and vans and combination tractors. Also exclusive to the EPA program are the EPA's N_2O and CH_4 standards that will apply to all heavy-duty engines, pickups, and vans. For purposes of this program, the heavy-duty fleet incorporates all on-road vehicles rated at a gross vehicle weight at or above 8,500 pounds, and the engines that power them, except those covered by the current GHG emissions and Corporate Average Fuel Economy standards for model year 2012–2016 passenger vehicles.

The Heavy-Duty National Program is projected to reduce fuel use and GHG emissions from medium- and heavy-duty vehicles, from semi trucks to the largest pickup trucks and vans, as well as all types and sizes of work trucks and buses in between. Vehicles covered by this program make up the transportation segment's second largest contributor to oil consumption and GHG emissions. This comprehensive program is designed to address the urgent and closely intertwined challenges of dependence on oil, energy security, and global climate change. The EPA and the NHTSA estimate that the combined standards will reduce CO_2 emissions by about 270 million metric tons and save about 530 million barrels of oil over the life of vehicles built for the 2014 to 2018 model years, providing $49 billion in net program benefits. A second phase of regulations is planned for model years beyond 2018. The goals would include spurring innovation as well as updating the assessment of actual emissions and fuel use from this sector. Such future regulation would also be designed to align with similar programs developed outside the United States.

STATE

Executive Order S-3-05

Executive Order S-3-05 proclaims that California is vulnerable to the impacts of climate change. It declares that increased temperatures could reduce the Sierra's snowpack, further exacerbate California's air quality problems, and potentially cause a rise in sea levels. To combat those concerns, the Executive Order established total greenhouse gas emission targets. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80 percent below the 1990 level by 2050.

The Executive Order directed the Secretary of the California Environmental Protection Agency (CalEPA) to coordinate a multi-agency effort to reduce greenhouse gas emissions to the target levels. The Secretary will also submit biannual reports to the governor and state legislature describing (1) progress made toward reaching the emission targets, (2) impacts of global warming on California's resources, and (3) mitigation and adaptation plans to combat these impacts. To comply with the Executive Order, the Secretary of CalEPA created a Climate Action Team (CAT) made up of members from various state agencies and commissions. CAT released its first report in March 2006. The report proposed to achieve the targets by building on voluntary actions of California businesses, local government and community actions, as well as through state incentive and regulatory programs.

Assembly Bill 32, the California Global Warming Solutions Act of 2006

AB 32 (Health and Safety Code Sections 38500, 38501, 28510, 38530, 38550, 38560, 38561–38565, 38570, 38571, 38574, 38580, 38590, 38592–38599) requires that statewide GHG emissions be reduced to 1990 levels by the year 2020. The gases regulated by AB 32 include CO_2, CH_4, N_2O, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The reduction to 1990 levels will be accomplished through an enforceable statewide cap on GHG emissions phased in starting in 2012. To effectively implement the cap, AB 32 directs the California Air Resources Board (CARB) to develop and implement regulations to reduce statewide GHG emissions from stationary sources.

AB 32 requires that CARB adopt a quantified cap on greenhouse gas emissions representing 1990 emissions levels and disclose how it arrives at the cap, institute a schedule to meet the emissions cap, and develop tracking, reporting, and enforcement mechanisms to ensure the state achieves reductions in GHG emissions necessary to meet the cap. AB 32 also includes guidance to institute emissions reductions in an economically efficient manner and conditions to ensure that businesses and consumers are not unfairly affected by the reductions.

AB 32 Scoping Plan

As noted above, on December 11, 2008, CARB adopted the Scoping Plan to achieve the goals of AB 32. The Scoping Plan establishes an overall framework for the measures that will be adopted to reduce California's GHG emissions. CARB determined that achieving the 1990 emission level would require a reduction of GHG emissions of approximately 29 percent below what would otherwise occur in 2020 in the absence of new laws and regulations (referred to as "business as usual"). The Scoping Plan evaluates opportunities for sector-specific reductions, integrates all CARB and Climate Action Team early actions and additional GHG reduction measures by both entities, identifies additional measures to be pursued as regulations, and outlines the role of a cap-and-trade program. Additional development of these measures and adoption of the appropriate regulations will occur through the end of year 2013. The key elements of the Scoping Plan include:

- Expanding and strengthening existing energy efficiency programs as well as building and appliance standards;
- Achieving a statewide renewables energy mix of 33 percent;
- Developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system and caps sources contributing 85 percent of California's GHG emissions;
- Establishing targets for transportation-related GHG emissions for regions throughout California, and pursuing policies and incentives to achieve those targets;
- Adopting and implementing measures pursuant to existing state laws and policies, including California's clean car standards, heavy-duty truck measures, and the Low Carbon Fuel Standard; and
- Creating targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the State of California's long-term commitment to AB 32 implementation (CARB 2008a).

In 2009, a coalition of special interest groups brought a challenge to the Scoping Plan alleging that it violated AB 32 and that the environmental review document (called a "Functional Equivalent Document") violated CEQA by failing to appropriately analyze alternatives to the proposed cap-and-trade program. On May 20, 2011, the San Francisco Superior Court entered a final judgment ordering that CARB take no further action with respect to cap-and-trade rulemaking until it complies with CEQA. While CARB disagrees with the trial court finding and appealed the decision on May 23, 2011, in order to remove any doubt about the matter and in keeping with CARB's interest in public participation and informed decision-making, CARB revisited the alternatives. The revised analysis includes the five alternatives included in the original environmental analysis: a "no project" alternative (that is, taking no action at all); a plan relying on a cap-and-trade program for the sectors included in a cap; a plan relying more on source-specific regulatory requirements with no cap-and-trade component; a plan relying on a carbon fee or tax; and a plan relying on a variety of proposed strategies and measures. The public hearing to consider approval of the AB 32 Scoping Plan Functional Equivalent Document and the AB 32 Scoping Plan was held on August 24, 2011. On this date, CARB re-approved the Scoping Plan.

In August 2012, CARB released revised estimates of the expected 2020 emissions reductions. The revised analysis relies on emissions projections updated in light of current economic forecasts which account for the economic downturn since 2008 as well as reduction measures already approved and put in place. This reduced the projected 2020 emissions from 596 million metric tons (MMT) CO_2e to 545 MMTCO_2e. The reduction in projected 2020 emissions means that the revised business-as-usual (BAU) reduction necessary to achieve AB 32's goal of reaching 1990 levels by 2020 is now only 21 percent.

2013 Draft Climate Change Scoping Plan – First Update

As required by AB 32 legislation, CARB is required not only to prepare a scoping plan but also update the scoping plan at least once every five years (Health and Safety Code Section 38561(h)). In October 2013, a draft of the 2013 Update to the Climate Change Scoping Plan was publicly released. The 2013 update focuses on answering three key questions related to progress toward achieving the GHG reduction goals of AB 32:

a. How have GHG emissions changed since the passage of AB 32 and implementation of early action items?

b. What actions must continue to meet the prescribed course of action to 2020?

c. What steps must be taken in the coming years to continue cutting emissions and growing the economy to meet long-term climate goals?

It is anticipated that CARB will formally adopt the updated AB 32 Scoping Plan in early 2014.

Senate Bill 375

Senate Bill (SB) 375 (codified at Government Code Sections 65080, 65400, 65583, 65584.01, 65584.01, 65584.04, 65584.04, 65587, 65588, 14522.1, 14522.2, 65080.01 and Public Resources Code Sections 21061.3, 21159.28, and Chapter 4.2), signed in September 2008, aligns regional transportation planning efforts, regional GHG reduction targets, and land use and housing allocation. SB 375 requires metropolitan planning organizations (MPOs) to adopt a Sustainable Communities Strategy (SCS) or Alternative Planning Strategy (APS), which will prescribe land use allocation in that MPO's Regional Transportation Plan (RTP). CARB, in consultation with MPOs, will provide each affected region with reduction targets for GHGs emitted by passenger cars and light trucks in the region for the years 2020 and 2035. These reduction targets will be updated every eight years, but can be updated every four years if advancements in emissions technologies affect the reduction strategies to achieve the targets. CARB is also charged with reviewing each MPO's SCS or APS for consistency with its assigned targets. If MPOs do not meet the GHG reduction targets, transportation projects would not be eligible for funding programmed after January 1, 2012.

LOCAL

Mojave Desert Air Quality Management District

The Mojave Desert Air Quality Management District (MDAQMD) is the air quality regulating authority with jurisdiction over the desert portion of San Bernardino County, known as the Mojave Desert Air Basin (MDAB). The MDAB includes a portion of Kern County, Los Angeles County, Riverside County, and San Bernardino County. The project site is located within the MDAB; therefore, the MDAQMD retains air quality–related regulatory authority over the proposed project.

In August 2011, the MDAQMD revised the air district's CEQA and federal conformity guidelines, which provide background information and guidance on the district's preferred analysis approach. The revisions established significant emissions thresholds for greenhouse gases of 100,000 tons per year or 548,000 pounds per day.

South Coast Air Quality Management District

To provide guidance to local lead agencies on determining significance for greenhouse gas emissions in CEQA documents, South Coast Air Management District (SCAQMD) staff is convening an ongoing GHG CEQA Significance Threshold Working Group. Members of the working group include government agencies implementing CEQA and representatives from various stakeholder groups that provide input to the SCAQMD staff on developing the significance thresholds. On October 8, 2008, the SCAQMD released the Draft AQMD Staff CEQA GHG Significance Thresholds. These thresholds have not been finalized and continue to be developed through the working group.

On September 28, 2010, SCAQMD Working Group Meeting #15 considered use of the 6.6 metric tons per service population metric as a threshold for plan-level analysis, though it has not adopted any thresholds for the land use sector to date. Thus, it is only a concept that has been discussed at the staff level and is not a SCAQMD recommendation at this time. Furthermore, the SCAQMD's staff concept (as indicated in the September 28, 2010, working group presentation) is that the service population metric is only employed for significance determination after considering whether a CEQA plan or project is consistent with a climate action plan.

As of SCAQMD staff's meeting on September 28, 2010, the draft tiered threshold provides the following guidance:

- **Tier 1:** Is the project exempt from CEQA? If yes, the project is not significant and no further analysis is required.
- **Tier 2:** Is the project consistent with an approved regional climate action plan? If yes, the project is not significant and no further analysis is required.
- **Tier 3:** Would the project result in emissions below the screening level criteria? If yes, the project is not significant and no further analysis is required.
  - Propose 10,000 metric tons (MT) per year CO_2e industrial project threshold for use by all lead agencies
  - Propose 3,000 MT per year CO_2e for all residential and commercial land use types
  - Threshold value by land use type acceptable if used consistently
  - Residential: 3,500 MT/year CO_2e
  - Commercial: 1,400 MT/year CO_2e
  - Mixed use: 3,000 MT/year CO_2e
  - Both options based on review of the Office of Planning Research (OPR) database (711 CEQA projects) using the 90 percent capture rate approach
- **Tier 4**: Would the project comply with certain performance-based standards? If yes, the project is not significant and no further analysis is required.
  - Option #1: Percent Emission Reduction Target
    - No recommendation at this time
  - Option #2: Early Implementation of Applicable AB 32 Scoping Plan Measures
    - Incorporated in Option #3
  - Option #3: SCAQMD Efficiency Target
    - 2020 Targets – 4.8 MT/year CO_2e per service population (SP) for project-level threshold (land use employment only)
    - 2035 Targets – 3.0 MT/year CO_2e per SP for project-level threshold

The SCAQMD has not announced when staff is expecting to present a finalized version of these thresholds to the Governing Board. The SCAQMD has also adopted Rules 2700, 2701, and 2702 that address GHG reductions; however, these rules are currently applicable only to boilers and process heaters, forestry, and manure management projects.

San Bernardino County Greenhouse Gas Reduction Plan

In September 2011, San Bernardino County adopted a Greenhouse Gas Reduction Plan and amended the General Plan to include a policy addressing the County's intention to reduce GHG emissions that are reasonably attributable to (1) the County's internal activities, services, and facilities; and (2) private industry and development that is located within the area subject to the County's land use and building permit authority.

Additionally, the GHG reduction plan included a Development Code Amendment (GHG Plan Appendix F) to ensure the development review process and procedures to provide certainty in how projects should evaluate GHG emissions and determine significance for CEQA purposes are streamlined by (1) applying a uniform set of performance standards to all development projects, and (2) utilizing Screening Tables to mitigate project GHG emissions. The development review process was designed to streamline project analysis related to GHG emissions analysis and ensure the elements of the GHG reduction plan are appropriately implemented, when applicable to certain project types and land uses. The applicable portions of the development review process are described below.

a. County Performance Standards. All development projects, including those otherwise determined to be exempt from CEQA, are subject to applicable Development Code provisions, including the GHG performance standards, and state requirements, such as the California Building Code requirements for energy efficiency. With the application of the GHG performance standards, projects that are exempt from CEQA and small projects that do not exceed 3,000 $MTCO_2e$ per year are considered to be consistent with the plan and determined to have a less than significant individual and cumulative impact for GHG emissions.

b. Regulatory Agency Performance Standards. When, and if, the South Coast Air Quality Management District or Mojave Basin Air Quality Management District adopts standards, the County will consider such guidance and incorporate all applicable standards.

c. Projects Using Screening Table. For projects exceeding 3,000 $MTCO_2e$ per year of GHG emissions, the County uses Screening Tables as a tool to assist with calculating GHG reduction measures and the determination of a significance finding. Projects that garner 100 or greater points would not require quantification of project-specific GHG emissions. The point system was devised to ensure project compliance with the reduction measures in the GHG Plan such that the GHG emissions from new development, when considered together with those of existing development, allow the County to meet its 2020 target and support reductions in GHG emissions beyond 2020. Consistent with the CEQA Guidelines, such projects are consistent with the plan and therefore have a less than significant individual and cumulative impact for GHG emissions.

d. Projects Not Using Screening Tables. Projects exceeding 3,000 $MTCO_2e$ of GHG emissions that do not use the Screening Tables are required to quantify project-specific GHG emissions and achieve the equivalent level of GHG emissions efficiency as a 100-point project. Consistent with the CEQA Guidelines, such projects are consistent with the plan and therefore are determined to have a less than significant individual and cumulative impact for GHG emissions.

3.6.3 IMPACTS AND MITIGATION MEASURES

To meet the GHG emission targets of AB 32, California would need to generate less GHG emissions in the future than current levels. It is recognized, however, that for most projects there is no simple metric available to determine if a single project would substantially increase or decrease overall GHG emission levels or conflict with the goals of AB 32. Moreover, emitting CO_2 into the atmosphere is not itself an adverse environmental effect. It is the increased concentration of GHG emissions in the atmosphere resulting in global climate change and the associated consequences of climate change that results in adverse environmental effects (e.g., sea level rise, loss of snowpack, severe weather events). Although it is possible to generally estimate a project's incremental contribution of GHGs into the atmosphere, it is typically not possible to determine whether or how an individual project's relatively small incremental contribution might translate into physical effects on the environment. Given the complex interactions between various global and regional-scale physical, chemical, atmospheric, terrestrial, and aquatic systems that result in the physical expressions of global climate change, it is impossible to discern whether the presence or absence of GHGs emitted by the project would result in any altered conditions.

However, the State of California has established GHG reduction targets and has determined that GHG emissions as they relate to global climate change are a source of adverse environmental impacts in California that should be addressed under CEQA. Although AB 32 did not amend CEQA, it identifies the myriad environmental problems in California caused by global warming (Health and Safety Code Section 38501[a]). In response to the relative lack of guidance on addressing GHGs and climate change, SB 97 was passed in order to amend CEQA by directing the Office of Planning and Research to prepare revisions to the State CEQA Guidelines addressing the mitigation of GHGs or their consequences.

STANDARDS OF SIGNIFICANCE

The impact analysis provided below is based on the application of the following State CEQA Guidelines Appendix G thresholds of significance:

1) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment.

2) Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

In its Final Statement of Reasons for Regulatory Action accompanying the CEQA Amendments (FSOR), the California Natural Resources Agency (CNRA) (2009) explains that quantification of GHG emissions "is reasonably necessary to ensure an adequate analysis of GHG emissions using available data and tools" and that "quantification will, in many cases, assist in the determination of significance." However, as explained in the FSOR, the revised Section 15064.4(b) assigns lead agencies the discretion to determine the methodology to quantify GHG emissions. The FSOR also notes that CEQA case law has long stated that "there is no iron-clad definition of 'significance.' Accordingly, lead agencies must use their best efforts to investigate and disclose all that they reasonably can, concerning a project's potential adverse impacts."

Thresholds of significance illustrate the extent of an impact and are a basis from which to apply mitigation measures. Through the development of the San Bernardino County Greenhouse Gas Reduction Plan, and associated amendments to the development review process, significance thresholds for GHG emissions resulting from land use development projects have been

established in San Bernardino County. Determining thresholds of significance for a project's climate change impacts poses a special difficulty for lead agencies. Much of the science in this area is new and is evolving constantly. At the same time, neither the state nor local agencies are specialized in this area, nor are there currently any specific regional or state thresholds that have been adopted based on substantial evidence to determine whether the proposed project has a significant impact on climate change. The CEQA Guidelines do not prescribe specific significance thresholds but instead leave considerable discretion to lead agencies to develop appropriate thresholds to apply to projects within their jurisdiction.

As noted earlier, AB 32 is a legal mandate requiring that statewide GHG emissions be reduced to 1990 levels by 2020. In adopting AB 32, the legislature determined the necessary GHG reductions for the state to make in order to sufficiently offset its contribution to the cumulative climate change problem to reach 1990 levels. AB 32 is the only legally mandated requirement for the reduction of greenhouse gases. As such, compliance with AB 32 is the adopted basis on which the agency can base its significance threshold for evaluating the project's GHG impacts.

Because the County's Greenhouse Gas Reduction Plan and associated thresholds were prepared for the purpose of complying with the requirements of AB 32, and are based on substantial evidence, as detailed in the GHG Reduction Plan, the 3,000 $MTCO_2e$ per year threshold is used as the significance threshold concerning project generation of GHG emissions for this project. Additionally, the GHG Reduction Plan threshold is also the most restrictive of the three screening criteria (proposed as 100,000 tons per year by the MDAQMD or 10,000 $MTCO_2e$ by the SCAQMD). Therefore, should the project meet the thresholds identified by the GHG Reduction Plan, it would meet all three screening criteria thresholds. The project would be considered to contribute substantially to a cumulative impact and the impact would be considered significant if the projected emissions would surpass 3,000 $MTCO_2e$ annually.

In terms of project conformance with an applicable plan to reduce GHG emissions, the project is compared specifically to San Bernardino County's Greenhouse Gas Reduction Plan. The plan was designed to be consistent with the San Bernardino County General Plan and further implement the strategies of AB 32, the AB 32 Scoping Plan, SB 375, and the Southern California Association of Governments' Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS).

This DEIR assesses the proposed project's potential to result in a significant GHG impact by determining its consistency with the applicable thresholds of significance and comparison to the applicable GHG-reducing strategies of San Bernardino County's Greenhouse Gas Reduction Plan. By determining that the proposed project is consistent with the GHG reduction plan, it can be determined that the project is also consistent with the state-level plans, policies, and regulations adopted as a result of AB 32 and SB 375 for the purposes of reducing GHG emissions.

METHODOLOGY

The GHG emissions of the proposed project were calculated by Sespe Consulting, Inc., and independently reviewed by Urban Crossroads, Inc., and PMC. **EIR Appendix C** contains the detailed analysis, including assumptions and results. Both the baseline and proposed project GHG emissions were calculated using methods and parameters from the Mineral Industry Emissions Inventory Guidance, AP-42, EMFAC2011, OFFROAD2011, and the California Emissions

Estimator Model (CalEEMod), version 2011.1.1.[1] CalEEMod is a statewide land use emissions computer model designed to provide a uniform platform for the use of government agencies, land use planners, and environmental professionals. This model is the most current emissions model approved for use in California by various air districts.

PROJECT IMPACTS AND MITIGATION MEASURES

Generate Greenhouse Gas Emissions, Either Directly or Indirectly, That May Have a Significant Impact on the Environment (Standard of Significance 1)

Impact 3.6.1 Implementation of the proposed project would result in an incremental increase of 1,893 $MTCO_2e$ per year. Thus, the proposed project would neither directly or indirectly generate more than 3,000 $MTCO_2e$ per year and would result in a **less than cumulatively considerable** impact relating to GHG emissions.

GHG emissions are generated both on- and off-site through the use of diesel generators and vehicles or equipment used in the excavation, crushing, or transportation process. **EIR Appendix C** provides a full analysis of the GHG emissions generated by type of equipment and estimated annual use for both the baseline and proposed project conditions.

The baseline conditions report estimates that the Sentinel-Butterfield Quarry transports 378,217 tons per year to the Lucerne Valley processing plant and the White Knob Quarry transports 275,418 tons per year, for a total of 653,635 tons per year transported to the processing plant. The processing plant is physically limited to processing 680,000 tons per year. The proposed project would allow the processing plant maximum capacity to be excavated exclusively from the White Knob Quarry, which would result in all quarry operations at the Sentinel-Butterfield Quarry to cease. With the overall proposed change in operations, this analysis incorporates both the increased operations at White Knob as well as the decreased operations at Sentinel-Butterfield.

Baseline operations at the White Knob and Sentinel-Butterfield Quarries generate an estimated 20,725 $MTCO_2e$ per year. As a worst case scenario, should all ore sent to the processing plant come from the White Knob Quarry, a maximum of 680,000 tons per year as this is the limit of ore that is permitted to be processed at the Omya processing plant, the White Knob Quarry emissions would increase by 9,435 $MTCO_2e$/yr. However, if the maximum capacity of the processing plant is met exclusively from the White Knob Quarry, operations at the Sentinel-Butterfield quarry would cease and would result in reduced emissions of 7,542 $MTCO_2e$ per year. The proposed project therefore would result in a maximum increase of 1,893 $MTCO_2e$ per year (see **Table 3.6-3**).

[1] While the project is limited to expanding the White Knob/White Ridge Quarries areas, overall combined production from all quarries is limited by the processing plant maximum production rate. The project would allow up to the maximum production rate to be extracted exclusively from the White Knob and White Ridge Quarries. This would result in no material being quarried at the Butterfield and Sentinel Quarries, which is an indirect effect of the project that necessitates calculation of Butterfield and Sentinel Quarries emissions in the baseline.

TABLE 3.6-3
BASELINE AND PROJECT EMISSIONS ($MTCO_2E$ PER YEAR)

Emissions Source	Ore Hauled to Plant (tons per year)	Emissions ($MTCO_2e$/yr)
Baseline (White Knob)	275,418	13,183
Baseline (Butterfield-Sentinel)	378,217	7,542
Baseline (White Knob + Butterfield-Sentinel)	653,635	20,725
White Knob Project Emissions (Proposed Project)	680,000	+9,435
Sentinel-Butterfield Reduced Emissions from ceased operations	0	-7,542
Total Change	**26,365**	**1,893**

Source: EIR Appendix C, Sespe 2013

Mitigation Measures

None required.

Conflict with an Applicable Plan, Policy, or Regulation Adopted for the Purpose of Reducing the Emissions of Greenhouse Gases (Standard of Significance 2)

Impact 3.6.2 Implementation of the proposed project is consistent with San Bernardino County's Greenhouse Gas Reduction Plan, the county's applicable plan adopted for the purpose of reducing the emissions of greenhouse gases. This impact is **less than cumulatively considerable.**

As previously mentioned, the County's Greenhouse Gas Reduction Plan identifies a path for achieving consistency with the AB 32 GHG reduction goals, through the reduction of baseline emissions by 15 percent by 2020 (to 5,296,034 $MTCO_2e$ for external emissions and to 256,712 $MTCO_2e$ for internal emissions).

The plan describes the reduction strategies currently being employed by the County, as well as those that will be employed by the County, through implementation of the GHG Plan, and by the State, through a variety of legislation and regulations. The combination of existing reduction strategies and proposed new strategies identified in the reduction plan will be assembled into an integrated plan to reduce the countywide GHG emissions level. In addition, proposed new private developments will also contribute to GHG emissions reduction through the County's GHG development review process, AB 32 requirements, and other state initiatives.

The GHG emissions reduction measures identified in the Greenhouse Gas Reduction Plan include existing and proposed state, regional, county, and other local measures that would reduce GHG emissions from the county in both the internal and external categories. Reduction measures have been organized into a classification system that recognizes both the origin of the measures, i.e., state, regional, or local, and also whether the measure is quantifiable in terms of calculating a volume of emission reduction. The emissions reduction measures are organized as follows for each sector:

- Reduction Class 1 (R1) includes adopted, implemented, and proposed state and regional measures that do not require additional County action and that will result in GHG reductions for the County's land use authority area and internal operations. These measures may require County action to achieve the GHG reductions, but that action is limited and compulsory.

- Reduction Class 2 (R2) includes measures currently implemented or in the process of implementation by the County, as well as any additional quantifiable measures that require County action and will further reduce the GHG emissions for the County's land use authority area and internal operations. R2 also includes any state and regional measures that require substantial action by the County to achieve the expected GHG reductions. These measures are specific, quantifiable measures as well as reductions achieved through the development review process.

  Measurable reductions of GHG emissions will be achieved through the County's development review process by applying appropriate reduction requirements as part of the discretionary approval of new development projects. Through the development review process, the County will implement CEQA, requiring new development projects to quantify project GHG emissions and adopt feasible mitigation to reduce project emissions below a level of significance. The CEQA process for evaluating GHG impacts and determining significance will be streamlined as follows:

  a. County Performance Standards. All development projects, including those otherwise determined to be exempt from CEQA, are subject to applicable Development Code provisions, including the GHG performance standards, and state requirements, such as the California Building Code requirements for energy efficiency. With the application of the GHG performance standards, projects that are exempt from CEQA and small projects that do not exceed 3,000 $MTCO_2e$ per year are considered to be consistent with the plan and determined to have a less than significant individual and cumulative impact for GHG emissions.

  b. Regulatory Agency Performance Standards. When, and if, the South Coast Air Quality Management District or Mojave Basin Air Quality Management District adopts standards, the County will consider such guidance and incorporate all applicable standards.

  c. Projects Using Screening Table. For projects exceeding 3,000 $MTCO_2e$ per year of GHG emissions, the County uses Screening Tables as a tool to assist with calculating GHG reduction measures and the determination of a significance finding. Projects that garner 100 or greater points would not require quantification of project-specific GHG emissions. The point system was devised to ensure project compliance with the reduction measures in the GHG Plan such that the GHG emissions from new development, when considered together with those of existing development, allow the County to meet its 2020 target and support reductions in GHG emissions beyond 2020. Consistent with the CEQA Guidelines, such projects are consistent with the plan and therefore have a less than significant individual and cumulative impact for GHG emissions.

d. Projects Not Using Screening Tables. Projects exceeding 3,000 $MTCO_2e$ of GHG emissions that do not use the Screening Tables are required to quantify project-specific GHG emissions and achieve the equivalent level of GHG emissions efficiency as a 100-point project. Consistent with the CEQA Guidelines, such projects are consistent with the plan and therefore are determined to have a less than significant individual and cumulative impact for GHG emissions.

- Reduction Class 3 (R3) includes additional measures that were not used to demonstrate achievement of the proposed County's 2020 GHG emissions reduction target. For these measures, emissions reductions have either not been quantified due to a lack of available data or protocols required for quantification or because of uncertainty regarding the County's jurisdictional control over relevant emissions sources. Some of these measures are quantifiable but require additional refinement and are therefore not included in R1 or R2.

As noted in the Greenhouse Gas Reduction Plan's discussion of Reduction Class 2 (R2), by meeting San Bernardino County's "applicable Development Code provisions including the GHG performance standards, and state requirements, such as the California Building Code requirements for energy efficiency," projects that are exempt from CEQA and small projects that do not exceed 3,000 $MTCO_2e$ per year are considered to be consistent with the plan and determined to have a **less than cumulatively considerable** impact for GHG emissions. The proposed project will not exceed 3,000 $MTCO_2e$ per year and is therefore consistent with the applicable plans and policies adopted for the purpose for reducing GHG emissions.

Mitigation Measures

None required.

This section discusses the existing environmental and regulatory setting of the project hydrology and water quality, identifies potential impacts related to implementation of the project, and proposes mitigation measures for those impacts determined to be significant. Setting information in this section was compiled from the Reclamation Plan Amendment (RPA) (Omya California 2013), technical reports prepared in support of the RPA (**EIR Appendix G**, Stantec 2013), and peer reviews of those reports, geographic information system (GIS) data, and resource agency websites and databases.

The County published a Notice of Preparation and Initial Study (NOP/IS) for the proposed project on June 12, 2013. A copy of the NOP/IS, along with comments received during the public review period, is contained in **EIR Appendix A**. The Office of Mine Reclamation (OMR) submitted comments regarding drainage. OMR's comments were considered in the preparation of the analysis.

3.7.1 EXISTING SETTING

REGIONAL CLIMATE AND PRECIPITATION

The White Knob/White Ridge Limestone Quarries lie on the northeast side of the White Mountains, which form a portion of the northern San Bernardino Mountains, approximately 6 miles southwest of Lucerne Valley. Elevations within the White Knob area range between 4,980 and 7,146 feet above mean sea level (amsl). Annual precipitation for the Lucerne Valley area typically ranges between 5 and 10 inches per year (NWS 2006), while in the mountains adjacent to the project it ranges from 10 to 21 inches, as shown in **Figure 3.7-1**. Precipitation typically occurs in the form of periodic heavy showers, but the area experiences heavy winter snowfall at times along the top of the White Mountains. Historic temperature extremes for Lucerne Valley range between 0˚F in the winter and 114˚ F in the summer, with an annual average temperature of 60.7˚F. Climate normals from 1981 to 2010 for the project are shown in **Table 3.7-1**.

TABLE 3.7-1
WHITE KNOB/WHITE RIDGE LIMESTONE QUARRIES CLIMATE DATA – 1980–2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Tmax,ºF	51.35	52.07	56.98	65.03	74.25	82.80	88.03	87.10	81.00	71.19	58.44	51.30	68.29
Tmin, ºF	30.58	30.70	33.21	36.45	41.83	49.48	56.07	56.52	52.03	42.66	35.69	30.65	41.32
Prec, in.	2.53	2.55	1.88	0.58	0.16	0.09	0.44	0.40	0.47	0.53	0.96	1.62	12.20

Source: WRCC 2006

SURFACE WATER HYDROLOGY AND DRAINAGE

On-site surface water flow occurs in response to precipitation only (ephemeral flow), flowing northeastward from the crest of the White Mountains downward through the White Knob/White Ridge Quarries area into the nearby Rabbit (dry) Lake-Lucerne Valley depression. No springs or perennial streams occur within the White Knob/White Ridge Limestone Quarries area (USGS 1971a, 1971b, 1996a, 1996b). Several watersheds drain surface water away from or through the White Knob Quarry area, as shown in **Figures 3.7-2** and **3.7-3**. Drainage at higher elevations occurs mainly by steep, deeply incised drainages that have been eroded into the bedrock to be replaced by gentler, relatively shallow drainages that have been eroded into the alluvium at lower elevations. Local springs are discussed later in this chapter.

Flooding

The Federal Emergency Management Agency (FEMA) is responsible for mapping areas subject to flooding during a 100-year flood event (i.e., a flood event that has a 1 percent chance of occurring in a given year). FEMA flood hazard mapping has not been done for the project area based on a search of the FEMA Map Service Center for FEMA panels (06071C7275H, 06071C7280H, 06071C6575H, and 06071C6550H) that cover the project site. The potential for flooding and associated hazards was evaluated by Stantec (2011) for the quarry area and the haul road, both on- and off-site.

Hydrologic calculations were performed in accordance with the latest version of the County of San Bernardino Hydrology Manual (1986, 2010). Since all drainages studied are smaller than 640 acres in size, the rational method was used for all calculations. CivilDesign engineering software (Version 7.0; 2007) was utilized for the project hydrology analyses. The runoff coefficient is based on soil types, type of ground cover, and the Antecedent Moisture Condition (AMC). Soil types for this study were obtained from the U.S. Department of Agriculture Natural Resources Conservation Service's (2013) Web Soil Survey. Soil types used in the drainage calculations include Type B, C, and D (the dominant soil types used were Type B and D).[1] The land use for the study area is undeveloped with no appreciable impervious areas. The only disturbed areas in the drainages are the quarry and the haul road. For areas above the quarry, the ground cover was assumed to be average, while the ground cover in the quarry and downstream of the quarry was assumed to be poor. Based on the recommendations in the San Bernardino County Hydrology Manual, AMC II was used for 2-year, 10-year, and 25-year calculations, and AMC III was used for the 100-year calculation.

Local rainfall intensity was obtained from the National Oceanic and Atmospheric Administration's (2013) Precipitation Frequency Data Server Atlas 14. A point near the centroid of the drainage area was selected, and one-hour rainfall rates for return frequencies ranging from 2 to 100 years were obtained (see **Table 3.7-2**). Rainfall intensities for other time periods were based on the slope of the intensity duration graph from the County of San Bernardino Hydrology Manual (1986, 2010). For desert and mountain areas in the county, a moderate correlation coefficient value of 0.7 is used for the slope of this graph. Two different locations were selected for rainfall intensities, one for the quarry and Turnout 64 drainages, and another for the four smaller culverts east of Turnout 64.

[1] The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

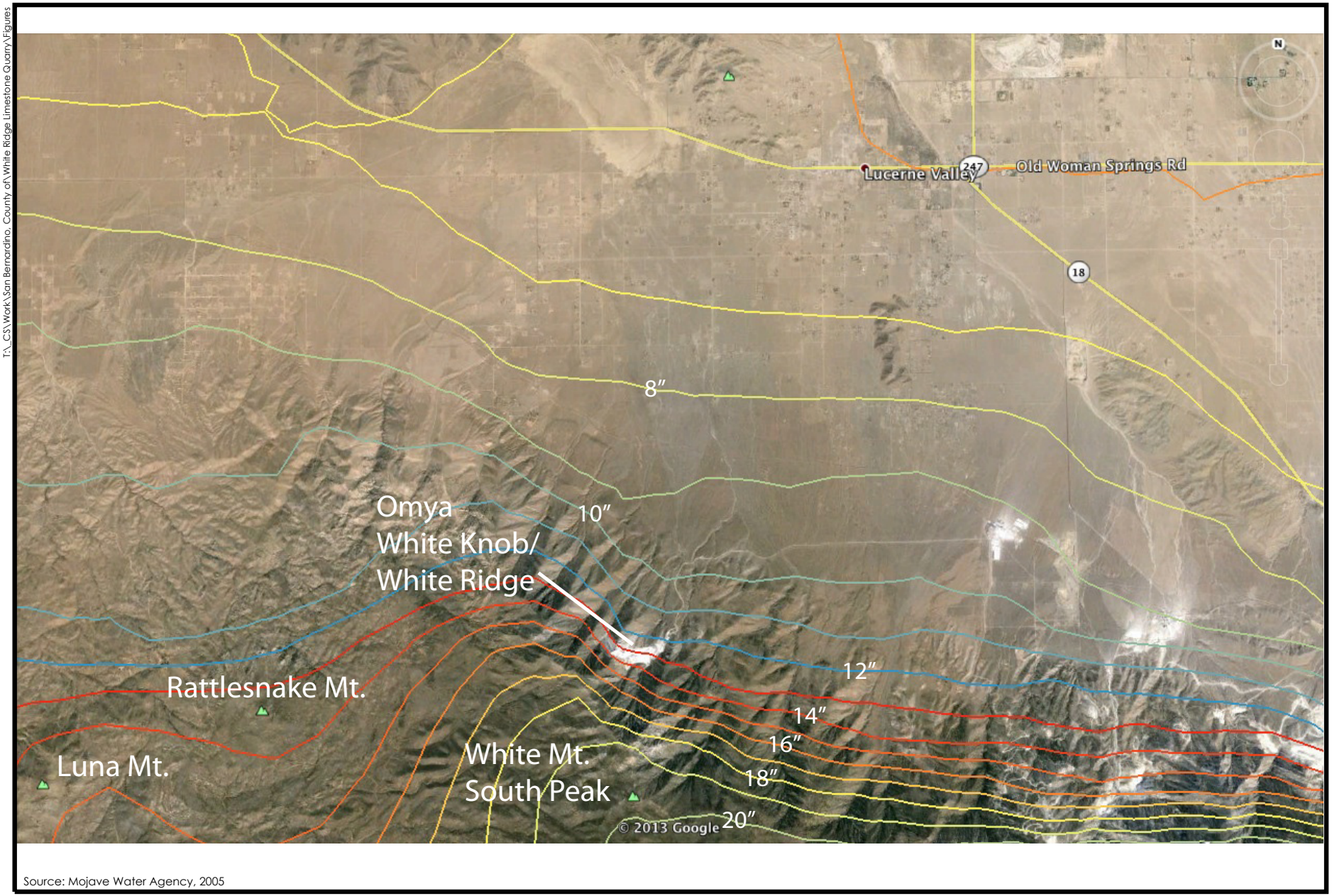
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

T:_CS\Work\San Bernardino, County of\White Ridge Limestone Quarry\Figures



Source: Mojave Water Agency, 2005

0 1.5 3
MILES

N

Figure 3.7-1
PRIZM Precipitation Contours 1980 -2010
for White Knob/White Ridge Quarries

PMC®

T:_CS\Work\San Bernardino County of\White Ridge Limestone Quarry\Figures

TURNOUT 64

EXPLOSIVES STORAGE FACILITY

QUARRY

PLANT SITE

HAUL ROAD

Culvert 1
Culvert 2
Culvert 3
Culvert 4
Culvert 5
Culvert 6
Culvert 7
Culvert 8
Culvert 9
Culvert 10
Culvert 11
Culvert 12
Culvert 13
Culvert 14

SAN BERNARDINO NATIONAL FOREST

LEGEND

DRAINAGE AREA BOUNDARY

HAUL ROAD

CULVERTS

Source: Stantec Consulting Inc.

1,250 0 2,500 5,000

MILES

N

Figure 3.7-2

Drainage Area Boundary Map

PMC

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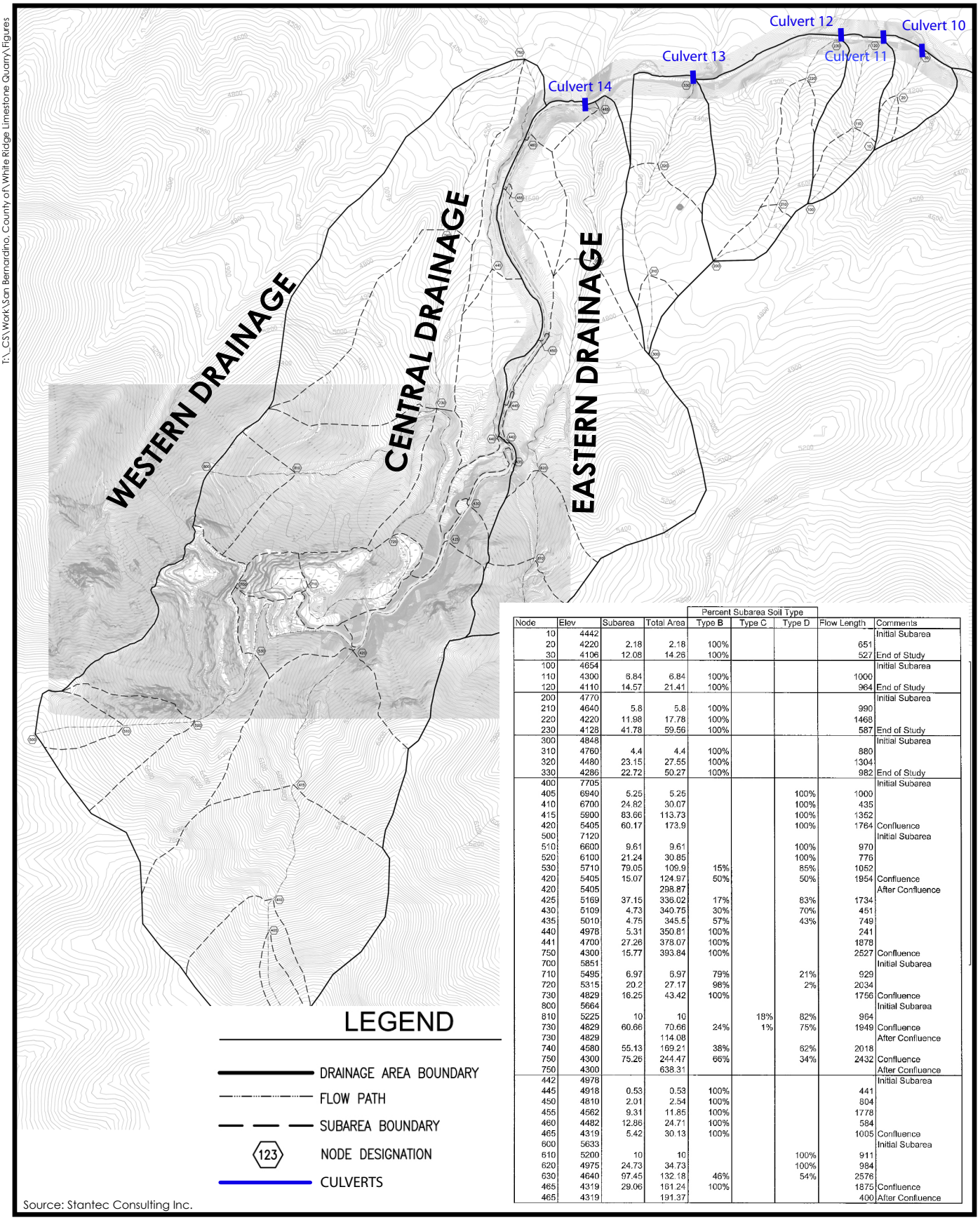

				Percent Subarea Soil Type				
Node	Elev	Subarea	Total Area	Type B	Type C	Type D	Flow Length	Comments
10	4442							Initial Subarea
20	4220	2.18	2.18	100%			651	
30	4106	12.08	14.26	100%			527	End of Study
100	4654							Initial Subarea
110	4300	6.84	6.84	100%			1000	
120	4110	14.57	21.41	100%			964	End of Study
200	4770							Initial Subarea
210	4640	5.8	5.8	100%			990	
220	4220	11.98	17.78	100%			1468	
230	4128	41.78	59.56	100%			587	End of Study
300	4848							Initial Subarea
310	4760	4.4	4.4	100%			880	
320	4480	23.15	27.55	100%			1304	
330	4286	22.72	50.27	100%			982	End of Study
400	7705							Initial Subarea
405	6940	5.25	5.25			100%	1000	
410	6700	24.82	30.07			100%	435	
415	5900	83.66	113.73			100%	1352	
420	5405	60.17	173.9			100%	1764	Confluence
500	7120							Initial Subarea
510	6600	9.61	9.61			100%	970	
520	6100	21.24	30.85			100%	776	
530	5710	79.05	109.9	15%		85%	1052	
420	5405	15.07	124.97	50%		50%	1954	Confluence
420	5405		298.87					After Confluence
425	5169	37.15	336.02	17%		83%	1734	
430	5109	4.73	340.75	30%		70%	451	
435	5010	4.75	345.5	57%		43%	749	
440	4978	5.31	350.81	100%			241	
441	4700	27.26	378.07	100%			1878	
750	4300	15.77	393.84	100%			2527	Confluence
700	5851							Initial Subarea
710	5495	6.97	6.97	79%		21%	929	
720	5315	20.2	27.17	98%		2%	2034	
730	4829	16.25	43.42	100%			1756	Confluence
800	5664							Initial Subarea
810	5225	10	10		18%	82%	964	
730	4829	60.66	70.66	24%	1%	75%	1949	Confluence
730	4829		114.08					After Confluence
740	4580	55.13	169.21	38%		62%	2018	
750	4300	75.26	244.47	66%		34%	2432	Confluence
750	4300		638.31					After Confluence
442	4978							Initial Subarea
445	4918	0.53	0.53	100%			441	
450	4810	2.01	2.54	100%			804	
455	4562	9.31	11.85	100%			1778	
460	4482	12.86	24.71	100%			584	
465	4319	5.42	30.13	100%			1005	Confluence
600	5633							Initial Subarea
610	5200	10	10			100%	911	
620	4975	24.73	34.73			100%	984	
630	4640	97.45	132.18	46%		54%	2576	
465	4319	29.06	161.24	100%			1875	Confluence
465	4319		191.37				400	After Confluence

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Figure 3.7-3
Quarries Drainage Area Boundary Map1

TABLE 3.7-2
ONE-HOUR RAINFALL DEPTH – WHITE KNOB/WHITE RIDGE LIMESTONE QUARRIES

Return Frequency (years)	Quarry and Turnout 64 Drainages[1,2]	Smaller Culvert Drainages[1,2]
2	0.491	0.45
10	0.811	0.745
25	1.03	0.944
100	1.39	1.28

Source: NOAA 2013
1. Rainfall depths are in inches.
2. Figure 3.7-2 shows locations of points where rainfall intensity was calculated; Figure 3.7-3 shows the drainages and nodes for which calculations were made.

Tributary drainage areas were determined from topographical maps of the area. A hydrology map was prepared to show the overall drainage areas, subareas, and nodes. Hydrologic model calculations were made as shown in **Figure 3.7-3. Table 3.7-3** gives the node number, tributary area, and design flows for 2-, 10-, 25-, and 100-year storm events for critical hydrology locations in the project area.

Three main drainages cross the White Knob/White Ridge Limestone Quarries area, while the east–west haul road has 6 Arizona crossings and 14 culverts, as is shown in **Figure 2.0-2**. Stantec analyzed the hydrology for the project and determined the capacities of the existing hydraulic structures, e.g., sedimentation basins, drainage conveyances, and haul road culverts. Stantec concluded that with some minor modification, the existing hydraulic structures were adequate for the predicted 10-year stormwater flow, except Culvert 5. Hydraulic calculations for Culvert 5 suggest that it is undersized, but 24 years of historic performance suggests that it is adequate (see additional discussion below under the subheading Culvert Design and Riprap).

TABLE 3.7-3
CULVERT FLOW CAPACITY – WHITE KNOB/WHITE RIDGE LIMESTONE QUARRIES

Node	Description	Tributary Area (ac)[1]	2-Year Flow (cfs)[2]	10-Year Flow (cfs)[2]	25-Year Flow (cfs)[2]	100-Year Flow (cfs)[2]
30	Culvert 10	14.26	14.8	28.6	37.9	57.1
120	Culvert 11	21.41	17.9	35.8	48.0	73.9
230	Culvert 12	59.56	35.2	76.6	104.8	167.4
330	Culvert 13	50.27	28.9	63.4	86.9	139.2
420	Flow from off-site at southernmost basin	173.90	146.9	283.1	377.3	570.5
420	Flow from quarry road at southernmost basin	124.97	98.3	185.9	246.3	379.1
425	Flow in haul road	336.02	244.3	471.1	636.9	983.6
440	Flow in haul road near explosive storage	350.81	244.3	471.1	636.9	983.6
445	Flow in haul road just north of explosive storage	0.53	0.7	1.3	1.7	2.4
455	Flow in haul road	11.58	3.2	10.7	16.0	28.4

Node	Description	Tributary Area (ac)[1]	2-Year Flow (cfs)[2]	10-Year Flow (cfs)[2]	25-Year Flow (cfs)[2]	100-Year Flow (cfs)[2]
465	Flow in haul road near culvert 14	30.13	5.5	21.9	34.0	63.2
465	Culvert 14	191.37	128.0	262.8	358.6	559.8
750	Downstream confluence	638.31	399.6	774.9	1046.9	1609.1

Source: EIR Appendix C, Stantec 2013, p. 2.9
1. Ac = acres
2. cfs = cubic feet per second

Quarry Area Runoff

Surface water flowing from and through the White Knob/White Ridge Limestone Quarries area occurs through three separate drainages (see **Figure 3.7-3**). The western sector of the White Knob Quarry area drains into the Western Drainage and flows downstream through the Ruby Springs area. The eastern portion of the project area initially drains through the Eastern Drainage down to the Turnout 64 area. The central and largest portion of the quarry areas drains through the Central Drainage, which has been partially displaced by overburden stockpile OB-1. The White Knob/White Ridge Quarries area is not located within any recognized floodways or 100-year floodplains, but it is occasionally subject to ephemeral flash flooding. At the end of mining, the three proposed quarries would function as basins collecting runoff from the quarry highwalls and upslope areas. These quarry basins should lessen the potential effects of flash flooding, including reducing the off-site transportation of mining-derived sediments.

Groundwater

The White Knob/White Ridge Limestone Quarries area is located south of the southern border of the Upper Mojave River Valley Groundwater Basin, per California Department of Water Resources Bulletin 118 groundwater basin No. 6-42 (DWR 2004). The majority of this groundwater basin underlies the north–south elongate Mojave River Valley to the west. However, a small southeast portion of this basin extends southeast into Fifteenmile Valley just north of the White Knob/White Ridge Quarries area, which is part of the Mojave River Este Subarea, also named the Rabbit Lake Subwatershed and the Fifteenmile Valley Groundwater Basin (MWA 2005). The Este Subarea is one of the Adjudicated Mojave River subareas managed by the Mojave Water Agency (see **Figure 3.7-4**)**.** Locally, the groundwater basin is bounded on the south by the contact between Quaternary sediment deposits and unconsolidated basement rocks of the San Bernardino Mountains (including the White Mountains), on the southeast by the Helendale fault, and on the north by the unconsolidated basement exposures of the mountains that surround Apple Valley (the Granite Mountains). The Helendale fault forms a hydraulic barrier in this part of the Este Subarea that causes groundwater to flow northwestward under a surface drainage divide into the Mojave River drainage instead of northeastward into Lucerne Lake (dry) in the Lucerne Valley Basin (DWR 2004; MWA 2005) (see **Figure 3.7-5**).

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Helendale Fault

The active Helendale fault zone is a set of en echelon, right-stepping fault strands extending from the vicinity of Cushenbury Canyon in the San Bernardino Mountains northwest towards the southern flank of Kramer Hills [Bowen, 1954; and Morton et al., 1980]. The Helendale fault south of the community of Lucerne Valley is a 31 mile (50 km) zone marked by fault scarps, compressional ridges, and lines of springs [Aksoy, 1986]. Initiation of this fault has been constrained by Dokka and Travis [1990a and 1990b] to lie between ~1.5 to 0.7 Ma. Movement along the Helendale fault is evidenced by 1.2 miles (1.9 km) of displaced Pleistocene (?) aged older alluvial deposits, Mesozoic aged basement rocks, and stream courses since its initiation [Aksoy, 1986]. Additionally, Bouguer gravity field anomaly patterns across the Lucerne Valley groundwater basin correspond to the northwest structural grain of this area. Significant gravity lows along the fault trace suggest a structurally controlled basin filled with sediments, whereas gravity highs in the north and northeast adjacent to the Ord and Fry Mountains indicate a shallow basement covered by alluvial fans [Aksoy, 1986]. The gravity data supports the topographic and geologic data which indicate that there is a separation of groundwater basins between Lucerne Valley and Fifteenmile Valley.

Lenwood Fault & Camp Rock Fault

Both the Lenwood and Camp Rock faults transect the northwest portion of the Este Hydrologic Sub-basin. Characteristic of the Mojave Desert Block region and the Eastern California shear zone (ECSZ), both these faults are northwest-trending, right-lateral strike-slip faults that are late Tertiary to early Quaternary in age. The Lenwood fault extends for about 47 miles (75 km) and is part of the larger Lockhart-Lenwood fault system. The Lenwood segment of the fault intersects the eastern segment of the North Frontal thrust system. The Camp Rock fault has a length of approximately 22 miles (35 km) and is part of the Camp-Emerson-Copper Mountain fault system. According to Dokka and Travis [1990a and 1990b], the total amount of displacement along the Lenwood and Camp Rock faults, since their initiation in the late Cenozoic, has been 0.93 miles and 1.86 miles (1.5 km and 3.0 km), respectively.

Source: Mojave Water Agency

North Frontal Thrust System of the San Bernardino Mountains

The North Frontal thrust system (NFTS) of the San Bernardino Mountains is a 50 mile-long (80 km) thrust system of discontinuous, overlapping scarps and folds in Pleistocene alluvium and older shear zones in bedrock. It spans a 0.6 mile-wide zone (1 km) adjacent to the northern front of the San Bernardino Mountains transecting both the Lucerne Valley and Fifteenmile Valley groundwater basins [Miller, 1987; Bryant, 1986; and Eppes et al., 2002]. These faults are the result of transpressional, right-lateral, strike-slip movement along the San Andreas fault, and subsequently are responsible for the uplift of the Big Bear plateau. The NFTS has been mapped by Dibblee [1964a] to have displaced the Old Woman Sandstone and older fanglomerates, but not younger surficial sediments. The age of the system has been constrained to the late Pleistocene [Spotila and Sieh, 2000].

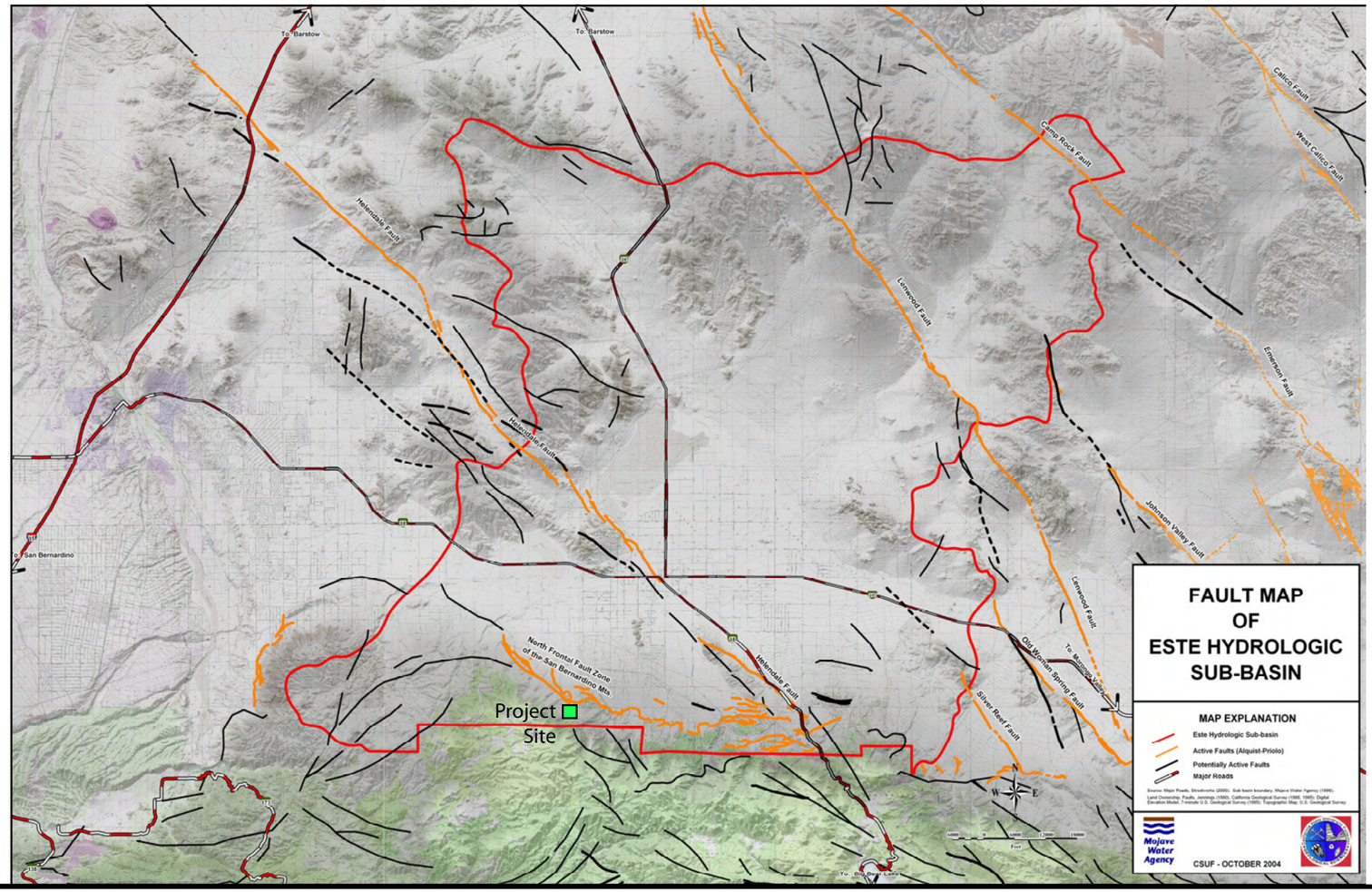

Figure 3.7-4
Fault Map of Este Sub-Basin and White Knob/White Ridge Quarries

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Current Groundwater Occurrence and Movement

The direction of groundwater movement within the Lucerne Valley groundwater basin has historically been from the outer perimeter towards the center of the valley [Goodrich, 1978, Schaefer, 1979; Brose, 1987]. Current groundwater levels (measurements by MWA in November, 2003) in the Lucerne Valley groundwater basin confirm the direction of groundwater flow is radially from the outer perimeter of the basin towards Lucerne (dry) Lake. The groundwater gradient from the northern portion of the basin to the south is 0.0067 ft/ft; from the eastern portion of the basin westward towards the center of basin is 0.0033 ft/ft; and from the southeastern portion of Lucerne Valley groundwater basin to the dry lake area the gradient is 0.0007 ft/ft. Within the Fifteenmile Valley groundwater basin, groundwater flow is towards the Mojave River. The groundwater gradient westward from the Helendale fault is 0.0096 ft/ft.

Groundwater flow patterns have changed little since the first available data in 1916-1917 and are probably similar to those prior to man's influence [Schaefer, 1979]. A review of contour maps for the Este Hydrologic Sub-basin area [DWR, 1967; Brose, 1987; Pirnie, 1990; USGS, 1994, 1996, 1998, 2000, and 2002] confirms this assessment. Within both basins, groundwater occurs primarily within the older alluvial deposits and the Old Woman Sandstone deposits at variable depths and to a limited extent within bedrock fractures. Groundwater elevations range from 2,900 to 2,740 feet (884 to 835 m) (amsl) in the Lucerne Valley groundwater basin and 2,920 to 2,840 feet (890 to 866 m) (amsl) in the Fifteenmile Valley groundwater basin. Depth to groundwater ranges from 100 to 250 feet (30 to 76 m) below ground surface in the central portion of the Lucerne Valley groundwater basin, 20 to 250 feet (6 to 76 m) below ground surface in the Fifteenmile Valley groundwater basin, and approximately 20 feet (6 m) below ground surface near the western side of the Helendale fault.

Source: Mojave Water Agency

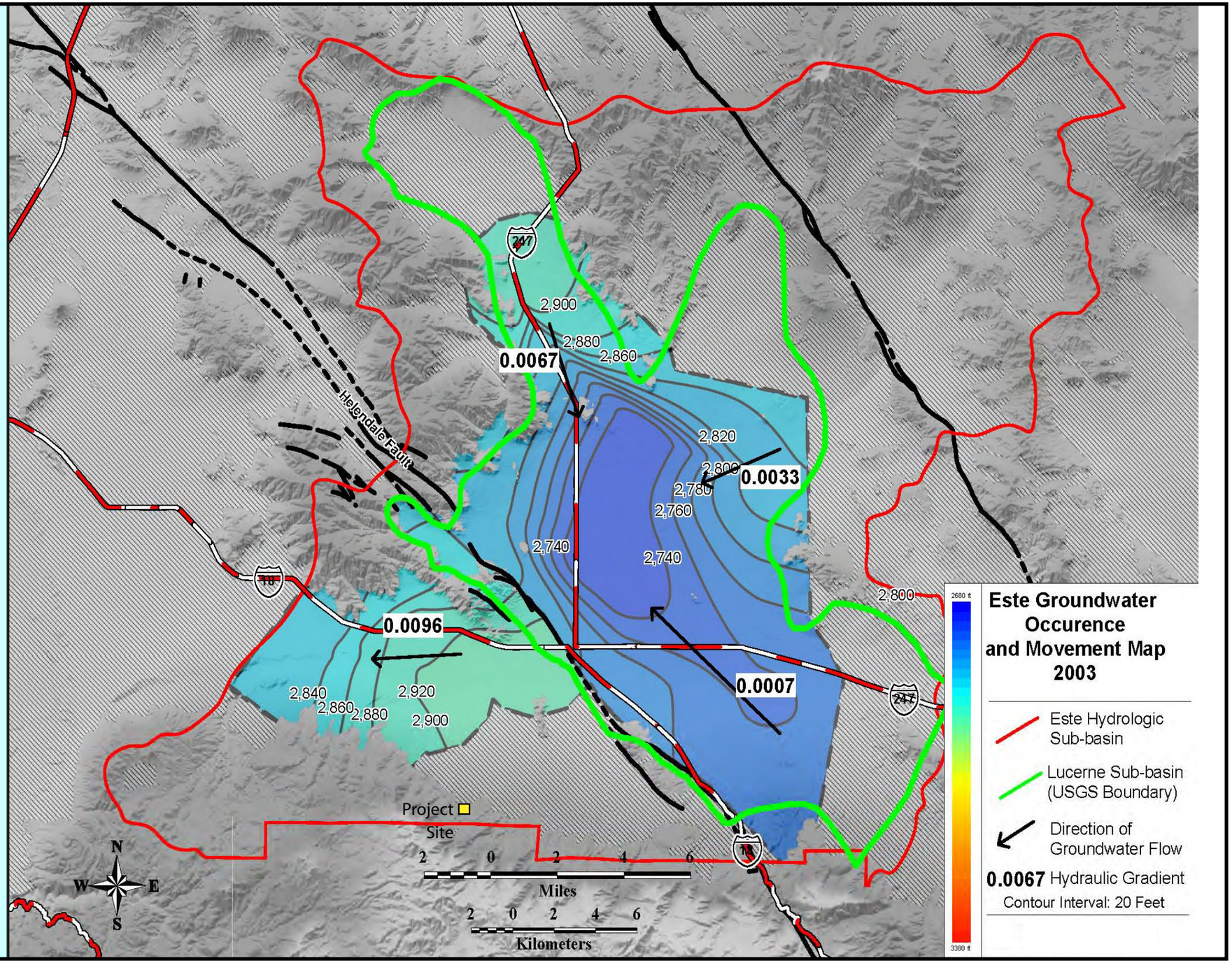

Figure 3.7-5

Este Sub-Basin Groundwater Occurance and Movement Map

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Water-bearing formations of the Fifteenmile Valley Groundwater Basin consist of regional Pliocene and younger alluvial fan deposits (the fan unit), overlain by Pleistocene and younger river channel and floodplain deposits (the floodplain unit) (DWR 2004). Groundwater generally occurs under unconfined conditions. The fan unit typically occurs within 1 mile of the active Mojave River channel, indicating that the basin portion that underlies Fifteenmile Valley comprises the younger floodplain unit. This unit occurs in thicknesses up to 1,000 feet, with permeability decreasing with depth. Specific yields for this unit range between 4 and 25 percent, with an estimated average of 10 percent. It is expected that the specific yield decreases significantly in the vicinity of Rabbit Lake (dry) because of the increase in percentage of silts and clays.

Groundwater within the hard rock that underlies the vicinity of the White Knob/White Ridge Limestone Quarries area is expected to be under fracture-flow conditions (Bulot 2004; DCI 2006a, 2007a, 2007b, 2008). An alignment of several springs extending southeastward from Ruby Springs to Quail Spring (west of Dry Canyon) is part of the North Frontal Fault Zone (CDMG 1966; Morton and Miller 2003) that intercepts groundwater flowing from the higher elevations of the White Mountains toward Rabbit Lake (dry). As the groundwater flows within the faults and joints, it is forced up to the ground surface along this fault system. Surface flow at the springs typically occurs for only short distance and then percolates into the channel sediments or is lost to evapotranspiration.

Springs

Groundwater movement across a fault may be impeded because of one or more of the following conditions: (1) permeable beds set against impermeable beds; (2) the zone consists of gouge (ground rock and clay) that has a very low hydraulic conductivity; and (3) deformation of adjacent beds (MWA 2005). Recharge entering both the Lucerne Valley and Fifteenmile Valley groundwater basins as subsurface flow is primarily derived from the San Bernardino Mountains. The North Frontal Fault Zone that runs along the northern base of the San Bernardino Mountains creates a series of springs where natural barriers such as faults and jointed bedrock force groundwater to the surface at a weak point (see **Figure 3.7-6**).

There are no springs within the White Knob/White Ridge Limestone quarry sites, but there are several adjacent springs. The Ruby Springs area, which includes an "unnamed spring," lies to the northwest along the Western Drainage (DCI 2012). Another unnamed spring occurs east of the Eastern Drainage northeast of the White Ridge Quarry.

Periodic spring discharge measurements were made at the Ruby Springs area from 1932 to 1967 and ranged from 0.25 to 13.9 gallons per minute (gpm) (DCI 2012). Omya began collecting periodic spring discharge and surface water flow distance measurements at Ruby Springs along with precipitation data in 2005 (DCI 2012, Table 3). Omya collected precipitation data from two local residential-use rain gauges, RGS-1 and RGS-2, as shown in **Figure 3.5-17** (DCI 2012). Local precipitation and Ruby Springs discharge data since mid-2007 have been analyzed and graphed, as shown in **Figure 3.7-7** (DCI 2012). The unnamed spring east of the project has no discharge data for comparison.

Ruby Spring's discharge rates measured from October 2005 through June 2012 ranged between approximately 1.10 gpm and 9.5 gpm, with surface flow distances ranging between approximately 432 and 953 feet (DCI 2012). All of the measured discharges from Ruby Springs fall within the 1932 to 1967 historical discharge rates. No historical Ruby Springs surface flow distances prior to October 2005 are available.

Figure 3.7-7 indicates that short-duration cycles of the Ruby Springs discharge rate occur repeatedly and are superimposed onto a long-duration discharge cycle. The short-duration cycles appear to represent the relatively immediate responses of Ruby Springs to Western Drainage storm events that occur in the lower portion of the drainage closer to Ruby Springs (DCI 2012). The short-duration cycles appear to occur during the winter rainy season, with discharge increasing following the onset of precipitation, then decreasing with the cessation of precipitation. These short-duration cycles can also be interpreted as a "base flow" condition where the surface water flow is derived entirely from groundwater discharge with the rate of flow dependent on the amount of groundwater in storage.

The cause of the long-duration cycle appears to be the response of Ruby Springs discharge precipitation occurring in the upper portion of the Western Drainage watershed (DCI 2012). The longer cycle period is likely a function of the cumulative effects of multiyear cycles of wet and dry. Thus, a series of drought years that reduce recharge resulting in a decrease in aquifer storage, regardless of the relative short-term effects of individual rain events in the lower portion of the drainage, will cause the discharge at Ruby Springs to decrease each successive year of the drought. Conversely, a series of wet years will tend to increase aquifer recharge and aquifer storage, causing higher discharge at Ruby Springs with each successive wet year. The long-duration cycle appears to represent the natural fluctuation in Ruby Springs' base-flow discharge. This was demonstrated by the decline in Ruby Springs discharge from approximately 9.5 gpm in May 2007 to approximately 1.1 gpm in December 2009, at the end of a period of drought. Following an increase in precipitation in early 2010, Ruby Springs discharge steadily increased to approximately 4.71 gpm by June 2012.

Ruby Springs surface water flow distances that have been measured since October 2005 (DCI 2012). Surface flow distances measured from October 2005 through September 2011 ranged from approximately 432 and 953 feet. In contrast to spring discharge that recovered with an increase in precipitation, surface flow distances have tended to steadily decrease over the 2008 to 2012 period of monitoring. Surface flow distances ranged from approximately 641 to 654 feet in the 2008–2009 reporting period, approximately 441 to 620 feet in the 2009–2010 reporting period, and approximately 432 to 435 feet in the 2010–2011 rain year.

During the 2011–2012 reporting period, measured surface flow distances ranged between approximately 421 and 442 feet. The decrease in surface flow distances may be the results of apparent increase in re-established vegetation within Reaches +12 through +14 due to an increase in evapotranspiration (see **Figure 3.5-17**).

WATER QUALITY

The term *water quality* is non-specific. That is, the standard applied to the quality of a water source depends on the water use. Thus, varying levels of water quality may be acceptable, depending on whether the water is used for industrial processes, drinking, or irrigation. The most important elements for the economic survival of San Bernardino County are the availability, beneficial use, and conservation of its water (San Bernardino County 2006, p. 6-126).

Groundwater underlying nearby Apple Valley is sodium-chloride in nature, with calcium bicarbonate groundwater located near the San Bernardino Mountains (DWR 2004; MWA 2005). Natural recharge occurs primarily from direct precipitation, ephemeral steam flow, and subsurface flow from the San Bernardino Mountains. Man-made recharge occurs primarily via septic tank effluent discharge and irrigation waters (DWR 2004).

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Structural Groundwater Barriers

Groundwater movement across a fault may be impeded because of one or more of the following conditions:

1. Permeable beds set against impermeable beds;
2. The zone consists of gouge (ground rock and clay) which has a very low hydraulic conductivity; and
3. Deformation of adjacent beds

Helendale Fault

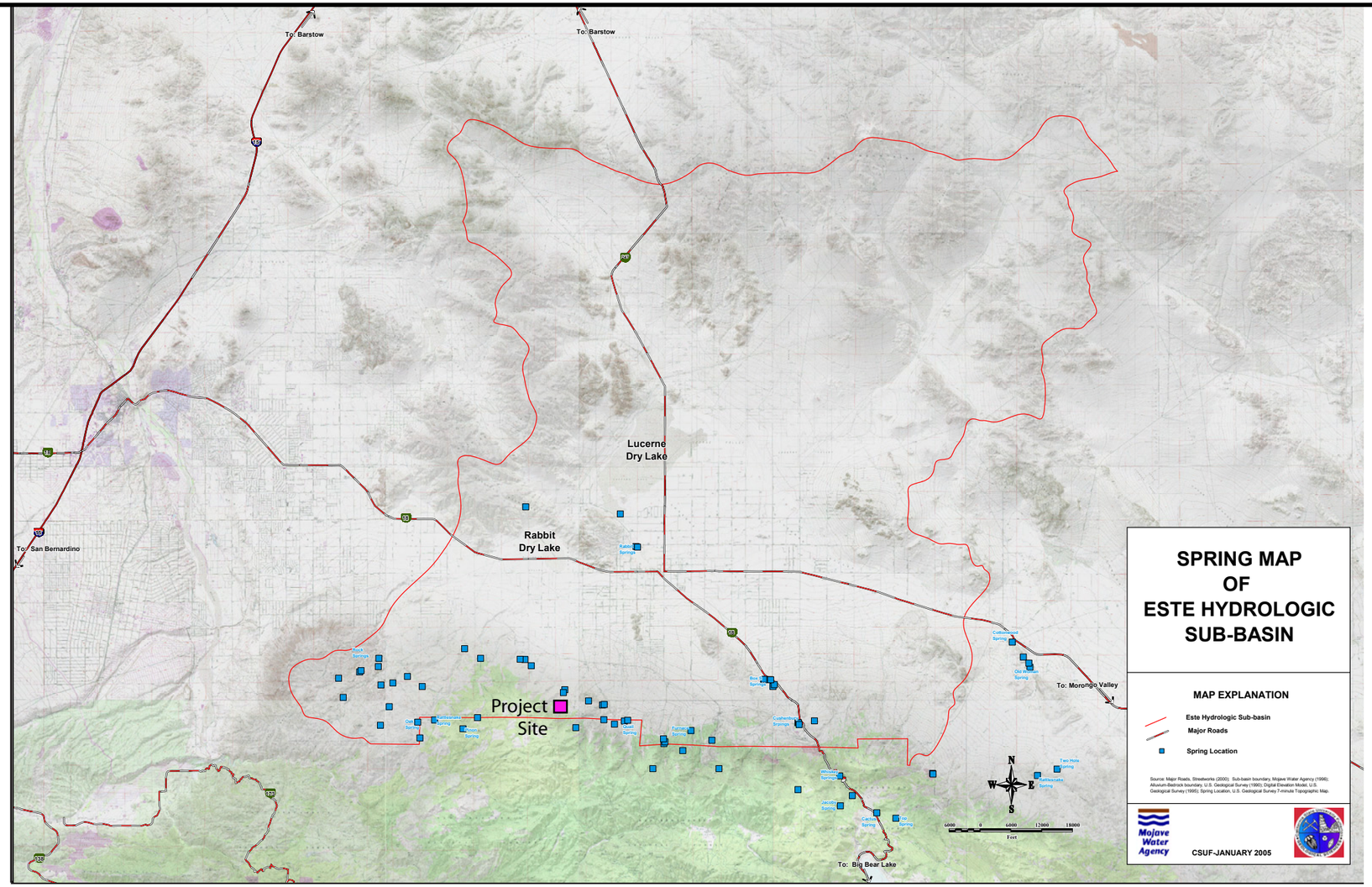
The Helendale fault, which divides the Lucerne Valley and Fifteenmile Valley groundwater basins impedes groundwater flow [Goodrich, 1978; Schaefer, 1979; Brose, 1987; Stamos et al., 2001, and current data from MWA]. The figure on the previous page clearly shows the Helendale fault acting as a hydrologic barrier to groundwater flow. Water level differences across the Helendale fault range from 20 to 250 feet below ground surface (6 to 76 m) [DWR, 1967; Goodrich, 1978; Schaefer, 1979; Brose 1987; USGS, 1994, 1996, 1998, 2000, and 2002; and current data from MWA]. Because of the boundary nature of the Helendale fault, and the direction of groundwater movement in both basins, as well as the impact of well production, groundwater levels are typically higher in the Fifteenmile Valley groundwater basin. The question of whether or not groundwater is leaking across the Helendale fault from the Fifteenmile Valley groundwater basin into the Lucerne Valley groundwater basin is still under investigation.

Lenwood & Camp Rock Fault

Just north of the study area, the Lockhart-Lenwood fault system impedes groundwater flow in older alluvium and the Camp Rock-Emerson-Copper Mountain segment affects the subsurface flow within the Middle Mojave River Basin [Brose, 1987; and Stamos et al., 2001]. Both these faults have been reported by [Brose, 1987; and Stamos et al., 2001] to impede groundwater flow outside of the Lucerne Valley groundwater basin, thus separating the Este Hydrologic Sub-basin from Morongo Hydrologic Sub-basin (Johnson Valley) to the northeast.

Old Woman Springs Fault

Just east of the Este Hydrologic Sub-basin, the Old Woman Springs fault zone has disrupted the basins, developing gouge zones in the alluvium and older rock, which act as impediments to groundwater flow [Bechtel Corporation, 1992]. Between the north and south branch of the Old Woman Springs fault the direction of groundwater is generally to the northwest Once it passes the north branch of the fault, groundwater movement shifts to the northeast where it flows towards the Morongo Hydrologic Sub-basin (Johnson Valley) and not the Este Hydrologic Sub-basin [Geoscience Support Service Inc., 1992].



North Frontal Thrust System Faults

Recharge entering both Lucerne Valley and Fifteenmile Valley groundwater basins as subsurface flow is primarily derived from the San Bernardino Mountains. Along the San Bernardino Mountains, the NFTS is marked by a series of springs where natural barriers such as faults and jointed bedrock force groundwater to the surface at a weak point. These are evident on the map above.

Source: Mojave Water Agency

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Figure 3.7-6
Springs Map of Este Sub-Basin and White Knob/White Ridge Quarries

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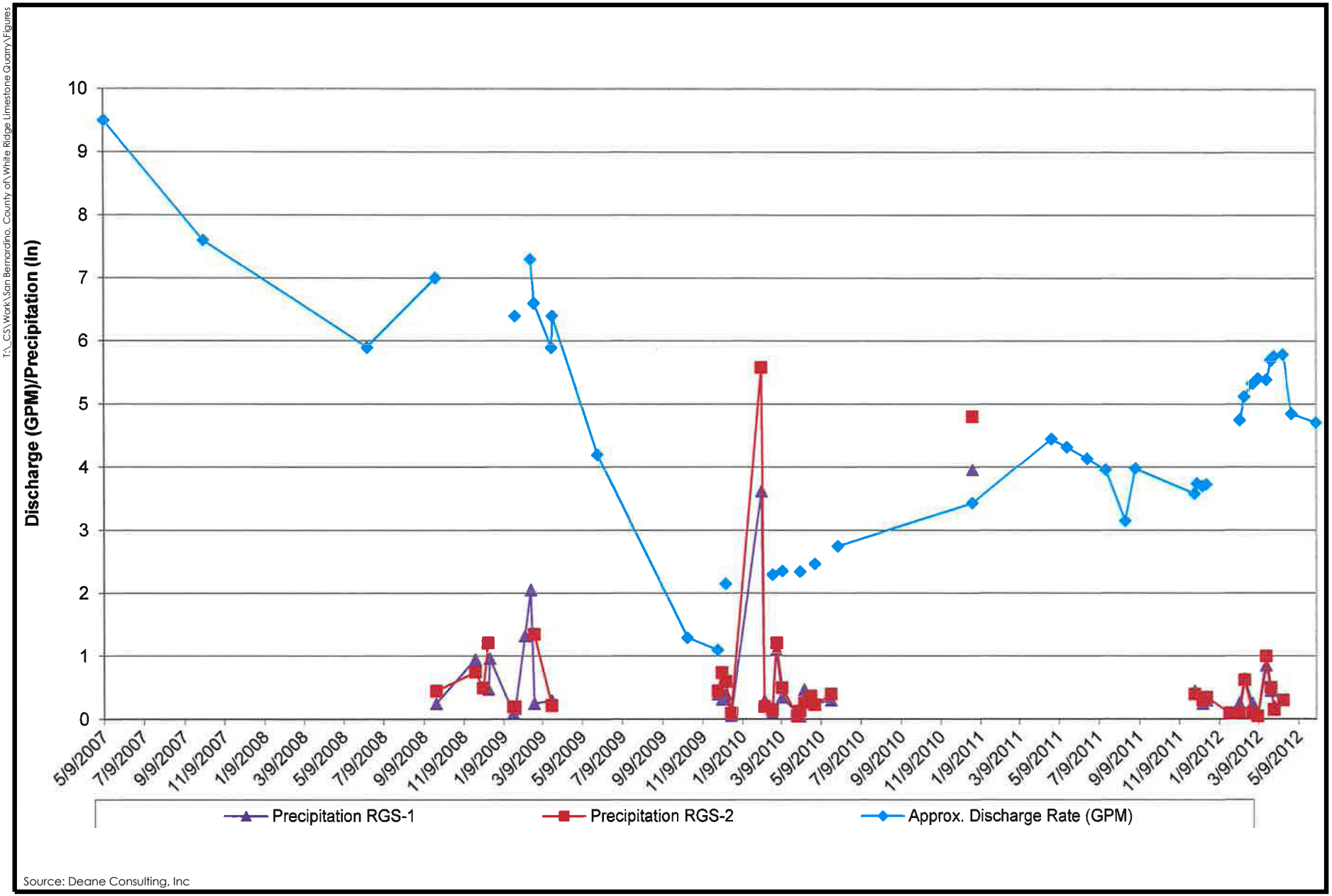

Source: Deane Consulting, Inc

Figure 3.7-7

Western Drainage Precipitation and Ruby Springs Discharge

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Surface water quality at the White Knob/White Ridge Limestone Quarries area is generally related to storm flow because there are no perennial streams, other than those that flow for a short duration from a spring source. The White Knob Quarry currently has an Industrial Storm Water Pollution Prevention Plan (SWPPP) (Stantec 2008) under the State Water Resources Control Board's (SWRCB) Water Quality Order No. 97-03-DWQ and National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS000001, Waste Discharge Identification (WDID) 736I000880.

The project's SWPPP has been approved by the SWRCB and will continue until mining ceases. The plan includes specific prohibitions, effluent limitations, stormwater pollution prevention plans, including source identification, practices to reduce pollutants, assessment of pollutant sources, materials inventory, preventive maintenance program, spill prevention and response procedures, general stormwater management practices, training, record keeping, sampling procedures, and monitoring program.

All operations on-site comply with the NPDES General Permit for Storm Water Discharges associated with industrial activities and employ stormwater best management practices (BMPs) during construction and mining operations, and temporary cessation of mining operations. NPDES goals are to eliminate unauthorized non-stormwater discharges and to monitor stormwater discharge requirements.

WATER AVAILABILITY AND USE

The project site is not in the service area of a public water supplier, but it is within the boundaries of the Mojave Water Agency (MWA). The MWA is a State Water Project contractor, a regional groundwater management agency, and serves as Watermaster for the adjudicated Mojave Basin. The MWA published its Nineteenth Annual Report for the 2011–12 Water Year on May 1, 2013. The report summarizes information required by the adjudication judgment and includes a summary of the Watermaster's activities and water supply conditions for the water year. [2]

Water used to control dust is obtained from two previously permitted sources: a well located at the plant site in Lucerne Valley and a well located in Crystal Creek Canyon near Turnout 5 on the Crystal Creek haul road. These water sources will be used to meet water demands of the proposed operations. No substantial changes in overall water use are proposed. Both existing wells are permitted by the State Water Resources Control Board and the County of San Bernardino Department of Environmental Health Services (Permit #06259026) (see Appendix C2 of the Amended Reclamation Plan). The plant well has been assigned recordation number 36011 by the SWRCB. Bottled drinking water for employees at the mining area is brought to the site as necessary. No surface water is used in the operation.

The White Knob/White Ridge Limestone Quarries utilize a relatively small amount of groundwater during operations. Approximately 2.75 acre-feet of water are used annually for dust suppression in the quarries, overburden placement areas, haul/access roads, and at the crusher.

[2] Subsequent to completion of the WSA in June 2013 and after the NOP/IS was released for public review in June 2013, the MWA published its Twentieth Annual Report of the Mojave Basin for Water Year 2012-2013, dated May 1, 2014 (MWA 2014). The Twentieth Annual Report presents the most current available information about conditions in the Este Subarea as of the publication date of this EIR. A review of the data in the Twentieth Annual Report indicates similar conditions to those in the Nineteenth Annual Report for the Este Subarea, including Omya's water use, and no substantial differences were identified.

Under the Mojave River adjudication, Omya has a verified base annual production allocation of 23 acre-feet per year for its two wells (MWA 2013). Water usage over the past six years (2007 through 2012) has been 19, 14, 14, 14, 14, and 14 acre-feet per year, respectively (MWA 2013). Approximately 2.75 acre-feet of this annual water is used for dust suppression at the White Knob/White Ridge Quarries site.

WATER POLLUTION CONTROL AND STORMWATER MANAGEMENT

For stormwater discharges associated with industrial activities, the SWRCB has adopted the Industrial Storm Water General Permit, SWRCB Order 97-03-DWQ, NPDES General Permit No. CAS000001 (General Industrial Permit). This permit regulates discharges associated with 10 broad categories of industrial activities, including hard rock and aggregate mining. Existing operations at the project site, as well as those activities proposed as part of the project, are and will be regulated under the General Industrial Permit (or an equivalent or more specific individual NPDES permit, as determined by the SWRCB). The General Industrial Permit serves to cover the operational life of an industrial activity. It requires the implementation of management measures that will achieve the performance standard of best available technology (BAT) economically achievable and best conventional pollutant control technology (BCT) in order to reduce or eliminate stormwater pollutants associated with industrial activity.

The General Industrial Permit also requires the development of a SWPPP and a monitoring and reporting program. In the SWPPP, sources of pollutants are to be identified and the means to manage these sources to reduce stormwater pollution are to be described (e.g., best management practices [BMPs]). The General Industrial Permit also requires that an annual report be submitted by July 1 of each year. The Omya White Knob Quarry currently has a General Industrial Permit for Storm Water that was approved in March 1992. Omya prepares and submits annual stormwater discharge reports, which contain the results of sampling and/or other runoff monitoring that occur during any given year. These records and the requirements included in the federal Clean Water Act ensure that water quality is maintained. See Appendix J of the 2013 Amended Reclamation Plan for the cover sheet of Omya's current SWPPP (Stantec 2008).

California adopted the Aboveground Petroleum Storage Act (APSA) in 1990 (California Health and Safety Code Sections 25270–25270.13), which implemented the requirements of the Federal APSA, Code of Federal Regulations, Title 40, Chapter I, Subchapter D, Part 112 (commencing with Section 112.1) (40 CFR 112). In January 2008, amendments to the California APSA gave the Certified Unified Program Agencies (CUPAs) the responsibility and authority to implement the APSA program.

The APSA requires facilities storing a combined volume of petroleum products equal to or greater than 1,320 gallons in one or more aboveground tanks or containers to file a storage statement with the local CUPA and prepare a spill prevention, control, and countermeasures plan (SPCC). The plan must identify appropriate spill containment measures and equipment for preventing and containing spills, as well as discuss facility-specific requirements for the storage system, inspections, recordkeeping, security, and personnel training. All petroleum base materials that are used or stored at the project, including motor oil (new and used), diesel fuel, hydraulic fluids, and lubrication oil, are covered under the SPCC. Fuels contained in tanks on mobile equipment and vehicles do not count toward the cumulative APSA storage volume, but a spill from these tanks and vehicles would be controlled using measures provided in the SPCC.

The existing SWPPP and SPCC for Omya's Lucerne Valley operations would continue to cover industrial activities at the White Knob/White Ridge Quarries until mining ceases. The SWPPP will be updated to account for the modification of stormwater control and conveyance features contemplated in the proposed 2013 Amended Reclamation Plan. The SWPPP will be updated, if

necessary, to address the provisions of the amendment to the General Industrial Storm Water Permit currently being processed by the State Water Resources Control Board.

Erosion and Sedimentation Control

Omya has been working with San Bernardino County, the Bureau of Land Management (BLM), the California Department of Fish and Wildlife, the California Department of Conservation, Office of Mine Reclamation (OMR), and consultants to design and implement drainage control improvements along roads and other mine facilities (EIR Appendix G, Stantec 2011). Existing erosion and sedimentation controls are inspected by both Omya California and government agency personnel, and are maintained as necessary. The objective of all drainage control measures is to limit runoff to minimize or prevent erosion and to promote settling of suspended solids before the runoff leaves the site.

The April 20, 2011, Settlement Agreement with the BLM includes as Part B a section entitled "Repair, Remediate, and Monitor Improvements to the White Knob Quarry Right-of-Way Access Road and Associated Facilities to Protect Drainages." Stantec (2011) prepared the *White Knob Quarry Haul Road Drainage Report and Plan of Development* (Plan of Development) to analyze the existing drainage conditions at the quarry and along the haul road, and to provide recommendations for facilities to control stormwater and sediment runoff and provide protection to surrounding drainages.

Sediment and Debris Production Calculations

Sediment and debris production calculations for the White Knob/White Ridge Limestone Quarries utilize the methods outlined in the Los Angeles County, Department of Public Works *Sedimentation Manual*, 2nd Edition (Los Angeles County 2006; EIR Appendix G, Stantec 2011). This method determines the debris production for a Design Debris Event, which is defined as the quantity of sediment produced by a saturated watershed significantly recovered from a burn (after four years) as a result of a 50-year, 24-hour rainfall amount. The project site is located on the north-facing slope of the San Bernardino Mountains above the Lucerne Valley. For purposes of debris production analysis, this area is assumed to be similar to the north-facing slope of the San Gabriel Mountains above the Antelope Valley.

The manual calculates the potential debris volume using different Debris Production Area (DPA) zones. For the project, the Valyermo and Mescal Creek quadrangle maps in Appendix A of the *Sedimentation Manual* were used. The upper slope areas of these maps are in DPA Zones 3 and 5, while the lower elevations are in DPA Zones 8 and 9. The delineation between upper slopes and lower elevations varies from elevation 4,500 to 5,000 feet amsl.

Based on field observations and comments from Omya quarry staff, the undisturbed land surrounding the quarry and haul road has relatively light debris production. Because of this, undisturbed areas were assumed to be in DPA Zone 9, while disturbed areas (quarry and haul road) were be assumed to be in DPA Zone 5.

There are eight existing debris basins along the haul road from the quarry site to the drainage near Turnout 64. According to quarry staff, the upper four basins, from the quarry to the area near the explosives storage facility (see **Figures 3.7-2** and **2.0-2**), routinely fill up with sediment and debris, fail, and allow debris to flow down to the next basin. These upper four basins do not have overflow spillways, which seems to be the primary cause of these failures. The four basins between the explosives storage facility and Turnout 64 have spillway structures and have not experienced failure.

For these reasons, the debris production calculations were performed for two major areas: (1) the entire area tributary to the two basins near the explosives storage facility, and (2) the area between these two basins and Turnout 64. The location of the explosives storage facility is also a logical breaking point in the study because at this point the drainage can easily leave the roadway and return to its natural drainage course (EIR Appendix G, Stantec 2011).

- The drainage tributary to the basins near the explosives storage facility is 350.81 acres, of which 25.40 acres are disturbed (a portion of the quarry and the haul road). Using the above assumptions for debris production areas, this drainage area can be expected to produce 7,729 cubic yards of debris and sediment (3,254 cubic yards from the disturbed area and 4,475 from the undisturbed area).

- The drainage tributary to the haul road from the explosives storage facility to Turnout 64 is 30.13 acres, of which 3.62 acres are disturbed. Debris production from this area is expected to be 1,147 cubic yards of debris and sediment (464 cubic yards from the disturbed area and 683 from the undisturbed area).

On-Site Haul Road

The on-site haul road within the quarry area from the crusher area to the northeast corner of the project site east of overburden stockpile #1 (OB-1) carries stormwater from the southern quarry areas northward. The area where the haul road is located does not have the width to design a separate drainage channel. The 2011 Stantec study determined that the required 4-foot berms on each side (or a hillside slope or eventually the side slope of OB-1), as required for truck safety per the Mine Safety and Health Administration (MSHA), are adequate to contain the 10-year design flow and the 100-year flow within the roadway with over 2 feet of freeboard. The proposed haul road improvements would be graded with a 2 percent cross fall and berm openings for the sediment catchment basins. Omya is aware that roadway damage may occur during heavy storms, but has adequate on-site equipment and aggregate materials to quickly make repairs.

Quarries

Existing and future mining activities will create and/or deepen the pit floors at each of the three quarries, White Knob, Annex, and White Ridge. Stormwater runoff from slopes, highwalls, benches, roads, and ramps along with any sediment will be directed into the mined-out portion of the quarry or into sediment sumps located down the haul roads in the vicinity of OB-1. In the Annex and White Ridge Quarries, the final floor elevation would be lower than the exit roadways, thereby creating infiltration ponds that would be approximately 75 to 95 feet deep, which should be adequate to contain a 20-year/1-hour precipitation event. Therefore, much of the rainfall in these quarries would infiltrate rather than run off, and sediment would be trapped.

Sediment Catchment Basins

There are currently eight sediment catchment basins from the quarry site to Turnout 64: Sediment Basins 1, 3, 4, and 5 along the haul road, two just downstream outside of the quarry area (Basins 6 and 7), and Basins 8 and 9 farther down the haul road near Turnout 64 (**Figure 2.0-2**). The sediment debris production calculations determined that the four quarry area basins have a volume of 3,280 cubic yards, which is less than half of the 7,729 cubic yards of sedimentation predicted from the design 50-year, 24-hour rain event (**EIR Appendix G**, Stantec 2011). Improvements to these four basins and the construction of an additional basin, proposed Basin 2, would increase the pond volume to 8,190 cubic yards, which is sufficient to hold the anticipated sedimentation.

Culvert Design and Riprap

The portion of the project access haul road running generally east–west from the Lucerne Valley Processing Plant to approximately Turnout 64 has 14 culverts and 6 Arizona crossings (see **Figure 2.0-2**). The hydraulic design of the culverts was completed in 1987 Morrison-Knudsen Engineers, Inc. The capacities of the existing haul road culverts were checked relative to the predicted 20-year stormwater flow, which are shown in **Table 3.7-4**. The capacities of the existing haul road culverts were checked relative to the predicted 10-year and 20-year stormwater flows (see Section 2.4 in Stantec 2011 and Section 2.3 in Stantec 2013 and **Table 3.7-4**). All culverts had adequate capacity for a 10-year storm, with the exception of the 36-inch corrugated metal pipe at haul road station 54+35, Culvert 5. Analysis for a 20-year storm event (**EIR Appendix G**, Stantec 2013) found that 8 of the 14 culverts would be overtopped (**Table 3.7-4**). However, capacities of 5 of the 8 culverts are near the 20-year flow. Because of the difficult nature of predicting flows in an alluvial fan and the fact that these culverts have been in place for 26 years without reported problems, Stantec concluded that the culverts are adequately sized.

The lower haul road culverts appear to have been provided with outlet riprap protection in accordance with the 1987 Morrison-Knudsen plans. Although Stantec didn't have the original specifications for the riprap, both the thickness called out and their field observations indicate it is equivalent to a California Department of Transportation (Caltrans) Light Class riprap gradation. The 2011 Stantec report concluded that with the exception of the culverts at Stations 154+20 (Culvert 12), 170+50 (Culvert 13), and 182+00 (Culvert 14), the riprap size provided in the 1987 Morrison-Knudsen plans is adequate. The 2013 Stantec report in Section 2.4 concluded that protection for the 20-year flow requires riprap size greater than what they recommended in their 2011 report for the three culverts at Stations 19+00 (Culvert 2), 54+35 (Culvert 5), and 182+00 (Culvert 14) (see **Table 3.7-5**).

TABLE 3.7-4
CULVERT HYDRAULICS

Culvert No.[1]	Station	CMP Culvert Size (in)[2]	20-Year Flow (cfs)[3]	Headwater Depth (ft)[4]	Outlet Velocity (fps)[5]	Overtopping?
1	17+70	24	25	4.40	8.74	Yes
2	19+00	48	112	5.30	15.37	Yes
3	43+50	24	25	4.48	8.53	No
4	49+35	36	62	5.81	13.48	Yes
5	54+35	36	62	3.33	11.48	Yes
6	57+75	48	112	6.48	10.39	Yes
7	62+30	24	25	4.33	9.33	Yes
8	88+15	24	25	4.52	10.92	No
9	90+00	24	25	4.16	10.40	Yes
10	144+70	36	35	3.34	15.84	No
11	150+40	36	44	3.99	15.16	No
12	154+20	36	95	8.02	20.16	Yes
13	170+50	36	79	8.34	18.98	No
14	182+00	84	326	8.54	27.85	No

Source: EIR Appendix G, Stantec 2013
1. Culvert station number given on Morrison-Knudsen Engineers 1987 plans for haul road; culvert number corresponds to Figure 2.0-2.
2. in = inches in diameter
3. cfs = cubic feet per second
4. ft = feet
5. fps = feet per second

To check the adequacy of the culvert outlet protection, Stantec utilized the methods outlined in Section 10.2 of the Federal Highway Administration's (2006) Hydraulic Engineering Circular 14, Third Edition. This method sizes a riprap apron with the following configuration:

- The required riprap rock size is determined based on the design discharge, culvert diameter, and tail water depth.
- All of the culverts are steep enough to have supercritical flow, so the culvert diameter used in the equation is adjusted based on the normal flow depth in the culvert.
- Once the rock size is determined, the apron dimensions are determined from a table found in Hydraulic Engineering Circular 14.

Calculations for the individual culvert locations are summarized in **Table 3.7-5,** and the calculations are in Appendix G of the 2011 Stantec report and in the September 12, 2013, Stantec technical memorandum[3]. The riprap class and required thickness are based on Caltrans Standard Specifications.

TABLE 3.7-5
CULVERT RIPRAP SIZE AND THICKNESS[1]

Culvert No.	Station	Pipe Size (in)[2]	Apron Class	Apron Length (ft)[3]	Required Riprap D_{50} Size (ft)[3]	Required Riprap D_{50} Weight (lbs)[4]	Specified Riprap Class	Riprap Thickness (ft)[3]
1	17+70	24	3	10	0.80	44.4	Light	2.5
2	19+00	48	4	28	1.57	333.6	¼ Ton	3.3
3	43+50	24	3	10	0.82	48.4	Light	2.5
4	49+35	36	5	21	1.24	166.2	Light	2.5
5	54+35	36	4	21	1.41	243.3	¼ Ton	3.3
6	57+75	48	4	28	1.21	153.3	Light	2.5
7	62+30	24	3	12	0.84	51.2	Light	2.5
8	88+15	24	3	12	0.90	63.1	Light	2.5
9	90+00	24	3	12	0.90	63.8	Light	2.5
10	144+70	36	3	15	0.74	34.4	Light	2.5
11	150+40	36	4	18	0.92	68.3	Light	2.5
12	154+20	36	6	24	2.36	1142.5	1 Ton	5.4
13	170+50	36	6	24	1.78	488.5	¼ Ton	3.3
14	182+00	84	5	56	2.01	702.9	1/2 Ton	4.3

Source: EIR Appendix G, Stantec 2013
1. Riprap, class, size, and thickness based Caltrans standard specifications.
2. in = CMP diameter in inches
3. ft = feet
4. lbs = pounds

[3] The 2011 Stantec report and the 2013 Stantec technical memorandum are included in **EIR Appendix G**.

Incidental Boulder Roll

Boulder rolling and surficial sliding of side-cast overburden material has occurred on the slopes northwest and north of the White Knob Quarry. In the past, the side-casted overburden material on the northwestern slope has been transported downslope during high intensity rainfall events and deposited in the Western Drainage and in the upper portions of the Central Drainage. The Western Drainage eventually drains to Ruby Springs, one of several areas of natural springs that occur along the faulted flank of the San Bernardino Mountains. The impacts on the Western Drainage and Ruby Springs are discussed in greater detail in Section 3.5, Geology and Soils.

All White Knob/White Ridge Limestone Quarries operations comply with the requirements of the Industrial Storm Water General Permit, SWRCB Order 97-03-DWQ, NPDES General Permit No. CAS000001. Activities associated with minimizing impacts from stormwater discharge associated with industrial activities employ stormwater BMPs during construction, operations, and temporary cessation of operations. The procedures implemented in 2003 to minimize incidental boulder rolling are part of the SWPPP best management practices. NPDES goals are to eliminate unauthorized non-stormwater discharges and to monitor stormwater discharge requirements. Omya prepares and submits annual stormwater discharge reports, which contain the results of sampling and or other runoff monitoring that occur during any given year. These records and the requirements included in the federal Clean Water Act ensure that water quality is maintained.

3.7.2 REGULATORY FRAMEWORK

FEDERAL

Clean Water Act

The Clean Water Act (CWA) regulates the water quality of all discharges into waters of the United States, including wetlands and perennial and intermittent stream channels. Section 401, Title 33, Section 1341 of the CWA sets forth water quality certification requirements for "any applicant applying for a federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters."

Section 303(d) of the Clean Water Act requires that all states in the United States identify water bodies that do not meet specified water quality standards and that do not support intended beneficial uses. Identified waters are placed on the Section 303(d) List of Impaired Waters. Once placed on this list, states are required to develop a water quality control plan—called a Total Maximum Daily Load (TMDL)—for each impacted water body and each associated pollutant/stressor. TMDLs are discussed in more detail below.

The CWA contains two strategies for managing water quality: (1) a technology-based approach that envisions requirements to maintain a minimum level of pollutant management using the best available technology; and (2) a water quality–based approach that relies on evaluating the condition of surface waters and setting limitations on the amount of pollution to which the water can be exposed without adversely affecting the beneficial uses of those waters.

National Pollutant Discharge Elimination System

The National Pollutant Discharge Elimination System (NPDES) permits are issued for waste discharges to surface waters pursuant to the federal Clean Water Act and regulations. California is one of the states authorized to issue NPDES permits in lieu of direct regulation by the U.S.

Environmental Protection Agency (EPA). California Water Code Sections 13370–13389 provide the statutory authority for the State Water Resources Control Board and Regional Water Quality Control Boards (RWQCBs) to implement the NPDES permit program. The SWRCB and the nine RWQCBs preserve and enhance the quality of the state's waters through the development of water quality control plans (Basin Plans) and the issuance of waste discharge requirements (WDRs). In California, discharges to surface waters require dual permits—the WDRs (state) and NPDES (federal) that are issued by either the Regional Water Quality Control Boards or the State Water Resources Control Board whenever the discharge occurs in more than one region. The SWRCB has issued two general permits for stormwater dischargers in California, one applying to industrial dischargers, SWRCB Order 97-03-DWQ, NPDES General Permit No. CAS000001, and the other relating to construction activities, SWRCB Order 2012-0006-DWQ (amends 2009-0009-DWQ), CAS000002.

The NPDES was established by the Clean Water Act to regulate municipal and industrial discharges to surface waters of the United States. Each NPDES permit contains limits on allowable concentrations and mass emissions of pollutants contained in the discharge. Sections 401 and 402 of the act contain general requirements regarding NPDES permits. Section 307 of the CWA describes the factors that the EPA must consider in setting effluent limits for priority pollutants. The purpose of the NPDES program is to establish a comprehensive stormwater quality program to manage urban stormwater and minimize pollution of the environment to the maximum extent practicable. The NPDES program consists of (1) characterizing receiving water quality, (2) identifying harmful constituents, (3) targeting potential sources of pollutants, and (4) implementing a comprehensive stormwater management program.

In California water quality law, the Porter-Cologne Water Quality Control Act, California Water Code Section 13000 et seq. (Porter-Cologne Act,) requires each RWQCB to formulate and adopt Basin Plans for all areas in its region, which designate beneficial uses of water and establish water quality objectives to protect those uses. It also requires that a program of implementation be developed that describes how water quality standards will be attained. The Basin Plan provides narrative and numeric water quality objectives and standards to protect the beneficial uses of California's surface water and groundwater. A Basin Plan is used to set effluent limitations implementing the water quality objectives adopted by a RWQCB or the SWRCB, or water quality criteria promulgated by the Environmental Protection Agency. NPDES and WDR permits specify effluent limitations and other provisions that must be achieved to assure compliance with the water quality objectives of the affected receiving waters and protection of the beneficial uses of those waters. The water quality objectives can vary between RWQCBs and basins in one region because of variations in background water quality and beneficial uses.

Individual NPDES Permits

All point source discharges to waters of the United States not covered by a general permit are required to apply for an individual federal NPDES permit. In California, either an RWQCB or the SWRCB, when discharges cross regional boundaries, issues a NPDES permit that also serves as state waste discharge requirements, along with a monitoring and reporting requirements to ensure compliance with the Clean Water Act and the Porter-Cologne Act. The RWQCB will deny or limit a mixing zone and dilution credit as necessary to protect the beneficial use of state waters.

Total Daily Maximum Load

Section 303(d) of the CWA requires that states make a list of waters that are not attaining standards after the technology-based limits are put into place. For waters on this list, states develop Total Maximum Daily Loads. A TMDL must account for all sources of the pollutants that

caused the water to be listed. Federal regulations require that the TMDL, at a minimum, account for contributions from point sources (federally permitted discharges) and contributions from nonpoint sources. The EPA is required to review and approve the list of impaired waters and each TMDL. If the Environmental Protection Agency cannot approve the list or a TMDL, the EPA is required to establish them for the state.

TMDLs are established at the level necessary to implement the applicable water quality standards. A TMDL requires that all sources of pollution and all aspects of a watershed's drainage system be reviewed, not just the pollution coming from discrete conveyances (known as point sources), such as a discharge pipe from a factory or a sewage treatment plant. Point sources are defined in the Clean Water Act, Section 502.

"Nonpoint source" pollution (also called polluted runoff) is the release of pollutants from everything other than point sources. These include landscape-scale sources such as stormwater and agricultural runoff, and dust and air pollution that find their way into water bodies. Nonpoint source pollution is not typically associated with discrete conveyances. Nonpoint sources are not defined by statute, but are considered everything that is not covered under the point source definition.

Although the Clean Water Act does not require the implementation of TMDLs, CWA Sections 303(d) and 303(e) and their implementing regulations require that approved TMDLs be incorporated into Basin Plans. In addition, the EPA regulations (40 CFR 122) require that National Pollutant Discharge Elimination System permits be consistent with any approved TMDL. Federal regulation also requires that implementation plans be developed along with the TMDLs. The SWRCB has interpreted state law, the Porter-Cologne Act, to require that implementation be addressed when Total Maximum Daily Loads are incorporated into Basin Plans.

There are a number of 303(d) listed in San Bernardino County including: Deep Creek, Mojave River, Green valley Lake Creek, Sheep Creek, Holcomb Creek, Big Bear Lake, Searles Lake, Colorado River, as well as, as others (DWR 2010). However, all drainages on the project site do not connect to any listed 303(d) waters.

Federal Flood Insurance Program

Congress passed the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 with the intent to reduce the need for large publicly funded flood control structures and disaster relief by restricting development on floodplains. The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program to provide subsidized flood insurance to communities that comply with FEMA regulations limiting development on floodplains. FEMA issues Flood Insurance Rate Maps (FIRMs) for communities participating in the National Flood Insurance Program. FIRMs delineate flood hazard zones in the community.

STATE

Surface Mining and Reclamation Act (SMARA)

The County of San Bernardino is the SMARA lead agency for the White Knob/White Ridge Limestone Quarries and the CEQA lead agency for this project. SMARA contains a number of provisions addressing geotechnical and slope stability issues (see Section 3.5, Geology and Soils, for further detail) as well as drainage diversion structures, waterways (14 California Code of Regulations (CCR) (14 CCR Section 3706) and stream protection, including surface water and groundwater (14 CCR Section 3710). SMARA also requires that erosion control methods be

designed for the 20-year/1-hour intensity storm event (14 CCR Section 3706(d)) and control erosion and sedimentation (14 CCR Section 3706(c)). The SMARA regulations also require reclamation plans to include performance standards for drainage and erosion to protect water quality, including streams, surface water, and groundwater. These performance standards must ensure compliance with the Clean Water Act, the Porter-Cologne Act, and other legal requirements (14 CCR Sections 3706, 3710(a)).

Porter-Cologne Water Quality Act

The Porter-Cologne Act, California Water Code Section 13000 et seq., is the principal law governing water quality control in California. It establishes a comprehensive program to protect water quality and the beneficial uses of waters of the State. The act applies broadly to all state waters, including surface waters, wetlands, and groundwater; it covers waste discharges to land as well as to surface water and groundwater, and applies to both point and nonpoint sources of pollution. Basin Plans designate beneficial uses of water and establishes water quality objectives to protect those uses. The beneficial use designations and water quality objectives in a Basin Plan, together with the state's anti-degradation policy (SWRCB Resolution No. 68-16), constitute water quality standards for purposes of the federal Clean Water Act.

The Porter-Cologne Act governs the coordination and control of water quality in the state and provides that "all discharges of waste into the waters of the State are privileges, not rights." Furthermore, all dischargers are subject to regulation under the Porter-Cologne Act including both point and nonpoint source dischargers. The SWRCB and RWQCBs have permitting authority in the form of waste discharge requirements (WDRs), waivers of WDRs, and Basin Plan prohibitions to address ongoing and proposed waste discharges. Permits take into consideration the beneficial uses to be protected, the water quality objectives reasonably required for that purpose, other waste discharges, the need to prevent nuisance, and the provisions of California Water Code Section 13241.

With the exception of persons discharging into community sewer systems, any person discharging or proposing to discharge waste that could affect water quality must file a report of waste discharge with the appropriate Regional Water Quality Control Board, unless the RWQCB waives the filing. A report of waste discharge also is required if a discharger proposes a material change in the character, volume, or location of a discharge. The RWQCB must then determine the appropriate action to take, either issuing WDRs to the discharger or conditionally waiving the requirements. WDRs can prohibit the discharge of waste or certain types of waste, either under specific conditions or in specified areas. As an alternative, the RWQCB may prohibit the discharge of waste or certain types of waste in a Basin Plan. A categorical waiver of waste discharge requirements, for instance, could be adopted as a RWQCB Basin Plan amendment. The SWRCB and RWQCBs have broad discretion in how they use the administrative tools provided by the Porter-Cologne Act.

State Water Resources Control Board and Regional Water Quality Control Boards

The State Water Resources Control Board is a statewide agency that has, as one of its responsibilities, the administrative oversight of the nine Regional Water Quality Control Boards (RWQCBs) that together with the SWRCB are responsible for preserving California's water quality. The RWQCBs issue waste discharge permits (WDRs), take enforcement action against violators, and monitor water quality. The SWRCB and the RWQCBs jointly administer most of the federal clean water laws. However, the SWRCB retains oversight responsibility and, like the EPA, may intervene if it determines a project is not in compliance with SWRCB regulations. The SWRCB sets statewide policies and develops regulations for the implementation of water quality control

programs mandated by state and federal water quality statutes and regulations. The RWQCBs develop and implement Basin Plans that consider regional beneficial uses, water quality characteristics, and water quality problems. The water quality regulations vary between RWQCBs even in one region. The SWRCB has sole authority in the administration of California's system of water rights.

In San Bernardino County, regulation of water quality is made even more complex by the fact that watersheds in the county may lie within more than one RWQCB jurisdiction (Santa Ana Region, Lahontan Region, and Colorado River Region), have point and/or nonpoint source pollution, and be affected by multiple pollutants, each with different health implications and necessitating different cleanup strategies (San Bernardino County 2006, p. 6-126).

The Omya White Knob/White Ridge Quarries are in a surface water basin that is overseen by the Colorado River Basin Regional Water Quality Control Board (Colorado River RWQCB). Interestingly, the Fifteenmile Valley groundwater basin to which the project groundwater drains is technically under the jurisdiction of the Colorado River RWQCB, while the direction of groundwater flow is toward the Mojave River, because of the Helendale fault (**Figure 3.7-4**), which is part of the Lahontan Regional Water Quality Control Board.

Department of Water Resources

The Department of Water Resources' major responsibilities include preparing and updating the California Water Plan to guide development and management of the state's water resources, planning, designing, constructing, operating, and maintaining the State Water Resources Development System, regulating dams, providing flood protection, assisting in emergency management to safeguard life and property, educating the public, and serving local water needs by providing technical assistance. In addition, the department cooperates with local agencies on water resources investigations, supports watershed and river restoration programs, encourages water conservation, explores conjunctive use of groundwater and surface water, facilitates voluntary water transfers, and, when needed, operates a state drought water bank.

LOCAL

County of San Bernardino Flood Control District

The San Bernardino County Flood Control District was formed in the aftermath of the disastrous March 1938 floods, which took many lives and caused millions of dollars in property damage. The district exercises control over all main streams in the county; acquires right-of-way for all main channels; and constructs, channels, and has carried out an active program of permanent channel improvements in coordination with the U.S. Army Corps of Engineers. Through the years, the district has been primarily concerned with control of floodwaters in major watercourses and channels under the district's jurisdiction. Due to the vastness of the county, it has been impossible for the district to provide assistance to individual property owners countywide (San Bernardino County 2006, p. IV-85).

San Bernardino Development Code

Division 2, Land Use Zoning Districts and Allowed Land Uses

Chapter 82.14.000 of the Development Code provides for greater public safety, promotes public health, and minimizes public and private economic losses due to flood conditions by establishing regulations for development and construction within flood prone areas. The overlays

described in Chapter 82.14.000 are applied to areas of special flood hazard identified by FEMA or the Federal Insurance Administration. A project proposed in one of these areas is subject to Flood Hazard Development Review. This review ensures that a proposed project complies with the Development Code regarding flood protection measures and requires the submittal of an elevation certificate completed by a land surveyor, engineer, or architect who is authorized by state or local law to certify elevation information. In areas where no regulatory floodway has been designated, no new construction, substantial improvement, or other development (including fill) is permitted in any flood zone areas designated by FEMA, unless it is demonstrated that the cumulative effect of the proposed development when combined with all other existing and anticipated development will not increase the water surface elevation of the base flood more than 1 foot at any point in the community.

Division 5, Permit Application and Review Procedures

Chapter 85.07.000 of the Development Code provides a process for Flood Hazard Development Review. Section 85.11.030 (Soil Erosion Pollution Prevention and Inspection Required) of Chapter 85.11.000 (Preconstruction Flood Hazard and Soil Erosion Pollution Prevention Inspection) requires a County-approved soil erosion pollution prevention plan prior to issuance of any development permit or authorization of any land-disturbing activity of more than 1 acre.

County of San Bernardino Surface Mining and Reclamation Overlay

The County of San Bernardino Surface Mining and Reclamation Overlay, Chapter 88.03.000 of the San Bernardino County Development Code, was adopted in order to comply with and implement the provisions of SMARA by adopting procedures for reviewing, approving, and/or permitting surface mining operations, reclamation plans, and financial assurances in the unincorporated areas of the county. The overlay sets forth the general procedural, operational, and reclamation requirements that must be complied with, where applicable, by surface mining and production operations in the county. The overlay contains requirements for the content of a reclamation plan, the review procedure, and mining standards. Applicability of the County's SMARA Overlay to California SMARA law and regulation is found in Section 88.03.090(a)(1) and (a)(2), which require reclamation plans to comply with Public Resources Code Sections 2777–2773 and California Code of Regulations Sections 3500–3505 and 3700–3713. In addition, performance standards in Division 3, Section 88.03.090(b), of the San Bernardino County Countywide Development Standards also apply to reclamation plans.

County of San Bernardino General Plan

The General Plan includes policies and programs that are intended to address hydrology and water quality–related issues and to guide future development in a way that lessens hydrologic impacts. For instance, the General Plan requires program review and permitting procedures for proposed land uses that have the potential to introduce hazardous substances. There is also a provision for the inspection of hazardous material handlers and hazardous waste generators. The following General Plan policies and programs that pertain to the proposed project assist in the protection of water quality in the county:

Policy CO 5.1 Because the San Bernardino County Flood Control District is responsible for debris basin construction and maintenance at the base of the mountains, development in these areas will be coordinated with that agency.

Policy CO 5.4 Drainage courses will be kept in their natural condition to the greatest extent feasible to retain habitat, allow some recharge of groundwater basins and resultant savings. The feasibility of retaining features of existing drainage courses will be determined by evaluating the engineering feasibility and

overall costs of the improvements to the drainage courses balanced with the extent of the retention of existing habitat and recharge potential.

Programs

1. Seek to retain all natural drainage courses in accordance with the Flood Control Design Policies and Standards where health and safety is not jeopardized.

2. Prohibit the conversion of natural watercourses to culverts, storm drains, or other underground structures except where required to protect public health and safety.

5. When development occurs, maintain the capacity of the existing natural drainage channels where feasible, and flood-proof structures to allow 100-year storm flows to be conveyed through the development without damage to structures.

7. Where technically feasible as part of its efforts to protect residents from flood hazards, require naturalistic drainage improvement where modifications to the natural drainage course are necessary. As an example, channel linings that will allow the re-establishment of vegetation within the channel may be considered over impervious linings (such as concrete). Where revegetation is anticipated, this must be addressed in the channel's hydraulic analysis and the design of downstream culverts.

9. Do not place streams in underground structures where technically feasible, except to serve another public purpose and where burial of the stream is clearly the only means available to safeguard public health and safety.

Policy M/CO 3.1 Utilize open space and drainage easements as well as clustering of new development as stream preservation tools.

Policy M/CO 3.2 Require naturalistic drainage improvements where modifications to the natural streamway are required.

Policy M/CO 3.3 Prohibit exposed concrete drainage structures. Acceptable designs include combinations of earthen landscaped swales, rock rip-rap lined channels or rock-lined concrete channels. Property owners must provide for the maintenance of underground drainage structures.

Policy M/CO 3.6 Minimize the runoff of surface water and establish controls for soil erosion and sedimentation through the following policies:

a. Through the development review process, require replanting of ground cover in denuded areas with vegetation, either indigenous to the area or compatible with the climate and soil characteristics of the region.

b. When development occurs, provide for the retention of natural drainage channels and capacity of the site where feasible.

c. When feasible, require developers, through the development review process, to maintain existing percolation and surface water runoff

3.7.4 IMPACTS AND MITIGATION MEASURES

STANDARDS OF SIGNIFICANCE

The impact analysis provided below is based on the following State CEQA Guidelines Appendix G thresholds of significance, as well as criteria utilized in the General Plan EIR for the evaluation of hydrology and water quality impacts of the General Plan (San Bernardino County 2006, p. IV-87).

1) Violate any water quality standards or waste discharge requirements.

2) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).

3) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.

4) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site.

5) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.

6) Otherwise substantially degrade water quality.

7) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.

8) Place within a 100-year flood hazard area structures that would impede or redirect flood flows.

9) Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of a failure of a levee or dam.

10) Inundation by seiche, tsunami, or mudflow.

The Initial Study prepared for the proposed project (see **EIR Appendix A**) determined that there would be a less than significant impact or no impact related to the following: violation of any water quality standards or waste discharge requirements or otherwise substantially degrade water quality, substantially deplete groundwater supplies or interfere substantially with groundwater recharge, place housing within a 100-year flood hazard area, impede or redirect flood flows, expose persons or structures to inundation by dam or levee failure or seiche, tsunami or mudflow (standards of significance 1, 2, 6, 7, 8, 9, and 10).

The reader is referred to the NOP/IS for a complete analysis of these impact areas. A copy of the NOP/IS, along with comments received during the public review period, is contained in **EIR Appendix A**.

METHODOLOGY

The following impact analysis is based on independent review of project-specific hydrological data, and analyses and findings that have been developed by the project's hydrological consultants.

PROJECT IMPACTS AND MITIGATION MEASURES

Substantially Alter Drainage Pattern (Standards of Significance 3, 4, and 5)

Impact 3.7.1 The project will substantially alter the existing drainage pattern in the quarry area, while maintaining the existing haul road drainage. Quarrying will remove existing vegetation and soils and expose bedrock, thereby potentially increasing the amount of runoff. Overburden and mine waste materials will be placed into existing drainages, creating three sloped fills, and will backfill the lower portion of the White Knob Quarry, thereby increasing the potential for sedimentation and erosion. This would result in a **potentially significant** impact.

Numerous erosion and sedimentation controls currently exist in the mining and stockpile areas and along the haul road to limit runoff, to minimize or prevent erosion, and to promote settling of suspended solids before the runoff leaves the site. Along the haul road, runoff is contained within the roadway by berms. As part of the proposed project, the roadway would be graded to direct runoff into catchment basins. In the quarries, runoff from slopes, benches, roads, and ramps would be directed into the mined-out portion of the quarries or into sediment sumps located near OB-1, OB-2, and OB-3.

Existing and future mining activities would create and/or deepen the pit floors at each of the three quarries, White Knob, Annex, and White Ridge. Stormwater runoff from slopes, benches, roads, and ramps along with any sediment would be directed into the mined-out portion of the quarry or into sediment sumps located down the main haul road in the vicinity of OB-1.

For the White Knob Quarry, the final backfill would be designed to act as a permanent sediment basin for future sediment control by sloping the drainage toward the west into the quarry walls with sufficient capacity to handle potential runoff for a 20-year/1-hour precipitation event. A small berm of approximately 5 feet in height may also be constructed along the 5,575-foot contour if needed. The drainage controls will minimize the potential for off-site transport and would eliminate any potential adverse effect on downstream property.

In the Annex and White Ridge Quarries, the final floor elevation would be lower than the exit roadways, thereby creating infiltration ponds that will be approximately 75 to 95 feet deep, which should be adequate to contain a 20-year/1-hour precipitation event. Stormwater runoff from slopes, benches, roads, and ramps along with any sediment would be directed into the mined-out portion of these quarries or into sediment sumps located down the main haul road in the vicinity of OB-1. Therefore, much of the rainfall in the quarries would infiltrate rather than run off, and sediment will be trapped.

Three main drainages cross the White Knob/White Limestone Ridge Quarries area, while the east–west haul road has 6 Arizona crossings and 14 culverts (see **Figures 2.0-2, 3.7-2,** and **3.7-3**). Stantec analyzed the hydrology for the project and determined that the capacities of the existing hydraulic structures, e.g., sedimentation basins, drainage conveyances, and haul road culverts, with some minor modification to the existing hydraulic structures, were adequate for the predicted 10-year stormwater flow, while most are marginal for a 20-year storm event. Stantec also recommended that the on-site haul road be graded with a 2 percent cross fall, that the road surface be an aggregate base course that is free of calcium carbonate materials, and that the low side of the roadway be determined by which side the next downstream catchment basin is on. These recommendations are included in mitigation measure **MM 3.7.1** item a. Stantec also concluded that the 4-foot-high earthen berms along the haul road are adequate to contain both the 10-year design flow and the 100-year flow within the roadway with over 2 feet of freeboard.

These lower haul road culverts appear to have been provided with outlet riprap protection in accordance with the 1987 Morrison-Knudsen plans. Although Stantec did not have the original specifications for the riprap, both the thickness called out and their field observations indicate it is equivalent to a Caltrans Light Class riprap gradation. The 2011 Stantec report concluded that with the exception of the culverts at Stations 154+20 (Culvert 12), 170+50 (Culvert 13), and 182+00 (Culvert 14), the riprap size provided in the 1987 Morrison-Knudsen plans is adequate. The 2013 Stantec report in Section 2.4 concluded that protection for the 20-year flow requires riprap size greater than what they recommended in their 2011 report for the three culverts at Stations 19+00 (Culvert 2), 54+35 (Culvert 5), and 182+00 (Culvert 14) (see **Table 3.7-5**). In addition, the length of protection downstream of the culvert outlet should be extended for all culverts to provide the length of protection shown in **Table 3.7-5**. These recommendations are included in mitigation measure **MM 3.7.1** item a.

There are eight existing debris basins along the haul road from the quarry site to the drainage near Turnout 64 (see **Figures 3.7-2** and **2.0-2**)**.** The upper four basins don't have overflow spillways and routinely fill up with sediment and debris, fail, and allow debris to flow down to the next basin. The lower four basins between the explosives storage facility and Turnout 64 have spillway structures and have not experienced failure. The sediment debris production calculations (**EIR Appendix G**, Stantec 2011) determined that the upper four quarry area basins have a volume of 3,280 cubic yards, which is less than half of the 7,729 cubic yards of sedimentation predicted from the design 50-year, 24-hour rain event. Improvements to these four basins and the construction of an additional basin, Basin 2, will increase the pond volume to 8,190 cubic yards, which is sufficient to hold the anticipated sedimentation.

The lower four sediment basins between the quarries and Turnout 64 already have adequate holding capacity with a calculated volume of 1,450 cubic yards versus an estimated sedimentation volume of 1,147 cubic yards. Although these lower four sediment basins have adequate capacity, Stantec recommended that an additional basin, Basin 10, be constructed further downhill because of the 1,000-foot distance between Basin 9 and the point where runoff leaves the roadway and flows to the 84-inch culvert (Culvert 14) near Turnout 64 (see **Figure 2.0-2**)**.** This recommendation is included in mitigation measure **MM 3.7.1** item a.

Sediment basins would be monitored, maintained, and excavated as necessary and sediment removed from the sites to an overburden site at the quarry. The basins and captured sediment would be maintained for the life of the quarry. Each basin site requires access, which will support loading and haulage equipment and would meet required federal MSHA safety standards. Access roads and sedimentation basins would be reclaimed as part of the long-term reclamation plan for the mine site. Details of these improvements to the sediment basins are shown in **Figure**

2.0-5 through **2.0-9** and given in Appendix E of the 2011 Stantec report (included in **EIR Appendix G**).

At the end of reclamation, the project would have eight permanent sediment basins. These basins would continue to trap sediment. Following reclamation, the volume of sedimentation from the mined lands should be near the pre-mining condition because the three quarries would trap runoff and associated sediment, which reduces the drainage area, and revegetation would bring the mined lands outside of the quarries back to a native condition. The purpose of the eight permanent sediment basins is discussed briefly below (Omya 2013; EIR Appendix G, Stantec 2011):

- Basin 1: Located at the base of the proposed OB-2 in a confined area with little room for expansion. A concrete spillway would allow overflow of the 10-year design storm without failure of the basin embankment.

- Basin 2: A new basin located in the upper drainage area about 400 feet north of Basin 1 with a designed volume of 960 cubic yards. Note that Basin 1 and Basin 2 would eventually be covered over with overburden during approximately the last 10 years of operations. After that time, stormwater and sediment would be redirected into the permanent sediment basin constructed on the floor of the former White Knob Quarry floor.

- Basin 3: An existing basin along the main haul road near the northwest corner of the White Ridge Quarry. This basin can not be expanded. A concrete spillway would allow overflow of the 10-year design storm.

- Basins 4 and 5: Located adjacent to each other at the east of the proposed OB-1 expansion area. These two basins will be combined into one basin with a concrete spillway from Basin 4 into Basin 5, and a concrete spillway with a 50-foot riprap apron from Basin 5 to the natural drainage to the north. Per Stantec's design, the bottoms of the basins would have a maximum grade of 10 percent and a total volume capacity of 6,380 cubic yards.

- Basins 11 and 12[4]: Future basins to be constructed on the northeast and north side of OB-1 to control potential runoff and sediment off of OB-1. Both would have riprap spillways that discharge into the natural drainages.

- Basin 13[5]: A future basin to be constructed at the toe of OB-3 to handle runoff and sediment from the east side of the White Ridge Quarry. Basin 13 would have a riprap spillway and discharge into the natural eastern drainage. The overburden stockpiles would be constructed with berms near the crest of the fill benches to prevent runoff over the fill slope. Typically, due to the porosity of the overburden, little runoff occurs. Drainage would be directed away from the rims. Riprap, catchment basins, and various energy dissipaters would be placed along the toe of fills as needed to trap sediment and minimize the potential for off-site transport. These drainage controls would be periodically inspected and maintained, as necessary.

[4] Shown as Sediment Basins OB-A and OB-1B in Omya 2013 and Stantec 2011. These basins were re-numbered to reflect changes in the revised site plan (Figure 2.0-4).

[5] Shown as Sediment Basin OB-3 in Omya 2013 and Stantec 2011. This basin was re-numbered to reflect changes in the revised site plan (Figure 2.0-4).

The on-site haul road within the quarry area from the crusher area to the northeast corner of the project site east of overburden stockpile OB-1 carries stormwater from the southern quarry areas northward. The area where the haul road is located does not have the width to design a separate drainage channel. The Stantec 2011 study determined that the required 4-foot berms on each side (or a hillside slope or eventually the side slope of OB-1), as required for truck safety per the Mine Safety and Health Administration, are adequate to contain the 10-year design flow and the 100-year flow within the roadway with over 2 feet of freeboard. The haul road will be graded with a 2 percent cross fall and berm openings for the sediment catchment basins. Omya is aware that roadway damage may occur during heavy storms, but has adequate on-site equipment and aggregate materials to quickly make repairs.

A large number of energy dissipaters, temporary sediment capture basins, riprap, hay bales, and/or silt fences trap sediment and minimize the potential for off-site transport. Operations also limit surface disturbance to minimum areas, and concurrent reclamation and revegetation would stabilize disturbed pads and slopes.

Boulder rolling and surficial sliding of side-cast overburden material has occurred on the slopes northwest and north of the White Knob Quarry. In the past, the side-casted overburden material on the northwestern slope has been transported downslope during high intensity rainfall events and deposited in the Western Drainage. The Western Drainage eventually drains to Ruby Springs, one of several areas of natural springs that occur along the faulted flank of the San Bernardino Mountains. Since 2003, precautions have been taken and new mining procedures have been implemented to minimize future roll-down. However, because of remaining cliffs, some roll-down would be unavoidable, as it is necessary to continue to mine the ridge down and daylight in order to safely recover the ore. Once the limit of the ore is reached, no additional roll-down or visible changes would occur.

The existing SWPPP and SPCC for Omya's Lucerne Valley operations would continue to cover industrial activities at the White Knob/White Ridge Limestone Quarries until mining ceases. The SWPPP includes specific prohibitions, effluent limitations, stormwater pollution prevention plans, including source identification, practices to reduce pollutants, assessments of pollutant sources, materials inventory, preventative maintenance program, spill prevention and response procedures, general stormwater management practices, training, record keeping, sampling procedures, and monitoring program. The SWPPP would be updated to account for the modification of stormwater control and conveyance features contemplated in the Amended Reclamation Plan. The SWPPP would be updated, if necessary, to address the provisions of the amendment to the General Industrial Storm Water Permit recently adopted by the State Water Resources Control Board.

The White Knob/White Ridge Limestone Quarries utilize a relatively small amount of groundwater during operations. Approximately 2.75 acre-feet of water are used annually for dust suppression in the quarries, overburden placement areas, haul/access roads, and at the crusher. With the increase in production, water usage is expected to increase to approximately 5 acre-feet per year. Therefore, the proposed project would not substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level. No substantial changes are proposed other than that adequate dust control will be maintained. Note that the use of magnesium chloride on roads and other active mine areas and the occurrence of typically wet winter weather reduce the amount of water needed to control dust. Impacts on groundwater supply are discussed in Section 3.8, Utilities and Service Systems, of this DEIR.

Mitigation Measures

MM 3.7.1 The following mitigation measures shall be implemented in addition to requirements contained in the project's SWPPP and SPCC and incorporated into the final Amended Mine and Reclamation Plan:

a. Implement the recommendations for modifications of the project's haul road drainage and sediment control structures given in the September 12, 2013, Stantec technical memorandum and August 2011 Stantec report, White Knob Haul Road Drainage Study and Plan Development, to implement Sections 15, 16, and 17 of the April 20, 2011, Settlement Agreement between Omya and the Bureau of Land Management in sections:

- 2.3 Culvert Flow Calculations (EIR Appendix G, Stantec 2013, p.6);
- 2.4 Culvert Riprap Calculations (EIR Appendix G, Stantec 2013, p. 7);
- 3.1.2, Roadway Grading and Ditch Recommendations (EIR Appendix G, Stantec 2011, p. 3.3);
- 3.2.2, Sediment Catchment Basins Recommendations(EIR Appendix G, Stantec 2011, p. 3.6); and
- 4.0, Right-of-Way Recommendations (EIR Appendix G, Stantec 2011, p. 4.1).

Inclusion of these improvements would ensure that no flow increases to downstream flows during flood events.

b. All quarry areas, overburden fills, and haul roads shall be maintained to minimize erosion and sedimentation.

c. Sedimentation basins shall be inspected regularly, at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. Sediment shall be removed and basin function restored as needed.

d. Any sediment removed from basins shall be deposited on the overburden areas or into the White Knob Quarry sedimentation pond. Sediment placed on the overburden areas shall utilize temporary stormwater BMPs to prevent further sediment discharge and shall be revegetated in accordance with the 2013 Amended Reclamation Plan.

e. Basin spillways shall remain in good working condition and repaired as necessary.

f. Areas in haul roads that experience erosion shall be backfilled and rocked to minimize future erosion.

g. Overburden fill slopes and benches shall be inspected regularly, at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½

inch of direct rainfall. If erosion or sedimentation is observed, temporary BMPs shall be utilized on overburden slopes and benches as soon as possible to minimize future erosion.

h. Areas of erosion or sediment deposition in overburden areas shall be permanently remediated as soon as possible, preferably before the next precipitation event. Remediated overburden slopes and benches shall be revegetated and/or armored in accordance with the 2013 Amended Reclamation Plan.

i. Haul road culverts and Arizona crossings shall be inspected regularly at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. Culverts and crossing shall be repaired and maintained to allow for proper passage of floodwaters.

j. If any of the haul road culverts are damaged or washed out, they shall be replaced with a culvert that provides a minimal capacity to pass a 20-year storm event without overtopping or excess erosion.

k. The seven procedures that were implemented to minimize boulder roll-down shall continue for the life of the project. These procedures are identified in mitigation measure **MM 3.1.1**. Procedures shall be modified and/or additional measure put in place, as necessary, to achieve minimal boulder roll-down.

Timing/Implementation: *Required to be placed in the final version of the Amended Plan and implemented during mining and reclamation activities*

Enforcement/Monitoring: *County of San Bernardino Land Services Department*

This mitigation measure will ensure that runoff and sedimentation from the mining operation does not cause any significant on- and off-site erosion or flooding impacts. Improvements to project stormwater structures and facilities as recommended by Stantec (2011) will be implemented. The mitigation monitoring measures given above will provide for the timely inspection of project areas and watercourses so that repairs and/or additional best management practices can be implemented to minimize erosion and properly control runoff. Mitigation to prevent excessive sediment load being generated due to slope instability is described in Section 3.5, Geology and Soils, of this Draft EIR. Haul roads, drainage ditches, swales, benches, and sedimentation basins all serve to convey runoff and capture excess sediment and would be inspected, cleared, and maintained as needed, and will be sufficient to convey the 10- and 20-year precipitation events and safely release 100-year flows. Standard procedures and implementation of the measures described in the project's SWPPP and SPCC plans, in addition to the mitigation given above, will prevent or remediate accelerated and damaging on- and off-site erosion or flooding due to the project. Implementation of mitigation measure **MM 3.7.1** would reduce this impact to **less than significant**.

This section evaluates the potential impacts of the proposed project related to water supply and stormwater drainage infrastructure and capacity. Hydrological impacts as a result of stormwater drainage are discussed in Section 3.7, Hydrology and Water Quality, of this DEIR. This section describes existing water supplies and associated infrastructure as well as existing stormwater drainage facilities and provides an analysis of the proposed project's potential impacts related to increased water supply demand and the construction of new and expanded stormwater drainage facilities. Project impacts related to solid waste and wastewater were determined to have no impact in the Notice of Preparation/Initial Study (NOP/IS). As such, these impact areas are not evaluated in this section. The reader is referred to the NOP/IS (EIR Appendix A) for a discussion regarding these topics and Section 3.9, Environmental Effects Determined Not to Be Significant.

This section is based on a Water Supply Assessment (WSA) prepared for the proposed project by Lilburn Corporation in June 2013 (included in **EIR Appendix H**), an existing stormwater pollution prevention plan (SWPPP) prepared for the quarry operation in 2008, a technical study entitled "White Knob Quarry Haul Road Drainage Report and Plan of Development" prepared by Stantec in 2011, and a "Technical Memorandum: White Knob Quarry and Haul Road" prepared by Stantec in September 2013 that supplements the 2011 drainage report (included in **EIR Appendix G**), as well as the proposed Amended Plan.

The County published a Notice of Preparation and Initial Study (NOP/IS) for the proposed project on June 12, 2013. A copy of the NOP/IS, along with comments received during the public review period, is contained in **EIR Appendix A**. No comments were received regarding utilities and service systems.

3.8.1 STORMWATER DRAINAGE FACILITIES

3.8.1.1 EXISTING SETTING

DRAINAGE FLOWS AND INFRASTRUCTURE

Within the quarry areas, runoff is directed into the quarries. Outside of the quarry areas, runoff collects in natural drainage channels caused by topographical lows in the surrounding terrain and flows north off-site into the natural drainage. The on-site haul road from the crusher area to the northeast corner of the project site east of OB-1 serves as one such channel carrying stormwater from the southern areas northward. There are no permanent water bodies to which these drainage channels discharge; instead, drainage appears to be lost to infiltration and evapotranspiration (Stantec 2008, p. 7). A brief discussion of the project drainage facilities is provided below

Existing Control Measures

Numerous erosion and sedimentation controls have been and will continue to be implemented in the quarries and stockpile areas to control, minimize, and prevent off-site sedimentation. Runoff is directed into the quarries, and many sediment basins, culverts, dips, or drains direct water off roads. A number of energy dissipaters, riprap, hay bales, catch basins, and/or silt fences trap sediment and prevent it from traveling off-site (Omya California 2013, p. 37). These facilities are used to control to the amount of stormwater and sedimentation flowing off-site during a storm event.. Sedimentation and erosion monitoring reports have been competed periodically for the project. The most recent is the Sedimentation and Erosion Monitoring, 2012–2013 Reporting Period, completed by Deane Consulting, Inc. These reports identify the annual rate of sedimentation and erosion, and volumetric changes of Western Drainage soils in

response to storm events. The western sector of the White Knob Quarry area drains into the Western Drainage and flows downstream through the Ruby Springs area. A detailed discussion of these facilities and the drainage areas is provided in Section 3.7, Hydrology and Water Quality.

On-Site Haul Road/Drainage

The on-site haul road within the quarry area from the crusher area to the northeast corner of the project site east of OB-1 carries stormwater from the southern areas northward. The area where the haul road is located does not have the width to provide a separate drainage channel. The drainage report determined that the existing required 4-foot berms on each side (or a hillside slope or eventually the side slope of OB-1), as required for truck safety per the Mine Safety and Health Administration (MSHA), are adequate to contain the 10-year design flow and the 100-year flow within the roadway with over 2 feet of freeboard. The haul road would be graded as needed with a 2 percent cross fall and berm openings for the existing sediment catchment basins on the site. Equipment and aggregate material is located on-site to make repairs to the roadway/drainage damaged during a storm.

Sediment Basins

There are currently four sediment catchment basins on the quarry site as well as two basins off-site. Sediment Basins 1, 3, 4, and 5 are located along the haul road, while Basins 6 and 7 are located just off-site. See Figures 2.0-2 and 2.0-3 in Chapter 2.0, Project Description, for sediment basin locations.

Quarries

The existing and future mining activities located on the site would create and deepen the quarry pit floors. Currently, runoff is directed into the existing sediment basins where it is allowed to infiltrate or evaporated naturally. Future runoff down slopes, benches, roads, and ramps and any sediment will be directed into the mined-out portion of the quarry or into sediment basins. For the White Knob Quarry, the final backfill will be designed to act as a permanent sediment basin.

3.8.1.2 REGULATORY FRAMEWORK

STATE

Surface Mining and Reclamation Act

The California Surface Mining and Reclamation Act (SMARA) contains a number of provisions addressing drainage diversion structures, waterways (14 California Code of Regulations [CCR] Section 3706), and stream protection including surface water and groundwater (14 CCR Section 3710). SMARA also requires that erosion control methods be designed for the 20-year/1-hour intensity storm event (14 CCR Section 3706(d)) and control erosion and sedimentation (14 CCR Section 3706(c)). The SMARA regulations also require reclamation plans to include performance standards for drainage and erosion to protect water quality, including streams, surface water, and groundwater. These performance standards must ensure compliance with the Clean Water Act, the Porter-Cologne Water Quality Control Act, and other legal requirements (14 CCR Sections 3706 and 3710(a)).

LOCAL

San Bernardino County General Plan

The General Plan includes policies and programs that are intended to address drainage facilities. For instance, the General Plan requires new development to use site design, source control, and treatment control best management practices (BMPs) on applicable projects to achieve compliance with the County Municipal Stormwater National Pollutant Discharge Elimination System (NPDES) Permit. The NPDES Permit Program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Please refer to Section 3.7, Hydrology and Water Quality, for an expanded discussion of the NPDES. The General Plan includes the following project-related drainage policies:

Policy CO 5.1 Because the San Bernardino County Flood Control District is responsible for debris basin construction and maintenance at the base of the mountains, development in these areas will be coordinated with that agency.

Policy CO 5.4 Drainage courses will be kept in their natural condition to the greatest extent feasible to retain habitat, allow some recharge of groundwater basins and resultant savings. The feasibility of retaining features of existing drainage courses will be determined by evaluating the engineering feasibility and overall costs of the improvements to the drainage courses balanced with the extent of the retention of existing habitat and recharge potential.

Policy M/CO 3.2 Require naturalistic drainage improvements where modifications to the natural streamway are required.

Policy M/CO 3.3 Prohibit exposed concrete drainage structures. Acceptable designs include combinations of earthen landscaped swales, rock rip-rap lined channels or rock-lined concrete channels. Property owners must provide for the maintenance of underground drainage structures.

Policy M/CO 3.6 Minimize the runoff of surface water and establish controls for soil erosion and sedimentation through the following policies:

a. Through the development review process, require replanting of ground cover in denuded areas with revegetation, either indigenous to the area or compatible with the climate and soil characteristics of the region.

b. When development occurs, provide for the retention of natural drainage channels and capacity of the site where feasible.

c. When feasible, require developers, through the development review process, to maintain existing percolation and surface water runoff rate by discouraging the paving of large surface areas.

San Bernardino County Code

Chapter 83.09: Infrastructure Improvement Standards

Chapter 83.09 of the San Bernardino County Code establishes the infrastructure improvements required for proposed development in order to ensure that the development does not result in

fiscal liabilities to county residents. The intent is to require an appropriate range of infrastructure facilities and services to support areas of high-intensity development and areas of low-intensity development. The requirements are based on the direct relationship between the intensity of land uses and the amounts of facilities and services that are needed to support the uses.

Chapter 88.03: Surface Mining and Land Reclamation

The County of San Bernardino is the SMARA lead agency for the White Knob/White Ridge Limestone Quarries and the CEQA lead agency for this project. The purpose and intent of Chapter 88.03 is to ensure the continued availability of important mineral resources, while regulating surface mining operations. Section 88.03.080(2)(b)(4) requires financial assurances to ensure compliance with elements of the reclamation plan related to erosion and drainage control.

3.8.1.3 IMPACTS AND MITIGATION MEASURES

STANDARDS OF SIGNIFICANCE

Based on Appendix G of the CEQA Guidelines, a stormwater drainage impact is considered significant if project implementation would result in the following:

i. Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.

METHODOLOGY

The following analysis is based on the proposed drainage improvements described in the Amended Plan as well as the Stantec *White Knob Haul Road Drainage Study and Plan of Development Report* and the *Technical Memorandum,* both provided in **EIR Appendix G.**

IMPACTS AND MITIGATION MEASURES

Construction of New Stormwater Drainage Infrastructure (Standard of Significance 1)

Impact 3.8.1.1 The proposed project includes drainage improvements and the construction of new stormwater drainage infrastructure, the construction of which could result in significant environmental effects. These effects are addressed in the appropriate technical sections of this EIR and, where necessary, are mitigated to a less than significant level with mitigation measures identified in this EIR. Therefore, this impact would be **less than significant**.

The proposed project includes improvements to the primary access/haul road within the existing Bureau of Land Management (BLM) right-of-way. These improvements include grading the haul road with a 2 percent cross fall and creating openings in the berms that run along the road to allow runoff to flow into existing sediment catchment basins on the site.

Within the quarries, future mining activities would create and deepen the existing and proposed pit floors. Future runoff down slopes, benches, roads, and ramps and any associated sediment would continue to be directed into the mined-out portion of the quarry or into existing or proposed sediment basins.

At the site of OB-1, Basins 4 and 5 would be improved per the updated sedimentation control plan, and secondary sediment basins would be constructed to the stockpile's northwest and north to prevent sediment from leaving the site. At the site of OB-2, Basin 11 would also be improved per the updated sedimentation control plan. At the site of OB-3, Basin 3 would be constructed at the toe to collect sediment from the stockpile.

All project drainage infrastructure improvements would be constructed on-site and would not require the expansion of off-site improvements.

During reclamation of the site, drainage improvements would generally involve grading or reshaping disturbed areas on the project site, establishing effective drainage, placement of plant growth media, and revegetation. Following reclamation, the majority of surface runoff from quarry areas would be retained in the quarry limits, where it would either infiltrate or evaporate. For the White Knob Quarry, the final backfill would be designed to act as a permanent sediment basin.

There are a number of regulations in SMARA regarding site drainage, erosion, and water quality. SMARA Section 3502(h)(1) requires that an amended plan must conform to the current reclamation standards required by SMARA regarding drainage systems or storage that the new area would utilize. Additionally, Section 3503(d) requires that permanent piles or dumps of mine waste rock and overburden are stable and not restrict the natural drainage without suitable provisions for diversion. Further Section 3503(e) requires that grading and revegetation be designed to minimize erosion and to convey surface runoff to natural drainage courses or interior basins designed for water storage. Basins that would store water during periods of surface runoff are to be designed to prevent erosion of spillways when these basins have outlet to lower ground.

SMARA Section 3706(d) requires that surface runoff and drainage from surface mining activities be controlled by berms, silt fences, sediment ponds, revegetation, hay bales, or other erosion control measures to ensure that surrounding land and water resources are protected from erosion, gullying, sedimentation, and contamination. Erosion control methods must be designed to handle runoff from not less than the 20-year/1-hour intensity storm event. Section 3706(e) requires that where natural drainages are covered, restricted, rerouted, or otherwise impacted by surface mining activities, mitigating alternatives are to be proposed and specifically approved in the reclamation plan to assure that runoff does not cause increased erosion or sedimentation.

San Bernardino County Code Section 88.03.080(2)(b)(4) requires financial assurances to ensure compliance with elements of the reclamation plan related to slope stability and erosion and to drainage control during and at the conclusion of a project.

The construction of these proposed improvements in areas not previously disturbed by project operations would include grading, excavating, cut and fill, and other earthmoving and construction activities that could result in temporary environmental effects such as greenhouse gas and other air emissions, disturbance of biological or cultural resources, soil erosion, water quality degradation, increased noise and truck traffic related to construction of the drainage improvements, and increased water demand for dust control. These potential impacts were either addressed and found to be less than significant in the NOP/IS prepared for the proposed project or are addressed in the appropriate technical sections of this EIR and, where necessary, are mitigated to a less than significant level with mitigation measures identified in this EIR. Therefore, this impact would be **less than significant**.

Mitigation Measures

None required.

3.8.2 WATER SUPPLY

3.8.2.1 EXISTING SETTING

REGIONAL WATER SYSTEM

There is no public water supplier for the project site. Residents of Lucerne Valley, north of the project site, receive water via individual wells, mutual water companies, or small county water districts. The County of San Bernardino has a County Service Area (CSA 29) in Lucerne Valley that serves commercial customers only and does not overlie the project site. On the north shore of Big Bear Lake, south of the project site, the community of Fawnskin is served by the Big Bear Department of Water and Power, and the remainder of the north shore lies within CSA 53-C. The project is not part of a regional water system (**EIR Appendix H**, Lilburn Corporation 2013, p. 5).

WATER SUPPLY

Groundwater

The existing mining operation uses groundwater from two wells, one of which is located on-site, while the other is located near the processing plant north of the project site. The wells pump groundwater from the Este Subarea of the Mojave Water Basin.

The Watermaster for the Mojave Water Basin,1 the Mojave Water Agency (MWA), in its Nineteenth Annual Report of the Mojave Basin Area for Water Year 2011–12, dated May 1, 2013, indicates that water levels in the Este Subarea have remained stable for the past several years, indicating a relative balance between recharge and discharge. Unused Free Production Allowance (FPA) for the Este Subarea, as reported by the Watermaster, was 14,430 acre-feet for Water Year 2009–10, 13,632 acre-feet for Water Year 2010–11, and 14,800 for Water Year 2011–12. Based on the Watermaster report, the Water Year 2012–13 FPA for the Este Subarea is recommended to be set at 80 percent of the Base Production Allowance of 19,277 acre-feet, or 15,422 acre-feet. **Table 3.8-1** summarizes the 2011–12 Watermaster Report data, as reported in the WSA for the proposed project (**EIR Appendix H**, Lilburn Corporation 2013, p. 8).[2]

1 As Watermaster, the MWA's main responsibilities are to monitor and verify water production for approximately 475 parties (1,700 wells), collect required assessments, conduct studies, and prepare an annual report of its findings and activities to the court. Watermaster also acts as the clearinghouse for recording water transfers, maintains records for all such transfers, and reports changes in ownership of Base Annual Production rights to the court.

2 Subsequent to completion of the WSA in June 2013 and after the NOP/IS was released for public review in June 2013, the MWA published its Twentieth Annual Report of the Mojave Basin for Water Year 2012-2013, dated May 1, 2014 (MWA 2014). The Twentieth Annual Report presents the most current available information about conditions in the Este Subarea as of the publication date of this EIR. A review of the data in the Twentieth Annual Report indicates similar conditions to those in the Nineteenth Annual Report for the Este Subarea, including Omya's water use, and no substantial differences were identified that would affect the conclusions of the WSA.

TABLE 3.8-1
WATERMASTER DATA FOR ESTE SUBAREA GROUNDWATER PRODUCTION (ACRE-FEET)

2011–12 Verified Production	Production Safe Yield	2011–12 Free Production Allowance	2012–13 Recommended Free Production Allowance
5,433	7,156	16,376	15,422

Source: EIR Appendix H, Lilburn Corporation 2013, p. 8

The Mojave Groundwater Basin is subject to adjudication (see subsection 3.8.2.2, Regulatory Framework, below). In carrying out the Mojave Basin Judgment (the adjudication), the Mojave Water Agency assigned Base Annual Production (BAP) amounts to each producer using 10 acre-feet per year or more, based on historical production (1986–1990). The total BAP from all producers was ramped down in each year from 1994 to 2005 in order to achieve the point where water imports and inflows versus consumption achieve safe yield of the basin. The MWA achieved its target rampdown in 2004/2005.

Each pumper also has been assigned a variable Free Production Allowance, which is a uniform percentage of BAP set for each area. A substantial make-up water assessment is charged for water pumped in excess of the assigned FPA. Water purveyors also have the option of leasing additional water rights from the open market.

Omya has an FPA that was allocated as part of the adjudication. Omya's original (1993) BAP was set at 23 acre-feet per year. This was ramped down annually to a current FPA of 19 acre-feet per year (82.6 percent of BAP). Note that these allocations are for both of Omya's existing mining operations in the area—the White Knob/White Ridge Quarries and the Butterfield/Sentinel Quarries.

Any groundwater that Omya pumps over and above the FPA is subject to replacement. Replacement can occur either by paying the Watermaster to purchase supplemental water from the MWA or by acquiring/transferring unused production rights within that subarea from another party to the Mojave Basin Judgment. Historically, Omya has had prior year carryover from unused FPA, with a prior year carryover of 19 acre-feet, and a total adjusted FPA of 38 acre-feet. **Table 3.8-2** shows FPA, verified production, carryover credits, and unused FPA for the period of water years 2002–03 through 2011–12, as reported in the WSA (**EIR Appendix H**, Lilburn Corporation 2013, p. 9).

TABLE 3.8-2
OMYA FREE PRODUCTION ALLOWANCE AND PRODUCTION
WATER YEARS 2002-03 THROUGH 2011-12

Water Year	Free Production Allowance (acre-feet)	Verified Production (acre-feet)	Carryover Credits[1] (acre-feet)	Unused FPA[2] (acre-feet)
2002–03	19	15	19	19
2003–04	19	14	19	19
2004–05	19	14	19	19
2005–06	19	18	19	19
2006–07	19	19	19	19
2007–08	19	14	19	19
2008–09	19	14	19	19

Water Year	Free Production Allowance (acre-feet)	Verified Production (acre-feet)	Carryover Credits[1] (acre-feet)	Unused FPA[2] (acre-feet)
2009–10	19	14	19	19
2010–11	19	13	19	19
2011–12	19	14	19	19

Source: EIR Appendix H, Lilburn Corporation 2013, p. 9
Notes:
1. Carryover credits are based on a total adjusted FPA of 38 acre-feet.
2. Unused FPA is based on a total adjusted FPA of 38 acre-feet. As such, 38 acre-feet adjusted FPA minus the FPA of 19 ace-feet equals 19 acre-feet.

Historical Groundwater Data

According to the Mojave Water Agency's 2010 Urban Water Management Plan (UWMP), verified groundwater production in the Este Subarea decreased from 8,800 acre-feet in 1994 to 6,500 acre-feet in 2004. Since 1998, verified groundwater production in the Este Subarea has been less than 7,100 acre-feet.

The Mojave Basin Judgment mandates that groundwater extraction from the basin not exceed the estimated annual supplies and empowers the Watermaster to enforce pumping limits as mandated by the court. The MWA will continue to recharge the aquifer so that groundwater will remain a reliable source of water for the foreseeable future. Among other things, the MWA has established a groundwater replenishment program for the Mojave Water Basin, including the Este Subarea, the purpose of which is to reduce annual and cumulative groundwater overdraft through artificial recharge to the groundwater basin.

The Omya production well located near the plant (Plant Well) was drilled in 1987; depth to groundwater at the time of well installation was 867 feet below ground surface (bgs). The second well located in Crystal Canyon (Crystal Creek Well) was drilled in 1990, and depth to groundwater was recorded as 85 feet bgs. Omya has not recently maintained depth to water records for either well (**EIR Appendix H**, Lilburn Corporation 2013, p. 10).

Surface Water

The Mojave River is the primary source for replenishment of the Mojave Basin, with an average natural inflow of 65,500 acre-feet. The local surface inflows depend on climatic conditions and represent a small portion of the total supply. Recharge flows are often subsurface and not available for surface water capture or treatment. Water from the State Water Project is the only other surface water that may be considered for treatment or direct use and is limited by the variability of the supply from the Delta and the amount of water the MWA has available after contractual deliveries are met. Surface water is not treated or used for domestic water purposes (**EIR Appendix H**, Lilburn Corporation 2013, p. 11).

Recycled Water

No recycled water is available to the project site or within the area of the water supply. The existing plant administrative offices are connected to a septic system. Portable toilets are used at the quarry sites (**EIR Appendix H**, Lilburn Corporation 2013, p. 12).

State Water Project

The MWA is one of 29 State Water Project (SWP) contractors. The SWP includes 660 miles of aqueduct and conveyance facilities extending from Lake Oroville in the north to Lake Perris in the south. The SWP is contracted to deliver 4.1 million acre-feet per year to the 29 contracting agencies. However, state and federal biological opinions to protect endangered fish, climate change, and levee vulnerability in the Delta have decreased projected deliveries to 60 percent of contracted amounts until the year 2028, increasing to 61 percent in 2029 (**EIR Appendix H**, Lilburn Corporation 2013, p. 11). SWP delivery reliability factors of between 60 and 61 percent were utilized in the MWA Urban Water Management Plan, yielding projected supplies as shown in **Table 3.8-3**.

TABLE 3.8-3
MOJAVE WATER AGENCY
SUMMARY OF CURRENT AND PLANNED WATER SUPPLIES (ACRE-FEET PER YEAR)

Supply Type	2010	2015	2020	2025	2030	2035
Local	131,994	137,633	141,314	147,121	152,921	54,778
State Water Project	49,680	51,480	53,880	53,880	54,778	158,712
Total	181,674	189,113	195,194	201,001	207,699	213,490

Source: EIR Appendix H, Lilburn Corporation 2013, p. 11

The MWA has recognized the need for additional imported water in order to eliminate groundwater overdraft and has purchased additional water from the SWP when available. Additional SWP water is not expected to be available on a regular basis in the future and should not be relied on as the only long-term source of overdraft reduction in the Mojave Water Basin. Purchase of additional SWP water involves the purchase of water on the spot market, as opposed to the purchase of entitlement to an ongoing supply of that water. It should be noted that the spot market comes into play when all of the MWA's entitlements are being imported into the basin.

The MWA reached agreement with the Metropolitan Water District (MWD) of Southern California in 2003 to store up to 75,000 (45,000 delivered to date) acre-feet for the MWD in the Mojave Water Basin. This storage is being provided in exchange for the MWD's right to receive an equal amount of water in the future, through entitlement exchange, should there be a significant drought. In addition to the spot market, on an ongoing basis the MWA is pursuing additional State Water Project entitlements when they become available. In dry years when SWP or Colorado River supplies are reduced, the MWD will have the ability to call back some of the transferred water stored in the Mojave Water Basin, based on the limitations of the storage agreement between the MWD and the MWA (EIR Appendix H, Lilburn Corporation 2013, p. 11).

WATER SUPPLY RELIABILITY

The Mojave Water Agency 2004 Regional Water Management Plan projects the single-dry year conditions to be based on the 1977 Southern California drought conditions. Such hydrologic conditions are used by the California Department of Water Resources as conditions under which State Water Project water deliveries would be limited to 4 percent of SWP contractors' entitlements. As shown in Table 5-16 of the MWA 2004 Regional Water Management Plan, the Este Subarea would experience deficits (in five-year increments) as follows:

2005 (2,650) acre-feet

2010 (2,850) acre-feet

2015 (3,050) acre-feet

2020 (1,500) acre-feet

2025 (1,650) acre-feet

2030 (1,850) acre-feet

The BPA is a percentage of water production that occurred during the "base year" as established in the Judgment and is used by the Watermaster for purposes of annually establishing an FPA for each major groundwater producer. According to the Nineteenth Annual Report of the Mojave Basin Area Watermaster, the Este Subarea may be subject to future rampdown of the BPA to 65 percent immediately if water use conditions change.

The water supplies and demands of the Mojave Water Agency's entire service area were projected in the 2010 UWMP to account for a single-dry year event and a four-year multiple-dry year event occurring during the period 2010 through 2035. The analyses presented in the 2010 UWMP show that the Mojave Water Agency has adequate supplies to meet demands during average, single-dry, and multiple-dry years throughout the 20-year planning period (**EIR Appendix H**, Lilburn Corporation 2013, pp. 12-13).

Water Demand

Existing Project Demands

Lucerne Valley lies within the Este Subarea of the Mojave Basin. The 2010 UWMP shows that the subarea had a population of 6,680 in 2005, and the population was projected to grow to 11,785 by the year 2035. Water production in the Este Subarea has declined according to reports filed with the Mojave Basin Watermaster. Water production was 9,700 acre-feet in 1996, 7,100 acre-feet in 1998 and 2000, and 5,900 acre-feet in 2003. Projected water demand within the Este Subarea was estimated to increase from 6,981 acre-feet in 2005 to 7,369 acre-feet in 2035 (**EIR Appendix H**, Lilburn Corporation 2013, p. 6).

The average annual production from Omya's two wells (utilized by both the White Knob/White Ridge and Butterfield/Sentinel mining operations), verified by the Watermaster during the five-year period of 2007/08 to 2011/12, was 13.8 acre-feet (**EIR Appendix H**, Lilburn Corporation 2013, p. 6). The White Knob/White Ridge Quarries portion of this annual demand is estimated at approximately 2.75 acre-feet per year (Omya California 2013, p. 34).

3.8.2.2 REGULATORY FRAMEWORK

STATE

Senate Bill 610

Senate Bill (SB) 610 (Water Code Section 10910(c)(2)) makes changes to the Urban Water Management Planning Act to require additional information in Urban Water Management Plans if groundwater is identified as a source available to the supplier. Required information includes a

copy of any groundwater management plan adopted by the supplier, a copy of the adjudication order or decree for adjudicated basins, and if nonadjudicated, whether the basin has been identified as being overdrafted or projected to be overdrafted in the most current California Department of Water Resources (DWR) publication on that basin. If the basin is in overdraft, the plan must include current efforts to eliminate any long-term overdraft. A key provision in SB 610 requires that any project subject to CEQA supplied with water from a public water system be provided a specified water supply assessment, except as specified in the law. Water supply assessments are required under SB 610 for industrial projects occupying more than 40 acres of land (DWR 2003). Therefore, the proposed project is subject to this requirement. A Water Supply Assessment (Lilburn Corporation 2013) was prepared for the proposed project and is included in **EIR Appendix H**.

LOCAL

Mojave Groundwater Basin Adjudication

The Mojave Basin, including the Este Subarea where the proposed project is located, has been the subject of adjudication to determine the water rights of the various producers. The adjudication process of the groundwater in the basin began in 1990, with cross complaints filed in 1991. In 1992, numerous parties agreed to conduct good faith negotiations, and by 1993, over 75 percent of the parties involved were agreed to the Stipulated Judgment, thus binding the involved parties. In 1995, a trial of the non-stipulated parties was completed. The final judgment was entered in 1996 adopting the physical solution set forth in the Stipulated Judgment. The purpose of the Stipulated Judgment was to create incentives to conserve local water, guarantee that downstream producers will not be adversely affected by upstream producers, and assess producers to obtain funding for the purchase of imported water.

In addition, the Stipulated Judgment required that the Mojave Basin Area Watermaster generate an annual report summarizing yearly Watermaster activities and water supply conditions for the Mojave Water Basin, which includes the Alto Subarea, Baja Subarea, Centro Subarea, Este Subarea, and Oeste Subarea. The project site obtains groundwater from wells in the Este Subarea (EIR Appendix H, Lilburn Corporation 2013, p. 9).

San Bernardino County General Plan

The General Plan includes policies and programs that address water supply. For instance, the General Plan requires new development to implement measures to conserve and reclaim water and to ensure that adequate water supply and conveyance infrastructure is available prior to approval of new development projects. The General Plan includes the following project-related policies and programs that address water supply:

Policy CO 5.3 The County will promote conservation of water and maximize the use of existing water resources by promoting activities/measures that facilitate the reclamation and reuse of water and wastewater.

Programs

6. New development will implement feasible water conservation measures recommended by the water agency or purveyor that supplies the development with water.

Policy M/CO 3.9 Support and apply water conservation and reuse measures through the development review process.

Policy CI 11.9 Encourage water conservation, replenishment programs, and water sources in areas experiencing difficulty in obtaining timely or economical water service from existing potential suppliers, or water quality or quantity problems.

Policy CI 11.12 Prior to approval of new development, ensure that adequate and reliable water supplies and conveyance systems will be available to support the development, consistent with coordination between land use planning and water system planning.

3.8.2.3 IMPACTS AND MITIGATION MEASURES

STANDARDS OF SIGNIFICANCE

Based on Appendix G of the CEQA Guidelines, a water supply impact is considered significant if project implementation would result in the following:

1) Have insufficient water supplies available to serve the project from existing entitlements and resources requiring new or expanded entitlements.

The NOP/IS prepared for the proposed project (see **EIR Appendix A**) concluded that the project would not require or result in the construction of new water treatment facilities or the expansion of existing facilities, and no impact would occur related to this issue. Therefore, this issue is not addressed further in this section.

METHODOLOGY

The following analysis is based on a Water Supply Assessment prepared for the proposed project by Lilburn Corporation in June 2013 (see **EIR Appendix H**).

IMPACTS AND MITIGATION MEASURES

Adequate Water Supply (Standard of Significance 1)

Impact 3.8.2.1 The proposed project would increase the mining operation's total demand for groundwater but would not exceed existing entitlements. This impact would be **less than significant**.

The proposed project would require additional water supply for dust control and limited irrigation for establishing revegetation areas. At completion, the proposed project would generate a maximum water demand totaling an estimated 2.25 acre-feet per year over existing water use. This estimate is based on historic water use records compared to proposed quarry production. The use of magnesium chloride on roads and other active mine areas and the occurrence of typically wet winter weather can contribute to a reduction in this maximum water demand during any given year.

The mining operation currently uses approximately 2.75 acre-feet of water annually for dust control at the quarries, overburden placement areas, haul roads, and at the crusher. Therefore, with implementation of the proposed project, the total demand at maximum production would

be approximately 5 acre-feet per year. All water supplied to the project would come from the existing two wells and infrastructure, and no new wells or infrastructure would be needed to supply future water to the project site.

Omya's FPA under the Mojave Basin adjudication, for both of its mining operations, is currently 19 acre-feet per year. The average annual production from Omya's two wells during the five-year period of 2007/08 to 2011/12 was 13.8 acre-feet. This indicates an average annual FPA surplus of approximately 5 acre-feet per year, which is sufficient to accommodate the proposed project's projected demand increase of 2.25 acre-feet per year.

The WSA concluded the analyses presented in the 2010 UWMP show that the MWA has adequate supplies to meet demands during average, single-dry, and multiple-dry years throughout the 20-year planning period of the UWMP. In the event water supplies become limited, Omya could maintain a limitation on its water use to be equivalent or less than 65 percent of its BPA (or 14.95 acre-feet). Under current projections, this limitation on water use would not require the implementation of conservation measures (**EIR Appendix H**, Lilburn Corporation 2013, p. 13).

Therefore, Omya has sufficient water supplies available to serve the proposed project from existing entitlements under the Mojave Basin adjudication, and no new or expanded entitlements are required. This impact would be **less than significant**.

The reader is referred to Section 3.7, Hydrology and Water Quality, as well as Section 3.9 Environmental Effects Determined Not to be Significant, for an analysis of the proposed project's potential impacts on groundwater supplies.

Mitigation Measures

None required.

As discussed in Chapter 1.0, Introduction, the County prepared a Notice of Preparation (NOP) for the proposed project on June 10, 2013. As part of the NOP, an Initial Study (IS) was prepared providing a preliminary analysis of the proposed project's potential environmental effects. The IS concluded that the proposed project would have no impact or a less than significant impact on numerous issue areas and these issues would not require further evaluation in the EIR. The following is a summary of these issue areas and the analysis contained in the IS. While there were issue areas resulting in less than significant impacts on biological resources and cultural resources, these issues were further discussed in this DEIR and therefore are not included in the summary below. The complete NOP and responses by interested parties are presented in **EIR Appendix A**.

3.9.1 AESTHETICS

The reader is referred to Section 3.1, Aesthetics, for a discussion of the project's potentially significant impacts on aesthetics that were identified in the IS for the proposed project. The IS for the project identified the following issue areas as having no impact on aesthetics:

Issue Area b) **Damage Scenic Resources Within a State Scenic Highway**. The proposed project would not be located in an area with a designated state scenic highway. This would result in **no impact**.

In San Bernardino County, several state highways (State Routes 2, 18, 40, 58, 91, 142, 138, 173, 189, 247, and 330) and one interstate highway (I-15) are listed as eligible state scenic highways (Caltrans 2013). However, these highways have not been officially designated as scenic highways at this time. One section of State Route (SR) 38, below Big Bear Lake, is a designated state scenic highway. This section of highway is approximately 14 miles from the proposed project site, and because of the intervening mountains, the project site cannot be seen from SR 38. The proposed project would not be visible from highways designated by the State of California as a scenic route. SR 18 is located approximately 6 miles north and east of the project site; however, it is not designated as a scenic route. There would be no impact.

Issue Area d) **Create Light or Glare.** The proposed project would not create new sources of nighttime light or daytime glare. The project would have **no impact** in this area.

The proposed project is an expansion of an existing use. This expansion does not propose the construction of new buildings or increase the operating hours of the existing site beyond those already in use. All lighting sources would be similar to existing uses, and no new light sources are proposed. As such, the proposed project would not create a new source of substantial light or glare that would adversely affect day or nighttime views in the area. There would be no impact.

3.9.2 AGRICULTURE AND FORESTRY RESOURCES

The IS for the project identified the following issue areas as having no impact on agriculture and forestry resources:

Issue Area a, e) **Conversion of Farmland to Nonagricultural Uses.** The proposed project would not be located in an area with existing agricultural uses or in an area identified as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance. Therefore, the project would have **no impact** in this area.

The California Resources Agency, Department of Conservation, defines Prime Farmland, Unique Farmland, and Farmland of Statewide Importance for San Bernardino County as farmlands that include dryland grains of wheat, barley, and oats, and dryland pasture. The project site does not meet these characteristics.

The project site is located on the steep northern slopes of the San Bernardino Mountains, where both the topography and the soils are unsuitable for agriculture. The project site is not zoned for agricultural use and is not designated as Prime Farmland, Unique Farmland, or Farmland of Statewide Importance on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the Department of Conservation (DOC 2013). The proposed project would have no impact on Prime Farmland, Unique Farmland, or Farmland of Statewide Importance. Therefore, the project would have no impact in this area.

Issue Area b) **Conflict with Agricultural Zoning or a Williamson Act Contract.** The project site is not located on or adjacent to areas under Williamson Act contracts or identified as agriculture in the County's Zoning Ordinance. Therefore, the project would have **no impact** in this area.

The project site is located on land zoned as RC (Resource Conservation) with the overlay zones of BR (Biotic Resources), FS-1 (Fire Safety Overlay), AR-4 (Airport Safety Overlay), and GH (Geologic Hazard Overlay – Earthquake Fault Zone). The project site is not zoned for agricultural use and is not subject to a Williamson Act contract. The proposed project would not result in conflicts with agricultural zoning or Williamson Act lands. Therefore, the project would result in no impact in this area.

Issue Area c, d) **Convert Forestland or Conflict with Forest or Timber Land Zoning.** The project site is in the semi-desert of the Mojave Desert ecological region, not within an area considered "forested." The project site is not located on or adjacent to areas identified as forest or timber land in the County's Zoning Ordinance. Therefore, the project would have **no impact** in this area.

The project site is located within the Mojave Desert ecological section of the American Semi-Desert and Desert ecological province. The site comprises a mix of urban/barren land uses, along with natural community types. Uses associated with the urban/barren areas include roads and areas affected by the mining operation. The remainder of the site consists of a mix of desert scrub, juniper, mixed chaparral, montane chaparral, pinyon-juniper community types, and desert wash. The project site does not contain any forested land. As previously stated, the zoning on the site is RC, and the site is not zoned as forestland or timberland. As such, the proposed project would have no impact.

3.9.3 AIR QUALITY

The reader is referred to Section 3.2, Air Quality, for a discussion of the project's potentially significant impacts on air quality that were identified in the IS for the proposed project. The IS for the project identified the following air quality issue area as having no impact:

Issue Area e) **Create Objectionable Odors Affecting a Substantial Number of People.** The project uses diesel trucks, which may produce objectionable odors. However, the site is over 2 miles from the nearest residence and is not surrounded by a substantial number of persons. Therefore, the project would have **no impact** in this issue area.

The nearest residence to the project site is located approximately 2 miles northeast of the site and approximately 0.5 mile north of the haul road. The closest residential community is approximately 3 miles from the site and 1.25 miles from the off-site haul road. While the project would continue to use diesel trucks and other equipment to process and haul the material, because of the distances to the residences, persons would not be impacted by the odor of diesel fumes. The proposed project would not produce any objectionable odors that would affect a substantial number of people.

3.9.4 GEOLOGY AND SOILS

The reader is referred to Section 3.5, Geology and Soils, for a discussion of geologic and soils-related potentially significant impacts that were identified in the IS for the proposed project. The IS for the project identified the following geology and soils issue areas as having no impact:

Issue Area d) **Expansive Soils.** The project site is not located in an area that has been identified by the County Building and Safety Geologist as having the potential for expansive soils. There would be **no impact**.

Expansive soils, or those soils with high expandable clay contents, can, over time, misalign some foundation structures or warp asphalt and concrete pavement. The project site is underlain by rocky and gravelly soils with a low shrink-swell potential. The final reclamation would result in the dismantling, removal, and off-site transport of all structures in the mine area. Thus, risks to life or property with respect to expansive soil, if present, would remain unchanged from baseline conditions for as long as existing structures remain on-site, and would be eliminated following final reclamation when structures are removed. For this reason, the presence of expansive soil is not considered an issue for the project, and no impact would result.

Issue Area e) **Soils Incapable of Adequately Supporting Septic Tanks or Wastewater Disposal Systems.** The proposed project would not use septic tanks or alternative wastewater systems. Therefore, there would be **no impact** in this issue area.

The proposed project does not include the construction of septic tanks and/or alternative wastewater disposal systems. All existing wastewater disposal systems would remain as they currently exist.

3.9.5 HAZARDS AND HAZARDOUS MATERIALS

The IS for the project identified the following issue areas as having a less than significant or no impact resulting from the use of hazards or hazardous materials:

Issue Area a, b) **Create Public Hazard Through Transport, Use, Disposal, or Release of Hazardous Materials.** The project would continue to comply with all applicable federal and state safety rules and regulations regarding hazardous materials. Therefore, this is considered a **less than significant** impact.

The potential for the proposed project to create a hazard to the public or the environment does exist, as the project would involve the transport, storage, and use of fuels, lubricants, and explosives. However, as required, the operator would continue to comply with all applicable federal and state safety rules and regulations regarding hazardous materials.

Waste oil generated at the mine site is collected and transported for off-site disposal by approved methods and by properly trained and licensed personnel. No processing chemicals are used and no wastewater is produced from the mining and crushing operations. Blasting occurs approximately once every other month and would not be increased with the proposed project. However, blasting would occur for the extended life of the mine through 2055. Blasting operations would continue to be conducted by licensed individuals in such a manner as to meet or exceed Mine Safety and Health Administration (MSHA) and California Division of Occupational Safety and Health (Cal-OSHA) requirements. Further, the closest residence is located over 2 miles north of the project site, and one or more major mountain ridges are present between the quarries and residences to the south. Blasting has occurred for over 25 years with no adverse impact on people, structures, or wildlife. Based on the current measures in place, it is anticipated that impacts would be less than significant.

Issue Area c) **Emit of Handle Hazardous Materials Near a School.** There are no existing schools located near the project site. There would be **no impact** in this issue area.

The project site is located in an area with no urban-type development. No existing school facilities or proposed school facilities are located within a quarter-mile radius of the project site. The closest schools include North Shore Elementary, located approximately 6 miles southeast of the project site in Big Bear Lake, and Lucerne Valley Middle School located approximately 6 miles northeast of the project site. There would be no impact on nearby schools.

Issue Area d) **Located on a Site That Is Listed as a Hazardous Materials Site.** The project site is not identified on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5. There would be **no impact**.

The State of California Hazardous Waste and Substances Site List (also known as the Cortese List) is a planning document used by state and local agencies and by private developers to comply with California Environmental Quality Act (CEQA) requirements in providing information about the location of hazardous materials sites. Under Government Code Section 65962.5, both the Department of Toxic Substances Control (DTSC) and the State Water Resources Control Board (SWRCB) are required to maintain lists of sites known to have hazardous substances present in the environment. Both agencies maintain up-to-date lists on their websites. A search of the DTSC and SWRCB lists identifies no hazardous waste violations in the project area and does not identify any hazardous material sites at or within 6 miles of the project site. Therefore, the project site is not on a parcel included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 (DTSC 2013; SWRCB 2013).

Issue Area e, f) **Create Public Hazard Related to Public or Private Airport Operations.** The proposed project does not include the construction of new buildings, merely the expansion of existing quarry areas. Therefore, the project would have **no impact** in this issue area.

As shown on San Bernardino County General Plan Hazards Overlay Maps FI09B and FH16B, the project site occurs within Airport Safety Review Area 4 (AR4). According to County Development Code Section 82.09.030, Airport Safety, AR4 includes the low-altitude/high-speed corridors designated for military aircraft use. The closest public/private airports include Big Bear City Airport, located approximately 8 miles southeast of the site, and Rabbit Ranch Airport in Lucerne Valley, approximately 4 miles north of the site. As no new human-occupied structures are proposed, potentially significant impacts are not anticipated. In addition, existing and proposed operations do not exceed height limits that could potentially impact military aircraft flight

patterns. No impact would occur. The project site is not in the vicinity or approach/departure flight path of a private airstrip. No impacts related to a private airstrip would occur.

Issue Area g) **Interfere with an Adopted Emergency Response or Evacuation Plan.** The project site is not located in an area that would interfere with an emergency response or evacuation plan. The proposed project is the expansion of an existing limestone quarry and would have **no impact** on an emergency response or evacuation plan.

The Office of Emergency Services (County OES) is a Division of the San Bernardino County Fire Department. County OES is responsible for disaster planning and emergency management coordination throughout the San Bernardino County Operational Area) by functioning as the lead agency for the Operational Area. County OES is also responsible for development and implementation of the Operational Area Emergency Operations Plan (EOP). The EOP identifies hazards and response, roles and responsibilities, and other key activities of government during a disaster.

The project is located in a remote part of San Bernardino County with no urban areas within 3 miles of the project site. The project site is reached by a roadway that only serves the project and is not used by the public. The roadway would not be used as a public evacuation roadway in the event of a disaster. Therefore, the proposed project would have no impact in this issue area.

Issue Area h) **Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Wildland Fires.** The proposed project is the expansion of an existing quarry, which has been in operation since 1986. Expansion of the quarry would not expose person or structures to wildland fires over existing conditions. Therefore, the project would have a **less than significant** impact in this issue area.

According to San Bernardino County General Plan Maps FI09B and FH16B, the project site is located in Fire Safety Review Area (FS-1), which includes areas in the mountains and the valley foothills. It also includes all the land generally within the San Bernardino National Forest boundary and is characterized by areas with moderate and steep terrain and moderate to heavy fuel loading contributing to high fire hazard conditions. The project site includes internal haul/access roads to allow for emergency egress and safety zones in the event of a wildfire. The proposed project would not contribute to or be impacted by surrounding fuel loads, and a fuel modification zone would not be required. Further, no new human-occupied structures are proposed as part of the project. Therefore, this impact would be less than significant.

3.9.6 HYDROLOGY AND WATER QUALITY

The reader is referred to Section 3.7, Hydrology and Water Quality, for a discussion of the project's potentially significant impacts on hydrology and water quality. The IS for the project identified the following hydrology or water quality issue areas as having a less than significant or no impact as a result of implementation of the project:

Issue Area b) **Deplete Groundwater Supplies or Interfere with Recharge.** The proposed project would not substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level. This would result in a **less than significant** impact.

The existing quarry operation utilizes a relatively small amount of water during operations. Approximately 2.75 acre-feet of water is used annually for dust suppression in the quarries, overburden placement areas, haul/access roads, and at the crusher site. With implementation of the proposed project, water usage is expected to increase to approximately 5 acre-feet per year. All water utilized for quarry operations is obtained from two previously permitted sources: (1) a well located at the plant site in Lucerne Valley and (2) a well located in Crystal Creek Canyon near Turnout 5 on the Crystal Creek Haul Road. These water sources would be used to meet water demands of the proposed operations. Bottled drinking water for mine employees is brought to the site as necessary.

The project site is not within the service area of a public water supplier, but it is within the boundaries of the Mojave Water Agency (MWA). The MWA is a State Water Project contractor, a regional groundwater management agency, and serves as Watermaster for the adjudicated Mojave Basin. The MWA published its Eighteenth Annual Report for the 2012–11 Water Year on May 1, 2012. The report summarizes information required by the judgment and includes a summary of the Watermaster's activities and water supply conditions for the water year. Omya has a verified base annual production allocation of 23 acre-feet per year for its two wells, and water usage over the past five years (2007 through 2011) has been 19, 14, 14, and 14 acre-feet per year (respectively).[1] Approximately 2.75 acre-feet of this annual water usage is used for dust suppression at the project site. The expected increase of water usage for the proposed project of 2.25 acre-feet per year would not exceed Omya's base allocation, even considering the higher usage amount in 2007 of 10 acre-feet per year and other planned projects in the area. Therefore, this impact would be less than significant.

Issue Area g, h) **Place Housing Within a Flood Hazard Area or Impede or Redirect Flood Flows.** The proposed project is not located in an area subject to flooding. There would be **no impact** in this issue area.

The project site is located on FEMA Map Panel 06071C7275H. The project site is not within a 100-year flood hazard area. The project does not include the construction of housing nor would it place housing within a floodplain. There would be no impact.

Issue Area i) **Create a Public Hazard Related to Flooding from Dam or Levee Failure.** The project site is not located in an area identified as a potential dam inundation area. There would be **no impact** in this issue area.

The project site is at an elevation of approximately 5,350 feet amsl, while the valley floor is at an elevation of approximately 4,050 feet (Google Earth 2013). In order for flooding due to dam failure to occur at the project site, the water would have to rise approximately 1,300 feet. There are no large water bodies in the vicinity that could potentially flood the project site due to dam failure. The project site and surrounding area are not located inside a designated dam failure inundation area. Further, there are no levees in the project area, and no levees are proposed as part of the project. There would be no impact.

[1] Subsequent to completion of the WSA in June 2013 and after the NOP/IS was released for public review in June 2013, the MWA published its Twentieth Annual Report of the Mojave Basin for Water Year 2012-2013, dated May 1, 2014 (MWA 2014). The Twentieth Annual Report presents the most current available information about conditions in the Este Subarea as of the publication date of this EIR. A review of the data in the Twentieth Annual Report indicates similar conditions to those in the Nineteenth Annual Report for the Este Subarea, including Omya's water use, and no substantial differences were identified that would affect the IS's conclusions regarding groundwater supplies.

Issue Area j) **Create a Public Hazard Related to Inundation by Seiche, Tsunami, or Mudflow.** The project site is not located in an area identified as having the potential for tsunami or seiche. While theoretically mudflows could occur at the site, the possibility is remote that these mudflows would create a public hazard. There would be **no impact** in this issue area.

A seiche is an oscillating surface wave in a restricted or enclosed body of water generated by ground motion, usually during an earthquake. Inundation from a seiche can occur if the wave overflows a containment wall or the banks of a water body. A tsunami is a large, often destructive, sea wave produced by a submarine earthquake, subsidence, or volcanic eruption. Mudflow is a downhill movement of soft wet earth and debris, made fluid by rain or melted snow and often building up great speed. The project site is not located adjacent to a body of water that has the potential for seiche or tsunami. Mudflow has the potential to occur at the site; however, the average precipitation in the wettest months (January and February) is only 2.53 and 2.55 inches (WRCC 2006) making this potential remote. Additionally, the site is not open to the public, which removes the possibility as a public hazard. There would be no impact.

3.9.7 LAND USE AND PLANNING

The potential for the project to conflict with Carbonate Habitat Management Strategy, a habitat conservation plan for carbonate soil types, is discussed in Section 3.3, Biological Resources, of this DEIR. The IS for the project identified the following land use and planning issue areas as having no impact as a result of implementation of the project:

Issue Area a) **Physically Divide an Established Community.** The site is not located in an established community. There would be **no impact** in this issue area.

The project site is surrounded by vacant open space, with the closest community, Lucerne Valley, located approximately 6 miles to the north. Further, the proposed project is an expansion of an existing use and would be consistent with the County General Plan land use designation for the site. Therefore, the proposed project would not result in the division of an established community. There would be no impact.

Issue Area b) **Conflict with Land Use Plan, Policy, or Regulation.** The proposed project would not conflict with any land use plan, policy, or regulation. **No impact** would result in this issue area with implementation of the project.

The project site is located on land zoned as RC (Resource Conservation) with the overlay zones of BR (Biotic Resources), FS-1 (Fire Safety Overlay), AR-4 (Airport Safety Overlay), and GH (Geologic Hazard Overlay – Earthquake Fault Zone). The proposed project is an expansion in size of an existing, previously approved use. The proposed project would be consistent with all applicable land use designation policies and regulations of the County of San Bernardino General Plan. No other land use plans, policies or regulations are applicable. There would be no impact.

3.9.8 MINERAL RESOURCES

The IS for the project identified the following mineral resource areas as having no impact as a result of implementation of the project:

Issue Area a, b) **Result in the Loss of Availability of a Mineral Resource or Mineral Resource Recovery Site.** The proposed project is the expansion in size of an existing project for the extraction of a mineral resource. There would not be a loss of availability of this resource due to implementation of the proposed project. Therefore, the proposed project would have **no impact** on mineral resources.

A mineral resource or mineral resource recovery site is considered lost if development of the land by urban uses prohibits the ability to extract that resource. The primary goal in evaluating a land use that does not include mineral extraction activities is to ensure that the mineral potential of land is recognized and that decision-makers do not preclude the conservation, potential for development, and use of the valuable mineral resource. Regulation and reclamation of the project site as required by SMARA would permit the continued availability of the mineral resources and provide for the protection and subsequent beneficial use of those mineral resources while minimizing impacts on the public and the environment. There would be no impact.

3.9.9 NOISE

The IS for the project identified the following noise issue areas as having a less than significant impact or no impact as a result of implementation of the project:

Issue Area a, c, d) **Generate Excessive Noise Levels/Temporarily or Permanently Increase Ambient Noise Levels.** The proposed project is the expansion in size and time of an existing use. This expansion would not decrease distances to the closest population centers. The project would result in a **less than significant** impact related to noise levels.

County Code Section 83.01.080 discusses San Bernardino County's performance standards related to noise. The proposed project operations are required to comply with all applicable County noise control regulations. The active quarry is located near the base of the range in the central portion of the San Bernardino Mountains. The closest residence is located over 2 miles north of the quarries, and one or more major mountain ridges are present between the quarries and residences to the south. Blasting occurs on the project site once per week and is restricted to daylight hours. Operations and blasting are not currently audible to any residential areas and have occurred for over 25 years with no adverse impact on people, structures, or wildlife. No changes are proposed from the existing permitted arrangements. These impacts would be less than significant.

Issue Area b) **Generate Excessive Groundborne Vibration or Noise.** The proposed project is the expansion in size and extended duration of an existing use. This expansion would not decrease distances to the closest population centers. The project would result in a **less than significant** impact related to excessive groundborne vibration or noise levels.

Blasting occurs on the project site once per week and is restricted to daylight hours. Further, blasts in the Omya quarries are relatively small to maximize selectivity. The site is located near the base of the range in the central portion of San Bernardino Mountains. There are no residences or other sensitive receptors within 2 miles of the site, and one or more major mountain ridges are present between the quarries and residences to the south. Operations and blasting cannot be seen, heard, or felt in any residential areas or by other sensitive receptors. No changes are proposed from the existing permitted operations. This impact would be less than significant. The potential effects of blasting noise and vibration on wildlife are discussed further in Section 3.3, Biological Resources, of this DEIR.

Issue Area e, f) **Expose People to Excessive Noise Levels Associated with Public or Private Airport Operations.** There is not a public or private airport within 2 miles of the project site. Implementation of the proposed project would not expose persons to excessive airport noise. Therefore, the project would have **no impact** in this issue area.

As shown on San Bernardino County General Plan Hazards Overlay Maps FI09B and FH16B, the project site occurs within Airport Safety Review Area 4 (AR4). According to County Development Code Section 82.09.030, Airport Safety, AR4 includes the low-altitude/high-speed corridors designated for military aircraft use. However, the proposed project does not include the development of residential uses that would be affected by low-flying military aircraft. The nearest public/private airports include Big Bear City Airport, located approximately 8 miles southeast of the site, and Rabbit Ranch Airport in Lucerne Valley, approximately 4 miles north of the site. The project site is well outside of the airport overfly zones and the airport 65 CNEL noise contours. This impact would be less than significant.

3.9.10 POPULATION AND HOUSING

The IS for the project identified the following population and housing issue areas as having no impact as a result of implementation of the project:

Issue Area a) **Directly or Indirectly Induce Substantial Population Growth**. The proposed project would not increase the number of residential units in the area nor does it propose a large increase in employment. Additionally, the project would not expand public utilities to the project site. Therefore, implementation of the project would have **no impact** in this issue area.

The proposed project would not directly stimulate population growth (e.g., it would not add housing or create a new business) nor would it indirectly stimulate growth (e.g., through the construction of new infrastructure). There would be no impact.

Issue Area b, c) **Displace Housing or People.** There are no existing residential units in the proposed expansion area. The project would have **no impact** in this issue area.

The proposed project would not displace substantial numbers of existing housing units or people or require the construction of replacement housing elsewhere because there are no residential units in the proposed expansion area and no housing units are proposed to be demolished. There would be no impact.

3.9.11 PUBLIC SERVICES

The IS for the project identified the following public services issue areas as having no impact as a result of implementation of the project:

Issue Area a) **Increase Demand for Public Services or Facilities.** The proposed project would not involve the increase of demand for fire, police, schools, parks, or other public services. Implementation of the project would have **no impact** in this issue area.

The proposed project would not result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities or the need for new or physically altered governmental facilities. Generally, an increase in demand for public services is based on population growth. Proposed operations would not result in a substantial change in employment or increased population, and therefore demand for services would not increase significantly. There would be no impact.

3.9.12 RECREATION

The IS for the project identified the following recreation issue areas as having no impact as a result of implementation of the project:

Issue Area a, b) **Increase Use of Existing Parks or Include Construction of New Parks**. The proposed project would not result in an increase in population or the demand for additional recreation facilities. The proposed project would have no impact in this issue area.

The proposed project does not include housing that could induce population growth in an adjacent area. Therefore, use of existing parks would not increase. Further, no new or expanded park facilities are proposed as part of the project. There would be no impact.

3.9.13 TRANSPORTATION AND TRAFFIC

The IS for the project identified the following transportation and traffic issue areas as having a less than significant or no impact as a result of implementation of the project:

Issue Area a, b) **Conflict with Circulation System Measures of Performance.** The proposed project operations would not substantially increase traffic on public roadways. This is considered a **less than significant** impact.

Existing and proposed operations include transporting crushed ore in off-road haul trucks approximately 5 miles northeast to the existing processing plant on a haul road that is not open to the public. Implementation of the proposed project would not increase haul truck trips to and from the project site, and the trips would continue to occur on public roadways and would not affect area traffic conditions. The proposed project would not increase worker trips to and from the project site. Trips are expected to be minimal and would not have a significant effect on area traffic conditions. These impacts would be less than significant.

Issue Area c) **Change Air Traffic Patterns.** The proposed project is not within a public or private airport overfly zone. The proposed project is the expansion of an existing facility and does not propose any new buildings. Therefore, implementation of the proposed project would have **no impact** in this issue area.

Implementation of the proposed project would not affect air traffic patterns at any airport or airstrip because there are none in the immediate vicinity and because the project does not involve the construction of any tall structures or other obstacles to air traffic and navigation.

Issue Area d) **Increase Hazards Due to a Design Feature or Incompatible Uses.** The project does not propose the construction of new public roadways. Therefore, implementation of the proposed project would have **no impact** in this issue area.

Existing and proposed operations at the project site would not affect public streets. The proposed project would not involve any road development or design features that could substantially increase hazards on a public road, or changes in the transportation of rock or other materials on public roads. The project site is surrounded by vacant Bureau of Land Management (BLM) land, and the proposed project is an expansion of an existing use. Therefore, no incompatible uses would occur. There would be no impact.

Issue Area e) **Result in Inadequate Emergency Access.** The proposed project would not involve the construction barriers that would impede the ability for emergency response. Therefore, implementation of the proposed project would have **no impact** in this issue area.

Activities associated with the proposed project would not impede existing emergency response plans for the project site and/or other land uses in the vicinity. All vehicles and stationary equipment would be staged off public roads and would not block emergency access routes. In addition, no road closures would be required with implementation of the project. There would be no impact.

Issue Area f) **Decrease Performance or Safety of Public Transit, Bicycle, or Pedestrian Facilities**. Implementation of the proposed project would not involve construction that would not involve any long-term increase of traffic that would interfere with alternative transportation. Therefore, implementation of the proposed project would have **no impact** in this issue area.

The proposed project is the expansion of an existing use. However, this expansion is not expected to substantially increase employment in the area or increase traffic to the project site. The proposed project would not involve any long-term increases in traffic that would conflict with adopted policies, plans, or programs supporting alternative transportation. There would be no impact.

3.9.14 UTILITIES AND SERVICE SYSTEMS

The IS for the project identified the following utilities and service systems issue areas as having no impact as a result of implementation of the project:

Issue Area a) **Exceed Wastewater Treatment Requirements.** The proposed project would not increase the amount of wastewater produced under existing conditions. Therefore, implementation of the proposed project would have **no impact** in this issue area.

No additional wastewater is or would be discharged from the on-site operations. Water applied to roads and active mining areas to reduce fugitive dust would evaporate. Control of surface drainage, erosion, and sedimentation from operations and the haul road are included in Omya's Stormwater Pollution Prevention Plan (SWPPP), which has been filed with the State Water Resources Control Board. Further, all operations on-site would comply with the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges associated with industrial activities and employ stormwater best management practices (BMPs). Because the project would not generate any wastewater and all surface drainage would be managed in compliance with an approved SWPPP, this impact would be less than significant.

Issue Area b) **Require New or Expanded Water or Wastewater Treatment Facilities.** The proposed project would not require the expansion or construction of new wastewater or water facilities. Therefore, implementation of the proposed project would have **no impact** in this issue area.

The proposed project's water demands would be met with the use of groundwater pumped from existing wells that serve the current mine operation, and no expansion of water treatment systems would be required. Further, the project would not generate any additional wastewater, and no new or expanded treatment facilities would be required. Water applied for dust abatement would evaporate and employees use on-site portable toilets.

Issue Area d) **Require New or Expanded Water Supply Entitlements.** The proposed project would use groundwater to minimize fugitive dust on the haul road. However, expansion of the site would not increase the use of this groundwater beyond the current allocation for the site. Therefore, implementation of the proposed project would have a **less than significant** impact in this issue area.

The project site is not within the service area of a public water supplier, but it is within the boundaries of the Mojave Water Agency (MWA). The MWA is a State Water Project contractor, a regional groundwater management agency, and serves as Watermaster for the adjudicated Mojave Basin. The MWA published its Eighteenth Annual Report for the 2012–11 Water Year on May 1, 2012. The report summarizes information required by the judgment and includes a summary of the Watermaster's activities and water supply conditions for the water year. Omya has a verified base annual production allocation of 23 acre-feet per year for its two wells, and water usage over the past five years (2007 through 2011) has been 19, 14, 14, and 14 acre-feet per year (respectively).[2] Approximately 2.75 acre-feet of this annual water usage is used for dust suppression at the project site. The expected increase of water usage for the proposed project of 2.25 acre-feet per year would not exceed Omya's base allocation, even considering the higher usage amount in 2007 of 10 acre-feet per year and other planned projects in the area. Therefore, this impact would be less than significant.

Water is obtained from two previously permitted sources: a well located at the plant site in Lucerne Valley and a well located in Crystal Creek Canyon near Turn 5 on the Crystal Creek haul road. No surface water is used in the operation. There are no planned additional diversions or storage for water supply. No treatment facilities would be needed. Water would be hauled in a water truck and sprayed on the haul roads and active mining and overburden areas to minimize fugitive dust. The water truck would work during active quarry operations as needed to control visible dust.

The proposed project would not substantially deplete water supplies or require new entitlements. Therefore, this impact would be less than significant.

[2] Subsequent to completion of the WSA in June 2013 and after the NOP/IS was released for public review in June 2013, the MWA published its Twentieth Annual Report of the Mojave Basin for Water Year 2012-2013, dated May 1, 2014 (MWA 2014). The Twentieth Annual Report presents the most current available information about conditions in the Este Subarea as of the publication date of this EIR. A review of the data in the Twentieth Annual Report indicates similar conditions to those in the Nineteenth Annual Report for the Este Subarea, including Omya's water use, and no substantial differences were identified that would affect the IS's conclusion regarding water supply.

Issue Area e) **Exceed Capacity of Wastewater Treatment Provider.** All wastewater produced as a result of implementation of the proposed project would be treated by existing resources. The project is not expected to increase the amount of wastewater. Therefore, implementation of the proposed project would have **no impact** in this issue area.

The project site is not served by a public sewer system, and the proposed project would not require sewer collection or treatment services. Therefore, no off-site discharge of treated wastewater would occur. No impacts related to wastewater treatment would occur.

Issue Area f, g) **Exceed Permitted Capacity of Landfill or Conflict with Solid Waste Regulations.** The proposed project would not increase the amount of solid waste coming from the project above existing conditions. Therefore, implementation of the proposed project would have **no impact** in this issue area.

The proposed project would not require any additional solid waste services, as no office operations would be expanded over existing levels. Waste rock would be stockpiled on-site. No impact would occur.

This section identifies the cumulative impacts associated with the proposed project as statutorily required by the California Environmental Quality Act (CEQA). Cumulative impacts expected from the project are the result of combining the potential effects of the project with other cumulative development anticipated by growth in the greater area. The following discussion considers the impacts of the relevant environmental areas using the information provided in the technical analyses in Sections 3.1 through 3.8 of this Draft EIR.

This section also discusses the long-term implications of the project as required by CEQA. The topics discussed include significant irreversible environmental changes/irretrievable commitment of resources, growth-inducing impacts, and significant and unavoidable environmental effects.

4.1 CUMULATIVE IMPACTS

INTRODUCTION

CEQA requires that an environmental impact report (EIR) contain an assessment of the cumulative impacts that could be associated with the proposed project. According to CEQA Guidelines Section 15130(a), "an EIR shall discuss cumulative impacts of a project when the project's incremental effect is cumulatively considerable." *Cumulatively considerable* means that the incremental effects of an individual project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (as defined by Section 15130). As defined in CEQA Guidelines Section 15355, a cumulative impact is an impact created as a result of the combination of the project evaluated in the EIR together with other projects causing related impacts. A cumulative impact occurs from:

> *. . . the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time.*

In addition, Section 15130(b) identifies the following elements as necessary for an adequate cumulative impact analysis:

> *1) Either:*
>
> *(A) A list of past, present, and probable future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the agency; or,*
>
> *(B) A summary of projections contained in an adopted general plan or related planning document, or in a prior environmental document which has been adopted or certified, which described or evaluated regional or area-wide conditions contributing to the cumulative impact. Any such planning document shall be referenced and made available to the public at a location specified by the lead agency.*
>
> *2) A definition of the geographic scope of the area affected by the cumulative effect and a reasonable explanation for the geographic limitation used;*

3) *A summary of the expected environmental effects to be produced by those projects with specific reference to additional information stating where that information is available; and*

4) *A reasonable analysis of the cumulative impacts of the relevant projects. An EIR shall examine reasonable, feasible options for mitigating or avoiding the project's contribution to any significant cumulative effects.*

Where a lead agency is examining a project with an incremental effect that is not cumulatively considerable, a lead agency need not consider that effect significant, but shall briefly describe its basis for concluding that the incremental effect is not cumulatively considerable.

This document uses a combination of the projection- and list-based approaches; together, the projections and projects analyzed are referred to as the "cumulative scenario."

APPROACH TO THE CUMULATIVE IMPACT ANALYSIS

The geographic scope of area and time horizon considered for each cumulative impact evaluated in the EIR is dictated by the specific type and nature of impact being considered. For example, when considering a project's incremental contribution to cumulative air quality criteria pollutants, the geographic scope of area is the air basin in which the project is located. In contrast, geology impacts are generally site-specific and limited to the physical footprint of a project site, and water quality impacts are considered within the watershed in which the project is located. Specific geographic and temporal scopes of cumulative effects consideration are identified on a resource-by-resource basis.

The general cumulative setting conditions considered in this Draft EIR are based on:

- **General Plans**. These are the existing land use plans that provide general growth patterns in the region, consisting of unincorporated San Bernardino County and the cities of San Bernardino, Victorville, Apple Valley, Hesperia, Big Bear Lake, Lake Arrowhead, Crestline, and Running Springs.

- **Large-Scale Surface Mining Projects**. This includes current large-scale proposed and approved surface mining projects in San Bernardino County Supervisorial District 1, which encompasses the project site (see **Table 3.0-1**) in Chapter 3.0, Introduction to the Environmental Analysis and Assumptions Used. It should be noted that this list is not intended to be all-inclusive of surface mining activities in the county, but rather a general description of current surface mining activities.

IMPACTS

Aesthetic and Visual Resources

Impact 4.0.1 Implementation of the proposed project, in combination with other reasonably foreseeable mining projects in San Bernardino County, would contribute to the alteration of the visual character of the San Bernardino Mountains. This is considered a **cumulatively considerable** and **significant and unavoidable** impact.

The cumulative setting for cultural resources includes those projects listed in **Table 3.0-1** along the north slope of the San Bernardino Mountains. Large-scale mining operations on the north slope of the San Bernardino Mountains have resulted in surface disturbances that are visible from much of Lucerne Valley. These disturbances are highly evident on the mountain slopes due to the generally light color of the limestone deposits in contrast to other mostly undisturbed steep slopes. The extent of the landscape alteration in the viewshed and the contrast between the linear-appearing mine features and the non-linear nature of the undisturbed areas also contribute to the landscape alteration. Limestone mines contribute a greater share of this impact due to the greater color contrast between mined and unmined areas and because of their position on the mountain slopes overlooking the valley. Due to their lower elevation and lesser color contrast, the aggregate mines are generally less visible to surrounding areas. Most of the existing mining operations are active, and final reclamation has been implemented on relatively small portions of the permitted mining areas. The mines are anticipated to operate for decades, and final reclamation will not be complete until several years after the completion of the last mining. While the existing disturbance is part of the environmental setting or baseline, additional surface disturbance is expected to occur as existing mining operations continue and as proposed new mines and mine expansions are approved and developed. This additional disturbance would have a cumulatively considerable impact on the visual resources in the region.

Changes to the visual character of the area from implementation of the proposed project are shown in **Figures 3.1-3** through **3.1-5**. As discussed under Impact 3.1.1, the proposed project would have a significant and unavoidable effect on the visual character and quality of the site and the surrounding scenic vistas provided by the San Bernardino Mountains. The only true mitigation to remove this impact would be the ceasing of all development. This, however, is not realistic. Feasible mitigation to lessen this impact is not possible. Therefore, the proposed project, along with the projects shown in **Table 3.0-1,** contributes to this cumulative impact and would result in a **cumulatively considerable** and **significant and unavoidable** impact.

Air Quality

Impact 4.0.2 Implementation of the proposed project, in combination with cumulative development in the Mojave Desert Air Basin (MDAB), would result in a cumulatively considerable net increase of criteria air pollutants for which the MDAB is designated nonattainment. This is considered a **less than cumulatively considerable** impact.

The cumulative setting for air quality is the Mojave Desert Air Basin, which is under the jurisdiction of the Mojave Desert Air Quality Management District (MDAQMD). The MDAB is an assemblage of mountain ranges interspersed with long broad valleys that often contain dry lakes. The western area of the MDAB where the project is located is designated as nonattainment for federal and state ozone standards as well as for federal and state PM_{10} standards.

Those projects listed in **Table 3.0-1** are considered in this air quality cumulative analysis. According to the MDAQMD, cumulative impacts are similar to direct and indirect impacts of the project, which the project contributes to. Therefore, a new mine project should be evaluated with all other mining projects, from the standpoint of each type of impact (cumulative construction emissions, diesel equipment emissions, blasting emissions, fugitive emissions, transportation, congestion, etc.). As shown in **Table 3.0-1,** there are at least 21 other mine-related projects proposed and/or approved in the county.

As discussed in Chapter 3.0, Project Description, Omya operates two other quarries in the area. These two quarries, the Sentinel and Butterfield Quarries, are located approximately 3 miles south of the processing plant on Crystal Creek Road. (The Sentinel and Butterfield Quarries are currently undergoing a separate CEQA evaluation for proposed expansion.) The air quality analysis for the proposed project is based on all production coming from the project. The combined production from all the operating quarries (Butterfield, Sentinel, and White Knob) is limited by the processing plant's maximum production rate capacity, which is 680,000 tons per year of finished ore. The project would not increase this capacity; however, if all production were to come from the proposed project site, operations at the Sentinel and Butterfield Quarries would cease, thereby eliminating air quality emissions from those sites, and actually decrease the potential air quality impacts.

Considering that the proposed project is the expansion in permitted area and extension of time to mine the area and that the project is an already existing quarry with its attributed existing air emissions and will not result in emissions above those described in Section 3.2, Air Quality, of this Draft EIR, which can be reduced to a less than significant impact, cumulative air quality impacts are considered minimal. Furthermore, as evaluated under **Impact 3.2.1**, the project would not exceed long-term operational standards and therefore would not violate air quality standards. In addition, the project conforms to all MDAQMD Attainment Plans, as it complies with all applicable district rules and regulations, complies with all proposed control measures from the applicable plans, and is consistent with the growth forecasts in the applicable plans.

For these reasons, the project would result in **less than cumulatively considerable** impacts.

Biological Resources

Impact 4.0.3 The proposed project in combination with other reasonably foreseeable projects could result in mortality and loss of habitat for special-status species, as well as biologically sensitive habitats. Therefore, this impact is considered **cumulatively considerable**.

The Project Study Area (PSA) and the surrounding area of San Bernardino County as a whole is considered the cumulative context for the purpose of evaluating land use conversion issues associated with biological resources on a cumulative level. In particular, this cumulative setting condition includes planned development under the current Land Use Element of the San Bernardino County General Plan, existing land use conditions, planned and proposed land uses in the vicinity of the PSA, as well as consideration of development patterns in the rest of San Bernardino County. These land uses and developments have the potential to adversely affect the biological resources in the region and could contribute to the loss of potential habitat.

The implementation of project-related activities would contribute incrementally to the cumulative loss of native plant communities, wildlife habitat values, special-status species and their potential habitat, and wetland/aquatic resources within San Bernardino County region. On a cumulative level, the change in land uses will contribute to a loss of potential habitat for special-status species including, but not limited to, rare plants, special-status wildlife, as well migratory birds and raptors that currently inhabit the area or could inhabit the area in the future. In addition to potential direct impacts on biological resources, project-related activities may also result in indirect impacts biological resources. Indirect impacts could disturb breeding and foraging behavior of wildlife, which would result in a significant and unavoidable cumulative impact. Another indirect impact would be stormwater runoff. Each project is required to participate in the NPDES permit program for stormwater runoff, which effectively reduces water quality impacts to below a level of significance. While project specific measures would be

undertaken to minimize direct and indirect effects to biological resources, the combined effect of all new development approved or planned in the area would create a significant and unavoidable cumulative impact.

The PSA has several biologically sensitive resources that could be impacted during future implementation of project-related activities. The mosaic of upland, aquatic, and riparian habitat types within the PSA provide suitable nesting, breeding, and foraging habitat for a variety of species including mule deer, bighorn sheep, golden eagles, desert tortoise, Mohave ground squirrel, coast horned lizards, Le Conte's thrasher, as well as a variety of other migratory birds and raptors.

The vegetation communities/habitats within the PSA represent only a small portion of the communities/habitats available for special-status species within the project vicinity. However, implementation of the proposed project may result in degradation of habitat through a variety of actions which, when combined with other habitat impacts occurring from mining activities within surrounding areas, would result in significant cumulative impacts. Future development in the vicinity of the PSA would have an unknown and unquantifiable impact on special-status species and biologically sensitive habitats. As project-related activities may contribute incrementally to these effects, the impact is considered **cumulatively considerable**.

Omya, along with other mining stakeholders on the North Slope, are actively participating in the SBNF Raptor Conservation Strategy as well as the Carbonate Habitat Management Strategy. The Raptor Conservation Strategy identifies monitoring objectives, schedules, and protocols; as well as measures to avoid, minimize, rectify, and reduce effects to nesting raptors along the North Slope. The Carbonate Habitat Management Strategy was developed to facilitate the preservation and recovery of Cushenbury buckwheat (*Eriogonum ovalifolium* var. *vineum*), Cushenbury milk-vetch (*Astragalus albens*), Cushenbury oxytheca (*Oxytheca parishii* var. *goodmaniana*), and Parish's daisy (*Erigeron parishii*); while at the same time providing a method for mining projects to obtain FESA compliance. The participation of Omya and other mining stakeholders in the region in the Raptor Conservation Strategy and the Carbonate Habitat Management Strategy will ensure that potential cumulative impacts from mining activities in the region will be mitigated to a **less than cumulatively considerable** level.

In addition, the mining stakeholders in the region would also be required analyze project impacts in accordance with CEQA Guidelines and develop appropriate avoidance, minimization, and mitigation measures to ensure project impacts would not result in substantial adverse impacts. Implementation of avoidance, minimization, and mitigation measures **MM 3.3.1a** through **MM 3.3.1i, MM 3.3.2, MM 3.3.3a** and **MM 3.3.3b, MM 3.3.4, MM 3.3.5, MM 3.3.6, MM 3.3.7, MM 3.3.9,** and **MM 3.3.10** will reduce potentially cumulative impacts to a **less than cumulatively considerable** level.

Cultural and Paleontological Resources

Impact 4.0.4 Implementation of the proposed project could result in the inadvertent disturbance of previously unknown cultural and/or paleontological resources, contributing to a cumulative impact on such resources in the region. This impact would be **less than cumulatively considerable**.

The cumulative setting for cultural resources includes those projects listed in **Table 3.0-1** along the north slope of the San Bernardino Mountains. As discussed in Impacts 3.4.1, 3.4.2, and 3.4.3 in Section 3.4, Cultural and Paleontological Resources, no evidence of significant archaeological, historical, or paleontological resources has been identified for the project site. However, there is

a possibility that previously unknown cultural and/or paleontological resources could be discovered during earthmoving and mining activities. In combination with other mining operations and other development along the north slope of the San Bernardino Mountains and in the surrounding area, such inadvertent discoveries could contribute to a cumulative impact on cultural and paleontological resources. However, implementation of mitigation measures **MM 3.4.1** and **MM 3.4.3**, as well as compliance with Section 5097.98 of the California Public Resources Code, Section 7050.5 of the California Health and Safety Code, and CEQA Section 15064.5(d) and (e), would ensure that any cultural and/or paleontological resources discovered during project activities would be analyzed to determine significance, and if necessary, appropriate mitigation would be implemented to ensure its protection. Therefore, the proposed project's contribution to this potential impact would be **less than cumulatively considerable**.

Geology and Soils

Impact 4.0.5 Implementation of the proposed project, along with other cumulative projects in the area, could result in cumulative geological, soils, or seismic impacts. This impact would be **less than cumulatively considerable**.

Much of California lies within a seismically active region with a wide range of geologic and soil conditions that can vary widely in a short distance; each site has unique conditions that influence susceptibility to these hazards. With respect to mining projects in particular, each mine is subject to the same general hazards and each operation is required to reduce potential hazards to acceptable levels, including compliance with mine safety programs administered by the Mine Safety and Health Administration (MSHA) and the Occupational Safety and Health Administration (OSHA). Thus, the cumulative context for potential impacts on people and structures related to geologic and seismic hazards is more localized or site-specific. In the case of the proposed project, the cumulative setting includes the White Knob Quarry, the Annex Quarry, the White Ridge Quarry, the haul road, and all other areas within the Amended Mine and Reclamation Plan. The temporal scope includes operation and reclamation of the project.

As analyzed in Section 3.5, Geology and Soils, the project would have no impacts related to being located on expansive soils or having soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems. The project would cause less than significant impacts related to exposing people or structures to potential substantial adverse effects (e.g., rupture of a known earthquake fault, strong seismic ground shaking, seismically induced ground failure, or landslides), erosion or loss of topsoil, or unstable geologic units or soil. Implementation of mitigation measure **MM 3.5.3** would reduce rock and soil talus impacts on the Western Drainage and Ruby Springs area to a less than significant level.

As a result of the geologic hazards evaluations and resultant procedures adopted by the project applicant, the potential to expose structures or people to seismic hazards is considered less than significant. Additionally, the proposed project's geological impacts are limited to the project site, which is mitigated by the provisions in the Amended Mine and Reclamation Plan, the County of San Bernardino Surface Mining and Reclamation Overlay, Chapter 88.03.000, and mitigation measure **MM 3.5.3** of this Draft EIR. Therefore, the project's incremental contribution to geology and soils would be **less than cumulatively considerable**.

Greenhouse Gas Emissions

Impact 4.0.6 Implementation of the proposed project is consistent with San Bernardino County's Greenhouse Gas Reduction Plan, the County's applicable plan adopted for the purpose of reducing the emissions of greenhouse gases. This impact is **less than cumulatively considerable.**

Because greenhouse gases and climate change have impacts on a global scale, the cumulative setting for greenhouse gas emissions would necessarily have to be all of planet earth. However, because it is virtually impossible to identify all pending, proposed, and future projects on the planet, this greenhouse gas emissions cumulative analysis is based on all areas within San Bernardino County. The County's Greenhouse Gas Reduction Plan identifies a path for achieving consistency with the Assembly Bill (AB) 32 GHG reduction goals, through the reduction of baseline emissions by 15 percent by 2020 (to 5,296,034 metric tons of carbon dioxide equivalents ($MTCO_2e$) for external emissions and to 256,712 $MTCO_2e$ for internal emissions).

The plan describes the reduction strategies currently being employed by the County, as well as those that will be employed by the County, through implementation of the reduction plan, and by the State, through a variety of legislation and regulations. The combination of existing reduction strategies and proposed new strategies identified in the County's Greenhouse Gas Reduction Plan will be assembled into an integrated plan to reduce the countywide greenhouse gas (GHG) emissions level. In addition, proposed new private developments will also contribute to GHG emissions reduction through the County's GHG development review process, AB 32 requirements, and other state initiatives.

The GHG emissions reduction measures identified in the Greenhouse Gas Reduction Plan include existing and proposed state, regional, county, and other local measures that would reduce GHG emissions from the county in both the internal and external categories. Reduction measures have been organized into a classification system that recognizes both the origin of the measures, i.e., state, regional, or local, and also whether the measure is quantifiable in terms of calculating a volume of emissions reduction. The emissions reduction measures are organized as follows for each sector:

- Reduction Class 1 (R1) includes adopted, implemented, and proposed state and regional measures that do not require additional County action and that will result in GHG reductions for the County's land use authority area and internal operations. These measures may require County action to achieve the GHG reductions, but that action is limited and compulsory.

- Reduction Class 2 (R2) includes measures currently implemented or in the process of implementation by the County, as well as any additional quantifiable measures that require County action and will further reduce the GHG emissions for the County's land use authority area and internal operations. R2 also includes any state and regional measures that require substantial action by the County to achieve the expected GHG reductions. These measures are specific, quantifiable measures as well as reductions achieved through the development review process.

  Measurable reductions of GHG emissions will be achieved through the County's development review process by applying appropriate reduction requirements as part of the discretionary approval of new development projects. Through the development review process, the County will implement CEQA, requiring new development projects to quantify project GHG emissions and adopt feasible mitigation to reduce project

emissions below a level of significance. The CEQA process for evaluating GHG impacts and determining significance will be streamlined as follows:

a) County Performance Standards. All development projects, including those otherwise determined to be exempt from CEQA, are subject to applicable Development Code provisions, including the GHG performance standards, and state requirements, such as the California Building Code requirements for energy efficiency. With the application of the GHG performance standards, projects that are exempt from CEQA and small projects that do not exceed 3,000 $MTCO_2e$ per year are considered to be consistent with the plan and determined to have a less than significant individual and cumulative impact for GHG emissions.

b) Regulatory Agency Performance Standards. When, and if, the South Coast Air Quality Management District or Mojave Basin Air Quality Management District adopts standards, the County will consider such guidance and incorporate all applicable standards.

c) Projects Using Screening Table. For projects exceeding 3,000 $MTCO_2e$ per year of GHG emissions, the County uses Screening Tables as a tool to assist with calculating GHG reduction measures and the determination of a significance finding. Projects that garner 100 or greater points would not require quantification of project-specific GHG emissions. The point system was devised to ensure project compliance with the reduction measures in the GHG Plan such that the GHG emissions from new development, when considered together with those of existing development, allow the County to meet its 2020 target and support reductions in GHG emissions beyond 2020. Consistent with the CEQA Guidelines, such projects are consistent with the plan and therefore have a less than significant individual and cumulative impact for GHG emissions.

d) Projects Not Using Screening Tables. Projects exceeding 3,000 $MTCO_2e$ of GHG emissions that do not use the Screening Tables are required to quantify project-specific GHG emissions and achieve the equivalent level of GHG emissions efficiency as a 100-point project. Consistent with the CEQA Guidelines, such projects are consistent with the plan and therefore are determined to have a less than significant individual and cumulative impact for GHG emissions.

- Reduction Class 3 (R3) includes additional measures that were not used to demonstrate achievement of the proposed County's 2020 GHG emissions reduction target. For these measures, emissions reductions have either not been quantified due to a lack of available data or protocols required for quantification or because of uncertainty regarding the County's jurisdictional control over relevant emissions sources. Some of these measures are quantifiable but require additional refinement and are therefore not included in R1 or R2.

As noted in the Greenhouse Gas Reduction Plan's discussion of Reduction Class 2 (R2), by meeting San Bernardino County's "applicable Development Code provisions including the GHG performance standards, and state requirements, such as the California Building Code requirements for energy efficiency," projects that are exempt from CEQA and small projects that do not exceed 3,000 $MTCO_2e$ per year are considered to be consistent with the plan and determined to have a less than significant individual and cumulative impact for GHG emissions. The proposed project will not exceed 3,000 $MTCO_2e$ per year. It is therefore consistent with the applicable plans and policies adopted for the purpose for reducing GHG emissions and will result in a **less than cumulatively considerable** impact.

Hydrology and Water Quality

Impact 4.0.7 Implementation of the proposed project, as well as other projects in the area, could result in a cumulative impact on hydrology and water quality through alteration of the existing drainage pattern, increasing the potential for erosion and sedimentation. This impact would be **less than cumulatively considerable**.

The cumulative setting for the proposed project hydrology and water quality impacts is the Western Drainage and Ruby Springs watershed area for surface water impacts and the Lucerne Valley Groundwater Basin for groundwater impacts.

Three main drainages cross the White Knob/White Limestone Ridge Quarries area. On-site surface water flow occurs in response to precipitation only (ephemeral flow), flowing northeastward from the crest of the White Mountains downward through the White Knob/White Ridge Quarries area into the nearby Rabbit (dry) Lake-Lucerne Valley depression. No springs or perennial streams occur within the White Knob/White Ridge Limestone Quarries area. Several watersheds drain surface water away from or through the White Knob Quarry area. Erosion and sedimentation in these drainages, as well as impacts on other drainages within the Lucerne Valley watershed that may occur due to development identified in **Table 3.0-1**, would have an adverse cumulative impact if not mitigated to a less than significant level.

As analyzed in Section 3.7, Hydrology and Water Quality, the project would have no impacts related to flooding or inundation by seiche, tsunami, or mudflow. The project would cause less than significant impacts related to violating water quality standards and the depletion of groundwater. Implementation of mitigation measure **MM 3.7.1** would offset the project's potential erosion, sediment, and flow impacts on the area drainages to a less than significant level.

The only existing surface water body located on adjacent to or near the project site is Ruby Springs. With the exception of the proposed project, there are no closely related past, present, or reasonably foreseeable or probable future projects upgradient of Ruby Springs or within the surface drainage that will be affected by the project. However, other projects may impact the Lucerne Valley watershed. Implementation of mitigation measure **MM 3.7.1** would offset the project's potential for water quality and flow impacts due to erosion and sedimentation.

The Lucerne Valley Groundwater Basin is approximately 230 square miles in area or 148,000 acres. The project will disturb 191 acres in this watershed, or 0.13 percent of the area. The 191 acres to be disturbed by the project occur entirely within ephemeral drainage areas. While other projects listed in **Table 3.0-1** may or may not impact the Lucerne Valley Groundwater Basin, the proposed project would not.

Therefore, impacts related to hydrology and water quality would be **less than cumulatively considerable**.

Public Services and Utilities

Impact 4.0.8 Implementation of the proposed project would not result in cumulative impact on storm drainage or water services, as the project provides its own water and stormwater drainage. This impact would be **less than cumulatively considerable**.

The cumulative setting for water supply is the adjudicated Mojave Basin, and for stormwater drainage services it is the project site. The proposed project does not result in the need for additional services from public water or stormwater drainage agencies. The Mojave Basin has been the subject of adjudication to determine the water rights of the various producers. The final judgment for the Mojave Basin was entered in 1996 adopting the physical solution set forth in the Stipulated Judgment. The purpose of the Stipulated Judgment was to create incentives to conserve local water, guarantee that downstream producers will not be adversely affected by upstream producers, and assess producers to obtain funding for the purchase of imported water. The project, which is included in this judgment, provides its own water from two existing wells and will not exceed their permitted groundwater allocation with expansion of the project.

All stormwater facilities are provided by the project, and these facilities would not connect to a public storm drain system. Implementation of the proposed project would not result in the need for additional public water and storm drainage facilities. As such, the proposed project would have a **less than cumulatively considerable** impact in these areas.

4.2 SIGNIFICANT UNAVOIDABLE IMPACTS

CEQA Section 21100(b)(2)(A) requires an EIR to identify significant environmental effects that cannot be avoided if a project is implemented. Most of the impacts of the project either would be less than significant or would be mitigated to a less than significant level. The impacts below are those that would remain significant and unavoidable after mitigation.

Aesthetics Impact 3.1 Substantial Adverse Effect on a Scenic Vista and the Existing Visual Character

Implementation of the proposed project could have a substantial effect on a scenic vista. The project design and proposed reclamation activities would minimize this effect. However, the overall visual impacts are still considered unavoidable significant impacts consistent with the 1986 EIR. Therefore, this impact would be **significant and unavoidable**.

Aesthetics Impact 4.1 Cumulative Impact on Aesthetics and Visual Resources

Implementation of the proposed project, in combination with other reasonably foreseeable mining projects in San Bernardino County, would contribute to the alteration of the visual character of the San Bernardino Mountains. There are no feasible mitigations to reduce this impact. Therefore, this is considered a **cumulatively considerable** and **significant and unavoidable** impact.

4.3 GROWTH-INDUCING IMPACTS

CEQA Section 15126.2(d) discusses the requirements for identifying growth-inducing impacts of a proposed project. Section 15126.2(d) reads as follows:

> *Growth-Inducing Impact of the Proposed Project. Discuss the ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Included in this are projects which would remove obstacles to population growth (a major expansion of a waste water treatment plant might, for example, allow for more construction in service areas). Increases in the population may tax existing community service facilities, requiring construction of new facilities that could cause significant environmental effects. Also discuss the characteristic of some projects which may encourage and facilitate other activities that could significantly affect the environment, either individually or*

> *cumulatively. It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment.*

The White Knob Quarry has been in operation since 1987. The proposed project is for the expansion of area and extension of time for the operation of the White Knob/White Ridge Quarries. This mine and reclamation plan does not include the development of any residential units or the extension of public utility services to serve the project. Implementation of the proposed project would not create a substantial amount of new employment resulting in a demand for new services or new housing units elsewhere. Therefore, adoption of the Amended White Knob/White Ridge Mine and Reclamation Plan would not result in any growth-inducing impacts.

4.4 SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES

INTRODUCTION

Public Resources Code Section 21100(b)(2), a part of CEQA, requires that EIRs prepared for the adoption of a plan, policy, or ordinance of a public agency include a discussion of significant irreversible environmental changes of project implementation. In addition, CEQA Guidelines Section 15126.2(c) describes irreversible environmental changes as follows:

> *Uses of nonrenewable resources during the initial and continued phases of the project may be irreversible since a large commitment of such resources makes removal or nonuse thereafter unlikely. Primary impacts and, particularly, secondary impacts (such as highway improvement which provides access to a previously inaccessible area) generally commit future generations to similar uses. Also irreversible damage can result from environmental accidents associated with the project. Irretrievable commitments of resources should be evaluated to assure that such current consumption is justified.*

Operation of the proposed project would require some nonrenewable resources, such as fuel for vehicles and equipment. The project currently uses nonrenewable resources for the operation of the site. Some of these nonrenewable resources, such as diesel fuel and gasoline, would represent an increase above baseline conditions for those operations that would mine the expanded quarry areas. However, these uses are not expected to result in substantial increases in the expenditure of a nonrenewable resource.

At the conclusion of the proposed project, all existing buildings and other energy-consuming uses would be decommissioned, dismantled, and removed from the project area. No further energy demand would be generated in the project area.

Accidents, such as the release of hazardous materials, could trigger irreversible environmental damage. However, project operations that would result in the transport of hazardous materials off-site would be transported by an approved carrier in accordance with state and local regulations. Considering the types and minimal quantities of hazardous materials that are and would continue to be used at the site, and emergency response plans and procedures that are ongoing as part of the existing project, accidental release of substantial quantities is unlikely. State and federal regulations and safety requirements would ensure that public health and safety risks are maintained at acceptable levels, so significant irreversible changes from accidental releases are not expected.

4.5 ENERGY CONSERVATION

INTRODUCTION

Public Resources Code Section 21100(b)(3) and CEQA Guidelines Section 15126.4 require EIRs to describe, where relevant, the wasteful, inefficient, and unnecessary consumption of energy caused by a project. In 1975, largely in response to the oil crisis of the 1970s, the State Legislature adopted Assembly Bill (AB) 1575, which created the California Energy Commission (CEC). The statutory mission of the CEC is to forecast future energy needs, license thermal power plants of 50 megawatts or larger, develop energy technologies and renewable energy resources, plan for and direct State responses to energy emergencies, and—perhaps most importantly—promote energy efficiency through the adoption and enforcement of appliance and building energy efficiency standards. CEQA Guidelines Appendix F identifies several factors that should be considered in determining whether a project will result in the inefficient, wasteful, and unnecessary consumption of energy. For the reasons set forth below, this EIR concludes that the proposed project would not result in the wasteful, inefficient, and unnecessary consumption of energy and therefore would not create a significant impact on energy resources.

BACKGROUND

Energy usage is typically quantified using the British thermal unit (BTU). As a point of reference, the approximate amounts of energy contained in common energy sources are as follows:

TABLE 4.5-1
BTUS FOR ENERGY USE

Energy Source	BTUs
Gasoline	124,000 per gallon
Diesel Fuel	139,000 per gallon
Natural Gas (compressed gas)	1,000 per cubic foot
Electricity	3,414 per kilowatt-hour

Sources: USDOE 2013

Total energy usage in California was 7,858 trillion BTUs in 2011, which equates to an average of 209 million BTUs per capita. Of California's total energy usage, the breakdown by sector is 38.3 percent transportation, 22.8 percent industrial, 19.6 percent commercial, and 19.3 percent residential. Petroleum satisfies 43 percent of California's energy demand, natural gas 28 percent, electricity 11 percent, and renewables 12 percent. Nuclear electric power accounts for less than 5 percent and coal fuel less than 1 percent of California's total energy demand. Electricity and natural gas in California are generally consumed by stationary users such as residences and commercial and industrial facilities, whereas petroleum consumption is generally accounted for by transportation-related energy use (EIA 2014).

Given the nature of the proposed project, the following discussion focuses on the source of energy that are most relevant to the project, which is the diesel fuel used for vehicle hauling trips and processing equipment, as well as the increased electricity usage at the processing plant. Also, since the Amended Plan would increase the operational years of the quarry by 24 years from the existing permit expiration date of 2031 to the year 2055, the use of the required fuel to power vehicle trips in addition to the fuel and electricity for material processing for an additional 24 years is considered.

Current Energy Use

The baseline conditions report estimates that the White Knob Quarry transports 275,418 tons per year for processing at the processing plant. The baseline fuel use associated with the hauling and processing of this amount of material from the White Knob Quarry is 1,298,818 gallons annually and 3,558 gallons daily (see **EIR Appendix I**).

APPLICABLE REGULATIONS

Federal and state agencies regulate energy use and consumption through various means and programs. At the federal level, the US Department of Transportation, the US Department of Energy, and the US Environmental Protection Agency (EPA) are three agencies with substantial influence over energy policies and programs. Generally, federal agencies influence and regulate transportation energy consumption through establishment and enforcement of fuel economy standards for automobiles and light trucks, through funding of energy-related research and development projects, and through funding for transportation infrastructure improvements.

Fuel Efficiency Standards for Heavy-Duty Engines and Vehicles

On August 9, 2011, the EPA and the National Highway Traffic Safety Administration (NHTSA) announced fuel economy standards for medium- and heavy-duty trucks, which apply to vehicles from model years 2014–2018. Both the EPA and the NHTSA have adopted standards for fuel consumption tailored to each of three main vehicle categories: combination tractors, heavy-duty pickup trucks and vans, and vocational vehicles.

CEQA Guidelines

CEQA Guidelines Appendix F requires that EIRs contain an evaluation of the potential energy impacts of a project with an emphasis on reducing the wasteful, inefficient, or unnecessary consumption of energy. CEQA Guidelines Appendix F further states that the means of achieving the goal of energy conservation includes the following:

- Decreasing overall per capita energy consumption.
- Decreasing reliance on fossil fuels such as coal, natural gas, and oil.
- Increasing reliance on renewable energy sources.

PROJECT ENERGY CONSUMPTION AND CONSERVATION

As described previously, the proposed project would introduce additional fuel usage above baseline operations. Additionally, the project would increase the operational years of the quarry by 24 years from the existing permit expiration date of 2031 to the year 2055.

Using conversion ratios for carbon dioxide equivalents contained in the California Climate Action registry, the 1,893 metric tons of carbon dioxide equivalents generated by project haul trips and material processing would result from the consumption of 186,502 gallons of fuel annually, which is 0.001 percent of typical annual fuel usage in the state as reported by the CEC (see **Table 4.5-2**). It is noted that new haul trips associated with the project would be subject to the fuel economy standards adopted by the NHTSA and EPA, described above. Therefore, the fuel efficiency by haul trucks traveling from the mine to the processing plant would improve as the vehicle fleet improves.

As also shown in **Table 4.5-2**, the increase of 24 years to the existing permit would equate to the use of an additional 1,485,320 gallons of fuel annually for 24 years (existing baseline fuel use of 1,298,818 gallons + project incremental fuel use of 186,502 gallons = 1,485,320 gallons, which is 0.01 percent of typical annual fuel usage in the state; see **EIR Appendix I**); resulting in the approximate total of 35,647,680 gallons of fuel over this 24-year timeframe.

TABLE 4.5-2
BASELINE AND PROJECT FUEL USAGE

Activity	Gallons of Fuel Used Annually	Percentage of 2014 Fuel Sales in California
White Knob Baseline	1,298,818	0.007%
White Knob Project (Proposed Project)	186,502	0.001%
Combined One Year Total for Baseline and Project	1,485,320	0.01%
24-Year Total Between 2031 and 2055	**35,647,680**	

Source: Appendix I

In 2013, taxable gasoline sales (including aviation gasoline) in California accounted for 14,532,944,431 gallons of gasoline (CEC 2014). As shown in **Table 4.5-1**, the proposed project would result in fuel usage that equals 0.001 percent of the typical annual fuel usage in the state yearly until 2031. From 2031 to 2055, the project would result in fuel usage that equals 0.01 percent of the typical annual fuel usage in the state yearly. The proposed project demand for fuel would not result in the need for new or altered facilities since it would equal a very small percentage of total state fuel sales on an annual basis. In addition, the project is not anticipated to result in an inefficient use of energy, as the mining operation would purchase its own diesel fuel from local suppliers and would conserve the use of their supplies to minimize costs to the project.

CONCLUSION

The proposed project would result in fuel usage that equals 0.001 percent of the typical annual fuel usage in the state yearly until 2031. From 2031 to 2055, the project would result in fuel usage that equals 0.01 percent of the typical annual fuel usage in the state yearly. The proposed project would not result in the need for new or altered energy producing facilities nor would it result in an inefficient use of energy.

5.1 INTRODUCTION TO THE ALTERNATIVES ANALYSIS

California Environmental Quality Act (CEQA) Guidelines Section 15126.6(a) states that an environmental impact report (EIR) shall describe and analyze a range of reasonable alternatives to a project. These alternatives should feasibly attain most of the basic objectives of the project, while avoiding or substantially lessening one or more of the significant environmental impacts of the project. An EIR need not consider every conceivable alternative to a project, nor is it required to consider alternatives that are infeasible. The discussion of alternatives shall focus on those which are capable of avoiding or substantially lessening any significant effects of the project, even if they impede the attainment of the project objectives to some degree or would be more costly (CEQA Guidelines Section 15126.6[b]).

As identified on page 2.0-11 and reiterated here, the objectives of the proposed project defined by the project proponent are to:

- Continue the mining and recovery of a unique high calcium limestone resource to supply the Lucerne Valley processing plant for the production of a wide range of calcium carbonate products.
- Minimize additional land disturbance through the expansion of contiguous existing and previously approved quarries and minimal expansion of existing overburden stockpiles and haul roads.
- Place overburden within completed portions of Overburden Site #1 (OB-1) to limit the area of disturbance.
- Meet the requirements of SMARA and the County surface mining ordinance.
- Minimize impacts to sensitive plants and wildlife through quarry design and ongoing bighorn sheep programs.
- Reclaim the site for post-mining uses which would include open space habitat.
- Reduce the slopes on overburden fill areas to an overall maximum slope of 2H:1V and revegetate disturbed areas to minimize aesthetic and erosion impacts
- Mitigate for lost, threatened, and endangered plant species habitat in accordance with the CHMS [Carbonate Habitat Management Strategy, April 2003] requirements by relinquishing unpatented mining claims or transfer of private property as determined adequate by the CHMS and regulatory agencies.
- Reclaim and maintain the site to eliminate hazards to public safety.

According to the State CEQA Guidelines, an EIR need only examine in detail those alternatives that could feasibly meet most of the basic objectives of the project. When addressing feasibility, CEQA Guidelines Section 15126.6 states that "among the factors that may be taken into account when addressing the feasibility of alternatives are site suitability, economic viability, availability of infrastructure, general plan consistency, jurisdictional boundaries, and whether the applicant can reasonably acquire, control or otherwise have access to alternative sites." The CEQA Guidelines also specify that the alternatives discussion should not be remote or speculative; however, they need not be presented in the same level of detail as the assessment of the proposed project.

The CEQA Guidelines indicate that several factors need to be considered in determining the range of alternatives to be analyzed in an EIR and the level of analytical detail that should be provided for each alternative. These factors include (1) the nature of the significant impacts of the proposed project; (2) the ability of alternatives to avoid or lessen the significant impacts associated with the project; (3) the ability of the alternatives to meet the objectives of the project; and (4) the feasibility of the alternatives. These factors would be unique for each project. The significant environmental impacts of the project that the alternatives will seek to eliminate or reduce were determined and based on the findings contained in each technical section evaluated in Sections 3.1 through 3.8 of this Draft EIR.

5.2 ALTERNATIVES CONSIDERED AND REJECTED FROM FURTHER ANALYSIS

REDUCED PROJECT ALTERNATIVE

This alternative includes the reduction in size of the proposed project by removing the White Ridge Quarry from the project. The currently approved Mine and Reclamation Plan includes the White Ridge Quarry as part of Phase 4, which can be mined under current approvals. However, upon analysis of this alternative, it was determined that the reduced project alternative would not necessarily reduce the project's environmental impacts. This is because much of the project's impacts are due to the mining of the overall site and the placement of the overburden, including the significant and unavoidable impacts on aesthetics. The exclusion of the White Ridge Quarry from the project would decrease the impacts on visual resources but not to an insignificant level, as impacts caused by the remainder of the quarry areas would remain. This alternative would also reduce significant biological resource impacts identified in Section 3.3, Biological Resources, but would not completely avoid these impacts. Additionally, this alternative would not meet the project's objective of the mining and recovery of a unique high calcium limestone resource to supply the Lucerne Valley processing plant for the production of a wide range of calcium carbonate products. Therefore, this alternative has been rejected.

BACKFILL ALL QUARRIES ALTERNATIVE

This alternative includes backfilling the overburden materials stored in OB-1, OB-2, and OB-3 into the White Knob, Annex, and White Ridge quarry pits during mining operations. However, because of how the quarries operate, placing overburden materials in an operating quarry is not possible, as this will not allow for the removal of the limestone and there are no land areas available on the site to store the overburden while mining occurs. Generally, the overburden is placed in an area that would not be mined in order to prohibit it from interfering with ongoing mining operations. Backfilling all of the quarries—White Knob, Annex, and White Ridge—during operation is not logistically possible.

Operation of the mine would still require the placement of overburden material in OB-1, OB-2 and OB-3, thereby impacting these areas. Removal of this overburden from OB-1, OB-2 and OB-3 upon quarry closure would increase the impacts on these areas by re-introducing earth moving equipment to the area, which, over the years of operation, may have begun to stabilize. Removal of overburden from OB-1, OB-2 and OB-3 and filling the quarries with overburden would increase the amount of air emissions, increase the amount of water quality impacts, as well as increase potential for biological resource impacts, as it would prolong the operation of the quarries and any earth moving activities. Additionally, these activities would interfere with concurrent reclamation activities. Therefore, this alternative has been rejected from further analysis.

REMOVAL OF OVERBURDEN FROM PROJECT SITE

This alternative includes the removal of overburden that would have been placed in OB-2 and OB-3 from the project site to another location. This alternative would reduce the impacts related to those areas as well as decrease the project size by 16 acres (13 acres for OB-2 and 3 acres for OB-3). However, this alternative would result in moving large amounts of overburden by truck to another site. This would result in a significant increase in air quality impacts due to transporting the overburden as well as potential impacts on aesthetics, biological resources, cultural resources, geologic and seismic hazards, hydrology and water quality, and possibly other impact areas to the area in which the overburden would be placed. Additionally, this alternative would not allow for the backfilling of the project quarries, which will increase the post-closure impacts on the site by not allowing for the reclamation of the site, much of which depends on the backfilling of the quarries. Therefore, this alternative has been rejected from further analysis.

5.3 PROJECT ALTERNATIVES

ALTERNATIVE 1 – NO PROJECT ALTERNATIVE

Overview of Alternative

This alternative would retain the approved 1986 White Knob-White Ridge Limestone Mine Site Approval and Reclamation Plan. The 1986 Plan has an expiration date of December 31, 2031. The approved quarry site consists of 145 acres of mining facilities within 357.5 acres of patented fee land, portions of which are leased and owned by Omya. **Table 5.0-1** identifies the approved area of the 1986 Plan.

TABLE 5.0-1
1986 PLAN OPERATIONAL AREAS

Quarry or Area	Approximate Acres
White Knob Quarry	35
White Knob Annex Quarry	7
White Ridge Quarry	18
Overburden Site #1	15
Ancillary Disturbance Limits[1]	70
Total	145

Source: Omya 2013, p. 2

1. Ancillary disturbance limits include haul/access roads to quarries and overburden sites, sediment basins and other erosion control features, storage pads, crusher location, west slope impacts, and incidental impacts from boulder roll-down.

Additionally, as with the proposed project, Alternative 1 would include proposed changes to the existing haul road to the White Knob/White Ridge Quarries from the processing plant. This road is approximately 5.1 miles long; the first 4.4 miles of the haul road crosses land managed by the Bureau of Land Management (BLM). Use of the haul road on 67 acres was authorized under a Federal Land Policy Management Act (FLPMA) right-of-way (CACA 16644) approved by the BLM Barstow Resource Office in July 1988. The BLM and Omya signed a Settlement Agreement for the use and remediation of the road and drainage. In order to accommodate the improvements required to adequately repair and remediate the right-of-way access road and drainage facilities, the existing right-of-way was expanded from the existing 67 acres to 83.5 acres. The

BLM requires final reclamation on approximately 40 acres of the total 83.5 acres of federal public land under a separate existing agreement. This is included in the Amended Plan. All components of the haul road are included as part of this alternative.

Existing throughputs are based on the three-year average from 2004 through 2006. It is assumed for this alternative that these throughputs will remain similar throughout the life of the 1986 Plan. **Table 5.0-2** identifies the 1986 Plan throughputs.

TABLE 5.0-2
THREE-YEAR AVERAGE THROUGHPUTS

	Material Excavated (ore and overburden)	Ore to Crusher	Overburden & Non-Spec Rock to On-Site Overburden Stockpile	Overburden & Non-Spec Rock for Aggregate (to processing plant)	Crushed Ore to Processing Plant (production)	Crusher Fines to Stockpile (est. 17% of ore to crusher)
3-Year Average (Baseline) (2004–2006)	512,000 (tons/yr)	324,000 (tons/yr)	188,000 (tons/yr)	0 (tons/yr)	275,400 (tons/yr)	48,600 (tons/yr)

Source: Omya 2013, p. 10

Comparative Impacts

The following analysis is based on the potentially significant environmental impacts and significant and unavoidable impacts identified in Sections 3.1 through 3.8, as well as the cumulatively considerable impacts identified in Section 4.1, Cumulative Impacts. Impacts that were identified as being less than significant in Sections 3.1 through 3.8 were not included in this alternative analysis because the impacts were not considered to affect the environment to a degree requiring mitigation.

Aesthetics

Impact 3.1 Substantial Adverse Effect on a Scenic Vista and the Existing Visual Character

The proposed project would result in a **significant and unavoidable** impact on scenic vistas and visual character.

While Alternative 1 is a smaller impact area, impacts on scenic vistas and visual character would be similar to the proposed project. The quarrying of limestone would still require the removal of existing soils and land, revealing lighter-colored subsurface rock formations and the changing of the natural contours of the land. This provides a stark contrast to the surrounding mountains. Reclamation of the site would reduce this contrast, however, but not to a point of unification with the surrounding area. This alternative would also result in a significant and unavoidable impact and would be similar to the proposed project.

Impact 4.0.1 Cumulative Impact on Aesthetics and Visual Resources

Implementation of the proposed project, in combination with other reasonably foreseeable mining projects in San Bernardino County, would contribute to the alteration of the visual character of the San Bernardino Mountains. There is no feasible mitigation to reduce this impact. Therefore, this is considered a **cumulatively considerable** and **significant and unavoidable** impact.

While Alternative 1 would disrupt a smaller area through the mining of limestone, the use of this area for mining would also present visual impacts in the San Bernardino Mountains. Development of Alternative 1, along with other mining projects in the area, would also result in a cumulative impact on aesthetics and visual resources and would result in a cumulatively considerable impact. Thus, Alternative 1 would have a similar result regarding this impact area when compared to the proposed project.

Air Quality

Impact 3.2.1: Emissions of Air Pollutants Resulting in Violation of Air Quality Standards or Contributing to Existing Violations

Implementation of the proposed project would result in **potentially significant** impacts regarding the violation of air quality standards. This impact would be mitigated to a less than significant level with incorporation of the measures listed under mitigation measure **MM 3.2.1**.

Air quality impacts from the proposed project would be largely due to increased PM_{10} levels from use of the haul road for transportation of the ore to the processing plant. Alternative 1 would result in similar air quality impacts because of the use of the haul road for the transportation of ore in this alternative. Much like the proposed project, these impacts could be mitigated to a less than significant level. However, because the No Project Alternative would have a shorter operational period, air quality impacts resulting from transportation of ore on the haul road would be for a shorter time period. Therefore, the air quality impacts of this alternative would be less than the proposed project.

Impact 3.2.4: Exposure of Sensitive Receptors to Localized Criteria Pollutants

Implementation of the proposed project would result in **potentially significant** impacts on sensitive receptors as a result of increased PM_{10} levels. This impact would be mitigated to a less than significant level with incorporation of the measures listed under mitigation measure **MM 3.2.1**.

The proposed project's impacts on sensitive receptors are also largely due to increased PM_{10} levels on the haul road. Alternative 1 would result in similar air quality impacts because of the inclusion of the haul road in this alternative. However, much like the proposed project, these impacts could be mitigated to a less than significant level. Therefore, the air quality impacts of this alternative would be similar to the proposed project.

Biological Resources

Impact 3.3.1 though Impact 3.3.10: Impacts on Candidate, Sensitive, or Special-Status Species

The species or species groups identified in Section 3.3 were determined to have the potential to be substantially adversely affected by project-related activities, either directly or through habitat modifications. Impacts on these species would be considered **potentially significant**. However, mitigation measures **MM 3.3.1a** through **MM 3.3.1i, MM 3.3.2, MM 3.3.3a** and **MM 3.3.3b, MM 3.3.4, MM 3.3.5, MM 3.3.6, MM 3.3.7, MM 3.3.9,** and **MM 3.3.10** would reduce the potential impacts to a less than significant level.

Alternative 1 would result in impacts on special-status species, although because of the smaller disturbed area of Alternative 1, the impacts on the special-status species' habitat may not be as extensive as the proposed project's impacts. The currently approved Mine and Reclamation Plan includes mitigation for the impacts on biological resources that were identified in the 1987 environmental review. As such, Alternative 1 would result in similar impacts on biological resources when compared to the proposed project.

Impact 3.3.11: Impacts on Riparian Habitat or Sensitive Natural Communities

Sensitive habitats include those that are of special concern to resource agencies and those that are protected under the CEQA, Section 1600 of the Fish and Game Code (FGC), and Section 404 of the Clean Water Act (CWA). Project-related activities have the potential to substantially adversely affect riparian vegetation. Impacts on these resources would be considered **potentially significant**. However, mitigation measure **MM 3.3.11** would reduce the potential impacts to a less than significant level.

Alternative 1 would impact less area. No specific areas of riparian vegetation were identified in the approved Mine and Reclamation Plan environmental review. However, the plan includes mitigation for the impacts on biological resources that were identified. As such, Alternative 1 would result in similar impacts on biological resources when compared to the proposed project.

Impact 4.0.3: Cumulative Impacts on Biological Resources

The proposed project in combination with other reasonably foreseeable projects could result in mortality and loss of habitat for special-status species, as well as biologically sensitive habitats. Therefore, this impact is considered **cumulatively considerable**. Implementation of avoidance, minimization, and mitigation measures **MM 3.3.1a** through **MM 3.3.1i, MM 3.3.2, MM 3.3.3a** and **MM 3.3.3b, MM 3.3.4, MM 3.3.5, MM 3.3.6, MM 3.3.7, MM 3.3.9,** and **MM 3.3.10** will reduce potentially cumulative impacts to a less than cumulatively considerable level.

Alternative 1 would result in cumulative impacts on biological resources, although because of the smaller disturbed area of Alternative 1, the impacts on biological resources may not be as extensive as the proposed project's impacts. The currently approved Mine and Reclamation Plan includes mitigation for the impacts on biological resources that were identified in the 1987 environmental review. As such, Alternative 1 would result in similar impacts on cumulative biological resources when compared to the proposed project.

Cultural and Paleontological Resources

Impact 3.4.1: Substantial Adverse Change in the Significance of an Archaeological or Historical Resource

Implementation of the proposed project would result in a **potentially significant** impact on archaeological or historical resources. Processing of the quarries may result in the unearthing of unknown historical or archaeological resources. This impact would be reduced to a less than significant level with incorporation of mitigation measure **MM 3.4.1**.

Alternative 1 may result in impacts on historical or archaeological resources. Processing of the quarries would still have the potential to unearth unknown resources. However, the current Mine and Reclamation Plan EIR provides mitigation for the possible discovery of unknown historical or archaeological resources. As such, Alternative 1's impact on archaeological of historical resources is similar to the proposed project in that impacts can be reduced to a less than significant level with the incorporation of mitigation measures.

Impact 3.4.3: Destroy a Unique Paleontological Resource or Geologic Feature

Implementation of the proposed project would result in a **potentially significant** impact on paleontological resources because of the undetermined potential for the project site to contain significant nonrenewable paleontological remains, primarily invertebrate fossils. Implementation of

mitigation measure **MM 3.4.3** would ensure that any previously unknown unique paleontological resources or geologic features resources inadvertently discovered during project implementation are protected and would reduce this impact to a level that is less than significant.

Alternative 1 may result in impacts on paleontological resources. Processing of the quarries would still have the potential to impact unknown unique paleontological resources or geologic features. However, the current Mine and Reclamation Plan EIR provides mitigation for the possible discovery of unknown unique paleontological resources or geologic features. As such, Alternative 1's impact on paleontological resources is similar to the proposed project in that impacts can be reduced to a less than significant level with the incorporation of mitigation measures.

Geology and Soils

Impact 3.5.3: Rock and Soil Talus Erosion

The proposed project's rock and soil talus on the northwest slope and within the Western Drainage could impact the Ruby Springs area, resulting in a **potentially significant** impact. Past mining operations at White Knob Quarry allowed white talus overburden material to fall onto the northwest slope. An intense rain storm event could cause some of this talus material to reach the Western Drainage. As such, mitigation measure **MM 3.5.3** is included in this Draft EIR, which upon implementation, would reduce the impact to a less than significant level.

Alternative 1 would also result in impacts in the Ruby Springs/Western Drainage area as a result of rock and soil talus. This is an existing condition. In April 20, 2011, a Settlement Agreement between the BLM and Omya relating to activities at the White Knob Quarry included six separate components (Parts A–F). The Part A component deals with Ruby Springs and the Western Drainage and requires the following:

- Part A – Omya has agreed to study and monitor Ruby Springs, located to the northwest of the quarry. Ongoing monitoring through 2014 is being undertaken and reported to the BLM, and no substantial impacts to the drainage or springs have been observed.

Alternative 1 would be subject to this Settlement Agreement. From a geology and soils perspective, this alternative may result in a greater potential for significant impacts as compared to the proposed project. The currently approved 1986 Reclamation Plan does not require backfilling of the White Knob Quarry; therefore, all of the overburden and waste rock would be placed in OB-1, expanding its area and height. The proposed project extends mining for 23 years to the year 2055 from the current year 2032, and final reclamation is completed 28 years later, in the year 2065 from the current year 2037. Reclamation activities will ultimately still be required and completed, as required under SMARA.

The proposed project includes precautions to minimize future boulder roll-down. However, because of remaining cliffs, some roll-down would be unavoidable, as it is necessary to continue to mine the ridge down and daylight in order to safely recover the ore. The following procedures are to continue for the life of the project to minimize boulder roll-down:

1. Precision drilling and buffer blasting when the outside edge is approached.

2. Drilling lifters on the edge to undercut the remaining slope and let it fall into the pit (like directional falling of a tree).

3. Excavator to pull down and pull in toward the pit blasted rock away from the edge.

4. Use of alternatives to blasting along the outside such as rock breakers, surface miners, cutting heads, and excavators.

5. Loader to pull back material from the edge.

6. Loader to dig at an angle to the edge or parallel to the edge when possible.

7. Manually scaling boulders from the highwalls where they may be above a haulage road.

Alternative 1 does not include these steps. Instead, the alternative would allow for reclamation of the project under the SMARA standards at the time of approval (1986). The project's Amended Reclamation Plan includes the more recent reclamation standards, SMARA Sections 3700–3713, while the currently approved Mine and Reclamation Plan does not because the plan was approved prior to adoption of the new standards. The new SMARA standards provide for improved reclamation on mine sites. Therefore, Alternative 1 would have a greater result in this impact area when compared to the proposed project and would result in a significant impact.

Hydrology and Water Quality

Impact 3.7.1: Substantially Alter Drainage Pattern

The project will substantially alter the existing drainage pattern in the quarry area, while maintaining the existing haul road drainage, thereby increasing the potential for sedimentation and erosion. This would result in a **potentially significant** impact. Implementation of mitigation measure **MM 3.7.1** would reduce this impact to less than significant.

Three main drainages cross the White Knob/White Limestone Ridge Quarries area, while the east–west haul road has 6 Arizona crossings and 14 culverts. Alternative 1 would not alter the existing drainage beyond those changes identified in the 1986 Mine and Reclamation Plan. In 2011, Stantec analyzed the hydrology for the project and determined that the capacities of the existing hydraulic structures, e.g., sedimentation basins, drainage conveyances, and haul road culverts, with some minor modification to the existing hydraulic structures, were adequate for the predicted 10-year stormwater flow, while most are marginal for a 20-year storm event. Stantec also recommended that the on-site haul road be graded with a 2 percent cross fall, that the road surface be an aggregate base course that is free of calcium carbonate materials, and that the low side of the roadway be determined by which side the next downstream catchment basin is on. Alternative 1 would also include changes in the cross fall of the haul road and therefore would direct stormwater flows into the catchment basins. As such, although Alternative 1 does not expand the quarry areas beyond those already approved, the inclusion of the additional haul road areas would present new drainage impacts not analyzed in the 1986 Mine and Reclamation Plan EIR (Michael Brandman, Inc. 1986). However, these impacts could be mitigated to a less than significant level using the same mitigations listed under mitigation measure **MM 3.7.1**.

From a hydrology and water quality perspective, Alternative 1 may result in a greater potential for significant impacts relative to the proposed project. The currently approved 1986 Reclamation Plan does not require backfilling of the White Knob Quarry; therefore, all of the overburden and waste rock would be placed in OB-1, expanding its area and height. The proposed project extends mining for 23 years to the year 2055 from the current year 2032, and

final reclamation is completed 28 years later, in the year 2065 from the current year 2037. Reclamation activities will ultimately still be required and completed, as required under SMARA.

This alternative would allow for reclamation of the project under the SMARA standards at the time of approval, 1986. The project's Amended Reclamation Plan includes the more recent reclamation standards, SMARA Sections 3700–3713, while the currently approved Mine and Reclamation Plan does not because the plan was approved prior to adoption of the new standards. The new SMARA standards provide for improved reclamation on mine sites. As such, this alternative may have greater impacts when compared to the proposed project, and would result in a significant impact.

ALTERNATIVE 2 – ELIMINATION OF OB-2

Overview of Alternative

Under Alternative 2, overburden site 2 (OB-2) would be eliminated from the project. This alternative would remove the impacts on the wetland features in this area. The overburden that would have been placed in this 13-acre site would be placed in OB-1 or OB-3, increasing the size and height of these areas. The elimination of OB-2 would also result in the reduction in size of the project area from 335.1 acres to 322.1 acres. The proposed project lists the total size of OB-1 as 31.9 acres and OB-3 as 3.0 acres. Assuming the overburden from the OB-2 site would be absorbed into OB-1 and OB-3 using the same proportional size, OB-1 is approximately 10.6 times the size of OB-3, OB-1 would increase to 43.7 acres and OB-3 to 4.3 acres in size. Additional changes to these overburden sites would also have to be incorporated into this alternative such as additional sedimentation basins or other drainage features and the re-contouring of OB-1 and OB-3 to accommodate the additional overburden, as well as the realignment of the on-site haul road to reach the White Ridge Quarry.

Comparative Impacts

As previously stated, the following analysis is based on the potentially significant environmental impacts and significant and unavoidable impacts identified in Sections 3.1 through 3.8, as well as the cumulative considerable impacts identified in Chapter 4.0. Impacts that were identified as being less than significant in Sections 3.1 through 3.8 were not included in this alternative analysis because the alternatives could not result in a lesser impact than the proposed project.

Aesthetics

Impact 3.1 Substantial Adverse Effect on a Scenic Vista and the Existing Visual Character

The proposed project results in a **significant and unavoidable** impact on scenic vistas and visual character.

Alternative 2 would result in greater visual impacts when compared to those identified for the proposed project. This alternative would still disturb land through the mining of limestone, creating a visual impact. Although like the proposed project, Alternative 2 would be required to provide for the reclamation of the disturbed area, the elimination of OB-2 would reduce the disturbed area by 13 acres, leaving that area in its natural state. However, while Alternative 2 would result in a slightly smaller project area, the visual impact caused by the mining of the limestone would create a larger visual impact. Currently, as proposed, the visual impacts of OB-1 and OB-3 are blocked by intervening hills. However, relocating overburden to OB-1 and/or OB-3 would result in a higher overburden, which could then be seen from residences in the area and

by travelers on local roadways. While the proposed project results in a significant and unavoidable impact, Alternative 2 would result in a greater impact on visual resources because a greater amount of quarry impacts could be observed from the surrounding area. Although similar to the proposed project, much of the scenic impact could be mitigated through resources identified in the reclamation plan, Alternative 2 would result in a significant and unavoidable impact.

Impact 4.1 Cumulative Impact on Aesthetics and Visual Resources

Implementation of the proposed project, in combination with other reasonably foreseeable mining projects in San Bernardino County, would contribute to the alteration of the visual character of the San Bernardino Mountains. There is no feasible mitigation to reduce this impact. Therefore, this is considered a **cumulatively considerable** and **significant and unavoidable** impact.

While Alternative 2 would disrupt a smaller area, the removal of OB-2 would result in more visual impacts identified for the OB-1 and/or OB-3 areas. Development of Alternative 2, along with other mining projects in the area, would also result in a cumulative impact on aesthetics and visual resources and result in a cumulatively considerable impact. Thus, Alternative 2 would have a similar result regarding this impact area when compared to the proposed project.

Air Quality

Impact 3.2.1: Emissions of Air Pollutants Resulting in Violation of Air Quality Standards or Contributing to Existing Violations

Implementation of the proposed project would result in **potentially significant** impacts regarding the violation of air quality standards. This impact would be mitigated to a less than significant level with incorporation of the measures listed under mitigation measure **MM 3.2.1**.

The proposed project's air quality impact is largely due to increase PM_{10} levels on the haul road. Alternative 2 would also include the haul road and result in similar air quality impacts. The removal of OB-2 would have little effect on PM_{10} levels. However, much like the proposed project, these impacts could be mitigated to a less than significant level. Therefore, this alternative is similar to the proposed project.

Impact 3.2.4: Exposure of Sensitive Receptors to Localized Criteria Pollutants

Implementation of the proposed project would result in **potentially significant** impacts on sensitive receptors as a result of increase PM_{10} levels. This impact would be mitigated to a less than significant level with incorporation of the measures listed under mitigation measure **MM 3.2.1**.

The proposed project's impacts on sensitive receptors are also largely due to increased PM_{10} levels on the haul road. Alternative 2 would result in similar air quality impacts because of the inclusion of the haul road in this alternative. However, much like the proposed project, these impacts could be mitigated to a less than significant level. Therefore, this alternative is similar to the proposed project.

Biological Resources

Impact 3.3-1 though Impact 3.3.10: Impacts on Candidate, Sensitive, or Special-Status Species

The species or species groups identified in Section 3.3 were determined to have the potential to be substantially adversely affected by project-related activities, either directly or through habitat modifications. Impacts on these species would be considered a **potentially significant** impact. However, mitigation measures **MM 3.3.1a** through **MM 3.3.1i, MM 3.3.2, MM 3.3.3a** and **MM 3.3.3b, MM 3.3.4, MM 3.3.5, MM 3.3.6, MM 3.3.9,** and **MM 3.3.10** would reduce the potential impacts to a less than significant level.

Alternative 2 would result in impacts on special-status species, although because of the smaller disturbed area of Alternative 2, the impacts on the special-status species' habitat may not be as extensive. Adoption of Alternative 2 would require an environmental review. It is assumed that as a part of the environmental review, the impacts on special-status species will be analyzed and mitigated to a less than significant level. However, the overburden that would have been placed in OB-2 would be relocated to OB-1 and OB-3. This relocation would cause an expansion of OB-1 and OB-3. Expansion of OB-3 could encroach into the sensitive habitat located to the north of the White Ridge Quarry site. Expansion of OB-1 by 11.8 acres would result in an encroachment on the sensitive habitat west of OB-1. The following special-status plants have been identified to exist in or adjacent to OB-1 and/or OB-3: Cushenbury oxytheca, San Bernardino Mountains dudleya, Parish's daisy, Cushenbury buckwheat, Parish's alumroot, Latimer's woodland-gilia (see **Figure 3.3-3** in Section 3.3). Expansion of these areas may create a greater impact on these plants. As such, Alternative 2 would have a greater impact on special-status species than those of the proposed project as is would have a greater impact area. However, the inclusion of the mitigation described above would result in a less than significant impact.

Impact 3.3.10: Impacts on Riparian Habitat or Sensitive Natural Communities

Sensitive habitats include those that are of special concern to resource agencies and those that are protected under CEQA, Section 1600 of the FGC, and Section 404 of the CWA. Project-related activities have the potential to substantially adversely affect riparian vegetation. Impacts on these resources would be considered a **potentially significant** impact. However, mitigation measure **MM 3.3.11** would reduce the potential impacts to a less than significant level.

Alternative 2 would also impact riparian vegetation, as this alternative would impact drainage areas identified as locations A, B1, B2, D, and E (see **Figure 3.3-2**), which are considered to have good habitat conditions for riparian vegetation in undisturbed areas. However, Alternative 2 would not impact the drainage identified as location C on **Figure 3.3-2**, as OB-2 would not be expanded into this area in Alternative 2. As previously stated, adoption of Alternative 2 would require an environmental review. It is assumed that as a part of the environmental review, the impacts on riparian vegetation will be analyzed and mitigated to a less than significant level. Because Alternative 2 would disturb a smaller area, impacts on potential riparian vegetation should be less on a quantitative scale. However, the overburden that would have been placed in OB-2 would be relocated to OB-1 and OB-3. This relocation would cause an expansion of OB-1 and OB-3. Expansion of OB-3 could encroach into the sensitive habitat located to the north of the White Ridge Quarry site. Expansion of OB-1 by 11.8 acres would encroach on the sensitive habitat west of OB-1. As such, Alternative 2 would have a greater environmental impact on riparian habitat as compared to the proposed project as is would have a greater impact area. However, the inclusion of the mitigation described above would result in a less than significant impact.

Impact 4.0.3: Cumulative Impacts on Biological Resources

The proposed project in combination with other reasonably foreseeable projects could result in mortality and loss of habitat for special-status species, as well as biologically sensitive habitats. Therefore, this impact is considered **cumulatively considerable**. Implementation of avoidance, minimization, and mitigation measures **MM 3.3.1a** through **MM 3.3.1i, MM 3.3.2, MM 3.3.3a** and **MM 3.3.3b, MM 3.3.4, MM 3.3.5, MM 3.3.6, MM 3.3.9,** and **MM 3.3.10** will reduce potentially cumulative impacts to a less than cumulatively considerable level.

Alternative 2 would also result in cumulative impacts on biological resources, although because of the smaller disturbed area associated with Alternative 2, the impacts on biological resources may not be as extensive in OB-2. However, the overburden that would have been placed in OB-2 would be relocated to OB-1 and OB-3. This relocation would cause an expansion of OB-1 and OB-3. Expansion of OB-3 could encroach into the sensitive habitat located to the north of the White Ridge Quarry site. Expansion of OB-1 by 11.8 acres would encroach on the sensitive habitat west of OB-1. As such, Alternative 2 would have a greater environmental impact on cumulative biological resources when compared to the proposed project.

Cultural and Paleontological Resources

Impact 3.4.1: Substantial Adverse Change in the Significance of an Archaeological or Historical Resource

Implementation of the proposed project would result in a **potentially significant** impact on archaeological or historical resources. Processing of the quarries may result in the unearthing of unknown historical or archaeological resources. This impact would be reduced to a less than significant level with incorporation of mitigation measure **MM 3.4.1**.

Alternative 2 may result in impacts on historical or archaeological resources. Processing of the quarries would still have the potential to unearth unknown resources. The exclusion of OB-2 as part of this alternative would not lessen the potential to unearth unknown historical or paleontological resources. Because the placement of overburden in the OB-2 site would not involve the removal of soil from that site, the potential to unearth cultural resources on that site is negligible. As such, the potential to unearth historical or paleontological resources for Alternative 2 is similar to the proposed project.

Impact 3.4.3: Destroy a Unique Paleontological Resource or Geologic Feature

Implementation of the proposed project would result in a **potentially significant** impact on paleontological resources because of the undetermined potential for the project site to contain significant nonrenewable paleontological remains, primarily invertebrate fossils. Implementation of mitigation measure **MM 3.4.3** would ensure that any previously unknown unique paleontological resources or geologic features resources inadvertently discovered during project implementation are protected and would reduce this impact to a level that is less than significant.

Alternative 2 could also result in impacts on paleontological resources. Processing of the quarries would still have to potential impact unknown unique paleontological resources or geologic features. However, as discussed above, the placement of overburden in the OB-2 site would not involve the removal of soil from that site, so the potential to unearth cultural resources on that site is negligible. The remainder of the project site will be quarried, and the potential to destroy a unique paleontological resource or geologic feature as a part of the quarrying process is possible. As such, the potential to discover and destroy an unknown paleontological resource or

geologic feature for Alternative 2 is similar to the proposed project and could be mitigated to a less than significant level.

Geology and Soils

Impact 3.5.3: Rock and Soil Talus Erosion

The proposed project's rock and soil talus on the northwest slope and within the Western Drainage could impact the Ruby Springs area, resulting in a **potentially significant** impact. Past mining operations at White Knob Quarry allowed white talus overburden material to fall onto the northwest slope. An intense rain storm event could cause some of this talus material to reach the Western Drainage. As such, mitigation measure **MM 3.5.3** is included in this Draft EIR to remove impacts on the drainage. Implementation of the mitigation measure would reduce the impact to a less than significant level.

Alternative 2 would also result in impacts in the Ruby Springs/Western Drainage area as a result of rock and soil talus. This is an existing condition. In April 20, 2011, a Settlement Agreement between the BLM and Omya relating to activities at the White Knob Quarry included six separate components (Parts A–F). The Part A component deals with Ruby Springs and the Western Drainage by requiring an analysis and monitoring of Ruby Springs. Alternative 2 will continue to require this monitoring. Exclusion of OB-2 would have no impact in this area, as it is not located in the northwest slope area. As such, Alternative 2 is similar to the proposed project, and with incorporation of **MM 3.5.3**, this impact would be less than significant.

Hydrology and Water Quality

Impact 3.7.1: Substantially Alter Drainage Pattern

The project will substantially alter the existing drainage pattern in the quarry area, while maintaining the existing haul road drainage, thereby increasing the potential for sedimentation and erosion. This would result in a **potentially significant** impact. Implementation of mitigation measure **MM 3.7.1** would reduce this impact to less than significant.

Alternative 2 is the proposed project without OB-2. This alternative was proposed because of the potential impacts on the drainage and wetlands on the OB-2 site. The removal of OB-2 would result in no impact on the drainage in this area. However, other drainages that are to be altered in the project would be included in Alternative 2. Overburden that would have been placed in OB-2 would have to be located to OB-1 and OB-3 with this alternative. This would cause the expansion of these two areas. Expansion of OB-3 could encroach into the sensitive habitat located to the north as well as intrude on land that is currently not within the project. Expansion of OB-1 by 11.8 acres has the potential to create the need for additional sedimentation basins and drainage improvements. This would not only increase the height of this overburden site, but would also result in a larger impact area to accommodate the new overburden. This expansion may result in substantially altering the existing drainage and encroach on the sensitive habitat west of OB-1. As such, Alternative 2 would have a greater environmental impact on drainage as compared to the proposed project.

ALTERNATIVE 3 – BACKFILL CENTRAL WHITE KNOB AND ANNEX QUARRIES

Overview of Alternative

Alternative 3 would include the backfilling of the White Knob and Annex Quarries. This alternative would be similar to the proposed project except that upon reclamation the OB-1 overburden storage area and central portions of the White Knob and Annex Quarries would be much higher because material placed in the White Ridge Quarry would now be placed in the White Knob and Annex Quarries. This would require that the final backfill elevation of OB-1 and the White Knob and Annex Quarries be raised to accommodate the additional fill, depending on slope stability. Under the proposed project, design of overburden fill slopes in all three disposal areas was found to have adequate slope stability; however, Alternative 3 would remove the fill in OB-3, the upper portions of OB-2, and some portion of the toe of OB-1, thereby reducing the potential for the mining-related fill slopes to fail or otherwise become unstable, and reducing the area of disturbance in the central and eastern drainages. The amount of fill that can be placed in each quarry would be restricted by the stability of the final fill, i.e., the slope angle and height. Overburden that could not be placed in the White Knob and Annex Quarries would continue to be placed in OB-1.

The height of the backfill at OB-2 would be reduced, leaving more of the drainage in a natural condition. However, additional drainage control structures would likely be needed to collect and control the additional runoff because the project's White Knob sedimentation basin would not be constructed and the Annex Quarry would no longer capture quarry rainfall. The drainage east of the White Ridge Quarry would not be filled with overburden, and the need for drainage control structures in that area would be lessened or eliminated.

Comparative Impacts

As previously stated, the following analysis is based on the potentially significant environmental impacts and significant and unavoidable impacts identified in Sections 3.1 through 3.8, as well as the cumulative considerable impacts identified in Chapter 4.0. Impacts that were identified as being less than significant in Sections 3.1 through 3.8 were not included in this alternative analysis because the alternatives could not result in a lesser impact than the proposed project.

Aesthetics

Impact 3.1 Substantial Adverse Effect on a Scenic Vista and the Existing Visual Character

The proposed project results in a **significant and unavoidable** impact on scenic vistas and visual character.

Alternative 3 would result in similar visual impacts when compared to those identified for the proposed project. This alternative would still disturb land through the mining of limestone creating visual impact, although like the proposed project, Alternative 3 would be required to provide for the reclamation of the disturbed area. However, the OB-1 overburden storage area and central portions of the White Knob and Annex Quarries would be much higher because material placed in the White Ridge Quarry would now be placed in the White Knob and Annex Quarries. This additional height would increase the potential for scenic impacts because areas which would be blocked from view by intervening mountains in the proposed project would be seen in Alternative 3. While the proposed project results in a significant and unavoidable impact, Alternative 3 would result in a greater impact on visual resources because a greater amount of quarry impacts could be observed from the surrounding area. Although, similar to the proposed

project, much of the scenic impact could be mitigated through resources identified in the reclamation plan, Alternative 3 would result in a significant and unavoidable impact.

Impact 4.1 Cumulative Impact on Aesthetics and Visual Resources

Implementation of the proposed project, in combination with other reasonably foreseeable mining projects in San Bernardino County, would contribute to the alteration of the visual character of the San Bernardino Mountains. There is no feasible mitigation to reduce this impact. Therefore, this is considered a **cumulatively considerable** and **significant and unavoidable** impact.

While Alternative 3 would disrupt an equal amount of area as the proposed area, backfilling of the quarries would result in higher backfill and OB-1 elevations, which could then be seen. Development of Alternative 3, along with other mining projects in the area, would also result in a cumulative impact on aesthetics and visual resources and result in a cumulatively considerable impact. Thus, Alternative 3 would have a similar result regarding this impact area when compared to the proposed project, as it would result in a cumulatively considerable and significant and unavoidable impact.

Air Quality

Impact 3.2.1: Emissions of Air Pollutants Resulting in Violation of Air Quality Standards or Contributing to Existing Violations

Implementation of the proposed project resulted in **potentially significant** impacts regarding the violation of air quality standards. This impact would be mitigated to a less than significant level with incorporation of the measures listed under mitigation measure **MM 3.2.1**.

The proposed project air quality impact is largely due to increase PM_{10} levels on the haul road. Alternative 3 would also include the haul road and result in similar air quality impacts. The backfilling of the quarries would have little effect on PM_{10} levels. However, much like the proposed project, these impacts could be mitigated to a less than significant level. Therefore, this alternative is similar to the proposed project.

Impact 3.2.4: Exposure of Sensitive Receptors to Localized Criteria Pollutants

Implementation of the proposed project resulted in **potentially significant** impacts on sensitive receptors as a result of increase PM_{10} levels. This impact would be mitigated to a less than significant level with incorporation of the measures listed under mitigation measure **MM 3.2.1**.

The proposed project's impacts on sensitive receptors is also largely due to increased PM_{10} levels on the haul road. Alternative 3 would result in similar air quality impacts because of the inclusion of the haul road in this alternative. However, much like the proposed project, these impacts could be mitigated to a less than significant level. Therefore, this alternative is similar to the proposed project.

Biological Resources

Impact 3.3-1 though Impact 3.3.10: Impacts on Candidate, Sensitive, or Special-Status Species

The species or species groups identified in Section 3.3 were determined to have the potential to be substantially adversely affected by project-related activities, either directly or through habitat

modifications. Impacts on these species would be considered a **potentially significant** impact. However, mitigation measures **MM 3.3.1a** through **MM 3.3.1i, MM 3.3.2, MM 3.3.3a** and **MM 3.3.3b, MM 3.3.4, MM 3.3.5, MM 3.3.6, MM 3.3.9,** and **MM 3.3.10** would reduce the potential impacts to a less than significant level.

Alternative 3 would result in the same level of impact on candidate, sensitive, or special-status species as the proposed project. However, this alternative would have a smaller amount of disturbance area compared to the proposed project as a result of a slightly smaller area for OB-2 and OB-1, and the removal of OB-3. The areas around OB-1 and OB-3 are known locations of special-status plant species. All special-status species impacts would require mitigation, and it is assumed that this mitigation would result in a less than significant impact, as it does with the proposed project. Impacts resulting from implementation of Alternative 3 would be less compared to those of the proposed project.

Impact 3.3.10: Impacts on Riparian Habitat or Sensitive Natural Communities

Sensitive habitats include those that are of special concern to resource agencies and those that are protected under CEQA, Section 1600 of the FGC, and Section 404 of the CWA. Project-related activities have the potential to substantially adversely affect riparian vegetation. Impacts on these resources would be considered a **potentially significant** impact. However, mitigation measures **MM 3.3.11** would reduce the potential impacts to a less than significant level.

Alternative 3 would also impact riparian vegetation, as this alternative would impact all drainage areas identified in **Figure 3.3-2**. However, this alternative would have the smaller amount of disturbance area compared to the proposed project as the result of a slightly smaller area for OB-2 and OB-1, and the removal of OB-3. Adoption of Alternative 3 would require an environmental review. It is assumed that as a part of the environmental review, the impacts on riparian vegetation will be analyzed and mitigated to a less than significant level. As such, Alternative 3 would result in less impact on riparian vegetation when compared to the proposed project and also result in a less than significant impact with mitigation.

Impact 4.0.3: Cumulative Impacts on Biological Resources

The proposed project in combination with other reasonably foreseeable projects could result in mortality and loss of habitat for special-status species, as well as biologically sensitive habitats. Therefore, this impact is considered **cumulatively considerable**. Implementation of avoidance, minimization, and mitigation measures **MM 3.3.1a** through **MM 3.3.1i, MM 3.3.2, MM 3.3.3a** and **MM 3.3.3b, MM 3.3.4, MM 3.3.5, MM 3.3.6, MM 3.3.9,** and **MM 3.3.10** will reduce potentially cumulative impacts to a less than cumulatively considerable level.

Alternative 3 would also cumulatively impact biological resources, as this alternative would impact all drainage areas identified in **Figure 3.3-2**, as well as species or species groups identified in Section 3.3. However, this alternative would have the smaller amount of disturbance area compared to the proposed project as the result of a slightly smaller area for OB-2 and OB-1, and the removal of OB-3. Adoption of Alternative 3 would require an environmental review. It is assumed that as a part of the environmental review, the impacts on biological resources will be analyzed and mitigated to a less than significant level and therefore reduce the potential for cumulative impacts on biological resources. As such, Alternative 3 would result in similar cumulative impacts on biological resources when compared to the proposed project.

Cultural and Paleontological Resources

Impact 3.4.1: Substantial Adverse Change in the Significance of an Archaeological or Historical Resource

Implementation of the proposed project would result in a **potentially significant** impact on archaeological or historical resources. Processing of the quarries may result in the unearthing of unknown historical or archaeological resources. This impact would be reduced to a less than significant level with incorporation of mitigation measure **MM 3.4.1**.

Alternative 3 may also result in impacts on historical or archaeological resources. Processing of the quarries would still have to potential to unearth unknown resources. Alternative 3 does not decrease the amount of disturbed area when compared to the proposed project. The backfilling of quarries would not lessen the potential to unearth unknown historical or paleontological resources. As such, the potential to unearth historical or paleontological resources for Alternative 3 is similar to the proposed project.

Impact 3.4.3: Destroy a Unique Paleontological Resource or Geologic Feature

Implementation of the proposed project would result in a **potentially significant** impact on paleontological resources because of the undetermined potential for containing significant nonrenewable paleontological remains, primarily invertebrate fossils. Implementation of mitigation measure **MM 3.4.3** would ensure that any previously unknown unique paleontological resources or geologic features resources inadvertently discovered during project implementation are protected and would reduce this impact to a level that is less than significant.

Alternative 3 could also result in impacts on paleontological resources. Processing of the quarries would still have to potential impact unknown unique paleontological resources or geologic features. Alternative 3 does not reduce the potential impact area, and the potential to destroy a unique paleontological resource or geologic feature as a part of the quarrying process is possible. As such, the potential to discover and destroy an unknown paleontological resource or geologic feature for Alternative 3 is similar to the proposed project and would be mitigated to a less than significant level.

Geology and Soils

Impact 3.5.3: Rock and Soil Talus Erosion

The proposed project's rock and soil talus on the northwest slope and within the Western Drainage could impact the Ruby Springs area, resulting in a **potentially significant** impact. Past mining operations at White Knob Quarry allowed white talus overburden material to fall onto the northwest slope. An intense rain storm event could cause some of this talus material to reach the Western Drainage. As such, mitigation measure **MM 3.5.3** is included in this Draft EIR to remove impacts on the drainage. Implementation of the mitigation measure would reduce the impact to a less than significant level.

Impacts on geology and soils under Alternative 3 would be similar to those described under the analysis of the project, except that upon reclamation the OB-1 overburden storage area and central portions of the White Knob and Annex Quarries would be much higher than the proposed project because material placed in the White Ridge Quarry would now be placed in the White Knob and Annex Quarries. Alternative 3 would not reduce impacts on the Western Drainage or Ruby Springs during project operation.

Alternative 3 would also result in impacts in the Ruby Springs/Western Drainage area as a result of rock and soil talus. Alternative 3 will continue to require monitoring of the Ruby Springs/Western Drainage area per the BLM/Omya Settlement Agreement. As such, Alternative 3 is similar to the proposed project, and with incorporation of **MM 3.5.3**, this impact would be less than significant.

Hydrology and Water Quality

Impact 3.7.1: Substantially Alter Drainage Pattern

The project will substantially alter the existing drainage pattern in the quarry area, while maintaining the existing haul road drainage, thereby increasing the potential for sedimentation and erosion. This would result in a **potentially significant** impact. Implementation of mitigation measure **MM 3.7.1** would reduce this impact to less than significant.

Under the proposed project, design of overburden fill slopes in all three disposal areas was found to have adequately minimized erosion and control runoff; however, Alternative 3 would remove the fill in OB-3 and the upper portions of OB-2, along with some portion of the toe of OB-1. However, disturbance of existing drainage will, as with the proposed project, be substantially altered. This alternative does not change the amount or area of disturbance, only the way the site is reclaimed. While this would reduce the potential for the mining-related fill slopes to fail or otherwise become unstable, and reduces the area of disturbance in the central and eastern drainages, the potential impacts are shifted to the White Knob and Annex Quarries. The amount of fill that can be placed in each quarry would be restricted by the stability of the final fill slopes, i.e., the slope angle and height. If the final fill slope heights and grades are greater and steeper than currently analyzed, additional slope stability analysis would be required. Overburden that could not be placed in the White Knob and Annex Quarries would continue to be placed in OB-1.

The height of the backfill at OB-2 would be reduced, leaving more of the drainage in a natural condition. The relocation of overburden storage would reduce potential impacts related to erosion and soil loss because of a reduction in the total surface area of the fills and the fill slopes compared to the project. However, additional drainage control structures would likely be needed to collect and control the additional runoff because the project's White Knob sedimentation basin would not be constructed and the Annex Quarry would no longer capture quarry rainfall. The drainage east of the White Ridge Quarry would not be filled with overburden, and the need for drainage control structures in that area would be lessened or eliminated.

Compared to the proposed project, Alternative 3 may reduce the potential for and intensity of impacts related to hydrology and water quality, but not to a level that would be substantial enough to change the overall CEQA significance determinations.

5.4 ALTERNATIVES COMPARISON

Table 5.0-3 provides a summary of the potential impacts of the EIR alternatives evaluated in this chapter, as compared with the potential impacts of the proposed project. The impact significance is identified for the alternatives, as is the ranking of the impact as compared to the proposed project. A "B" ranking means that the alternative would be "better" or would have less of an environmental impact than the proposed project, while a "W" ranking means the alternative would result in a "greater" impact. An "S" ranking identifies where the alternative has a "similar" impact as the proposed project. Based on the evaluation described in this section, the proposed project would be the environmentally superior alternative. It should also be noted that the proposed project, although large in size and disturbance area, would have less

environmental impact than Alternative 1, the No Project Alternative. This is mainly due to the more stringent requirements of SMARA that were not in place at the time of the currently approved Mine and Reclamation Plan.

TABLE 5.0-3
SUMMARY COMPARISON OF ALTERNATIVES

Project Environmental Impacts	Alternative 1 No Project/ Existing Approval	Alternative 2 Elimination of OB-2	Alternative 3 Backfill Central White Knob and Annex Quarries
Aesthetics			
Substantial adverse effect on a scenic vista and the existing visual character	No increase in a significant and unavoidable impact	No increase in a significant and unavoidable impact	Potential increase in a significant and unavoidable impact
Cumulative impact on aesthetics and visual resources	No increase in a significant and unavoidable impact	No increase in a significant and unavoidable impact	No increase in a significant and unavoidable impact
Ranking	S	S	W
Air Quality			
Emissions of air pollutants resulting in violation of air quality standards or contributing to existing violations	No new or more severe significant impact	No new or more severe significant impact	No new or more severe significant impact
Exposure of sensitive receptors to localized criteria pollutants	No new or more severe significant impact	No new or more severe significant impact	No new or more severe significant impact
Ranking	L	S	S
Biological Resources			
Impacts on Candidate, Sensitive, or Special-Status Species	No new or more severe significant impact	Potentially more severe significant impact	No new or more severe significant impact
Impacts on Riparian Habitat or Sensitive Natural Communities	No new or more severe significant impact	Potentially more severe significant impact	No new or more severe significant impact
Cumulative impacts on biological resources	No new or more severe significant impact	Potentially more severe significant impact	No new or more severe significant impact
Ranking	S	W	L
Cultural Resources			
Substantial adverse change in the significance of an archaeological or historical resource	No new or more severe significant impact	No new or more severe significant impact	No new or more severe significant impact
Destroy a unique paleontological resource or geologic feature	No new or more severe significant impact	No new or more severe significant impact	No new or more severe significant impact
Ranking	S	S	S

Project Environmental Impacts	Alternative 1 No Project/ Existing Approval	Alternative 2 Elimination of OB-2	Alternative 3 Backfill Central White Knob and Annex Quarries
Geology and Soils			
Rock and soil talus erosion	Potentially more severe significant impact	No new or more severe significant impact	No new or more severe significant impact
Ranking	W	S	S
Hydrology and Water Quality			
Substantially alter drainage pattern	Potentially more severe significant impact	Potentially more severe significant impact	No new or more severe significant impact
Ranking	W	W	S

Notes:

L: Alternative would result fewer or less severe environmental impacts than the proposed project.
S: Alternative would result in similar impacts as the proposed project.
W: Alternative would result in greater or more severe environmental impacts than the proposed project.

Environmentally Superior Alternative

Of the three Alternatives, Alternative 3, the Backfill Central White Knob and Annex Quarries Alternative, is considered to be the environmentally superior alternative. Alternative 3 would have fewer adverse environmental impacts than the other two alternatives. However, Alternative 3 would have a greater impact to aesthetics due to the additional height requirements for OB-1 and the central portions of the White Knob and Annex Quarries, but fewer impacts to biological resources than the proposed project because less area would be disturbed in OB-3 and OB-2. As with the proposed project, impacts to biological resources could be reduced to less than significant by incorporating mitigation measures, but impacts to aesthetics would remain significant and unavoidable.

While this alternative may technically meet most of the project's primary objectives, the backfilling of the White Knob and Annex Quarries present logistical problems during operation of the quarries as the backfilling of the White Knob and Annex quarries could not occur until those quarries cease operation. This would require the placing of overburden material in areas temporarily until the material can be moved, which may in itself, increase the potential for environmental impacts. The reductions in environmental impacts under this alternative may therefore be temporary.

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COUNTY OF SAN BERNARDINO

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Geographic Information Analyst ..... Jonathan Faoro
Technical Editor ..... Suzanne Wirth
Internal Service Provider ..... Stephanie Wolfe

APPENDIX A
NOTICE OF PREPARATION/INITIAL STUDY AND COMMENTS RECEIVED

County of San Bernardino

NOTICE OF PREPARATION

FROM: San Bernardino County Land Use Services Department
385 N. Arrowhead Avenue, First Floor, San Bernardino, CA 92415-0182

TO: Interested Agencies, Organizations, and Individuals

SUBJECT: Notice of Preparation of a Draft Environmental Impact Report

The County of San Bernardino (County) will be the lead agency pursuant to the requirements of the California Environmental Quality Act (CEQA) and will prepare an Environmental Impact Report (EIR) for the White Knob/White Ridge Limestone Quarries Expansion Project (proposed project). A summary of the project description and location is provided below. A more detailed project description and location as well as a preliminary analysis of the proposed project's environmental effects are provided in the attached Initial Study.

Project Title: White Knob/White Ridge Limestone Quarries Expansion Project (proposed project)

Project Applicant: Omya California, a division of Omya Inc.

Project Location: The White Knob/White Ridge Limestone Quarries are located in the San Bernardino Mountains in southwestern San Bernardino County approximately 6 miles southwest of the community of Lucerne Valley and 8 miles northwest of Big Bear Lake just north of the San Bernardino National Forest. The project site consists of a 475.1-acre area including 335.1 acres of existing or planned surface mining operation–related disturbance and approximately 40 acres of existing BLM haul road right-of-way on federal public land. The project site location is shown on **Figures 1** and **2** of the attached Initial Study.

Project Description: Omya California (Omya) has submitted the following:

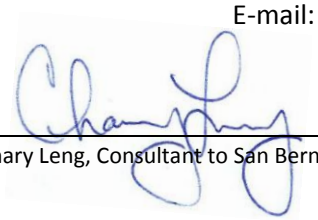
- A Mining and Land Reclamation Plan Conditional Use Permit application submitted to the County of San Bernardino
- An Amended Mine and Reclamation Plan (Amended Plan) submitted to the County of San Bernardino and the California Office of Mine Reclamation

Combined, these applications propose the expansion of the existing White Knob/White Ridge Limestone Quarries, a limestone mining operation. The Amended Plan includes expansion of the existing quarries' operation (White Knob Quarry, White Ridge Quarry, and White Knob Annex Quarry) and the existing Overburden (OB) site, the creation of two new OB sites, and the expansion of the ancillary disturbance areas, which include haul and access roads, sediment basins and other erosion control features, storage pads, crusher location, west slope impacts, and incidental impacts from boulder roll-down. In addition, the proposed project would increase operational years of the quarries by 24 years from the existing permit expiration date of 2031 to the year 2055. The total existing permitted operational area is approximately 145 acres. The Amended Plan would add approximately 190.1 acres, for a total permitted operational area of approximately 335.1 acres. The amendment does not propose any new quarries.

The complete proposed Amended Mine and Reclamation Plan is available for review on the County's website: http://cms.sbcounty.gov/lus/Planning/Environmental/NoticesDeterminations/Mountain.aspx

Questions about the County's review of the proposed project and approval processes may be directed to:

Channary Leng
Consultant to:
San Bernardino County
Land Use Services Department
385 N. Arrowhead Avenue
San Bernardino, CA 92415
(949) 450-0171, ext. 314
E-mail: channary@rgpcorp.com

Signature:  Date: 6/10/2013

Channary Leng, Consultant to San Bernardino County

Introduction

This Notice of Preparation provides a description of the proposed project and solicits comments on the scope and content of the environmental document being prepared to analyze the environmental impacts of the proposed project. Comments are hereby solicited from federal, state, and local agencies and from the general public. Comments received in response to this NOP will be reviewed and considered in determining the scope of the EIR. The County requests that agency comments regarding the scope and content of the environmental document also be pertinent to that agency's statutory responsibilities in connection with the proposed project. Where applicable, it is recommended that agencies make use of the EIR prepared by the County when considering its permitting or other approvals related to the proposed project.

Commenters are asked to include their name, telephone number, address, and e-mail address (if applicable) in the event it is necessary to further clarify the comments offered. Agencies submitting comments are asked to provide the name, telephone number, and e-mail address of the agency's contact person. Please write *"Omya White Knob/White Ridge Limestone Quarries Project*" in the subject line. Due to CEQA-defined time limits, comments should be sent at the earliest possible date, but no later than July 12, 2013. Please direct comments and questions related to the EIR to:

Pat Angell
PMC
2729 Prospect Park Drive, Suite 220
Rancho Cordova, CA 95670
Phone: (916) 231-3373
Fax: (916) 361-1574
E-mail: pangell@pmcworld.com

Project Description

Please see the attached Initial Study.

Government Agency Reviews and Permits

The County will be the CEQA lead agency and will consider the Amended Mine and Reclamation Plan based upon the environmental analysis disclosed in the EIR. The applicant's requested public agency actions include:

- County of San Bernardino approval of a Mining and Land Reclamation Plan Conditional Use Permit Application
- U.S. Fish and Wildlife Service – Section 7 Consultation with the Forest Service through the Carbonate Habitat Management Strategy Plan
- U.S. Army Corps of Engineers – Section 404 permitting
- Office of Mine Reclamation – Approval of Amended Mine and Reclamation Plan
- Regional Water Quality Control Board – National Pollutant Discharge Elimination System Permit

- California Department of Fish and Wildlife – Streambed Alteration Agreement
- Mojave Desert Air Quality Management District – Air Quality Permitting

Potential Environmental Impacts

The lead agency has determined that the proposed project could result in significant environmental impacts and/or have a significant impact on the quality of the human environment. As such, preparation of an EIR is appropriate. The EIR will evaluate the environmental impacts of the proposed project, after having first established the environmental setting, or baseline, for the environmental analysis. In the Initial Study prepared for the proposed project, the following potentially significant impacts were identified for further evaluation, the results of which will be disclosed in the EIR. In each instance, the significance of potential project impacts, cumulative impacts, and appropriate mitigation measures will be disclosed in the EIR.

- Aesthetics
- Air Quality
- Biological Resources
- Cumulative Impacts
- Geology and Soils
- Greenhouse Gas Emissions
- Hydrology and Water Quality
- Utilities and Service Systems

In addition, the EIR will discuss the following area even though the Initial Study concluded that there would be no impact or a less than significant impact associated with it:

- Cultural Resources

Attachments

Initial Study for the White Knob/White Ridge Limestone Quarries Expansion Project

The complete proposed Amended Mine and Reclamation Plan is available on the County's website: http://cms.sbcounty.gov/lus/Planning/Environmental/NoticesDeterminations/Mountain.aspx

SAN BERNARDINO COUNTY
INITIAL STUDY ENVIRONMENTAL CHECKLIST FORM

This form and the descriptive information in the application package constitute the contents of the Initial Study pursuant to County Guidelines under Ordinance 3040 and Section 15063 of the State CEQA Guidelines.

PROJECT LABEL

APN:	446-011-04, 446-011-06, 446-021-11, and 446-021-35
Applicant:	Omya California, a Division of Omya Inc. 7225 Crystal Creek Road Lucerne Valley, CA 92356
Community:	Lucerne Valley
Location:	6 miles south of Highway 18 and 5 miles west of Crystal Creek Road
Project No:	AP 20080046
Staff:	Channary Leng
Rep:	Lilburn Corporation
Proposal:	Revision to Mining CUP and amendment to Mine and Reclamation Plan on a total of 375.1 acres for the White Knob/White Ridge Limestone Quarries

USGS Quad:	Butler Peak/Fifteen Mile Valley, California
T, R, Section:	T3N R1W, Secs. 5, 6, 7 & 8
Thomas Bros.:	2005, p. 4660
Planning Area:	Lucerne Valley
LUSD:	RC (Resource Conservation)
Overlays:	BR (Biotic Resources) FS-1 (Fire Safety Overlay) AR-4 (Airport Safety Overlay) GH (Geologic Hazard Overlay – Earthquake Fault Zone)

PROJECT CONTACT INFORMATION

Lead agency:	County of San Bernardino Land Use Services Department 385 N. Arrowhead Avenue San Bernardino, CA 92415-0184
Contact person:	Channary Leng
Phone No:	(949) 450-0171 Fax No: (949) 450-0182
E-mail:	channary@rgpcorp.com
Project sponsor:	Omya California, a Division of Omya Inc. 7225 Crystal Creek Road Lucerne Valley, CA 92356
Preparer:	PMC

PROJECT DESCRIPTION

Omya California (Omya), a Division of Omya Inc., is proposing an Amended Mine and Reclamation Plan (Amended Plan) for the proposed expansion of the existing White Knob/White Ridge Limestone Quarries. Omya has submitted the Amended Plan to the County of San Bernardino (County) for review and approval.

The project site is located approximately 6 miles southwest of the community of Lucerne Valley and 8 miles northwest of Big Bear Lake just north of the San Bernardino National Forest (SBNF) in San Bernardino County, California (see **Figure 1** and **Figure 2**). The project site is within portions of Sections 5, 6, 7, and 8 of Township 3 North, Range 1 West, SBBM. The project site encompasses approximately 375.1 acres including the existing 145-acre permitted operational area, a 190.1-acre expansion area, and a 40-acre Bureau of Land Management (BLM) haul road right-of-way.

The Amended Plan (see **Figure 3** and **Figure 4**) incorporates supplemental data and modifications to mining and reclamation plans in order to expand operations at the quarries. The Amended Plan includes expansion of the existing quarries' operation (White Knob Quarry, White Ridge Quarry, and White Knob Annex Quarry) and the existing overburden (OB) site, the creation of two new OB sites, and the expansion of the ancillary disturbance limits, which include haul and access roads, sediment basins and other erosion control features, storage pads, crusher location, west slope impacts, and incidental impacts from boulder roll-down. In addition, the proposed project would increase operational years of the quarries by 24 years from the existing permit expiration date of 2031 to the year 2055. The total existing permitted operational area is approximately 145 acres. The Amended Plan would add approximately 190.1 acres, for a total permitted operational area of approximately 335.1 acres. The amendment does not propose any new quarries.

With the exception of the haul road right-of-way, the project site is located entirely within approximately 776.1 acres of patented fee lands, portions of which are leased or owned by Omya. The haul road is located on federal public land within a Bureau of Land Management right-of-way. Note: Approximately 70 acres of an unpatented mining claim on BLM-managed federal lands are in the process of being transferred to Omya ownership through a direct land sale. The Amended Plan and the EIR assume that this area is owned by Omya and is included as part of the project site.

Permitting of the proposed project would require compliance with the California Surface Mining and Reclamation Act (SMARA), implemented by the County (Development Code, Chapter 88.03). Therefore, in consultation with the County, Omya submitted an Amended Mine and Reclamation Plan per the County's Mine and Reclamation Plan Conditional Use Permit Application, Information Sheet, and Application. Both of these forms and applications are combined in the Amended Plan with four attached 30-inch by 40-inch, 200-scale mine and reclamation plan sheets and cross sections on file with the San Bernardino County Land Use Services Department. In addition, a Conditional Use Permit (CUP) application was submitted to the County.

Obtaining the necessary County approvals would require compliance with the California Environmental Impact Report (CEQA). An Environmental Impact Report (EIR) will be prepared to comply with CEQA.

Existing Approved Mine and Reclamation Plan

The San Bernardino County Planning Commission approved the existing White Knob/White Ridge Limestone Mine Site Approval and Reclamation Plan in 1986 (RP# 86M-04) with an expiration date of December 31, 2031. The site is designated as CA Mine ID# 91-36-0067. In addition, the Planning Commission certified the project EIR in 1986 with mitigation measures and adopted a Statement of Overriding Considerations for significant impacts in the following three areas:

1. The direct loss of rare plants and plant habitats.
2. Visual impacts from some areas in Lucerne Valley and dust generation from the preferred crusher site.
3. Visual disruption of the White Mountain viewshed from some vantage points in Lucerne Valley.

The haul road to the White Knob/White Ridge Quarries from the processing plant is approximately 5.1 miles long, going westerly from the processing plant for approximately 3.5 miles then turning southerly to climb at a 14 percent grade up to the quarry sites (see **Figure 2**). The first 4.4 miles of the haul road cross land managed by the BLM. Use and occupation of the haul road on 67 acres was authorized under a Federal Land Policy Management Act (FLPMA) right-of-way (CACA 16644) approved by the BLM Barstow Resource Office in July 1988.

On April 20, 2011, a Settlement Agreement (Agreement) was entered into by and between the BLM, the California Department of Fish and Wildlife, and Omya relating to activities at the White Knob Quarry. There are six separate components (Parts A through F) in the Agreement. Part B of the Agreement is entitled "Repair, Remediate, and Monitor Improvements to the White Knob Quarry Right-of-Way Access Road and Associated Facilities to Protect Drainages."

Figure 1

Page 2

Figure 2

Page 2

Figure 3

Page 2

Figure 4

Page 2

In August 2011, Stantec Consulting Inc. (Stantec) prepared the *White Knob Quarry Haul Road Drainage Report and Plan of Development* to analyze the existing drainage conditions at the quarries and along the haul road, and to provide recommendations for facilities to control stormwater and sediment runoff and provide protection to surrounding drainages. Omya subsequently submitted an amended right-of-way application to the BLM to make improvements to the haul road and drainages as recommended in the Stantec Plan of Development. In order to accommodate the improvements required to adequately repair and remediate the right-of-way access road and drainage facilities, the existing right-of-way would be extended from the existing 67 acres to 83.5 acres.

The components (Parts A through F) of the Agreement consist of the following:

- Part A – Omya has agreed to study and monitor Ruby Springs, located to the north of the White Knob quarry area. Ongoing monitoring through 2014 is being undertaken and reported to the BLM.
- Part B – As discussed previously, requires Omya to repair, remediate, and monitor measures to control runoff and sedimentation along the 4.4 miles of haul road on BLM-managed land.
- Part C – Requires that the former explosives storage facility located on BLM land be removed and reclaimed. The facility has been removed. The area is part of the 70-acre area purchased by Omya, and its future use and reclamation are part of the Amended Plan.
- Part D – Requires haul road improvements and reclamation to be incorporated into the overall reclamation plan.
- Part E – Requires Omya to apply to the BLM for the direct sale of 70 acres on which overburden material is proposed to be placed in the future.
- Part F – Recovery of costs for the BLM.

Proposed Amended Mine and Reclamation Plan (refer to **Figure 4**)

The proposed project would expand the operational disturbance area of the quarries by approximately 190.1 acres and includes expansion of the existing quarries by approximately 26.7 acres and expansion of Overburden Site #1 by 16.9 acres. In addition, the proposed project would result in the creation of two additional overburden sites and expansion of several ancillary uses, resulting in an overall increase of the ancillary disturbance limits by 130.5 acres (see **Table 1**).

Quarry and overburden stockpile development and expansion would be phased. Included in the phased expansion and reclamation is concurrent quarry development and reclamation of equipment-accessible mined-out portions of the quarries. Therefore, the project includes both expanded mining operations, beyond what is currently permitted, and reclamation of the disturbed areas.

Table 1
Existing and Planned Operational Areas
White Knob/White Ridge Quarries

Quarry or Area	Existing Approved Areas (acres)	Proposed New Areas (acres)	Total New Project Areas (acres)
White Knob Quarry	35	6.1	41.1
White Knob Annex Quarry	7	5.5	12.5
White Ridge Quarry	18	15.1	33.1
Overburden Site #1	15[1]	16.9	31.9

Quarry or Area	Existing Approved Areas (acres)	Proposed New Areas (acres)	Total New Project Areas (acres)
Overburden Site #2	–[1]	13.0	13.0
Overburden Site #3	–[1]	3.0	3.0
Ancillary Disturbance Limits[2] (outside of above)	70	130.5	200.5
Totals	**145**	**190.1**	**335.1**

Note: Areas from 1986 Plan estimated to whole acres; proposed areas rounded to nearest tenth of an acre. Totals may be slightly different due to rounding.
1. Combined waste areas; not individually estimated in 1986 Plan.
2. Ancillary disturbance limits include haul/access roads to quarries and overburden sites, sediment basins and other erosion control features, storage pads, crusher location, west slope impacts, and incidental impacts from boulder roll-down.

The White Knob/White Ridge Quarries are currently permitted to operate through the year 2031. Known limestone resources would accommodate an increase to approximately 8.9 million tons of ore to the plant for a proposed additional 40 years of operations (2016 through 2055). Depending on market demand, the White Knob/White Ridge Quarries' average ore-to-plant production rates may slightly decrease to approximately 222,500 tons per year compared to the 2004–2006 baseline average of 275,400 tons of ore to the plant per year (see **Table 2**). In order to ensure that the processing plant has sufficient limestone for production, a maximum amount of 680,000 tons per year is listed to show the White Knob/White Ridge Quarries solely supplying the Lucerne Valley processing plant in the event that production from the nearby Butterfield/Sentinel Quarries is unavailable.

Table 2
White Knob-White Ridge Quarries
Three-Year Average and Amended Plan Proposed Throughputs
(Tons/Year)

	Material Excavated (Ore and Overburden)	Ore to Crusher	Overburden & Non-Spec Rock to On-Site Overburden Stockpile	Overburden & Non-Spec rock for Aggregate (to Processing Plant)	Crushed Ore to Processing Plant (Production)	Crusher Fines to Stockpile (Est. 17% of Ore to Crusher)
3-Year Average[1] (Baseline) (2004–2006)	512,000	324,000	188,000	0	275,400	48,600
Proposed Amended Plan (Average)[1]	662,500	270,000[3]	392,500 (242,500)[4]	150,000[3]	222,500	47,500
Proposed Amended Plan (Maximum)[2]	1,950,000	800,000[3]	1,150,000 (850,000)[4]	Up to 300,000[3]	680,000	120,000

Sources: 3-year average from 2004–2006 White Knob Quarry Annual Production

Notes:
1. Three-year amounts are average actual production levels from 2004 through 2006, and the Amended Plan amounts are listed as both average and maximum proposed amounts. Percentages of ore, overburden and non-spec rock, and crusher waste (fines) vary with excavation phase and quality of limestone. The "material excavated" is the amount that includes the ore and overburden.
2. Maximum amounts are listed to show the White Knob/White Ridge Quarries solely supplying the Lucerne Valley processing plant in the event that production from the Butterfield/Sentinel Quarries is unavailable.
3. Per Amended Plan, varying amounts of quarry overburden and non-spec rock would be crushed and transported to the processing plant (along with fines) for aggregate sales depending on demand. Table lists potential overburden crushed and transported to the processing plant area.
4. Amounts of overburden including fines sold for aggregate would be subtracted from the amounts deposited on the overburden stockpiles.

The Amended Plan includes an option for crushing varying amounts of overburden and non-spec rock, and transporting this material to the processing plant (along with fines) for sales depending on demand. These amounts would be subtracted from the amounts deposited on the overburden stockpiles. **Table 2** lists potential overburden crushed and transported to the processing plant as an average of 150,000 tons per year with a maximum of 300,000 tons per year. The combination of all material transported to the processing plant would not exceed 680,000 tons per year.

Quarry and overburden stockpile development and expansion would be phased. Included in the phasing is concurrent quarry development and reclamation of equipment-accessible mined-out portions of the quarries.

The quarries are multi-bench open pit mines. Several working levels are operated at any one time within the quarries to supply the quota of ore needed to meet production demands. The multi-working-level concept allows for greater selectivity and blending of rock qualities to meet stringent quality standards of customers and allows maximum utilization of the resource. Four grades of ore are selectively mined. The ore is drilled and blasted, loaded into haul trucks, and crushed at the quarries. Crushed ore is loaded into off-road haul trucks and transported on the existing haul road as described previously to the processing plant in Lucerne Valley.

Once the final outer limit and bottom of the ore is reached in the White Knob Quarry, the quarry and the areas to its south (Central Area) would be partly backfilled to approximately the 5,575-foot level. The Amended Plan allows for backfill to be placed in the mined-out portions of the White Knob Quarry and also allows for an efficient mining plan, minimum disturbance of new ground, and concurrent reclamation of the quarries and overburden stockpiles.

At the conclusion of excavations, ten years of reclamation and revegetation activities would be implemented, followed by monitoring and remediation until revegetation goals are achieved. The reclaimed end use of the site would be open space wildlife habitat with native vegetation.

The previously approved SMARA reclamation plan includes a site-specific approved reclamation and revegetation plan, including growth media salvage, seeding and revegetation, seed collection and propagation, irrigation, site cleanup, public safety, rock and fill slope stability, drainage and erosion controls, a monitoring and maintenance plan, and bond release criteria. No changes in the approved revegetation plan are proposed other than increased acreage and timing.

Project Objectives

The Amended Plan was developed with the following objectives:

- Continue the mining and recovery of a unique high calcium limestone resource to supply the Lucerne Valley Processing Plant for the production of a wide range of calcium carbonate products.
- Minimize additional land disturbance through the expansion of contiguous existing and previously approved quarries and minimal expansion of existing overburden stockpiles and haul roads.
- Place overburden within completed portions of the White Knob Quarry to limit the area of disturbance to the degree possible.

- Meet the requirements of SMARA and the County surface mining ordinance.
- Minimize impacts to sensitive plants and wildlife through quarry design and ongoing bighorn sheep programs.
- Reclaim the site for post-mining uses which will include open space habitat.
- Reduce the slopes on overburden fill areas to an overall maximum slope of 2H:1V and revegetate disturbed areas to minimize aesthetic and erosion impacts.
- Mitigate for lost, threatened, and endangered species habitat in accordance with the Carbonate Habitat Management Strategy (CHMS) requirements by relinquishing unpatented mining claims or transfer of private property as determined adequate by the CHMS and regulatory agencies.
- Reclaim and maintain the site as necessary to eliminate hazards to public safety.

SURROUNDING LAND USE

AREA	EXISTING LAND USE	OFFICIAL COUNTY LAND USE DISTRICT
Site	Active mining including quarries, overburden stockpiles, access/haul roads, and sediment basins on private and federal lands	Resource Conservation (RC)
North	Vacant BLM land	RC
South	Vacant BLM land	RC
East	Vacant BLM land	RC
West	Vacant BLM land	RC

The project site is located in the San Bernardino Mountains southwest of Lucerne Valley in southwestern San Bernardino County. The White Knob/White Ridge Quarries are located on approximately 776.1 acres of patented fee lands under private ownership. The associated haul road is located on federal public land within a BLM right-of-way. The existing mine and planned expansions are bounded on all sides by vacant, open space managed by the BLM. Other than mining, which has historically been active in the area since the nineteenth century, land use in the surrounding area has been limited to occasional use by hikers and hunters.

OTHER PUBLIC AGENCIES WHOSE APPROVAL MAY BE REQUIRED (E.G., PERMITS, FINANCING APPROVAL, OR PARTICIPATION AGREEMENT)

- U.S. Fish and Wildlife Service – Section 7 Consultation with Forest Service through the Carbonate Habitat Management Strategy
- U.S. Army Corps of Engineers – 404 Permit
- Office of Mine Reclamation – Approval of Amended Mine and Reclamation Plan
- Regional Water Quality Control Board – National Pollutant Discharge Elimination System Permit
- California Department of Fish and Wildlife – Streambed Alteration Agreement
- Mojave Desert Air Quality Management District – Air Quality Permitting

EVALUATION FORMAT

This Initial Study is prepared in compliance with the California Environmental Quality Act (CEQA) pursuant to Public Resources Code Section 21000, et seq., and the State CEQA Guidelines (California Code of Regulations Title 14 Section 15000, et seq.). Specifically, the preparation of an Initial Study is guided by Section 15063 of the State CEQA Guidelines. The format of the study is presented as follows. The proposed project is evaluated based upon its effect on 18 major categories of environmental factors. Each factor is reviewed by responding to a series of questions regarding the impact of the project on each element of the overall factor. The Initial Study Checklist provides a formatted analysis that provides a determination of the effect of the proposed project on the factor and its elements. The effect of the proposed project is categorized into one of the following four categories of possible determinations:

Potentially Significant Impact	Less Than Significant Impact With Mitigation Incorporated	Less Than Significant Impact	No Impact

"Substantiation" is provided to explain each determination. One of the four following conclusions is provided as a summary of the analysis for each of the major environmental factors.

1. **No Impact:** No impacts are identified or anticipated. Therefore, no mitigation measures are required and analysis in an Environmental Impact Report (EIR) is not required.

2. **Less Than Significant Impact:** No significant adverse impacts are identified or anticipated. Therefore, no mitigation measures are required, and analysis in an EIR is not required.

3. **Less Than Significant Impact With Mitigation Incorporated:** An impact that may have a “substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project” (CEQA Guidelines Section 15382). However, the incorporation of mitigation measures that are specified after analysis would reduce the project-related impact to a less than significant level. In the context of the Notice of Preparation (NOP), this Initial Study does not propose mitigation measures. Rather, issues that are identified as having potentially significant impacts will be addressed in the EIR. The EIR will propose appropriate mitigation measures and will evaluate the expected effectiveness of the measures in reducing the potential “significance” of the impact.

4. **Potentially Significant Impact:** Potentially significant adverse impacts have been identified or anticipated. An EIR is required to evaluate these impacts.

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☒ Aesthetics	☐ Agriculture and Forestry Resources	☒ Air Quality
☒ Biological Resources	☐ Cultural Resources	☒ Geology/Soils
☒ Greenhouse Gas Emissions	☐ Hazards & Hazardous Materials	☒ Hydrology/Water Quality
☐ Land Use/Planning	☐ Mineral Resources	☐ Noise
☐ Population/Housing	☐ Public Services	☐ Recreation
☐ Transportation/Traffic	☐ Utilities/Service Systems	☒ Mandatory Findings of Significance

DETERMINATION: (To be completed by the lead agency)

On the basis of this initial evaluation, the following finding is made:

☐ The proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ Although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☒ The proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ The proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect (1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and (2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ Although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Signature: Channary Leng, Consultant to County of San Bernardino

Date

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
I. AESTHETICS – Would the project				
a) Have a substantial adverse effect on a scenic vista?	☒	☐	☐	☐
b) Substantially damage scenic resources, including but not limited to trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☒	☐	☐	☐
d) Create a new source of substantial light or glare, which would adversely affect day or nighttime views in the area?	☐	☐	☐	☒

SUBSTANTIATION: *(Check ☐ if project is located within the viewshed of any scenic route listed in the General Plan)*

a, c) **Potentially Significant Impact.** Due to topography and the orientation of the quarry sites, views are and would be limited to those from the north, northwest, and northeast within Lucerne Valley. The project site is not and would not be visible from any developed/populated areas to the south within the San Bernardino National Forest, including the City of Big Bear Lake (and from the lake itself), Fawnskin, and Big Bear City, due to the intervening ridges located north of the lake and the relatively lower elevations of the lake itself.

The Amended Plan includes expansion of the existing OB-1 and the addition of OB-2 and OB-3 on existing and proposed mine areas that would be visible as additional white slopes or small mounds. The white tones of mined limestone and the overburden areas would increase with project development but would be similar in nature to the existing conditions and other quarries to the east. Phased, concurrent, and final reclamation would colorize and revegetate the roll-down slopes, overburden areas, and quarry benches to blend with the natural-colored slopes. Rock staining and vegetation on the existing north slopes have demonstrated a marked reduction in the contrasting tones and reduced visual contrasts.

Regardless, the proposed project has the potential to significantly adversely affect a scenic view and/or substantially degrade the existing visual character and quality of the site. Therefore, potential long-term visual impacts of the proposed Amended Plan will be analyzed in the EIR.

b) **No Impact.** The proposed project would not be visible from highways designated by the State of California as a scenic route. State Route 18 is located approximately 6 miles north and east of the project site; however, it is not designated by the State of California as a scenic route. This impact will not need to be evaluated further in the EIR.

d) **No Impact.** The proposed project would not create a new source of substantial light or glare that would adversely affect day or nighttime views in the area. No new light sources are proposed, and therefore no impacts would occur. This impact will not need to be evaluated further in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
II. AGRICULTURE AND FORESTRY RESOURCES – In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Department of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland, are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment Project; and forest carbon measurement methodology provided in Forest Protocols adopted by the California Air Resources Board. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland) as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to nonagricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forestland (as defined in Public Resources Code Section 12220(g)), timberland (as defined by Public Resources Code Section 4526), or timberland zoned Timberland Production (as defined by Government Code Section 51104(g))?	☐	☐	☐	☒
d) Result in the loss of forestland or conversion of forestland to non-forest use?	☐	☐	☐	☒
e) Involve other changes in the existing environment, which, due to their location or nature, could result in conversion of Farmland to nonagricultural use or conversion of forestland to non-forest use?	☐	☐	☐	☒

SUBSTANTIATION: *(Check ☐ if project is located in the Important Farmlands Overlay)*

a, e) **No Impact.** The California Resources Agency defines Prime Farmland, Unique Farmland, and Farmland of Statewide Importance for San Bernardino County as farmlands that include dryland grains of wheat, barley, and oats, and dryland pasture. The project site does not meet these characteristics.

The project site is located on the steep northern slopes of the San Bernardino Mountains, where both the topography and the soils are unsuitable for agriculture. The proposed project would not directly or indirectly convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency. Therefore, no impact is anticipated, and this impact will not need to be analyzed further in the EIR.

b) **No Impact.** The project site is not designated as an agricultural land use and is not subject to a Williamson Act contract. The proposed project is consistent with existing on-site uses and would not conflict with current zoning or uses at the site. No impacts would result, and this impact will not need to be analyzed further in the EIR.

c, d) **No Impact.** The project site does not contain any forested land and is not zoned as forestland or timberland. Implementation of the Amended Plan would not directly or indirectly result in the conversion or rezoning or any such land. No impacts would result, and this impact will not need to be analyzed further in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
III. AIR QUALITY – Where available, the significance criteria established by the applicable air quality management or air pollution control district might be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☒	☐	☐	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☒	☐	☐	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☒	☐	☐	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☒	☐	☐	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒

SUBSTANTIATION: *(Discuss conformity with the South Coast Air Quality Management Plan, if applicable)*

a–c) **Potentially Significant Impact.** An air quality study will be prepared for the EIR for the proposed project. Criteria pollutant emission calculations and air quality modeling will be performed for the proposed expansion of quarry operations. Results will be compared with federal and state ambient air quality standards and the Mojave Desert Air Quality Management District (MDAQMD) CEQA emissions significance thresholds to determine potential significant impacts. Potential conflicts with implementation of the MDAQMD air quality plans and cumulative impacts will be assessed in the EIR. Findings of the air quality study will be evaluated in the EIR and mitigation provided as applicable.

d) **Potentially Significant Impact.** Toxic air contaminant (TAC) emission calculations and a project health risk analysis will be prepared for the proposed operational increase and compared with the applicable federal, state, and MDAQMD CEQA health risk significance thresholds. Potential impacts will be evaluated in the EIR.

e) **No Impact.** The proposed project would not produce any objectionable odors. No impacts would result, and this impact will not need to be analyzed further in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
IV. BIOLOGICAL RESOURCES – Would the project:				
a) Have substantial adverse effects, either directly or through habitat modifications, on any species identified as a candidate, sensitive or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☒	☐	☐	☐
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☒	☐	☐	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☒	☐	☐	☐
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☒	☐	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☒	☐
f) Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☒	☐

SUBSTANTIATION: *(Check if project is located in the Biological Resources Overlay or contains habitat for any species listed in the California Natural Diversity Database ☒)*

Note to the reader: As of January 1, 2013, the agency formerly known as the California Department of Fish and Game (CDFG) changed its name to the California Department of Fish and Wildlife (CDFW). For purposes of this discussion, the agency names and abbreviations are interchangeable.

a, b) **Potentially Significant Impact.** The carbonate soils, including limestone, in the northern San Bernardino Mountains provide a unique habitat, and there are five federally listed threatened or endangered plant species endemic to carbonate soils. The project site is not located within

designated critical habitat for these carbonate-endemic plants. An intensive collaborative effort led to the development of the CHMS in 2003. The strategy is designed to provide long-term protection for the carbonate-endemic plants and also provide for continued long-term mining in the San Bernardino Mountains. Portions of the carbonate habitats are protected from mining impacts in perpetuity within the carbonate habitat reserves dedicated and managed as described in the CHMS. "Take" of listed carbonate-endemic plants is permitted under the strategy and mitigated by permanent mining claim or private property set-aside and through management of off-site plant occurrences as outlined in the CHMS.

Although the site is not designated as critical habitat for any species by the USFWS, three federally listed threatened or endangered plant species do occur near or on the project site: Cushenbury buckwheat, Cushenbury oxytheca, and Parish's daisy. Several special-status plants also occur on either the proposed White Ridge deposit access road alignment or in the potential roll-down area: bluish spike-moss, Coville's dwarf abronia, San Bernardino Mountains dudleya, Parish's alumroot, and an unidentified jewelflower (either San Bernardino jewelflower or southern jewelflower).

Biological surveys of the project site were completed in 2007 and 2012. No wildlife species currently listed on the federal list of threatened or endangered species are known to inhabit the expansion areas. However, sensitive wildlife could occur in the project area, including the desert tortoise, southern rubber boa, gray vireo, loggerhead shrike, raptors, Mojave ground squirrel, lodgepole chipmunk, Nelson's bighorn sheep, and American badger.

Omya intends to develop the quarry sites consistent with the CHMS and guidelines and would mitigate impacts to listed species as applicable through permanent relinquishment of mining claims or transfer of private property in accordance with the CHMS requirements and consultation with the County. The EIR will assess biological resources, potential impacts, and consistency with the CHMS.

c) **Potentially Significant Impact.** Numerous drainage channels occur on or near the project site. Construction activities and ongoing mining activities could result in impacts to these drainages. A jurisdictional delineation of the project area was conducted to identify potentially occurring state and federal jurisdictional water resources, and to identify potential project impacts to these resources. A total of 3.4 acres of ephemeral streambed vegetated with California juniper series upland vegetation was identified in the delineation report to occur within the project survey area. Drainages at the project site are tributary to Rabbit Lake, a dry lakebed. Additionally, the jurisdictional delineation identified a total of 0.75 acres of wetland habitat. Three wetlands were identified to occur at the location of ground water springs and a seep. Potential impacts to these drainage and wetland features will be evaluated in the EIR.

d) **Potentially Significant Impact.** The project site is in an area that has been partially fragmented by previous and ongoing mining. The proposed project would contribute to the existing cumulative effects of these alterations to regional wildlife movement, including north–south movement by terrestrial species between the desert to the north and forests to the south, including Nelson's bighorn sheep. Potential impacts will be evaluated in the EIR.

e) **Less Than Significant Impact.** The San Bernardino County Native Plant Protection policy (1989) regulates removal of trees greater than 6 inches diameter at breast height (dbh), smoke trees, mesquite, creosote rings, and all plants in the agave family, including Joshua trees. Due to elevation

and habitat, no smoke trees, mesquite, or creosote rings would be expected on the site. This will be evaluated in the EIR.

f) **Less Than Significant Impact.** The project site lies within the Carbonate Habitat Management Strategy (Olson 2003), a habitat conservation plan for carbonate soil types. The proposed project's consistency with and implementation of this plan will be evaluated in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
V. CULTURAL RESOURCES – Would the project				
a) Cause a substantial adverse change in the significance of a historical resource as defined in Section 15064.5?	☐	☐	☒	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?	☐	☐	☒	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☒	☐
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☒	☐

SUBSTANTIATION: *(Check if the project is located in the Cultural ☐ or Paleontologic ☐ Resources overlays or cite results of cultural resource review)*

a–d) **Less Than Significant Impact.** Cultural resources and paleontological resources assessments were previously prepared for the proposed project. Based on the conclusions identified in these reports, the presence of cultural and paleontological resources within the study area are highly unlikely. No significant impacts are expected and recommendations to address resources discovered during mining operations have been identified. The EIR will address these cultural and paleontological resources recommendations.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
VI. GEOLOGY AND SOILS – Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map Issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☒	☐	☐	☐
ii. Strong seismic ground shaking?	☒	☐	☐	☐
iii. Seismic-related ground failure, including liquefaction?	☒	☐	☐	☐
iv. Landslides?	☒	☐	☐	☐
b) Result in substantial soil erosion or the loss of topsoil?	☒	☐	☐	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?	☒	☐	☐	☐
d) Be located on expansive soil, as defined in Table 181-B of the California Building Code (2001) creating substantial risks to life or property?	☐	☐	☐	☒
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	☐	☐	☐	☒

SUBSTANTIATION: *(Check ☒ if project is located in the Geologic Hazards Overlay District)*

a, c) **Potentially Significant Impact.** (i–iv) No active faults are located in the area of the quarries. No adverse geological conditions have been identified that would have an adverse impact on existing or future mining operations. A slope stability study has been completed for the project to address stability of future cut and embankment slopes. Geologic stability will be analyzed further in the EIR.

b) **Potentially Significant Impact.** Numerous erosion and sedimentation controls currently exist in the mining and stockpile areas and along the haul road to limit runoff, to minimize or prevent erosion, and to promote settling of suspended solids before the runoff leaves the site. Along the haul road, runoff is contained within the roadway by berms. As part of the proposed project, the roadway would be graded to direct runoff into catchment basins. Within the quarries, runoff from slopes, benches, roads, and ramps would be directed into the mined-out portion of the quarries or into sediment sumps located near OB-1. At the quarries, the final backfill would be designed to act as a permanent sediment basin for future sediment control.

A large number of energy dissipaters, sediment capture basins, riprap, hay bales, and/or silt fences trap sediment and minimize the potential for off-site transport. Operations also limit surface disturbance to minimum areas, and concurrent reclamation and revegetation would stabilize disturbed pads and slopes. Erosion control impacts and measures for the proposed project will be further evaluated in the EIR.

d) **No Impact.** The project site is not located in an area that has been identified by the County Building and Safety Geologist as having the potential for expansive soils. No impacts would result, and this impact will not need to be analyzed further in the EIR.

e) **No Impact.** Septic tanks and/or alternative wastewater disposal systems are not proposed as part of the project. Therefore, no impacts would result, and this impact will not need to be analyzed further in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
VII. GREENHOUSE GAS EMISSIONS – Would the project:				
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☒	☐	☐	☐
b) Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☒	☐	☐	☐

SUBSTANTIATION:

a, b) **Potentially Significant Impact.** The State of California has determined that global climate change is a threat to the environment and that human activity generating greenhouse gases (GHG) influences global climate change. Global climate change refers to changes in average climatic conditions on earth as a whole, including temperature, wind patterns, precipitation, and storms.

Global climate change regulation is continuing to evolve. The County adopted a GHG Emission Reduction Plan in December 2011. This plan is based on the premise that the County and the community it represents are uniquely capable of addressing emissions associated with sources under the County's jurisdiction and that the County's emission reduction efforts should coordinate with the state strategies of reducing emissions in order to reduce emissions in an efficient and cost-effective manner. The GHG Emission Reduction Plan presents a comprehensive set of actions to reduce the county's internal and external GHG emissions to 15 percent below current levels by 2020, consistent with the AB 32 Scoping Plan.

An analysis will be prepared as part of the air quality study that will quantify the operational emissions of GHGs resulting from the proposed project, determine its GHG impact, and recommend mitigation as appropriate. Findings of the analysis will be evaluated in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
VIII. HAZARDS AND HAZARDOUS MATERIALS – Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☒	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☒	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☒	☐

SUBSTANTIATION:

a, b) **Less Than Significant Impact.** The proposed project involves the use of materials common to the mining industry and includes the transport, storage, and use of fuels, lubricants, and explosives. The project could potentially create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials, including explosives and fuel. The operator would continue to comply with all applicable federal and state safety rules and regulations regarding hazardous materials.

Fuel for mobile equipment is stored at the quarry sites in an approved double-walled tank with a spill control berm. Mine equipment is fueled at the fuel storage site. Scheduled equipment maintenance occurs at the main plant site. Minor or emergency repairs may be conducted at the quarries; however, any waste oil generated at the mine site is collected and transported for off-site disposal by approved methods and by properly trained and licensed personnel.

No processing chemicals are used and no wastewater is produced from the mining and crushing operations.

Existing and proposed mining operations would require one blast per week. Therefore, the overall current levels of blasting would remain the same. However, blasting would occur for the extended life of the project through 2055. Blasting operations would continue to be conducted by licensed individuals in such a manner as to meet or exceed Mine Safety and Health Administration (MSHA) and California Division of Occupational Safety and Health (Cal-OSHA) requirements.

Blasting operations would involve drilling, placement of charges, and detonation of the charges by a blaster with all required licenses and permits for handling explosives. All explosives and detonators would be transported, handled, and stored in accordance with all federal, state, and local regulations.

The blasting agent ammonium nitrate and fuel oil (ANFO) explosives used at the quarries are currently stored separately in magazines located at designated locations at Omya's Lucerne Valley operations per all federal, state, and local regulations. The explosives are only transported to the quarry sites by a licensed contractor as necessary.

Blasts in the Omya quarries are relatively small to maximize selectivity. The active quarry is located near the base of the range in the central portion of the mountain range. The closest residence is located over 2 miles north of the quarry, and one or more major mountain ridges are present between quarries and residences to the south. Blasting has occurred for over 25 years with no adverse impact on people, structures, or wildlife. The blasts cannot be seen, heard, or felt in any residential areas. Based on the current measures in place, it is anticipated that impacts would be less than significant.

The project has the potential to create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment. However, public safety measures and state and federal requirements have already been put in place at the project site. For example, vehicular access to the mining area is only on a restricted access/haul road with multiple highly visible warning signs directing the public

away from the active mining area. The haul road is also watched by company personnel during operating hours. During non-operating times, locked steel gates have been installed on all roads accessing both the active and inactive quarry sites to restrict vehicular access. Berms have been placed on jeep and off-road vehicle (ORV) trails to restrict ORV access to the project site. Signs have also been, and would in the future be, placed around the perimeter of the mining area directing vehicles and foot traffic away from the mining and reclamation area. All active mining areas comply with the MSHA and Cal-OSHA mine safety regulations. Furthermore, during the proposed activities, signs would be posted at all site access points identifying the area as private property and specifying that only authorized personnel shall be allowed entry. In addition, the mining pit perimeter is currently fenced off to vehicle and foot traffic with posted signs. Based on these precautions, the proposed project would create a less than significant impact on public health and safety. These issues will not be discussed further in the EIR.

c) **No Impact.** The proposed project involves the use of materials common to the mining industry and includes the transport, storage, and use of fuels, lubricants, and explosives. The operator would continue to comply with all applicable federal and state safety rules and regulations regarding hazardous materials. During operations, diesel exhaust would be generated by heavy construction-type equipment; however, no existing school facilities or proposed school facilities are located within a quarter-mile radius of the project site. The nearest schools include North Shore Elementary, located approximately 6 miles southeast of the project site in Big Bear Lake, and Lucerne Valley Middle School, located approximately 6 miles northeast of the project site. No impacts to nearby schools are anticipated, and this impact will not be analyzed in the EIR.

d) **No Impact.** The project site is not identified on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5. No impacts will occur, and this issue will not be analyzed in the EIR.

e) **No Impact.** As shown on San Bernardino County General Plan Hazards Overlay Maps FI09B and FH16B, the project site occurs within Airport Safety Review Area 4 (AR4). According to San Bernardino County Development Code Section 82.09.030, Airport Safety, AR4 includes the low-altitude/high-speed corridors designated for military aircraft use. The nearest public/private airports include Big Bear City Airport, located approximately 8 miles southeast of the site, and Rabbit Ranch Airport in Lucerne Valley, approximately 4 miles north of the site. Since no new human-occupied structures are proposed, potentially significant impacts are not anticipated. In addition, existing and proposed operations do not exceed height limits that could potentially impact military aircraft flight patterns. Therefore, the proposed project would not result in safety hazard impacts from aircraft-related uses. No additional discussion is warranted in the EIR.

f) **No Impact.** The project site is not within the vicinity or approach/departure flight path of a private airstrip. No impacts related to a private airstrip would occur, and this impact will not need to be analyzed further in the EIR.

g) **No Impact.** Activities associated with the proposed project would not impede existing emergency response plans for the project site and/or other land uses in the project vicinity. All vehicles and stationary equipment would be staged off public roads and would not block emergency access routes. Therefore, implementation of the proposed project would not impair implementation of, or physically interfere with, an adopted emergency response plan or emergency evacuation plan. This impact will not need to be analyzed further in the EIR.

h) **Less Than Significant Impact.** According to San Bernardino County General Plan Maps FI09B and FH16B, the project site is located in Fire Safety Review Area (FS-1), which includes areas in the mountains and the valley foothills. It also includes all the land generally within the San Bernardino National Forest boundary and is characterized by areas with moderate and steep terrain and moderate to heavy fuel loading contributing to high fire hazard conditions. The project site includes internal haul/access roads to allow for emergency egress and safe zones in the event of a wildfire. The proposed project would not contribute to or be impacted by surrounding fuel loads, and a fuel modification zone would not be required. No new human-occupied structures are proposed as part of the project. This impact will be less than significant and will not need to be analyzed further in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
IX. HYDROLOGY AND WATER QUALITY – Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☒	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level, which would not support existing land uses or planned uses for which permits have been granted)?	☐	☐	☒	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site?	☒	☐	☐	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?	☒	☐	☐	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	☒	☐	☐	☐
f) Otherwise substantially degrade water quality?	☐	☐	☒	☐
g) Place housing within a 100-year flood hazard area as mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structure which would impede or redirect flood flows?	☐	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒

SUBSTANTIATION:

a, f) **Less Than Significant Impact.** Numerous erosion and sedimentation controls currently exist in the mining and stockpile areas and along the haul road to limit runoff, to minimize or prevent erosion, and to promote settling of suspended solids before the runoff leaves the site. Along the haul road, runoff is contained within the roadway by berms. As part of the proposed project, the roadway would be graded to direct runoff into catchment basins. Within the quarries, runoff from slopes, benches, roads, and ramps would be directed into the mined-out portion of the quarries or into sediment sumps located near OB-1. At the quarries, the final backfill would be designed to act as a permanent sediment basin for future sediment control. Operations also limit surface disturbance to minimum areas, and concurrent reclamation and revegetation would stabilize disturbed pads and slopes.

All operations on-site would comply with a National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges associated with industrial activities and employ stormwater best management practices (BMPs). NPDES goals are to eliminate unauthorized non-stormwater discharges and to monitor stormwater discharge requirements. Water quality and erosion control will be evaluated in the EIR.

b) **Less Than Significant Impact**. The White Knob/White Ridge Quarries utilize a relatively small amount of groundwater during operations. Approximately 2.75 acre-feet of water are used annually for dust suppression in the quarries, overburden placement areas, haul/access roads, and at the crusher. With the increase in production, water usage is expected to increase to approximately 5 acre-feet per year. No substantial changes are proposed other than that adequate dust control would be maintained. Note that the use of magnesium chloride on roads and other active mine areas and the occurrence of typically wet winter weather reduce the amount of water needed to control dust.

Water used to control dust is obtained from two previously permitted sources: a well located at the plant site in Lucerne Valley and a well located in Crystal Creek Canyon near Turnout 5 on the Crystal Creek haul road. These water sources would be used to meet water demands of the proposed operations. No substantial changes in overall water use are proposed. Both existing wells are permitted by the California State Water Resources Control Board and the County of San Bernardino Department of Environmental Health Services (Permit #06259026). The plant well has been assigned recordation number 36011 by the State Water Resources Control Board. Bottled drinking water for employees at the mining area is brought to the site as necessary. No surface water is used in the operation. There would be no added diversions or storage for water supply.

The project site is not within the service area of a public water supplier, but it is within the boundaries of the Mojave Water Agency (MWA). MWA is a State Water Project contractor, a regional groundwater management agency, and serves as Watermaster for the adjudicated Mojave Basin. The MWA published its Eighteenth Annual Report for the 2010–11 Water Year on May 1, 2012. The report summarizes information required by the judgment and includes a summary of the Watermaster's activities and water supply conditions for the water year. Omya has a verified base annual production allocation of 23 acre-feet per year for its two wells, and water usage over the past five years (2007 through 2011) has been 19, 14, 14, 14, and 14 acre-feet per year, respectively (MWA 2012). Approximately 2.75 acre-feet of this annual water usage is used for dust suppression at the White Knob/White Ridge Quarries site. The expected increase of water usage for the proposed project of 2.25 acre-feet per year would not exceed Omya’s base allocation, even

considering the higher usage amount in 2007 of 19 acre-feet per year.

Accordingly, the proposed project would not substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level. Note that CEQA requires a Water Supply Assessment to be conducted for the project, and findings on water supply will be disclosed in the EIR.

c–e) **Potentially Significant Impact.** Numerous erosion and sedimentation controls currently exist in the mining and stockpile areas and along the haul road to limit runoff, to minimize or prevent erosion, and to promote settling of suspended solids before the runoff leaves the site. Along the haul road, runoff is contained within the roadway by berms. As part of the proposed project, the roadway would be graded to direct runoff into catchment basins. Within the quarries, runoff from slopes, benches, roads, and ramps would be directed into the mined-out portion of the quarries or into sediment sumps located near OB-1. At the quarries, the final backfill would be designed to act as a permanent sediment basin for future sediment control. Potential impacts resulting from these proposed storm drainage facility improvements will be evaluated in the EIR.

g, h) **No Impact.** The project site does not occur within a 100-year flood hazard area, does not include the construction of housing, and would not place housing within a floodplain. No impacts would occur, and no further analysis is required in the EIR.

i) **No Impact.** The project site and surrounding area is not located inside any designated dam inundation area. The proposed project would not expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding, as a result of the failure of a levee or dam, because no levee or dam is proposed as part of this project. No impacts would result, and this impact will not need to be analyzed further in the EIR.

j) **No Impact.** A seiche is an oscillating surface wave in a restricted or enclosed body of water generated by ground motion, usually during an earthquake. Inundation from a seiche can occur if the wave overflows a containment wall or the banks of a water body. Since the project site is not located adjacent to any body of water that has the potential of seiche or tsunami, no impacts are anticipated. This impact will not need to be analyzed further in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
X. LAND USE AND PLANNING – Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

SUBSTANTIATION:

a) **No Impact.** The project site is surrounded by vacant open space with the nearest community, Lucerne Valley, located approximately 2 miles to the north. Further, the proposed project is an expansion of an existing use and would be consistent with the County General Plan land use designation for the site. Therefore, the proposed project would not result in the division of an established community and would have no impact. This impact will not need to be analyzed further in the EIR.

b) **No Impact**. The proposed project would not conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project because the project is consistent with all applicable land use policies and regulations of the County of San Bernardino General Plan. No impacts would result.

c) **No Impact.** The project site lies within the Carbonate Habitat Management Strategy (Olson 2003), a habitat conservation plan for carbonate soil types. The proposed project's consistency with and implementation of this plan will be evaluated in the Biological Resources section of the EIR, as described in Section IV of this Initial Study.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
XI. MINERAL RESOURCES – Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	☐	☐	☐	☒

SUBSTANTIATION: *(Check ☒ if project is located within the Mineral Resource Zone Overlay): MRZ-3a*

a, b) **No Impact.** Once mined, a measurement of this resource would be depleted; however, the proposed project is consistent with the County's policy that protects the current and future availability of mineral resources. The primary goal in evaluating a land use that does not include mineral extraction activities is to ensure that the mineral potential of land is recognized and that decision-makers do not preclude the conservation, potential for development, and use of the valuable mineral resources including water. Regulation and reclamation of the project site as required by SMARA would permit the continued availability of the mineral resources and provide for the protection and subsequent beneficial use of those mineral resources while minimizing impacts on the public and the environment. No impact to mineral resources is expected, and this impact will not need to be analyzed further in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
XII. NOISE – Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☒	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

SUBSTANTIATION: *(Check if the project is located in the Noise Hazard Overlay District ☐ or is subject to severe noise levels according to the General Plan Noise Element ☐):*

a, c, d) **Less Than Significant Impact.** Operations are required to conform with all applicable County noise control regulations. The active quarry is located near the base of the range in the central portion of the mountain range. The closest residence is located over 2 miles north of the quarries, and one or more major mountain ridges are present between quarries and residences to the south. Operations and blasting are not currently audible to any residential areas and have occurred for over 25 years with no adverse impact on people, structures, or wildlife. These impacts would be less than significant and will not need to be analyzed further in the EIR.

b) **Less Than Significant Impact.** Blasting operations would continue to be conducted by licensed individuals in such a manner as to meet or exceed MSHA and Cal-OSHA requirements. Mining activities vary throughout the year and may occur 24 hours per day, 7 days a week, depending on operational requirements. Blasting is restricted to daylight hours. These operational hours are not

changing with implementation of the proposed project.

Blasts in the Omya quarries are relatively small to maximize selectivity. The active quarry is located near the base of the range in the central portion of the mountain range. There are no residences or other sensitive receptors within 2 miles of the quarry, and one or more major mountain ridges are present between quarries and residences to the south. Operations and blasting cannot be seen, heard, or felt in any residential areas or by other sensitive receptors. No changes are proposed from the existing permitted arrangements. In terms of potential effects on people, this impact will be less than significant and will not be analyzed further in the EIR. However, a discussion of the potential effects of blasting noise and vibration on wildlife will be addressed in the Biological Resources section of the EIR.

e, f) **No Impact.** As shown on San Bernardino County General Plan, Hazards Overlay Maps FI09B and FH16B, the project site occurs within Airport Safety Review Area 4 (AR4). According to San Bernardino County Development Code Section 82.09.030, Airport Safety, AR4 includes the low-altitude/high-speed corridors designated for military aircraft use. The nearest public/private airports include Big Bear City Airport, located approximately 8 miles southeast of the site, and Rabbit Ranch Airport in Lucerne Valley, approximately 4 miles north of the site. Since no new human-occupied structures are proposed, potentially significant impacts are not anticipated. In addition, existing and proposed operations do not exceed height limits that could potentially impact military aircraft flight patterns. No impacts from airport-related noise would result, and this impact will not need to be analyzed further in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
XIII. POPULATION AND HOUSING – Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

SUBSTANTIATION:

a) **No Impact.** The proposed project would not directly stimulate population growth (e.g., it would not add housing or create a new business) nor would it indirectly stimulate growth (e.g., through the construction of new infrastructure). No impacts would result, and this impact will not need to be analyzed further in the EIR.

b, c) **No Impact.** The proposed project would not displace substantial numbers of existing housing units or people or require the construction of replacement housing because no housing units are proposed to be demolished. No impacts would result, and this impact will not need to be analyzed further in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
XIV. PUBLIC SERVICES				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
Fire protection?	☐	☐	☐	☒
Police protection?	☐	☐	☐	☒
Schools?	☐	☐	☐	☒
Parks?	☐	☐	☐	☒
Other public facilities?	☐	☐	☐	☒

SUBSTANTIATION:

a) **No Impact.** The proposed project would not result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services, including fire and police protection, schools, parks or other public facilities. Although the proposed project would result in a change in mine production levels, proposed operations would not require a substantial change in employment, and therefore demands for services would not increase significantly. No impacts would result, and this impact will not need to be analyzed further in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
XV. RECREATION				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒

SUBSTANTIATION:

a, b) **No Impact.** The project does not include housing that would induce population growth in adjacent areas and ultimately increase the use of park facilities or other recreational facilities in the region. No impacts are anticipated, and this impact will not need to be analyzed further in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
XVI. TRANSPORTATION/TRAFFIC – Would the project:				
a) Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?	☐	☐	☒	☐
b) Conflict with an applicable congestion management program, including, but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways?	☐	☐	☒	☐
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	☐	☐	☐	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
e) Result in inadequate emergency access?	☐	☐	☐	☒
f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety facilities?	☐	☐	☐	☒

SUBSTANTIATION:

a, b) **Less Than Significant Impact.** Existing and proposed operations include transporting crushed ore in off-road haul trucks approximately 5 miles northeast on a haul road that is not open to the public to the existing processing plant. Implementation of the proposed project would increase haul truck trips to and from the project site. However, these additional trips would not occur on public roadways and would not affect area traffic conditions. The proposed project could increase worker trips to and from the project site; however, these additional trips are expected to be minimal and would not have a significant effect on area traffic conditions. These impacts would be less than significant and will not need to be analyzed further in the EIR.

c) **No Impact.** Implementation of the proposed project would not affect air traffic patterns at any airport or airstrip because there are none in the immediate vicinity and because the project does not involve the construction of any tall structures or other obstacles to air traffic and navigation. No impacts would result, and this impact will not need to be analyzed further in the EIR.

d) **No Impact.** Existing and proposed operations at the project site would not affect public streets. The proposed project does not involve any road development or design features that could substantially increase hazards on public road, or changes in the transportation of rock or other materials on public roads. The project site is surrounded by vacant BLM land, and the proposed project is an expansion of an existing use. Therefore, no inconsistent uses would occur. No impacts would result, and this impact will not need to be analyzed further in the EIR.

e) **No Impact.** Activities associated with the proposed project would not impede existing emergency response plans for the project site and/or other land uses in the vicinity. All vehicles and stationary equipment would be staged off public roads and would not block emergency access routes. In addition, no road closures would be required. No impacts would result, and this impact will not need to be analyzed further in the EIR.

f) **No Impact.** The proposed project would not involve any long-term increases in traffic that would conflict with adopted policies, plans, or programs supporting alternative transportation. No impacts would result, and this impact will not need to be analyzed further in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
XVII. UTILITIES AND SERVICE SYSTEMS – Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☒	☐
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
c) Require or result in the construction of new stormwater drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☒	☐
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☒	☐
e) Result in a determination by the wastewater treatment provider, which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☐	☒
f) Be served by a landfill(s) with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☐	☒
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒

SUBSTANTIATION:

a) **Less Than Significant Impact.** No wastewater is or would be discharged from the on-site operations. Control of surface drainage, erosion, and sedimentation of operations and the haul road are included in Omya's Stormwater Pollution Prevention Plan (SWPPP), which has been filed with the California State Water Resources Control Board. The SWPPP would continue to be updated until mining and reclamation activities end. The SWPPP includes specific prohibitions; effluent limitations; and stormwater pollution prevention plans, including source identification, practice to reduce pollutants, assessment of pollutant sources, materials inventory, preventative maintenance program, spill prevention and response procedures, general stormwater management practices, training, record keeping, sampling procedures, and monitoring programs.

All operations on-site would comply with a NPDES General Permit for Storm Water Discharges associated with industrial activities and employ stormwater best management practices. NPDES

goals are to eliminate unauthorized non-stormwater discharges and to monitor stormwater discharges requirements. Water applied to roads and active mining areas to reduce fugitive dust would evaporate; therefore, the proposed project would not produce any runoff during normal operations. Because the project would not generate any wastewater and all surface drainage would comply with an approved SWPPP, this impact would be less than significant and will not need to be evaluated further in the EIR.

b) **No Impact**. The proposed project's water demands would be met with the use of groundwater pumped from existing wells that serve the current mine operations. No expansion of a water treatment system would be required. In addition, the project would not generate wastewater. The only water use would be water applied to roads and active mining areas to control fugitive dust. Employees are provided portable toilets on-site. No impacts to water or wastewater treatment systems would occur, and these impacts will not need to be analyzed further in the EIR.

c) **Less Than Significant Impact.** The project proposes expansion of existing and construction of new stormwater basins on the project site. The construction of these improvements will be analyzed further in the EIR.

d) **Less Than Significant Impact.** The White Knob-White Ridge Quarries utilize groundwater during operations. The project site is not within the service area of a public water supplier but is within the boundaries of the Mojave Water Agency (MWA). MWA is a State Water Project contractor, a regional groundwater management agency, and serves as Watermaster for the adjudicated Mojave Basin. The MWA published its Eighteenth Annual Report for the 2010–11 Water Year on May 1, 2012. The report summarizes information required by the judgment and includes a summary of the Watermaster's activities and water supply conditions for the water year. Omya has a verified base annual production allocation of 23 acre-feet per year for its two wells, and water usage over the past five years (2007 through 2011) has been 19, 14, 14, 14, and 14 acre-feet per year, respectively (MWA 2012). Approximately 2.75 acre-feet of this annual water usage are currently used for dust suppression at the White Knob-White Ridge Quarries site. The expected increase of water usage for the proposed project of 2.25 acre-feet per year would not exceed Omya's base allocation, even considering the higher usage amount in 2007 of 19 acre-feet per year.

Water is obtained from two previously permitted sources: a well located at the plant site in Lucerne Valley and a well located in Crystal Creek Canyon near Turn 5 on the Crystal Creek haul road. No surface water is used in the operation. There are no planned additional diversions or storage for water supply. No treatment facilities would be needed. Water would be hauled in a water truck and sprayed on the haul roads and active mining and overburden areas to minimize fugitive dust. The water truck would work during active quarry operations as needed to control visible dust.

The proposed project would not substantially deplete water supplies or require new entitlements. Therefore, this impact would be less than significant. Note that CEQA requires a Water Supply Assessment to be conducted for the project, and findings on water supply will be discussed in the Hydrology and Water Quality section of the EIR.

e) **No Impact.** The project site is not served by a public sewer system, and the proposed project would not require sewer collection or treatment services. Therefore, no off-site discharge of treated wastewater would occur. No impacts related to wastewater treatment would occur, and this impact will not need to be analyzed in the EIR.

f, g) **No Impact.** The proposed project would not require any additional solid waste services. Office operations would not increase over existing levels associated with an increase in production levels, and therefore solid waste generated on-site would not increase. Waste rock would be stockpiled within the quarry footprints to eliminate the need for off-site waste rock stockpiles or hauled to the processing plant for production of aggregate. No impacts would result, and this impact will not need to be analyzed further in the EIR.

Issues	*Potentially Significant Impact*	*Less Than Significant Impact With Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
XVIII. MANDATORY FINDINGS OF SIGNIFICANCE				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☒	☐	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☒	☐	☐	☐
c) Does the project have environmental effects, which will cause substantial adverse effects on human beings, either directly or indirectly?	☒	☐	☐	☐

SUBSTANTIATION:

a) **Potentially Significant Impact.** The proposed project may potentially affect biological resources including listed carbonate-endemic plants by removal of soils, vegetation, and habitat throughout the site and the indirect or off-site effects of dust and other disturbances to adjacent vegetation and wildlife habitat. Potential impacts to biological resources will be evaluated in the EIR.

b) **Potentially Significant Impact.** This Initial Study has identified potentially significant impacts that could also be cumulatively considerable. Potentially significant cumulative effects will be discussed in the EIR.

c) **Potentially Significant Impact.** An air quality study will be prepared as part of the EIR for the proposed project. Criteria pollutant emission calculations will be performed for the baseline and mine activities, and the proposed project operational emissions increases will be compared with federal and state ambient air quality standards and MDAQMD CEQA emissions significance thresholds. Toxic air contaminant (TAC) emission calculations will be estimated and a project health risk analysis will be prepared.

GENERAL REFERENCES

California Department of Conservation, Office of Mine Reclamation. 2012. Surface Mining and Reclamation Act (SMARA).

California Department of Toxic Substances Control. Envirostor Website.

CEQA Guidelines, Appendix G, as updated through 2011.

Mojave Water Agency. 2012. *Eighteenth Annual Report for the 2010–11 Water Year.*

Omya California. 2013. *Amended Mine and Reclamation Plan.*

San Bernardino County. *San Bernardino County General Plan* (with updates).

San Bernardino County. Land Use Plan General Plan Hazard Overlays: Map Panel FH16 B – Butler Peak.

San Bernardino County. Land Use Plan General Plan Hazard Overlays: Map Panel FI09 B – Fawnskin.

San Bernardino National Forest Association prepared by Todd G. Olson. 2003. *Carbonate Habitat Management Strategy (CHMS).*

Good afternoon Ms. Leng and Mr. Angell:

The Department of Fish and Wildlife (Department) appreciates the opportunity to comment on the Notice of Preparation (NOP) for the Draft Environmental Impact Report (EIR) for the White Knob-White Ridge Limestone Quarries Expansion Project (Project) [State Clearinghouse No. 2013061020]. The Department is responding to the NOP as a Trustee Agency for fish and wildlife resources (California Fish and Game Code Sections 711.7 and 1802, and the California Environmental Quality Act [CEQA] Guidelines Section 15386), and as a Responsible Agency regarding any discretionary actions (CEQA Guidelines Section 15381), such as the issuance of a Lake or Streambed Alteration Agreement (California Fish and Game Code Sections 1600 et seq.) and/or a California Endangered Species Act (CESA) Permit for Incidental Take of Endangered, Threatened, and/or Candidate species (California Fish and Game Code Sections 2080 and 2080.1).

Project Description

The Project is located approximately 6 miles southwest of the community of Lucerne Valley and 8 miles northwest of Big Bear Lake just north of the San Bernardino National Forest, in the County of San Bernardino, California. The Project site totals 335.1 acres, consisting of 145 acres of existing surface mining operation-related disturbance and approximately 40 acres of existing Bureau of Land Management (BLM) haul road right-of-way on federal public land. Omya California, a division of Omya Inc. (Omya), proposes an Amended Mine and Reclamation Plan for the phased expansion of the existing White Knob/White Ridge Limestone Quarries. The Amended Plan includes: expansion of the existing White Knob/White Ridge Limestone Quarries operations, including the White Knob Quarry, White Ridge Quarry, and White Knob Annex Quarry; expansion of the existing Overburdon (OB) site; creation of two new OB sites; expansion of the ancillary disturbance areas, which includes haul and access roads, sediment basins and other erosion control features, storage pads, crusher location, west slope impacts, and incidental impacts from boulder roll-down; and extension of the operational years of the quarries by 24 years, from the existing expiration date of 2031 to the year 2055. The Amended Plan would expand the existing mining operations from 145 acres to 335.1 acres, for a total expansion area of 190.1 acres.

Biological Resources and Impacts

The NOP briefly mentions that biological surveys were conducted in 2003 and 2012, however, those survey were not included in the NOP. The CEQA document should contain sufficient, specific, and current biological information on the existing habitat and species at the Project site; all biological documents used to determine impacts, including, species specific survey data, habitat assessments, and methodology; measures to minimize and avoid sensitive biological resources; and mitigation measures to offset the loss of native flora and fauna and State waters. The CEQA document should not defer impact analysis and mitigation measures to future regulatory discretionary actions, such as a Lake or Streambed Alteration Agreement.

Sensitive species have been identified on the Project site, including gray vireo (*Vireo vicinior*), loggerhead shrike (*Lanius ludovicianus*), American badger (*Taxidea taxus*), bluish spike-moss (*Selaginella asprella*), Coville's dwarf abronia (*Abronia nana covillei*), San Bernardino Mountains dudleya (*Dudleya abramsii affinis*), Parish's alumroot (*Heuchera parishii*), and an unidentified jewelflower (*Streptanthus sp.*). All sensitive species with the potential to occur onsite should be identified and assessed within the DEIR. Species specific surveys for plants and animals that have the potential to occur onsite should be conducted using methods approved by the Department, or the DEIR should assume the presence of the

species throughout the project site. Surveys should be conducted with one year of submission of the CEQA document. To assist with review, an accompanying map showing the areas of impact should be included in the subsequent CEQA document. Additional maps detailing the location of sensitive species should also be included in the subsequent CEQA document.

Carbonate Habitat Management Strategy Plan

Compliance with approved habitat plans, such as the Carbonate Habitat Management Strategy Plan (CHMS), should be discussed in the DEIR. Specifically, Section 15125(d) of the CEQA Guidelines requires that the CEQA document discuss any inconsistencies between a proposed Project and applicable general plans and regional plans, including habitat conservation plans and natural community conservation plans. An assessment of the effects to the CHMS as a result of this Project is necessary to address CEQA requirements.

Federally listed Cushenberry oxytheca (Oxytheca parishii var. goodmaniana), Cushenberry buckwheat (*Eriogonum ovalifolium var. vineum*), and Parish's daisy (*Erigeron parishii*) have been identified onsite. OMYA proposes to develop the Project consistent with the CHMS and mitigate impacts to the covered species in accordance with the CHMS requirements, and in consultation with the County. The DEIR should discuss how the Project will maintain compliance with the CHMS and discuss any mitigation measures required to maintain consistency with the Plan.

California Endangered Species Act

The NOP states that several listed species have the potential to occur onsite, including state and federally listed desert tortoise (*Gopherus agassizii*); state listed Mohave ground squirrel (*Xerospermophilus mohavensis*), Peninsular bighorn sheep (*Ovis canadensis nelson*), and southern rubber boa (*Charina umbratica*). A CESA Incidental Take Permit (ITP) must be obtained if the project has the potential to result in take of species of plants or animals listed under CESA, either during construction or over the life of the project. The Department's CESA ITP states that a project must fully minimize and mitigate impacts to State-listed resources.

Lake and Streambed Alteration Program

A Notification of Lake or Streambed Alteration is required by the Department, should the site contain jurisdictional waters. The Department is responsible for assessing and evaluating impacts to jurisdictional waters; typically accomplished through reviewing jurisdictional delineation (JD) reports, supporting information, and conducting site visits. Following review of a JD, the Department may request changes to the JD. The Department may also recommend that additional project avoidance and/or minimization measures be incorporated, or request additional mitigation for project-related impacts to jurisdictional areas.

The Department recommends submitting a notification early in the project planning process, since modification of the proposed project may be required to avoid or reduce impacts to fish and wildlife resources. To obtain a Lake or Streambed Alteration notification package, please go to http://www.dfg.ca.gov/habcon/1600/forms.html .

A JD was not included with the CEQA document. The Department recommends that the entirety of the project site be assessed for the potential presence of Department jurisdictional areas. The Department

has already determined Ruby Springs to be jurisdictional. The CEQA document should summarize the Ruby Springs monitoring reports monitoring, please provide complete copies of the Ruby Springs monitoring reports directly to Department staff. To assist in the preparation of the JD, please reference *A Review of Stream Processes and Forms in Dryland Watersheds* available at: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=25779

The Department opposes the elimination of ephemeral, intermittent, and perennial streams, channels, lakes, and their associated habitats. The Department recommends avoiding stream and riparian habitat to the greatest extent possible. Any unavoidable impacts need to be compensated with the creation and/or restoration of in-kind habitat either on-site or off-site at a minimum 3:1 replacement-to-impact ratio, depending on the impacts and proposed mitigation. Additional mitigation requirements through the Department's Lake and Streambed Alteration Agreement process may be required, depending on the quality of habitat impacted, proposed mitigation, project design, and other factors.

The following information will be required for the processing of a Notification of Lake or Streambed Alteration and the Department recommends incorporating this information into the CEQA document to avoid subsequent documentation and project delays:

1) Delineation of lakes, streams, and associated habitat that will be temporarily and/or permanently impacted by the proposed project (include an estimate of impact to each habitat type);
2) Discussion of avoidance and minimization measures to reduce project impacts; and,
3) Discussion of potential mitigation measures (per section 15370 of the CEQA Guidelines) required to reduce the project impacts to a level of insignificance.

In the absence of specific mitigation measures in the CEQA document, the Department believes that it cannot fulfill its obligations as a Trustee and Responsible Agency for fish and wildlife resources. Permit negotiations conducted after and outside of the CEQA process are not CEQA-compliant because they deprive the public and agencies of their right to know what project impacts are and how they are being mitigated (CEQA Guidelines Section 15002).

Environmental Impacts

The Project is proposed within sensitive habitat. The phased nature of the project may lead to significant temporal impacts, and direct impacts to species such as big horn sheep, raptors, and plants associated with carbonate soils. A thorough consideration and discussion of the environmental impacts associated with project activities, and the phased approach to development and reclamation should be developed as described under CEQA Guidelines Sections 15126 and 15126.2.

Cumulative Impacts

The Project is proposed in the San Bernardino National Forest. The regional scarcity of biological resources may increase the cumulative significance of Project activities. Cumulative effects analysis should be developed as described under CEQA Guidelines Section 15130. Please include all potential direct and indirect project related impacts to riparian areas, wetlands, vernal pools, alluvial fan habitats, wildlife corridors or wildlife movement areas, aquatic habitats, sensitive species and other sensitive habitats, open lands, open space, and adjacent natural habitats in the cumulative effects analysis.

Alternatives Analysis

The CEQA document should analyze a range of fully considered and evaluated alternatives to the Project (CEQA Guidelines Section 15126.6). The analysis should include a range of alternatives which avoid or otherwise minimize impacts to sensitive biological resources. The Department considers Rare Natural Communities as threatened habitats, having both local and regional significance. Thus, these communities should be fully avoided and otherwise protected from Project-related impacts. The CEQA document should include an evaluation of specific alternative locations with lower resource sensitivity where appropriate. Off-site compensation for unavoidable impacts through acquisition and protection of high-quality habitat should be addressed.

Please note that the Department generally does not support the use of relocation, salvage, and/or transplantation as mitigation for impacts to rare, threatened, or endangered species. Department studies have shown that these efforts are experimental in nature and largely unsuccessful.

Bighorn Sheep, Mule Deer and Raptors

Immediately foreseeable impacts to be addressed in the DEIR, include impacts to approximately 190.1 acres of habitat as a result of expanded and ongoing mining operation. The project area is used by bighorn sheep, mule deer and other native mammal, reptile, raptors and other avian species for foraging, movement between habitats, bedding, escape terrain, and other important activities. Actions to prevent and mitigate losses to these important forage resources and habitat components should be addressed.

Disturbance to bighorn sheep should be addressed, as well as the potential loss of individuals to mortality related to blasting, vehicle collision, or other mining activities, or as a consequence of decreased access to forage. Procedures to minimize and avoid disturbance and loss of individuals should be evaluated. Consequences of loss of individuals should address population-level impacts to the persistence of this small population.

Domestic sheep were found in adjacent project areas in 2007 and domestic dogs in 2008, posing risks of disease and predation, respectively, to bighorn sheep. The movement of both domestic species is facilitated by haul roads, necessitating steps to mitigate risk. The loss of habitat and disturbance from mining activity may cause bighorn sheep to move from the area, potentially increasing the risk of contact with domestic animals and concomitant risk for disease and predation.

The expanded quarries may present barriers to movement of bighorn sheep both for within-range movement and for immigration and emigration, and the consequences should be evaluated. The topography of the quarries (slopes, bench height) should be assessed relative to the permeability for movement of bighorn sheep, deer, fox, bobcat, etc. Design of high-walls should address the ability of bighorn sheep and other species to traverse slopes, such as by planning for non-vertical slopes and benches with ramps between levels.

In addition to impacts to habitat and wildlife, limits to access by recreational hunters to the project areas should be addressed.

Department Recommendations

The Department has the following concerns about the Project, and requests that these concerns be addressed in the CEQA document:

1. The DEIR should quantify impacts to habitats and species as per the informational requirements of CEQA. An accompanying map showing the areas of impact should also be included.

2. The DEIR should include current (completed within the 12 month period prior to circulation of the CEQA document) biological surveys for fauna and flora. The Department recommends that the Lead Agency contact the Department's California Natural Diversity Database (CNDDB) in Sacramento, (916) 327-5960, to obtain current information on any previously reported sensitive species and habitat, including Significant Natural Areas identified under Chapter 12 of the California Fish and Game Code. If sensitive species may occur within the project area, species specific surveys, conducted at the appropriate time of year and time of day, should be included with the CEQA document. Acceptable species specific surveys have been developed by the Department, and by the U.S. Fish and Wildlife Service, and are accessible through each agencies websites. The Department recommends that assessments for rare plants and rare plant natural communities follow the Department's 2009 Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities. The guidance document is available at: http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/protocols_for_surveying_and_evaluating_impacts.pdf

3. The CEQA document should provide an analysis of the Projects effects on the CHMS. The CEQA document should include a discussion of how the project will affect plan assembly; how the Project will affect the goals and objectives of the CHMS; the applicable policies and procedures that pertain to the Project; a discussion of survey requirements; and a list of proposed mitigation measures required. A copy of any documents required by the CHMS should be included with the CEQA document.

4. The analysis in the DEIR document should satisfy the requirements of the Department's Lake and Streambed Alteration Program and CESA (if deemed necessary).

5. A CESA ITP must be obtained if the Project has the potential to result in "take" (California Fish and Game Code Section 86 defines "take" as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill") of State-listed CESA species, either through construction or over the life of the Project. CESA ITPs are issued to conserve, protect, enhance, and restore State-listed CESA species and their habitats. The Department encourages early consultation, as significant modification to the proposed project and mitigation measures may be required in order to obtain a CESA ITP. Revisions to the California Fish and Game Code, effective January 1998, require that the Department issue a separate CEQA document for the issuance of a CESA ITP unless the Project CEQA document addresses all Project impacts to listed species and specifies a mitigation monitoring and reporting program that will meet the requirements of a CESA permit.

6. The DEIR should provide a thorough analysis of direct, indirect, and cumulative impacts and identify specific measures to offset such impacts.

7. The DEIR should analyze a range of fully considered and evaluated alternatives to the Project (CEQA Guidelines Section 15126.6).

8. The Department recommends the project proponent host a site visit with Department staff to provide guidance on avoiding impacts to bighorn sheep, mule deer, raptors, and other sensitive species,

and to assess the cumulative impacts and develop mitigation strategies to address the past, current, and proposed mining activities.

9. To avoid confusion between the mine site "reclamation" required by the Forest Service Mineral Regulations and the California Surface Mining and Reclamation Act (SMARA) and "mitigation" required under CEQA and other programs, the Department requests the DEIR include a thorough analysis and comparison of the reclamation for the mining and the mitigation for the environmental impacts. The Department also recommends updating the revegetation plan within the approved SMARA reclamation plan.

In summary, the Department requests that the DEIR document include current information regarding biological resources, adequately address whether the project will impact State-listed species, provide a thorough analysis of cumulative impacts, provide a thorough JD, and provide an alternatives analysis. If you should have any questions pertaining to these comments, please contact Jeff Brandt at (909) 987-7161.

Sincerely,

Jeff Brandt
Senior Environmental Scientist
CA Department of Fish and Wildlife
Inland Deserts Region
(909) 987-7161
3602 Inland Empire Blvd., Suite C-220
Ontario, CA 91764

cc: State Clearinghouse, Sacramento

DEPARTMENT OF CONSERVATION
OFFICE OF MINE RECLAMATION
801 K STREET • MS 09-06 • SACRAMENTO, CALIFORNIA 95814
PHONE 916 / 323-9198 • FAX 916 / 445-6066 • TDD 916 / 324-2555 • WEB SITE conservation.ca.gov

August 6, 2013

VIA EMAIL: channary@rgpcorp.com
ORIGINAL SENT BY MAIL

Ms. Channary Leng
San Bernardino County Land Use Services Department
385 N. Arrowhead Avenue
San Bernardino, CA 92415-0182

Ms. Leng:

WHITE KNOB - WHITE RIDGE QUARRIES
AMENDED MINE AND RECLAMATION PLAN AND INITIAL STUDY AND NOTICE OF PREPARATION OF DRAFT ENVIRONMENTAL IMPACT REPORT
CALIFORNIA MINE ID# 91-36-0067

The Department of Conservation's Office of Mine Reclamation (OMR) has reviewed the Amended Mine and Reclamation Plan and Initial Study and Notice of Preparation of a Draft Environmental Impact Report (DEIR) for the White Knob-White Ridge Quarries dated February 2013. The applicant, OMYA California, is proposing to expand the existing mining operation by 190.1 acres and extend the existing permit expiration date by 24 years with an additional 10 years for reclamation. The maximum amount of all material excavated annually will also increase to up to 1,950,000 tons.

The project site is along the north slope of the San Bernardino Mountains approximately six miles southwest of Lucerne Valley. OMR staff conducted a site visit on July 10, 2013 to inspect site conditions and discuss reclamation issues.

The Surface Mining and Reclamation Act of 1975 (SMARA) (Public Resources Code section 2710 et seq.) and the State Mining and Geology Board Regulations (California Code of Regulations (CCR) Title 14, Division 2, Chapter 8, Subchapter 1) require that specific items be addressed or included in reclamation plans. The following comments prepared by Leah Gardner, Restoration Ecologist, and John Wesling, Senior Engineering Geologist, are offered to assist in your review of this project. We recommend that the reclamation plan be revised and/or supplemented to fully address these items.

OMR has no specific comments on the Initial Study at this time, but we look forward to the opportunity to review and comment on the Draft EIR. It is recommended that the reclamation plan not be finalized or approved until mitigation is determined during

environmental review, since mitigation measures developed under CEQA may substantially change the manner in which mining and reclamation are accomplished.

Mining Operation and Closure

(Refer to SMARA sections 2770, 2772, 2773, CCR sections 3502, 3709, 3713)

The amended reclamation plan includes a number of maps and cross sections that must bear the signature and stamp of the licensed professional in responsible charge who prepared them. Pursuant to the Professional Engineers Act, Geologist and Geophysicist Act, and Professional Land Surveyors' Act (Business and Professions Code sections 6700 – 6799, 7800 – 7887, and 8700 – 8805, respectively), all applicable documents shall be prepared by a California-licensed professional, shall include his or her license number and name, and shall bear the signature and seal of the licensee. When reviewing documents submitted pursuant to SMARA section 2774, OMR must have confidence that the documents are complete and genuine, and have been prepared by or under the supervision of licensed professionals if and as required by law and regulation. Therefore, at least one copy of all documents which must, under applicable law, regulation, or code, be prepared by or under the supervision of licensed professionals bearing an original signature, stamp impression or seal, and date affixed by the author must be submitted to OMR prior to approval. As a quasi-judicial body operating in the public trust, the County of San Bernardino should consider adopting a policy similar to that of the State Mining and Geology Board's Internal Policy on Validating and Accepting Professionally Prepared Reports and Other Documents Submitted for Consideration. The State Mining and Geology Board's policy can be found at: http://www.conservation.ca.gov/smgb/staffreports2004/May/Documents/0513-3a.pdf.

End Land Use

(Refer to SMARA section 2772, CCR sections 3707, 3708)

SMARA section 2772(c)(8) requires a description of reclamation measures adequate for the proposed end use. Additionally, it is the intent of SMARA to assure that adverse environmental effects of mining are prevented or minimized and that mined lands are reclaimed to a usable condition which is readily adaptable for alternative land uses, and that residual hazards to the public health and safety are eliminated (SMARA section 2712). The reclamation plan does not address stabilization and reclamation of the Northwest Slope to the west of the Annex Quarry, the area of side-cast material directly northeast of the Annex Quarry, or the area of inadvertent boulder roll directly north of the White Knob Quarry. The reclamation plan should include measures to stabilize and reclaim these areas.

Geotechnical Requirements

(Refer to CCR sections 3502, 3704)

CCR sections 3501, 3502 and 3704 require reclamation plans to include final slope designs that are stable with a minimum slope stability factor of safety that is suitable for the proposed end use and that conforms with surrounding topography and/or end use. The final cut slope design in granite and calcite marble will have an overall inclination of 1H:1V (i.e., horizontal to vertical slope ratio); the slopes will be benched at 50-foot vertical intervals with 25-foot-wide benches and bench faces inclined at approximately 0.5H:1V.

The January 14, 2013 CHJ Consultants (CHJ) study entitled, "*Slope Stability Investigation, Proposed Amended Plan of Operations, White Knob Quarry Mining and Reclamation Plan, Lucerne Valley, California*" addresses the design and stability of final cut slopes. The study concludes that final cut slopes will have suitable factors of safety against failure of the overall slope (referred to as "global" stability) for both static and pseudostatic results. Additionally, kinematic analyses completed indicate that block, wedge and topple failures may be possible for certain quarry wall orientations. The following items should be addressed and the report revised, as appropriate, prior to approval:

- The study by CHJ includes no engineering geologic cross sections of the final slopes. Engineering geologic cross sections of final slopes should be included in the study, and those sections should form the basis for stability models.

- Stability analyses on fill slopes do not consider the presence of groundwater. However, Overburden Storage Site #2 (OB #2) will be constructed within a drainage with substantial drainage area above. This drainage likely will concentrate water on OB #2 and likely affect the stability of the fill slopes. The CHJ study should be revised to account for the presence of water in the fill materials.

- Stereonet analyses indicate that planar, wedge, and topple failures are kinematically possible, and the analyses by CHJ only note factors of safety of less than 1.0 for some planar joints. CHJ indicates that the joints with geometries suitably oriented for planar failures have a limited extent and concludes that the potential for large planar failures is low. However, there appears to be a potential for smaller, bench-scale failures. Slope inspection measures to identify potentially unstable areas should be included in the reclamation plan, and mitigation measures for stabilizing these areas should be proposed and evaluated in the CEQA analyses.

Hydrology and Water Quality

(Refer to SMARA sections 2772, 2773, CCR sections 3502, 3503, 3706, 3710, 3712)

CCR section 3706(d) requires that surface runoff and drainage from surface mining activities be controlled by berms, silt fences, sediment ponds, revegetation, hay bales, or other Best Management Practices (BMPs) that are designed to handle runoff from not less than the 20-year, one-hour intensity storm event. The drainage study by Santec entitled, "*White Knob Haul Road, Drainage Study and Plan of Development*," dated August 2011 is included as Appendix E. However, the report is not signed and stamped by the professional in responsible charge of the study. OMR cannot review preliminary work. The study must be finalized and resubmitted to OMR for reviewand the finalized study should bear the signature and stamp of the person in responsible charge.

CCR section 3706(f) states that when stream diversions are required, they shall be constructed in accordance with the Department of Fish and Game (now named Department of Fish and Wildlife, DFW), the requirements of the Clean Water Act Section 301 and 404, and Section 10 of the Rivers and Harbors Act. The applicant should consult with DFW to determine if a Stream and Lake Bed Alteration Agreement (SAA) SAA will be required for the mining operation. The amended reclamation plan should be revised to include any conditions of the SAA that affect reclamation of the site.

Resoiling and Revegetation

(Refer to SMARA section 2773, CCR sections 3503, 3704, 3705, 3707, 3711)

CCR 3705(a) requires that the density, cover and species richness of naturally occurring habitats shall be documented in baseline studies in order to establish a self-sustaining vegetative cover similar to the surrounding habitat and CCR section 3705(m) requires that the reclamation plan include success criteria that can be quantified by cover, density, and species richness. The amended reclamation plan provides recommended success criteria in Table 12 on page 61. The table may need to be revised for accuracy. OMR questions whether the figures are accurate and if the numbers for density and species richness may have been inadvertently reversed.

For example, under Pinyon Woodlands, the baseline for density is 10 per acre and for species richness is 84 per acre. It is more believable for there to be 10 different species present with 84 total plants per acre. Referring to the 2008 Revegetation Plan in Appendix D1, Table 1 on page 5 does provide these figures in reverse order: 84 trees per acre for density and 10 species per acre for species richness, based on data provided by Neel, 2000. However, because it specifies 84 trees per acre, OMR

recommends reevaluating the baseline data in order to have a quantifiable density figure for all native perennials and calculating 50% of that figure for the success criteria.

The baseline density for shrubs under Blackbush Scrub is only 13 per acre. This seems like a very low figure for this community type. Referring to Table 1 in the 2008 plan, the figure of 15 per acre is given for tree density. This also suggests the necessity of performing new baseline transects to derive data for all native perennials, not just trees and/or shrubs, and recalculating the success criteria.

Administrative Requirements

(Refer to SMARA sections 2772, 2773, 2774, 2776, 2777, PRC section 21151.7)

SMARA section 2772(c)(10) states that the reclamation plan shall include an applicant's signed statement accepting responsibility for reclamation per the approved reclamation plan. This statement must be added to the reclamation plan prior to approval.

SMARA section 2773.1 authorizes OMR to review cost estimates prior to lead agency approval. The reclamation plan does not include a calculation of financial assurance. The financial assurance estimate should include detailed calculations that support any costs identified for site reclamation, including mobilization to and from the site, costs for seeds and plants, etc. The financial assurance mechanism must include both the lead agency and the Department of Conservation as obligees. Prior to approval, a copy of the financial assurance must be forwarded to our office for a 45-day review.

SMARA section 2774 addresses the requirements with respect to lead agency approvals of reclamation plans, plan amendments, and financial assurances. Once OMR has provided comments, a proposed response to the comments must be submitted to the Department at least 30 days prior to lead agency approval. The proposed response must describe whether you propose to adopt the comments. If you do not propose to adopt the comments, the reason(s) for not doing so must be specified in detail. At least 30 days prior notice must be provided to the Department of the time, place, and date of the hearing at which the reclamation plan is scheduled to be approved. If no hearing is required, then at least 30 days notice must be given to the Department prior to its approval. Finally, within 30 days following approval of the reclamation plan, a final response to these comments must be sent to the Department. Please ensure that your agency allows adequate time in the approval process to meet these SMARA requirements.

Sincerely,

Leah Gardner for

Beth Hendrickson, Manager
Reclamation Unit

cc: Terri Rahal, San Bernardino County Land Use Services

Mojave Desert Air Quality Management District
14306 Park Avenue, Victorville, CA 92392-2310
760.245.1661 • fax 760.245.2699
Visit our web site: http://www.mdaqmd.ca.gov
Eldon Heaston, Executive Director

June 19, 2013

Pat Angell
PMC
2729 Prospect Park Drive, Suite 220
Rancho Cordova, CA 95670

RE: White Knob/White Ridge Limestone Quarries Expansion Project

Dear Pat Angell:

The Mojave Desert Air Quality Management District (District) has reviewed White Knob/White Ridge Limestone Quarries Expansion Project. This action proposes the expansion of the existing White Knob/White Ridge Limestone Quarries, a limestone mining operation. The Amended Plan includes expansion of the existing quarries' operation (White Knob Quarry, White Ridge Quarry, and White Knob Annex Quarry) and the existing Overburden (OB) site, the creation of two new OB sites, and the expansion of the ancillary disturbance areas, which include haul and access roads, sediment basins and other erosion control features, storage pads, crusher location, west slope impacts, and incidental impacts from boulder roll-down. In addition, the proposed project would increase operational years of the quarries by 24 years from the existing permit expiration date of 2031 to the year 2055. The total existing permitted operational area is approximately 145 acres. The Amended Plan would add approximately 190.1 acres, for a total permitted operational area of approximately 335.1 acres. The amendment does not propose any new quarries.

Based on the information provided in the Initial Study, the District agrees with the proposed assessment of potential impacts to be addressed in the Environmental Impact Report. District attainment plans and California Environmental Quality Act guidelines are located at http://www.mdaqmd.ca.gov/rules_plans/rules-plans.htm for your information and review.

Thank you for the opportunity to review this planning document. If you have any questions regarding this letter, please contact me at (760) 245-1661, extension 6726, or Tracy Walters at extension 6122.

Sincerely,

Alan J. De Salvio
Supervising Air Quality Engineer

AJD/tw Omya White Knob White Ridge Expansion

FISCAL ADMIN
2013 JUN 26 PM 2:28

STATE OF CALIFORNIA Edmund G. Brown, Jr., Governor

NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Boulevard
West Sacramento, CA 95691
(916) 373-3715
(916) 373-5471 – FAX
e-mail: ds_nahc@pacbell.net

June 24, 2013

Ms. Channary Leng, Planner

County of San Bernardino
385 N. Arrowhead Avenue, 1st Floor
san Bernardino, CA 92415-0184

RE: SCH# 2013061020 CEQA Notice of Preparation (NOP); draft Environmental Impact Report (DEIR2013-112) for the **White Knob-White Ridge Limestone Quarries Expansion Project (Amendment to Mining & Reclamation Plan);** located in the Lucerne Valley; San Bernardino County, California.

Dear Ms. Leng:

The Native American Heritage Commission (NAHC) has reviewed the CEQA Notice regarding the above referenced project. In the 1985 Appellate Court decision (170 Cal App 3rd 604), the court held that the NAHC has jurisdiction and special expertise, as a state agency, over affected Native American resources impacted by proposed projects, including archaeological places of religious significance to Native Americans, and to Native American burial sites.

The California Environmental Quality Act (CEQA) states that any project that causes a substantial adverse change in the significance of an historical resource, which includes archeological resources, is a significant effect requiring the preparation of an EIR (CEQA guidelines 15064.5(b)). To adequately comply with this provision and mitigate project-related impacts on archaeological resources, the Commission recommends the following actions be required:

Contact the appropriate Information Center for a record search to determine :If a part or all of the area of project effect (APE) has been previously surveyed for cultural places(s), The NAHC recommends that known traditional cultural resources recorded on or adjacent to the APE be listed in the draft Environmental Impact Report (DEIR).

If an additional archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey. We suggest that this be coordinated with the NAHC, if possible. The final report containing site forms, site significance, and mitigation measurers should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for pubic disclosure pursuant to California Government Code Section 6254.10.
Contact has been made to the Native American Heritage Commission for :a Sacred Lands File Check. A list of appropriate Native American Contacts for consultation concerning the project site has been provided and is attached to this letter to determine

if the proposed active might impinge on any cultural resources. Lack of surface evidence of archeological resources does not preclude their subsurface existence.

Lead agencies should include in their mitigation plan provisions for the identification and evaluation of accidentally discovered archeological resources, per California Environmental Quality Act (CEQA) §15064.5(f). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American, with knowledge in cultural resources, should monitor all ground-disturbing activities.
Also, CEQA Guidelines Section 21083.2 require documentation and analysis of archaeological items that meet the standard in Section 15064.5 (a)(b)(f). Lead agencies should include in their mitigation plan provisions for the disposition of recovered artifacts, in consultation with culturally affiliated Native Americans.
Lead agencies should include provisions for discovery of Native American human remains in their mitigation plan. Health and Safety Code §7050.5, CEQA §15064.5(e), and Public Resources Code §5097.98 mandates the process to be followed in the event of an accidental discovery of any human remains in a location other than a dedicated cemetery.

Sincerely,

Dave Singleton
Program Analyst
(916) 653-6251

CC: State Clearinghouse

Attachment: Native American Contacts list

Native American Contacts
San Bernardino County
June 24, 2013

Ramona Band of Cahuilla Mission Indians
Joseph Hamilton, Chairman
P.O. Box 391670 — Cahuilla
Anza , CA 92539
admin@ramonatribe.com
(951) 763-4105
(951) 763-4325 Fax

Colorado River Indian Tribe
Wayne Patch, Sr. ,Chairman; Ginger Scott,
26600 Mojave Road — Mojave
Parker , AZ 85344 — Chemehuevi
crit.museum@yahoo.com
(928) 669-9211-Tribal Office
(928) 669-8970 ext 21
(928) 669-1925 Fax

San Manuel Band of Mission Indians
Carla Rodriguez, Chairwoman
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Highland , CA 92346
(909) 864-8933
(909) 864-3724 - FAX
(909) 864-3370 Fax

San Fernando Band of Mission Indians
John Valenzuela, Chairperson
P.O. Box 221838 — Fernandeño
Newhall , CA 91322 — Tataviam
tsen2u@hotmail.com — Serrano
(661) 753-9833 Office — Vanyume
(760) 885-0955 Cell — Kitanemuk
(760) 949-1604 Fax

Chemehuevi Reservation
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Chemehuevi Valley CA 92363
chair1cit@yahoo.com
(760) 858-4301
(760) 858-5400 Fax

AhaMaKav Cultural Society, Fort Mojave Indian
Linda Otero, Director
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Mohave Valley AZ 86440
(928) 768-4475
LindaOtero@fortmojave.com
(928) 768-7996 Fax

Fort Mojave Indian Tribe
Timothy Williams, Chairperson
500 Merriman Ave — Mojave
Needles , CA 92363
(760) 629-4591
(760) 629-5767 Fax

San Manuel Band of Mission Indians
Daniel McCarthy, M.S.., Director-CRM Dept.
26569 Community Center. Drive — Serrano
Highland , CA 92346
(909) 864-8933, Ext 3248
dmccarthy@sanmanuel-nsn.gov
(909) 862-5152 Fax

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

TThis list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed CEQA Notice of Preparation (NOP) draft Environmental Impact Report (DEIR) for the White Knob-White Ridge Limestone Quarries Expansion Project; located in the Lucern Valley; San Bernardino County, California.

Native American Contacts
San Bernardino County
June 24, 2013

Fort Mojave Indian Tribe
Nora McDowell, Aha Makav Society
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(928) 768-4475
noramcdowall-antone@fortmojave.com
(760) 629-5767 Fax

Morongo Band of Mission Indians
Robert Martin, Chairperson
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Banning , CA 92220 Serrano
(951) 849-8807
(951) 755-5200
(951) 922-8146 Fax

Serrano Nation of Mission Indians
Goldie Walker, Chairwoman
P.O. Box 343 Serrano
Patton , CA 92369

(909) 528-9027 or
(909) 528-9032

Ernest H. Siva
Morongo Band of Mission Indians Tribal Elder
9570 Mias Canyon Road Serrano
Banning , CA 92220 Cahuilla
siva@dishmail.net
(951) 849-4676

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

TThis list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed CEQA Notice of Preparation (NOP) draft Environmental Impact Report (DEIR) for the White Knob-White Ridge Limestone Quarries Expansion Project; located in the Lucern Valley; San Bernardino County, California.

Appendix B
Aesthetics

VISUAL RESOURCES ASSESSMENT

FOR THE

OMYA CALIFORNIA
WHITE KNOB-WHITE RIDGE
LIMESTONE QUARRIES
AMENDED MINE
AND
RECLAMATION PLAN

Prepared For:

OMYA CALIFORNIA
7225 Crystal Creek Road
Lucerne Valley, CA 92356

Prepared By:

LILBURN CORPORATION
1905 Business Center Drive
San Bernardino, CA 92408

July 2013

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VISUAL RESOURCES ASSESSMENT
FOR THE
OMYA CALIFORNIA
WHITE KNOB-WHITE RIDGE LIMESTONE QUARRIES
AMENDED MINE AND RECLAMATION PLAN

1.0 INTRODUCTION

The Visual Resources Assessment Report is divided into five sections including this Introduction (Section 1). Section 2 reviews the Amended White Knob-White Ridge Limestone Quarries Mine and Reclamation Plan (Amended Plan) and describes how quarrying and reclamation will occur. Section 3 introduces the concept of the Visual Resources Assessment (VRM) Contrast Rating System and describes the existing landscape using the VRM System. The VRM System was established by the Bureau of Land Management (BLM, 1984) for rating the quality of visual resources and evaluating changes in scenic quality attributed to a proposed action. Section 4 contains an evaluation of potential impacts associated with amended operations, using the BLM's VRM System. This system is used to measure the degree of contrast between the existing landscape and proposed quarrying/reclamation activities. Section 5 contains the conclusions of the visual resources assessment.

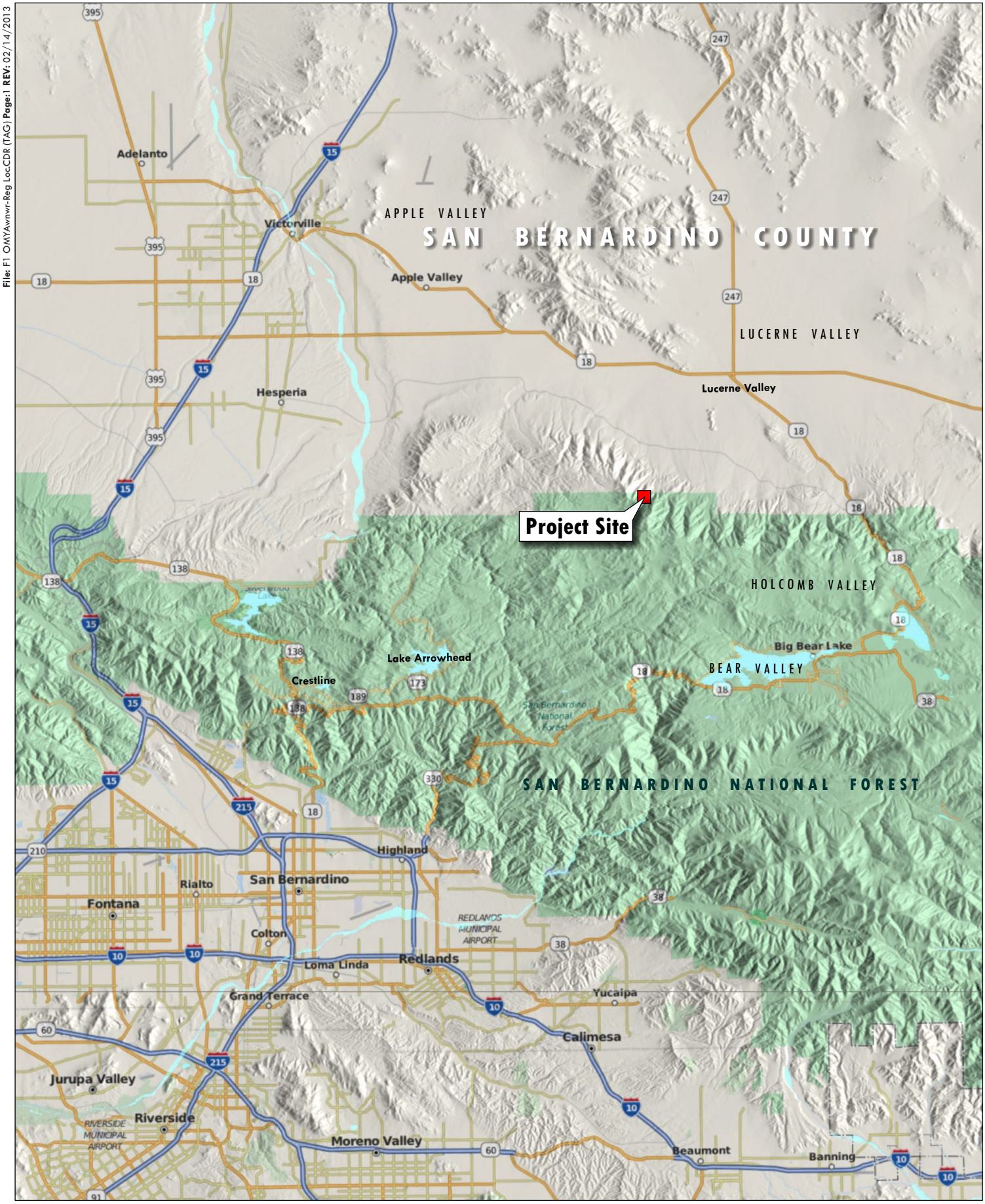
This assessment evaluates the potential impacts to the scenic quality associated with implementation of the Amended Plan. The assessment focuses on the project site and the area surrounding the site when viewed from three different public viewpoints within Lucerne Valley.

1.1 PROJECT BACKGROUND

Omya Inc.'s ("Omya") (formerly known as Pluess-Staufer (California) Inc.) existing permitted White Knob - White Ridge Limestone Quarries are located in the Lucerne Valley area on the north slope of the San Bernardino Mountains in San Bernardino County, California (see Figure 1). The approved quarry site consists of approximately 145 acres of mining facilities within 353 acres of patented fee land, portions of which are leased or owned by Omya. The San Bernardino County Planning Commission certified an Environmental Impact Report (EIR) and approved the White Knob-White Ridge Limestone Mine Site Approval and Reclamation Plan in 1986 (86M-04) with an expiration date of December 31, 2031. The CA mine ID# is 91-36-0067.

During the original permitting of the White Knob Quarry in 1986, it was recognized that there would be significant, un-mitigable visual impacts from the quarry development. It was determined that the impacts, although visible, are consistent with the general visual character of the Lucerne Valley limestone mining area which includes numerous quarries, overburden sites, haul roads and limestone processing plants. A Statement of Overriding Consideration regarding environmental effects of the White Knob Quarry was prepared and accepted by the San Bernardino County Planning Commission, in which the visual impacts of the quarry development that could not be mitigated to a level below significance were recognized. The Planning Commission found that the economic, social and other benefits to the region as a result of the project outweighed the significance of the project impacts upon visual resources.

File: F1 OMYAwnwr-Reg Loc.CDR (TAG) Page:1 REV: 02/14/2013



0 5.25
Mile
Source: World Topo Map, 2013

LILBURN CORPORATION

LEGEND

- **Project Site Location** (Geographic Location)
  California Zone 5 (FIPS 405): 6859727.90 1956210.48
  Lat/Lon: 34° 21' 49.3863" N, 117° 00' 44.3577" W

REGIONAL LOCATION

VISUAL ASSESSMENT - WHITE KNOB and WHITE RIDGE QUARRIES
Amended Mine and Reclamation Plan
Omya California, County of San Bernardino, California

FIGURE 1

1.2 PROPOSED PROJECT SUMMARY

The Amended Plan has been prepared to incorporate modifications to mining and reclamation plans since the original plan was approved in 1986. The planned quarry activities propose to disturb approximately an additional 190 acres on a total area of 423.1 acres. (Note that approximately 70 acres of an unpatented mining claim on BLM managed federal lands are in the process of being transferred to Omya ownership through a direct land sale.) The total existing and proposed quarry areas will be approximately 335 acres on private land (see Figures 2 and 3). This Amended Plan is prepared to satisfy the requirements of the San Bernardino County mining ordinance and the State Mining and Reclamation Act (SMARA) as overseen by the Office of Mine Reclamation (OMR).

The White Knob - White Ridge Quarries discussed in the Amended Plan include the active mining area consisting of the White Knob and Annex Quarries and the approved White Ridge Quarry, existing and planned overburden sites, crusher plant site, internal haul roads, erosion control facilities, and the existing access haul road to Omya's Lucerne Valley processing plant. These changes allow for substantial optimization of the site's future operational activities. The Amended Plan includes:

- Increased excavations, ore and overburden production;
- Addition of 24 years from the existing permit expiration date of 2031 through the year 2055;
- Continued crushing and hauling of ore;
- Hauling of overburden or non-spec rock and fines to the Lucerne Valley processing plant for off-site sales. This would incrementally reduce overburden stockpiles;
- Expansion of the existing overburden site (OB-1);
- Construction of one previously approved overburden site (OB-2) and one additional overburden site (OB-3);
- Backfilling part of the White Knob Quarry to reduce additional overburden areas;
- Construction of new haul roads within the mining area to access the White Ridge deposit;
- Changes in mining plans for the White Ridge Quarry that will increase its size but will leave a ridge to the north to reduce visual impacts;
- Changes to the final ultimate outer disturbance limits on an additional 190 acres on a total project area of 335 acres; and
- Reclamation of half width of access road within the BLM ROW on approximately 40 acres.

Quarry and overburden stockpile development and expansion will be phased per the existing phasing plan. Included in the phased expansion is concurrent reclamation of equipment-accessible mined out portions of the quarries and completed overburden stockpiles. Once the final outer limit and bottom of the ore is reached, the White Knob Quarry will be partially backfilled up to the approximately 5,575-foot elevation. The Amended Plan allows for substantial overburden to be placed in the mined out portions of the quarry, and also allows an

File: F1 OMYAwnwr-Proj Vic.CDR (TAG) Page:1 REV: 07/20/2013

Township 4 North
Township 3 North

Haul Road ROW to Processing Plant

Turnout 64

Turnout 50

OMYA Processing Plant

Crystal Creek Road

Project Site

Annex Quarry

White Knob Quarry

White Ridge Quarry

OB 1

OB 2

OB 3

Proposed OB 2

Basin

Culvert

SILVER CREEK

DEEP CANYON

CRYSTAL CREEK

SAN BERNARDINO NATIONAL FOREST

N

0 1,800
Feet
Sources: Lilburn Corp., 2013

LILBURN CORPORATION

LEGEND

- Project Boundary Private Lands
- Limits of Planned Disturbance
- Major Facilities
- Haul Road Right-of-way on BLM Land CACA 16644
- OB Overburden Stockpile
- SB Sediment Basin
- Proposed / Improved SB
- Existing Major Contour
- Existing Minor Contour
- Existing Drainages
- San Bernardino National Forest Boundary

PROJECT VICINITY

VISUAL ASSESSMENT - WHITE KNOB and WHITE RIDGE QUARRIES
Amended Mine and Reclamation Plan
Omya California, County of San Bernardino, California

FIGURE 2

File: F1 OMYAvnvr-Ex Q and Plan Ops.CDR (TAG) Page:1 REV: 07/20/2013

Project Site

Sensitive Habitat to be Avoided

Sensitive Habitat to be Avoided

1,970' +/-

2,605' +/-

655' +/-

670' +/-

660' +/-

660' +/-

170' +/-

697' +/-

160' +/-

1930' +/-

2,590' +/-

2,655' +/-

2,650' +/-

SECTION 6 SECTION 5

SECTION 7 SECTION 8

Boulder Rolldown Area Revegetated in 2006

Northwest Slope

ANNEX QUARRY

WHITE KNOB QUARRY

WHITE RIDGE QUARRY

OB 1

OB 3

OB-3
SB-1

OB 2

Existing Haul Road

Existing Haul Road

Existing Haul Road to Processing Plant

Right-of-way

Right-of-way

Existing Crusher

Existing Haul Roads

Ancillary Haul Road Area

Ancillary Haul Road Area

S.B.N.F.

S.B.N.F.

SAN BERNARDINO NATIONAL FOREST

N

0 500

Feet

Sources: Lilburn Corp., 2013

LILBURN CORPORATION

LEGEND

- Project Boundary Private Lands
- Existing Approved Operations (Estimated)
- Limits of Planned Disturbance
- Major Facilities
- Haul Road Right-of-way on BLM Land CACA 16644
- Amended Operating Area
- OB Overburden Stockpile
- Existing Drainages

EXISTING APPROVED QUARRIES and AMENDED OPERATIONS

VISUAL ASSESSMENT - WHITE KNOB and WHITE RIDGE QUARRIES

Amended Mine and Reclamation Plan

Omya California, County of San Bernardino, California

FIGURE 3

efficient mining plan, minimum disturbance of new ground, phased incremental disturbance of new ground, and concurrent reclamation of the quarries, overburden stockpiles, and roads. At the conclusion of excavations, ten years of reclamation and revegetation activities will be implemented, followed by monitoring and remediation until revegetation goals are achieved.

1.3 ENVIRONMENTAL SETTING

The White Knob-White Ridge Quarries are located in the Lucerne Valley area on the north slope of the San Bernardino Mountains in San Bernardino County, California. The complex geologic history of the San Bernardino Mountains has allowed the formation of several large, high purity limestone deposits which are currently being mined by several mining companies along the north slopes. The White Knob and Annex Quarries are a multi-bench open pit and side-slope mine, with two or three working levels operated at any one time to supply the quota of ore needed to meet production demands. Access to the various levels is via a series of switchback roads cut into the adjacent granite rock mountain side.

The existing natural landscape character of the project area consists of steep mountain slopes, rock outcrops, ridges, vertical cliffs over 100 feet in height, and canyons. Vegetation is characterized as Mojave or open desert shrubland and semi-desert chaparral at lower elevations transitioning to pinyon-juniper-mountain mahogany woodland at higher elevations. Vegetation tends to be denser on north slopes and gullies, and more open on south slopes and along ridges. Most of the project site and areas south and west of the site were burned in wildfires in 2007 and appear sparsely vegetated to barren from a distance. Mining features have been part of the landscape for over 50 years and are an integral part of the north slope of the mountains visible from Lucerne Valley.

Figure 1 shows the project site and vicinity. Public views of the area are primarily limited to State Highways (SH) 18 and 247 located approximately five to six miles northwest and east of the site and from other local roads and residences in the Lucerne Valley. Due to topography and the orientation of the quarry sites, views are and will be limited to those from the northwest to east within Lucerne Valley. The project is not and will not be visible from any developed/populated areas to the south within the San Bernardino National Forest (SBNF) including the City of Big Bear Lake (and from the lake itself), Fawnskin, and Big Bear City due to the intervening ridges located north of the lake and the relatively lower elevations of the lake itself.

The existing views toward the project area are dominated by the mountain ridgeline that extends to the east and west, forming a dominant landscape on the entire southern horizon. The project site is currently altered by mining activities that have occurred over the past 25 years. The White Knob Quarry, overburden stockpile, haul roads, and boulder roll down on the north and west facing slopes have created un-natural forms, lines and color contrasts.

1.4 PROJECT SITE AND VICINITY

The White Knob –White Ridge Quarries operation occurs at the base of the north range front of the San Bernardino Mountains - Lucerne Valley area. The project site is within the larger San Bernardino Mountains - Lucerne Valley mining district, in which several large scale limestone

mines are present along the north slope over a west to east distance of about 10 miles. Land use in the immediate project area is dominated by the existing mining activities. The terrain in the vicinity of the site is very rugged and mountainous. Other than mining, which has historically been active in the area since the 19th century, land use in the rugged mountainous area in the vicinity of the quarry, has been limited to occasional use by hikers and hunters. During the past years, Off-Highway Vehicle (OHV) use in the general area has increased.

The only permitted road access to the site is via the existing haul road approved for use by the BLM in 1986. The site is designated as Resource Conservation (RC) on the San Bernardino County General Plan/Lucerne Valley Community Plan Land Use Map. The White Knob limestone deposit is defined as a Mineral Resource Zone 2 (MRZ-2) rating, which indicates it is recognized by the state as a valuable proven mineral resource with substantial reserves. MRZ-2 status is significant as it recognizes the significance and importance of mineral resources and mining in land use planning.

Land to the south of the quarry is within the SBNF managed by the United States Forest Service (USFS). To the south and west of the quarry, no residences are located for at least five miles. Fawnskin is located approximately seven miles to the southeast. To the north, west and east, public land is managed by the BLM. To the north of BLM land is private property within or adjacent to the town limits of Lucerne Valley. The junction of SHs 18 and 247 is located approximately six miles to the northeast of the project site. The nearest occupied residences are located to the north and northeast of the quarry at a distance of approximately 3 miles.

2.0 PROPOSED PROJECT

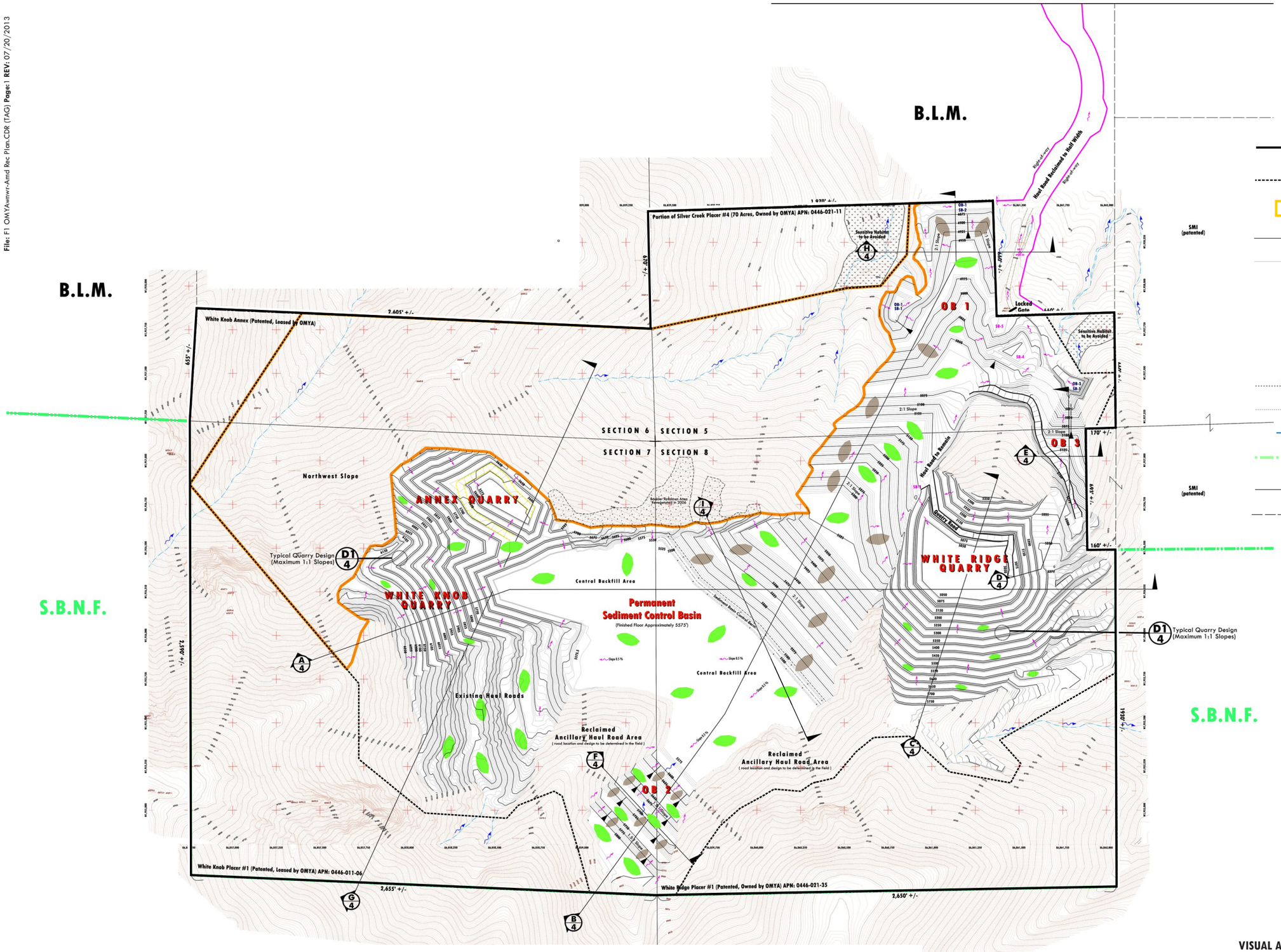
The detailed project description is provided in the "Omya California Amended Mine and Reclamation Plan White Knob - White Ridge Limestone Quarries" submitted to the County of San Bernardino by Omya in September 2013. A summary of the Proposed Project's operations and reclamation plans is provided below.

2.1 DESCRIPTION OF QUARRY OPERATIONS

The White Knob - White Ridge Quarries discussed in the Amended Plan consist of the approved active White Knob and Annex Quarries and the approved undeveloped White Ridge Quarry, existing and planned overburden sites, crusher plant, internal haul roads, erosion control facilities, and the haul road to the Lucerne Valley processing plant. The planned development of the quarries would disturb approximately an additional 190 acres on a total fee area of 423.1 acres (see Table 1 and refer to Figure 3). The approved 1986 Plan included operations on approximately 145 acres.

The principal changes in the Amended Plan with respect to visual resources are the increase in size of the overburden stockpiles, the increase in size of the approved undeveloped White Ridge Quarry, and the increase in the number of ancillary haul roads west and east of OB-2. The redesign of the north half of the White Ridge Quarry and the list of project design features in Section 2.3 would reduce visual impacts. These changes are shown on Figures 3 and 4 and would be the incremental changes to visual impacts of the Proposed Amendment as compared to the existing and 1986 approved operations.

File: F:\ OMYA\wnwr-Amd Rec Plan.CDR (TAG) Page:1 REV: 07/20/2013



LEGEND

- Amended Project Boundary Private Land
- Limits of Planned Disturbance
- Previously Mitigated April 201 Incidental Disturbance Area
- Operating Major Contour
- Operating Minor Contour
- Haul Road
- Slope Indicator
  - Top of slope
  - Toe of slope
- Design Drainage
- Existing Major Contour
- Existing Minor Contour
- Existing Drainages
- San Bernardino National Forest Boundary
- USGS Survey Section
- Claim / Parcel Line

Revegetation

- Soil Islands
- Darker Material

NOTE:
Soil Islands and Darker Material placement areas are schematic only. Final placement will be determined in the field prior to Reclamation.

This is a reduced 200 scale sheet. To review details, see attached Sheet 2 in Mine and Reclamation Plan.

N

0 550

Feet

Sources: Lilburn Corp., 2013.

AMENDED RECLAMATION PLAN

VISUAL ASSESSMENT - WHITE KNOB and WHITE RIDGE QUARRIES
Amended Mine and Reclamation Plan
Omya California, County of San Bernardino, California

FIGURE 4

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Table 1
Existing and Planned Operational Areas
White Knob – White Ridge Quarries

Quarry or Area	Existing 1986 Plan Approved Areas (approx. acres)	Proposed New Areas (acres)	Total Amended Project Areas (acres)
White Knob Quarry	35	6.1	41.1
Annex Quarry	7	5.5	12.5
White Ridge Quarry	18	15.1	33.1
Overburden Site #1	15[1]	16.9	31.9
Overburden Site #2	---[1]	13.0	13.0
Overburden Site #3	---[1]	3.0	3.0
Ancillary Disturbance Limits[2] (outside of above)	70	130.5	200.5
Totals	**145**	**190.1**	**335.1**

Note: Areas in 1986 Plan estimated to whole acres; proposed areas rounded to nearest tenth of an acre. Totals may be slightly different due to rounding.
[1] – Combined waste areas; not individually estimated in 1986 Plan.
[2] – Ancillary disturbance limits include haul/access roads to quarries and overburden sites, sediment basins and other erosion control features, storage pads, crusher location, west slope impacts, and incidental impacts from boulder roll down.

The ultimate development of the quarry is phased. Four phases were previously identified and development of the middle benches during Phases 1 and 2 has been completed. Phase 3 is in progress and includes full development of the existing White Knob and Annex Quarries with mining expected to be completed around 2045. Phase 4 includes development of the approved White Ridge Quarry deposit to the east and is scheduled to begin around 2015 and last until 2055. Phase 5 is reclamation of the mine site generally after completion of mining. The backfilling of portions of the White Knob Quarry and the Central Area will be initiated during the last 20 years of operations (approximately after year 2035).

White Knob Quarry

The White Knob Quarry is an existing side hill quarry that will be developed into a narrow V-shaped quarry day lighting to the east once the footwall of the deposit is reached. Two or three working levels are operated at any one time to supply the quality of ore needed to meet production demands. The multi working level concept allows for greater selectivity and blending of rock qualities to meet stringent quality standards of customers, and allow maximum utilization of the resource.

The haul road to the top of White Knob Quarry has been established and mining will continue from the top down to the footwall of the deposit. Benches established previously will be pushed back to the south, west and north as far as economic limits will allow. The elongated quarry will be approximately 2,500 feet west to east and 600 feet wide and will reach a maximum elevation of 6,200 feet amsl on the west to a floor elevation of 5,300 feet day lighting on the east.

The ore is drilled and blasted, loaded with a front end loader into haul trucks and hauled to the crusher at the 5,500-foot level. Overburden is deposited in the OB-1 stockpile. At the crusher, the rock is reduced in size, screened and separated into the various quality grades. Fines are screened out and fines that are not sold are placed in the overburden stockpiles. Crushed ore is loaded into haul trucks and transported on the White Knob haul road to the existing Lucerne Valley processing plant.

Annex Quarry

The Annex Quarry area is a 12.5-acre area contiguous to the northwest of the White Knob Quarry. The Annex Quarry will be mined concurrently with the White Knob Quarry from the top down based on mining logistics and specific ore grades in demand. The oval shaped quarry will be approximately 900 feet west to east and 550 feet wide and will reach a maximum elevation of 6,075 feet on the southwest to a floor elevation of 5,575 feet.

White Ridge Quarry

The White Ridge Quarry area consists of about 33 acres on the east side of the site. This area was previously approved for mining in the 1986 Plan but has not been developed. The White Ridge deposit is the eastward continuation of the White Knob ore body. The box-shaped quarry will be approximately 1,200 feet north to south and 900 feet west to east and will reach a maximum elevation of 5,750 feet on the south to a floor elevation of 5,050 feet. The Amended Plan will increase its size but will leave a ridge to the north to reduce visual impacts.

Access to the White Ridge deposit is to be constructed from the west directly to the upper level of approximately 5,750 feet. The ore will be hauled to the crusher and overburden and waste rock will be deposited in the proposed overburden Site 2 (OB-2) in the canyon to the west and at the existing OB-1. The new access roads will access the top of the deposit, and the site will be mined from the top down. A small 3-acre overburden site (OB-3) and an associated access road are planned on the southeast side of the White Ridge Quarry to handle overburden for the northern portion of the quarry.

OB-1 (Overburden Stockpile-1)

The existing approved OB-1 stockpile of approximately 15 acres will be progressively extended to the south into the White Knob Quarry and north by about 1,300 feet onto an additional 17 acres into former BLM land west of the haul road. As overburden removal progresses, the pad will be incrementally built southward to a planned elevation of 5,325 feet. OB-1 will be developed as a series of benches of varied widths reclaimed to a slope of 2 horizontal:1 vertical (2H:1V). Backfilling of the eastern portion of the White Knob Quarry during about the last 20 years of operations will occur to minimize OB-1 expansion and to minimize disturbance of new ground.

Reclamation and revegetation will occur concurrently where operationally feasible and the final reclamation will occur in Phase 5.

OB-2 (Overburden Stockpile-2)

OB-2 will be developed on approximately 13 acres in a canyon area south of the crusher and west of the White Ridge Quarry in Phase 4. Overburden from the White Ridge Quarry will be transported on haul roads along level alignments along the contour. Overburden and waste rock will be placed at OB-2 between the elevations of 5,800 feet and 5,425 feet. OB-2 will be approximately 1,150 feet southwest to northeast and approximately 550 feet wide at its widest and will be developed as a series of approximately six 50-foot wide benches. The overall slope of OB-2 will be no greater than approximately 2H:1V.

Backfilling of the Central Area during about the last 20 years of operations will backfill the lower 150 vertical feet of OB-2 decreasing the remaining slope height to 225 feet. Reclamation and revegetation of this area will occur concurrently where operationally feasible and be completed during Phase 5 when backfilling is completed.

OB-3 (Overburden Stockpile-3)

OB-3 will be developed on approximately three acres to the northeast of the White Ridge Quarry in Phase 4. Overburden from the White Ridge Quarry will be placed at OB-3 between approximate elevations of 5,200 and 5,025 feet. OB-3 will be approximately 750 feet north to south and approximately 200 feet wide at its widest and developed as a series of benches with reclaimed slopes no greater than 2H:1V. Reclamation and revegetation of this area will occur concurrently where operationally feasible and completed during Phase 5.

White Knob Quarry and Central Area Backfill

After completion of mining in the White Knob Quarry likely during the last 20 years of operations, the eastern portion of the quarry will be partially backfilled with overburden to create a floor elevation at approximately the 5,575-foot level. The backfilling would reduce the overall 900-foot quarry slope to 625 feet. The final backfill will be designed to act as a permanent sediment basin for future sediment control by sloping the drainage towards the west into the quarry walls.

This area is lower than the remaining ridges to the north and will be minimally visible from Lucerne Valley. Backfilling greatly reduces the size of potential new overburden sites limiting additional impacts to undisturbed lands and to biological and visual resources.

Approximately 11 acres in the Central Area of the site including the crusher area, haul roads to the White Ridge Quarry, and the lower half of OB-2 will also be utilized for deposition of overburden. This area will be backfilled up to approximate elevation of 5,575 feet as feasible and merge into the White Knob Quarry backfill.

2.2 SUMMARY OF RECLAMATION ACTIVITIES

The County approved the White Knob Quarry Reclamation Plan in 1986. The approved Plan includes a revegetation plan that was updated in 2008 and updated design measures as listed in

Section 2.3 below. The mine site will be reclaimed to meet current SMARA and County standards. Concurrent and final reclamation will include final slope stabilization, ripping of compacted areas, placement of growth media, revegetation, colorization where needed and feasible, haul road removal and revegetation, monitoring of revegetation progress, and remediation as necessary until success criteria is achieved.

The lighter colored slopes of the quarries and overburden stockpiles will be darkened by the placement of darker material as available, revegetation, and colorization where feasible on slopes where raveling is not expected, by the use of a permanent rock colorization method which colors the rocks brown to blend in with the natural colors of the mountainsides. Concurrent and final reclamation will colorize and revegetate the rolldown slopes to blend with the natural colored slopes and will reduce impacts to less than now exist in some areas (refer to Figure 4).

Permanent rock colorization was applied in January 2006 to approximately five acres where mining related visual impacts had occurred on the north facing slope. The visual contrast has been substantially reduced as the brown colored stain on the boulders blends with the natural hill side color. Revegetation of the upper slopes was also undertaken, utilizing native species, slow release fertilizer, and commercial mycoriza inoculations. Irrigation occurred for two years to allow a higher proportion of germination. Although less visible from a distance, the revegetation helps stabilize the upper slopes and to reduce erosion and sediment transport.

2.3 PROJECT DESIGN FEATURES TO MINIMIZE VISUAL IMPACTS

The Amended Reclamation Plan will meet State and local mining and reclamation requirements. The regulatory standards, monitoring and enforcement, ensure that reclamation will be successful, and meet the standards. The Amended Plan includes designs and reclamation to reduce existing and future visual impacts from the quarries, overburden sites, and roll down areas. These measures have been incorporated into the visual impact assessment and include the following:

- Implement measures to minimize boulder roll down;
- Maintain the existing crusher site at the White Knob Quarry or use a portable plant within an active quarry to reduce its visibility from Lucerne Valley;
- Deposit overburden and waste rock within the White Knob Quarry footprint, as described in the Amended Plan, to reduce the area of disturbance for overburden stockpiles and reduce visual impact outside the quarry;
- Design and phase mining of the White Ridge Quarry, which allows for concurrent reclamation and leaves an approximately 300-foot high ridge of undisturbed hillside facing Lucerne Valley to minimize visual impacts;
- Implement reclamation and revegetation on completed equipment accessible quarry benches and on overburden stockpiles concurrent with mining where feasible;
- Utilize approved color-staining product to darken the visible quarry and roll down slopes where not subject to raveling to reduce visual impacts;

- Deposit darker overburden and waste rock on final overburden slopes where available to reduce color contrast;
- Design adequate erosion control features along the haul and access roads and quarry to control and limit erosion and sediment transport;
- Construct catchment berms at foot of stockpiles to reduce rock roll down and sediment flow;
- Limit surface disturbances to areas identified in the Amended Plan; and
- Implement appropriate dust controls to reduce visible dust.

3.0 VISUAL RESOURCE MANAGEMENT (VRM) ASSESSMENT

The following assessment of visual impacts was conducted in accordance with the BLM's Visual Resource Management Program guidelines. This program has established a system for evaluating and estimating the visual resources to determine appropriate protection or enhancement of the visual environment (BLM 1986). The VRM is an accepted methodology by many government agencies for assessing impacts to visual resources.

Visual Resources Management System

The VRM system was developed by the BLM and has two purposes: to manage the quality of the visual environment and to reduce the visual impact of development activities. Even though this is a private project on private land, the use of the BLM's VRM system is particularly appropriate for evaluating the proposed project as the areas to the north, east, and west and the haul road are within BLM managed public land and the area to the south is USFS managed public land. The VRM system is an appropriate analytical tool to identify existing and project-impacted scenic values and visual quality and to determine measures to reduce potential visual impacts.

The perception of visual quality in a landscape is based on several common principals.

1. Landscape character, which is primarily determined by the four basic visual elements of form, line, color and texture. Although all four elements are present in every landscape, the amount of influence on visual quality that each may exert will vary with the scene.
2. The stronger the influence each of the visual elements exerts, the more interesting the landscape will be.
3. The more visual variety there is in a landscape, the more visually interesting the landscape will be.

The VRM process consists of two steps: 1) an inventory of the existing landscape to evaluate visual resources. Resources are analyzed and assigned a relative visual rating or management classification; and 2) assigning a contrast rating. The degree of contrast between the proposed activity and the existing landscape is measured and the determination of the significance of the contrast or impact is determined.

Visual Resources Assessment Methodology

Data Collection

In order to determine areas from which the proposed amended operations could be seen, a potential viewshed of the Proposed Amendment area was prepared based on United States Geological Survey (USGS) topographic mapping. Figure 5 shows that the Proposed Amendments would be visible from the northwest through east (refer to shaded areas on Figure 5). The area was surveyed for representative viewpoints and photographs were taken of the site from various vantage points. SHs 18 and 247 are identified as Eligible State Scenic Highways but are not designated as such. These highways are designated as scenic routes under the Lucerne Valley Community Plan by the County of San Bernardino.

Field surveys and the photographs were used to evaluate existing visual conditions and three viewpoint locations were selected to provide the basis for computer-generated simulations showing the Proposed Amendment in relation to the surrounding environment. A land use survey was also conducted to identify existing land uses and their relevance to the Proposed Amendment. Figure 5 also shows the locations of the three viewpoint locations:

- Viewpoint 1 - SH 18 and Custer Avenue looking south from a distance of approximately 5.7 miles; residential and some business.
- Viewpoint 2 – Lucerne Valley Market at Barstow Road and SH 18 looking southwest from a distance of approximately 6.7 miles; business.
- Viewpoint 3 – Onyx and Carnelian Roads looking southwest from a distance of approximately 4.2 miles; residential.

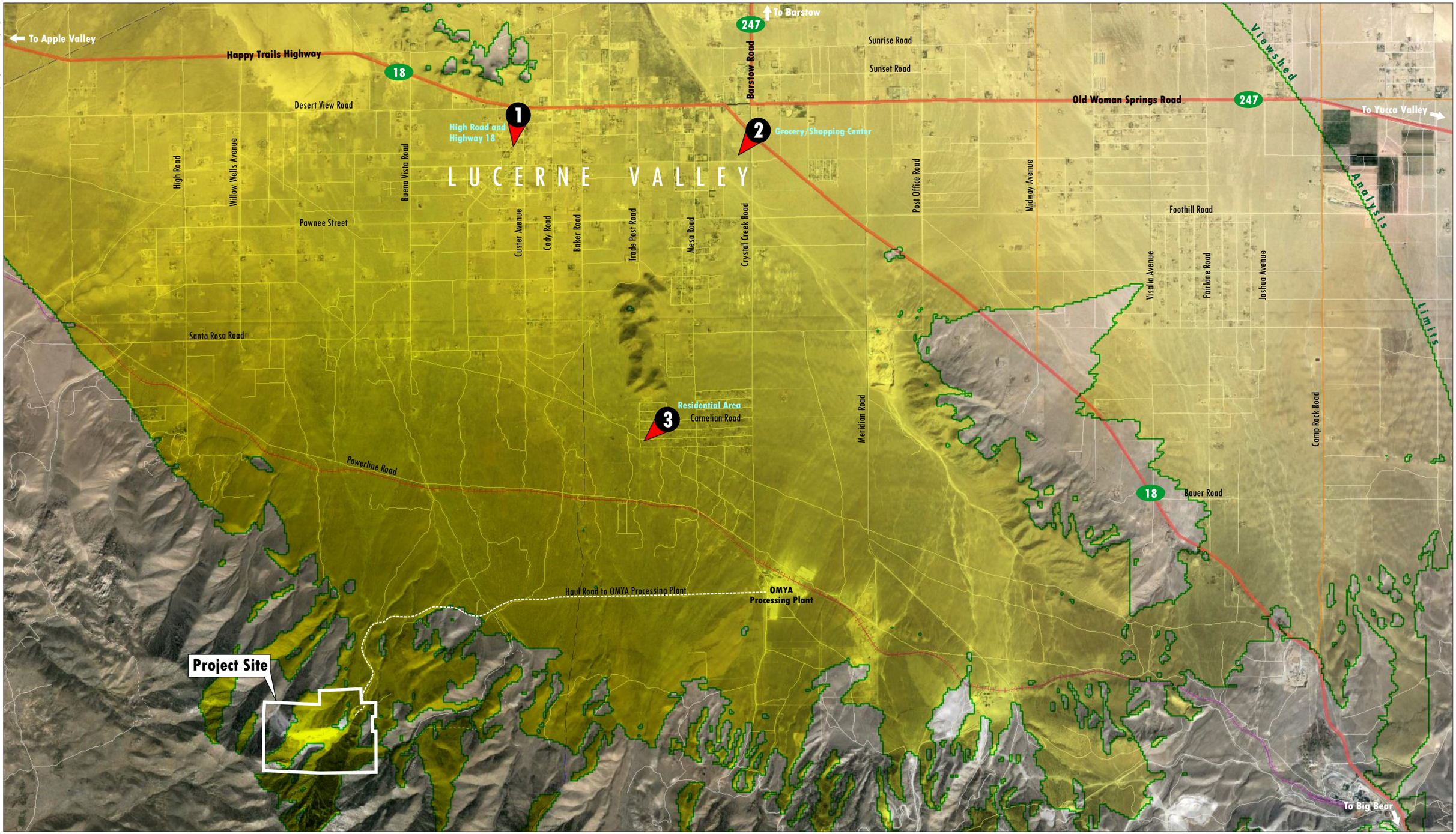
Model Methodology

The simulations are created using three dimensional terrain models developed from the design plans and merged with the existing topography. The final terrain model is meshed, consisting of triangles or squares, and becomes a close representation of the physical environment. The model is registered to a 3-dimensional coordinate system by using USGS topo quads or aerial imagery. The computer rendered model is overlayed or matched to the existing site photography. The projection is colored to simulate color, textures and shading consistent with the surface and subsurface conditions. A photograph is then rendered that simulates future visual conditions. Proposed design elements are isolated and textured to more closely represent real world coloring.

Preparation of Computer Simulations

Viewpoints 1 and 2 were chosen as representative views available to travelers along SHs 18 and 247 respectively and local businesses and residents in the Lucerne Valley. The market area near the junction of SHs 18 and 247 is considered the “center” of town. Highway views were chosen because they represent the most common views of the area (i.e. the largest number of viewers either travel along the highway or live nearby).

File: F5 OMYAwnwr-Sim Loc.CDR (TAG) Page: 1 REV: 07/20/2013



N

0 1.25 2.5

Mile

Source: Lilburn Corporation and USGS
Data: US Forest Service Web Site - Pacific Southwest Region
San Bernardino National Forest Last modified: Tuesday, 26 August 2008.
(http://www.fs.fed.us/r5/forestvisitormaps/sanbernardino/)

LILBURN CORPORATION

LEGEND

Areas of Potential Visibility
Note: The Viewshed Analysis data comprised of only USGS Digital Elevation Models. The data set did not account for trees, houses and other obstructions above ground elevation. Analysis covered a 10 mile radius.

2 Viewpoint Location and Direction of View (3 Total)

OVERALL VIEWSHED ANALYSIS and SIMULATION VIEWPOINT LOCATIONS

VISUAL ASSESSMENT - WHITE KNOB and WHITE RIDGE QUARRIES
Amended Mine and Reclamation Plan
Omya California, County of San Bernardino, California

FIGURE 5

Viewpoint 3 was chosen to represent residential views in an area that is the closest residential area to the site not blocked by intervening hills. From this viewpoint, the site is highly visible. Rock staining conducted in the past years is evident in the center of the slope area.

Photographs taken from these viewpoints were used as a base to simulate the Proposed Amendments to the quarries and overburden stockpiles within the existing visual conditions and setting.

Preparation of a Visual Resources Assessment

The project site is located in an area that could be considered as visually sensitive. According to the County of San Bernardino General Plan, the desert landscape and natural resources define the rural character of the area. However, mining has been part of the landscape for over 70 years and is an integral part of the north slope of the mountains visible from Lucerne Valley. Development may have the potential to increase a substantially adverse visual impact when viewed from a common public viewing area in terms of normal, unaided vision for any length of time.

Scenic Quality

Scenic Quality is described as the overall impression retained after walking or driving through the area or from living and working in the area.

In assessing the visual effects of a Proposed Amendment, rating scenic quality requires a description of the existing scenic values in the landscape both on the project site and surrounding the site. The following factors were considered in the assessment of scenic quality of the proposed project site and vicinity:

- Landform
- Vegetation
- Water
- Color
- Influence of adjacent scenery
- Cultural modification
- Scarcity (one of a kind, rare or unusually memorable)

The VRM system uses a points system to evaluate scenic quality. Each of the factors listed above is assigned points based on whether scenic quality will be of great importance, some importance or little importance. Examples of the range of point values are shown in Table 2. The lower the number of points, the less that factor influences the overall scenic quality of the site. The values are totaled for the area and a Scenic Quality Class is determined and assigned. These classes are:

- Class A - areas that combine the most outstanding characteristics of each rating factor (19 to 33 points)
- Class B – areas in which there is a combination of some outstanding features and some that are fairly common to the physiographic region (12 to 18 points)

- Class C – areas in which the features are fairly common to the physiographic region (0 to 11 points)

Table 2
Scenic Quality Inventory/Evaluation Rating Criteria and Score

Landform	Vegetation	Water	Color	Adjacent Scenery	Scarcity	Cultural Modifications
High vertical relief such as prominent cliffs, spires or massive rock outcrops; or severe surface variation or highly eroded formations including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing, such as glaciers. **5**	A variety of vegetative types in interesting form, texture, and patterns. **5**	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape. **5**	Rich color combinations, variety or vivid color; or pleasing contrasts in the soil, rock, vegetation, water or snow fields. **5**	Adjacent scenery greatly enhances visual quality. **5**	One of a kind; or unusually memorable; or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing. **6**	Free from aesthetically undesirable or discordant sights and influences; or modifications add favorably to visual variety. **2**
Steep canyons, mesas, buttes, cinder cones and drumlins; or interesting erosional patterns or variety in size and shape of landforms; or detail features present and interesting though not dominant or exceptional. **3**	Some variety of vegetation, but only one or two types. **3**	Flowing or still, but not dominant in the landscape. **3**	Some intensity or variety in colors and contrast of the soil. Rock, and vegetation, but not a dominant scenic element. **3**	Adjacent scenery moderately enhances overall visual quality. **3**	Distinctive, though somewhat similar to others within the region. **3**	Scenic quality is somewhat depreciated by inharmonious intrusions, but not so extensively that they are entirely negated; or modification add little or no visual variety to the area. **0**
Low rolling hills, foothills or flat valley bottoms. Interesting detailed landscape features few or lacking. **1**	Little or no variety or contrast in vegetation. **1**	Absent, or not noticeable. **0**	Subtle color variations, contrast or interest; generally muted tones. **1**	Adjacent scenery has little or no influence on overall visual quality. **0**	Interesting within its setting, but fairly common within the region. **1**	Modifications are so extensive that scenic qualities are mostly nullified or substantially reduced. **-4**

Source: Bureau of Land Management, Visual Resource Management Guidelines, 1980.

The evaluation of the effects of the Proposed Amendments on scenic quality presented in Section 4 is based on the criteria contained in Table 2. The following is a description of existing conditions and an evaluation of scenic quality at and in the vicinity of the site. The description of existing conditions is then used as a baseline for which to evaluate changes in scenic quality that may result from the Proposed Amendment.

Landform

Topography in the area of the quarry is mountainous with some extremely steep and rugged slopes. The site is part of the north slope of the San Bernardino Mountains that form a substantial ridge line visible throughout the Valley. The project site includes steep cliffs draining toward the

larger unnamed canyon to the west. The site has interesting features however; it is similar in size and topography to other portions of the north slope in the area, so that it is not considered unique or dominant. **Therefore the landform portion of the scenic quality inventory is rated 3.**

Vegetation

Two principal biogeographic realms are present; alluvial desert scrub at lower elevations and desert montane pinyon-Juniper woodland plant community at higher elevations. Typical plant species are shrubby in stature and adapted to xeric conditions. Geologically the area is characterized by abundant rock outcrops composed of limestone carbonate rock which possess little or no topsoil, and granitic rocks in which soil is generally better developed.

The lower elevations at the edge of the Valley are rolling hills with scattered desert scrub vegetation that appear barren with distance. The upper elevations are steep, with numerous rock outcrops and appear darker with increasing vegetation. The White Knob Quarry is currently being mined and appears as white areas with no vegetation. **Therefore the vegetation portion of the scenic quality inventory is rated 3.**

Water

No visible springs or perennial streams occur within the White Knob Quarry area. Several watersheds drain surface water away from or through the White Knob Quarry area. Drainage at higher elevations occurs mainly in steep, deeply incised drainages that have been eroded into the bedrock and gentler, relatively shallow drainages that have been eroded into the alluvium at lower elevations. However, visually, water is absent from the project site or is not noticeable to viewers. **Therefore the water portion of the scenic quality inventory is rated 0.**

Color

The project area contains generally subtle or muted natural colors ranging from shades of white to light brown to golden. Muted green tones appear in the upper reaches as vegetation increase with elevation. The existing quarry is distinguishable with its white tones of exposed limestone.

Colors of vegetation range from brown to golden and from light green to dark green. Where soil and rock outcroppings are exposed, colors are various shades of brown to black. There is some intensity and variety of color within these two color types however, there are no rich color combinations or variety present on-site. **The color portion of the scenic quality inventory is rated 1.**

Adjacent Scenery

The mountain range and slopes stretching east and west along the southern horizon moderately enhances the overall visual quality. **Therefore the Adjacent Scenery portion of the scenic quality inventory is rated 3.**

Scarcity

The scenic setting of the project site and vicinity is distinctive though somewhat similar to the rest of the mountain range. **The Scarcity portion of the scenic quality inventory is rated 3.**

Cultural Modifications

The project site is already disturbed by ongoing quarry activities. Areas of the Valley floor adjacent to the site have also been modified by scattered rural residences. There are no man-made structures visible from the Valley floor. **The Cultural Modification portion of the scenic quality inventory is rated 0.**

The overall rating for Scenic Quality is 13 which places the proposed project site in Scenic Quality Class B. Class B sites contain areas in which there is a combination of some outstanding features and some that are fairly common to the physiographic region.

Sensitivity Levels

As shown in the previous exercise, landscapes have common elements that can be measured, but there is a subjective dimension to landscape aesthetics. This is because each viewer brings perceptions formed by individual influences (e.g., culture, familiarity with local geography, personal values). Sensitivity levels measure regional and individual public concern for scenic quality and are rated high, medium, or low by evaluating various indicators listed and assessed in Table 3 below:

- Type of Users – travelers on roads and residents (medium)
- Amount of Use (or number of viewers) - travelers on roads and residents (medium)
- Public Interest or concern – local residents high to medium interest based on location in Lucerne Valley and when considering the other views of existing mine activities along the north slope.
- Adjacent Land Uses (low)
- Special Areas such as national parks, wilderness areas (low).

The Lucerne Valley has a long history of mining activities. Most of the mining operations along the north face of the San Bernardino Mountains to the east of the site and are permitted for many decades. Concurrent reclamation in the form of revegetation, covering of exposed areas with darker material, erosion control, and rock staining is required of most mining operations as a specific phase or area is completed. Despite these design features, existing and permitted mining on the north face of the San Bernardino Mountains has resulted in extensive surface disturbances that are highly visible from Lucerne Valley. The project site has been actively mined for over 25 years and is currently permitted through 2031. The planned modifications will not create any new uses to the already altered site; but will add incrementally to the overall impact area by increasing the size and intensity of the White Ridge Quarry, OB-1 and OB-2 in the central area of the site. Figure 6A was prepared to schematically illustrate the existing and 1986 approved mine areas as compared to the proposed Amended Plan (see Figure 6B).The combined results of the sensitivity levels result in an overall sensitivity level of Medium, according to the Sensitivity Level Matrix in Table 3.

Table 3
Sensitivity Level Matrix

Sensitivity Level Rating Unit and Dis	Type of Use	Amount of Use	Public Interest	Adjacent Land Uses	Special Areas	Overall Rating	Distance Zone	Explanation
VP 1(north of site; SH 18)	M	M	M	L	L	M	bg	Visible from SH 18 & residences
VP 2 (Northeast of site; SH 247)	M	M	M	L	L	M	bg	Visible from businesses & residences
VP 3 (northeast of site; local residential)	M	M	H	L	L	M	f/m	Visible from nearby residences

Source: BLM, Visual Resource Management Guidelines, 1984.
Key: H = High, M = Medium, L = Low
Distance Zones: (f/m) foreground/middleground - less than 3 to 5 miles away; (bg) background 5 to 15 miles away; and seldom seen (ss), hidden from view by intervening topography or distance.

Distance Zones

Using the VRM system, the visual quality of a landscape is determined by the visibility of a site from major viewing routes or key observation points (BLM 1986). The setting can be divided into three distance zones: foreground/middleground (f/m), less than 3 to 5 miles away; background (bg), 5 to 15 miles away; and seldom seen (ss), hidden from view by intervening topography or distance.

Figure 5 shows the locations of the three selected viewpoints that provide representative views of the existing site conditions and vicinity at different distances. The view from Viewpoint 1 at SH 18 is approximately 5.7 miles north of the project site. Viewpoint 2 is near the junction of SH 18 and 247, the most heavily traveled roads in the area. This view of the site is at a distance of approximately 6.7 miles to the northeast. Because of the distance and scenic quality, views of the site from these two viewpoints would be considered as background views. Viewpoint 3 is from the residential area located approximately 4.2 miles to the northeast. Views of the site are considered foreground.

The area has a Scenic Quality Class B rating which means a combination of outstanding features (dominant mountain ridge landscape) and some that are fairly common to the physiographic region. Because most of the Lucerne Valley scattered residential uses and businesses are generally five miles or greater from the project site, the project would rate a distance zone classification of background.

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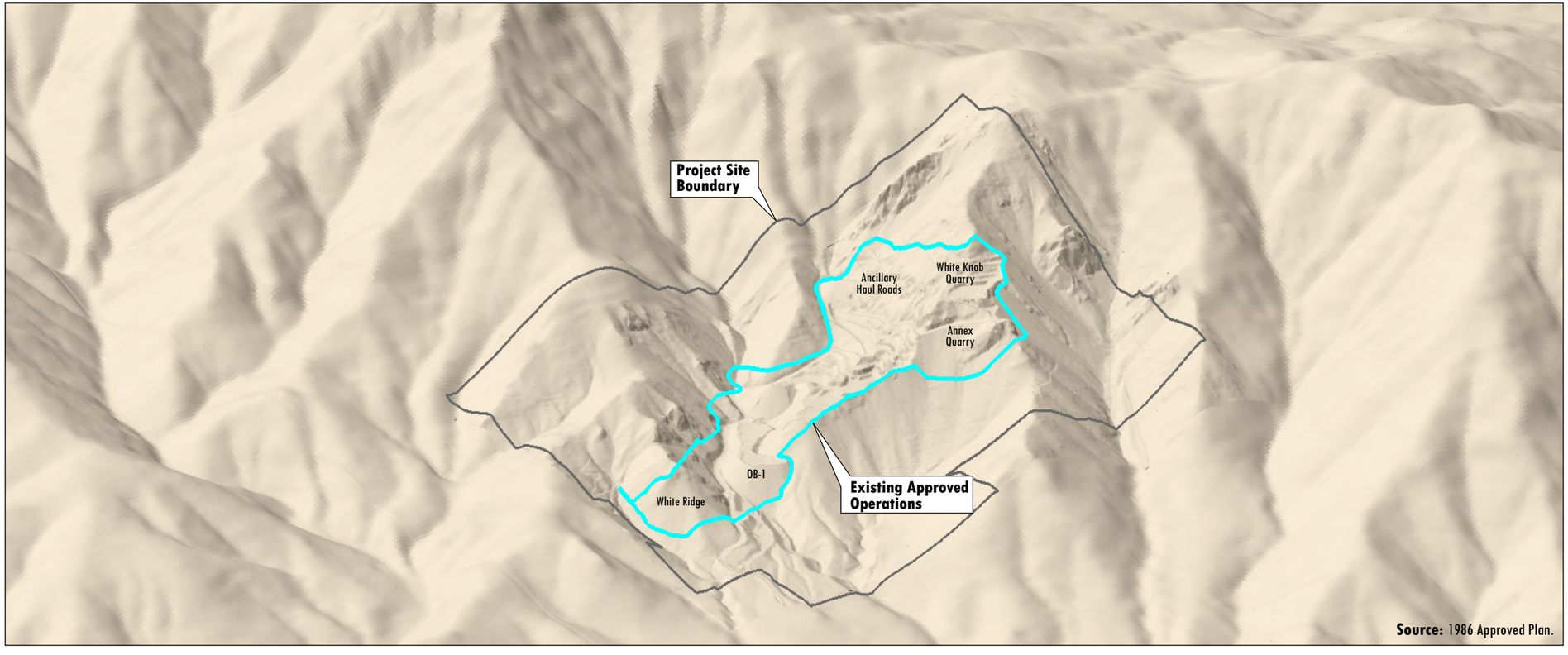

Source: 1986 Approved Plan.

Figure 6A:

Existing Approved Operations

Estimated Limits of 1986 Approved Operations

Existing Project Site Boundary

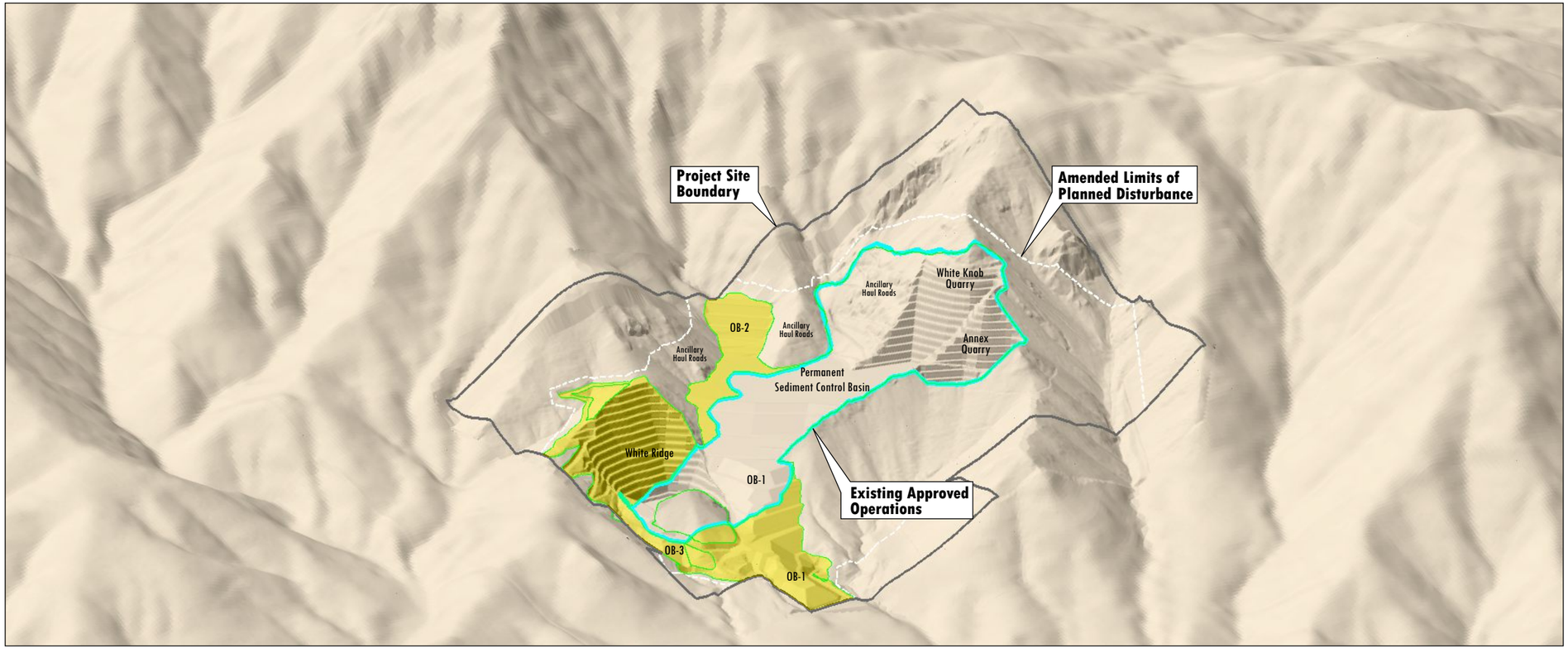

Figure 6B:

Amended Operations

Estimated Limits of 1986 Approved Operations

Existing Project Site Boundary

Major Facilities

Amended Operating Area

SCHEMATIC of EXISTING APPROVED and AMENDED OPERATIONS

VISUAL ASSESSMENT - WHITE KNOB and WHITE RIDGE QUARRIES
Amended Mine and Reclamation Plan
Omya California, County of San Bernardino, California

FIGURE 6

Visual Resource Classes and Objectives

Management classes of the VRM system are used to determine varying degrees of modification to basic elements of the landscape. The class rating is derived from an overlay technique that combines scenic quality, sensitivity levels and distance zones that are used to identify areas with similar combinations of factors. These areas are assigned to one of five management classes according to the predetermined criteria. Table 4 combines the scenic quality, sensitivity level, and distance zones previously described. The class rating is then used to assess the impact of the Proposed Amendment. The class categories are defined as follows:

- Class I Objective – preserve the existing character of the landscape and generally applies to wilderness areas, wild and scenic rivers, and other similar situations.

- Class II Objective – retain the existing character and the level of change should be low and should not attract the view of a casual observer.

- Class III Objective - partially retain the existing character and the level of change should be moderate and should not dominate the view of a casual observer.

- Class IV Objective – provide for activities which require major modification and the level of change can be high; however, impacts should be minimized as feasible.

Table 4
Visual Resource Inventory Classes

Visual Sensitivity		High			Medium			Low
Special Areas		I	I	I	I	I	I	I
Scenic Quality	A	II	II	II	II	II	II	II
	B	II	III	III* IV*	III	**IV**	IV	IV
	C	III	IV	IV	IV	IV	IV	IV
Distance Zones		f/m	bg	ss	f/m	bg	ss	ss

*If adjacent areas is Class III or lower assign Class III, if higher assign Class IV.
Source: BLM, Visual Resource Inventory, 1986

A medium use Sensitivity Level with a Class B Scenic Quality rating in the background Distance Zone would fall into Class IV objectives.

4.0 IMPACTS OF THE PROPOSED PROJECT

4.1 CONTRAST RATING ANALYSIS

The previous exercises were designed to evaluate and characterize the existing landscape by preparing an inventory and evaluation, and designating a visual resource class in order to more objectively assess the visual impacts of Proposed Amendment. The Contrast Rating System is

used to measure the degree of contrast between the Proposed Amendment and the existing conditions and approved activities.

Figure 6 shows the three locations where views of the Amended Plan were simulated within the context of the existing conditions. Due to topography and the orientation of the quarry site, views are limited to those from the northwest to east. Figures 7, 8, and 9 show existing and future views with reclamation of the project site. The proposed project is the Amended Plan's changes to the existing and 1986 approved mine and reclamation plan. The principal changes with respect to visual resources are the increase in size of the overburden stockpiles, the increase in size of the approved White Ridge Quarry, and the increase in the number of ancillary haul roads west and east of OB-2. These changes are shown on Figures 3 and 6 and would be the incremental changes to visual impacts of the Proposed Amendment as compared to the existing and 1986 approved operations.

The analysis segregates a landscape into its major features (land/water surface, vegetation, and structures) and each feature in turn, into its basic elements (form, line, color and texture). For the proposed project, landform is the key feature. Each element is assigned a degree of contrast as follows:

- **None** The element contrast is not visible or perceived.
- **Weak** The element contrast can be seen but does not attract attention.
- **Moderate** The element contrast begins to attract attention and begins to dominate the characteristic landscape.
- **Strong** The element contrast demands attention, will not be overlooked, and is dominate in the landscape.

4.2 POTENTIAL IMPACT ASSESSMENT

During the original permitting of the White Knob Quarry in 1986, it was recognized that there would be significant, un-mitigable visual impacts from the quarry development. It was determined that the impacts, although visible, are consistent with the general visual character of the Lucerne Valley limestone mining area which includes numerous quarries, overburden sites, haul roads and limestone processing plants. A Statement of Overriding Consideration regarding environmental effects of the White Knob Quarry was prepared and accepted by the San Bernardino County Planning Commission, in which the visual impacts of the quarry development that could not be mitigated to a level below significance was recognized. The Planning Commission found that the economic, social and other benefits to the region as a result of the project outweighed the significance of the project impacts upon visual resources.

Figures 7, 8, and 9 show the existing and future conditions with reclamation from three viewpoints in Lucerne Valley. The top photographs in these figures show existing conditions while the bottom photographs show the site after the end of mining with concurrent and approximately 10 years of final reclamation that will implement the reclamation design features listed in Section 2.3 above. Revegetation, coloring of feasible areas, placement of darker material, and natural weathering will reduce the exposed white areas to darker shades of white and tans over time. Omya tested colorization and revegetation methods on the north facing slopes on approximately five acres. The visual contrast has been substantially reduced as the

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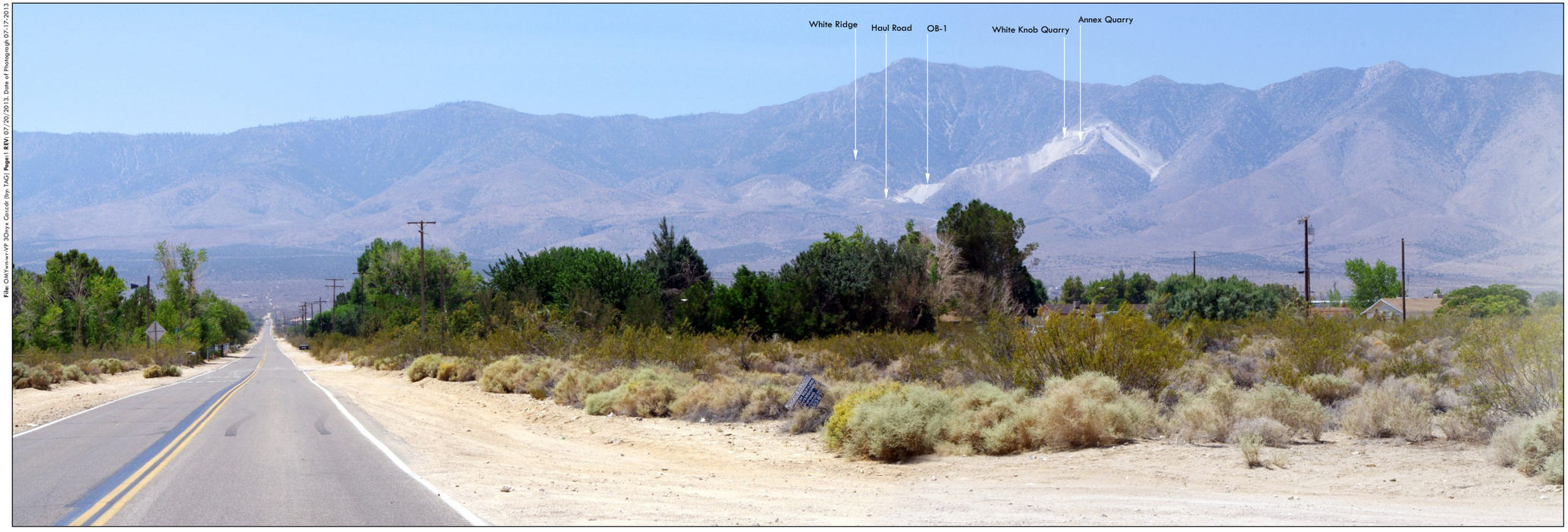

Figure 7A:

Existing Conditions

View from 5.7 miles looking south from the intersection of Custer Avenue and Highway 18.

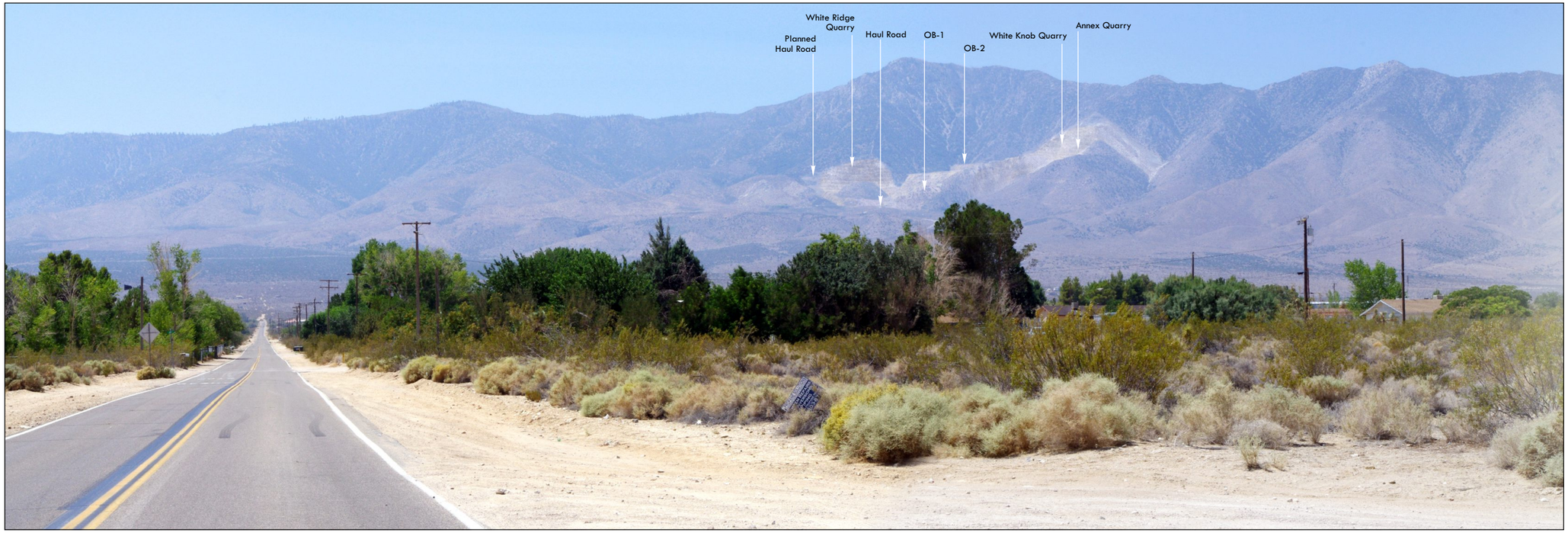

Figure 7B:

Amended Project Buildout with Reclamation

View looking south from from the intersection of Custer Avenue and Highway 18 at the Amended Project buildout with concurrent reclamation and approximately10 years of final reclamation in place.

VIEWPOINT 1

VISUAL ASSESSMENT - WHITE KNOB and WHITE RIDGE QUARRIES
Amended Mine and Reclamation Plan
Omya California, County of San Bernardino, California

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FIGURE 7

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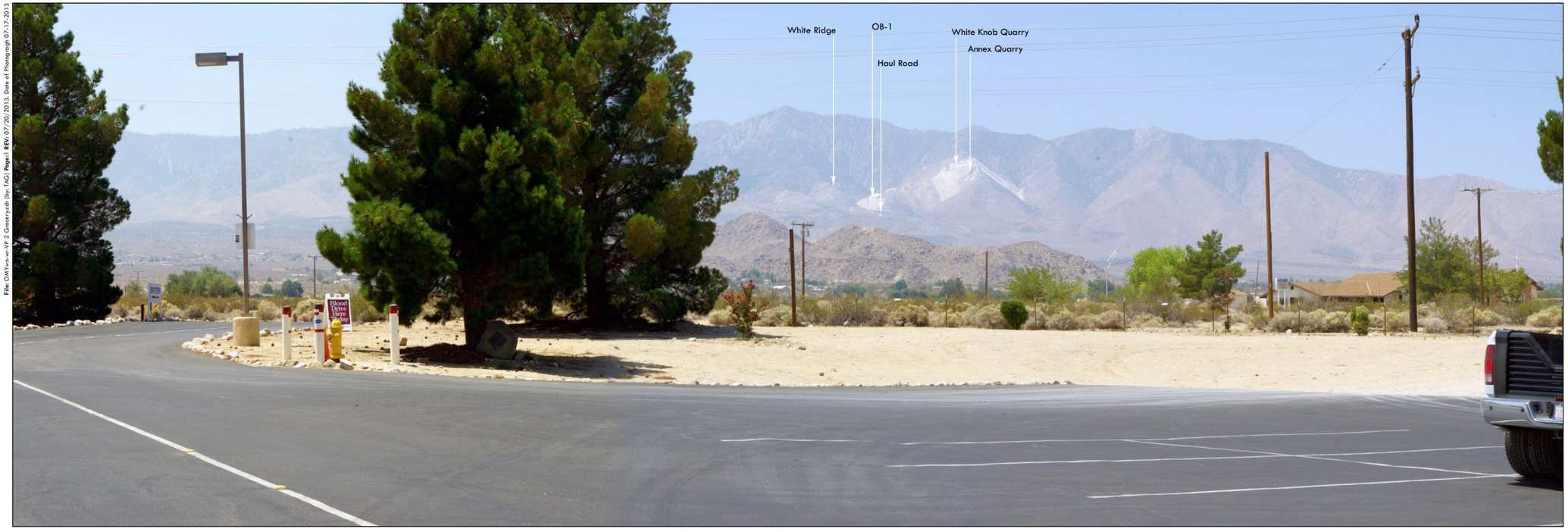

Figure 8A:

Existing Conditions

View from 6.7 miles looking southwest from the main grocery store/shopping center adjacent to highway 18.

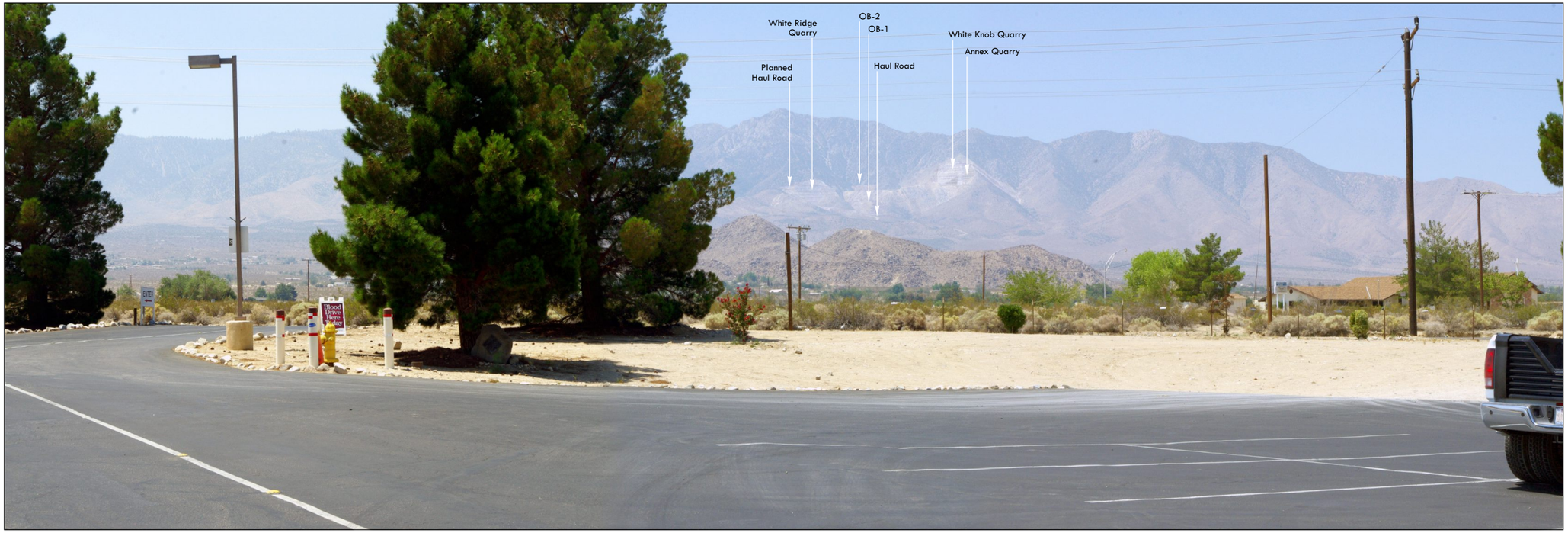

Figure 8B:

Amended Project Buildout with Reclamation

View looking southwest from the main grocery store/shopping center, adjacent to Highway 18, at the Amended Project buildout with concurrent reclamation and approximately10 years of final reclamation in place.

VIEWPOINT 2

VISUAL ASSESSMENT - WHITE KNOB and WHITE RIDGE QUARRIES
Amended Mine and Reclamation Plan
Omya California, County of San Bernardino, California

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FIGURE 8

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Figure 9A:

Existing Conditions

View from 4.2 miles looking southwest, within a residential neighborhood, from the intersection of Carnelian Road and Onyx Road.

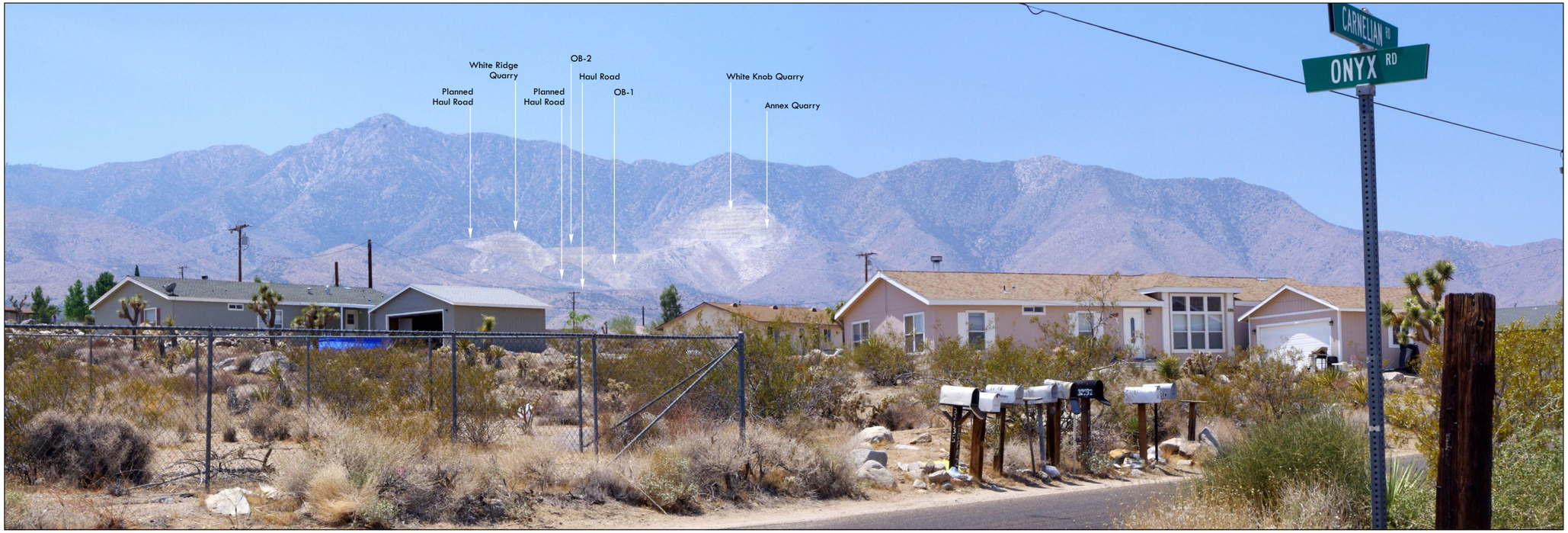

Figure 9B:

Amended Project Buildout with Reclamation

View looking southwest from Carnelian Road and Onyx Road at the Amended Project buildout with concurrent reclamation and approximately10 years of final reclamation in place.

VIEWPOINT 3

VISUAL ASSESSMENT - WHITE KNOB and WHITE RIDGE QUARRIES
Amended Mine and Reclamation Plan
Omya California, County of San Bernardino, California

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FIGURE 9

brown colored stain on the boulders blends with the natural hill side color. Revegetation of the upper slopes was also undertaken, utilizing native species. These positive effects are illustrated in the center of the disturbed project on all three existing figures.

A comparison of the existing and permitted mine activities to the Proposed Amendment simulations were used to evaluate potential visual impacts. The principal changes in the Amended Plan are the increase in size of the overburden stockpiles, the increase in size of the approved White Ridge Quarry, and the increase in the number of ancillary haul roads west and east of OB-2. The redesign of the north half of the White Ridge Quarry will leave a ridge to the north to reduce visual impacts. These changes are shown on Figures 3 and 6 and would be the incremental changes to visual impacts of the Proposed Amendment as compared to the existing and 1986 approved Plan.

Viewpoint 1 - SH 18 and Custer Avenue

(Please refer to Figure 7.) The project site is located approximately 5.7 miles to the south as viewed near the intersection of SH 18 and Custer Avenue, west of the town center. This area includes travelers on SH 18, scattered rural residential, and businesses along the highway. The existing quarry is visible halfway up the north slope of the range (see Figure 7A). The main visible features are the white rock slopes to the west and north of the quarry and OB-1 on the lower east. These features have altered the color, form, and line of the natural slopes.

The simulation after project build-out with ten years of final reclamation and time for reclamation to take effect shows the permitted expansion of the White Knob and Annex Quarries on the upper west as a series of benches that may be visible depending on shadowing and color (see Figure 7B). The White Ridge Quarry to the east is also shown as a series of benches that may be visible depending on shadowing and color. Note the gray hill in the foreground of the White Ridge which blocks views of the lower half of this quarry. The expansion of OB-1 and OB-2 are seen as plateaus of white rock. OB-3 is seen to the lower left of the White Ridge Quarry. The quarries and overburden stockpiles will darken with reclamation and weathering over time.

The proposed Amended Plan will incrementally add mine development primarily in the center and eastern portions of the project site but will not increase the overall width of the mine along the background of the mountain ridge. The changes will cause physical alterations to form, line, and in particular color as compared to the existing and permitted project. The overall scenic integrity of the site will not substantially decrease from that of the existing and permitted project as no new uses are being added to the overall viewshed. However, the overall visual impacts are still considered unavoidable significant impacts consistent with the 1986 EIR.

Viewpoint 2 – Lucerne Valley Market

(Please refer to Figure 8.) The project site is located approximately 6.7 miles to the southwest as viewed from the Lucerne Valley Market near the intersection of SH 18 and Barstow Road in the town center. This area includes travelers on SH 18, scattered rural residential, and businesses along the highways. The existing quarry is visible halfway up the north slope of the range (see

Figure 8A). The main visible features are the white rock slopes to the west and north of the quarry and OB-1 on the lower east. These features have altered the color, form, and line of the natural slopes.

The simulation after quarry build-out with ten years of final reclamation and time for reclamation to take effect shows the permitted expansion of the White Knob and Annex Quarries on the upper west as a series of benches that may be visible depending on shadowing and color (see Figure 8B). The White Ridge Quarry to the east is also depicted as a series of benches that may be visible depending on shadowing and color. Note the gray hill in the foreground of the White Ridge Quarry which blocks views of the lower half of this quarry. OB-1 is more visible from this angle of view looking up the canyon with the "face" and benches of the stockpile seen as plateaus of white rock. OB-2 is seen at the top of OB-1 as another plateau. The overburden stockpiles will darken with reclamation and weathering. OB-3 is barely visible at the bottom of the White Ridge Quarry. The quarries and overburden stockpiles will darken with reclamation and weathering over time.

The proposed Amended Plan will incrementally add physical alterations to form, line, and in particular color as compared to the existing and permitted project. The overall scenic integrity of the site will not substantially decrease from that of the existing and permitted project as no new uses are being added to the overall viewshed. However, the overall visual impacts are still considered unavoidable significant impacts consistent with the 1986 EIR.

Viewpoint 3 – Onyx and Carnelian Roads

(Please refer to Figure 9.) The project site is located approximately 4.2 miles to the southwest as viewed from the intersection of Onyx and Carnelian Roads in a rural residential area. The existing quarry is visible along the north slope of the range (see Figure 9A). Due to its closer location, views from this area may be able to discern quarry benches and haul roads. The main visible features are the white rock slopes to the north of the quarry and OB-1 on the lower east. These features have altered the color, form, and line of the natural slopes.

The simulation after quarry build-out with ten years of final reclamation and time for reclamation to take effect shows the permitted expansion of the White Knob and Annex Quarries on the upper west as a series of benches (see Figure 9B). The White Ridge Quarry to the east is also shown as a series of benches that may be visible depending on shadowing and color. Note the gray hill in the foreground of the White Ridge Quarry which blocks views of the lower half of this quarry. OB-1 is more visible from this angle of view looking up the canyon with the "face" and benches of the stockpile seen as plateaus of white rock. OB-2 is seen at the top of OB-1 as another plateau. OB-3 is located to the bottom of the White Ridge Quarry below the gray hill. The quarries and overburden stockpiles will darken with reclamation and weathering over time.

The proposed Amended Plan will add to the physical alterations to form, line, and in particular color as compared to the existing and permitted project. The overall scenic integrity of the site will not substantially decrease from that of the existing and permitted project as no new uses are

being added to the overall viewshed. However, the overall visual impacts are still considered unavoidable significant impacts consistent with the 1986 EIR.

5.0 CONCLUSION

This visual resource assessment analyzed the potential impacts to visual resources from the proposed Amended Plan for the White Knob – White Ridge Quarries. The BLM Visual Resource Management Guidelines were utilized to objectively categorize the surrounding existing visual resources and to compare the existing and 1986 approved plan with the Amended Plan. During the original permitting of the White Knob Quarry in 1986, it was recognized that there would be significant, un-mitigable visual impacts from the quarry development and a Statement of Overriding Consideration was accepted by the County Planning Commission. The Planning Commission found that the economic, social and other benefits to the region as a result of the project outweighed the significance of the project impacts upon visual resources.

The principal changes in the Amended Plan are the increase in size of the overburden stockpiles, the increase in size of the approved White Ridge Quarry, and the increase in the number of ancillary haul roads west and east of OB-2. The redesign of the north half of the White Ridge Quarry will increase its size but will leave a ridge to the north to reduce visual impacts.

Photographs from three locations to the north and northeast of the site and simulations with representative public views were used to assess the existing and future visual quality. The quarry site is not visible from the south, west or distinctly visible from the east due to its location and topography in relation to general public views from Lucerne Valley. Simulations from each of the three viewpoints found that the proposed Amended Plan will add to the existing and permitted physical alterations to form, line, and in particular color. The overall scenic integrity of the site will not substantially decrease from that of the existing and permitted project as no new uses are being added to the overall viewshed. However, the visual impacts from the overall development are still considered unavoidable significant impacts consistent with the 1986 EIR.

5.1 MITIGATION

The Amended Plan includes designs and reclamation to reduce existing and future visual impacts from the quarries, overburden sites, and roll down areas. Monitoring and enforcement by the County and reclamation bonding will ensure that reclamation will be successful and meet the regulatory standards. These measures have been incorporated into the visual impact assessment and include the following:

- Implement measures to minimize boulder roll down;
- Maintain the existing crusher site at the White Knob Quarry or use a portable plant within an active quarry to reduce its visibility from Lucerne Valley;
- Deposit overburden and waste rock within the White Knob Quarry footprint, as described in the Amended Plan, to reduce the area of disturbance for overburden stockpiles and reduce visual impact outside the quarry;

- Design and phase mining of the White Ridge Quarry, which allows for concurrent reclamation and leaves an approximately 300-foot high ridge of undisturbed hillside facing Lucerne Valley to minimize visual impacts;
- Implement reclamation and revegetation on completed equipment accessible quarry benches and on overburden stockpiles concurrent with mining where feasible;
- Utilize approved color-staining product to darken the visible quarry and roll down slopes where not subject to raveling to reduce visual impacts;
- Deposit darker overburden and waste rock on final overburden slopes where available to reduce color contrast;
- Design adequate erosion control features along the haul and access roads and quarry to control and limit erosion and sediment transport;
- Construct catchment berms at foot of stockpiles to reduce rock roll down and sediment flow;
- Limit surface disturbances to areas identified in the Amended Plan; and
- Implement appropriate dust controls to reduce visible dust.

6.0 REFERENCES

Bureau of Land Management, 1984 & 1986. "Visual Resources Management," BLM Manuals 8400 (1984); Manual H-8410-1 (1986); and Manual 8431 (1986).

County of San Bernardino, 1986. "White Knob-White Ridge Limestone Mine Site Approval and Reclamation Plan (86M-04) and EIR." November 1986.

Omya California, 2013. "Amended Mine and Reclamation Plan, White Knob – White Ridge Limestone Quarries." February 2013.

APPENDIX C
AIR QUALITY AND GREENHOUSE GAS EMISSIONS

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AIR QUALITY AND GREENHOUSE GAS IMPACT ASSESSMENT

Omya White Knob and White Ridge Quarries Expansion
County of San Bernardino

November 5, 2013

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AIR QUALITY AND GREENHOUSE GAS IMPACT ASSESSMENT

Omya White Knob and White Ridge Quarries Expansion
County of San Bernardino

November 5, 2013

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AIR QUALITY AND GREENHOUSE GAS IMPACT ASSESSMENT

Omya White Knob and White Ridge Quarries Expansion
County of San Bernardino, California

November 5, 2013

1.0 INTRODUCTION

This Air Quality and Greenhouse Gas Impact Assessment report (AQIA) has been prepared for the Omya White Knob and White Ridge Quarries Expansion project ("Project"). The Project is located adjacent to the San Bernardino National Forest (SBNF) 6.5 miles southwest of the intersection of State Route 18 and State Route 247 in the Lucerne Valley. The Project is 4.2 miles west-southwest of the existing Omya processing plant located near the intersection of Crystal Creek Road and Powerline Road. An existing access haul road connects the Project to the processing plant.

The Project involves the expansion of two quarries and three fill areas. Specifically, the existing White Knob Quarry and Overburden Site #1 would be expanded. The White Ridge Quarry and White Knob Annex Quarry do not currently exist but are already approved and would be expanded. Overburden Sites #2 and #3 would be added to the existing plan. Primary crushing occurs near the quarries and ore is hauled north down the mountain and then east along the foothills to the processing plant.

Omya operates two other quarries in the area. The Sentinel and Butterfield Quarries are located approximately 3 miles south of the processing plant on Crystal Creek Road. The Sentinel and Butterfield Quarries are currently undergoing a separate CEQA evaluation for proposed expansion. Cloudy and Claudia Quarries are inactive and in the process of being reclaimed. Cloudy and Claudia Quarries are located approximately 5 miles south of the processing plant at the terminus of Crystal Creek Road.

The combined production from all the operating quarries (Butterfield, Sentinel, and White Knob) is limited by the processing plant maximum production rate. The Project would allow up to the maximum production rate of 680,000 tons per year of finished ore to be extracted exclusively from the White Knob and White Ridge quarries. This would result in no material being quarried at Sentinel and Butterfield which is an indirect effect of the Project that necessitates calculation of Sentinel and Butterfield emissions in the air quality baseline. Moreover the available vehicular activity data does not distinguish which units operate in each quarry. Thus, the emissions from vehicles are calculated for the fleet and apportioned to quarries based on throughput amount and to units operating on roads by vehicle miles traveled (VMT).

Impacts from alternatives to the Project are assessed in this report and described in Section 8.0. The two alternatives include: No Action and Mixed Production with Sentinel and Butterfield.

2.0 ENVIRONMENTAL SETTING

Air pollutants are regulated in order to protect public health and welfare. Health effects of common air pollutants are presented in Appendix B. Effects of pollutants on public welfare include visibility impairment; and impacts to animals, crops, vegetation, and buildings.

2.1 Existing Sources and Receptors

The Omya processing plant receives ore from the Butterfield, Sentinel and White Knob Quarries. Omya provided information on historical activity levels and equipment that was used to develop a baseline for the Project. In general, the quarries and processing plant consist of operations and equipment that emit fugitive dust and diesel exhaust. Detailed discussion of how the baseline emissions were quantified is presented in Section 5.0.

2.2 Meteorology and Topography

The MDAQMD Guidelines state:

> *The Mojave Desert Air Basin (MDAB) is an assemblage of mountain ranges interspersed with long broad valleys that often contain dry lakes. Many of the lower mountains which dot the vast terrain rise from 1,000 to 4,000 feet above the valley floor. Prevailing winds in the MDAB are out of the west and southwest. These prevailing winds are due to the proximity of the MDAB to coastal and central regions and the blocking nature of the Sierra Nevada mountains to the north; air masses pushed onshore in southern California by differential heating are channeled through the MDAB. The MDAB is separated from the southern California coastal and central California valley regions by mountains (highest elevation approximately 10,000 feet), whose passes form the main channels for these air masses. The Antelope Valley is bordered in the northwest by the Tehachapi Mountains, separated from the Sierra Nevadas in the north by the Tehachapi Pass (3,800 ft elevation). The Antelope Valley is bordered in the south by the San Gabriel Mountains, bisected by Soledad Canyon (3,300 ft). The Mojave Desert is bordered in the southwest by the San Bernardino Mountains, separated from the San Gabriels by the Cajon Pass (4,200 ft). A lesser channel lies between the San Bernardino Mountains and the Little San Bernardino Mountains (the Morongo Valley).*
>
> *During the summer the MDAB is generally influenced by a Pacific Subtropical High cell that sits off the coast, inhibiting cloud formation and encouraging daytime solar heating. The MDAB is rarely influenced by cold air masses moving south from Canada and Alaska, as these frontal systems are weak and diffuse by the time the reach the desert. Most desert moisture arrives from infrequent warm, moist and unstable air masses from the south. The MDAB averages between three and seven inches of precipitation per year (from 16 to 30 days with at least 0.01 inches of precipitation). The MDAB is classified as a dry-hot desert climate (BWh), with portions classified as dry-very hot desert (BWhh), to indicate at least three months have maximum average temperatures over 100.4° F.*

2.3 Ambient Air Quality

Appendix C contains the airborne pollutant concentration data and number of days exceeding each Ambient Air Quality Standard (AAQS) monitored by local air districts. The Project is located near the Lucerne Valley monitoring station which measures PM_{10}. Concentrations at this station were less than

the federal standard in all but one year (2007) of the decade reviewed (i.e. 2002 to 2011, see Appendix C). Concentrations are estimated to have exceeded the California PM_{10} standard six or less days each year except 2007 when the estimate is 37 days exceeding.

The Hesperia monitoring station is the closest location where ozone is monitored. Ozone levels exceed the 2008 federal 8-hour standard between 40 and 73 days per year between 2002 and 2011 (Appendix C). The California 1-hour standard is exceeded between 15 and 46 days per year.

The Victorville monitoring station collects a full suite of pollutants and is the closest station to monitor CO and NO_2 which are both attainment pollutants.

The South Coast AQMD operates a $PM_{2.5}$ monitoring station in the City of Big Bear Lake. $PM_{2.5}$ concentrations at this station exceeded the federal standard on a handful of days in each year 2005 through 2009. 2010 and 2011 did not have exceedences (Appendix C).

Table 1: Ambient Pollutant Concentrations

Pollutant	Averaging Time	2007	2008	2009	2010	2011
Ozone (ppm)	1-hr	0.132	0.132	0.123	0.119	0.132
	8-hr	0.109	0.106	0.101	0.101	0.113
Carbon Monoxide (ppm)	1-hr (Max.)	2.1	1.4	1.8	8.7	1.9
	8-hr (Max.)	1.6	1.0	1.1	2.3	1.5
Nitrogen Dioxide (ppm)	1-hr (98th %ile)	0.063	0.064	0.059	0.065	0.060
	Annual	0.018	0.016	0.015	0.015	0.015
Respirable Particulate Matter (PM_{10}) ($\mu g/m^3$)	24-hr (Max.)	229	67	93	43	33
	Annual	31	20.7	17.3	14.6	13.8
Fine Particulate Matter ($PM_{2.5}$) ($\mu g/m^3$)	24-hr (98th %ile)	34.0	33.2	29.4	27.5	30.6
	Annual	10.3	9.1	9.9	8.4	8.4

Ozone is from Hesperia Monitoring Station operated by MDAQMD.
NO_2 & CO concentrations are from Victorville Monitoring Station operated by MDAQMD.
PM_{10} concentrations are from Lucerne Valley Middle School Monitoring Station operated by MDAQMD.
$PM_{2.5}$ concentrations are from Big Bear City Monitoring Station operated by South Coast AQMD.

2.4 Ambient Health Risk

The MDAQMD does not publish health risk estimates for areas within its jurisdiction. The Project is near the boundary of Mojave Desert and South Coast Air Basins. Thus, the SCAQMD Multiple Air Toxics Exposure Study (MATES) III risk maps which show total cancer risk of approximately 85 excess cancer cases per one million people exposed in the Big Bear Lake area is considered representative of conditions in the area of the Project as documented on Figure 3 (Appendix A).

It should be noted that the SCAQMD's MATES study is based on ambient air quality monitoring data from several monitoring stations in the South Coast Air Basin. The MATES III study includes fixed monitoring sites (where data is collected over multiple years) and microscale or temporary sites where monitoring occurred for a limited time period (six to ten weeks). The nearest fixed air monitoring site to the Project vicinity is the Inland Valley San Bernardino station located at 14360 Arrow Highway in Fontana, CA which is over sixty (60) miles southwest of the Project. The MATES III study did include a temporary site that appears to be located closer to the Project but no address is provided in the MATES III documentation. The MATES III study acknowledges that "Since the sampling periods for the microscale sites are limited, annual averages for measured substances cannot be calculated." (Page 2-4, MATES III). The ambient health risk identified in Figure 3 (Appendix A) includes projection of risk levels from locations that were monitored to those that were not. This report overlooks these details and considers the risk map published by SCAQMD at face value such that it represents existing conditions at the project site.

Diesel particulate matter (DPM) is identified as a TAC and accounts for roughly 70% of the cancer risk from air pollution in urban areas where on-road sources dominate the inventory. Diesel engines are a ubiquitous source and thus it is not surprising that stationary source TAC effects "are generally much lower than region-wide risk levels, region-wide risks tend to overwhelm any potential local 'hot spots.'" (SCAQMD Mates II Study, Section 7.3).

2.5 Effects of Greenhouse Gases

The effect of greenhouse gas emission regulations are potentially far reaching. On December 7, 2009, United States Environmental Protection Agency (US EPA) Administrator Lisa Jackson signed a final action, under Section 202(a) of the Clean Air Act, finding that six key well-mixed greenhouse gases constitute a threat to public health and welfare, and that the combined emissions from motor vehicles cause and contribute to the climate change problem. The "endangerment finding" allows the US EPA to begin regulating the six GHGs that are identified.

Key effects that US EPA claims support the determination that GHGs endanger public health include:

> *"**Temperature**. There is evidence that the number of extremely hot days is already increasing. Severe heat waves are projected to intensify, which can increase heat-related mortality and sickness. Fewer deaths from exposure to extreme cold is a possible benefit of moderate temperature increases. Recent evidence suggests, however, that the net impact on mortality is more likely to be a danger because heat is already the leading cause of weather-related deaths in the United States.*

***Air Quality**. Climate change is expected to worsen regional ground-level ozone pollution. Exposure to ground-level ozone has been linked to respiratory health problems ranging from decreased lung function and aggravated asthma to increased emergency department visits, hospital admissions, and even premature death. The impact on particulate matter remains less certain.*

***Climate-Sensitive Diseases and Aeroallergens**. • Potential ranges of certain diseases affected by temperature and precipitation changes, including tick-borne diseases and food and water-borne pathogens, are expected to increase. • Climate change could impact the production, distribution, dispersion and allergenicity of aeroallergens and the growth and distribution of weeds, grasses, and trees that produce them. These changes in aeroallergens and subsequent human exposures could affect the prevalence and severity of allergy symptoms.*

***Vulnerable Populations and Environmental Justice**. • Certain parts of the population may be especially vulnerable to climate impacts, including the poor, the elderly, those already in poor health, the disabled, those living alone, and/or indigenous populations dependent on one or a few resources. • Environmental justice issues are clearly raised through examples such as warmer temperatures in urban areas having a more direct impact on those without air-conditioning.*

***Extreme Events**. Storm impacts are likely to be more severe, especially along the Gulf and Atlantic coasts. Heavy rainfall events are expected to increase, increasing the risk of flooding, greater runoff and erosion, and thus the potential for adverse water quality effects. These projected trends can increase the number of people at risk from suffering disease and injury due to floods, storms, droughts and fires." (EPA's Endangerment Finding - Health Effects Fact Sheet, US EPA).*

2.6 Class I and Class II Wilderness Areas

Class I Wilderness Areas are areas designated in the Clean Air Act (42 USC 7472) including:

- International parks;
- National wilderness areas which exceed 5,000 acres in size;
- National memorial parks which exceed 5,000 acres in size; and
- National parks which exceed 6,000 acres in size.

The Project is within 100 kilometers of the following Class I Wilderness Areas:

- San Gorgonio 23 km.
- Cucamonga 50 km.
- San Jacinto 56 km.
- Joshua Tree National Park 59 km.
- San Gabriel 75 km.

Class I areas are protected from impacts on visibility, ozone phytotoxicity, and deposition of nitrates and sulfates which can acidify water bodies. In addition, the deposition of fugitive dust onto plants is a concern particularly for protected species, such as the carbonaceous plants found near the quarries. The remainder of the SBNF is considered Class II Wilderness.

Good visibility is essential to the enjoyment of national parks and scenic areas. Across the United States, regional haze has decreased the visual range in these pristine areas from 140 miles to 35-90 miles in the West, and from 90 miles to 15-25 miles in the East. This haze is composed of small particles that absorb and scatter light, affecting the clarity and color of what humans see in a vista. The pollutants that create haze (also called haze species) are measurable as sulfates, nitrates, organic carbon, elemental carbon, fine soil, sea salt, and coarse mass. Anthropogenic sources of haze include industry, motor vehicles, agricultural and forestry burning, and dust from soils disturbed by human activities. Pollutants from these sources, in concentrations much lower than those which affect public health, can impair visibility anywhere. Natural forest fires, biological emissions, sea salt and other natural events also contribute to haze species concentrations. Visibility-reducing particles can be transported long distances from where they are generated, thereby producing regional haze. When they are transported to and occur in national parks and wilderness areas, the reduced visibility impairs the quality and the value of the wilderness experience.

Conditions in the San Gorgonio Wilderness Area would be of primary concern for this Project because it is closest and other areas would experience less severe impacts. The environmental setting for each Class I Wilderness Area within California is found in the California Regional Haze Plan. The San Gorgonio Wilderness Area description from this Plan is provided in Appendix D.

The Project is bounded on the south, west, and east by mountainous undeveloped Forest Lands and to the north by a rural area of the Lucerne Valley. Other than mining, which has historically been active in the area, land use in the rugged mountainous area has been limited to occasional use by hikers and hunters. Off highway vehicle use and fuel wood cutting have increased as more access roads were built.

The “Land Management Plan, Part 2 San Bernardino National Forest Strategy” (USDA September 2005) defines the project area as the “Desert Rim.” The Desert Rim is described as “a high desert, remote, rugged landscape formed by complex geological faulting. Today, the majority of the land is valued in the production of large quantities of high quality, limestone mineral deposits used in the production of pharmaceuticals and cement. These carbonate deposits are also valuable habitat supporting four species of threatened and endangered plants found nowhere else in the world.” An intensive collaborative effort led to the development of the Carbonate Habitat Management Strategy (CHMS) in 2003. The CHMS is designed to provide long-term protection for the carbonate endemic plants and also provide for continued long-term mining. Portions of the carbonate habitats are protected from mining impacts in perpetuity within the carbonate habitat reserves dedicated and managed as described in the CHMS.

3.0 REGULATORY SETTING

Regulations that affect air quality consist primarily of those promulgated under federal and state clean air acts as discussed in Section 3.1. Other regulations that affect air quality include those related to federal conformity (Section 3.2), impacts on Class I and Class II Wilderness Areas (Section 3.3), impacts on health risk (Section 3.4), and greenhouse gases (Section 3.5).

3.1 Air Quality Regulatory Framework

The Federal Clean Air Act and the California Clean Air Act each contain comprehensive frameworks for air quality planning and regulation. Title 40 of the Code of Federal Regulations and Title 17 of the California Code of Regulations contain requirements that have been promulgated under authority granted to US EPA and California Air Resource Board (CARB) by the Acts.

Criteria air pollutants include sulfur oxides (SOx), nitrogen oxides (NOx), particulate matter (PM), carbon monoxide (CO), lead (Pb), and ground-level ozone (O_3). AAQS are developed by US EPA and CARB for each of the criteria pollutants. Primary AAQS are designed to protect human health, with an adequate margin of safety, including sensitive populations such as children, the elderly, and individuals suffering from respiratory disease. Secondary AAQS are designed to protect public welfare from any known or anticipated adverse effects of a pollutant (e.g. building facade degradation, reduced visibility, and damage to crops and domestic animals).

AAQS and related monitoring programs are among the many devices established by air quality regulations (40 CFR 50 - 51). Geographic areas called “attainment areas” are classified by US EPA and CARB based on whether the ambient air in the area meets the AAQSs. An “attainment area” is an area in which pollutant concentrations are less than or equal to the AAQS while “non-attainment areas” have pollution levels above the AAQS. State and federal AAQS are shown in Table 2.

In order to make progress towards attainment with the AAQS, each state and air district containing federal non-attainment areas is required to develop a written plan for improving air quality in those areas. These plans are called State Implementation Plans (SIP) and Attainment Plans. California’s SIP contains mobile source and consumer product emission control strategies proposed by CARB and a compilation of stationary and area source strategies that have been developed by local air districts under CARB supervision. Through these plans, the state and local air districts outline efforts that they will take to reduce air pollutant concentrations to levels below the standards. Federal and State attainment status designations assigned by US EPA and CARB for the Project area are summarized in Table 3.

California Ambient Air Quality Standards (CAAQS) are more stringent than the National Ambient Air Quality Standard (NAAQS). Existing law requires district plans for attaining CAAQS to assess the cost-effectiveness of available and proposed emission control measures. Proposed emission control measures in the Attainment Plans are typically developed into air district rules.

The MDAQMD assists CARB in preparing the State Implementation Plan by preparing Attainment Plans that demonstrate how the Ambient Air Quality Standards will be achieved. The Attainment Plans describe the rules that will be developed and other means by which the MDAQMD will manage the emissions within the jurisdiction. MDAQMD Attainment Plans are listed in Table 4.

Table 2: Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards [1]		National Standards [2]		
		Concentration [3]	Method [4]	Primary [3,5]	Secondary [3,6]	Method [7]
Ozone (O)	1 Hour	0.09 ppm (180 µg/m^3)	Ultraviolet Photometry	—	Same as Primary Standard	Ultraviolet Photometry
	8 Hour	0.070 ppm (137 µg/m^3)		0.075 ppm (147 µg/m^3)		
Respirable Particulate Matter (PM10)	24 Hour	50 µg/m^3	Gravimetric or Beta Attenuation	150 µg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 µg/m^3		—		
Fine Particulate Matter (PM2.5)	24 Hour	—	—	35 µg/m^3	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 µg/m^3	Gravimetric or Beta Attenuation	12 µg/m^3		
Carbon Monoxide (CO)	1 Hour	20 ppm (23 mg/m^3)	Non-Dispersive Infrared Photometry (NDIR)	35 ppm (40 mg/m^3)	—	Non-Dispersive Infrared Photometry (NDIR)
	8 Hour	9.0 ppm (10 mg/m^3)		9 ppm (10 mg/m^3)	—	
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m^3)		—	—	
Nitrogen Dioxide (NO_2)[8]	1 Hour	0.18 ppm (339 µg/m^3)	Gas Phase Chemiluminescence	100 ppb (188 µg/m^3)	—	Gas Phase Chemiluminescence
	Annual Arithmetic Mean	0.030 ppm (57 µg/m3)		0.053 ppm (100 µg/m^3)	Same as Primary Standard	
Sulfur Dioxide (SO_2)[9]	1 Hour	0.25 ppm (655 µg/m^3)	Ultraviolet Fluorescence	75 ppb (196 µg/m^3)	—	Ultraviolet Flourescence; Spectrophotometry (Pararosaniline Method)
	3 Hour	—		—	0.5 ppm (1300 µg/m^3)	
	24 Hour	0.04 ppm (105 µg/m^3)		0.14 ppm (for certain areas)[9]	—	
	Annual Arithmetic Mean	—		0.030 ppm (for certain areas)[9]	—	
Lead[10,11]	30 Day Average	1.5 µg/m^3	Atomic Absorption	—	—	High Volume Sampler and Atomic Absorption
	Calendar Quarter	—		1.5 µg/m^3 (for certain areas)[11]	Same as Primary Standard	
	Rolling 3-Month Average	—		0.15 µg/m^3		
Visibility Reducing Particles[12]	8 Hour	See footnote 12	Beta Attenuation and Transmittance through Filter Tape	**No National Standards**		
Sulfates	24 Hour	25 µg/m^3	Ion Chromatography			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 µg/m^3)	Ultraviolet Fluorescence			
Vinyl Chloride[10]	24 Hour	0.01 ppm (26 µg/m^3)	Gas Chromatography			

See footnotes here: http://www.arb.ca.gov/research/aaqs/aaqs2.pdf Last checked on June 24, 2013

Table 3: MDAQMD Attainment Status

Standard	MDAQMD Attainment Status
One-hour Ozone (Federal) – standard has been revoked, this is historical information only	Non-attainment; classified Severe-17 (portion of MDAQMD outside of Southeast Desert Modified Air Quality Management Area is unclassified/attainment)
Eight-hour Ozone (Federal 84 ppb)	Subpart 2 Non-attainment; classified Moderate (portion of MDAQMD outside of Western Mojave Desert Ozone Non- attainment Area is unclassified/attainment)
Eight-hour Ozone (Federal new standard, 75 ppb or lower)	Non-attainment; classified Severe-15
Ozone (State)	Non-attainment; classified Moderate
PM_{10} (Federal)	Non-attainment; classified Moderate (portion of MDAQMD in Riverside County is unclassified)
$PM_{2.5}$ (Federal)	Unclassified/attainment
$PM_{2.5}$ (State)	Non-attainment (portion of MDAQMD outside of Western Mojave Desert Ozone Non- attainment Area is unclassified/attainment)
PM_{10} (State)	Non-attainment
Carbon Monoxide (State and Federal)	Attainment
Nitrogen Dioxide (State and Federal)	Attainment/unclassified
Sulfur Dioxide (State and Federal)	Attainment/unclassified
Lead (State and Federal)	Attainment
Particulate Sulfate (State)	Attainment
Hydrogen Sulfide (State)	Unclassified (Searles Valley Planning Area is non-attainment)
Visibility Reducing Particles (State)	Unclassified

Source: MDAQMD CEQA Guidelines (August 2011).

Table 4: MDAQMD Attainment Plans

Name of Plan	Date of Adoption	Standard(s) Targeted	Applicable Area	Pollutant(s) Targeted	Attainment Date*
Federal 8-Hour Ozone Attainment Plan (Western Mojave Desert Non-attainment Area)	9-Jun-08	Federal eight hour ozone (84 ppb)	Western Mojave Desert Non-attainment Area (MDAQMD portion)	NO_X and VOC	2021
2004 Ozone Attainment Plan (State and Federal)	26-Apr-04	Federal one hour ozone	Entire District	NO_X and VOC	2007
Triennial Revision to the 1991 Air Quality Attainment Plan	22-Jan-96	State one hour ozone	Entire District	NO_X and VOC	2005
Mojave Desert Planning Area Federal Particulate Matter Attainment Plan	31-Jul-95	Federal daily and annual PM_{10}	Mojave Desert Planning Area	PM_{10}	2000
1991 Air Quality Attainment Plan	26-Aug-91	State one hour ozone	San Bernardino County portion	NOx and VOC	1994

* Note: A historical attainment date given in an attainment plan does not necessarily mean that the affected area has been re-designated to attainment.

The MDAQMD Attainment Plans contain the rules proposed for adoption. As this document was being prepared the MDAQMD Rule Development Calendar had last been updated on January 9, 2012 (Appendix E). Current MDAQMD rules that apply to Project sources include:

- **Rule 201 – Permits to Construct** applies to the construction of air emissions sources that are not otherwise exempt under Rule 219.
- **Rule 203 – Permit to Operate** requires air emissions sources that are not exempted by Rule 219 to obtain operating permit.
- **Rule 204 – Requirements** contains rule language describing New Source Review including Best Available Control Technology (BACT) and emissions offset requirements for stationary sources.
- **Rule 401 – Visible Emissions** limits visibility of fugitive dust to less than No. 1 on the Ringlemann Chart (i.e. 20% opacity).
- **Rule 402 – Nuisance** applies when complaints from the public are received by the District.
- **Rule 403 – Fugitive Dust** prohibits visible dust beyond the property line of the emission source, requires "every reasonable precaution" to minimize fugitive dust emissions and prevent trackout of materials onto public roadways, and prohibits greater than 100 $\mu g/m^3$ difference between upwind and downwind particulate concentrations.
- **Rule 403.2 – Fugitive Dust Control for the Mojave Desert Planning Area** contains the following requirements applicable to limestone processing facilities:
    a. Stabilize industrial unpaved roads carrying more than ten vehicle trips per day with the majority of those vehicles weighing 30 tons or more;
    b. Enclose exterior belt conveyors sufficiently to cover the top and sides of the bulk material being transferred, or employ an alternate dust suppression system sufficient to prevent visible fugitive dust.
    c. Manage or treat bulk material open storage piles sufficiently to prevent visible fugitive dust emissions. For purposes of this Rule, active watering during visible dusting episodes shall be sufficient to maintain compliance;
    d. Cover loaded bulk material haul vehicles while traveling upon publicly maintained paved surfaces;
    e. Employ a dust suppression system at bulk material transfer points sufficient to prevent visible fugitive dust;
    f. Stabilize or eliminate bulk material open storage piles that have been or are expected to be inactive for at least one year;
    g. Stabilize as much unpaved operations area as is feasible;
    h. Vacuum sweep bulk material spills on paved surfaces weekly or more often, as needed;
    i. Prevent facility-related bulk material trackout on publicly maintained paved surfaces;
    j. Clean up facility-related bulk material trackout and spills on publicly maintained roads within twenty-four hours; and
    k. Employ belt cleaners and/or conveyor return scrapers to minimize conveyor spillage.
- **Rule 404 – Particulate Matter Concentration** sets concentration limits based upon the flow rate

of the discharge. The concentration limits would apply to discharge from a stack (e.g. baghouse).

- **Rule 405 – Solid Particulate Matter Weight** limits emissions based upon the weight of material processed.
- **Rule 900 – New Source Performance Standards** incorporates Federal regulation (40 CFR 60) which affects the construction of emissions units. Requirements may or may not apply depending upon the size, construction and manufacture date of equipment that will be used. Specifically, NSPS OOO (40 CFR 60.670) applies to equipment in non-metallic mineral processing plants.
- **Regulation XIII – New Source Review** contains a number of rules that are applied to new and modified sources.
- **Rule 1520 – Control of Toxic Air Contaminants from Existing Sources** implements AB 2588 Air Toxics Hot Spots requirements.
- **Rule 2002 – General Federal Actions Conformity** requires federal actions to conform to the applicable implementation plan.

3.2 Conformity

A project is conforming if it complies with all applicable District rules and regulations, complies with all proposed control measures that are not yet adopted from the applicable plan(s), and is consistent with the growth forecasts in the applicable plan(s) (or is directly included in the applicable plan). A project is non-conforming if it conflicts with or delays implementation of any applicable attainment or maintenance plan. Conformity with growth forecasts can be established by demonstrating that the project is consistent with the land use plan that was used to generate the growth forecast. An example of a non-conforming project would be one that increases the gross number of dwelling units, increases the number of trips, and/or increases the overall vehicle miles traveled in an affected area (relative to the applicable land use plan).

Federal Conformity regulation (40CFR93) and MDAQMD Rule 2002 which mirrors the federal regulation were adopted in order to ensure that federal actions conform to the applicable implementation plan. Federal actions where the total of direct and indirect emissions in a nonattainment or maintenance area is less than specified rates would screen out of conformity analysis. As presented in Table 3, the western area of the MDAQMD where the Project is located is severe non-attainment for federal ozone, and moderate non-attainment for federal PM_{10}. On the basis of those attainment designations, the Project would screen-out of conformity analysis if:

- NOx and VOC emissions are less than 25 tons per year each;
- PM_{10} emissions are less than 100 tons per year; and
- Emissions are less than 10% of the non-attainment area emissions inventory.

3.3 Federal Land Managers' Air Quality Related Values

The Federal Land Manager (FLM) and the Federal official with direct responsibility for management of Federal Class I parks and wilderness areas (i.e., Park Superintendent, Refuge Manager, Forest Supervisor) have an affirmative responsibility to protect the Air Quality Related Values (AQRVs)

(including visibility) of such lands, and to consider whether a proposed project with emissions exceeding the "major" source thresholds will have an adverse impact on such values. The FLM's decision regarding whether there is an adverse impact is then conveyed to the permitting authority for consideration in its determinations regarding the permit. The permitting authority's determinations generally consider a wide range of factors, including the potential impact of the new source or major modification on the AQRVs of Class I areas, if applicable.

At the request of both State permitting agencies and permit applicants, the FLMs formed the Federal Land Managers' Air Quality Related Values Work Group (FLAG) to provide better consistency pertaining to their role in the review of new source permit applications near Federal Class I areas. The purpose of FLAG is twofold: (1) to develop a more consistent and objective approach for the FLMs to evaluate air pollution effects on public AQRVs in Class I areas, including a process to identify those resources and any potential adverse impacts, and (2) to provide state permitting authorities and potential permit applicants consistency on how to assess the impacts of new and existing sources on AQRVs in Class I areas.

The FLMs are also concerned about resources in Class II parks and wilderness areas because they have other mandates to protect those areas as well. The information and procedures outlined in the FLAG Report are generally applicable to evaluating the effect of new or modified sources on the AQRVs in both Class I and Class II areas, including the evaluation of effects as part of Environmental Assessments and/or Environmental Impact Statements under the National Environmental Policy Act (NEPA). However, FLAG does not preclude more refined or regional analyses being performed under NEPA or other programs.

The FLAG 2010 Phase I Report update recommends how to evaluate visibility, ozone phytotoxicity, and deposition impacts from new or modified sources. The FLAG Phase I Report recommends that an applicant apply the "Q/D test" for sources greater than 50 km from a Class I area to determine whether or not any further analysis is necessary. The Q/D test sums emissions of SO_2, NOx, PM_{10}, and H_2SO_4 (i.e. Q in tons per year) and then divides that total by the distance between the source and receptor (D in kilometers). Results equal to or less than 10 do not require further assessment (i.e. $Q/D \leq 10$).

3.4 Health Risk

Toxic air contaminants (TACs) are pollutants listed by the State of California that pose acute, chronic, and/or cancer health risks to exposed individuals. Hazardous air pollutants (HAP) are pollutants listed by US EPA that pose acute, chronic, and/or cancer health risks to exposed individuals.

The California Office of Environmental Health Hazard Assessment (OEHHA) is responsible for developing the scientific basis for listing and evaluation of health risk from TACs. CARB is responsible for quantifying TAC emissions and controlling TACs by promulgation and enforcement of air toxic control measures (ATCM). Assembly Bill 1807 (AB1807) passed in 1983 requires the state of California to identify and control TACs. TACs are formally identified through a detailed process which starts when a chemical's risk to human health and the environment is above certain criteria. Once TACs are identified, the emission sources, controls, technologies and costs are reviewed to determine if regulation is needed to reduce emissions. In 1993, AB 1807 was amended by passage of Assembly Bill 2728 (AB 2728) which requires the State to list the 189 federal HAPs in the TAC list.

In 1987, the AB 2588 air toxics "hot spots" program was established. This program requires subject

facilities to report their air toxics emissions, determine localized health risks, and notify nearby residents for whom risk may exceed the notification level.[1] The program was amended in 1992 to require facilities to reduce high risks (e.g. greater than 100 in 1 million cancer risk; or 10 hazard index) through the development of a risk management plan. The Hotspots Analysis and Reporting Program (HARP) is a software program that calculates TAC emission inventories and performs health risk assessments (HRA) for use in the AB 2588 Program.

The Off-Road Vehicle Regulation (13 CCR 2449) was adopted by the CARB in 2007 to reduce diesel particulate matter (PM) and oxides of nitrogen (NOx) emissions from in-use off-road heavy-duty diesel vehicles in California. The regulation was amended by the CARB in December 2010. Prior to that time, the regulation phased in from 2010 to 2020; but the December 2010 rulemaking pushed the start date back to 2014 and the date of final implementation back to 2024. In addition, until CARB receives a waiver from US EPA to regulate in-use off-road engines, the provisions that require further control are not enforceable. Registering fleets through the Diesel Off-road On-line Reporting System (DOORS), labeling equipment, idling limits and sale notification are requirements of the Off-Road Regulation that are still in effect. Regulatory Advisory 10-414 describes the enforcement delay and was last updated in May 2011.

The On-Road Heavy Duty Diesel Vehicle (In-Use) Regulation (13 CCR 2025) was adopted in December 2010. The regulation requires diesel trucks and buses that operate in California to be upgraded to reduce emissions. Heavier trucks must be retrofitted with PM filters beginning January 1, 2012, and older trucks must be replaced starting January 1, 2015. By January 1, 2023, nearly all trucks and buses will need to have 2010 model year engines or equivalent. The regulation applies to nearly all privately and federally owned diesel fueled trucks and buses and to privately and publicly owned school buses with a gross vehicle weight rating (GVWR) greater than 14,000 pounds.

Portable engines are regulated by an air toxic control measure (17 CCR 93116) that limits diesel particulate matter and may also be regulated by the Portable Equipment Registration Program (PERP) or local air district permit. In-use portable engines regulated by the ATCM begin phasing in controls to meet emissions reductions criteria on January 1 of 2013, 2017, and 2020. By 2020, in-use portable engines will have Tier 4 particulate emissions characteristics. The PERP program requires applications for new registrations are accepted only for engines that emit less than the interim Tier 4 standards.

3.5 Greenhouse Gas Regulations

On May 13, 2010 US EPA finalized the GHG Tailoring Rule (75 FR 31514, June 3, 2010). The Tailoring Rule sets major source emissions thresholds that define when federal operating permits under Prevention Significant Deterioration (PSD) or Title V are required. The Tailoring Rule establishes a threshold of 100,000 tpy of GHGs from new sources above which sources are considered major sources requiring a federal operating permit. Modification of an existing source that increases GHG emissions by an amount greater than 75,000 tpy is considered a major modification.

CARB approved the AB 32 Scoping Plan at the Board hearing on December 12, 2008. The Scoping Plan contains the main strategies that California will use to reduce GHGs as required by AB 32. On August 24, 2011, the CARB Board approved the Final Supplement to the AB 32 Scoping Plan Functionally Equivalent

[1] http://www.arb.ca.gov/ab2588/district_levels.htm

Document which accounted for progress already made towards reducing statewide GHG emissions and the effect of the severe and prolonged economic downturn that occurred after 2006.

Control measures contained in the Scoping Plan that may affect Project emissions include, but are not limited to:

- **Transportation Measures**. These measures propose to reduce GHG's from vehicles by making vehicles more efficient, reducing the carbon content of the fuels, and reducing the vehicle miles traveled. Thus, vehicles would emit less GHG emissions in the future.
    a. Light Duty Vehicle GHG Standard (T-1). This measure implements AB 1493 (Pavley) standards and planned second phase of the program. Align zero-emission vehicle, and alternative and renewable fuel and vehicle technology programs with long-term climate change goals.
    b. Low Carbon Fuel Standard (T-2). This measure will reduce the carbon intensity of California's transportation fuels by at least ten percent (10%) by 2020. CARB had previously identified this measure as a Discrete Early Action item which will be implemented through a rulemaking by 2010.
    c. Vehicle Efficiency Measures (T-4). This includes measures such as sustainable tire practices, properly inflating vehicle's tires, and possibly fuel-efficient tire standards.
- **Energy Measures**. These measures propose that utility operators replace some fossil fuel electricity generation capacity with renewable sources and reinforces incentives that are offered by local governments to encourage the placement of solar panels on new and existing structures. The Renewables Portfolio Standard (RPS) increases renewables from 12% in the baseline year(s) to 20% in 2020. The Renewable Electricity Standard (RES) is a separate measure that requires 33% renewables by 2020. The RES is implemented by the California Energy and Public Utilities Commissions under SBX1-2, signed by Governor Brown in April 2011.

Senate Bill 375 (SB 375) "Transportation planning: travel demand models: sustainable communities strategy: environmental review" was signed by the Governor on September 30, 2008. SB 375 is most concerned with automobile and light truck traffic, but the goal of reducing GHGs covers all transportation sources based on the need for sustainable communities.

> *"each transportation planning agency … shall prepare and adopt a regional transportation plan directed at achieving a coordinated and balanced regional transportation system, including, but not limited to, mass transportation, highway, railroad, maritime, bicycle, pedestrian, goods movement, and aviation facilities and services." (Section 65080(a), underline added.)*

The regional transportation plan is to be an internally consistent document and include a sustainable communities strategy (SCS).

> *"The sustainable communities strategy shall …(v) gather and consider the best practically available scientific information regarding resource areas and farmland in the region …." (Section 65080(b)(2)(B)(v), underline added.)*

Resource areas include: "areas of the state designated by the State Mining and Geology Board as areas of statewide or regional significance pursuant to Section 2790 of the Public Resources Code, and lands under Williamson Act contracts." (Section 65080.01(a)(4).)

Thus, SB 375 recognizes the limestone deposits as a regionally significant resource that requires special consideration in transportation and land use planning efforts.

County of San Bernardino Climate Action Plan (CAP, September 2011) may affect sources that would be considered part of the Project. The CAP assesses "GHG emissions in two distinct ways: (1) through the exercise of its land use authority it can affect community/external emissions; (2) through its management of County government and facilities it can affect municipal/internal emissions. The External Inventory includes GHG emissions from land uses within the County's unincorporated areas where the County has jurisdictional land use authority." (CAP, Page 2-1). The Project is a land use within the unincorporated County area.

The CAP Appendix F includes draft development review processes (DRP) that are presumably being implemented. The DRP procedures for evaluating GHG impacts and determining significance for CEQA purposes are streamlined by (1) applying a uniform set of performance standards to all development projects, and (2) utilizing Screening Tables to mitigate project GHG emissions. Projects have the option of preparing a project-specific technical analysis to quantify and mitigate GHG emissions. A review standard of 3,000 $MTCO_2e$ per year is used to identify projects that require the use of Screening Tables or a project-specific technical analysis to quantify and mitigate project emissions. The complete Development Review Process, including the use of performance standards, for assessing and mitigating GHG emissions is paraphrased from CAP Appendix F in the text below.

a) <u>County Performance Standards</u>*. All development projects, including those otherwise determined to be exempt from CEQA are subject to applicable Development Code provisions, including the GHG performance standards, and state requirements, such as the California Building Code requirements for energy efficiency. With the application of the GHG performance standards, projects that are exempt from CEQA and small projects that do not exceed 3,000 $MTCO_2e$ per year are considered to be consistent with the Plan and determined to have a less than significant individual and cumulative impact for GHG emissions.*

b) <u>Regulatory Agency Performance Standards</u>*. When, and if, South Coast Air Quality Management District or Mojave Basin Air Quality Management District adopts standards, the County will consider such guidance and incorporate all applicable standards.*

c) <u>Projects Using Screening Table</u>*. For projects exceeding 3,000 $MTCO_2e$ per year of GHG emissions, the County uses Screening Tables as a tool to assist with calculating GHG reduction measures and the determination of a significance finding. Projects that garner a 100 or greater points would not require quantification of project specific GHG emissions. The point system was devised to ensure to Project compliance with the reduction measures in the GHG Plan such that the GHG emissions from new development, when considered together with those existing development, allow the County to meet its 2020 target and support reductions in GHG emissions beyond 2020. Consistent with the CEQA Guidelines, such projects are consistent with the Plan and therefore have a less than significant individual and cumulative impact for GHG emissions.*

d) <u>Projects Not Using Screening Tables</u>. Projects exceeding 3,000 MTY of GHG emissions that do not use the Screening Tables, are required to quantify project-specific GHG emissions and achieve the equivalent level of GHG emissions efficiency as a 100-point project. Consistent with the CEQA Guidelines, such projects are consistent with the Plan and therefore are determined to have a less than significant individual and cumulative impact for GHG emissions.

With respect to Item b), an interim GHG significance threshold for projects where the SCAQMD is lead agency was adopted by that governing board December 5, 2008. Since the CAP was published in September 2011 it would appear that the 10,000 $MTCO_2e$ per year screening criteria used for SCAQMD projects would have informed the CAP and therefore would not be considered applicable under Item b).

However, Item b) is triggered by publication of the CEQA and Federal Conformity Guidelines (MDAQMD, August 2011). The MDAQMD Guidelines were being prepared at the same time as the CAP and therefore could not have been considered in the CAP. The CEQA and Federal Conformity Guidelines contain a GHG significance threshold of 100,000 tons CO_2e per year. Item b) states "the County will consider such guidance and incorporate all applicable standards." Clearly the MDAQMD standard is applicable since it is meant to be used for CEQA GHG impact analyses and therefore it should be incorporated.

The Project is not of a type that could use the screening tables to avoid further analysis under Item c). If such a project were to exceed the 3,000 $MTCO_2e$ per year review standard, then it would need to "achieve the equivalent level of GHG emissions efficiency as a 100-point project…. Where a project does not use the screening tables, the project is required to quantify its unmitigated emissions and provide a 31 percent reduction of those emissions in order to be considered less than significant." It appears that the CAP does not take into account the AB-32 Scoping Plan Functionally Equivalent Document (CARB, 2011) that reduces the amount of reductions needed to 16% below business as usual by 2020.

4.0 SIGNIFICANCE THRESHOLDS

Significance thresholds for evaluating potential air quality impacts associated with the Project were developed from Environmental Checklist Form (State CEQA Guidelines, Appendix G) and the MDAQMD Guidelines.

The CEQA Checklist contains the following guidance for air quality impacts assessment:

> *Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:*
>
> *a) Conflict with or obstruct implementation of the applicable air quality plan?*
> *b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?*
> *c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?*
> *d) Expose sensitive receptors to substantial pollutant concentrations?*
> *e) Create objectionable odors affecting a substantial number of people?*

MDAQMD Guidelines provide the following text which describes the significance criteria that have been established by that agency:

> *Any project is significant if it triggers or exceeds the most appropriate evaluation criteria. The*

District will clarify upon request which threshold is most appropriate for a given project; in general, the emissions comparison (criteria number 1) is sufficient:

1. *Generates total emissions (direct and indirect) in excess of the thresholds given in [Table 5];*
2. *Generates a violation of any ambient air quality standard when added to the local background;*
3. *Does not conform with the applicable attainment or maintenance plan(s);*
4. *Exposes sensitive receptors to substantial pollutant concentrations, including those resulting in a cancer risk greater than or equal to 10 in a million and/or a Hazard Index (HI) (non-cancerous) greater than or equal to 1.*

A significant project must incorporate mitigation sufficient to reduce its impact to a level that is not significant. A project that cannot be mitigated to a level that is not significant must incorporate all feasible mitigation. Note that the emission thresholds are given as a daily value and an annual value, so that multi-phased project (such as project with a construction phase and a separate operational phase) with phases shorter than one year can be compared to the daily value.

Table 5: Significant Emissions Thresholds

Criteria Pollutant	Annual Threshold (tons)
Greenhouse Gases (CO_2e)	100,000
Carbon Monoxide (CO)	100
Oxides of Nitrogen (NO_X)	25
Volatile Organic Compounds (VOC)	25
Oxides of Sulfur (SO_X)	25
Particulate Matter (PM_{10})	15
Particulate Matter ($PM_{2.5}$)	15
Hydrogen Sulfide (H_2S)	10
Lead (Pb)	0.6

Source: MDAQMD CEQA Guidelines (August 2011).

As discussed in Section 3.2, a project is non-conforming if it conflicts with or delays implementation of any applicable attainment or maintenance plan. A project is conforming if it complies with all applicable District rules and regulations, complies with all proposed control measures that are not yet adopted from the applicable plan(s), and is consistent with the growth forecasts in the applicable plan(s) (or is directly included in the applicable plan). These criteria are used to assess Project impact and address the Environmental Checklist Form Item a) above.

The MDAQMD significance threshold for GHGs (100,000 tons/yr), while higher than other screening criteria (i.e. SCAQMD 10,000 $MTCO_2e$/yr; San Bernardino County Climate Action Plan 3,000 $MTCO_2e$/yr), is applied because it is supported by substantial evidence and most directly applicable to the Project. Specifically, 100,000 tons/year of GHG emissions from a single facility constitutes a major source that

requires a federal operating permit. Similarly, the MDAQMD NOx significance threshold of 25 tons/year is equal to the major source threshold applicable to areas designated severe non-attainment for ozone.

MDAQMD states that, in general, emissions less than those listed in Table 5 will result in less than significant impact on air quality. Thus, regional impacts from a project that adds emissions to the air basin in quantities which are less than those listed in Table 5 would be less than cumulatively considerable. Consideration of thresholds in Table 5 addresses Items b) and c) from the Environmental Checklist Form.

Localized impacts from stationary sources are not addressed by the values in Table 5. The Project's modeled concentration of pollutants may not exceed the increment between the AAQS and background concentrations. For pollutants where background already exceeds the AAQS, Significant Impact Levels (SILs) published by SJVAPCD to the Dispersion and Risk Assessment Modelers Group list server (August 12, 2013) are used to evaluate the cumulative impact. Specifically, SJVAPCD guidance contains separate SILs for point and fugitive sources of PM_{10} and $PM_{2.5}$. SILs are normally used in the context of PSD permitting and represent a de minimis threshold in attainment areas.[2] For non-attainment areas any additional degradation would be significant and so this AQIA uses the SILs (i.e. de minimis level) as significance thresholds.

The increment and SIL methodologies address the Project impact as well as the cumulative impact on local concentrations satisfying Item b) and partially addressing Item d) in the Environmental Checklist Form. Health risk assessment is required to determine whether risk levels exceed the MDAQMD criteria (see Item 4 in the excerpt above) and address the remaining requirements of Item d) in the Environmental Checklist Form.

The Project does not emit objectionable odors and so no threshold has been chosen to address Item e) in the Environmental Checklist Form.

5.0 ASSESSMENT METHODOLOGY

Emissions were estimated using methods and parameters from the Mineral Industry Emissions Inventory Guidance (Appendix F), AP-42, EMFAC2011, OFFROAD2011, and CalEEMod. Air dispersion/deposition modeling and health risk assessment were then performed to determine the potential for the Project to result in significant localized impacts.

As discussed in Section 1.0, the Project is limited to expanding the White Knob and White Ridge Quarries areas but overall combined production from all quarries is limited by the processing plant maximum production rate. The Project would allow up to the maximum production rate to be extracted exclusively from the White Knob and White Ridge Quarries. This would result in no material being quarried at the Butterfield and Sentinel Quarries which is an indirect effect of the Project that necessitates calculation of Butterfield and Sentinel Quarries emissions in the baseline.

5.1 Baseline Activity Levels

Appendix F contains information that was provided by Omya. Table 6 presents baseline tonnages for

[2] http://www.epa.gov/NSR/fs20070912.html

the years 2004 through 2006 that were averaged in order to determine the annual baseline production and throughput. Daily and hourly ore fed to the primary crushers (i.e. Sentinel-Butterfied and White Knob) is based on the maximum throughput in each crusher system's permit to operate. Other daily and hourly throughputs are based upon ratio of annual tonnages (i.e. if 20% is waste annually, then 20% daily and hourly is assumed).

Table 6: Baseline Activity Levels

	2004	2005	2006	Baseline (tpy)	Baseline (tpd)	Baseline (tph)
Ore to Primary Crusher						
Sentinel-Butterfield	386,835	509,221	438,828	444,962	5,000	600
White Knob	309,168	311,999	350,895	324,021	4,000	400
Total	696,004	821,220	789,724	768,982	9,000	1,000
Ore Hauled to Plant						
Sentinel-Butterfield	328,810	432,838	373,004	378,217	4,250	510
White Knob	262,793	265,199	298,261	275,418	3,400	340
Total	591,603	698,037	671,265	653,635	7,650	850
Waste Total						
Sentinel-Butterfield	204,702	243,816	289,404	245,974	2,822	339
White Knob	151,860	281,698	130,590	188,049	2,258	226
Total	356,562	525,514	419,994	434,023	5,080	564
Waste Crusher Fines						
Sentinel-Butterfield	58,025	76,383	65,824	66,744	750	90
White Knob	46,375	46,800	52,634	48,603	600	60
Total	104,401	123,183	118,459	115,347	1,350	150
TOTAL EXCAVATED	948,165	1,223,551	1,091,259	1,087,658	12,730	1,414

Note: The Project baseline for White Knob Quarry is 275,418 tons per year as shown in this table. The indirect effect of the Project on the processing plant production is relative to the baseline year activity level for the processing plant of 653,635 tons per year shown in this table. The processing plant is physically limited to less than 680,000 tons per year which is the maximum that may be delivered from the Project and doing so would necessitate cessation of operation in the White Knob Quarry which is an indirect effect that is incorporated into this impact assessment.

5.1.1 Vehicles

Vehicle engine size, model year, and hours of operation are presented in Table 7. Some vehicles have no activity. This may be because the equipment was purchased after the baseline years or because the vehicle did not operate in the baseline. Other vehicles were active during the baseline years but have since been retired.

Table 7: Baseline Vehicle Activity

EQUIP #	DOORS #	Type	hp	Engine Year	2006 (hr)	2005 (hr)	2004 (hr)	Average (hr)	Avg. (hp-hr)
330600	3306	Bobcat	50	1983	184.0	109.0	110.0	134.3	6,717
330700	3307	Bobcat	50	1983	177.0	82.0	51.0	103.3	5,167
293301	retired	Bobcat	50	1987	0	0	0	0	0
299100	retired	Bobcat	50	2001	17.0	0	0	5.7	283
205300	retired	Crane	150	1977	0.0	55.0	46.0	33.7	5,050

EQUIP #	DOORS #	Type	hp	Engine Year	2006 (hr)	2005 (hr)	2004 (hr)	Average (hr)	Avg. (hp-hr)
333018	3418	Dozer	250	1977	31.0	14.0	23.0	22.7	5,667
333062	3462	Dozer	370	1990	30.0	66.0	218.0	104.7	38,727
333064	3464	Excavator	195	1995	278.0	342.0	261.0	293.7	57,265
825400	8254	Forklift	52	1992	129.0	73.0	129.0	110.3	5,737
826800	8268	Forklift	52	2000	1975.0	2279.0	2955.0	2403.0	124,956
826900	8269	Forklift	47	2001	3775.0	3294.0	3913.0	3660.7	172,051
827000	8270	Forklift	52	2003	4316.0	4138.0	4998.9	4484.3	233,184
827200	8272	Forklift	57	2004	2693.0	2192.0	1387.0	2090.7	119,168
208252	retired	Forklift	50	1986	0	124.0	91.0	71.7	3,583
213400	retired	Forklift	50	1989	78.0	55.0	105.0	79.3	3,967
825700	retired	Forklift	50	1990	0	0	126.0	42.0	2,100
825900	retired	Forklift	50	1992	0	0	0	0	0
826100	retired	Forklift	50	1993	0	15.0	244.0	86.3	4,317
826300	retired	Forklift	50	1994	348.0	351.0	650.0	449.7	22,483
826400	retired	Forklift	50	1994	564.0	242.0	207.0	337.7	16,883
826500	retired	Forklift	50	1996	1127.0	1337.0	1008.6	1157.5	57,877
826600	retired	Forklift	50	1997	1594.0	1010.0	225.6	943.2	47,160
826700	retired	Forklift	50	1998	1312.0	1683.0	1445.4	1480.1	74,007
6100 1102	retired	Generator	890	1992	499.0	470.0	1887.0	952.0	847,280
333410	3410	Grader	275	1987	537.0	725.0	575.0	612.3	168,392
330100	3301	Loader	375	1985	84.0	0.0	0	28.0	10,500
330200	3302	Loader	690	2004	998.0	870.0	554.0	807.3	557,060
298600	3303	Loader	235	1992	239.0	278.0	259.0	258.7	60,787
330500	3305	Loader	690	2004	796.0	715.0	612.0	707.7	488,290
330800	3308	Loader	690	1985	1535.0	834.0	639.0	1002.7	691,840
333046	3346	Loader	690	1995	1225.0	1450.0	1392.0	1355.7	935,410
333060	3360	Loader	690	1994	1107.0	1373.0	1300.0	1260.0	869,400
331200	retired	Loader	500	1985	0	7.0	1.0	2.7	1,333
207500	retired	Manlift	150	1999	87.0	0.0	0.0	29.0	4,350
299000	on-road	Dump Truck	300	1988	785.1	731.7	137.5	551.4	165,430
332102	on-road	Grease Truck	300	1969	25.0	27.0	31.7	27.9	8,370
332132	on-road	Lube Van	300	1987	199.0	330.0	320.0	283.0	84,900
332136	on-road	Fuel Truck	300	1973	82.0	108.0	65.0	85.0	25,500
293413	5134	Sweeper	150	1983	0.0	0.0	1.0	0.3	50
826000	retired	Sweeper	150	1992	0.0	6.0	67.0	24.3	3,650
827100	retired	Sweeper	150	2002	227.0	911.0	201.0	446.3	66,950
-	2202	Lube Truck	215	1985	0	0	0	0.0	0
-	2232	Lube Truck	322	1988	0	0	0	0.0	0

EQUIP #	DOORS #	Type	hp	Engine Year	2006 (hr)	2005 (hr)	2004 (hr)	Average (hr)	Avg. (hp-hr)
-	2237	Fuel Truck	370	1994	0	0	0	0.0	0
-	2271	Guzzler	322	2001	0	0	0	0.0	0
-	2290	Dump Truck	425	1989	0	0	0	0.0	0
-	5171	Sweeper	52	2003	0	0	0	0.0	0
330900	3209	Truck	1050	1991	1310.0	1220.0	1386.0	1305.3	1,370,600
333411	3211	Truck	635	2006	739.0	600.0	477.0	605.3	384,387
331600	3216	Truck	938	2000	0	0	0	0.0	0
333251	3251	Truck	1050	1982	2435.0	2472.0	2367.0	2424.7	2,545,900
333252	3252	Truck	1050	2002	2466.0	2914.0	2666.0	2682.0	2,816,100
333053	3253	Truck	635	2004	597.0	1123.0	471.0	730.3	463,762
333254	3254	Truck	1050	2004	2380.0	2837.0	2059.0	2425.3	2,546,600
333255	3255	Truck	1050	2004	2549.0	3281.0	2357.0	2729.0	2,865,450
333256	3256	Truck	1050	1997	2768.0	1715.0	1334.0	1939.0	2,035,950
333257	3257	Truck	760	2000	1143.0	629.0	510.8	760.9	578,309
333091	3291	Truck	635	1992	984.0	1186.0	904.0	1024.7	650,663
333098	3298	Truck	635	1990	638.0	1063.0	418.0	706.3	448,522

5.1.2 Crushing

Primary crushing systems are operated in the Sentinel and Butterfield Quarries area (electrified) and in the White Knob Quarry area (diesel generator, see Table 7). Table 8 presents baseline throughputs for each crushing system and the processing plant. Maximum daily and hourly rates are limited by MDAQMD permits to operate (Appendix G). It is assumed that the crushing systems and processing plant were operated at the maximum permitted daily and hourly rates during the baseline.

Table 8: Baseline Stationary Source Throughputs

Source	kW-hr / ton	Tons / Year	Tons / Day	Tons / Hour
Sentinel Crushing System	0.33	444,962	5,000	600
White Knob Crushing System	0.0	324,021	4,000	400
Processing Plant	40.0	653,635	7,650	850

Note: Daily and hourly rates for the crushing systems are based upon permit condition limitations. Processing plant daily and hourly rates assume the fraction of waste rock produced annually applies on a daily and hourly basis.

5.1.3 Roads

Dust entrained from paved roads occurs only off-site because on-site roads are unpaved. The average distance traveled from the processing plant to Omya's customers is 110 miles. However, 60% of the trips are estimated to travel west from the Mojave Desert Air Basin to the South Coast Air Basin; a distance of 47.4 miles. The average distance of off-site truck travel within the Mojave Desert Air Basin is 72.44 miles. The baseline production amount (653,635 tons/year) is assumed to be placed in 25 ton capacity trucks.

Dust entrained from unpaved roads occurs only on-site because off-site roads are paved. The amount of travel on each unpaved road segment presented in Table 9 is calculated based upon the average truck capacity of 75 tons and the tonnages moved on each road segment in the baseline. Figure 2 shows the location of each road segment.

Table 9: Baseline Activity on Roads

Road Segment	Length (ft)	VMT/yr	Annual	VMT/day	Daily	VMT/hr	Hourly
A - Butterfield Pit	3,360	1,618	1.2%	15	0.99%	1.8	1.1%
B - Waste Pile	775	963	0.72%	11	0.71%	1.3	0.8%
C - West Road	1,015	1,355	1.0%	16	1.1%	2.0	1.1%
D – Not Used	0	0	0.0%	0	0.00%	0	0.00%
E - Sentinel Pit	3,000	8,013	6.0%	93	6.0%	11	6.4%
F – Not Used	0	0	0.0%	0	0.00%	0	0.00%
G - Sentinel/Butterfield to Plant	38,000	72,587	54%	816	52%	98	56%
H - White Ridge to Plant	24,260	33,746	25%	417	27%	42	24%
I - Plant Feed	365	1,205	0.90%	14	0.91%	1.6	0.9%
J - White Knob Pit	3,725	8,719	6.5%	106	6.8%	11	6.1%
K - On-Road Trucks*	6,186	20,421	*	239	*	27	*
L - Crusher to White Ridge	2,300	5,384	4.0%	66	4.2%	6.6	3.8%
M - White Ridge Pit	1,300	0	0.0%	0	0.00%	0	0.00%
TOTAL*		154,011	100%	1,794	100%	201	100%

* Segment K is used for purposes of modeling only and is not included in the total length of roads on-site.

5.1.4 Mining Activities

Mining emissions consist mainly of dust emissions from various sources (e.g. blasting, bulldozing, wind, etc.) and other criteria pollutant emissions from explosives used in blasting (i.e. NOx and CO). Excavated tons from each quarry that were reported in 2008 (Appendix G) to the MDAQMD and were used in the baseline to create scale factors. Emissions from the 2008 report were then scaled to determine the baseline. The following changes to the 2008 report and assumptions were used in the process of calculating emissions for mining sources:

- Bulldozing reported for the White Knob Quarry was used to scale Sentinel Quarry bulldozing activity because the Sentinel Quarry reported unusually low bulldozing emissions in 2008 and the White Knob bulldozing was judged to be more reflective of typical conditions. The higher activity level is assessed in both the baseline and project scenarios so that the baseline is not inflated for this source.
- Vehicular exhaust and road dust emissions are calculated from scratch except for road dust in the processing plant area which is scaled based on the 2008 emissions.
- Surface areas used for calculation of windblown dust emissions are assigned a scale factor of 1.0 because the size of active areas does not change.

- Control efficiency assigned for chemical dust suppressants on windblown dust from roads was increased from 75% to 90% because the suppressants should be at least as effective as watering which is assigned 90% in the 2008 report.

5.2 Baseline Emissions

Emissions factors presented in Table 10 were calculated for each diesel engine using the methods described in Appendix H. On-road engines were quantified using offroad factors because there are few on-road vehicles and offroad methods result in greater emissions for the same model year engine (i.e. new on-road engines were controlled by regulation before offroad engines). Vehicles that retired before 2012 were excluded so that the emissions characteristics represent the fleet as it existed at the time the Notice of Preparation for the Project was published.

Table 10: Vehicle Emissions Factors

EQUIP #	DOORS #	Type	hp	Engine Year	HC EF (g/hp-hr)	NOx EF (g/hp-hr)	PM EF (g/hp-hr)	CO EF (g/hp-hr)	SO2 EF (g/hp-hr)	Load Factor
330600	3306	Bobcat	50	1983	2.39	7.13	0.81	8.23	0.00028	0.3685
330700	3307	Bobcat	50	1983	2.39	7.13	0.81	8.23	0.00028	0.3685
293301	Retired	Bobcat	50	1987	-	-	-	-	-	-
299100	Retired	Bobcat	50	2001	-	-	-	-	-	-
205300	Retired	Crane	150	1977	-	-	-	-	-	-
333018	Retired	Dozer	250	1977	-	-	-	-	-	-
333062	3462	Dozer	370	1990	0.67	8.95	0.43	12.78	0.00028	0.4288
333064	3464	Excavator	195	1995	0.71	9.28	0.46	3.38	0.00028	0.3819
825400	8254	Forklift	52	1992	1.11	10.39	0.93	6.32	0.00028	0.201
826800	8268	Forklift	52	2000	1.01	7.90	0.91	4.32	0.00028	0.201
826900	8269	Forklift	47	2001	2.15	6.07	0.79	4.25	0.00028	0.201
827000	8270	Forklift	52	2003	0.94	7.59	0.83	4.13	0.00028	0.201
827200	8272	Forklift	57	2004	0.48	5.95	0.45	4.06	0.00028	0.201
208252	Retired	Forklift	50	1986	-	-	-	-	-	-
213400	Retired	Forklift	50	1989	-	-	-	-	-	-
825700	Retired	Forklift	50	1990	-	-	-	-	-	-
825900	Retired	Forklift	50	1992	-	-	-	-	-	-
826100	Retired	Forklift	50	1993	-	-	-	-	-	-
826300	Retired	Forklift	50	1994	-	-	-	-	-	-
826400	Retired	Forklift	50	1994	-	-	-	-	-	-
826500	Retired	Forklift	50	1996	-	-	-	-	-	-
826600	Retired	Forklift	50	1997	-	-	-	-	-	-
826700	Retired	Forklift	50	1998	-	-	-	-	-	-
6100 1102	Retired*	Generator	890	1992	0.59	9.12	0.29	13.84	0.000028	0.525
333410	3410	Grader	275	1987	0.86	12.27	0.62	13.84	0.00028	0.4087
330100	3301	Loader	375	1985	0.86	12.27	0.62	14.18	0.00028	0.3618

EQUIP #	DOORS #	Type	hp	Engine Year	HC EF (g/hp-hr)	NOx EF (g/hp-hr)	PM EF (g/hp-hr)	CO EF (g/hp-hr)	SO2 EF (g/hp-hr)	Load Factor
330200	3302	Loader	690	2004	0.26	4.64	0.14	1.11	0.00028	0.3618
298600	3303	Loader	235	1992	0.76	9.71	0.51	5.53	0.00028	0.3618
330500	3305	Loader	690	2004	0.26	4.64	0.14	1.11	0.00028	0.3618
330800	3308	Loader	690	1985	0.86	12.27	0.62	14.18	0.00028	0.3618
333046	3346	Loader	690	1995	0.69	9.12	0.45	3.34	0.00028	0.3618
333060	Retired	Loader	690	1994	-	-	-	-	-	-
331200	Retired	Loader	500	1985	-	-	-	-	-	-
207500	Retired	Manlift	150	1999	-	-	-	-	-	-
299000	Retired	Dump Truck	300	1988	-	-	-	-	-	-
332102	Retired	Grease Truck	300	1969	-	-	-	-	-	-
332132	Retired	Lube Van	300	1987	-	-	-	-	-	-
332136	Retired	Fuel Truck	300	1973	-	-	-	-	-	-
293413	5134	Sweeper	150	1983	1.05	13.06	0.74	5.79	0.00028	0.4556
826000	Retired	Sweeper	150	1992	-	-	-	-	-	-
827100	Retired	Sweeper	150	2002	-	-	-	-	-	-
-	2202	Lube Truck	215	1985	0.99	13.06	0.74	5.67	0.00028	0.3417
-	2232	Lube Truck	322	1988	0.69	9.13	0.45	13.84	0.00028	0.3417
-	2237	Fuel Truck	370	1994	0.69	9.12	0.45	13.84	0.00028	0.3417
-	2271	Guzzler	322	2001	0.22	5.10	0.13	1.03	0.00028	0.3417
-	2290	Dump Truck	425	1989	0.69	9.13	0.45	13.84	0.00028	0.3417
-	5171	Sweeper	52	2003	0.93	7.54	0.82	4.10	0.00028	0.3417
330900	3209	Truck	1050	1991	0.59	9.12	0.29	13.84	0.00028	0.3819
333411	3211	Truck	635	2006	0.27	2.66	0.14	1.12	0.00028	0.3819
331600	3216	Truck	938	2000	0.33	7.11	0.20	3.34	0.00028	0.3819
333251	Retired	Truck	1050	1982	-	-	-	-	-	-
333252	3252	Truck	1050	2002	0.33	7.11	0.20	3.34	0.00028	0.3819
333053	3253	Truck	635	2004	0.29	4.73	0.14	1.14	0.00028	0.3819
333254	3254	Truck	1050	2004	0.33	7.11	0.20	3.34	0.00028	0.3819
333255	3255	Truck	1050	2004	0.33	7.11	0.20	3.34	0.00028	0.3819
333256	3256	Truck	1050	1997	0.59	9.29	0.32	13.84	0.00028	0.3819
333257	3257	Truck	760	2000	0.33	7.11	0.20	3.34	0.00028	0.3819
333091	Retired	Truck	635	1992	-	-	-	-	-	-
333098	Retired	Truck	635	1990	-	-	-	-	-	-

* White Knob Generator was replaced by a contractor-owned portable crushing system. The White Knob Generator emissions characteristics are retained for purposes of analysis. Classes of units that are retired (i.e. crane and manlift) are assumed to be replaced by contractor or rental equipment with equal emissions characteristics.

Emissions factors in Table 10 were combined with activity data in Table 6 to calculate baseline vehicular emissions that are presented in Table 11.

Table 11: Baseline Vehicle Emissions

Location	Type	Avg. (hp-hr)	HC (lb/yr)	NOx (lb/yr)	PM (lb/yr)	CO (lb/yr)	SOx (lb/yr)	CO_2 (tpy)
Pit	Dozer Total	44,393	28	376	18	536	0.012	26
Pit	Excavator Total	57,265	34	447	22	163	0.013	33
Pit	Loader Total	3,543,333	1,468	21,668	950	13,951	0.781	2,064
Plant	Bobcat Total	12,167	24	70	8	81	0.003	7
Plant	Crane Total	5,050	4	46	2	19	0.001	3
Plant	Forklift Total	887,473	447	2,981	308	1,816	0.109	517
Plant	Guzzler Total	0	-	-	-	-	-	-
Plant	Loader Total	71,287	46	625	32	561	0.016	42
Plant	Manlift Total	4,350	2	21	1	9	0.001	3
Plant	Sweeper Total	70,650	62	640	48	307	0.017	41
Roads	Dump Truck Total	165,430	87	1,137	56	1,725	0.034	96
Roads	Fuel Truck Total	25,500	13	175	9	266	0.005	15
Roads	Grader Total	168,392	130	1,862	95	2,101	0.042	98
Roads	Lube Truck Total	93,270	59	780	42	685	0.019	54
Roads	Truck Total	16,706,243	4,897	91,813	2,789	57,696	3.885	9,730
WKQ	Generator Total	847,280	575	8,940	285	13,576	0.271	493
	Grand Total	22,692,682	7,869	131,513	4,663	93,464	5.207	13,217

Note: WKQ = White Knob Quarry.

Table 12 presents the emissions summed by area. Quarry emissions are assumed to occur in locations where material is being excavated (quarries) and deposited (overburden areas). Plant emissions are assumed to occur at the processing plant. Road emissions are further allocated to specific roads based upon the vehicle miles traveled (VMT) presented in Table 9. Figure 2 shows the location of each road segment. VMT is calculated based upon the tons of material being transported and the capacity of haul trucks.

Table 12: Baseline Vehicle Emissions by Location

	Average (hp-hr)	HC (lb/yr)	NOx (lb/yr)	PM (lb/yr)	CO (lb/yr)	SOx (lb/yr)	CO_2 (tpy)
Quarry Subtotal	3,644,992	1,531	22,491	990	14,650	0.806	2,123
Plant Subtotal	1,041,576	578	4,316	396	2,765	0.144	607
Roads Subtotal	17,158,834	5,186	95,767	2,990	62,474	3.987	9,994
WKQ Generator	847,280	575	8,940	285	13,576	0.271	493
Total	22,692,682	7,869	131,513	4,663	93,464	5.207	13,217

Note: WKQ = White Knob Quarry.

The Roads Subtotal in Table 12 is combined with road dust emissions and offsite haul truck emissions in Table 13.

Table 13: Baseline Emissions on Roads

	On-site	Off-site	Total
VMT (miles/yr)	133,590	3,787,946	3,921,535
TSP – Dust (tpy)	248.44	69.74	318.18
PM_{10} – Dust (tpy)	70.65	13.95	84.60
$PM_{2.5}$ – Dust (tpy)	7.06	3.42	10.49
TSP – Exhaust (tpy)	1.50	2.95	4.44
PM_{10} – Exhaust (tpy)	1.50	2.95	4.44
$PM_{2.5}$ – Exhaust (tpy)	1.38	2.71	4.09
HC (tpy)	2.59	2.72	5.31
NOx (tpy)	47.88	51.33	99.21
CO (tpy)	31.24	12.32	43.6
SOx (tpy)	0.002	0.07	0.07
CO_2 (tpy)	9,994	7,067	17,061

Table 14 presents mining and processing dust emissions that were scaled up from the 2008 reporting and adjusted as described previously in this section. Table 15 presents combustion emissions.

Table 14: Baseline Mining and Processing Dust Emissions

Emission Source / Operation / Activity	Processing Plant (tons per year)			Butterfield and Sentinel Quarries (tons per year)			White Knob Quarry (tons per year)		
	TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	PM2.5	TSP	PM_{10}	$PM_{2.5}$
Drilling	-	-	-	0.31	0.25	0.25	0.23	0.19	0.19
Blasting	-	-	-	14.46	7.52	0.43	5.41	2.81	0.16
Explosives	-	-	-	-	-	-	-	-	-
Bulldozing, Scraping and Grading Of Material	0.185	0.090	0.028	28.27	13.75	4.20	20.99	10.21	3.12
Loading Quarry / Pad	0.0072	0.0035	0.0011	0.39	0.19	0.06	1.65	0.81	0.25
Primary Crushing	-	-	-	8.43	1.48	0.46	11.83	3.83	1.20
Ball Mill #1	1.68	0.106	0.033	-	-	-	-	-	-
Tertiary Crushing	34.7	2.25	0.69	-	-	-	-	-	-
Roller Mill #1	3.61	0.242	0.076	-	-	-	-	-	-
Roller Mill #2	2.66	0.167	0.052	-	-	-	-	-	-
Roller Mill #3	1.62	0.104	0.033	-	-	-	-	-	-
Roller Mill #4	1.60	0.104	0.033	-	-	-	-	-	-
Surface Treating Plant	0.011	0.0010	0.0003	-	-	-	-	-	-
Rock Storage System/Plan	19.5	5.47	1.71	-	-	-	-	-	-

Emission Source / Operation / Activity	Processing Plant (tons per year)			Butterfield and Sentinel Quarries (tons per year)			White Knob Quarry (tons per year)		
Optical Sorter	0.019	0.014	0.004	-	-	-	-	-	-
Coarse Product Storage System	0.48	0.080	0.025	-	-	-	-	-	-
Silo 81-70c	0.58	0.082	0.026	-	-	-	-	-	-
Bulk Loadout 82 System	0.16	0.025	0.008	-	-	-	-	-	-
Bulk Loadout 83 System	0.028	0.005	0.001	-	-	-	-	-	-
Stockpiles - Wind Erosion	1.06	0.53	0.21	0.67	0.34	0.13	0.18	0.09	0.04
Exhaust - Stationary and Portable Equipment	0.047	0.046	0.046	0.04	0.04	0.04	-	-	-
Exhaust - Mobile and Vehicular Equipment*	-	-	-	-	-	-	-	-	-
Paved Roads - Entrained Dust*	-	-	-	-	-	-	-	-	-
Unpaved Roads - Entrained Dust*	30.84	9.10	1.40	-	-	-	-	-	-
Wind Erosion From Unpaved Operational Areas and Roads	11.25	5.62	2.25	20.10	10.05	4.02	20.66	10.33	4.13
Total	110.03	24.04	6.62	72.66	33.61	9.59	60.96	28.27	9.08

Notes: In general, engine exhaust and road dust emissions are calculated elsewhere with exception of the following which were scaled from levels reported in 2008: road dust within the processing plant facility and portable engine exhaust from engines used to pump water. Windblown dust is not scaled because the active area that is disturbed daily is assumed to remain unchanged.

Table 15: Baseline Mining and Processing Combustion Emissions

Sources	CO (tpy)	NOx (tpy)	ROG (tpy)	SOx (tpy)
Sentinel Quarry Blasting & Water Pumps	4.2	1.6	0.042	0.037
White Knob Quarry Blasting *	3.71	0.94	0	0
Processing Plant Heaters	0.12	0.48	0.01	0.01
Total	8.03	3.02	0.052	0.047

* White Knob quarry generator emissions are quantified with the offroad vehicle emissions in Table 12.

5.3 Potential Future Emissions

The Project is limited to expanding the White Knob and White Ridge Quarries area but overall combined production from all quarries is limited by the processing plant maximum production rate. The Project would allow up to the maximum production rate to be extracted exclusively from the White Knob and White Ridge Quarries. This would result in no material being quarried at Butterfield and Sentinel Quarries which is an indirect effect of the Project that necessitates calculation of Butterfield and Sentinel Quarry emissions in the baseline. Moreover, vehicular activity data provided by Omya does not distinguish which units operate in each quarry. Thus, the emissions from vehicles are calculated for the fleet and apportioned to quarries based on throughput amount and to units operating on roads by VMT. Potential future activity levels are presented in Table 16.

Table 16: Activity Scaling Factors

Source	Baseline Value	Project Value	Scale Factor
Processing Plant (all associated sources except wind erosion)	653,635 tons/yr	680,000 tons/yr	1.04
Processing Plant wind erosion	14.88 acres	14.88 acres	1.00
Off-site Road Emissions	3,787,945 VMT/yr	3,940,736 VMT/yr	1.04
On-site Road Emissions	133,590 VMT/yr *	136,002 VMT/yr *	1.02
Emissions from Vehicles Working in Quarries (based on total tons excavated)	1,087,658 tons/yr	1,950,000 tons/yr	1.79
Crusher Engine	847,280 hp-hr/yr	2,143,755 hp-hr/yr	n/a

* Value calculated based upon tonnage moved, capacity of trucks, and road segments traveled. White Knob haul distance to processing plant is shorter than the haul from the Sentinel crusher. The amount of waste rock is greater in the Project than the Baseline. These characteristics offset each other to result in little change in VMT with the Project.

Project emissions are calculated in Appendix I and presented in the following tables.

Table 17: Project Vehicle Emissions by Location

	Average (hp-hr)	HC (lb/yr)	NOx (lb/yr)	PM (lb/yr)	CO (lb/yr)	SOx (lb/yr)	CO_2 (tpy)
Quarry Subtotal	6,534,896	2,744	40,322	1,776	26,265	1.44	3,806
Plant Subtotal	1,093,368	607	4,531	416	2,902	0.15	643
Roads Subtotal	17,468,707	5,279	97,496	3,044	63,602	4.06	10,174
Mobile Crusher	2,143,755	1,072	9,879	317	6,451	0.69	656
Total	27,240,727	9,702	152,228	5,554	99,220	6.34	15,278
Baseline*	22,692,682	7,869	131,513	4,663	93,464	5.21	13,222
Increment	**4,548,045**	**1,833**	**20,715**	**891**	**5,756**	**1.13**	**2,056**

* See also Table 12.

Table 18 presents potential future emissions on roads and the increment from baseline that would result from the Project.

Table 18: Project Emissions on Roads

	On-site	Off-site	Total	Baseline	Increment
VMT (miles/yr)	136,002	3,940,736	4,076,738	3,921,535	155,203
TSP – Dust (tpy)	252.93	72.55	325.48	318.18	7.30
PM_{10} – Dust (tpy)	71.92	14.51	86.43	84.60	1.84
$PM_{2.5}$ – Dust (tpy)	7.19	3.56	10.75	10.49	0.27
TSP – Exhaust (tpy)	1.51	3.07	4.57	4.44	0.13
PM_{10} – Exhaust (tpy)	1.51	3.07	4.57	4.44	0.13
$PM_{2.5}$ – Exhaust (tpy)	1.39	2.82	4.21	4.09	0.12
HC (tpy)	2.64	2.83	5.47	5.31	0.16
NOx (tpy)	48.75	53.40	102.14	99.21	2.93
CO (tpy)	31.80	12.81	44.62	43.55	1.06
SOx (tpy)	0.002	0.07	0.07	0.07	0.003
CO_2 (tpy)	10,174	7,339	17,514	17,061	453

Note: See also Table 13 and Table 17.

Table 19 presents Project emissions and incremental emissions from mining and processing activities. The Sentinel and Butterfield Quarries would have zero emissions because there would be no activity there if the Project maximum were to be quarried from the White Knob and White Ridge Quarries.

Table 19: Project On-Site Particulate Matter Emissions

Emission Source / Operation / Activity	Processing Plant (tons per year)			Butterfield and Sentinel Quarries (tons per year)			White Knob (tons per year)		
	TSP	PM10	PM2.5	TSP	PM10	PM2.5	TSP	PM10	PM2.5
Drilling	-	-	-	-	-	-	0.98	0.78	0.78
Blasting	-	-	-	-	-	-	22.76	11.83	0.68
Explosives	-	-	-	-	-	-	-	-	-
Bulldozing, Scraping And Grading Of Material	0.19	0.09	0.03	-	-	-	88.31	42.96	13.13
Loading Quarry / Pad	0.01	0.00	0.00	-	-	-	6.96	3.39	1.03
Primary Crushing	-	-	-	-	-	-	49.77	16.12	5.06
Ball Mill #1	1.75	0.11	0.03	-	-	-	-	-	-
Tertiary Crushing	36.05	2.34	0.72	-	-	-	-	-	-
Roller Mill #1	3.75	0.25	0.08	-	-	-	-	-	-
Roller Mill #2	2.77	0.17	0.05	-	-	-	-	-	-
Roller Mill #3	1.68	0.11	0.03	-	-	-	-	-	-
Roller Mill #4	1.67	0.11	0.03	-	-	-	-	-	-

Emission Source / Operation / Activity	Processing Plant (tons per year)			Butterfield and Sentinel Quarries (tons per year)			White Knob (tons per year)		
	TSP	PM10	PM2.5	TSP	PM10	PM2.5	TSP	PM10	PM2.5
Surface Treating Plant	0.01	0.00	0.00	-	-	-	-	-	-
Rock Storage System/Plan	20.33	5.69	1.78	-	-	-	-	-	-
Optical Sorter	0.02	0.01	0.00	-	-	-	-	-	-
Coarse Product Storage System	0.50	0.08	0.03	-	-	-	-	-	-
Silo 81-70c	0.60	0.09	0.03	-	-	-	-	-	-
Bulk Loadout 82 System	0.16	0.03	0.01	-	-	-	-	-	-
Bulk Loadout 83 System	0.03	0.00	0.00	-	-	-	-	-	-
Stockpiles - Wind Erosion	1.06	0.53	0.21	-	-	-	0.18	0.09	0.04
Exhaust - Stationary and Portable Equipment	0.05	0.05	0.05	-	-	-	-	-	-
Exhaust - Mobile and Vehicular Equipment*	-	-	-	-	-	-	-	-	-
Paved Roads - Entrained Dust	-	-	-	-	-	-	-	-	-
Unpaved Roads - Entrained Dust*	32.08	9.47	1.45	-	-	-	-	-	-
Wind Erosion From Unpaved Operational Areas and Roads	11.25	5.62	2.25	-	-	-	20.66	10.33	4.13
Project Total by Area	113.97	24.77	6.79	-	-	-	190	85.5	24.9
Baseline by Area	110.03	24.04	6.62	72.7	33.6	9.59	61.0	28.3	9.08
Increment by Area	3.94	0.72	0.17	-72.7	-33.6	-9.59	129	57.2	15.8
Increment Total	59.9	24.4	6.35						

Note: Elimination of windblown dust from White Knob Quarry accounts for beneficial effect on $PM_{2.5}$. See also Table 14.
* Unpaved roads outside the processing area are assessed separately.

Table 20 presents Project emissions and the Project increment from mining and processing activities.

Table 20: Project Mining and Processing Combustion Emissions

Sources	CO (tpy)	NOx (tpy)	ROG (tpy)	SOx (tpy)
Sentinel Quarry Blasting & Water Pumps	0	0	0	0
White Knob Quarry Blasting	15.6	3.96	0	0
Processing Plant Heaters	0.12	0.50	0.0054	0.13
Total	15.7	4.5	0.0054	0.13
Baseline	8.03	3.02	0.052	0.047
Increment	**7.7**	**1.5**	**-0.04**	**0.083**

Note: mobile crusher engine emissions are accounted for vehicle emissions presented in Table 17.

Table 21 summarizes the incremental change in emissions that would occur if the Project were to operate at the maximum rate of 680,000 tons per year production and 100% of the ore being mined from the White Knob and White Ridge Quarries.

Table 21: Incremental Change in Emissions

	Total Sentinel Butterfield (tons/yr)	Total White Knob (tons/yr)	Total Processing Plant (tons/yr)	Total Offsite (tons/yr)	Total Project w/o Sentinel-Butterfield Reductions (tons/yr)	Total Project w/ Sentinel-Butterfield Reductions (tons/yr)
HC	-2.08	2.99	0.01	0.11	3.11	1.03
NOx	-36.8	47.1	0.10	2.07	49.3	12.5
CO	-24.0	26.8	0.07	0.50	27.4	3.4
SOx	-0.0015	0.0021	0.0000	0.0027	0.0048	0.0033
TSP	-210	292	4.04	2.93	299	89
PM_{10}	-69.2	104.8	0.76	0.68	106.3	37.1
$PM_{2.5}$	-11.1	21.9	0.18	0.25	22.4	11.31
CO_2	-7,542	9,408	26.7	0.14	9,435	1,893

5.4 Dispersion Modeling

Dispersion modeling was performed utilizing flat terrain. Flat terrain is conservative for this Project because the receptors are generally located at lower elevations than the sources and the emissions points are close to the ground. In general, Project plumes will travel along the ground between sources and receptors, which is conservatively modeled as flat terrain (i.e. the actual distance between the source and receptor is greater with actual elevation changes than it is with flat terrain and utilization of flat terrain minimizes the amount of vertical mixing).

Meteorological data used in the modeling was purchased from Lakes Environmental which used the Pennsylvania State University / National Center for Atmospheric Research Mesoscale Model known as MM5 to predict the meteorological conditions near the Project for the five year period of 2008 through 2012. MM5 data was chosen in consultation with the MDAQMD on the basis that there is no representative station data available and the dataset would enable the AERMOD model to be used rather than the older ISCST model.

Several models with a consistent set of volume sources and varying list of receptors (i.e. discrete, boundary, and grid) were run. The discrete receptor model includes the receptors shown in Table 22 and Figure 4.

Table 22: Nearby Receptors

ID	UTM, Easting (meters)	UTM, Northing (meters)	Type – Location
1	493520	3801220	Horse Springs Campground
2	497885	3805925	Residence – 2 miles north of White Knob Quarry
3	500757	3805056	Residence – 1.75 miles northeast of White Knob Quarry
4	503805	3802145	Residence – 2.66 miles east of White Knob Quarry
5	504720	3804980	Residence – 0.25 miles northwest of processing plant
6	509570	3795820	Holcomb Valley Campground
7	498780	3797730	Big Pine Flat Campground

The boundary receptor run includes only receptors along a boundary around the quarry area (Figure 5). The boundary receptor run is used to estimate concentrations of PM_{10} and $PM_{2.5}$ at the point of maximum impact for comparison to primary ambient air quality standards (i.e. to protect human health). The boundary on the north was chosen to coincide with the east-west trending foothills. The boundaries on the south and west were chosen to reflect the concentration that may be experienced by an individual on the nearest roadway. The boundary on the east was chosen to exclude residences located in the foothills along Crystal Creek Road (i.e. since the residences are outside the project boundary, the boundary concentrations are closer to the sources and conservatively represent concentrations at the residences.

Grid receptor runs were used in the health risk assessment and the deposition model. The health risk assessment grid uses 200 meter spacing (Figure 6). The deposition model grid uses 500 meter spacing (Figure 7).

The deposition model is the only model run prepared for the Project that assumes the plume is depleted by deposition. The deposition model considers three sizes of particulates. TSP (i.e. PM_{30}), PM_{10}, and $PM_{2.5}$ are calculated for each source and the amount of each size varies based on the source accordingly. For instance, the dominant source of dust emissions is the roads which emit a combination of dust and diesel particulate matter. When dust and diesel PM emissions are combined the resulting fractionation for unpaved roadway particulates is 3.34% $PM_{2.5}$; 25.5% $PM_{10\text{-}2.5}$; and 71.2% $PM_{30\text{-}10}$. The combination of sources operating at the processing plant results in fractionation of 4.5% $PM_{2.5}$; 14.0% $PM_{10\text{-}2.5}$; and 81.5% $PM_{30\text{-}10}$. Other source fractionations were varied according to the calculated amounts of dust and diesel PM.

Table 23: Deposition Parameters

Particle Size Bin (µm)	Assumed Density (grams/cubic centimeter)
2.5	1.0
2.5 - 10 µm	1.75
10 - 30 µm	2.5

Source: http://www.arb.ca.gov/research/ltads/ltads-ws/4-dust.pdf.

The weight of particles presented in Table 23 is most appropriate for dust particles which constitute the majority of particulate matter emitted by project sources. Because the diesel particulates are emitted in smaller quantities, the dust densities are applied to all particulates regardless of their origin.

5.5 Health Risk Assessment

Constituents in diesel exhaust and dust emissions were speciated into toxic components using the following CARB Speciation Profiles:

- Particulate matter from unpaved roads (PM Profile #470);
- Particulate matter from paved roads (PM Profile #471);
- Particulate matter from aggregate processing (PM Profile #90013);
- Diesel particulate matter (PM Profile #6139 for the 2013 fleet); and
- Diesel total organic gases (Organic Profile #818).

The HRA calculations are performed using HARP. The AERMOD software air dispersion output data (χ/Q) is used as the input file for the HARP health risk assessment module. Before inputting the AERMOD output into HARP it was converted using the HARP ONRAMP software to a format that is compatible with HARP. Exposure to TACs by routes other than inhalation is included by the multi-pathway risk assessment. Exposure via home grown produce, dermal absorption, soil ingestion, and mother's milk are included. Deposition for the multipathway assessment is assumed to occur at a rate of 0.02 meters per second.

Cancer risk is assessed using a 70 year lifetime exposure, 63 kg body weight and the Derived (Adjusted) Method. The Derived (Adjusted) Method is similar to the Derived (OEHHA) Method which is described in the OEHHA HRA Guidelines (October 2003). The Derived (OEHHA) Method calculates cancer risk for two dominant (driving) exposure pathways using the high-end point-estimates of exposure, while the remaining exposure pathways use average point estimates. Specifically, the inhalation pathway which is a dominant pathway in the HRA would be based upon a Daily Breathing Rate of 373 liters of air per kilogram of body weight per day (L/kg BW *Day) under the Derived (OEHHA) Method.

The Derived (Adjusted) Method breathing rate is 80th percentile of exposure rather than the high-end point-estimate. The Derived (Adjusted) method is used when the inhalation pathway is determined to be a dominant exposure route in a multipathway assessment as described in the Recommended Interim Risk Management Policy for Inhalation-Based Residential Cancer Risk (CARB, October 9, 2003).

The dermal pathway risk would be calculated using 63 kg body weight, and average or high end values for soil loading (0.2 and 1.0 mg/cm^2-day), exposure frequency (121 and 350 days/yr), and surface area exposed (4,700 and 5,500 cm^2). Risk from soil ingestion is calculated using a point estimate of 1.7 mg/kg BW * Day. Ingestion via home grown produce accounts for average and high end of various produce including exposed, leafy, protected, and root which have varying consumption rates in units g/kg BW * Day. Breast milk consumption rates of 102 and 138 g/kg BW * Day are used for a period of one year.

6.0 PROJECT IMPACTS

The Project does not propose to construct any structures other than excavations and piles which are created from mining operations. Thus, only operation phase is assessed (Appendix I). Project emissions are compared to the mass-based thresholds from the MDAQMD CEQA Handbook in Table 24.

Table 24: Project Emissions Comparisons

Criteria Pollutant	Project Increment (tons/yr)	Significance Threshold (tons/yr)	Significant?
Greenhouse Gases (CO_2e)	1,893	100,000	No
Carbon Monoxide (CO)	3.4	100	No
Oxides of Nitrogen (NO_X)	12.5	25	No
Volatile Organic Compounds (VOC)	1.03	25	No
Oxides of Sulfur (SO_X)	0.003	25	No
Particulate Matter (PM_{10})	**37.1**	**15**	**Yes**
Particulate Matter ($PM_{2.5}$)	11.7	15	No
Hydrogen Sulfide (H_2S)	ND	10	ND
Lead (Pb)	0.06	0.6	No

Notes: ND = Not Determined. CO_2e emissions can be converted from tons to metric tonnes by multiplying by 90.7%. Comparison of Project emissions (i.e. 1,893 tons/yr * 0.907 = 1,717 $MTCO_2e$/yr) with the San Bernardino County Climate Action Plan "review standard" of 3,000 $MTCO_2e$/yr demonstrates that the Project is consistent with the Plan.

As shown in Table 24, the increment in emissions exceeds the mass-based thresholds for PM_{10}. Other pollutant emissions occur at or below levels that will significantly affect regional air quality.

6.1 Federal Conformity

As discussed in Section 3.1, federal conformity analysis is not required provided that:

- NOx and VOC emissions are less than 25 tons per year each;
- PM_{10} emissions are less than 100 tons per year; and
- Emissions are less than 10% of the non-attainment area emissions inventory.

As shown in Table 24, the Project emits 1.03 tons per year of VOC (i.e. ROG) and 12.5 tons per year of NOx which are each less than the 25 tons per year screening threshold. PM_{10} emissions are 37.1 tons per year which is less than the 100 ton per year federal conformity screening threshold.

In 2010, sources within San Bernardino portion of the Mojave Desert Air Basin (CARB 2009 Almanac) emitted NOx and PM_{10} in the amounts of 55,125 tons per year and 43,646 tons per year, respectively. The Project increment represents 0.023% of the NOx emissions and 0.085% of the PM_{10} emissions in the region. The standard is to evaluate the emissions inventory within the non-attainment area. However, those emissions were not readily available. The Project may represent a somewhat higher percentage of the total emissions within the Western Mojave Desert Ozone Non-Attainment Area and/or the "portion of MDAQMD outside of Southeast Desert Modified AQMA." However, is unlikely that the emissions would exceed 10% in any case.

6.2 Federal Land Managers' Air Quality Related Values

The Federal Land Managers' AQRVs apply to new or modified major sources and are generally used for PSD permitting under the Clean Air Act. The Project does not propose a new stationary major source or a modified stationary major source that would require a permit under the Clean Air Act. Fugitive area source emissions and vehicular emissions are excluded from determining whether the quarry is a major source. The Omya facility is not considered a major source as evidenced by the fact that it holds local district operating permits rather than a federal operating permit under Title V (i.e. 40 CFR Part 70). Thus, none of the sources operated by Omya are capable of producing effects that would trigger concerns with the AQRVs.

The incremental change in emissions from all of the sources combined would slightly exceed major source criteria but the effects are dispersed along roads and within pits. Thus, it is unlikely that the change in emissions will cause or contribute to effects addressed by the AQRVs. The FLAG report provides an equation (Quantity/Distance < 10; or Q/D < 10) by which projects can screen out of detailed analyses of AQRVs. Application of the equation is limited in the FLAG report to projects greater than 50 km from the Class I Wilderness Area. The Project is within 23 km of San Gorgonio but the Q/D test is applied here for disclosure purposes and to acknowledge the scale of emissions from the Project as compared to the screening threshold. Presumably sufficient buffer between the Project Q/D and the screening threshold would be evidence indicating less than significant effects on AQRVs regardless of the distance.

The Q/D test uses the sum of SO_2, NOx, PM_{10} and H_2SO_4 emissions. The Project emits 53.2 tons per year of these pollutants and the distance to San Gorgonio is 23 km. Thus, Q/D for the Project is 2.3 which is a quarter of the screening threshold. Given the fact that there is no single major source and that the emissions are distributed over a large area it seems reasonable to expect that the Project will result in less than significant impacts on AQRVs at Class I Wilderness Areas.

Moreover, monitoring performed in the San Gorgonio Wilderness Area indicates that nitrates, organic matter, and sulfates have the strongest contributions to degrading visibility on worst days (Appendix D). Concentrations of these pollutants result from regional sources and particularly emissions from South Coast Air Basin. The Project emits NOx, some of which may become nitrates but the relative amount as compared to the South Coast Air Basin is de minimis. The Project also emits particulate matter but the worst days are relatively unaffected by particulates. Thus, the Project is unlikely to emit pollutants in amounts that would affect visibility in the San Gorgonio and other nearby Class I Wilderness Areas. The Project impact on visibility and regional haze is considered to be less than significant.

Phytotoxic ozone concentrations may result where the plume from a large combustion source travels relatively intact a sufficient distance for the photo-chemical reaction between NOx and reactive organics to have occurred and produce ozone. The ozone would then be concentrated at a hot spot where vegetation could be affected. The Project sources of NOx are small and distributed over a large area. Therefore, it is unlikely that the Project would cause phytotoxic ozone concentrations and the Project impact for this AQRV is considered less than significant.

The deposition AQRV is concerned with the acidification of water bodies. Specifically, sulfur and nitrogen compounds cause sensitive freshwater lakes and streams to lose acid-neutralizing capacity and sensitive soils to become acidified. Other ecosystems, including the forest, may exhibit fertilization and other effects from excess nitrogen deposition. The Project sources of nitrogen and sulfur are small and distributed over a large area. Therefore, it is unlikely that the Project would cause acidification and the Project impact for this AQRV is considered less than significant.

6.3 Localized Criteria Pollutant Impacts

A project will have a "potentially significant impact" on air quality if it "violates any air quality standard or contributes substantially to an existing or projected air quality violation." Project emissions have the potential to create localized "hot spots" if, when summed with existing ambient concentrations, they result in concentrations greater than the applicable AAQS. The main criteria pollutants of concern for the Project are Total Suspended Particulates (used for deposition modeling), PM_{10}, and $PM_{2.5}$. Ambient air quality standards for pollutants that are less of a concern are discussed first followed by modeling results for the criteria pollutants of concern.

CO AAQS exceedence is generally a concern at high volume vehicular intersections in urban areas that operate at level of service (LOS) D or worse and where CO is emitted into partially or completely enclosed spaces such as parking structures and garages. CO modeling is not warranted for the Project and the impact on CO AAQS is considered less than significant.

SO_2 AAQS exceedences are normally a concern for facilities that burn coal or refine petroleum. Diesel fuel used by the Project will meet CARB specifications for sulfur content. SO_2 modeling is not warranted for the Project and the impact on SO_2 AAQS is considered less than significant.

NO_2 AAQS exceedences are normally a concern for facilities with a large combustion source. The quarrying and transportation of materials is performed by diesel engines which are a source of NO_2. However, the diesel vehicles are comparatively small emitters of NO_2 and they move in order to perform job tasks. Movement reduces the likelihood of a hot spot. NO_2 has annual and hourly AAQS.

On an annual basis, the Project NOx emissions are less than the CEQA Significance Threshold. Therefore, modeling to determine annual NO_2 concentration for comparison to the AAQS is not warranted.

On an hourly basis, the Project does not propose to change the equipment list. The potential for the Project to cause or contribute to an exceedence of the hourly NO_2 AAQS is unlikely given the size of the operational area (335.1 acres), distance from the quarries where activity is expected to be most intense to the boundary at which human health impacts are evaluated, and the limited potential increase in hourly activity at any one location on-site. Therefore, modeling hourly NO_2 concentrations is not warranted for the Project and the impact on NO_2 AAQS is considered less than significant.

Emissions of the criteria pollutants of concern for the Project (i.e. PM_{10}, $PM_{2.5}$) are modeled to predict concentrations at the off-site point of maximum impact (PMI). Table 25 shows impact assessment results for particulate matter air dispersion model that was prepared. AAQSs are applied when background is less than the AAQS and SILs are applied when background already exceeds the AAQS. Significant impact is when the project exceeds the AAQS. A cumulatively considerable impact occurs when the cumulative concentration exceeds the AAQS; or the project concentration exceeds the SIL in an area where the AAQS is exceeded by background concentrations.

Table 25: Increment in Concentration at Point of Maximum Impact

(all values in units µg/m^3)	PM_{10}-24hr	PM_{10}-Annual	$PM_{2.5}$-24hr	$PM_{2.5}$-Annual
5-Year Maximum Project Concentration	13.1	3.54	3.7	0.48
10-Year Maximum Background	93	25	30.6	10.6
Cumulative Concentration	106.1	28.5	34.3	11.1
Most Stringent AAQS / SIL	50 / 10.4	20 / 2.08	35 / 2.5	12 / 0.63
Exceeds AAQS?	**No**	**No**	**No**	**No**
Exceeds SIL?	**Yes**	**Yes**	**Yes**	**No**

Note: Annual average PMI occurs where the haul road crosses the project boundary (UTM 499604.71, 3803971.15) which is omitted from consideration in favor of the higher of the two adjacent boundary receptors (UTM 499559.62, 3803991.54). Daily PMI occurs on the southwest property boundary (UTM 4980909, 3801590).

Results of criteria pollutant modeling show that the Project would not exceed the AAQS but may increase pollutants concentrations above the SILs. The SILs represent the amount that is cumulatively considerable and are applied as the significance thresholds. An exception is the $PM_{2.5}$ annual SIL which is not exceeded by the Project. The exceedences are because of bulldozing and grading which is likely overestimated by the MDAQMD and US EPA AP-42 calculation methodology. Nevertheless, mitigations and alternatives are assessed in later sections that will reduce the impacts shown in Table 25.

Deposition of dust occurs onto plants surrounding the quarries and specifically areas called out for conservation in the Carbonate Plant Habitat Management Strategy. Deposition outside the operational areas of the quarries is generally between one and five grams per square meter per year (g/m^2-yr). Deposition is considered as an impact on Class II Wilderness Areas that surround the quarries (i.e. Class II areas are all areas in the National Forest that are not Class I).

6.4 Health Risk Impacts

TACs emitted from project operation consist mainly of those found in vehicle exhaust and, to a lesser extent, trace amounts of metals and silica found fugitive dust. Table 26 presents health risk predicted at nearby receptors. As shown in Table 26, health risk impacts from the Project are less than significant. Figure 10 through Figure 14 (Appendix A) contain contoured plots of health risk for the Project.

Table 26: Project Health Risk Impacts

Receptor ID	Cancer Risk *	Chronic Non-Cancer Risk (H.I.) *	Acute Non-Cancer Risk (H.I.)	Significant?
R1	0.54	0.05	0.09	No
R2	1.49	0.12	0.17	No
R3	3.08	0.17	0.24	No
R4	-0.47	0.02	0.05	No
R5	1.71	0.08	0.09	No
R6	-0.14	0.003	0.01	No
R7	0.54	0.05	0.11	No

* Excess cancer cases per million people exposed and hazard index (H.I.).

7.0 MITIGATED IMPACTS

The Project would result in significant PM_{10} emissions, and particulate matter concentrations except annual $PM_{2.5}$ concentration. The following mitigations are recommended to reduce impacts to less than significant levels or the maximum extent feasible:

Mitigation Measure AQ-1: Unpaved roads shall be controlled by at least 80%.

Mitigation Measure AQ-2: Areas to be graded and where bulldozer operates shall be treated with water as necessary to control dust emissions by 85%.

Table 27 presents the mitigated increment in emissions (Appendix J) and compares the increment to significance thresholds. As shown in Table 27, Mitigation Measures AQ-1 through AQ-4 reduce Project emissions to less than the MDAQMD significance thresholds.

Table 27: Mitigated Emissions Comparisons

Criteria Pollutant	Mitigated Increment (tons/yr)	Significance Threshold (tons/yr)	Significant?
Greenhouse Gases (CO_2e)	1,893	100,000	No
Carbon Monoxide (CO)	3.4	100	No
Oxides of Nitrogen (NOx)	12.5	25	No
Volatile Organic Compounds (VOC)	1.03	25	No
Oxides of Sulfur (SOx)	0.003	25	No
Particulate Matter (PM_{10})	-3.9	15	No
Particulate Matter ($PM_{2.5}$)	1.7	15	No
Hydrogen Sulfide (H_2S)	ND	10	ND
Lead (Pb)	0.06	0.6	No

Notes: ND = Not Determined. CO_2e emissions can be converted from tons to metric tonnes by multiplying by 90.7%. Comparison of Project emissions (i.e. 1,893 tons/yr * 0.907 = 1,717 $MTCO_2e$/yr) with the San Bernardino County Climate Action Plan "review standard" of 3,000 $MTCO_2e$/yr demonstrates that the Project is consistent with the Plan.

No additional mitigation is needed if localized cumulative impacts are to be reduced to less than significant levels as shown in Table 28.

Table 28: Mitigated Concentration at Point of Maximum Impact

(all values in units µg/m3)	PM_{10}-24hr	PM_{10}-Annual	$PM_{2.5}$-24hr	$PM_{2.5}$-Annual
5-Year Maximum Project Concentration	7.7	1.72	2.14	0.31
10-Year Maximum Background	93	25	30.6	10.6
Cumulative Concentration	100.7	26.7	32.7	10.9
Most Stringent AAQS / SIL	50 / 10.4	20 / 2.08	35 / 2.5	12 / 0.63
Exceeds AAQS?	**No**	**No**	**No**	**No**
Exceeds SIL?	**No**	**No**	**No**	**No**

Note: Annual average PMI occurs where the haul road crosses the project boundary (UTM 499604.71, 3803971.15) which is omitted from consideration in favor of the higher of the two adjacent boundary receptors (UTM 499559.62, 3803991.54). Daily PMI occurs on the southwest property boundary (UTM 4980909, 3801590).

8.0 ALTERNATIVES

Reasonable alternatives were developed that respond to the significant issues, reduce potential environmental impacts and address the purpose of and need for action and Project objectives. Alternatives that did not meet the purpose of and need for action, did not resolve environmental conflicts and/or were not available or feasible were eliminated from detailed consideration

The County identified the following two alternatives for detailed analysis in this DEIR/EIS, each of which is summarized below, followed by the detailed analysis.

8.1 Alternative 1: No Action/Mining under Current Entitlements

Under this alternative, Omya would not expand the White Knob and White Ridge Quarries. The existing permitted mining activities located on approximately 145 acres within the area controlled by Omya would continue in accordance with the approved POO and Reclamation Plans and other Federal, State and local regulations.

Cancer risk which would be less than for the Project due to the shortened life of the resource and exposure duration. Existing entitlements would allow the project maximum of 680,000 tons to be produced from the White Knob and White Ridge Quarries exclusively. Aside from the slightly reduced cancer risk, the air quality impacts of the No Action alternative are the same as the Project alternative.

8.2 Alternative 2: Combined Production with the Sentinel and Butterfield Quarries

Historically the limestone ore provided to the Lucerne Valley Processing Plant has been approximately a 60/40 ratio between the Butterfield and Sentinel Quarries and the White Knob Quarry. This alternative would assume that instead of the White Knob and White Ridge Quarries providing 100% (680,000 tpy) of the ore to the processing plant, a range of more realistic production mixes between the quarries would be evaluated.

This alternative would be more likely than the proposed Project and would result in less difference from the existing setting. The haul distance to the processing plant from the Sentinel and Butterfield Quarries is greater than from the White Knob and White Ridge Quarries. On the other hand, the amount of overburden to be removed at White Knob and White Ridge Quarries is greater by 500,000 tons per year than the amount that would need to be removed from the Sentinel and Butterfield Quarries for an equivalent amount of ore. Regardless, the impacts calculated for the Project are greater than those that would be calculated for this alternative.

9.0 REFERENCES

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Appendix B: Health Effects of Air Pollutants

Appendix C: Ambient Pollutant Concentrations

Appendix D: San Gorgonio Wilderness Area Description

Appendix E: MDAQMD Rule Development Calendar

Appendix F: MDAQMD Mineral Industry Emissions Inventory Guidelines

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Appendix K: Modeling Files on Electronic Media

APPENDIX D
BIOLOGICAL RESOURCES

U.S. Fish and Wildlife Service

Natural Resources of Concern

This resource list is to be used for planning purposes only — it is not an official species list.

Endangered Species Act species list information for your project is available online and listed below for the following FWS Field Offices:

CARLSBAD FISH AND WILDLIFE OFFICE
6010 HIDDEN VALLEY ROAD, SUITE 101
CARLSBAD, CA 92011
(760) 431-9440
http://www.fws.gov/carlsbad/

VENTURA FISH AND WILDLIFE OFFICE
2493 PORTOLA ROAD, SUITE B
VENTURA, CA 93003
(805) 644-1766

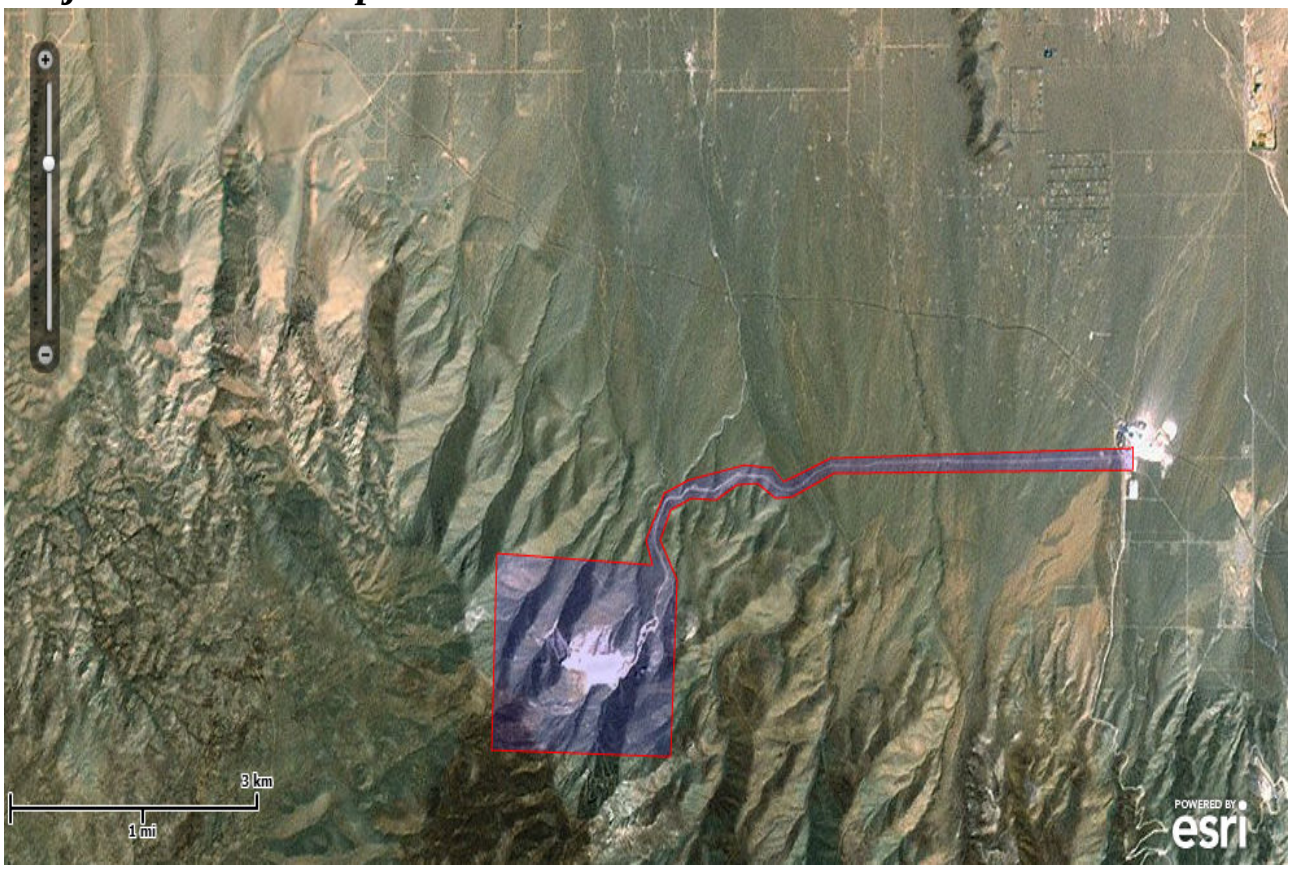
Project Name:

OMYA White Knob Mine

U.S. Fish and Wildlife Service

Natural Resources of Concern

Project Location Map:



Project Counties:

San Bernardino, CA

Geographic coordinates (Open Geospatial Consortium Well-Known Text, NAD83):

MULTIPOLYGON (((-116.943255 34.3824195, -116.943255 34.3804361, -116.9827372 34.3801528, -116.9882303 34.3781693, -116.9904619 34.3780276, -116.9928652 34.3793027, -116.9956118 34.379161, -116.9983583 34.3778859, -117.0016199 34.3780276, -117.0043751 34.3770359, -117.0057398 34.3744856, -117.0035168 34.3710851, -117.0043665 34.3560648, -117.0280643 34.3566316, -117.0273777 34.3733521, -117.0067783 34.3723603, -117.0076281 34.3744856, -117.0052334 34.3784527, -117.0019718 34.3795861, -116.9945904 34.3808611, -116.9908138 34.3805778, -116.9894405 34.3794444, -116.9875523 34.3800111, -116.9832607 34.3814278, -116.9434353 34.3822778, -116.943255 34.3824195)))

U.S. Fish and Wildlife Service

Natural Resources of Concern

Project Type:

Mining

Endangered Species Act Species List (USFWS Endangered Species Program).

There are a total of **10** threatened, endangered, or candidate species, and/or designated critical habitat on your species list. Species on this list are the species that may be affected by your project and could include species that exist in another geographic area. For example, certain fishes may appear on the species list because a project could cause downstream effects on the species. Please contact the designated FWS office if you have questions.

Species that may be affected by your project: (View all critical habitat on one map)

Amphibians	Status	Species Profile		Contact
arroyo toad (*Anaxyrus californicus*) Population: Entire	Endangered	species info		Carlsbad Fish And Wildlife Office
California red-legged frog (*Rana draytonii*) Population: Entire	Threatened	species info		Ventura Fish And Wildlife Office
Birds				
Least Bell's vireo (*Vireo bellii pusillus*) Population: Entire	Endangered	species info		Ventura Fish And Wildlife Office
Southwestern Willow flycatcher (*Empidonax traillii extimus*) Population: Entire	Endangered	species info		Ventura Fish And Wildlife Office, Carlsbad Fish And Wildlife Office
Flowering Plants				

Natural Resources of Concern

Bear Valley sandwort (*Arenaria ursina*)	Threatened	species info		Carlsbad Fish And Wildlife Office
Cushenbury buckwheat (*Eriogonum ovalifolium var. vineum*)	Endangered	species info		Ventura Fish And Wildlife Office, Carlsbad Fish And Wildlife Office
Cushenbury oxytheca (*Oxytheca parishii var. goodmaniana*)	Endangered	species info	Final designated critical habitat	Ventura Fish And Wildlife Office, Carlsbad Fish And Wildlife Office
Parish's daisy (*Erigeron parishii*)	Threatened	species info		Ventura Fish And Wildlife Office, Carlsbad Fish And Wildlife Office
Southern Mountain wild-buckwheat (*Eriogonum kennedyi var. austromontanum*)	Threatened	species info		Carlsbad Fish And Wildlife Office
Reptiles				

Natural Resources of Concern

Desert tortoise (*Gopherus agassizii*) Population: U.S.A., except in Sonoran Desert	Threatened	species info		Ventura Fish And Wildlife Office

FWS National Wildlife Refuges (USFWS National Wildlife Refuges Program).

There are no refuges found within the vicinity of your project.

FWS Migratory Birds (USFWS Migratory Bird Program).

Most species of birds, including eagles and other raptors, are protected under the Migratory Bird Treaty Act (16 U.S.C. 703). Bald eagles and golden eagles receive additional protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668). The Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.).

NWI Wetlands (USFWS National Wetlands Inventory).

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information on the extent and status of wetlands in the U.S., via the National Wetlands Inventory Program (NWI). In addition to impacts to wetlands within your immediate project area, wetlands outside of your project area may need to be considered in any evaluation of project impacts, due to the hydrologic nature of wetlands (for example, project activities may affect local hydrology within, and outside of, your immediate project area). It may be helpful to refer to the USFWS National Wetland Inventory website. The designated FWS office can also assist you. Impacts to wetlands and other aquatic habitats from your project may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal Statutes. Project Proponents should discuss the relationship of these requirements to their project with the Regulatory Program of the appropriate U.S. Army Corps of Engineers District.

1mi					
Occurrence Count	**Scientific Name**	**Common Name**	**Federal Listing**	**State Listing**	**Rare Plant Rank**
3	Acanthoscyphus parishii var. goodmaniana	Cushenbury oxytheca	Endangered	None	1B.1
2	Astragalus lentiginosus var. sierrae	Big Bear Valley milk-vetch	None	None	1B.2
2	Boechera dispar	pinyon rockcress	None	None	2.3
3	Boechera shockleyi	Shockley's rockcress	None	None	2.2
2	Chaetodipus fallax pallidus	pallid San Diego pocket mouse	None	None	
1	Charina umbratica	southern rubber boa	None	Threatened	
1	Dudleya abramsii ssp. affinis	San Bernardino Mountains dudleya	None	None	1B.2
1	Erigeron parishii	Parish's daisy	Threatened	None	1B.1
3	Eriogonum ovalifolium var. vineum	Cushenbury buckwheat	Endangered	None	1B.1
1	Falco mexicanus	prairie falcon	None	None	
1	Heuchera parishii	Parish's alumroot	None	None	1B.3
1	Phlox dolichantha	Big Bear Valley phlox	None	None	1B.2
1	Saltugilia latimeri	Latimer's woodland-gilia	None	None	1B.2

5mi					
Occurrence Count	**Scientific Name**	**Common Name**	**Federal Listing**	**State Listing**	**Rare Plant Rank**
13	Acanthoscyphus parishii var. goodmaniana	Cushenbury oxytheca	Endangered	None	1B.1
1	Accipiter cooperii	Cooper's hawk	None	None	
2	Aquila chrysaetos	golden eagle	None	None	
7	Astragalus albens	Cushenbury milk-vetch	Endangered	None	1B.1
1	Astragalus bernardinus	San Bernardino milk-vetch	None	None	1B.2
12	Astragalus lentiginosus var. sierrae	Big Bear Valley milk-vetch	None	None	1B.2
10	Astragalus leucolobus	Big Bear Valley woollypod	None	None	1B.2
1	Astragalus tidestromii	Tidestrom's milk-vetch	None	None	2.2
4	Athene cunicularia	burrowing owl	None	None	

1	Atriplex parishii	Parish's brittlescale	None	None	1B.1
1	Berberis fremontii	Fremont barberry	None	None	3
3	Boechera dispar	pinyon rockcress	None	None	2.3
1	Boechera lincolnensis	Lincoln rockcress	None	None	2.3
9	Boechera parishii	Parish's rockcress	None	None	1B.2
19	Boechera shockleyi	Shockley's rockcress	None	None	2.2
4	Calochortus palmeri var. palmeri	Palmer's mariposa-lily	None	None	1B.2
2	Calochortus striatus	alkali mariposa-lily	None	None	1B.2
1	Canbya candida	white pygmy-poppy	None	None	4.2
1	Castilleja cinerea	ash-gray paintbrush	Threatened	None	1B.2
2	Castilleja lasiorhyncha	San Bernardino Mountains owl's-clover	None	None	1B.2
3	Chaetodipus fallax pallidus	pallid San Diego pocket mouse	None	None	
2	Charina umbratica	southern rubber boa	None	Threatened	
1	Corynorhinus townsendii	Townsend's big-eared bat	None	None	
2	Cymopterus multinervatus	purple-nerve cymopterus	None	None	2.2
1	Drymocallis cuneifolia var. cuneifolia	wedgeleaf woodbeauty	None	None	1B.1
1	Dryopteris filix-mas	male fern	None	None	2.3
12	Dudleya abramsii ssp. affinis	San Bernardino Mountains dudleya	None	None	1B.2
1	Elymus salina	Salina Pass wild-rye	None	None	2.3
1	Ensatina klauberi	large-blotched salamander	None	None	
3	Eremogone ursina	Big Bear Valley sandwort	Threatened	None	1B.2
10	Erigeron parishii	Parish's daisy	Threatened	None	1B.1
2	Eriogonum kennedyi var. austromontanum	southern mountain buckwheat	Threatened	None	1B.2
1	Eriogonum microthecum var. johnstonii	Johnston's buckwheat	None	None	1B.3

17	Eriogonum ovalifolium var. vineum	Cushenbury buckwheat	Endangered	None	1B.1
2	Falco mexicanus	prairie falcon	None	None	
7	Heuchera parishii	Parish's alumroot	None	None	1B.3
1	Hydroporus simplex	simple hydroporus diving beetle	None	None	
1	Icteria virens	yellow-breasted chat	None	None	
3	Ivesia argyrocoma var. argyrocoma	silver-haired ivesia	None	None	1B.2
1	Lampropeltis zonata (parvirubra)	California mountain kingsnake (San Bernardino population)	None	None	
1	Lasionycteris noctivagans	silver-haired bat	None	None	
2	Lilium parryi	lemon lily	None	None	1B.2
1	Mimulus exiguus	San Bernardino Mountains monkeyflower	None	None	1B.2
1	Mimulus purpureus	little purple monkeyflower	None	None	1B.2
1	Myotis evotis	long-eared myotis	None	None	
1	Myotis volans	long-legged myotis	None	None	
1	Navarretia peninsularis	Baja navarretia	None	None	1B.2
7	Packera bernardina	San Bernardino ragwort	None	None	1B.2
1	Pebble Plains	Pebble Plains	None	None	
1	Perideridia parishii ssp. parishii	Parish's yampah	None	None	2.2
6	Phlox dolichantha	Big Bear Valley phlox	None	None	1B.2
1	Piranga rubra	summer tanager	None	None	
1	Plagiobothrys parishii	Parish's popcornflower	None	None	1B.1
1	Psychomastax deserticola	desert monkey grasshopper	None	None	
1	Saltugilia latimeri	Latimer's woodland-gilia	None	None	1B.2
1	Sidalcea hickmanii ssp. parishii	Parish's checkerbloom	None	Rare	1B.2
1	Sidalcea neomexicana	Salt Spring checkerbloom	None	None	2.2
1	Streptanthus bernardinus	Laguna Mountains jewel-flower	None	None	4.3

1	Symphyotrichum defoliatum	San Bernardino aster	None	None	1B.2
1	Taraxacum californicum	California dandelion	Endangered	None	1B.1
1	Thamnophis hammondii	two-striped garter snake	None	None	
8	Toxostoma lecontei	Le Conte's thrasher	None	None	
2	Xerospermophilus mohavensis	Mohave ground squirrel	None	Threatened	

10mi					
Occurrence Count	**Scientific Name**	**Common Name**	**Federal Listing**	**State Listing**	**Rare Plant Rank**
25	Acanthoscyphus parishii var. goodmaniana	Cushenbury oxytheca	Endangered	None	1B.1
1	Accipiter cooperii	Cooper's hawk	None	None	
3	Anaxyrus californicus	arroyo toad	Endangered	None	
13	Aquila chrysaetos	golden eagle	None	None	
18	Astragalus albens	Cushenbury milk-vetch	Endangered	None	1B.1
6	Astragalus bernardinus	San Bernardino milk-vetch	None	None	1B.2
21	Astragalus lentiginosus var. sierrae	Big Bear Valley milk-vetch	None	None	1B.2
38	Astragalus leucolobus	Big Bear Valley woollypod	None	None	1B.2
2	Astragalus tidestromii	Tidestrom's milk-vetch	None	None	2.2
4	Athene cunicularia	burrowing owl	None	None	
1	Atriplex parishii	Parish's brittlescale	None	None	1B.1
1	Berberis fremontii	Fremont barberry	None	None	3
7	Boechera dispar	pinyon rockcress	None	None	2.3
1	Boechera lincolnensis	Lincoln rockcress	None	None	2.3
25	Boechera parishii	Parish's rockcress	None	None	1B.2
29	Boechera shockleyi	Shockley's rockcress	None	None	2.2
1	Botrychium crenulatum	scalloped moonwort	None	None	2.2
21	Calochortus palmeri var. palmeri	Palmer's mariposa-lily	None	None	1B.2
4	Calochortus striatus	alkali mariposa-lily	None	None	1B.2

2	Calyptridium pygmaeum	pygmy pussypaws	None	None	1B.2
1	Canbya candida	white pygmy-poppy	None	None	4.2
26	Castilleja cinerea	ash-gray paintbrush	Threatened	None	1B.2
29	Castilleja lasiorhyncha	San Bernardino Mountains owl's-clover	None	None	1B.2
4	Chaetodipus fallax pallidus	pallid San Diego pocket mouse	None	None	
1	Charina trivirgata	rosy boa	None	None	
33	Charina umbratica	southern rubber boa	None	Threatened	
1	Claytonia lanceolata var. peirsonii	Peirson's spring beauty	None	None	3.1
2	Corynorhinus townsendii	Townsend's big-eared bat	None	None	
3	Cymopterus multinervatus	purple-nerve cymopterus	None	None	2.2
3	Drymocallis cuneifolia var. cuneifolia	wedgeleaf woodbeauty	None	None	1B.1
1	Dryopteris filix-mas	male fern	None	None	2.3
32	Dudleya abramsii ssp. affinis	San Bernardino Mountains dudleya	None	None	1B.2
1	Elymus salina	Salina Pass wild-rye	None	None	2.3
1	Empidonax traillii extimus	southwestern willow flycatcher	Endangered	Endangered	
2	Ensatina klauberi	large-blotched salamander	None	None	
21	Eremogone ursina	Big Bear Valley sandwort	Threatened	None	1B.2
19	Erigeron parishii	Parish's daisy	Threatened	None	1B.1
4	Eriogonum evanidum	vanishing wild buckwheat	None	None	1B.1
20	Eriogonum kennedyi var. austromontanum	southern mountain buckwheat	Threatened	None	1B.2
2	Eriogonum microthecum var. johnstonii	Johnston's buckwheat	None	None	1B.3
1	Eriogonum microthecum var. lacus-ursi	Bear Lake buckwheat	None	None	1B.1
26	Eriogonum ovalifolium var. vineum	Cushenbury buckwheat	Endangered	None	1B.1
1	Euchloe hyantis andrewsi	Andrew's marble butterfly	None	None	

1	Eumops perotis californicus	western mastiff bat	None	None	
3	Falco mexicanus	prairie falcon	None	None	
1	Gila orcuttii	arroyo chub	None	None	
1	Gilia leptantha ssp. leptantha	San Bernardino gilia	None	None	1B.3
3	Glaucomys sabrinus californicus	San Bernardino flying squirrel	None	None	
3	Gopherus agassizii	desert tortoise	Threatened	Threatened	
2	Haliaeetus leucocephalus	bald eagle	Delisted	Endangered	
15	Heuchera parishii	Parish's alumroot	None	None	1B.3
1	Hydroporus simplex	simple hydroporus diving beetle	None	None	
1	Icteria virens	yellow-breasted chat	None	None	
22	Ivesia argyrocoma var. argyrocoma	silver-haired ivesia	None	None	1B.2
1	Lampropeltis zonata (parvirubra)	California mountain kingsnake (San Bernardino population)	None	None	
1	Lasionycteris noctivagans	silver-haired bat	None	None	
9	Lewisia brachycalyx	short-sepaled lewisia	None	None	2.2
30	Lilium parryi	lemon lily	None	None	1B.2
6	Linanthus killipii	Baldwin Lake linanthus	None	None	1B.2
15	Mimulus exiguus	San Bernardino Mountains monkeyflower	None	None	1B.2
19	Mimulus purpureus	little purple monkeyflower	None	None	1B.2
2	Myotis evotis	long-eared myotis	None	None	
1	Myotis thysanodes	fringed myotis	None	None	
1	Myotis volans	long-legged myotis	None	None	
1	Myotis yumanensis	Yuma myotis	None	None	
13	Navarretia peninsularis	Baja navarretia	None	None	1B.2
7	Neotamias speciosus speciosus	lodgepole chipmunk	None	None	
25	Packera bernardina	San Bernardino ragwort	None	None	1B.2

18	Pebble Plains	Pebble Plains	None	None	
20	Perideridia parishii ssp. parishii	Parish's yampah	None	None	2.2
1	Phacelia parishii	Parish's phacelia	None	None	1B.1
24	Phlox dolichantha	Big Bear Valley phlox	None	None	1B.2
3	Phrynosoma blainvillii	coast horned lizard	None	None	
4	Physaria kingii ssp. bernardina	San Bernardino Mountains bladderpod	Endangered	None	1B.1
1	Piranga rubra	summer tanager	None	None	
1	Plagiobothrys parishii	Parish's popcornflower	None	None	1B.1
10	Poa atropurpurea	San Bernardino blue grass	Endangered	None	1B.2
1	Poliomintha incana	frosted mint	None	None	1A
1	Polygala intermontana	intermountain milkwort	None	None	2.3
2	Psychomastax deserticola	desert monkey grasshopper	None	None	
1	Puccinellia parishii	Parish's alkali grass	None	None	1B.1
13	Pyrrocoma uniflora var. gossypina	Bear Valley pyrrocoma	None	None	1B.2
6	Rana muscosa	Sierra Madre yellow-legged frog	Endangered	Candidate Endangered	
3	Saltugilia latimeri	Latimer's woodland-gilia	None	None	1B.2
1	Sidalcea hickmanii ssp. parishii	Parish's checkerbloom	None	Rare	1B.2
3	Sidalcea malviflora ssp. dolosa	Bear Valley checkerbloom	None	None	1B.2
1	Sidalcea neomexicana	Salt Spring checkerbloom	None	None	2.2
18	Sidalcea pedata	bird-foot checkerbloom	Endangered	Endangered	1B.1
1	Siphateles bicolor mohavensis	Mohave tui chub	Endangered	Endangered	
6	Streptanthus bernardinus	Laguna Mountains jewel-flower	None	None	4.3
4	Streptanthus campestris	southern jewel-flower	None	None	1B.3
2	Symphyotrichum defoliatum	San Bernardino aster	None	None	1B.2
18	Taraxacum californicum	California dandelion	Endangered	None	1B.1
1	Thamnophis hammondii	two-striped garter snake	None	None	
7	Thelypodium stenopetalum	slender-petaled thelypodium	Endangered	Endangered	1B.1

19	Toxostoma lecontei	Le Conte's thrasher	None	None	
3	Xerospermophilus mohavensis	Mohave ground squirrel	None	Threatened	

Scientific Name	Common Name	Rare Plant Rank	CESA	FESA	Elevation High (meters)	Elevation Low (meters)
Abronia nana var. covillei	Coville's dwarf abronia	4.2	None	None	3100	1524
Acanthoscyphus parishii var. goodmaniana	Cushenbury oxytheca	1B.1	None	FE	2377	1219
Acanthoscyphus parishii var. parishii	Parish's oxytheca	4.2	None	None	2600	1220
Allium parishii	Parish's onion	4.3	None	None	1465	900
Androsace elongata ssp. acuta	California androsace	4.2	None	None	1200	150
Astragalus albens	Cushenbury milk-vetch	1B.1	None	FE	2000	1095
Astragalus bicristatus	crested milk-vetch	4.3	None	None	2745	1700
Astragalus lentiginosus var. sierrae	Big Bear Valley milk-vetch	1B.2	None	None	2600	1800
Astragalus leucolobus	Big Bear Valley woollypod	1B.2	None	None	2885	1750
Boechera dispar	pinyon rockcress	2B.3	None	None	2540	1200
Boechera parishii	Parish's rockcress	1B.2	None	None	2990	1770
Boechera shockleyi	Shockley's rockcress	2B.2	None	None	2310	875
Calochortus palmeri var. palmeri	Palmer's mariposa lily	1B.2	None	None	2390	1000
Calochortus plummerae	Plummer's mariposa lily	4.2	None	None	1700	100
Calochortus striatus	alkali mariposa lily	1B.2	None	None	1595	70
Canbya candida	white pygmy-poppy	4.2	None	None	1460	600
Castilleja cinerea	ash-gray paintbrush	1B.2	None	FT	2960	1800
Castilleja lasiorhyncha	San Bernardino Mountains owl's-clover	1B.2	None	None	2390	1300
Castilleja montigena	Heckard's paintbrush	4.3	None	None	2800	1950
Castilleja plagiotoma	Mojave paintbrush	4.3	None	None	2500	300
Claytonia lanceolata var. peirsonii	Peirson's spring beauty	3.1	None	None	2745	2135
Cymopterus multinervatus	purple-nerve cymopterus	2B.2	None	None	1800	790
Drymocallis cuneifolia var. cuneifolia	wedgeleaf woodbeauty	1B.1	None	None	2215	1800
Dryopteris filix-mas	male fern	2B.3	None	None	3100	2400
Dudleya abramsii ssp. affinis	San Bernardino Mountains dudleya	1B.2	None	None	2600	1250
Elymus salina	Salina Pass wild-rye	2B.3	None	None	2135	1350
Eremogone ursina	Big Bear Valley sandwort	1B.2	None	FT	2900	1800
Erigeron parishii	Parish's daisy	1B.1	None	FT	2000	800
Eriogonum evanidum	vanishing wild buckwheat	1B.1	None	None	2225	1100
Eriogonum kennedyi var. austromontanum	southern mountain buckwheat	1B.2	None	FT	2890	1770
Eriogonum microthecum var. johnstonii	Johnston's buckwheat	1B.3	None	None	2926	1829
Eriogonum ovalifolium var. vineum	Cushenbury buckwheat	1B.1	None	FE	2440	1400

Scientific Name	Common Name	Rare Plant Rank	CESA	FESA	Elevation High (meters)	Elevation Low (meters)
Eriogonum umbellatum var. minus	alpine sulfur-flowered buckwheat	4.3	None	None	3068	1800
Frasera neglecta	pine green-gentian	4.3	None	None	2500	1400
Frasera neglecta	pine green-gentian	4.3	None	None	2500	1400
Heuchera parishii	Parish's alumroot	1B.3	None	None	3800	1500
Hulsea vestita ssp. parryi	Parry's sunflower	4.3	None	None	2895	1370
Ivesia argyrocoma var. argyrocoma	silver-haired ivesia	1B.2	None	None	2960	1463
Lewisia brachycalyx	short-sepaled lewisia	2B.2	None	None	2300	1370
Lilium parryi	lemon lily	1B.2	None	None	2745	1220
Mimulus exiguus	San Bernardino Mountains monkeyflower	1B.2	None	None	2315	1800
Mimulus johnstonii	Johnston's monkeyflower	4.3	None	None	2920	975
Mimulus mohavensis	Mojave monkeyflower	1B.2	None	None	1200	600
Mimulus purpureus	little purple monkeyflower	1B.2	None	None	2300	1900
Myosurus minimus ssp. apus	little mousetail	3.1	None	None	640	20
Navarretia peninsularis	Baja navarretia	1B.2	None	None	2300	1500
Packera bernardina	San Bernardino ragwort	1B.2	None	None	2300	1800
Packera ionophylla	Tehachapi ragwort	4.3	None	None	2700	1500
Perideridia parishii ssp. parishii	Parish's yampah	2B.2	None	None	3000	1465
Phacelia exilis	Transverse Range phacelia	4.3	None	None	2700	1100
Phacelia mohavensis	Mojave phacelia	4.3	None	None	2500	1400
Phacelia parishii	Parish's phacelia	1B.1	None	None	1200	540
Phlox dolichantha	Big Bear Valley phlox	1B.2	None	None	2970	1830
Physaria kingii ssp. bernardina	San Bernardino Mountains bladderpod	1B.1	None	FE	2700	1850
Pickeringia montana var. tomentosa	woolly chaparral-pea	4.3	None	None	1700	0
Plagiobothrys parishii	Parish's popcorn-flower	1B.1	None	None	1400	750
Poa atropurpurea	San Bernardino blue grass	1B.2	None	FE	2455	1360
Puccinellia parishii	Parish's alkali grass	1B.1	None	None	1000	700
Pyrrocoma uniflora var. gossypina	Bear Valley pyrrocoma	1B.2	None	None	2300	1600
Rupertia rigida	Parish's rupertia	4.3	None	None	2500	700
Saltugilia latimeri	Latimer's woodland-gilia	1B.2	None	None	1900	400
Sedum niveum	Davidson's stonecrop	4.2	None	None	3000	2075
Sidalcea hickmanii ssp. parishii	Parish's checkerbloom	1B.2	CR	None	2499	1000
Sidalcea malviflora ssp. dolosa	Bear Valley checkerbloom	1B.2	None	None	2685	1495

Scientific Name	Common Name	Rare Plant Rank	CESA	FESA	Elevation High (meters)	Elevation Low (meters)
Sidalcea neomexicana	salt spring checkerbloom	2B.2	None	None	1530	15
Sidalcea pedata	bird-foot checkerbloom	1B.1	CE	FE	2500	1600
Streptanthus bernardinus	Laguna Mountains jewel-flower	4.3	None	None	2500	670
Streptanthus campestris	southern jewel-flower	1B.3	None	None	2300	900
Syntrichopappus lemmonii	Lemmon's syntrichopappus	4.3	None	None	1830	500
Taraxacum californicum	California dandelion	1B.1	None	FE	2800	1620
Thelypodium stenopetalum	slender-petaled thelypodium	1B.1	CE	FE	2500	1600

Jurisdictional Delineation of Wetlands/Waters Subject to Regulatory Authority
White Knob - White Ridge Quarry
Lucerne Valley, California

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APPENDICES

Appendix A Wetland Determination Data Form

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1.0 INTRODUCTION

Tetra Tech, Inc. was contracted by Omya, CA to conduct a jurisdictional wetland/ waters of the U.S. and waters of the State delineation for unnamed drainages associated with a 302-acre survey area associated with the White Knob quarry in Lucerne Valley, San Bernardino County, California (Figure 1). The survey area includes areas currently being quarried and portions of the site that are undisturbed but are part of a proposed quarry expansion. The project site includes the existing mine features and all areas around the mine that would be affected by the proposed expansion, including for areas used for staging or access. The purpose of the delineation was to determine the limits of waters subject to regulatory authority under Section 404 and 401 of the Clean Water Act and those regulated under California Department of Fish and Wildlife Code 1600 et seq. for any potential waters subject to state regulatory authority found within areas that are part of the proposed quarry expansion.

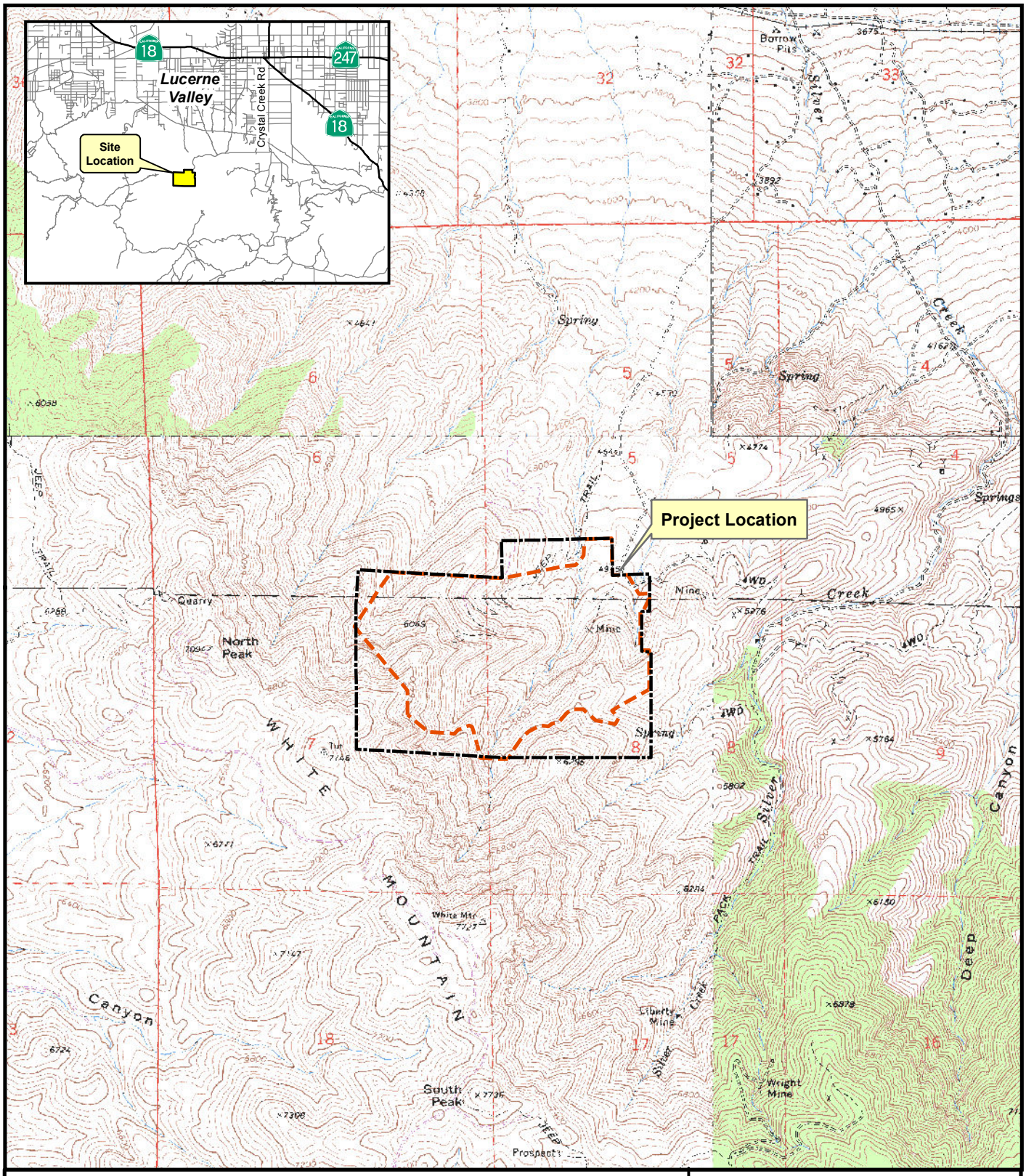
2.0 PROJECT LOCATION

The survey area, located in Lucerne Valley, California, in San Bernardino County, is an active limestone quarry. The area surveyed for jurisdictional waters is located in Sections 5, 6, 7 and 8, T3N, R1W, San Bernardino Baseline and Meridian (SBBM) of the Butler Peak 7.5-minute quadrangle (United States Geologic Survey 1988). The project site is located approximately 20 miles southeast of Victorville, California and eight air miles north of Big Bear, California. The quarry is located on the north-facing slopes of the San Bernardino Mountains and the topographic gradient at the site and regionally is from the south to the north. The area is surrounded by open undeveloped native habitat.

3.0 ENVIRONMENTAL SETTING

Plant communities within the portions of the quarry not being mined are characteristically chaparral communities of evergreen, drought-resistant sclerophyllous shrubs. The topography at the site is steep and drainages are deeply incised. Soils are undeveloped and sandy in texture with a lithic (bedrock) contact typically at a shallow depth. The survey was conducted during the fall of 2013, at a time of the year when evidence of annual herbaceous plants would unlikely be observed. Despite the timing of the survey, evidence of annual plants in the form of dried leaves and flowers were still present at within the survey area. The area in which the proposed project site is located is characterized by steep, dry ephemeral washes that generally contain water only during storm events. The climate at the site is arid, consisting of hot, dry summers and cool winters.

P:\GIS\White Knob_White Ridge\Fig 1 White Knob Topo .mxd



LEGEND

- Limits of Planned Disturbance
- Proposed White Knob - White Ridge Quarry Boundary

0 0.25 0.5 Miles

USGS 7.5' topographic quadrangle, Bulter Peak, CA. 1988

WHITE KNOB - WHITE RIDGE

Figure 1

Site Location Map

TETRA TECH

4.0 REGULATORY SETTING

4.1 FEDERAL REGULATORY SETTING

The U.S. Army Corps of Engineers (ACOE) regulates discharges of dredged or fill material into waters of the United States. These waters, or waters of the U.S., include wetlands and non-wetland bodies of water that meet specific criteria. U.S. Army Corps of Engineers regulatory jurisdiction pursuant to Section 404 of the Clean Water Act is founded on a connection or nexus between the water body in question and interstate commerce. This connection may be direct; through a tributary system linking a stream channel with traditional navigable waters used in interstate or foreign commerce, or may be indirect, through a nexus identified in the Corps regulations. The following definition of waters of the U.S. is taken from the discussion provided in 33 CFR 328.3.

"The terms waters of the U.S. means:

- All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
- All interstate waters including interstate wetlands;
- All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes or natural ponds, the use; degradation or destruction of which could affect interstate or foreign commerce including any such waters 1) which are or could be used by interstate or foreign travelers for recreational or other purposes; 2) from which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or 3) which are used or could be used for industrial purpose by industries in interstate commerce;
- All impoundments of waters otherwise defined as waters of the United States under the definition; and
- Tributaries of waters defined in earlier under the definition of waters found in this section."

Wetlands are a subset of special aquatic sites that support water-dependent vegetation, have wet soils, and possess wetland hydrology (frequent or prolonged flooding). Wetlands support a diverse assemblage of plant and wildlife species, and are important for migrating birds.

The ACOE define wetlands as follows: "Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions."

In order to be considered a jurisdictional wetland under Section 404, an area must possess three wetland characteristics: hydrophytic vegetation, hydric soils, and wetland hydrology. Each characteristic has a specific set of mandatory wetland criteria that must be satisfied in order for that particular wetland

characteristic to be met (Environmental Laboratory 1987; United States Army Corps of Engineers 2008). Several parameters may be analyzed to determine whether the criteria are satisfied.

The determination of waters of the U.S. associated with intermittent streams and washes in the arid southwest is made difficult by long periods of low to no water flow through these bodies. In recognition of these environments where field determination of jurisdictional waters is difficult, technical guidance on how to determine waters of the U.S. based on physical characteristics associated with dryland fluvial systems has been provided by the ACOE (United States Army Corps of Engineers 2008). With non-tidal waters, in the absence of adjacent wetlands, the extent of ACOE jurisdiction is defined by the "ordinary high water mark" (OHWM). This is defined in 33 CFR Part 329.1, as the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line on the bank; shelving; changes in the character of the soil; destruction of terrestrial vegetation; and presence of litter and debris (U.S Army Corps of Engineers 2008). In dryland fluvial systems typical of the semi-arid southwest, some of the more common physical characteristics that indicate the OHWM of an intermittent channel include a clear natural scour line impressed on the bank, recent bank erosion, destruction of native terrestrial vegetation and the presence of litter and debris.

In 2006, the Supreme Court addressed the jurisdictional scope of Section 404 of the Clean Water Act, specifically the term "the waters of the U.S.," in *Rapanos v. U.S.* and in *Carabell v. U.S*. Referred to as the Rapanos decision. The Supreme Court provided two new analytical standards for determining whether water bodies that are not Traditional Navigable Waters (TNWs), including wetland adjacent to those non-traditional navigable waters, are subject to the Clean Water Act. Water bodies are subject to Clean Water Act jurisdiction if 1) the water body is relatively permanent, or if the water body is a wetland that directly abuts (e.g., the wetland is not separated from the tributary by uplands, a berm, dike, or similar feature) a relatively permanent water body; or 2) if a water body, in combination with all wetlands adjacent to that water body, has a significant nexus with TNWs. Traditionally Navigable Waters include but are not limited to the "navigable waters of the United States". These waters are subject to the ebb and flow of the tide and/or the water body is presently used, or has been used in the past, or may be susceptible for use (with or without reasonable improvements) to transport interstate or foreign commerce. Relatively Permanent Waters that are tributaries to Traditional Navigable Waters are also subject to regulatory authority by the ACOE.

4.2 STATE OF CALIFORNIA REGULATORY SETTING

Under California State law, "waters of the state" means "any surface or groundwater including saline waters, within boundaries of the state". After the US Supreme Court decision in *Solid Waste Agency of*

Northern Cook County v. Army Corps of Engineers (SWANNC v. USCOE), the State Water Resources Control Board (SWRCB) confirmed the State's jurisdiction over isolated wetlands. The SWRCB has confirmed that under Section 401 of the Clean Water Act and the California Porter-Cologne Water Quality Control Act, discharges to wetlands and other "waters of the state" (including isolated wetlands) are subject to State regulations. The Regional Water Quality Control Board (RWQCB)-Colorado River Basin Region regulates discharge to wetlands and "waters of the state" found in the project area.

The Porter-Cologne Water Quality Control Act (Act), Water Code §13000 et seq. provides for overall regulation under state law of water quality involving waters of the State of California. This relates to both groundwater and surface water. The Act provides for specific regulations under federal law of discharge of pollutants to surface waters of the state. Dredging, filling or excavation of isolated waters constitutes a discharge of waste to waters of the state. The RWQCB claims jurisdiction over isolated wetlands that meet the Federal definition three-parameter definition of a wetland. For projects that would dredge, fill or excavate isolate waters, the project proponent would need to seek a waste discharge requirement (WDR) permit from the RWQCB

Pursuant to Division 2, Chapter 6, Sections 1600-1603 of the California Fish and Wildlife (CDFW) Code, the CDFW regulates all diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream or lake, which support fish or wildlife (i.e., bed to bank). The CDFW defines a "stream" (including creeks and rivers) as "a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having surface or subsurface flow that supports or has supported riparian vegetation." In their definition of "lake", the CDFW also includes "natural lakes or man-made reservoirs." The CDFW has interpreted the term "streambed" to encompass all portions of the bed, banks, and channel of any stream, including intermittent and ephemeral streams, extending laterally to the upland edge of riparian vegetation. Fish and Wildlife code does not specifically contain provisions regulating activities that would impact wetlands, isolate areas containing riparian vegetation or wetland hydrology.

5.0 WETLAND AND WATERS OF THE U.S./WATERS OF THE STATE DELINEATION AND DETERMINATION

5.1 METHODS

Prior to mobilizing into the field, Tetra Tech conducted a review of any potential drainage features within the region and the proposed project site using recent aerial topography, USGS 7.5-minute quadrangle maps and recent satellite aerial photographs. Field investigations were conducted by Tetra Tech biologists on September 23, 24, and 25, 2013, to identify the presence of waters subject to regulatory

authority. The focus of the field survey was to identify a definable channel bed and bank, determine the OHWM, and to determine if riparian vegetation extended above the OHWM in any locations. Indicators of OHWM included undercut banks on corners, scour pits on the downstream sides of rocks or other in-stream obstacles, sandy berms indicating meandering, sorted sediment deposits, drift lines, and matted vegetation on the upstream side of plants. Indicators of wildlife use and the presence of habitat for sensitive plant and animal species were also noted. The researchers walked each drainage or tributary and measured the width and length of those where OHWM indicators were identified, or where riparian habitat extended above the OHWM. The drainages were mapped using a Trimble GPS device with sub-meter accuracy. Drainage widths were measured on a regular basis. Aerial photographs were used to track the jurisdictional channels identified, and photographs were taken at each of the washes where indicators of OHWM or riparian habitat were identified.

Data sources reviewed in conjunction with the field survey included aerial photographs, US Geological Survey topographic maps, and the available soils information. The National Wetland Inventory (NWI) has not mapped wetlands within the quarry property boundaries (U.S. Fish and Wildlife Service 2013). Topographic maps and aerial photos were used to identify drainage patterns and washes through the project site. The *Review of Ordinary High Water Mark Indicators for Delineating Arid Streams in the Southwestern United States* (U.S. Army Corps of Engineers 2008) was used as guidance for identifying and determining limits of ACOE and CDFW jurisdiction. This report discusses the use of fluvial geomorphology, physical features that develop within arid stream channels as a result of precipitation events, and vegetation to determine the OHWM and limits of waters of the state within channels located in arid climates.

The use of vegetation patterns assists in identifying the OHWM in the arid southwest due to the close association between riparian vegetation and stream hydrology (U.S. Army Corps of Engineers 2008). Therefore, the presence of riparian species can be used to indicate that a wash would receive more frequent flows associated with smaller storm events and to more accurately determine the extent of waters subject to regulatory authority. Arid region riparian vegetation community species compositions can provide information about historic and present hydrological flow regimes. Certain vegetation communities and species are reliable vegetative indicators of surface flows and flow regimes in desert streams and washes.

The riparian vegetation classes in an arid environment can be defined into the following three wetness classes:

- Hydroriparian areas that are perennially saturated;
- Mesoriparian areas that are seasonally moist; and
- Xeroriparian areas that are predominantly dry, with infrequent flood events (U.S. Army Corps of Engineers 2008).

The dominant wetness class located at or above the OHWM was identified for the drainage in the study area. In addition to signs of OHWM, soil core samples to a depth of 12-inches below grade were taken at specified locations to document soil texture, color, and moisture. No soil pits were dug. Any hydric conditions such reduced color or mottles were noted. Field conditions for the sampling points within the drainages were documented on Wetland Delineation forms (Appendix A). Finally, the origin and terminus of the on-site drainage features were documented. A complete compendium of plants observed during the survey can be found in Appendix B.

5.2 RESULTS

Based on a review of aerial images and field verification, drainages located within the limits of planned disturbance were found to have field characteristics supporting a determination of jurisdictional waters of the state. As discussed later, field findings support that jurisdictional waters found within the planned disturbance area are likely isolated and may not be subject to oversight by the ACOE as waters of the U.S. Photographs 1 through 11 depict conditions for the surveyed jurisdictional drainages. One drainage located in the southeastern portion of the quarry property was determined to not have characteristics to support a determination of a jurisdictional water (Photograph 12). The location and orientation of these photos are indicated on Figure 2. Those drainages within the limits of planned disturbance for the quarry that were observed to have stream flow characteristics with definable bed-and-bank features are noted on Figure 2.

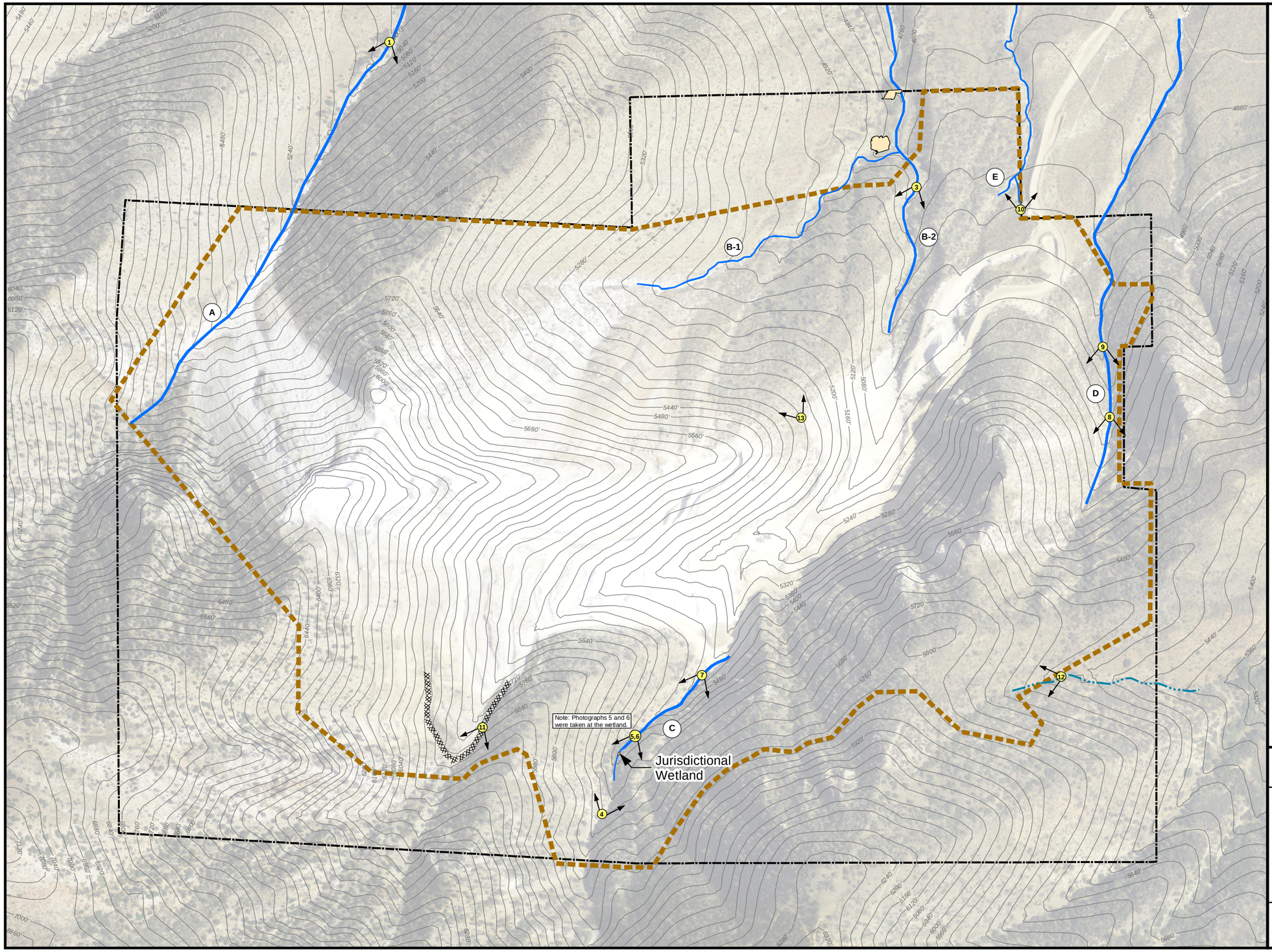
5.2.1 Vegetation

At lower altitudes within the mining property, California juniper plant series dominates the landscape. Joshua trees (*Yucca brevifolia*), singleleaf pinyon (*Pinus monophylla*) and California juniper (*Juniperus californicus*) are the dominate plants found within this series that were noted at the site (Sawyer and Keeler-Wolf 1995). Within the middle portions of the site, undisturbed areas are characterized by the Brittlebush series. Acton's encelia (*Encelia actoni*), big sagebrush (*Artemisia tridentata*) and California buckwheat (*Eriogonum fasciculatum*) as well as other buckwheats are the dominate plants within this series that were found at the site. Finally, the upper portions of the site are characterized by the Bitterbrush series plant community where antelope bitterbrush (*Purshia tridentata*), rubber rabbit bush (*Ericameria nauseous*) and Mormon tea (*Ephedra nevadensis*) are the dominate plants within this series found at the site.

Hydrophytic plants are adapted for life in permanently or periodically saturated soils. No hydrophytic plants or evidence of hydrophytic plants were observed in any of the drainages where sign of OHWM were observed with the exception for a small area associated with Drainage C. No desert riparian plants such as smoke tree (*Psorothamnus spinosa*) or ironwood (*Olneya tesota*) or trees and shrubs found in more mesic environments such as willows (*Salix* sp.) or cottonwood (*Populus fremontii*) were observed.

A small area within Drainage C was found to contain facultative emergent plants commonly associated with hydroriparian environments (Figure 2). Plants observed at the sampling point associated with the Drainage C wetland are noted in Table 1.

P:\GIS\White Knob_White Ridge\White Knob Juris Drainage.mxd

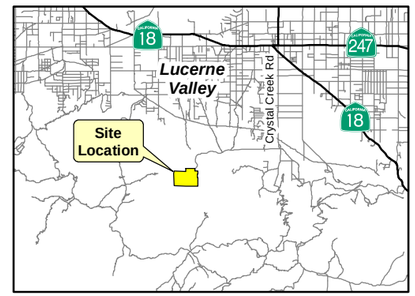


0 250 500 Feet

- Photograph Directional Arrow
- Jurisdictional Drainage
- Non-jurisdictional Drainage
- Limits of Planned Disturbance Line
- Road Cut (non-jurisdictional)
- Topographic Elevation Contour (USGS Butler Peak 7.5' quadrangle)
- Wetland
- White Knob-White Ridge Quarry Boundary

Jurisdictional Areas Within Planned Disturbance Limits

Location	Acres	Linear Feet
A	0.380	1,379
B-1	0.176	1,309
B-2	0.216	942
C	0.216	1,354
D	0.324	1,175
E	0.043	310
WETLAND	0.003	--
TOTAL	**1.358**	**6,469**



WHITE KNOB-WHITE RIDGE QUARRY

Figure 2

Survey Area and Jurisdictional Drainages

TETRA TECH

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Photograph 1 - Drainage A, facing south, with sediment deposits and defined bed to bank.

Photograph 2 - Drainage B1, facing west. Sorted sediments and defined bed to bank are present.

X:\GIS\White Knob_White Ridge\photo 3-4.CDR

Photograph 3 - Drainage B2, facing south. Typical bed configuration in a relatively flat parts of the drainage.

Photograph 4 - Drainage C, facing south, top of drainage. Indicators of waters of the state were not found above this point.

X:\GIS\White Knob_White Ridge\photo 5-6.CDR

Photograph 5 - Drainage C, facing north. View of jurisdictional wetland.

Photograph 6 - Drainage C, facing north. View of jurisdictional wetland and bed features.

X:\GIS\White Knob_White Ridge\photo 7-8.CDR

Photograph 7 - Drainage C, facing north. View of typical bed configuration found in the middle reach of the drainage.

Photograph 8 - Drainage D, facing south. Indicators include cut banks and sediment deposits in rocky center of the bed.

X:\GIS\White Knob_White Ridge\photo 9-10.CDR

Photograph 9 - Drainage D, facing south, typical section.

Photograph 10 - Drainage E, sorted sediments along the right bank indicate water movement and sediment transport.

X:\GIS\White Knob_White Ridge\photo 11-12.CDR

Photograph 11 - View of non-jurisdictional road cut. View to the southwest.

Photograph 12 - View of non-jurisdictional drainage on the southwestern side of the quarry boundary. View to the west.

Table 1 Plant Species Observed in the Drainage C Wetland

Scientific Name	Common Name	Wetland Plant Indicator Status
Juncus effusus	Common rush	FACW+
Salix laevigata	Arroyo willow	FACW+
Salix lasiolepis	Red willow	FACW
Baccharis salicifolia	Mule fat	FACW
Quercus wislizenii	Interior live oak	No Indicator
Taushia parishii	Parish's umbrellawort	No Indicator
Pinus monophylla	Pinyon pine	No Indicator
Penstemon sp.	Penstemon	No Indicator

Table 1 defines the wetland plant indicator status of the plants observed in the Drainage C wetland. Table 2 provides a definition of wetland plant indictor status. Additionally, a positive (+) sign or negative (-) sign may be used with the Facultative plant categories to more specifically define the regional frequency or occurrence in wetlands. The positive sign indicates the plant is more frequently found in wetlands. A negative sign indicates that a plant is less frequently found in wetlands.

Table 2 Wetland Plant Indicator Status

Category	Acronym	Probability
Obligate Wetland	OBL	Occur almost (estimated probability >99%) under natural conditions in wetlands.
Facultative Wetland	FACW	Usually occur in wetlands (estimated probability 67%-99%), but occasionally found in non-wetlands
Facultative	FAC	Equally likely to occur in wetlands or non-wetlands (estimated probability 34%-66%)

Category	Acronym	Probability
Facultative Upland	FACU	Usually occur in non-wetlands (estimated probability 67%-99%), but occasionally found on wetlands (estimated probability (1%-33%).
Obligate Upland	UPL	Occurs in wetlands in another region, but occur almost always (estimated probability > 99%) under natural conditions in non-wetlands in the region specified

The hydrophytic vegetation criterion for regulatory jurisdiction is met if more than 50 percent of the dominant plant species from all strata (tree, shrub and herb layer) are considered hydrophytic (Environmental Laboratory 1987; United States Army Corps of Engineers 2008). Hydrophytic species are those included on the National List of Plant Species that Occur in Wetlands: California (Region 0) (Reed 1988). The species found at the Drainage C wetland are listed as plants that occur in wetlands in California. The wetland in Drainage C is dominated by four plants that are categorized in California as hydrophytic vegetation.

5.2.2 Soils

Hydric soils, or soils associated with wetlands, are saturated or inundated long enough during the growing season to develop anaerobic conditions that favor growth and regeneration of hydrophytic vegetation. Soils are considered hydric when the following criteria for mineral soils are met.

I. All Histosols except Folists; or
II. Soils in Aquic suborders, Aquic subgroups, Albolls suborder, Salorthids great group, Pell great groups of Vertisols, Pachic suborders or Cumulic subgroups that are:
    A. Somewhat poorly drained and have a frequently occurring water table at less than 0.5 feet from the surface for a significant period (usually more than two weeks) during the growing season; or
    B. Poorly drained or very poorly drained and have either:
        (1) A frequently occurring water table at less than 0.5 feet from the surface for a significant period (usually more than two weeks) during the growing season if textures are coarse sands, or fine sands in all layers within 20 inches; or
        (2) A frequently occurring water table at less than 1.0 foot from the surface for a significant period (usually more than two weeks) during the growing season if permeability is greater than 6.0 inches/hour in all layers within 30 inches; or

(3) A frequently occurring water table at less than 1.5 feet from the surface for a significant period (usually more than two weeks) during the growing season if permeability is less than 6.0 inches/hour in all layers within 20 inches; or

III. Soils that are frequently ponded for a long duration or very long duration during the growing season; or

IV. Soils that are frequently flooded for a long duration or a very long duration during the growing season.

There are a number of indicators that may indicate the presence of hydric soils, including hydrogen sulfide generation, the presence of iron and/or manganese concretions, low chroma associated with the soil color, gleyed color, and mottling due to oxidation and reduction of accumulated metals such as iron.

A formal soil survey of the project site by the Natural Resources Conservation Service (NRCS) has been completed for only the southern-most portion of the quarry (United States Department of Agriculture 1986). The soils in this area have been classified as Arrastre-Rock complex series where 60 percent of the soils are Arrastre sandy loam soils with 20 percent rock outcrop with the remaining a mixtures of other sandy loam and loamy sand soils. Located on hillsides, ridges and side slopes of rugged upland foothills as seen within the quarry boundaries, these soils are thinly developed over limestone bedrock. With the exception of the soils associated with the wetland located in Drainage C, soils found within the surveyed drainages were noted as sandy loam in texture with no hydric characteristics. These soils appear to share characteristics of the Arrastre sandy loam series and were not determined to be hydric. Soils within the Drainage C wetland were found to be water-logged, sulfur smelling and a gleyed color (Munsell color 5G2.5). The soils associated with the Drainage C wetland were determined to be hydric.

5.2.3 Hydrology

As stated earlier, the area in which the proposed project site is located is characterized by steep, dry ephemeral washes that generally contain water only during storm events. The largest washes in the area are found low in the system, where the topography is most gentle. In this area, washes are low gradient with gravelly and/or sandy beds. Headwaters and small tributaries entering the washes from hillsides tend to be more heavily incised and have narrower beds. The drainage pattern is generally from south to north. Drainage runoff from mine area exits the project site and ultimately drains to Rabbit Dry Lake, located on the floor of Lucerne Valley to the north of the quarry (Photograph 13). Evidence of past water flow in the form of scour marks and deposition of sand and plant debris was observed in the jurisdictional drainages within the quarry boundaries.

5.2.4 Traditional Navigable Waters-Waters of the United States

The ACOE continues to assert jurisdiction over all waters that are in use, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which may be subject to the ebb and flow of the tide and are defined as Traditional Navigable Waters (U.S. Army Corps of Engineers and Environmental Protection Agency 2007). Field observations and review of relevant aerial photographs

X:\GIS\White Knob_White Ridge\photo 13.CDR

Photograph 13 - View of Rabbit Dry Lake playa, north of the quarry.
View to the north.

and topographic maps confirm that the un-named drainages within the quarry terminate in Rabbit Dry Lake playa found to the north of the quarry. No connection to the Mojave River for the drainages associated with the quarry was observed. A recent Approved Jurisdictional Determination (AJD) dated April 30, 2013 has been issued by the ACOE for the Marathon Solar Project located southeast of the quarry on the west side of Camp Rock Road, north of highway 247 (U.S. Army Corps of Engineers 2013). The drainages associated with this project terminate in Lucerne Dry Lake found east of Rabbit Dry Lake playa. The AJD for the Marathon Solar Project concluded that the on-site drainages are isolated and are not subject to ACOE regulation under Section 404. The Marathon Solar Project AJD indicates that Rabbit Dry Lake and Lucerne Dry Lake are part of the same depositional environment and are both located in the Lucerne Valley groundwater basin Este Subarea. Based on the AJD issued for the solar project that shares the same watershed as the quarry drainages, it is likely that jurisdictional drainages within the quarry are isolated and not subject to ACOE jurisdiction.

5.2.5 Waters of the State

Under Section 401 of the Clean Water Act and the Porter-Cologne Water Quality Act, the RWQCB-Lahontan Region asserts jurisdiction over jurisdictional wetlands and those non-isolated waters associated with Traditional Navigable Waters. As the on-site drainages do not connect to the Mojave River, they are not subject to regulatory authority by the RWQCB-Colorado River Basin under Section 401. The wetland associated with Drainage C meets the three-point Federal criteria as a wetland and may be subject to regulatory authority by the RWQCB-Colorado River Basin under the Porter-Cologne Act.

5.2.5.1 Definable Bed to Bank Streambed Features

Under Section 1600 et. seq. of the California Department of Fish and Wildlife Code, the CDFW regulates all diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream or lake, which support fish or wildlife. The drainages with the quarry with definable bed-and-bank features or other indicators of OHWM would be subject to regulatory authority by the CDFW.

5.3 DETERMINATION RESULTS AND RECOMMENDATIONS

5.3.1 Determination Results

Using the previously described criteria for hydrology, vegetation indicators, and fluvial geomorphology, five washes and tributaries were identified in the vicinity of the project area with an OHWM and determined to be jurisdictional waters of the state (Figure 2 and Appendix A). The other drainages in the vicinity of the project area did not contain a discernible bed and bank or other indicators of OHWM; therefore, these drainages were determined to not be waters of the state. A total of 1.358 acres (6,469

linear feet) were identified as jurisdictional waters of the state in the proposed project area (Table 4). A total of 0.003 acres of jurisdictional wetland was measured in Drainage C. The Drainage C wetland met all three criteria for a jurisdictional wetland and is also subject to regulatory authority as a jurisdictional water of the state by the RWQCB-Colorado River Basin Region under the Porter-Cologne Act.

Table 3 Total Jurisdictional Waters, White Knob-White Ridge Quarry

Drainage	Linear feet	Acres
Drainage A	1,379	0.380
Drainage B-1	1,309	0.176
Drainage B-2	942	0.216
Drainage C	1,354	0.216
Drainage D	1,175	0.324
Drainage E	310	0.043
Wetland, Drainage C	--	0.003
Total	**6,469**	**1.358**

For impacts to jurisdictional waters associated with the un-named drainages within the quarry expansion area, a Streambed Alteration Agreement issued by the CDFW will be required. The wetland found in Drainage C is potentially subject to regulatory authority from both the CDFW and the RWQCB-Lahontan Region. Streambed Alteration Agreement 1600-2003-5078-R6 has been issued for Drainage A (California Department of Fish and Game 2003). At the time of this report preparation, the terms and conditions of the Streambed Alteration Agreement for allowable activities in Drainage A are unknown. If proposed activities for quarry expansion into Drainage A are permitted by Streambed Alteration Agreement 1600-2003-5078-R6, total acreage of impacts to jurisdictional waters would be reduced to 0.978 acres.

5.3.2 Recommendations

The following recommendations are made related to jurisdictional drainages found within the proposed quarry expansion area.

- Contact the CDFW and discuss mitigation strategies to include in-lieu mitigation opportunities.
- Contact ACOE and determine if an AJD has been issued for any project with drainages that terminate in Rabbit Dry Lake. Confirm that Rabbit Dry Lake and Lucerne Dry Lake would be considered within the same watershed/hydrologic unit.
- Seek an AJD from the ACOE based on the findings of this report.
- Contact the RWQCB-Colorado River Basin and discuss requirements for a WDR permit related to the Drainage C wetland.

6.0 CERTIFICATION

"*Certification: I hereby certify that the statements furnished above and in the attached exhibits present data and information required for this jurisdictional water/wetlands delineation and that the facts, statements, and information presented are true and correct to the best of my knowledge and belief*."

DATE: 15 October 2013 SIGNED: Stephanie Pacheco

Report Author

Field Work Performed by: David Munro, Tetra Tech

Stephanie Pacheco, Tetra Tech

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APPENDIX A WETLAND DELINEATION FORMS

Date 25 September 2013 Client Omya, CA

Name of Project White Knob/White Ridge Quarry Site ID W. of Annex Quarry-Drainage A

Field Team D. Munro/S. Pacheco Photo #

Aspect Northeast Avg. Width of Channel at OHWM 12-feet

Weather (temp, precipitation, cloud cover) Clear/Cool

Plant Community Description California Juniper Series/Alluvial Wash

Plant Species (in order of dominance)

Yerba Santa	
Rubber rabbit bush	
Antelope brush	

Indicators Sediment deposition, scour

Riparian Vegetation Class (hydroriparian, mesoriparian, xeroriparian) Xeroriparian

Morphology Deeply incised riparian canyon, 10-12% slope

Soil Characteristics Sandy soils, no hydric soils present

Hydrology Ephemeral, intermittant streambed

Determination/Notes Waters of the State/US; upper reach disturbed due to past quarry activities.

Date 24 September 2013 Client Omya, CA

Name of Project White Knob/White Ridge Quarry Site ID Reach 2-Drainage B-2

Field Team D. Munro/S. Pacheco Photo #

Aspect East facing Avg. Width of Channel at OHWM 2-3 feet

Weather (temp, precipitation, cloud cover) 80 degrees, no cloud cover, no precipitation

Plant Community Description Alluvial wash/California Juniper Series

Plant Species (in order of dominance)

Yerba Santa	
Rubber rabbit bush	
Interior live oak	

Indicators Sediment deposits, matted vegetation, scour pools

Riparian Vegetation Class (hydroriparian, mesoriparian, xeroriparian) Xeroriparian

Morphology Cascading, rocky, incised, 10-12% slope

Soil Characteristics Sandy and rocky.

Hydrology Ephemeral

Determination/Notes Other waters of the US/Waters of the State

Date 24 September 2013 Client Omya, CA

Name of Project White Knob/White Ridge Quarry Site ID OB-2-Upper Reach 1/Drainage C

Field Team D. Munro/S. Pacheco Photo #

Aspect East facing Avg. Width of Channel at OHWM 1-2 feet

Weather (temp, precipitation, cloud cover) 80 degrees, no cloud cover, no precipitation

Plant Community Description Alluvial fan scrub/Brittlebush Series-Bitterbush Series

Plant Species (in order of dominance)

Yerba Santa	
Rubber rabbit bush	
Interior live oak	

Indicators Scour pools downstream of rocks, matted vegetation, sediment deposits

Riparian Vegetation Class (hydroriparian, mesoriparian, xeroriparian) Xeroriparian

Morphology Cascading, rocky, incised

Soil Characteristics Sandy and large boulders

Hydrology Ephemeral

Determination/Notes Other waters of the US/Waters of the State

Date 24 September 2013 Client Omya, CA

Name of Project White Knob/White Ridge Quarry Site ID OB-2 Wetland/Reach 2/Drainage C

Field Team D. Munro/S. Pacheco Photo #

Aspect East facing Avg. Width of Channel at OHWM 20 linear feet by 7 feet

Weather (temp, precipitation, cloud cover) Cool and clear

Plant Community Description Wetland macrophytic herbaceous and woody perennials; evidence of herbaceous annuals from the spring.

Plant Species (in order of dominance)

Arroyo willow	
Red willow	
Interior live oak	
pinyon pine	
Unknow scroph; possible penstemon	
Parish's umbrellawort	
Juncus sp.	
Mule fat	

Indicators Hydric soils, presence of standing water and obligate/facul

Riparian Vegetation Class (hydroriparian, mesoriparian, xeroriparian) Hydroriparian

Morphology Wetland present in incised canyon/riparian corridor

Soil Characteristics Hydric characteristics, sulfer smelling, reduced color (5G2.5), saturated soils

Hydrology Standing water observed

Determination/Notes Jurisdictional Wetland/Waters of the State

Date 24 September 2013 Client Omya, CA

Name of Project White Knob/White Ridge Quarry Site ID OB-2 Reach 3/Drainage C

Field Team D. Munro/S. Pacheco Photo #

Aspect East facing, 10% slope Avg. Width of Channel at OHWM 7 feet

Weather (temp, precipitation, cloud cover) Cool and clear

Plant Community Description Facultative plants/upland plants, Bitterbrush Series

Plant Species (in order of dominance)

Parish's umbrellawort	
Red willow	
Ceanothus	
Pinyon pine	
Rubber rabbit bush	

Indicators Plants and hydrology support presence of jurisdictional waters; no hydric soils present.

Riparian Vegetation Class (hydroriparian, mesoriparian, xeroriparian) Xeroriparian

Morphology Sign of OHWM, deeply incised canyon riparian corridor

Soil Characteristics Non-gleyed, damp soils in upper 3" of 6" core; 10YR3/2

Hydrology Evidence of past water flow; scour marks at edges of streambed

Determination/Notes Jurisdictional Waters of the State

Date 24 September 2013 Client Omya, CA

Name of Project White Knob/White Ridge Quarry Site ID OB-2 Reach 4/Drainage C

Field Team D. Munro/S. Pacheco Photo #

Aspect East facing, 10% slope Avg. Width of Channel at OHWM 12 feet

Weather (temp, precipitation, cloud cover) Cool and clear

Plant Community Description Alluvial fan scrub, Bitterbrush Series-Brittle Bush Series

Plant Species (in order of dominance)

Yerba Santa	
Rubber rabbit bush	
Manzanita	
Acton encelia	
Rubber rabbit bush	
Chaparral yucca	

Indicators Past hydrology

Riparian Vegetation Class (hydroriparian, mesoriparian, xeroriparian) Xeroriparian

Morphology Sign of OHWM, deeply incised canyon riparian corridor

Soil Characteristics No hydric characteristics

Hydrology Evidence of drift lines and sediment deposits

Determination/Notes Jurisdictional Waters of the State

Date 25 September 2013 Client Omya, CA

Name of Project White Knob/White Ridge Quarry Site ID OB-3, Drainage D

Field Team D. Munro/S. Pacheco Photo #

Aspect East facing, 10-12% slope Avg. Width of Channel at OHWM 12 feet

Weather (temp, precipitation, cloud cover) Cool and clear

Plant Community Description California Juniper Series

Plant Species (in order of dominance)

Yerba Santa	Calif. wishbone
Rubber rabbit bush	Calif. buckwheat
Manzanita	Joshua tree
Acton's encelia	Golden bush-E. linearifolia
Rubber rabbit bush	Bromus madritensis
Chaparral yucca	Mormon tea/E. nevadensis
White thorn	
Flannel bush	

Indicators Past hydrology only; no riparian plants or hydric soils.

Riparian Vegetation Class (hydroriparian, mesoriparian, xeroriparian) Xeroriparian

Morphology Sign of OHWM, deeply incised canyon riparian corridor

Soil Characteristics No hydric characteristics, 10YR5/4

Hydrology Evidence of drift lines and sediment/plant debris deposits

Determination/Notes Jurisdictional Waters of the State

Date 26 September 2013 Client Omya, CA

Name of Project White Knob/White Ridge Quarry Site ID Back Drainage/SE Corner of Site

Field Team D. Munro/S. Pacheco Photo #

Aspect East facing, 8% slope Avg. Width of Channel at OHWM None

Weather (temp, precipitation, cloud cover) Cool and clear

Plant Community Description Bitterbrush Series

Plant Species (in order of dominance)

Flannel bush	Yerba santa
Antelope brush/P. tridentata	Beaver tail cactus
Desert needle grass	Pinyon pine
Calif. buckwheat	Joshua tree
Calif. juniper	
Spanish bayonet/Y. whipplei	
Manzanita	
Big sagebrush	

Indicators No scour signs; signs of past water movement.

Riparian Vegetation Class (hydroriparian, mesoriparian, xeroriparian) None

Morphology Deeply incised canyon

Soil Characteristics No hydric characteristics, 10YR4/4

Hydrology No sign of past water movement; scour and deposition.

Determination/Notes Not a jurisdictional drainage

Date 26 September 2013 Client Omya, CA

Name of Project White Knob/White Ridge Quarry Site ID Drainage w/of OB3/Drainage E

Field Team D. Munro/S. Pacheco Photo #

Aspect north facing Avg. Width of Channel at OHWM 6 feet

Weather (temp, precipitation, cloud cover) Cool and clear

Plant Community Description Bitterbrush Series

Plant Species (in order of dominance)

Rubber rabbit bush	
Yerba santa	
Calif. juniper	

Indicators Scour signs; signs of past water movement.

Riparian Vegetation Class (hydroriparian, mesoriparian, xeroriparian) Xeroriparian

Morphology Moderately incised canyon riparian corridor

Soil Characteristics No hydric characteristics, 10YR4/4

Hydrology Sign of past water movement; scour and deposition.

Determination/Notes Jurisdictional Waters of the State; no special aquatic sites or wetlands observed.

APPENDIX B FLORAL COMPENDIUM

APPENDIX B
FLORA COMPENDIUM
WHITE KNOB/WHITE RIDGE QUARRY
LUCERNE VALLEY, CALIFORNIA 92356

Flora	Flowering Plants
Gymnospermae	**Pollen Producing Woody Gymnosperms**
Cupressaceae	**Cypress Family**
Calocedrus decurrens	Incense cedar
Juniperus californica	California juniper
Ephedraceae	**Ephedra Family**
Ephedra nevadensis	Mormon tea
Pinaceae	**Pine Family**
Pinus monophylla	Single-leaf pine
Angiospermae: Monocotyledonae	**Monocot Flowering Plants**
Junaceae	**Rush Family**
Juncus effusus.	Common rush
Liliaceae	**Lily Family**
Yucca brevifolia	Joshua tree
Yucca schidigera	Mohave yucca
Yucca whipplei	Spanish daggers
Poaceae	**Grass Family**
Achnatherum speciosum	Desert needlegrass
Bromus diandrus	Ripgut brome*
Bromus madritensis ssp. *rubens*	Red brome*
Angiospermae: Dicotyledonae	**Dicot Flowering Plants**
Anacardiaceae	**Sumac Family**
Rhus trilobata	Skunk bush
Apiaceae	**Carrot Family**
Tauschia parishii	Parish's umbrellawort
Asteraceae	**Aster Family**
Ambrosia dumosa	Burro bush
Artemisia tridentata	Big sagebrush
Baccharis pularis	Coyote broom
Baccharis salicifolia	Mulefat
Encelia actoni	Acton's brittle bush
Ericameria cuneata	Wedge-leaved golden bush
Ericameria linearifolia	Thread-leaved golden bush
Ericameria nauseousa	Rubber rabbit brush
Solidago velutina spp. *californica*	Velvety goldenrod
Brassicaceae	**Mustard Family**
Sisymbrium irio	London rocket*
Cactaceae	**Cactus Family**
Echinocereus engelmannii	Englemann's hedgehog cactus
Opuntia basilaris	Beavertail cactus
Chenopodiaceae	**Saltbush Family**
Grayia spinosa	Hopsage
Ericaceae	**Heath Family**
Actostaphylos glauca	Big berry manzanita
Fagaceae	**Oak Family**
Quercus wislizenii	Interior live oak

APPENDIX B
FLORA COMPENDIUM
WHITE KNOB/WHITE RIDGE QUARRY
LUCERNE VALLEY, CALIFORNIA 92356

Hydrophyllaceae	**Waterleaf Family**
Eriodictyon trichocalyx	Hairy yerba santa
Salvia dorrii	Desert sage
Malvaceae	**Mallow Family**
Sphaeralcea ambigua	Desert mallow
Nyctaginaceae	**Four O'clock Family**
Mirabilis bigelovii	Desert four o'clock
Oleracea	**Olive Family**
Forestiera pubescens	Desert olive
Polygonaceae	**Buckwheat Family**
Eriogonum fasiculatum	California buckwheat
Eriogonum inflatum	Desert trumpet
Rhamnaceae	**Buckthorn Family**
Ceanothus greggii	Cup leaf ceanothus
Ceanothus leucodermis	White thorn
Rosaceae	**Rose Family**
Coleogyne ramosissima	Black brush
Purshia tridentata	Antelope brush
Salicaceae	**Willow Family**
Populus fremontii	Cottonwood
Salix laevigata	Red willow
Salix lasiolepis	Arroyo willow
Sterculiaceae	**Cacao Family**
Fremontodendron californicum	California flannel bush

* Denotes non-native plant

Taxonomy and nomenclature follow Baldwin, B. G. et. al., 2012, *The Jepson Manual: Vascular plants of California, second edition*, University of California Press.

NORTH SLOPE

RAPTOR CONSERVATION STRATEGY

DRAFT Prepared by:
Robin Eliason, Mountaintop District, San Bernardino National Forest
September 2013

NORTH SLOPE RAPTOR CONSERVATION STRATEGY

INTRODUCTION

Strategy: The SBNF has developed this Raptor Conservation Strategy (RCS) for the San Bernardino Mountain's North Slope in coordination with the mining companies, USFWS, and CDFW.

The San Bernardino National Forest (SBNF) and the three North Slope mining companies (Mitsubishi, Omya, and Specialty Minerals) are cooperatively participating in the monitoring of nesting raptors on the SBNF's North Slope of the San Bernardino Mountains. This includes known North Slope nesting golden eagles (California fully-protected species and protected under the federal Bald and Golden Eagle Protection Act), and other raptors of concern that have the potential to nest (peregrine falcon, prairie falcon, and California condors).

The objective of the RCS is to provide consistent objectives, management actions, processes, and management tools across the affected mining companies on the North Slope. The mining companies have provided input to the development and finalization of the RCS and have agreed to follow the guidelines put forth in the effort. The RCS has been tailored for activities associated with mining activities and effects.

The RCS is expected to be a dynamic document, to be updated as new information and scientific understanding of the subject species become available. The RCS may be updated over time to include other raptors in the future if concerns develop over their local population status. The strategy includes monitoring objectives, schedules, and protocols, as well as measures to avoid, minimize, rectify, and reduce (or eliminate over time) effects to raptors nesting in the North Slope from mining and National Forest land and resource management activities. The intent is to use systematic monitoring of raptor nesting and observed behavior to develop and refine site- and activity- specific measures to ensure successful nesting and provide for adaptive management opportunities.

Due to the long life of the mining projects and potential for new technologies (both in raptor monitoring and mining), and the uncertainty of long term raptor population trends, the RCS will be reviewed and updated periodically with a goal of at least every five years.

The intent of the RCS is to:

- Ensure compliance with state and federal laws (Bald and Golden Eagle Protection Act, Migratory Bird Treaty Act, California Endangered Species Act, federal Endangered Species Act, etc.)
- Provide guidelines for reducing the likelihood of "take" of a State or Federally-protected species; and provide direction for acquiring an "incidental take permit" if necessary.
- Describe an adaptive management approach that provides protection of nests while continuing the mining operations and other activities. The purpose of adaptive management is to improve long-term management outcomes by recognizing where key uncertainties impeded decision-making, seeking to reduce those uncertainties over time, and applying that learning to subsequent decisions (**Walters 1986**).
- Provide continuity and a unified approach for managing nesting raptors and their habitat

on the North Slope for the mine operators in the area. By taking this approach, the parties may combine efforts, reducing costs and redundancy.

BACKGROUND

The North Slope's rugged terrain rises from the Mojave Desert floor. The steep slopes have an abundance of rocky pinnacles, outcrops, rock crevice formations, rock ledges, cliff potholes, and cliffs. These areas provide excellent nest sites for birds, including several cliff-nesting raptor species such as owls, golden eagles, California condors, peregrine and prairie falcons, red-tailed hawks, and other raptors.

The vegetation on the North Slope includes 1) pinyon/juniper woodland and montane conifer forests at the rim; 2) a pinyon/juniper-desert transition zone that includes Joshua trees, pinyon pines, junipers, yuccas, and desert shrubs; and, 3) high desert vegetation at the base of the mountain slopes. All of these vegetation communities provide foraging and nesting habitat for these raptors. The rugged terrain, and deep canyons/drainages also have suitable foraging and nesting sites. Golden eagles are known to nest on the North Slope and prairie falcons are suspected nesters.

a) Golden Eagle (*Aquila chrysaetos*) **RE-will update with more recent version

The golden eagle is a SBNF Watchlist species, a species identified by the Forest Service as a local viability concern, a CDFW Watchlist species, a California state fully-protected species. It is protected under the Bald and Golden Eagle Protection Act (Eagle Act) and the Migratory Bird Treaty Act (MBTA).

Life History and Baseline Information – Golden Eagle: In California, golden eagles are an uncommon permanent resident and migrant throughout most of the state, except the floor of the Central Valley. This species ranges from sea level to 11,500 feet. It is considered more common in southern California than in the northern part of the state. In southern California, it is an uncommon resident throughout most of the region except in the Colorado Desert and along the Colorado River, where it is a casual winter visitor. Historically, golden eagles were considered more abundant in remote parts of southern California than anywhere else in the United States.

Golden eagles nest primarily on cliffs and hunt for rabbits and other small mammals in nearby open habitats, such as grasslands, oak savannas, and open shrublands. They build their nests on rock outcrops, cliff ledges, or in trees, typically 10-100 feet above the ground. They often occupy remote mountain ranges and upland areas, often at or above treeline where vegetation is short or sometimes absent. In southern California, golden eagles generally avoid heavily forested mountains, the coast, and urban areas.

Wintering habitats in the western United States tend to include available perches and native shrub-steppe vegetation types (*e.g.*, comprising *Artemisia* and similar shrubs). Habitats with these characteristics typically support substantial prey populations of black-tailed jackrabbits (*Lepus californicus*).

The golden eagle breeding season begins in early February and peaks in March through July. The nest is constructed of branches, twigs, and stems of any kind and is added to continuously during the nesting period. The nest is large, but thin, and becomes more massive with successive use. Alternative nest sites within the breeding territory are occasionally used. Females typically lay two eggs and incubate them for 43–45 days. The semi-altricial eaglets are brooded by the female for an additional 30 days. The male delivers food to the female, and the female feeds the young. The young fly at about 50 days, remaining near the nest site for a few weeks. Breeding site fidelity in adult golden eagles is high. Juvenile golden eagles disperse from their natal area, traveling long distances before returning two or three years later. After they return, they often live nomadically near their natal area, presumably until they establish a territory.

In California, golden eagles are mostly resident. However, they may move altitudinally in response to changing weather conditions; they may also move upslope after the breeding season.

Golden eagles soar 98-297 feet above ground in search of prey or make low quartering flights 23-26 feet above ground. Golden eagles will occasionally hunt from an exposed perch, flying directly toward prey. Golden eagles eat primarily lagomorphs and rodents, but they will also take other mammals, reptiles, carrion, and birds. Studies of golden eagle diet indicate that mammals comprise 82 percent of the diet, supplemented by birds at 12.6 percent, with the remainder consisting of reptiles and fish.

Golden eagles are highly territorial, and life-long monogamous pairs will occupy a territory over their life span. Territorial boundaries are well defined and vigorously defended. Golden eagles tend to nest on the periphery of their territories, often near an adjacent nesting pair. (Source: **USFS 2006** Forest Plan Species Accounts)

***Population Status and Threats – Golden Eagle*:** Golden eagles remain threatened by human disturbance at nest sites, poison baits, shooting, and collisions with powerlines. However, these threats do not appear to substantially affect the population as a whole. However, they may be significant to the southern California population where serious declines have already been documented.

Near National Forest System lands in southern California, golden eagles are affected by private land development and rapid urbanization that encroaches on key foraging areas. There appears to be abundant nesting habitat on public land, but in many places the highest quality foraging areas are on private land.

Increased recreational activity, particularly rock climbing, in the vicinity of cliff nests is also a problem in some areas and can cause golden eagles to abandon nest sites. Mining activities on the desert slope of the San Bernardino Mountains may also be a threat to golden eagles if mining results in disturbance to nesting cliffs. Management consideration should be given to identifying and protecting active nest sites during the breeding season. Lead in the gut piles and carcasses of game animals left in the field may result in poisoning if fed on by golden eagles. (**Source: USFS Forest Plan 2006**)

Golden eagle populations are thought to be declining through much or all of its range in the U.S. Threats to golden eagles include powerlines (electrocutions and collisions), contaminants (*e.g.*, lead, secondary poisoning from rodenticides), shooting and poaching, incidental trapping in furbearer traps, drowning in stock-tanks, vehicle collisions, habitat loss, disturbance, and large-scale non-renewable and renewable energy developments (**Pagel, pers. comm. 2013**).

Mortality of golden eagles as a result of wind turbine collisions has been high (as many as an average of 64/year at Altmont Pass over the past six years). Large-scale solar panel projects result in losses of large acreages of foraging habitat for golden eagles. Within the foreseeable future, a number of new renewable energy projects are expected to come online in California's deserts, as suggested by the number of applications for renewable energy projects (http://www.energy.ca.gov/siting/solar/; http://www.blm.gov/ca/st/en /prog/energy/wind.html). Those combined with existing developments and other threats to golden eagles contribute to the concern for the golden eagle population in the western U.S.

Over the long life of the mining operations on the North Slope, it is likely that more high quality golden eagle nesting and foraging habitat will be affected by limestone mines and that displacement will occur with some part of the North Slope lacking this species. Given the current situation for golden eagles, there are concerns about cumulative effects for this species due to multiple threats (**Pagel, pers. comm. 2013**).

Occurrence on the North Slope – Golden Eagle: Golden eagles are known to nest on and near the North Slope, including in nearby Marble and Arctic Canyons in the 1990s and Blackhawk Mountain more recently. There are at least twenty known active and inactive nest sites for golden eagles within a 10-mile radius of the North Slope. In 2010, two active nests were located on the North Slope, both with fledglings. There are also a number of inactive nest sites on the North Slope. Golden eagles are known to have re-occupied nests that have been vacant for 30-40 years (**Pagel, pers. comm. 2013**).

The entire North Slope area supports suitable foraging habitat and there are a number of records for them in the area (**Kielhold 1993, MacKay and Thomas 2008, SBNF records**), including using wildlife drinkers at the mines.

Take – Golden Eagle: The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald and golden eagles, including their parts, nests, or eggs. Under the Eagle Act, "take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest or disturb." "Disturb" is defined in regulations as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that

interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment (Federal Register 74 (175): 46835-46879 9/11/09).

The regulation set forth in 50 CFR § 22.26 provides for issuance of permits to take golden eagles where the taking is associated with but not the purpose of the activity and cannot practicably be avoided. Most take authorized under this section will be in the form of disturbance; however, permits may authorize non-purposeful take that may result in mortality.

The regulation at 50 CFR § 22.27 establishes permits for removing eagle nests where: (1) necessary to alleviate a safety emergency to people or eagles; (2) necessary to ensure public health and safety; (3) the nest prevents the use of a human-engineered structure; or (4) the activity or mitigation for the activity will provide a net benefit to eagles. Only inactive nests may be taken, except in the case of safety emergencies. Inactive nests are defined by the continuous absence of any adult, egg, or dependent young at the nest for at least 10 consecutive days leading up to the time of take. (Source: http://www.fws.gov/migratorybirds/BaldAndGoldenEagleManagement.htm)

b) California Condor *(Gymnogyps californianus)* **RE-will update with more recent version
The California condor is both a federally and state listed as Endangered. Critical Habitat has been designated (1976) but none is present on the North Slope. A Recovery Plan exists for this species.

Life History and Baseline Information - California Condor: From 100,000 to 10,000 years ago, California condor ranged widely; with the extinction of the large Pleistocene mammals, the species declined in range and numbers. Condor remains reveal that the species once ranged over much of western North America, and as far east as Florida. Until about 2,000 years ago, the species nested in west Texas, New Mexico, and Arizona. When European settlers arrived on the Pacific coast of North America in the early 1800s, California condors occurred from British Columbia to Baja California, and also occasionally ranged into the American southwest.

Historically, California condor occurred in the Coast Ranges of California from Santa Clara and San Mateo Counties south to Ventura County, and east to the western slope of the Sierra Nevada and Tehachapi Mountains. It occurred primarily from sea level to 9,000 feet and nested at 2,000-6,500 feet. Almost all of the historic nest sites used by California condors are located on the Los Padres, Angeles, and Sequoia National Forests.

California condor nesting sites are typically located in chaparral, conifer forest, or oak woodland communities. Historically, condors nested on bare ground in caves and crevices, behind rock slabs, or on large ledges or potholes on high sandstone cliffs in isolated, extremely steep, rugged areas. Cavities in giant sequoia (*Sequoiadendron giganteum*) have also been used. The nest site is often surrounded by dense brush.

The appearance of many nest sites suggests that they have been long used, perhaps for centuries, whereas other apparently suitable sites in undisturbed areas show no signs of condor use. Characteristics of condor nests include:

- entrances were large enough for the adults to fit through;

- they had a ceiling height of at least 14.8 inches at the egg position;
- floors were fairly level with some loose surface substrate;
- the nest space was un-constricted for incubating adults; and
- there was a nearby landing point.

Condors often return to traditional sites for perching and resting. Traditional roost sites include cliffs and large trees and snags (roost trees are often conifer snags 40-70 feet tall, often near feeding and nesting areas. Condors may remain at the roost site until midmorning, and generally return in mid- to late afternoon.

Most foraging occurs in open terrain of foothills, grasslands, potreros with chaparral areas, or oak savannah habitats. Historically, foraging also occurred on beaches and large rivers along the Pacific coast. Water is required for drinking and bathing.

California condors typically breed every other year, but can breed annually if they are not caring for dependent young. California condors usually lay a single egg between late January and early April. The egg is incubated by both parents and hatches after approximately 56 days. Both parents share responsibilities for feeding the nestling. Feeding usually occurs daily for the first 2 months, then gradually diminishes in frequency. Juvenile condors leave the nest at 2-3 months of age, but remain in the vicinity of the nest and under their parents' care for up to a year. The California condor is nonmigratory. California condors are capable of extended flights (more than 100 miles in a day).

California condors are opportunistic scavengers, feeding exclusively on the carcasses of dead animals. Typical foraging behavior includes long-distance reconnaissance flights, lengthy circling flights over a carcass, and hours of waiting at a roost or on the ground near a carcass. California condors locate food by visual rather than olfactory cues, and require fairly open areas for feeding, allowing ease in approaching and leaving a carcass. California condors typically feed only 1-3 days per week.

Seasonal foraging behavior shifts may be the result of climatic cycles or changes in food availability. California condors maintain wide-ranging foraging patterns (*i.e.*, at least 2.8 to 11.6 square miles) throughout the year, an important strategy for a species that may be subjected to unpredictable food supplies.

Historically, condors probably fed on mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), pronghorn antelope (*Antilocarpa americana*), and various marine mammals. More recently, domestic livestock made up the majority of their diet. (Source: **USFS 2006** Forest Plan Species Account)

Population Status and Threats – California Condor: The California condor has been one of the most highly endangered bird species in the world throughout its modern history. As the result of an aggressive management program, including capture of the last six individuals remaining in the wild in 1986-87, captive breeding, and reintroduction of captive progeny, the total population continues to increase from the low point in 1982-82, when only 21-22 individuals were thought

to survive. The 9/30/12 California condor status report by the U.S. Fish and Wildlife Service showed a total population of 410 individuals, including 180 in captivity and 230 in the wild.

A high number of birds are still being lost to poisoning from lead ingested from carcasses, and this factor may preclude rapid recovery of the species in some areas. The ingestion of trash items, including glass fragments, china, plastic, and metal bottle tops, and non-digestible natural items such as small rocks, sticks, grass, wool, and fur, is a serious problem for condor chicks in California nests. (http://globalraptors.org/grin/SpeciesResults.asp?specID=8258)

Factors that led to California condor's century-long decline included illegal collection of adults and their eggs; poisoning by substances used to eradicate livestock predators; poisoning from ingestion of lead fragments of bullets embedded in animal carcasses; other forms of poisoning (DDT, cyanide, strychnine, compound 1080, antifreeze from car radiators); shooting; and collisions with structures such as transmission lines. In addition, the roads, cities, housing tracts, and weekend mountain retreats of modern civilization have replaced much of the open country condors need to find food. Their slow rate of reproduction and maturation undoubtedly make the California condor population as a whole more vulnerable to these threats.

Viability is a definite concern due to the extremely small population and vulnerability to many factors. Greatest among these are shooting, lead contamination, collision with overhead transmission lines and towers, trash, and general human disturbance (**USFS 2006** Forest Plan Species Account).

Rideout *et al.* (2012) documented the causes of death of free-ranging California condors between 1992 (the beginning of the reintroduction program) through 2009. Out of 76 dead condors for which the cause of death could be determined, 70% were from anthropogenic causes. Ingestion of trash was the most important cause of death for nestlings, and lead toxicosis was the most important factor for juveniles and adults. Other causes of death identified included: copper toxicosis (possibly from cattle troughs treated with copper sulfate to control algae), west Nile virus, powerline electrocution, powerline collision, ethylene glycol (antifreeze) ingestion, rattlesnake bite, predation, and gunshot.

There are many existing and ongoing threats to California condors, as described above. The risk to condors from man-made factors (trash, toxins, shooting, electrocution, and collisions) will continue and may increase in the foreseeable future as human populations in southern California grow.

Perhaps the greatest threat to condors in the foreseeable future is the expansion of renewable energy developments (solar and wind) throughout current condor's distribution as well as in areas where condors are expected to expand as the population continues to grow. The Bureau of Land Management has seen a surge in wind energy applications. Their website has data tables and maps displaying areas with existing applications for renewable energy projects (http://www.blm.gov/ca/st/en/prog/energy/wind.html).

Occurrence on the North Slope – California Condor: California condors have been observed at several locations in the San Bernardino Mountains since 2002, including the White Mountain

area of the North Slope. USFWS records of radio-tagged condors suggest that as S. California's condor population continues to grow, the areas they cover is expanding. Condors appear to be traveling long distances from the main population sites on the coast on a more frequent basis. While nesting is not currently known from the North Slope, it could occur over the 40-120 year life of the project.

Take for California Condor: The Endangered Species Act of 1973, as amended, makes it unlawful for a person to "take" a listed animal without a permit. Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." Through regulations, the term "harm" is defined as "an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering."

There are currently no nests known on the North Slope: take and disturbance to nesting California condors are considered very unlikely but the likelihood could change should nesting occur in the future. The Raptor Conservation Strategy contains provisions for annual monitoring and nest monitoring and for actions if an active condor nest were found in close proximity.

c) American Peregrine Falcon *(Falco peregrines anatus)* **RE-will update with more recent version

The peregrine falcon is a Forest Service Sensitive species and a CDFW "fully protected" species. It is a USFWS Bird of Conservation Concern. It has been removed from the Federal and State of California's Endangered Species list.

Life History and Baseline Information – Peregrine Falcon: Peregrine falcons nest almost exclusively on protected ledges of high cliffs, primarily in woodland, forest, and coastal habitats. A very small number of nests have been found on small outcrops and in trees, and a number of reintroduced pairs nest on tall buildings. Cliffs that provide ledges, potholes, or small caves (usually with an overhang), and that are relatively inaccessible to mammalian predators, are required components of nesting habitat. Nest sites usually provide a panoramic view of open country, are near water, and are associated with a local abundance of passerine, waterfowl, or shorebird prey. Peregrine falcons have been known to nest at elevations as high as 10,000 feet, but most occupied nest sites are below 4,000 feet.

The breeding season of peregrine falcon generally begins in February and lasts to June. Courtship (in February) typically involves the male provisioning the female with food. Females normally lay four eggs; egg-laying in California typically occurs in March. Both male and female incubate the eggs for 29–33 days. In California, fledging occurs in late May or early June when the young are 35–42 days old. Juvenile peregrine falcons begin hunting on their own and become independent 6–15 weeks after fledging.

Peregrine falcons feed almost exclusively on birds; most of their avian prey is medium-sized to moderately large. They typically feed on highly mobile, flocking, and colonial nesting birds, such as shorebirds, waterfowl, doves, and pigeons. Peregrine falcons chase and grab their prey, or dive down on them at speeds up to 100–200 miles per hour (*i.e.*, stooping). During the stoop,

a peregrine falcon grasps its prey or strikes it with its talons and subsequently retrieves it on the ground. Peregrine falcons hunt during the day or at dusk. During the breeding season, adult peregrine falcons attack and chase other raptors away from the nest, especially golden eagles and other peregrine falcons that move through their territory. Adults hunt over a large area around the nest site; foraging may occur up to 12 miles from the nest.

Population Status and Threats – Peregrine Falcon*:* Bans on the use of DDT in the 1970s and a major reintroduction program led by the Peregrine Fund have resulted in an impressive increase in the distribution and abundance of this species over the last 20 years. The population increase has been substantial enough to warrant the taxon's delisting, in August 1999, from the federal endangered status, although this decision is controversial. (Source: **USFS 2006** Forest Plan Species Accounts)

The widespread use of organochloride pesticides, especially DDT, was a primary cause of the decline in peregrine falcon populations. High levels of these pesticides and their metabolites (*i.e*., byproducts of organic decompositions) have been found in the tissues of peregrine falcons, leading to thin eggshells and reproductive failure. Environmental toxins continue to be a threat. Other threats include illegal shooting, illegal falconry activities, and habitat destruction. NFS lands in southern California do not support a large amount of high-quality habitat for American peregrine falcon. Protecting cliff-nesting sites from human disturbance has been identified as an important conservation measure for peregrine falcons on NFS lands.
(Source: **USFS 2006** Forest Plan Species Accounts)

Nesting sites for peregrine falcon on the North Slope are expected to continue to be affected by mining operations through disturbance and habitat alterations.

Occurrence on the North Slope – Peregrine Falcon: While not currently known to nest on the North Slope, peregrine falcon nesting territories in and near the San Bernardino Mountains have increased over the past decade. There are now successful nesting peregrines in downtown Riverside. Peregrine falcons are known to nest at one site in the San Bernardino Mountains. The nest site is approximately 75 feet high located on a cliff face. Successful fledging of chicks was documented in July 2009 and again in 2012. Another nesting territory was found in the Cajon Pass in 2012. Historically, both sites supported prairie falcon nesting. Peregrine falcons occur in the Big Bear and Baldwin Lake areas during spring and fall migration.

The North Slope has an abundance of rocky outcrops and cliffs that are suitable peregrine falcon nest sites. With successful nesting efforts in the mountain range and increasing populations of peregrine falcons in the western U.S., it is possible that over the life of the project, this species could nest on the North Slope of the San Bernardino Mountains.

Prairie Falcon (Falco mexicanus) **RE-will update with more recent version
Prairie falcons are a SBNF Watchlist species and a CDFW Watchlist species.

Life History and Baseline Information – Prairie Falcon: Prairie falcons inhabit shrub-steppe desert, open desert scrub, grassland, mixed shrub-grasslands, and alpine tundra. Prairie falcon habitat typically consists of dry open terrain, either hilly or level. Nests are located on cliffs,

generally in arid open areas. Desert scrub and grasslands are preferred foraging habitats in southern California. This species has declined in the coastal foothills of southern California, probably due to the loss of foraging habitat.

Prairie falcons breed in mid-April on cliff ledges or rock outcrops in open regions. Nests are typically scrapes located 30-40 feet high on a cliff or rock outcrop; they are occasionally found as high as 400 feet. Abandoned nests built by other birds are rarely used by prairie falcons. The female incubates a single clutch; clutches usually contain four-five eggs. Incubation lasts for approximately 29-31 days. The male feeds the female, rarely taking part in incubation duties.

Prairie falcons are described as more of a wanderer than a true migrant. They move seasonally, probably in response to food availability. Most of the species' southward movements occur between late August and late October, with the main return flight taking place in early March to late April.

Primary foods taken by prairie falcons include horned larks (*Eremophila alpestris*) and other small passerines, lizards, ground squirrels (*Spermophilus* spp.), and small rodents. Prairie falcons employ two main hunting strategies: one is to flush a prey item and fly along a route meant to conceal the prairie falcon until the last moment; the other is to patrol long distances close to the ground until it may surprise its quarry. Prairie falcons defend a small area around the nest site from conspecific and other intruders. However, prairie falcons forage over large, undefended areas, and do not defend territories at all during winter. (Source: **USFS 2006** Forest Plan Species Account)

Population Status and Threats – Prairie Falcon*:* The species is legally harvested in 19 states. Falconers legally take an estimated 0.2 percent of the prairie falcon population each year, making it the second most commonly harvested raptor in the United States. Because of prairie falcons' strong association with cliffs as nesting sites, they are especially susceptible to habitat loss adjacent to suitable nest structures. Prairie falcons can be adversely affected by large-scale agricultural development, especially in foraging areas with high densities of ground squirrels. Much of the prime foraging area for prairie falcons has been lost to development on the coastal side of the San Gabriel Mountains south to the Mexican border. The San Gabriel, San Bernardino, and Santa Ana Mountains are expected to be surrounded by urban development in the next 20-50 years. (Source: **USFS 2006** Forest Plan Species Account)

Occurrence on North Slope – Prairie Falcon*:* Prairie falcons are known to occur on the North Slope and adjacent SBNF lands. There is a migrant prairie falcon record at Cushenbury Spring (**Kielhold 1993**). There are several records on the North Slope, including in Crystal Creek, Dry Canyon, and Deep Canyon (SBNF records). They were detected in near the Mitsubishi mining area in May 2008 (**MacKay and Thomas 2008**). Suitable habitat exists for foraging and nesting exists in and near the project area. Nesting is suspected but has not been confirmed.

RAPTOR MANAGEMENT

The intent of the management actions described here is to have all mine operators with activities on National Forest system lands on the North Slope follow these measures in order to lower the

risk to raptors as a result of mining operations. These measures have been developed in conjunction with U.S. Fish and Wildlife, California Department of Fish and Wildlife, and the U.S. Forest Service. They are intended to provide for equity and consistency between the mine operators in terms of conducting activities on the North Slope that result in loss/degradation of nesting raptor (specifically golden eagle, California condor, peregrine falcon, and prairie falcon) habitat or disturbance that could harm, harass, or result in mortality of these species.

RAPTOR MANAGEMENT MEASURES

Mining companies commit to funding and participating in the following efforts. SBNF will also participate, and will contribute subject to availability of appropriated funds.

1. *Initial Evaluation/Identification of North Slope Nesting Habitat*: The objectives are to provide baseline population data and identify known active and inactive nests as well as likely nest sites. By doing an initial 1-time survey that covers the North Slope, we will gain an understanding of the minimum number of nesting territories that are currently active and the species currently nesting in the area. This will also provide a map of the known and likely nest sites.

   This initial evaluation would be a 1-time effort and cost. Most of the cliff-nesting raptor nest sites have been identified in previous surveys (Pete Bloom, pers. communication). This effort should be a matter of consolidating existing data and re-checking those areas and ground surveying trees/towers, and preparing a report and maps. This initial evaluation will help make annual monitoring (described in Item #2) more focused and efficient.

   For golden eagles, the USFWS's guidelines include a standard survey area of ten miles from the activity for solar, wind, and mining projects. This is based on the maximum practicable distance that a golden eagle typically travels from the nest centroid for foraging. Based on knowledge of the proposed North Slope mining projects, the topography, and an understanding of golden eagle biology, the USFWS has modified the survey area for this area to include the entire north slope area from near Terrace Springs west to the White Mountain, , from the toe of the slope to slightly south of the ridgeline (see attached map).

   Using smaller reconnaissance areas focused on areas of potential impacts would not allow for confident detection of nesting raptors that would likely be present in project areas and most at risk of impacts or injury.

   Annual Monitoring of Nest Sites: Annual monitoring of raptor nest sites on the North Slope is necessary to determine which raptor nesting territories are active in any given year and where they are relative to the active mining operation areas. It will also provide occupancy trend data over time. Because Step 1 will have identified the active and inactive raptor nests as well as areas of potential nest sites, this annual survey effort should be very focused and efficient (checking known nest sites and the previously-identified high quality habitat).

   Monitoring Objectives: The monitoring efforts will determine occupancy for known nest sites, species occupying the nest, chronology of nest building, egg laying, brooding, hatching,

fledging, etc., and nesting success. Over time, the monitoring efforts will provide trend data for raptors that are likely to be foraging around the active mining operations. After 5 years of monitoring and data gathering to establish baseline conditions, a reduction of the survey effort will be evaluated.

Monitoring Frequency and Duration: Monitoring of known nest sites will be conducted annually. If any 5-year annual monitoring period passes without an occupied raptor nest being located within the survey area, a reduction in survey frequency may be considered. If an active nest is located within the survey area, the survey frequency would resume or continue annually for the next 5 years. These survey requirements would continue for the duration of active mining operations.

Monitoring Area: The monitoring area has been delineated by the Forest Service in cooperation with the USFWS (see attached map). The area encompasses the North Slope area between White Mountain on the west and Terrace Springs on the east.

Monitoring Protocol/Methodology: Methodology will follow established protocols. Golden eagle reconnaissance and monitoring shall follow USFWS Interim Guidelines[1] and any future revisions to these guidelines. Surveys for other raptors will follow currently-applicable USFWS protocols or accepted survey standards. Where protocols do not exist, the survey techniques will be approved by the USFS prior to any field work. In the future, survey methodologies should consider new survey technologies with lower likelihood of disturbing both bighorn sheep and nesting raptors.

Monitoring efforts will be ground-based. Because of the disturbance potential for bighorn sheep, helicopter reconnaissance and monitoring will not be used.

Monitoring for golden eagles will start at the beginning of the courtship period (predicted for the survey area to be early to mid-January), to ensure detection of nesting attempts and abandonment. As nest occupancy and phenology of nesting raptors on the North Slope becomes better understood, the timing of survey efforts may be adjusted.

Notifications: Nest structures and/or evidence of an occupied nest territory detected during monitoring will be reported to the Forest Service biologist via email within 48 hours of detection. Monitoring results of individual flying or perched raptors, and unoccupied nests will also be reported. The Forest Service will coordinate appropriate notification, as necessary, with USFWS or CDFW.

Surveyor Qualifications: Monitoring will be conducted by qualified biologists who have verifiable prior experience, are directly knowledgeable of the species and the survey protocols, and who are approved by the Forest Service. Resumes should be submitted to the Forest Service for approval prior to hiring/contracting.

Monitoring for Behavioral Responses to Mining Activities: If, during annual monitoring, an active raptor nest is located within 1.5-miles of an active blasting site, site-specific nest monitoring

during the breeding season would be conducted to assess nesting success and disturbance responses. This monitoring will be to determine:

- Chronology of nest building, egg laying, brooding, hatching, fledging, etc.
- Reproductive success
- Behavioral responses to mining activities (including blasting)

Golden eagles are very sensitive to noise and visual stimuli; their senses of hearing and sight are much more acute than a human's. As such, there is greater potential for disturbance at farther distances. The data from those monitoring efforts and disturbance responses will be used to evaluate and develop appropriate management tools (*e.g.*, blasting techniques, noise and seismic attenuators, timing of blasting, etc.).

Additionally, the data would be used to refine the need and guidelines for future monitoring. If nesting eagles within certain distances of active mines (including blast sites) do not exhibit any changes in behavior, the monitoring requirement may be altered (*e.g.*, reduce the distance that triggers monitoring) or ceased.

2. *Coordination:* If an occupied nest for a federally-protected species (as of 2013, includes golden eagle and California condor) is found within 1.5 miles of an active quarry operation, the SBNF would conduct an evaluation to determine if an "incidental take" permit should be requested from U.S. Fish and Wildlife Service, under the applicable law (Endangered Species Act or federal Bald and Golden Eagle Protection Act).

STANDARD DESIGN FEATURES FOR MINING AND OTHER PROJECTS ON THE NORTH SLOPE

General

DF-1. Participate in the North Slope Raptor Conservation Strategy.

DF-2. Disturbance footprints for mine operations and development of new quarries and roads shall be limited to the greatest extent possible to the goal of minimizing impacts to adjacent habitat and sensitive biological resources.

DF-3. Any soil bonding or weighting agents to be used on unpaved surfaces shall be non-toxic to wildlife and plants and non-attractants for wildlife.

DF-4. All vehicles and equipment shall be maintained in proper working condition to minimize the potential for spill of motor oil, antifreeze, hydraulic fluid, grease, or other hazardous materials; except as necessary to repair or remove disabled vehicles or equipment, vehicle servicing shall take place only at a designated area.

DF-5. Maintain facilities and grounds in a manner that minimizes any potential impacts to raptors, predators, and scavengers (*e.g.*, minimize storage of equipment near active quarries that may attract prey, remove trash/garbage daily, etc.). All trash and food-related waste shall be secured in self-closing animal-proof containers and removed daily

from the site.

DF-6. No recreational target shooting will occur on NFS lands.

DF-7. The mine operators shall conduct wildlife/plant awareness programs for employees (including new employee orientation and annual refresher trainings). The program will address raptor nest awareness. This will include the importance of avoiding harassment/disturbance, adherence to speed limits, adherence to defined project boundaries, reporting guidelines, etc. The Forest Service will provide assistance in developing the training program.

DF-8. Avoid practices that attract/enhance prey populations and opportunities for raptor hunting or scavenging near active quarries, haul roads, and processing areas. This would also help discourage the spread of non-native birds; to discourage the spread of disease and pathogens, etc.

DF-9. Reduce vehicle collision risk to raptors and other scavengers by removing animal carcasses from haul and access roads immediately.

DF-10. New powerlines should be buried to reduce avian collisions and electrocution. Where it is not possible to bury lines, the Avian Power Line Interaction Committee (APLIC) guidance on power line construction and design (APLIC 2006).

Reclamation

The timing and planning of reclamation measures should consider improving or creating suitable foraging and nesting habitat for raptors. These measures may include:

RE-1. Phase reclamation where possible to re-establish suitable habitat for prey species in areas where mining activities have ceased.

RE-2. Where perch structures are lacking, consider construction/installation of artificial perches (*e.g.*, poles, rock piles, etc.) for foraging.

RE-3. Restrict vehicle use and human activity to the extent possible in reclamation areas. Remove and reclaim roads where possible.

RE-4. Revegetate with local native plant species that are favorable for raptor prey species.

RE-5. During reclamation, create suitable cover for prey species by considering spatial features on the landscape. Planting in groupings and mosaics and construction of brush and rock piles should be considered.

RE-6. If natural water sources are lacking in reclamation areas, evaluate the feasibility of artificial water sources (wildlife drinkers, guzzlers, catchment structures, etc.) during the reclamation period.

POSSIBLE PROTECTION MEASURES BASED ON NEED AS DETERMINED BY MONITORING RESULTS

Because this is viewed as a long-term management effort with the expectation that the mining operations may exist a century or more after approval, these measures are viewed as a tentative toolbox of possible approaches. Depending on site-specific conditions, one or more of these measures may be appropriate. Alternatively, development of new measures may be more appropriate, especially in response to changes in mining technology, changes in wildlife monitoring/management techniques, and based on a better understanding of the ecology of North Slope raptors.

PM-1. Where nest monitoring detects changes in behavior of nesting raptors associated with blasting activities, use of noise attenuation devices or techniques (*e.g.,* blast mats, different blasting compounds, etc.) would be used during the breeding season. In some cases, if a nest were extremely close (with ½-mile), noise attenuation devices or techniques should be considered without waiting for monitoring results.

PM-2. Where disturbance or mortality risk is determined to be very high due to close proximity (within ½-mile), a Limited Operating Period (LOP) should be considered with a restriction on blasting (or other activities likely to cause nest abandonment or failure) during the breeding season.

PM-3. If suitable nesting habitat is degraded to the point that suitable nest sites are a limiting factor, consider construction of artificial nest platforms at suitable sites away from disturbance sources.

DRAFT

[1] Golden eagle reconnaissance and monitoring shall follow USFWS Interim Guidelines (Pagel *et al.* 2010 – Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance, USFWS Division of Migratory Birds, Washington, DC) and any future revisions to these guidelines. Monitoring for other raptors will follow currently-applicable USFWS protocols or accepted survey standards.

The ground observation survey guidelines for golden eagles are summarized here (see the Pagel *et al.* 2010 for complete guidelines):

- Observation posts for monitoring known territories will be no closer than 300 meters for extended observations, and generally no further than 700 meters, where terrain allows. Maximum observation post distance would be 1600 meters.
- To inventory and determine occupancy of cliff systems, there will be at least 2 observation periods per season. To determine fledging success, additional observations may (or may not) be necessary. territory occupancy can be confirmed.
    - Observation periods will last at least 4 hours for known nest sites, or until
    - Observation periods will last for at least 4 hours per 1.6 km of cliff system, based from the center point of that cliff complex.
    - Observation periods will be at least 30 days apart for monitoring efforts.
- To collect monitoring data at a known nest territory, there will be at least 2 observation periods per season.
    - Observation periods from ground observation points will last at least 4 hours for known nest sites or until nesting chronology can be confirmed per visit. Observation periods will be at least 30 days apart.

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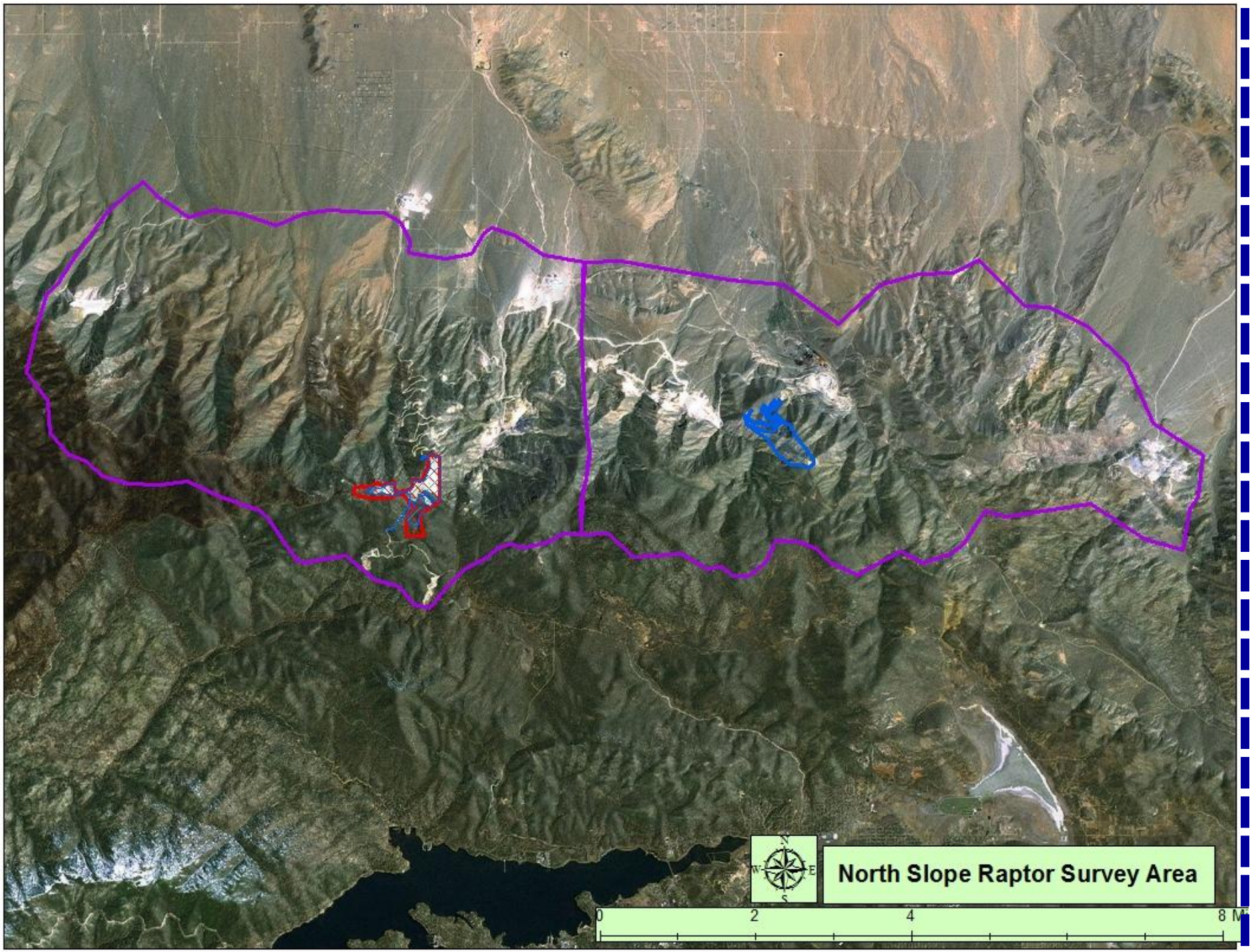
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Walters, C. J. 1986. Adaptive management of renewable resources. Macmillan, New York, New York, USA.

Websites with Draft Conservation Plan Guidance:

http://www.fws.gov/windenergy/docs/ECP_draft_guidance_2_10_final_clean_omb.pdf

There are a number of example "Bird and Bat Conservation Strategies" on-line that have been developed for renewable energy projects. Some examples:

Energy.gov

Centinelasolar.com

Minnesota State Conservation Strategies

Separate Attachments

Interim Golden Eagle Technical Guidance: Inventory and Monitoring Protocols; and Other Recommendations in Support of Golden Eagle Management and Permit Issuance. Pagel *et al.* 2010.

Eagle Conservation Plan Guidance: Module 1 - Land-Based Wind Energy (Version 2). U.S. Fish and Wildlife Service. April 2013.

MEMORANDUM OF UNDERSTANDING

among

USDI BUREAU OF LAND MANAGEMENT
CALIFORNIA DESERT DISTRICT;

the

USDA FOREST SERVICE,
SAN BERNARDINO NATIONAL FOREST;

the

COUNTY OF SAN BERNARDINO;

the

CALIFORNIA NATIVE PLANT SOCIETY;

and

VARIOUS PRIVATE PARTIES

This **MEMORANDUM OF UNDERSTANDING** (this "MOU") is hereby entered into as of this 29th day of April, 2003 by and among the United State Department of Interior Bureau of Land Management, California Desert District ("BLM"); the United States Department of Agriculture Forest Service, San Bernardino National Forest ("Forest Service"); the County of San Bernardino ("County"); the California Native Plant Society ("CNPS"); various private parties who have executed this MOU as the "Initial Transaction Parties"; various private parties who execute this MOU in the future with respect to a specified mining project by amendment to this MOU as "Compliance Parties"; and various private parties who execute this MOU in the future by amendment to this MOU as "Credit Holders."

A. Background and Purpose. The purpose of this MOU is to provide a framework for cooperation to implement the Carbonate Habitat Management Strategy dated April 29, 2003, which is hereby incorporated herein by reference (the "CHMS"). In the event of any conflict between the CHMS and the terms of this MOU, this MOU shall control.

1. On August 24, 1994, the following five plant species that are associated with the carbonate geology of the northeastern San Bernardino Mountains and adjacent Lucerne Valley were listed as threatened or endangered under the federal Endangered Species Act of 1973, as amended (the "ESA"): Cushenbury buckwheat (*Eriogonum ovalifolium* var. *vineum*), Cushenbury milk-vetch (*Astragalus albens*), Cushenbury oxytheca (*Oxytheca parishii* var. *goodmaniana*), Parish's daisy (*Erigeron parishii*), and San Bernardino Mountains bladderpod (*Lesquerella kingii* var. *bernardina*). Four of these plants (all but the San Bernardino Mountains blad-

derpod) shall be referred to collectively as the "Carbonate Plants".The Carbonate Plants occur on commercially valuable limestone deposits.

2. The coincidence of limestone deposits and habitat for the Carbonate Plants creates a potential for conflict between the public interest in, and ESA requirement of, preserving the Carbonate Plants, on the one hand, and the public interest and private property interest in mining the limestone deposits, on the other hand. The CHMS was developed over a period of about four years with the involvement of all of the initial parties to this MOU, the U. S. Fish and Wildlife Service ("USFWS"), and others to provide a strategy to resolve this potential conflict within an area identified in the CHMS as the Carbonate Habitat Management Area (the "CHMA").

3. The CHMS is designed to allow certain mining activities to occur while conserving habitat for the Carbonate Plants by establishing an initial habitat reserve for the Carbonate Plants (the "Habitat Reserve") that will be increased in size over time.

4. Under the CHMS, private parties (the Credit Holders hereunder) may receive tradable credits ("Conservation Credits") in exchange for making voluntary contributions to the Habitat Reserve ("Reserve Contributions").

5. Under the CHMS, individual mining projects within the CHMA can be brought into compliance with the ESA with respect to the Carbonate Plants ("ESA Compliance") upon satisfying the conditions of the CHMS for such compliance, which includes, without limitation, making sufficient Reserve Contributions or providing sufficient Conservation Credits as compensation for a proposed destruction of Carbonate Plant habitat. A private party (a Compliance Party hereunder) who satisfies the conditions for a parcel to achieve ESA Compliance is said to "obtain ESA Compliance" for that parcel.

6. Upon execution of this MOU, BLM and Forest Service shall cooperate to prepare and submit to USFWS a biological assessment of the effects of implementing the CHMS (the "CHMS Biological Assessment") in order to initiate a consultation with the USFWS under Section 7 of the ESA (the "CHMS Section 7 Consultation") in order to obtain from the USFWS a biological opinion under Section 7 of the ESA regarding implementation of the CHMS (the "CHMS Biological Opinion").

7. It is the intent of the parties hereto that if the CHMS Biological Opinion states that the implementation of the CHMS in accordance with its stated terms would not result in jeopardy to the continued existence of the Carbonate Plants or the destruction or adverse modification of critical habitat for the Carbonate Plants, the CHMS will be implemented consistent with the CHMS Biological Opinion.

8. The Initial Transaction Parties have mining interests within the CHMA and desire to enter into certain transactions with the federal government, including Forest Service or BLM, as applicable, with respect to their mining land and/or claims (the "Initial Transactions"). Such transactions may involve contributing land or claims

to the Habitat Reserve in exchange for Conservation Credits, obtaining ESA Compliance for particular mining parcels, selling land or claims to the federal government, and/or exchanging land or claims for land owned by the federal government.

9. By cooperating under this MOU to implement the CHMS as described in subsection 4 above, the parties hereto increase the likelihood of enjoying the benefits of the CHMS, as described in Section B below, without interruption.

10. As it is in the interest of the public to receive both the economic benefits of ongoing carbonate mining within the CHMA and environmental benefits of preserving the Carbonate Plants, the cooperation of the parties under this MOU serves the mutual interest of the parties and the public.

B. Statement of Mutual Benefit and Interests.

1. BLM shall benefit from the successful implementation of the CHMS in accordance with this MOU by:

(a) Establishing a process for ensuring compliance of mining projects located on lands it manages within the CHMA with the ESA as to Carbonate Plants that saves time and resources for BLM and its applicants.

(b) Establishing a biological framework for addressing the Carbonate Plants in future Federal Land Plans and other land management or ESA compliance plans that include portions of the CHMA, as well as in the NEPA compliance documentation that accompanies such plans.

(c) Attaining compliance with certain stipulations it has entered into with respect to certain pending litigation.

2. Forest Service shall benefit from the successful implementation of the CHMS in accordance with this MOU by:

(a) Establishing a process for ensuring compliance of mining projects located on lands it manages within the CHMA with the ESA as to Carbonate Plants that saves time and resources for Forest Service and its applicants.

(b) Establishing a biological framework for addressing the Carbonate Plants in future Federal Land Plans that include portions of the CHMA, as well as in the NEPA compliance documentation that accompanies such plans.

(c) Attaining compliance with certain stipulations it has entered into with respect to certain pending litigation.

3. County shall benefit from the successful implementation of the CHMS in accordance with this MOU by:

(a) Establishing a process that can be used to streamline the County's review under the California Environmental Quality Act of the biological impacts of mining projects on private land within the CHMA.

(b) Establishing a process that can be used to streamline the County's implementation of the California Surface Mining and Reclamation Act of 1975, as amended.

4. CNPS shall benefit from the successful implementation of the CHMS in accordance with this MOU because the CHMS coincides with CNPS' interest in conserving rare and endangered plants by providing a means for maintaining and managing the geomorphic and ecological processes of the landscape in large, well-placed blocks of habitat where the Carbonate Plants are found within the CHMA such that the Carbonate Plants are likely to persist indefinitely.

5. The Initial Transaction Parties shall benefit from the successful implementation of the CHMS in accordance with this MOU by:

(a) Receiving the benefits of being Compliance Parties and Credit Holders (see subsections 6 and 7 below), depending whether the transactions into which they enter place them in one or both of those statuses.

(b) Obtaining increased certainty regarding how the existence of habitat for Carbonate Plants on their particular holdings will be addressed.

6. The Compliance Parties shall benefit from the successful implementation of the CHMS in accordance with this MOU by:

(a) Establishing increased regulatory certainty under the ESA that the most valuable mineral deposits within the CHMA may be mined in the future.

(b) Establishing a definitive, streamlined process for future mining activities within the CHMA to comply with the ESA and County regulation of the Carbonate Plants.

(c) Establishing a framework for addressing impacts to the Carbonate Plants under the National Environmental Policy Act to the extent that provisions of the CHMS are incorporated into future Federal Land Plans.

7. The Credit Holders shall benefit from the successful implementation of the CHMS in accordance with this MOU by:

(a) Obtaining a means to receive Conservation Credits in exchange for making Reserve Contributions, which credits may be used, sold, or held, to obtain ESA Compliance.

(b) Obtaining a means to offer precise compensation given for impacts to Carbonate Plants, avoiding overcompensating to meet ESA requirements.

8. The parties shall mutually benefit from the successful implementation of the CHMS in accordance with this MOU by obtaining a means to facilitate economic limestone mining activity while conserving the Carbonate Plants, all under a sensible and efficient regulatory regime.

In consideration of the above premises, the parties agree as follows:

C. BLM and Forest Service shall each:

1. Cooperate together to expeditiously prepare the CHMS Biological Assessment.

2. Coordinate the mining and land use regulations administered by the Resource Management Agencies with the provisions of the CHMS to facilitate the use of the CHMS by prospective Compliance Parties to obtain ESA Compliance, such as by coordinating the administration of their respective land management plans (the "Federal Land Plans") with the CHMS.

2. In processing applications for mining activities, accept compliance with the CHMS as compliance with the Federal Land Plans, the ESA, and other federal laws and regulations with respect to impacts on the Carbonate Plants (subject, however, to review under the National Environmental Policy Act ("NEPA")).

3. Manage those portions of the Habitat Reserve that fall under their respective jurisdictions in a manner that is consistent with the CHMS.

4. Facilitate federal land designations as contemplated by the CHMS to help form the Habitat Reserve.

5. Facilitate federal land purchases and exchanges as contemplated by the CHMS to help form the Habitat Reserve.

6. Facilitate acceptance by the federal government of title to privately owned land contributed to the Habitat Reserve under the CHMS.

7. Notify the parties hereto if at any time Congress or the Secretary of the Interior determines that all or any part of the Habitat Reserve is no longer necessary to provide for the conservation of the Carbonate Plants and, as a consequence, an existing mineral withdrawal or other use restriction has been removed as to such land.

8. Work with the USFWS to develop and implement a plan for monitoring the effectiveness of, compliance with, and biological conditions under the CHMS.

9. Monitor the implementation of the CHMS for consistency with the CHMS Biological Opinion and immediately report to the parties hereto any potential or realized inconsistencies.

10. Monitor the CHMA for conditions that could require re-initiation of the CHMS Section 7 Consultation and immediately report any such conditions to the parties hereto.

11. In the event of a re-initiation of the CHMS Section 7 Consultation, suspend or partially suspend operation of the CHMS, if required by Section 7(d) of the ESA, and report the suspension to the parties hereto.

D. In addition to Section C above, Forest Service shall:

1. Maintain and update a geographical database of Carbonate Plant habitat within the CHMA (the "Habitat Inventory"), as described in the CHMS.

2. Administer the creation, use, and transfer of Conservation Credits as described in the CHMS.

3. Carry out the regular reporting functions described in the CHMS.

4. Receive, maintain, and make publicly available records and reports it receives pursuant to the CHMS, such as revegetation reports and various monitoring reports.

5. Maintain a complete original of this MOU, along with any and all amendments hereto, and make a duplicate thereof available to any of the parties hereto at any time upon request.

E. County shall:

1. Adopt standardized conditions of approval for addressing impacts to Carbonate Plants by proposed mining and reclamation projects in a manner that is consistent with the CHMS. Such conditions of approval shall apply under SMARA, the County land use ordinances, and CEQA, subject to the approval of the Board of Supervisors on a project-by-project basis.

2. Such conditions of approval shall provide for (a) habitat compensation requirements consistent with the those set forth in the CHMS and (b) revegetation standards and incentives consistent with those set forth in the CHMS.

F. CNPS shall: Acknowledge, as an active participant in the Working Group, representing the conservation interests of the Carbonate Plants and assuring that from their perspective, that the CHMS provides a good and practical solution to the conflicts between the public economic interest in ongoing carbonate mining and the public interest in conserving the Carbonate Plants within the CHMA.

G. The Initial Transaction Parties shall: Negotiate in good faith with BLM and/or Forest Service to enter into one or more transactions that directly or indirectly result in land within the CHMS containing habitat for the Carbonate Plants to be added to the Habitat Reserve. Such transactions may consist of a wide variety of components that are described in the CHMS, including, without limitation, selling land or mining claims to the federal government, exchanging land or mining claims to the federal government for government-owned land, and making Reserve Contributions in exchange for Conservation Credits. At the discretion of the respective Initial Transaction Parties, such transactions may be contingent upon both the issuance of a favorable CHMS Biological Opinion and upon the simultaneous closing of transactions involving some or all of the other Ini-

tial Transaction Parties. Although the Initial Transaction Parties intend to enter into such transactions, they are not contractually bound by this MOU to do so on any particular terms or to do so at all. Moreover, the Initial Transaction Parties may require certain other agency and industry acts to occur within a short time after the execution of this MOU before the Initial Transactions may be consummated. Each Initial Transaction Party may enter into transactions under the CHMS other than Initial Transactions both before and after such party or other Initial Transaction Parties enter into Initial Transactions. Each Initial Transaction Party may also, at any time, seek compliance with the ESA for projects within the CHMA outside and apart from the CHMS.

H. The Compliance Parties shall:

1. Remain in compliance with the ESA with respect to the covered mining project, taking into account that Covered Activities on the subject land are deemed to be in compliance with the ESA.

2. Remain in substantial compliance with all reclamation requirements that apply to the covered mining project.

3. Comply with the terms of any Use Restriction Agreements entered into by applicant under the CHMS in connection with making Relocatable Contributions.

4. Comply with the terms of any Surface Entry Restrictions entered into by applicant under the CHMS in connection with making split estate Reserve Contributions.

5. Conduct any future mining operations occurring within the area covered by the CHMS prior to the consummation of the Initial Transactions in a manner which is consistent with the terms of the CHMS.

Substantial compliance with the terms of this Section H is a condition for Compliance Parties to retain ESA Compliance under the CHMS.

I. The Credit Holders shall: Follow the processes set forth in the CHMS with respect to the use or transfer of the Conservation Credits they hold.

J. It is mutually agreed and understood by all parties that:

1. *Freedom of Information Act.* Any information furnished to Forest Service or BLM under this MOU is subject to the Freedom of Information Act (5 U.S.C. 552).

2. *Modification.* This MOU may be modified only by a written amendment signed and dated by all parties who could be adversely affected by such modification. Notwithstanding the foregoing, this MOU may be amended at any time to add additional Compliance Parties or additional Credit Holders without the consent of any other party.

3. *Critical Habitat Modification.* The parties to this MOU are planning on filing a petition requesting revision of the critical habitat designation boundaries for the carbonate plants to conform with the boundaries expressed in the CHMS.

4. *Participation in Similar Activities.* This MOU in no way restricts any of its parties from participating in similar activities with other public or private agencies, organizations, and individuals.

5. *Commencement/Expiration Date.* This MOU is executed as of April 29, 2003 and is effective until that date which is five years after the effective date. This MOU is subject to automatic extension for subsequent five-year periods unless one or more of the parties hereto objects to such extension by written notice to Forest Service at least 30 days, but no more than 120 days, prior to any expiration date, in which event this MOU shall expire upon the expiration date then in effect.

6. *Contingencies.* This MOU shall take effect upon the satisfaction of all of the following contingencies:

(a) Revision of the designation of critical habitat by USFWS to avoid conflict with the CHMS.

(b) Issuance of the CHMS Biological Opinion stating that the implementation of the CHMS in accordance with its stated terms would not result in jeopardy to the continued existence of the Carbonate Plants or the destruction or adverse modification of critical habitat for the Carbonate Plants.

(c) Creation of escrows providing for the simultaneous closing of those Initial Transactions whose Initial Transaction Parties desire such simultaneous closings.

(d) Inclusion of the CHMS in the Federal Land Plans of BLM and Forest Service that govern the areas encompassing the CHMA.

(e) Adoption by the County of standard conditions of approval consistent with the CHMS.

(f) Commitment of the federal funding, if any, needed to implement all Initial Transactions involving federal purchases of land and/or claims.

7. *Dependency of CHMS Biological Opinion.* The parties acknowledge that (a) the CHMS is wholly dependent on the issuance and continued validity of the CHMS Biological Opinion and the successful and continued implementation of its terms and conditions; and (b) the CHMS may be suspended, in whole or in part, pending any re-initiation of the CHMS Section 7 Consultation.

8. *Termination.*

(a) This MOU shall terminate automatically with respect to any Compliance Party whose mining projects that have obtained ESA Compliance under the CHMS have all ceased operations and had their respective underlying land fully reclaimed in accordance with all applicable laws and regulations.

(b) This MOU shall terminate automatically with respect to any Credit Holder who no longer holds any Conservation Credits.

(c) This MOU shall terminate automatically as to any Initial Transaction Party who no longer has any transaction pending under this MOU, except that this MOU shall continue in effect as to any status such party may have as a Compliance Party or as a Credit Holder if, until termination under subsections (a) and/or (b) above, as applicable.

(d) This MOU shall terminate automatically as to all parties in the event that the CHMS Biological Opinion states that the CHMS would result in either jeopardy to any of the Carbonate Plants or adverse modification of the critical habitat for any of the Carbonate Plants.

(e) No termination of, withdrawal from, or failure to comply with this MOU as to one or more of the parties shall change the effect of this MOU as to the other parties.

9. *Principal Contacts*. The principal contact and contact information for each party hereto are as shown on the signature page hereto for such party.

10. *Notices*. Forest Service shall notify the principal contact of each of the other parties at the addresses set forth on the respective signature pages below of the occurrence of any of the following as soon as reasonably practicable after such occurrence: (a) any modification of this MOU, (b) any objection by any party hereto to an automatic extension of this MOU under Section 4 above, and (c) any attempt of any party hereto (whether or not authorized hereby) to withdraw from this MOU.

11. *Non-Fund-Obligating Document.* This MOU is neither a fiscal nor a funds obligation document as to Forest Service and BLM. Any endeavor or transfer of anything of value involving reimbursement or contribution of funds between the parties to this MOU will be handled in accordance with applicable laws, regulations, and procedures including those for Government procurement and printing. Such endeavors will be outlined in separate agreements that shall be made in writing by representatives of the parties and shall be independently authorized by appropriate statutory authority. This MOU does not provide such authority. Specifically, this MOU does not establish authority for noncompetitive award to the cooperator of any contract or other agreement. Any contract or agreement for training or other services must fully comply with all applicable requirements for competition. Nothing in this MOU obligates the expenditure of funds in violation of the federal Antideficiency clause.

12. *Consistency with Federal Law.* Nothing in this MOU shall be interpreted contrary to the statutes, rules, or regulations of the federal agencies. In the event of a perceived inconsistency, the statue, rule, or regulation will control the interpretation of this MOU. In the event that one or more of the provisions in this MOU are de-

termined to be inconsistent with any statue, rule, or regulation of the federal agencies, such determination will not render any other provision inconsistent.

THE PARTIES HERETO have executed this MOU in counterparts on the following pages. This MOU shall be deemed effective as of the date first above written upon its execution by BLM, Forest Service, and County; it shall become effective as to each additional party as of the date that such party executes this MOU.

BLM:

USDI Bureau of Land Management, California Desert District

By: Linda Hansen Date: 4-29-03

Linda Hansen, District Manager

Principal contact information:

District Manager
California Desert District
Bureau of Land Management
22835 Calle San Juan de los Lagos
Moreno Valley, CA 92553
(909) 697-5206 (phone)
(909) 697-5299 (fax)

FOREST SERVICE:

USDA Forest Service, San Bernardino National Forest

By: _____ Date: 4.29.03
Gene Zimmerman, Forest Supervisor

Principal contact information:

Mountaintop District Botanist
Big Bear Ranger Station
42300 North Shore Drive
P.O. Box 290
Fawnskin, California 92333
(909) 866-3437 (phone)
(909) 866-2867 (fax)

INITIAL TRANSACTION PARTY:

Butterfield Claims Holders

By: Ella Mae Shofner Butterfield Date: 4/29/03
Ella Mae Shofner Butterfield, representative

Principal contact information:

Ella Mae Shofner Butterfield
P.O. Box 1408
Paso Robles, CA 93447
(805) 238-1383 (phone)
(805) 237-0874 (fax)

INITIAL TRANSACTION PARTY:

Cushenbury Mine Trust

By: Frank Bitonti Date: 4-29-03

Frank Bitonti, Trustee

Principal contact information:

Frank Bitonti, Trustee
P.O. Box 401081
Hesperia, CA 92340
(760) 948-0678
(760) 948-1987 (Fax)

INITIAL TRANSACTION PARTY:

Mitsubishi Cement Corporation

By: _____ Date: 4/29/03
Michael W. Jasberg, Executive Vice President

Principal contact information:

Michael W. Jasberg, Executive Vice President
3633 Inland Empire Boulevard
Empire Tower, Suite 900
Ontario, CA 91764-4910
(909) 466-5900
(909) 466-5910 (fax)

INITIAL TRANSACTION PARTY:

OMYA (California) Inc.

By: _____ Date: 4-29-03

Jim Reddy, President

Principal contact information:

Jim Reddy, President
P.O. Box 825
Lucerne Valley CA 92356
760 248-7306
760 248-9115

INITIAL TRANSACTION PARTY:

Specialty Minerals Inc.

By: Douglas Mayger Date: 4/29/03

Doug Mayger, Plant Manager

Principal contact information:

Doug Mayger, Plant Manager
P.O. Box 558
Lucerne Valley Calif . 92356
(760) 248-5300 (phone)
(760) 248-6707 (fax)

APPENDIX E
CULTURAL RESOURCES

MANAGEMENT SUMMARY

McKenna et al. completed this Class III cultural resources investigation for the Bureau of Land Management (BLM) Barstow Field Office, Barstow, San Bernardino County, California. The study was completed under Field Authorization No. CA-680-12-17 (BLM State Permit No. CA-10-26), by Jeanette A. McKenna, M.A. and R.P.A., and Principal Investigator for McKenna et al. The studies were initiated in April, 2012, and completed in November, 2012. The field survey was conducted on May 21-22, 2012, also by Jeanette A. McKenna.

The APE was approved through consultation with James Shearer, BLM Archaeologist, Barstow Field Office. As approved, the APE consists of an 70 acre property described as being in the southern half of the southwestern quarter of Section 5, Township 3 North, Range 1 West (SBBM). McKenna et al. also included a buffer around the property, where accessible, to insure total coverage. The survey was completed by traversing paralleling transects at 10-15 meter intervals in areas were terrain permitted the systematic approach and discretionary coverage in the remaining areas.

Where the systematic survey was not possible, McKenna et al. conducted a subjective and/or reconnaissance level of investigation, following the terrain, working around vegetation and slopes, and avoiding slopes exceeding 40 degrees. All proposed or future activities to be conducted within this 70 acre property will be limited to this property and only existing access roads will be used. McKenna et al. calculated the APE to involve a minimum of 70 acres and a maximum of 110 acres (with the buffer). The survey involved approximately 70 acres of the overall 110 acres and emphasized areas of potential effect.

Previous research identified one prehistoric archaeological site within the project area (36-005556), a lithic scatter just northeast of the APE, but within the buffer zone. This site was previously impacted by the development of the White Knob Haul Road and little evidence of the site remains. In addition, in 2012, McKenna et al. recorded a historic period resource, 36-024514 (CA-SBR-15565H; the Fife Mining Claim Road). McKenna et al. concluded 36-005556 is not a significant resource, but has a potential to yield additional data that may change this conclusion. Overall, the area should be considered

sensitive for additional cultural resources and an archaeological monitoring program, as recommended for the adjacent haul road, should be considered.

The Fife Mining Claim Road (36-024514) is not a significant resource. It has been impacted by prior construction and no artifacts or other features were found in association with the segment of the road running through the current project area. Therefore, McKenna et al. is not recommending any additional studies with respect to this resource. McKenna et al. has completed updated archaeological site records for these resources and these forms are appended to this report.

At this time, given the nature of the resources presented in this report, McKenna et al. is not recommending any Phase III or Class IV investigations. Rather, McKenna et al. is recommending the eastern half of the proposed White Knob Land Sale project area be monitored in conjunction with the haul road improvements project and during future ground altering activities. Monitoring of the western half of the project area can be considered at a lesser level and at the discretion of the BLM archaeological review. The extent and duration of the monitoring program can be defined once future plans are defined.

_____ _____

Jeanette A. McKenna, Principal Investigator, McKenna et al. Date

CLASS III CULTURAL RESOURCES SURVEY

WHITE KNOB QUARRY REVISION PROJECT

Amendment to Reclamation Plan No. 86M-04
Lucerne Valley Area, San Bernardino County, California

For Submittal to:

Bureau of Land Management
Barstow Field Office
2601 Barstow Road
Barstow, CA 92311

Prepared for:

George A. Webber, President
Webber and Webber Mining Consultants, Inc.
101 East Redlands Boulevard, Suite 240
Redlands, CA 92373

Prepared by:

CRM TECH
1016 East Cooley Drive, Suite A/B
Colton, CA 92324

Bai "Tom" Tang, Principal Investigator
Michael Hogan, Principal Investigator

November 14, 2008
CRM TECH Contract No. 2280A
BLM Cultural Resources Use Permit No. CA-07-12
Fieldwork Authorization No. FA-680-09-06

NATIONAL ARCHAEOLOGICAL DATABASE INFORMATION

Author(s): Deirdre Encarnación, Archaeologist/Report Writer
Daniel Ballester, Archaeologist/Field Director
Laura H. Shaker, Archaeologist/Native American Liaison

Consulting Firm: CRM TECH
1016 East Cooley Drive, Suite A/B
Colton, CA 92324
(909) 824-6400

Date: November 14, 2008 (fieldwork completed on October 2-3, 2008)

Title: Class III Cultural Resources Survey: White Knob Quarry Revision Project, Amendment to Reclamation Plan No. 86M-04, Lucerne Valley Area, San Bernardino County, California

For Submittal to: Bureau of Land Management
Barstow Field Office
2601 Barstow Road
Barstow, CA 92311
(760) 252-6000

Prepared for: George A. Webber, President
Webber and Webber Mining Consultants, Inc.
101 East Redlands Boulevard, Suite 240
Redlands, CA 92373
(909) 793-3416

USGS Quadrangle: Butler Peak, Calif., 7.5' quadrangle (Sections 5-8, T3N R1W, San Bernardino Base Meridian)

Project Size: Approximately 298 acres

Keywords: Lucerne Valley area, southern Mojave Desert, San Bernardino County; Phase I/Class III historical/archaeological resources survey; Assessor's Parcel Nos. 446-011-04, -05, and -06 and 446-021-11 and -35; no "historic property" found

MANAGEMENT SUMMARY

Between September and November 2008, at the request of Webber and Webber Mining Consultants, Inc., CRM TECH performed a cultural resources study on approximately 298 acres of vacant land, including an existing quarry, in an unincorporated area near the community of Lucerne Valley, San Bernardino County, California. The study is a part of the environmental review process for a proposed amendment to Reclamation Plan No. 86M-04, which would increase the area authorized for the White Knob-White Ridge Limestone Mine operated by OMYA California, Inc., under permit by the U.S. Bureau of Land Management (BLM).

The Area of Potential Effects (APE) for the proposed undertaking is located on Assessor's Parcel Nos. 446-011-04, -05, and -06 and 446-021-11 and -35, within Sections 5-8 of T3N R1W, San Bernardino Base Meridian, as depicted in the USGS Butler Peak, Calif., 7.5' quadrangle. A total 47.5 acres of the APE consists of U.S. government land under the jurisdiction of the BLM, which mandates compliance with Section 106 of the National Historic Preservation Act of 1966, as amended.

The purpose of the present study is to provide the BLM with the necessary information and analysis to determine whether the proposed undertaking would have any effects on historic properties that may exist in or near the APE, as mandated by Section 106. In order to identify such historic properties, CRM TECH conducted a historical/archaeological resources records search, pursued historical background research, contacted Native American representatives, and carried out a systematic field survey.

Throughout the course of the study, no "historic properties," as defined by Section 106 regulations, were encountered within or adjacent to the APE. However, Native American input during this study suggests that the APE lies within or in close proximity to a potential site of traditional cultural value, which the Native American source did not identify but seeks to protect through further consultation with the lead agency. Based on these findings, CRM TECH recommends that the BLM initiate formal government-to-government consultation with the Tongva Ancestral Territorial Tribal Nation for additional information on the site of Native American cultural concern.

No other cultural resources investigation is recommended for the proposed undertaking unless project plans undergo such changes as to include areas not covered by this study. However, if buried cultural materials are encountered during any earth-moving operations associated with the undertaking, all work in that area should be halted or diverted until a qualified archaeologist can evaluate the nature and significance of the finds.

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INTRODUCTION

Between September and November 2008, at the request of Webber and Webber Mining Consultants, Inc., CRM TECH performed a cultural resources study on approximately 298 acres of vacant land, including an existing quarry, in an unincorporated area near the community of Lucerne Valley, San Bernardino County, California (Fig. 1). The study is a part of the environmental review process for a proposed amendment to Reclamation Plan No. 86M-04, which would increase the area authorized for the White Knob-White Ridge Limestone Mine operated by OMYA California, Inc., under permit by the U.S. Bureau of Land Management (BLM).

As currently proposed, the undertaking includes an increase to the disturbance limits of the quarry operations by 147 acres to account for boulder roll-down to the north and the west; removal and stabilization of talus materials on the western slope to minimize future roll-down; expansion of an existing overburden site by 15 acres, 10 of which are currently undisturbed; the addition of three new overburden sites; and modification to an existing access road to the White Knob-White Ridge Limestone Mine.

The Area of Potential Effects (APE) for the proposed undertaking is located on Assessor's Parcel Nos. 446-011-04, -05, and -06 and 446-021-11 and -35, within Sections 5-8 of T3N R1W, San Bernardino Base Meridian, as depicted in the USGS Butler Peak, Calif., 7.5' quadrangle (Fig. 2). A total 47.5 acres of the APE consists of U.S. government land under the jurisdiction of the BLM, which mandates compliance with Section 106 of the National Historic Preservation Act of 1966, as amended.

CRM TECH performed the current study to provide the BLM with the necessary information and analysis to determine whether the proposed undertaking would have any

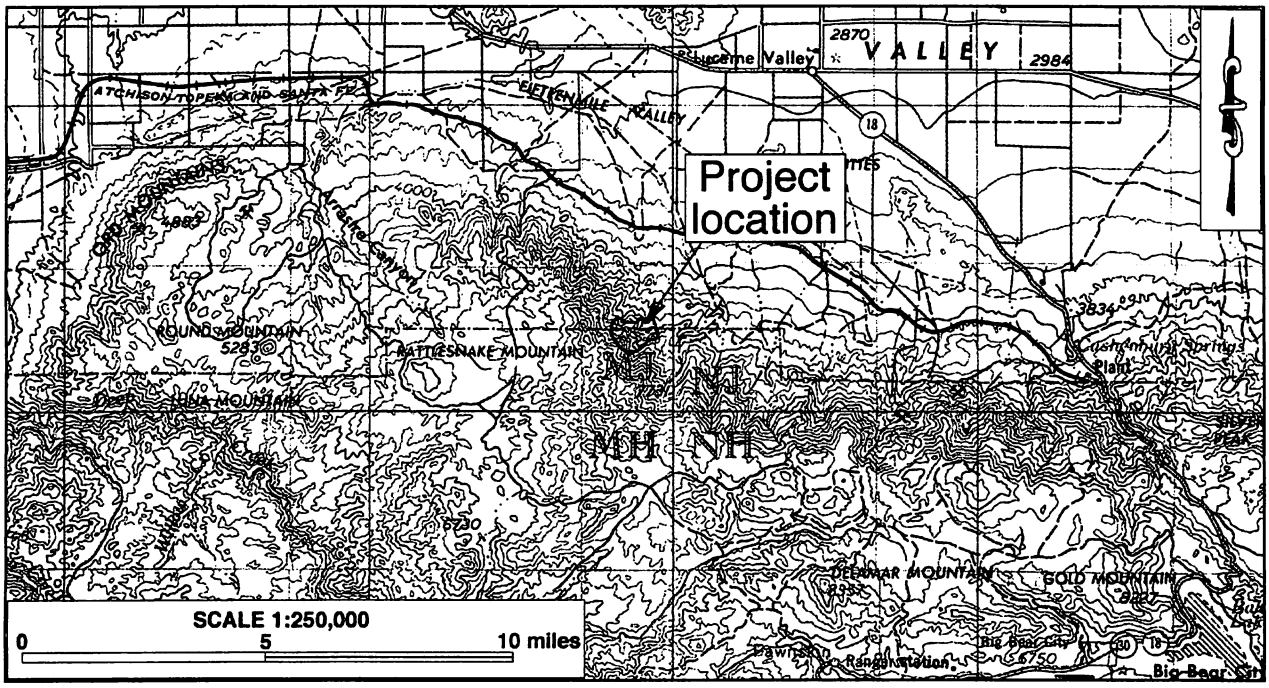

Figure 1. Project vicinity. (Based on USGS San Bernardino, Calif., 1:250,000 quadrangle [USGS 1969])

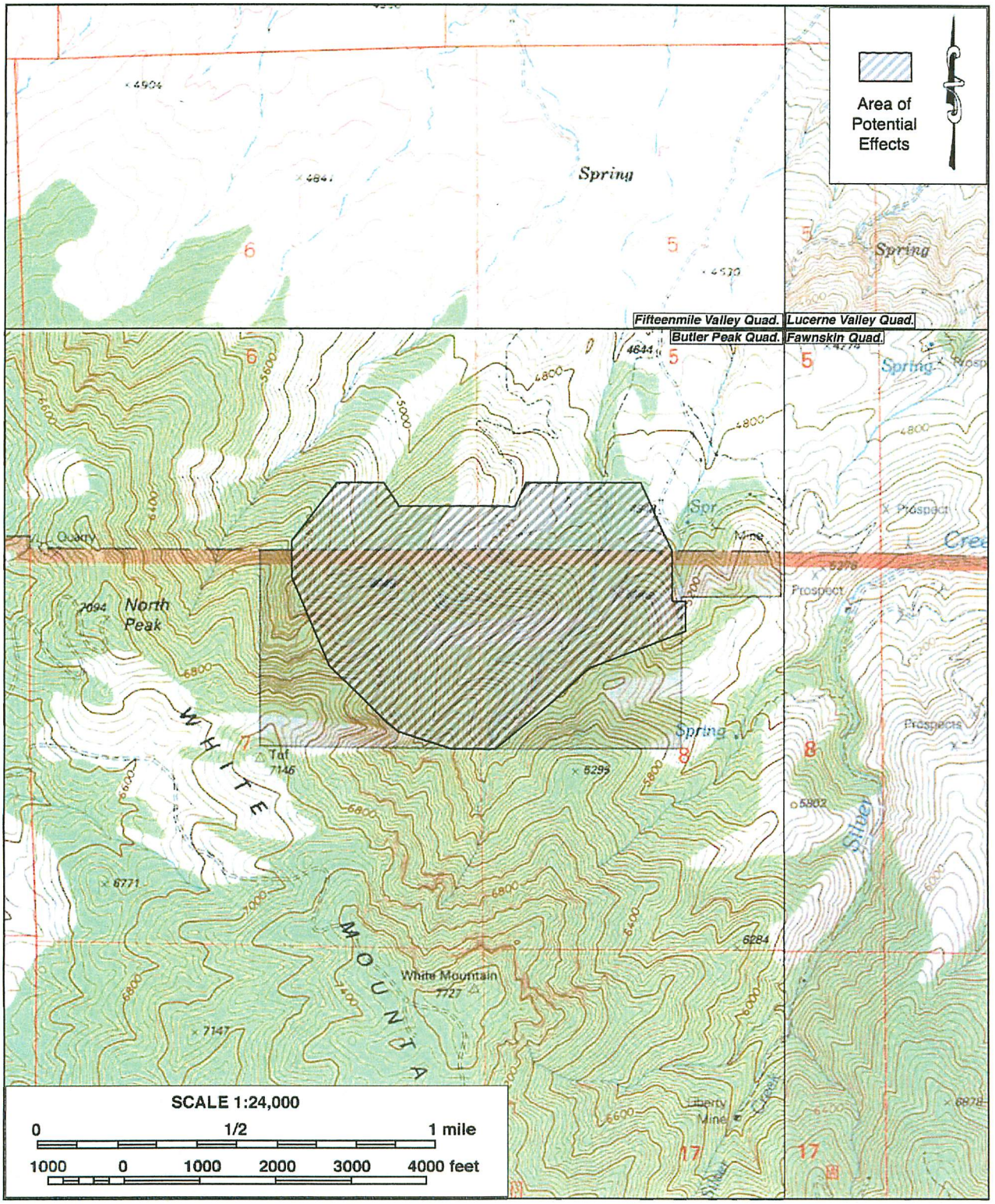

Figure 2. Area of Potential Effect. (Based on USGS Butler Peak, Fawnskin, Fifteenmile Valley, and Lucerne Valley, Calif., 1:24,000 quadrangles [USGS 1971; 1994; 1996a; 1996b])

effects on historic properties that may exist in or near the APE, as mandated by Section 106. In order to identify such historic properties, CRM TECH conducted a historical/ archaeological resources records search, pursued historical background research on the APE, contacted Native American representatives, and carried out a systematic field survey. The following report is a complete account of the methods and results of the various avenues of research, and the final conclusion of the study.

SETTING

CURRENT NATURAL SETTING

The APE is located in the foothills of the San Bernardino Mountains, overlooking the Lucerne Valley and the Fifteenmile Valley on the southern rim of the Mojave Desert. The climate and environment of the area is typical of the high desert region, so-called because of its higher elevation than the Colorado Desert to the southeast. The climate is marked by extremes in temperature and aridity, with summer highs reaching well over 110°F and winter lows dipping below freezing. Average annual precipitation is less than five inches.

The APE lies approximately six miles south of State Highway 18 and five miles west of Crystal Creek Road. A large portion of the APE is currently in use by the existing quarry operations. The terrain is steep and rugged, with several large drainages north of the quarry. Elevations in the APE ranging around 4,850-6,600 feet above mean sea level. Large bedrock outcrops and boulders are found on the slopes and within some of the drainages. Vegetation observed within the APE includes Joshua trees, pines, oaks, cactus, chollas, tumbleweeds, junipers, Manzanita bushes, and various grasses and shrubs (Fig. 3).

Figure 3. Overview of the current natural setting of the APE. (Photo taken on October 2, 2008; view to the northeast)

CULTURAL SETTING

Prehistoric Context

In order to understand Native American cultures prior to European contact, archaeologists have devised chronological frameworks on the basis of artifacts and site types that go back some 12,000 years. Currently, the chronology most frequently applied in the Mojave Desert divides the region's prehistory into five periods marked by changes in archaeological remains, reflecting different ways in which Native peoples adapted to their surroundings. According to Warren (1984) and Warren and Crabtree (1986), the five periods are as follows: the Lake Mohave Period, 12,000 years to 7,000 years ago; the Pinto Period, 7,000 years to 4,000 years ago; the Gypsum Period, 4,000 years to 1,500 years ago; the Saratoga Springs Period, 1,500 years to 800 years ago; and the Protohistoric Period, 800 years ago to European contact.

This time frame is based on general changes in artifactual remains from large stone projectile points with few stones for grinding food products, to smaller projectile points with an increase in the number of milling stone tools. The scheme also notes increases in population, changes in food procurement and resource exploitation, and more cultural complexity over time. During the Protohistoric Period, there is evidence of contact with the Colorado River tribes and the introduction of pottery across the Mojave Desert.

Ethnohistoric Context

The APE is located on the northern edge of the homeland of the Serrano Indians, whose traditional territory is centered at the San Bernardino Mountains but also includes the southern rim of the Mojave Desert, extending from Victorville eastward to Twenty-nine Palms. The name "Serrano" was derived from a Spanish term meaning "mountaineer" or "highlander." The basic written sources on Serrano culture are Kroeber (1925), Strong (1929), and Bean and Smith (1978). The following ethnographic discussion of the Serrano people is based on these sources.

Prior to European contact, the Serranos were primarily gatherers and hunters, and occasional fishers, who settled mostly where flowing water emerged from the mountains. They were loosely organized into exogamous clans, led by hereditary heads, and the clans, in turn, were affiliated with one of two exogamous moieties. The exact nature of the clans, their structure, function, and number are not known, except that each clan was the largest autonomous political and landholding unit, the core of which was the patrilineage. There was no pan-tribal political union among the clans.

Although contact with Europeans may have occurred as early as 1771 or 1772, Spanish influence on Serrano lifeways was negligible until 1819, when a mission *assistencia* was established on the southern edge of Serrano territory. Between then and the end of the mission era in 1834, most of the Serranos in the San Bernardino Mountains were removed to the nearby missions. At present, most Serrano descendants are found on the San Manuel and the Morongo Indian Reservations, where they participate in ceremonial and political affairs with other Native American groups on an inter-reservation basis.

Historic Context

Situated far from the coastline and any of the major desert trails, the Lucerne Valley area saw little change during the Spanish and Mexican periods, although sporadic mining activities reportedly took place in the vicinity (Fife 1988:172). After the American annexation of Alta California in 1848, mining and prospecting in the area began in earnest, especially in the aftermath of gold discoveries in the San Bernardino Mountains in the early 1860s. As in the rest of the vast Mojave Desert, mining remained for a long time the dominant economic pursuit in the Lucerne Valley area, and since then has continued to the present time, yielding a diverse variety of mineral products ranging from gold to clay (*ibid.*:173, 175-176).

The mid-19th century mining boom in the vicinity brought to the Lucerne Valley area its earliest Euroamerican settlers. During the 1870s, "Uncle Pete" Davidson, a former prospector in the San Bernardino Mountains, established a homestead near Rabbit Springs, and became the first permanent resident in the valley (Stack 1984:26; Fife 1988:174). In the meantime, the miniature gold rush in the San Bernardino Mountains and later the construction of the Big Bear dam in 1883-1884 brought a steady flow of traffic along a wagon road through the valley, so much so that Davidson's ranch came to be known as "Davidson's Stage and Way Station" (Garret 1996:117). In 1897, James "Dad" Goulding, a silver miner from Colorado, acquired the Box S Ranch, which had been established in 1886 but since abandoned (Fife 1988:174; Anonymous n.d.:1). In the late 19th and early 20th centuries, Goulding played a pivotal role in the growth of the small community that he named Lucerne Valley, after the type of alfalfa grown by the Mormons (Goulding 1948:120).

Around the turn of the century, more homesteaders started to filter into the valley, especially after Goulding's discovery of artesian water in 1905 (Goulding 1948:118-119; Stack 1984:26). Over the next few decades, the settlers attempted a number of money-making schemes, such as cultivating deciduous fruits and alfalfa, raising chicken, turkeys, and rabbits, and even luring Hollywood movie-makers, in most cases with only short-lived success (Gobar 1969:213-217, 256-263; Stack 1984:27). After WWII, guest ranches sprouted up throughout the valley, offering city dwellers a brief relief from the pressures of urban life (Stack 1984:27). Throughout these various "fevers," however, growth remained relatively slow for the remote desert area, which has allowed it to retain much of its rural character to the present day.

RESEARCH DESIGN

Scientific research should be directed by a theoretical orientation that is geared toward gathering data to answer questions of current research interest. While numerous theoretical orientations have been put forward and used to guide archaeological research and to improve data-collecting efforts, the cultural ecology approach still tends to be the most useful paradigm in archaeological endeavors, though it is often used in conjunction with newer models. Basically, the cultural ecology approach to understanding cultural development contends that people develop behavioral patterns in order to exploit the resources of the area by means of particular technologies. It also assumes that there is

interrelationship of these technologies, the environment, survival, and other aspects of the culture.

Since archaeology deals mostly with the cultural remains that are left long after the people are gone, this theoretical orientation has obvious advantages for archaeological research, although it is left to the archaeologist to determine the extent to which the behavior patterns used to exploit the environment affect other aspects of culture. Because of its continuing usefulness, the cultural ecology theoretical orientation is the basis of the archaeological investigation used in this study.

An archaeological investigation must also be guided by a thoughtful research design in order to contribute new insights to current knowledge and theory regarding the prehistory and/or history of a particular region by attempting to answer pertinent questions. While currently no overarching research design has been established for this part of the Mojave Desert, a standard set of research questions, or research domains, can be applied to archaeological investigations in the region, especially for Phase I studies such as this.

The primary goal of a Phase I archaeological investigation is to identify any prehistoric or historic-period cultural resources that may be present within the project area. This identification process includes a historical/archaeological resources records search, historical background research, Native American consultation, and a field inspection of the APE. While little detailed data may be available from the research methods employed during Phase I studies, some types of data gathered during the investigation may be used to address research issues, at least on a basic level. For instance, just the presence of cultural resources on a property indicates that people used the area. Other research questions, such as those posited below, can be addressed during Phase I studies only if certain types of artifacts or features are noted within or near the APE.

- *Is there any evidence that important events took place on the property or that the property is associated with a historically important person?*

Research may find that events that contribute to our cultural heritage or the broad patterns of California history may have occurred on the property or that the property is associated with a person who played an important role in our history. Physical evidence of past events or the roles that people played in history may or may not still be present on the property but there may be other records of the event or people.

- *Can we learn anything regarding the time period the area was used? Can we tell if people were using the area during early or late prehistoric times, or during the historic period?*

Some artifacts, both prehistoric and historic, can be linked to particular time periods. These types of artifacts, if present, could shed some light on the period of time when people were using the property. For instance, some projectile point types are correlated to particular periods. Styles of shell beads, pottery, historic-period artifacts, and buildings or building materials may indicate particular time periods of use.

- *Can we learn anything about the duration of the use of the land? Was the land used continuously for a long period of time, was it used only briefly, or was it used repeatedly over time?*

The density and types of artifacts, features, and structures that may be visible on the surface of the property during the Phase I survey may provide clues regarding the intensity and duration of the use of the area.

- *During a Phase I study, can we learn anything about the subsistence strategies of the people who used the land? Is there any evidence visible on the surface that indicates what food resources were being processed and/or consumed? Is there any evidence regarding the preparation of the food resources?*

Ethnographic and historical data provide information regarding the plants and animals that people used in prehistoric times, as well as how the foods were prepared. A review of natural plant community for the area would indicate whether any of those resources were present. Likewise, bedrock milling features and lithic debitage or projectile points indicate that gathering and hunting was occurring.

Similarly, some cans and bottles have distinctive shapes that allow for their identification regarding the type of food they contained, while evidence of agriculture would be obvious evidence of a subsistence strategy. Some structures or structural remains may also provide clues regarding economic pursuits that occurred on the subject property.

- *Would any of the information gathered during the Phase I study shed light on settlement patterns? Would we be able to relate activities in the project area with broader patterns of human habitation of the region? Could we tell if people lived on the subject property or if they lived somewhere else but used the resources on the property? If they lived on the property, was it a dense or sparse population? Does occupation of the subject property disclose any information regarding settlement strategies or preferences?*

The results of the records search and historic map review may reveal other settlements in the area. A review of pertinent literature might also provide insights regarding broad settlement patterns in the region. Some types of cultural remains on the property, such as midden soils and permanent structures, may offer important clues.

- *If there are features or structures on the property, are they somehow unique or special? Is there anything unusual about them?*

First of all, are they even more than 45 years old? The presence of man-made features or structures on the property means that they need to be examined for particular construction details that may make them important in their own right.

- *Can we learn anything about trade, travel, or cultural interactions?*

The presence of trails or roads would indicate that people were traveling across the property from one area to another. The presence of exotic goods such as stone or shell material, food containers, tools, clothing, and building materials from distant sources, would indicate trade, travel, and/or cultural interactions. Some artifacts (e.g., prehistoric water jars, wagon or automobile parts, and saddle fragments) and features (e.g., trails, wagon roads, and highways) would also indicate that people were traveling through the area.

While Phase I investigations typically can only determine the presence or absence of cultural resources on a property, some types of resources, if present, may provide basic, general information regarding the people who left the cultural remains behind. While the data gathered during the Phase I study may not be enough to contribute important new information to the understanding of the way people lived, it will help in determining the significance of the data or whether more research is needed.

RESEARCH METHODS

RECORDS SEARCH

On September 30, 2008, CRM TECH archaeologist Nina Gallardo (see App. 1 for qualifications) completed the records search at the Archaeological Information Center (AIC), San Bernardino County Museum, Redlands. During the records search, Gallardo checked the AIC's electronic database for previously identified historical/archaeological resources in or near the APE and existing cultural resources reports pertaining to the vicinity. Previously identified historical/archaeological resources include properties designated as California Historical Landmarks, Points of Historical Interest, or San Bernardino County Historical Landmarks, as well as those listed in the National Register of Historic Places, the California Register of Historical Resources, or the California Historical Resources Inventory.

HISTORICAL BACKGROUND RESEARCH

Bai "Tom" Tang, CRM TECH historian (see App. 1 for qualifications), conducted the historical background research on the basis of published literature in local history and historic maps of the Lucerne Valley area. Among maps consulted for this study were the U.S. General Land Office's (GLO) land survey plat map dated 1896 and the U.S. Geological Survey's (USGS) topographic maps dated 1902, 1947, and 1956. These maps are collected at the Science Library of the University of California, Riverside, and the California Desert District of the U.S. Bureau of Land Management, located in Moreno Valley.

NATIVE AMERICAN PARTICIPATION

As part of the research procedures, CRM TECH contacted the State of California's Native American Heritage Commission on September 22, 2008, to request a records search in the commission's sacred lands file. Following the commission's recommendations, CRM TECH further contacted a total of 11 Native American representatives in the region, both by mail and by telephone, between September 23 and October 29 to solicit local Native American input regarding any possible cultural resource concerns over the proposed undertaking. The correspondences between CRM TECH and the Native American representatives are attached to this report in Appendix 2.

FIELD SURVEY

On October 2 and 3, 2008, CRM TECH field director Daniel Ballester and project archaeologists Robert Porter and Andrea Stella (see App. 1 for qualification) carried out the pedestrian field survey of the APE. The relatively level areas of the APE were surveyed

intensively by walking parallel north-south transects spaced 15 meters (approx. 50 feet) apart. Since such regular transects were impracticable on the steep slopes, the more rugged terrain in the APE was surveyed by inspecting all areas accessible or demonstrating the potential for archaeological remains, such as the drainages and bedrock outcrops. Previously surveyed portions of the APE, where mining operations are currently ongoing, were given a cursory survey. In this way, the entire APE was examined systematically for any evidence of human activities dating to the prehistoric or historic periods (i.e., 50 years ago or older). Ground visibility ranged from poor (25%) to fair (70%) depending upon the density of the vegetation.

RESULTS AND FINDINGS

RECORDS SEARCH

According to AIC records, portions of the APE were previously surveyed between 1985 and 1992 (Fig. 4), but no cultural resources had been recorded on or adjacent to the property. Outside the APE boundaries but within a one-mile radius, AIC records show at least four other previous studies on various tracts of land and linear features (Fig. 4). As a result of these and other similar studies in the vicinity, three archaeological sites were recorded within the scope of the records search, as listed in Table 1 (see App. 3 for site locations). None of these sites was found in the immediate vicinity of the APE, and thus none of them requires further consideration during this study.

Table 1. Previously Recorded Cultural Resources within the Scope of the Records Search

Site No.	Recorded by/Date	Description
36-005319	Lerch 1985	Prehistoric roasting pit/hearth
36-005556	Lerch 1986; McCarthy 1988	Scatter of lithic flakes
36-006142	McCarthy 1988	Bedrock milling feature (metate)

HISTORICAL BACKGROUND RESEARCH

Situated in the foothills on the edge of the sparsely populated Mojave Desert country, the APE exhibited no evidence of any settlement or development activities throughout the historic period (Figs. 5-7). Between the 1850s and the 1950s, the only man-made features noted in the vicinity of the APE were a few dirt roads across the barren landscape (Figs. 5-7). Based on these historic maps, the APE appears to be relatively low in sensitivity for cultural resources from the historic period.

NATIVE AMERICAN PARTICIPATION

In response to CRM TECH's inquiry, the Native American Heritage Commission reports that the sacred lands record search identified no Native American cultural resources in the immediate project area. However, noting that "the absence of specific site information in the Sacred Lands File does not guarantee the absence of cultural resources in any project area," the commission recommends that local Native American representatives be contacted for further information, and provided a list of potential contacts in the region (see App. 2).

This map has been removed for confidentiality purposes

Upon receiving the commission's response, CRM TECH initiated correspondence with all nine individuals on the referral list and the organizations they represent. In addition, John Gomez, Jr., Cultural Resources Coordinator for the Ramona Band of Cahuilla Indians, and John Tommy Rosas, Tribal Administrator of the Tongva Ancestral Territorial Tribal Nation, were also contacted. As of this time, four responses have been received (see App. 2).

In a letter dated September 27, 2008, Charles Wood, Chairman of the Chemehuevi Indian Tribe, states that the area in and around the APE is sensitive for Native American cultural resources. The tribe is specifically concerned with any areas around Chimney rock, which is approximately six miles to the north of the APE. The presence of village sites, petroglyphs, and geoglyphs in the area is also among the tribe's concerns. Primarily, the tribe is concerned with Native

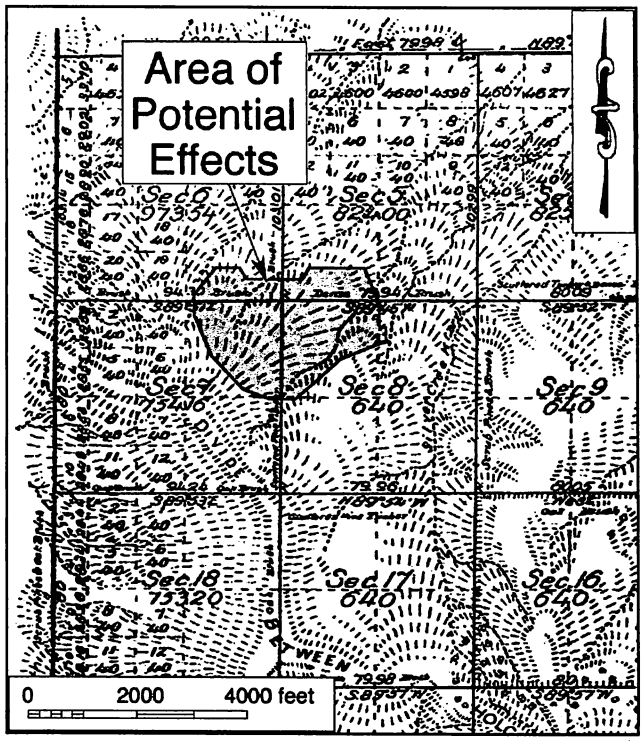

Figure 5. The APE and vicinity in 1855-1894. (Source: GLO 1896;)

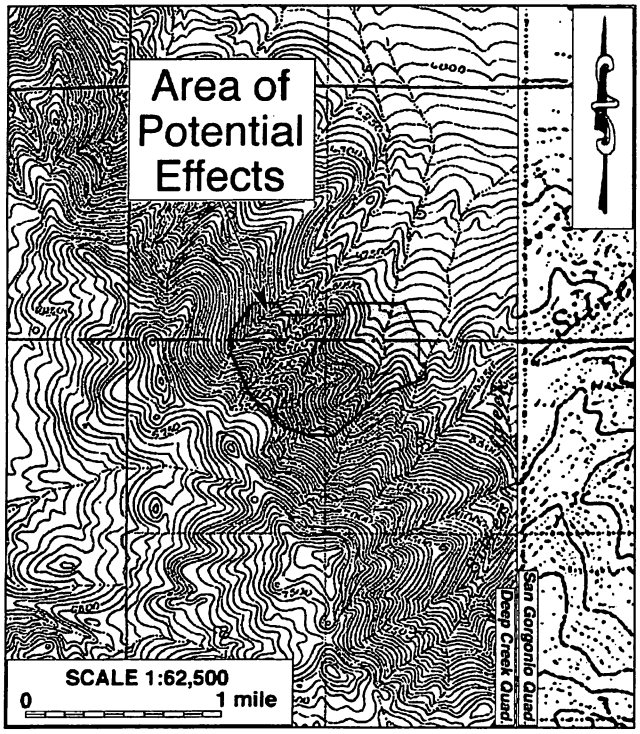

Figure 6. The APE and vicinity in 1898-1899. (Source: USGS 1902a; 1902b)

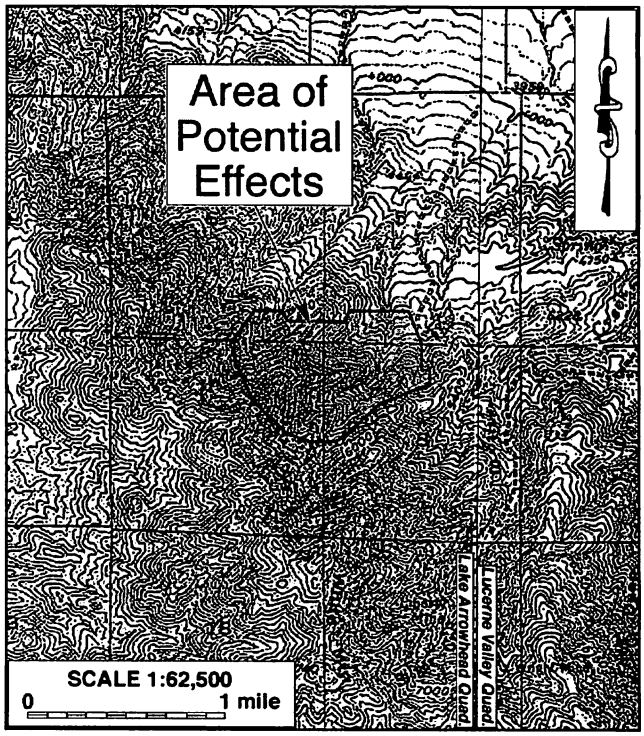

Figure 7. The APE and vicinity in 1945-1952. (Source: USGS 1947; 1956)

American artifacts, village sites, and human remains being discovered in the APE during the undertaking. In addition to requesting notification of any discovery of cultural resources in the APE, Mr. Wood requests that an aerial survey be conducted to identify any geoglyphs that may be present in the APE.

In e-mails dated October 2 and 24, 2008, John Tommy Rosas of the Tongva Ancestral Territorial Tribal Nation states that the APE lies within or in close proximity to a sacred site, in an area that is highly sensitive for unknown Native American cultural remain in buried deposits. He requests proper protection of the area through further consultation with the lead agency.

Michael Contreras, Cultural Heritage Program Manager for the Morongo Band of Mission Indians, replied by e-mail on October 15, 2008, stating that the tribe has no concerns at this time but wishes to be contacted regarding any archaeological discoveries. John Gomez, Jr., of the Ramona Band responded by telephone on October 28, and expressed the tribe's intention to defer to other Native American groups located closer to the APE.

FIELD SURVEY

The intensive-level field survey produced completely negative results for potential cultural resources. The entire APE was closely inspected for any evidence of human activities dating to the prehistoric or historic periods, but none was found. Much of the APE has been disturbed by the ongoing mining activities and the construction of access roads, and large piles of quartz mining refuse are scattered throughout the area. No buildings, structures, objects, sites, features, or artifacts more than 50 years of age were encountered during the survey.

DISCUSSION

The purpose of this study is to identify and evaluate any historic properties that may exist within or adjacent to the Area of Potential Effects of the proposed undertaking, and assess the undertaking's potential effects on such properties, if any. "Historic properties," as defined by the Advisory Council on Historic Preservation, include "prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior" (36 CFR 800.16(l)). The eligibility for inclusion in the National Register is determined by applying the following criteria, developed by the National Park Service as per provision of the National Historic Preservation Act:

> The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and
> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
> (b) that are associated with the lives of persons significant in our past; or
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic

values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

(d) that have yielded, or may be likely to yield, information important in prehistory or history. (36 CFR 60.4)

As discussed above, the records search, historical background research, and field survey for this study have all produced negative results, and no potential "historic properties" were encountered within or adjacent to the APE. However, one of the Native American representatives contacted by CRM TECH, John Tommy Rosas of the Tongva Ancestral Territorial Tribal Nation, reports that the APE lies within or in close proximity to a sacred site, which may qualify as a site of traditional cultural value if properly identified and documented.

At this time, Mr. Rosas has not disclosed the exact location, nature, or other attributes of the sacred site to CRM TECH, but intends to seek proper protection of the site through formal consultation with the lead agency for the proposed undertaking, namely the BLM. Prior to the completion of the formal consultation, it cannot be determined whether any "historic properties" may be affected by the proposed undertaking.

CONCLUSION AND RECOMMENDATIONS

The foregoing report has provided background information on the Area of Potential Effects, outlined the methods used in the current study, and presented the results of the various avenues of research. Throughout the course of the study, no "historic properties," as defined by Section 106 regulations, were encountered within or adjacent to the APE. However, Native American input during this study suggests that the APE lies within or in close proximity to a potential site of traditional cultural value. Based on these findings, CRM TECH presents to the BLM the following recommendations regarding the proposed undertaking:

- The BLM should initiate formal government-to-government consultation with the Tongva Ancestral Territorial Tribal Nation for additional information on the site of Native American cultural concern in order to determine whether it qualifies as a "historic property," as defined by Section 106 regulations, and whether the proposed undertaking will have an effect on the site.
- No other cultural resources investigation is necessary for the proposed undertaking unless project plans undergo such changes as to include areas not covered by this study.
- If buried cultural materials are discovered during any earth-moving operations associated with the undertaking, all work in that area should be halted or diverted until a qualified archaeologist can evaluate the nature and significance of the finds.

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1902b Map: San Gorgonio, Calif. (30', 1:125,000); surveyed in 1899.
1947 Map: Lucerne Valley, Calif. (15', 1:62,500); aerial photographs taken in 1945
1956 Map: Lake Arrowhead, Calif. (15', 1:62,500); aerial photographs taken in 1952.
1969 Map: San Bernardino, Calif. (1:250,000); 1958 edition revised.
1971 Map: Fifteenmile Valley, Calif. (7.5', 1:24,000); aerial photographs taken in 1969, field-checked in 1971.
1994 Map: Lucerne Valley, Calif. (7.5', 1:24,000); 1971 edition photorevised in 1994.
1996a Map: Butler Peak, Calif. (7.5', 1:24,000); 1971 edition photorevised in 1994.
1996b Map: Fawnskin, Calif. (7.5', 1:24,000); 1971 edition photorevised in 1994.

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APPENDIX 1

PERSONNEL QUALIFICATIONS

PRINCIPAL INVESTIGATOR/HISTORIAN
Bai "Tom" Tang, M.A.

Education

1988-1993	Graduate Program in Public History/Historic Preservation, UC Riverside.
1987	M.A., American History, Yale University, New Haven, Connecticut.
1982	B.A., History, Northwestern University, Xi'an, China.
2000	"Introduction to Section 106 Review," presented by the Advisory Council on Historic Preservation and the University of Nevada, Reno.
1994	"Assessing the Significance of Historic Archaeological Sites," presented by the Historic Preservation Program, University of Nevada, Reno.

Professional Experience

2002-	Principal Investigator, CRM TECH, Riverside/Colton, California.
1993-2002	Project Historian/Architectural Historian, CRM TECH, Riverside, California.
1993-1997	Project Historian, Greenwood and Associates, Pacific Palisades, California.
1991-1993	Project Historian, Archaeological Research Unit, UC Riverside.
1990	Intern Researcher, California State Office of Historic Preservation, Sacramento.
1990-1992	Teaching Assistant, History of Modern World, UC Riverside.
1988-1993	Research Assistant, American Social History, UC Riverside.
1985-1988	Research Assistant, Modern Chinese History, Yale University.
1985-1986	Teaching Assistant, Modern Chinese History, Yale University.
1982-1985	Lecturer, History, Xi'an Foreign Languages Institute, Xi'an, China.

Honors and Awards

1988-1990	University of California Graduate Fellowship, UC Riverside.
1985-1987	Yale University Fellowship, Yale University Graduate School.
1980, 1981	President's Honor List, Northwestern University, Xi'an, China.

Cultural Resources Management Reports

Preliminary Analyses and Recommendations Regarding California's Cultural Resources Inventory System (With Special Reference to Condition 14 of NPS 1990 Program Review Report). California State Office of Historic Preservation working paper, Sacramento, September 1990.

Numerous cultural resources management reports with the Archaeological Research Unit, Greenwood and Associates, and CRM TECH, since October 1991.

Membership

California Preservation Foundation.

PRINCIPAL INVESTIGATOR/ARCHAEOLOGIST
Michael Hogan, Ph.D., RPA*

Education

1991	Ph.D., Anthropology, University of California, Riverside.
1981	B.S., Anthropology, University of California, Riverside; with honors.
1980-1981	Education Abroad Program, Lima, Peru.
2002	Section 106—National Historic Preservation Act: Federal Law at the Local Level. UCLA Extension Course #888.
2002	"Recognizing Historic Artifacts," workshop presented by Richard Norwood, Historical Archaeologist.
2002	"Wending Your Way through the Regulatory Maze," symposium presented by the Association of Environmental Professionals.
1992	"Southern California Ceramics Workshop," presented by Jerry Schaefer.
1992	"Historic Artifact Workshop," presented by Anne Duffield-Stoll.

Professional Experience

2002-	Principal Investigator, CRM TECH, Riverside/Colton, California.
1999-2002	Project Archaeologist/Field Director, CRM TECH, Riverside.
1996-1998	Project Director and Ethnographer, Statistical Research, Inc., Redlands.
1992-1998	Assistant Research Anthropologist, University of California, Riverside
1992-1995	Project Director, Archaeological Research Unit, U. C. Riverside.
1993-1994	Adjunct Professor, Riverside Community College, Mt. San Jacinto College, U.C. Riverside, Chapman University, and San Bernardino Valley College.
1991-1992	Crew Chief, Archaeological Research Unit, U. C. Riverside.
1984-1998	Archaeological Technician, Field Director, and Project Director for various southern California cultural resources management firms.

Research Interests

Cultural Resource Management, Southern Californian Archaeology, Settlement and Exchange Patterns, Specialization and Stratification, Culture Change, Native American Culture, Cultural Diversity.

Cultural Resources Management Reports

Author and co-author of, contributor to, and principal investigator for numerous cultural resources management study reports since 1986.

Memberships

* Register of Professional Archaeologists.
Society for American Archaeology.
Society for California Archaeology.
Pacific Coast Archaeological Society.
Coachella Valley Archaeological Society.

PROJECT ARCHAEOLOGIST/REPORT WRITER
Deirdre Encarnación, M.A.

Education

2003	M.A., Anthropology, San Diego State University, California.
2000	B.A., Anthropology, minor in Biology, with honors; San Diego State University, California.
1993	A.A., Communications, Nassau Community College, Garden City, N.Y.
2001	Archaeological Field School, San Diego State University.
2000	Archaeological Field School, San Diego State University.

Professional Experience

2004-	Project Archaeologist/Report Writer, CRM TECH, Riverside/Colton, California.
2001-2003	Part-time Lecturer, San Diego State University, California.
2001	Research Assistant for Dr. Lynn Gamble, San Diego State University.
2001	Archaeological Collection Catalog, SDSU Foundation.

PROJECT ARCHAEOLOGIST
Nina Gallardo, B.A.

Education

2004	B.A., Anthropology/Law and Society, University of California, Riverside.

Professional Experience

2004-	Project Archaeologist, CRM TECH, Riverside/Colton, California.

Honors and Awards

2000-2002	Dean's Honors List, University of California, Riverside.

PROJECT ARCHAEOLOGIST
Andrea Stella, B.S.

Education

2003	B.S., Anthropology, University of California, Riverside.

Professional Experience

2002-	Project Archaeologist, CRM TECH, Riverside/Colton, California.

PROJECT ARCHAEOLOGIST/FIELD DIRECTOR
Daniel Ballester, B.A.

Education

1998	B.A., Anthropology, California State University, San Bernardino.
1997	Archaeological Field School, University of Las Vegas and University of California, Riverside.
1994	University of Puerto Rico, Rio Piedras, Puerto Rico.
2007	Certificate in Geographic Information Systems (GIS), California State University, San Bernardino.
2002	"Historic Archaeology Workshop," presented by Richard Norwood, Base Archaeologist, Edwards Air Force Base; presented at CRM TECH, Riverside, California.

Professional Experience

2002-	Field Director, CRM TECH, Riverside/Colton, California.
1999-2002	Project Archaeologist, CRM TECH, Riverside, California.
1998-1999	Field Crew, K.E.A. Environmental, San Diego, California.
1998	Field Crew, A.S.M. Affiliates, Encinitas, California.
1998	Field Crew, Archaeological Research Unit, University of California, Riverside.

PROJECT ARCHAEOLOGIST
Robert Allen Porter, B.A.

Education

2000	B.A., Anthropology, California State University, San Bernardino.

Professional Experience

2001-	Project Archaeologist, CRM TECH, Riverside/Colton, California.
2000	Archaeological field class under the direction of Claude Warren. Excavated units at Soda Lake in the Mojave Desert and produced lake bottom stratigraphic profiles and carbon sample collections.

Honors and Awards

Spring 2000	Dean's Honors List (G.P.A. of 4.0 in 15 units).
Fall 2000	Dean's Honors List (G.P.A. of 3.9 in 12 units).

APPENDIX 2

CORRESPONDENCE WITH NATIVE AMERICAN REPRESENTATIVES*

*A total of 11 local Native American representatives were contacted; a sample letter is included in this report.

CRM TECH

FAX COVER SHEET

1016 E. Cooley Drive
Suite B
Colton, CA 92324
909·824·6400·Tel
909·824·6405·Fax

To:
Native American Heritage Commission

Fax:
(916) 657-5390

From:
Nina Gallardo

Date:
September 22, 2008

Number of pages (including this cover sheet):
2

HARDCOPY:

_____ will follow by mail

__√__ will not follow unless requested

RE: Sacred Land records search

This is to request a Sacred Lands records search

Name of project:
White Knob Quarry Revision Project
CRM TECH #2280A (White Knob Expansion)

Project size:
300 acres

Location:
White Knob, near Lucerne Valley
San Bernardino County

USGS 7.5' quad sheet data:
Butler Peak, Calif.,
Fifteenmile Valley, Calif.,
Fawnskin, Calif.,
Lucerne Valley, Calif.
Sections 5, 6, 7 & 8, T3N R1W, SBBM

Please call if you need more information or have any questions.

Results may be faxed to the number above.

I appreciate your assistance in this matter.

Map included

STATE OF CALIFORNIA Arnold Schwarzenegger, Governor

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-6251
Fax (916) 657-5390
Web Site www.nahc.ca.gov
e-mail: ds_nahc@pacbell.net

September 23, 2008

Ms. Nina Gallardo, RPA
CRM TECH
1016 E. Cooley Drive, Suite B
Colton, CA 92324

Sent by FAX to: 909-824-6405
No. of Pages: 3

Re: Request for a Sacred Lands File records search and Native American Contacts list for the proposed **White Knob Quarry Revision Project (CRM TECH #2280A)**; located near Lucerne Valley; San Bernardino County, California

Dear Ms. Gallardo:

The Native American Heritage Commission was able to perform a record search of its Sacred Lands File (SLF) for the affected project area/area of potential effect (APE). The SLF failed to indicate the presence of Native American cultural resources in the immediate project area. The absence of specific site information in the Sacred Lands File does not guarantee the absence of cultural resources in any project area.

Early consultation with Native American tribes in your area is the best way to avoid unanticipated discoveries once a project is underway. Enclosed are the names of culturally-affiliated Native American Contacts that may have knowledge of cultural resources in the project area. A list of Native American contacts is attached to assist you. It is advisable to contact the persons listed; if they cannot supply you with specific information about the impact on cultural resources, they may be able to refer you to another tribe or person knowledgeable of the cultural resources in or near the affected project area. A local tribe or Native American individual may be the only source of a Native American cultural resource.

Lead agencies should consider avoidance, as defined in Section 15370 of the California Environmental Quality Act (CEQA) when significant cultural resources could be affected by a project. Also, Public Resources Code Section 15064.5(f) and Section 15097.98 and Health & Safety Code Section 7050.5 provide for provisions for accidentally discovered archeological resources during construction and mandate the processes to be followed in the event of an accidental discovery of any human remains in a project location other than a 'dedicated cemetery. Discussion of these should be included in your environmental documents, as appropriate.

If you have any questions about this response to your request, please do not hesitate to contact me at (916) 653-6251.

Sincerely,

Dave Singleton, Program Analyst

Attachment: Native American Contact List

Native American Contacts
San Bernardino County
September 23, 2008

Ramona Band of Cahuilla Mission Indians
Joseph Hamilton, Chairman
P.O. Box 391670 Cahuilla
Anza , CA 92539
admin@ramonatribe.com
(951) 763-4105
(951) 763-4325 Fax

San Manuel Band of Mission Indians
James Ramos, Chairperson
26569 Community Center Drive Serrano
Highland , CA 92346
(909) 864-8933
(909) 864-3724 - FAX
(909) 864-3370 Fax

Chemehuevi Reservation
Charles Wood, Chairperson
P.O. Box 1976 Chemehuevi
Chemehuevi Valley , CA 92363
chemehuevit@yahoo.com
(760) 858-4301
(760) 858-5400 Fax

Fort Mojave Indian Tribe
Tim Williams, Chairperson
500 Merriman Ave Mojave
Needles , CA 92363
(760) 629-4591
(760) 629-5767 Fax

San Fernando Band of Mission Indians
John Valenzuela, Chairperson
P.O. Box 221838 Fernandeño
Newhall , CA 91322 Tataviam
tsen2u@msn.com Serrano
(661) 753-9833 Office Vanyume
(760) 885-0955 Cell Kitanemuk
(760) 949-1604 Fax

AhaMaKav Cultural Society, Fort Mojave Indian Tribe
Linda Otero, Director
P.O. Box 5990 Mojave
Mohave Valley , AZ 86440
ahamakav@citlink.net
(928) 768-4475
(928) 768-7996 Fax

Morongo Band of Mission Indians
Michael Contreras, Cultural Heritage Prog. Manager
13000 Fields Road Cahuilla
Banning , CA 92220 Serrano
(951) 755-5025
(951)201-1866 - cell
(951) 922-0105 Fax

San Manuel Band of Mission Indians
Ann Brierty, Environmantal Department
101 Pure Water Lane Serrano
Highland , CA 92346
abrierty@sanmanuel-nsn.gov
(909) 863-5899 EXT-4321

(909) 862-5152 Fax

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed White Knob Quarry Revision Project (CRM TECH#2280A) located in White Knob, near the Lucerne Valley; San Bernardino County, California for which a Secred Lands File search and Native American Contacts list were requested.

Native American Contacts
San Bernardino County
September 23, 2008

Serrano Nation of Indians
Goldie Walker
6588 Valaria Drive Serrano
Highland , CA 92346
(909) 862-9883

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed White Knob Quarry Revision Project (CRM TECH#2280A) located in White Knob, near the Lucerne Valley; San Bernardino County, California for which a Sacred Lands File search and Native American Contacts list were requested.

September 23, 2008

Charles Wood, Chairperson
Chemehuevi Reservation
P. O. Box 1976
Chemehuevi Valley, CA 92363

RE: White Knob Quarry Revision Project
Near Lucerne Valley, San Bernardino County
CRM TECH Contract #2280A

Dear Mr. Wood:

As part of a cultural resources study for the project referenced above, I am writing to request your input on potential Native American cultural resources on/in or near the Area of Potential Effects (APE). Please respond at your earliest convenience if you have any specific knowledge of sacred/religious sites or other sites of Native American traditional cultural value within or near the APE. The lead agency for this project is the U.S. Bureau of Land Management for Section 106-compliance purposes.

The undertaking, located near Lucerne Valley, San Bernardino County, involves the expansion of the existing 145-acre White Knob quarry site to approximately 300 acres. The accompanying map, based on the USGS Butler Peak, Fawnskin, Fifteenmile Valley, and Lucerne Valley, Calif., 7.5' quadrangles, depicts the location of the APE in the Sections 5, 6, 7, and 8, T3N R1W, SBBM.

Any information, concerns or recommendations regarding cultural resources in the vicinity of the APE may be forwarded to CRM TECH by telephone, e-mail, facsimile or standard mail. Thank you for the time and effort in addressing this important matter.

Respectfully,

Laura Hensley Shaker
CRM TECH

Encl.: APE map

Chemehuevi Indian Tribe

P. O. Box 1976 · Havasu Lake, CA 92363 · (760) 858-4219 · Fax: (760) 858-5400

September 27, 2008

Laura Hensley Shaker
CRM TECH
1016 E. Cooley Drive, Suites A/B
Colton, CA 92324

RE: White Knob Quarry Revision Project

Ms. Shaker:

From the map provided I can not tell how far this APE is from Chimney Rock. As referenced below we have concerns about the area of Chimney Rock specifically and of the whole area in general.

The Chemehuevi have a long and well documented history in the desert areas of southern California, southern Nevada, and northern and western Arizona. In fact, we would have originally considered all of San Bernardino County and parts of Riverside, Kern and Inyo Counties as our ancestral, historical homeland. We also considered parts of southern Nevada and western Arizona as within our homeland territories. In the late 1800's the vast majority of this area was declared public domain by the US Federal Government and the various Tribes that had traditionally used this land on an intimate, daily basis lost the ability to freely use it as their ancestors once had. The Chemehuevi were just one of several nations of people whose ancestors freely used the area in question.

At one time we would have called the area between the Tehachapi Mountains to the Colorado River and from Death Valley to nearly Yuma, AZ as our ancestral territory. In addition, we would claim from Ash Meadows and the Pahrump area through Las Vegas and into the Muddy and Virgin Rivers area and on into the Valley of Fire.

The particular area that you speak of is of the utmost importance to the Chemehuevi. I only bring the following facts to your attention to show the obvious ancestral, historical presence of the Chemehuevi Indians in the greater area between Hesperia/Victorville and Barstow.

All along the length of the Mojave River are found areas of cultural resources; there may be burial sites, camp sites, 'sleeping circles' and village sites. This was a major

RECEIVED SEP 30 2008

residential and trade route in ancient times of my people between the coast and the Colorado River areas.

There are petroglyphs scattered across a wide swath of the Mohave and Colorado Deserts. In a publication titled, "Native American Rock Art at Ft. Irwin" distributed in both the Ft. Irwin Archaeology Center and the Mojave River Valley Museum in Barstow, the author states, "*Most likely, the Chemehuevi or Kawaiisu lived at Ft. Irwin*".

Also in, "Native American Rock Art at Ft. Irwin" the author states, "*The Fort Irwin petroglyphs dated by archaeologists so – far, however, are not the oldest examples of rock art in the Mojave Desert. Petroglyphs have been found in the Barstow area that are 12,000 years old, while examples at China Lake date to 19,000 years ago*".

There are also known geoglyphs in the area; many that may not be recognizable from ground level. For that reason I would request that an aerial survey be done of the area.

In a census conducted in the late 1800's of the Victor area (later to become Victorville) there were found 44 Indians. Of that group, 37 were Chemehuevi and 7 were Desert Kawaiisu. In fact, we have a picture taken of two Chemehuevi women and a child in their campground living near Victor in 1898. One of the women has been identified as Maria Chapula, a renowned Chemehuevi basket maker, who was born in Victor in 1856 and who lived there until her death in 1960 at the age of 104 years. This was most likely the ancient village site of Atongiabit.

In the mid 1800's three cowboys were killed by Chemehuevis on what is today 'The Las Flores Ranch' in Hesperia. This was the ancient village site of Guapiabit. This incident later led to the 'Chimney Rock Massacre' in the Lucerne Valley involving up to 200 Chemehuevi.

Several burials were un-earthed at the old 'Lane's Crossing' near what is today Oro Grande. I believe this was the ancient village site of Topiabit.

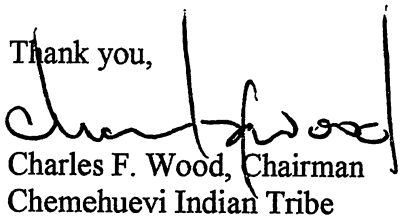
There is the recognized Chemehuevi Cemetery near Zzyzx.

I believe there were approximately nine (9) large permanent village sites along the Mojave River between the Narrows and the city of Barstow. Some of their names are as follows: Muscumbiabit, Guapiabit, Atongiabit, Najayabit, Guapian, Apiambit, Apiagma, Topiabit and Guaspect.

The question is not if there are artifacts or human remains, but where and when will they be found. I respectfully request notification if artifacts or human remains are found so we might consider repatriation.

While we no longer have intimate daily contact with the specific area in question we do have grave concerns, but we would not oppose the project as presented.

Thank you,



Charles F. Wood, Chairman
Chemehuevi Indian Tribe

From: Johntommy Rosas <tattnlaw@gmail.com>
Date: Wed, 1 Oct 2008 15:54:38 -0700
To: <lshaker@crmtech.us>
Subject: Re: CRM TECH project 2280

Hi Laura,

This area is a old/current sacred site and will be documented, I will send my doc on it later, ASAP, this area is also sensitive due to known surface and below grade cultural items, so the lead agency and applicant, feds or maybe NPS and other authorities need to secure and protect it, including from other [Indians?] who may be trespassing on our sacred site, this is a very critical area to protect, I will send TATTN names for the areas and villages,

Thanks

John Tommy/ 310 570- 6567 direct cell

since this is 106 TC, I will need the fed contact person also.

==========

From: Mike Contreras <Mike_Contreras@morongo.org>
Date: Wed, 15 Oct 2008 15:41:15 -0700
To: Laura Shaker <lshaker@crmtech.us>
Subject: RE: CRMTECH # 2280, White Knob Quarry Expansion project

Very good. Thank you for contacting me on this. We will submit no concern at this time, and we would like to be contacted should there be any discoveries.

Michael Contreras Jr.
Morongo Band of Mission Indians
Cultural Heritage Program Coordinator
951-755-5025 Office
951-201-1866 Cell

==========

From: Johntommy Rosas <tattnlaw@gmail.com>
Date: Fri, 24 Oct 2008 08:56:18 -0700
To: Laura Shaker <lshaker@crmtech.us>
Subject: Re: <no subject>

HI , THAT WHITE KNOB SITE IS A SACRED SITE AND WE NEED TO DO TRIBAL CONSULTATION UNDER, 106 SEC NHPA, AND SEC 7 NEPA,[ESA]. WE HAVE SIGNIFICANT SITES UP THERE AND IT NEEDS TO BE STUDIED AND TC, SO LET ME KNOW WHAT THE PLAN AND RESPONSES , THANKS JOHNTOMMY

TELEPHONE LOG

Name	Tribe/Affiliation	Telephone Contacts	Comments
Charles Wood, Chairperson	Chemehuevi Indian Tribe	None	Mr. Wood responded in a letter dated September 27, 2008 (copy attached).
Linda Otero, Director	Fort Mojave Indian Tribe (AhaMaKav Cultural Society)	4:05 pm, October 28, 2008 2:45 pm, October 29, 2008	Left messages; no response to date.
Tim Williams, Chairmperson	Fort Mojave Indian Tribe	3:40 pm, October 28, 2008 4:30 pm, October 29, 2008	Left messages; no response to date.
Mike Contreras, Jr., Cultural Heritage Project Manager	Morongo Band of Mission Indians	None	Mr. Contreras responded by e-mail on October 15, 2008 (copy attached).
Joseph Hamilton, Chairman	Ramona Band of Mission Indians	None	John Gomez, Jr., is the designated spokesperson for the tribe (see below).
John Gomez, Jr., Cultural Resources Coordinator	Ramona Band of Mission Indians	4:15 pm, October 28, 2008	The Ramona Band wishes to defer to other tribes located closer to the APE.
John Valenzuela, Chairperson	San Fernando Band of Mission Indians	4:08 pm, October 28, 2008 2:40 pm, October 29, 2008	Mr. Valenzuela wishes to be notified if anything were found in the APE.
James Ramos, Chairperson	San Manuel Band of Mission Indians	None	Ann Brierty is the designated spokesperson for the tribe (see below).
Ann Brierty, Cultural Resources Field Manager	San Manuel Band of Mission Indians	4:00 pm, October 28, 2008 2:47 pm, October 29, 2008	Left messages; no response to date.
Goldie Walker	Serrano Nation of Indians	4:17 pm, October 28, 2008 3:00 pm, October 29, 2008	No answer.
John Tommy Rosas, Tribal Administrator	Tongva Ancestral Territorial Tribal Nation	None	Mr. Rosas responded by e-mail on October 1 and 24, 2008 (copies attached).

APPENDIX 3

LOCATIONS OF RECORDED SITES IN THE VICINITY

(Confidential)

This map has been removed for confidentiality purposes

PALEONTOLOGICAL RESOURCES ASSESSMENT REPORT

WHITE KNOB QUARRY REVISION PROJECT

Amendment to Reclamation Plan No. 86M-04
Lucerne Valley Area, San Bernardino County, California

For Submittal to:

County of San Bernardino
Land Use Services Department
385 N. Arrowhead Avenue, Third Floor
San Bernardino, CA 92415

Bureau of Land Management
Barstow Field Office
2601 Barstow Road
Barstow, CA 92311

Prepared for:

George A. Webber, President
Webber and Webber Mining Consultants, Inc.
101 East Redlands Boulevard, Suite 240
Redlands, CA 92373

Prepared by:

Harry M. Quinn, Paleontologist/Geologist
Clarence Bodmer, Report Writer
CRM TECH
1016 East Cooley Drive, Suite A/B
Colton, CA 92324

Michael Hogan, Principal Investigator
Bai "Tom" Tang, Principal Investigator

March 9, 2009

CRM TECH Contract #2280P
Approximately 298 Acres
USGS Butler Peak, Calif., 7.5' (1:24,000) Quadrangle
Sections 5-8, T3N R1W, San Bernardino Base Meridian
BLM Cultural Resources Use Permit No. CA-07-12
Fieldwork Authorization No. FA-680-09-06

MANAGEMENT SUMMARY

Between September and November 2008, at the request of Webber and Webber Mining Consultants, Inc., CRM TECH performed a paleontological resource assessment on approximately 298 acres of vacant land, including an existing quarry, in an unincorporated area near the community of Lucerne Valley, San Bernardino County, California. The study is a part of the environmental review process for a proposed amendment to Reclamation Plan No. 86M-04, which would increase the area authorized for the White Knob-White Ridge Limestone Mine operated by OMYA California, Inc., under permit by the County of San Bernardino and the U.S. Bureau of Land Management (BLM).

The area of potential effects (APE) for the proposed project is located on Assessor's Parcel Nos. 446-011-04, -05, and -06 and 446-021-11 and -35, within Sections 5-8 of T3N R1W, San Bernardino Base Meridian, as depicted in the USGS Butler Peak, Calif., 7.5' quadrangle. A total 47.5 acres of the APE consists of U.S. government land under the jurisdiction of the BLM. The purpose of the present study is to provide the County of San Bernardino and the BLM with the necessary information and analysis to determine whether the proposed project would potentially disrupt or adversely affect any paleontological resources, and to design a paleontological salvage program for the project, if it becomes necessary.

In order to identify any paleontological resource localities that may exist in or near the APE and to assess the possibility for such resources to be encountered in future excavation and construction activities associated with the proposed project, CRM TECH initiated records searches at the San Bernardino County Museum and the Natural History Museum of Los Angeles County, conducted a literature search, consulted with OMYA California's geologist, and carried out a systematic field survey of the entire APE, in accordance with the guidelines of the Society of Vertebrate Paleontology.

Based on the results of these research procedures, the project's potential to impact significant nonrenewable paleontological resources appears to range from very low to indeterminate, depending upon the type of rock encountered during mining operations. The surficial deposits of older Quaternary alluvium, the Paleozoic metamorphic rocks, and the Mesozoic plutonic igneous rocks are considered to have a very low potential for containing significant nonrenewable paleontological remains. Therefore, no paleontological monitoring of earth-moving activities is recommended within the alluvial soils, the highly metamorphosed rock, or the igneous rock anywhere within the APE.

The Monte Cristo Limestone Formation, generally located in the central portion of the APE and not within BLM land, also has a very low potential to contain significant nonrenewable paleontological resources because of the metamorphic processes that have altered the limestone into marble. However, if small pockets of limestone exist within this formation that did not become completely metamorphosed into marble, then there is an indeterminate potential for the presence of nonrenewable fossil vertebrate and invertebrate remains of late Paleozoic age. Therefore, CRM TECH recommends that any non-metamorphosed fossiliferous limestone material found during mining operations, which might otherwise be discarded, be set it aside for examination by a qualified paleontologist before it is processed. Once a substantial collection is accumulated, a qualified paleontologist should be notified and the material should be visually inspected. In conjunction with the inspections, a program to mitigate impacts to paleontological resources that may be unearthed should be implemented.

Apparently there is virtually none of the carbonate rock that makes up the Monte Cristo Limestone Formation on BLM land. Thus, the potential for significant paleontological resources to be found on BLM land is even lower than in the quarry area itself.

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INTRODUCTION

Between September and November 2008, at the request of Webber and Webber Mining Consultants, Inc., CRM TECH performed a paleontological resource assessment on approximately 298 acres of vacant land, including an existing quarry, in an unincorporated area near the community of Lucerne Valley, San Bernardino County, California (Fig. 1). The study is a part of the environmental review process for a proposed amendment to Reclamation Plan No. 86M-04, which would increase the area authorized for the White Knob-White Ridge Limestone Mine operated by OMYA California, Inc., under permit by the County of San Bernardino and the U.S. Bureau of Land Management (BLM).

As currently proposed, the project includes an increase to the disturbance limits of the quarry operations by 147 acres to account for boulder roll-down to the north and the west; removal and stabilization of talus materials on the western slope to minimize future roll-down; expansion of an existing overburden site by 15 acres, 10 of which are currently undisturbed; the addition of three new overburden sites; and modification to an existing access road to the White Knob-White Ridge Limestone Mine.

The area of potential effects (APE) for the proposed project is located on Assessor's Parcel Nos. 446-011-04, -05, and -06 and 446-021-11 and -35, within Sections 5-8 of T3N R1W, San Bernardino Base Meridian, as depicted in the USGS Butler Peak, Calif., 7.5' quadrangle (Fig. 2). A total 47.5 acres of the APE consists of U.S. government land under the jurisdiction of the BLM. The purpose of the present study is to provide the BLM with the necessary information and analysis to determine whether the proposed project would potentially disrupt or adversely affect any paleontological resources, and to design a paleontological salvage program for the project, if it becomes necessary.

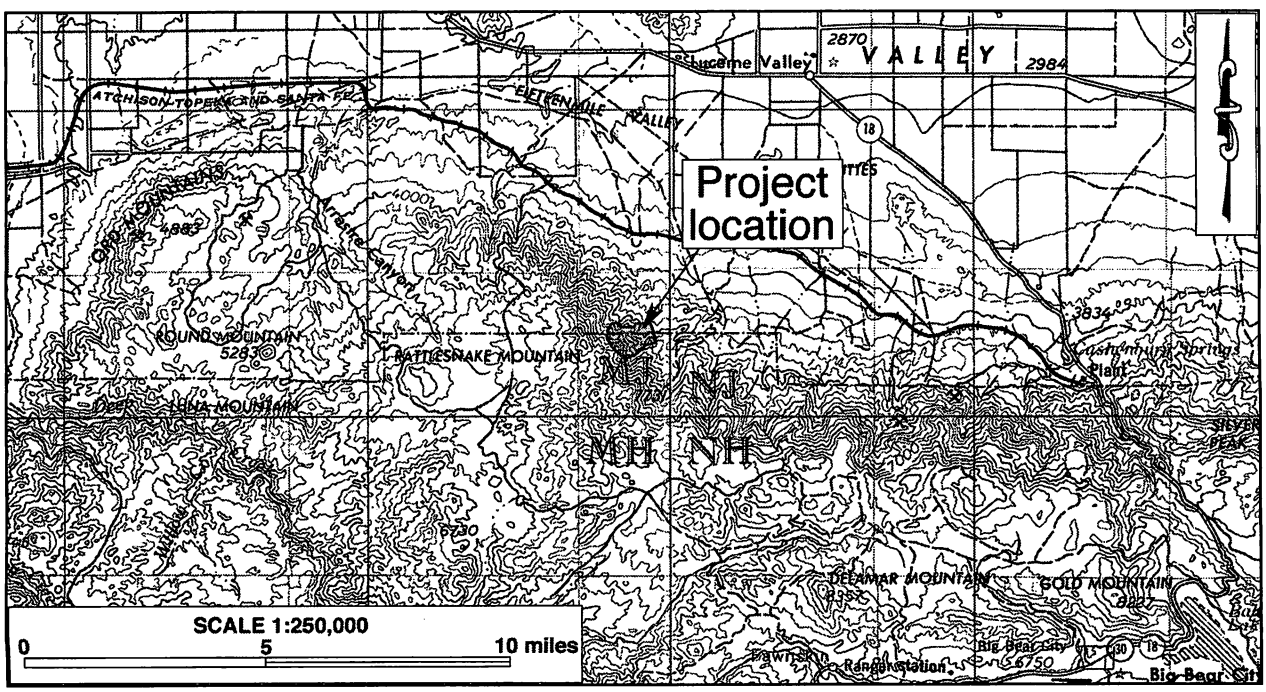

Figure 1. Project vicinity. (Based on USGS San Bernardino, Calif., 1:250,000 quadrangle)

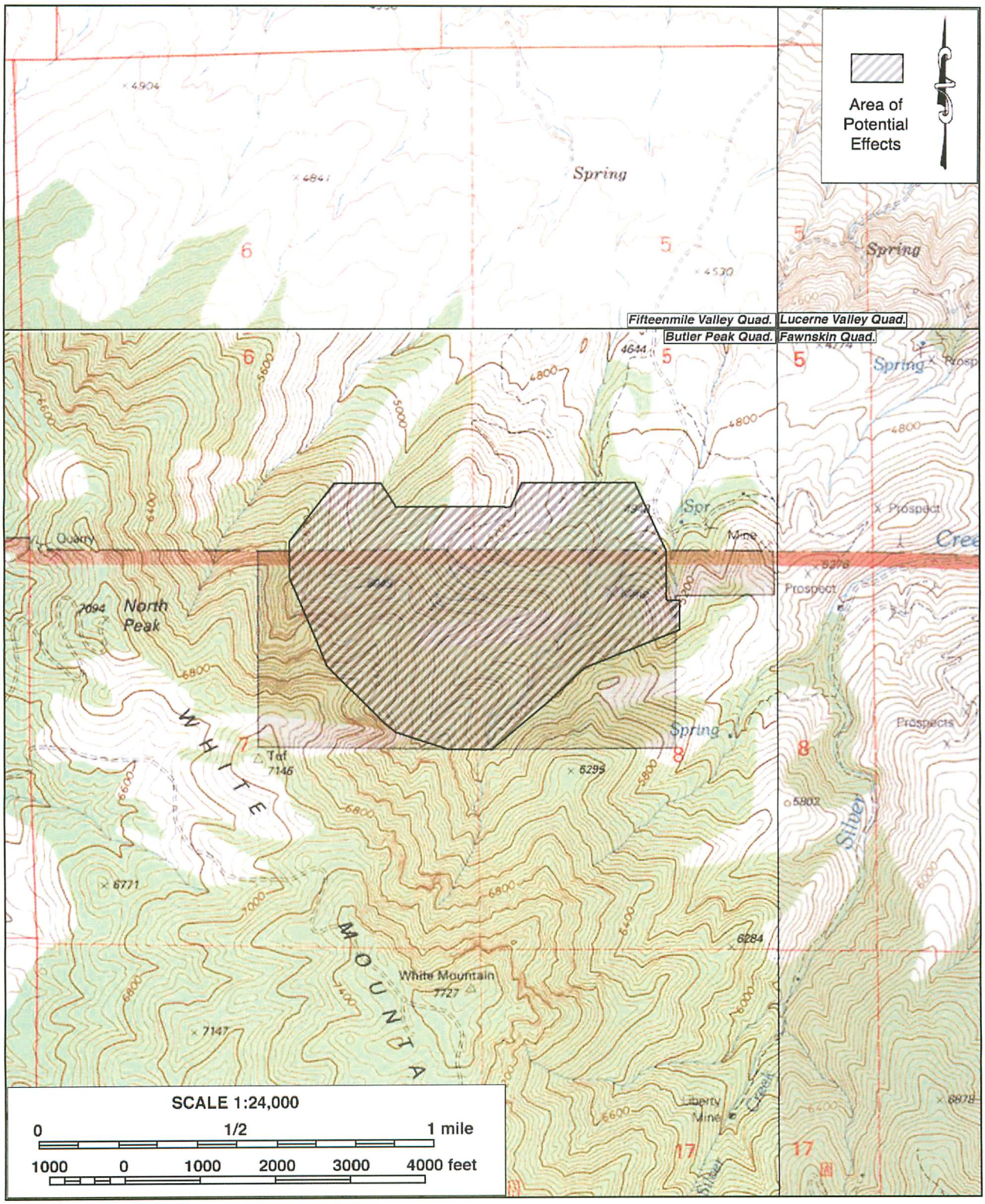

Figure 2. The area of potential effects. (Based on USGS Butler Peak, Fawnskin, Fifteenmile Valley, and Lucerne Valley, Calif., 1:24,000 quadrangles)

In order to identify any paleontological resource localities that may exist in or near the APE and to assess the possibility for such resources to be encountered in future excavation and construction activities associated with the proposed project, CRM TECH initiated records searches at the San Bernardino County Museum and the Natural History Museum of Los Angeles County, conducted a literature search, and carried out a systematic field survey of the APE, in accordance with the guidelines of the Society of Vertebrate Paleontology. The following report is a complete account of the methods, results, and final conclusion of this study.

PALEONTOLOGICAL RESOURCES

DEFINITION

Paleontological resources represent the remains of prehistoric life, exclusive of any human remains, and include the localities where fossils were collected as well as the sedimentary rock formations in which they were found. The defining character of fossils or fossil deposits is their geologic age, which is typically regarded as older than 10,000 years, the generally accepted temporal boundary marking the end of the last late Pleistocene glaciation and the beginning of the current Holocene epoch.

Common fossil remains include marine shells; the bones and teeth of fish, reptiles, and mammals; leaf assemblages; and petrified wood. Fossil traces, another type of paleontological resources, include internal and external molds (impressions) and casts created by these organisms. These items can serve as important guides to the age of the rocks and sediments in which they are contained, and may prove useful in determining the temporal relationships between rock deposits from one area and those from another as well as the timing of geologic events.

Fossil resources generally occur only in areas of sedimentary rock (e.g., sandstone, siltstone, mudstone, claystone, or shale). Because of the infrequency of fossil preservation, fossils, particularly vertebrate fossils, are considered to be nonrenewable paleontological resources. Occasionally fossils may be exposed at the surface through the process of natural erosion or as a result of human disturbances; however, they generally lay buried beneath the surficial soils. Thus, the absence of surface fossils does not preclude the possibility of their being present within subsurface deposits, while the presence of fossils at the surface is often a good indication that more remains may be found in the subsurface.

SIGNIFICANCE CRITERIA

According to guidelines proposed by Eric Scott and Kathleen Springer (2003) of the San Bernardino County Museum, paleontological resources can be considered to be of significant scientific interest if they meet one or more of the following criteria:

1. The fossils provide information on the evolutionary relationships and developmental trends exhibited among organisms, living or extinct;
2. The fossils provide data useful in determining the age(s) of the rock unit or sedimentary stratum, including data important in determining the depositional history of the region and the timing of geologic events therein;

3. The fossils provide data regarding the development of biological communities or the interactions between paleobotanical and paleozoological biotas;
4. The fossils demonstrate unusual or spectacular circumstances in the history of life; and/or
5. The fossils are in short supply and/or in danger of being depleted or destroyed by the elements, vandalism, or commercial exploitation, and are not found in other geographic locations.

PALEONTOLOGICAL SENSITIVITY

The fossil record is unpredictable, and the preservation of organic remains is rare, requiring a particular sequence of events involving physical and biological factors. Skeletal tissue with a high percentage of mineral matter is the most readily preserved within the fossil record; soft tissues not intimately connected with the skeletal parts, however, are the least likely to be preserved (Raup and Stanley 1978). For this reason, the fossil record contains a biased selection not only of the types of organisms preserved but also of certain parts of the organisms themselves. As a consequence, paleontologists are unable to know with certainty, the quantity of fossils or the quality of their preservation that might be present within any given geologic unit.

Sedimentary units, which are paleontologically sensitive, are those geologic units (mappable rock formations) with a high potential to contain significant nonrenewable paleontological resources. More specifically, these are geologic units within which vertebrate fossils or significant invertebrate fossils have been determined by previous studies to be present or are likely to be present. These units include, but are not limited to, sedimentary formations that contain significant paleontological resources anywhere within their geographical extent as well as sedimentary rock units temporally or lithologically amenable to the preservation of fossils.

A geologic formation is defined as a stratigraphic unit identified by its lithic characteristics (e.g., grain size, texture, color, and mineral content) and stratigraphic position. There is a direct relationship between fossils and the geologic formations within which they are enclosed, and with sufficient knowledge of the geology and stratigraphy of a particular area, it is possible for paleontologists to reasonably determine its potential to contain significant nonrenewable vertebrate, invertebrate, marine, or plant fossil remains.

The paleontological sensitivity for a geologic formation is determined by the potential for that formation to produce significant nonrenewable fossils. This determination is based on what fossil resources the particular geologic formation has produced in the past at other nearby locations. Determinations of paleontologic sensitivity must consider not only the potential for yielding vertebrate fossils but also the potential for a few significant fossils that may provide new and significant taxonomic, phylogenetic, and/or stratigraphic data.

The Society of Vertebrate Paleontology (1995:22-27) issued a set of standard guidelines intended to assist paleontologists to assess and mitigate any adverse effects/impacts to nonrenewable paleontological resources. The Society defined three potential categories of paleontological sensitivity for geologic units that might be impacted by a proposed project. These categories are described below, along with the criteria used to establish their sensitivity.

- **High sensitivity**: Geologic units assigned to this category are considered to have a high potential for significant nonrenewable vertebrate, invertebrate, marine, or plant fossils. Sedimentary rock units in this category contain a relatively high density of recorded fossil localities, have produced fossil remains in the vicinity, and are very likely to yield additional fossil remains.
- **Low sensitivity**: Geologic units are assigned to this category when they have produced no or few recorded fossil localities and are not likely to yield any significant nonrenewable fossil remains.
- **Undetermined sensitivity**: Geologic units are assigned to this category when there is limited exposure of the rock units in the area and/or the rock units have been poorly studied.

ENVIRONMENTAL SETTING

GEOLOGIC SETTING

The APE lies on the north flank of the San Bernardino Mountains, approximately six miles southwest of the small unincorporated community of Lucerne Valley, overlooking the Lucerne and Fifteenmile valleys on the southern rim of the Mojave Desert. The San Bernardino Mountains constitute a portion of the Transverse Ranges Geomorphic Province (Jenkins 1980:40-41; Harms 1996:169-172). These mountains have been uplifted to their present elevation during the last two million years by tectonic activity through a series of faults associated with the San Andreas Fault System and a series of high angle and thrust faults along the northern flank, separating the mountains from the Mojave Desert (Bailey and Jahns 1954: 103-104; Harms 1996: 170; Trent 1990:1). Most geologists consider these mountains to have been elevated during the past two million years, and they continue to rise in elevation even today (Harms 1996: 170; Trent 1990: 3). In support of such a relatively youthful age for the mountains are the deep, narrow canyons that fringe the flanks of the mountain range.

The uplift of the mountains occurred in two stages. The first stage is represented by block faulting and warping that likely took place during the late Miocene, approximately 5 to 11 million years ago (mya), which may have created an ancestral pre-San Bernardino Mountains of unknown elevation (Meisling and Weldon 1989). The second stage began with the uplift of the range in the Quaternary Period, starting approximately two mya, which created the elevated and eroding landscape that is visible today (Dibblee 1975; Sadler 1982).

The Morongo and the Twentynine Palms valleys separate the San Bernardino Mountains from the older Little San Bernardino Mountains located to the east. The northern portion of the San Bernardino Mountains was once a part of a late Precambrian-Paleozoic sea that was a southwest continuation of the Cordilleran miogeocline (Brown 1986:105; 1990:8). Among the Paleozoic sediments were some very extensive carbonate sequences of both limestones and dolomites (Brown 1986:110; 1990:13). These Paleozoic sediments were intruded upon by Jurassic- and Cretaceous-age igneous rock that metamorphosed most of the carbonate rock into marble (Brown 1986:105; 1990:8; Gantenbeim 1989: 101; 1990:20).

CURRENT NATURAL SETTING

Dictated by its desert setting, the climate and environment of the region around the APE are typical of the southern California high desert country, so-named because of its relatively high elevation in comparison to the Colorado Desert, or low desert, to the southeast. The climate is marked by extremes in temperature and aridity, with summer highs reaching well over 110°F and winter lows dipping below freezing. Average annual precipitation levels are less than five inches.

The APE lies approximately six miles south of State Highway 18 and five miles west of Crystal Creek Road. A large portion of the APE is currently in use by the existing quarry operations. The terrain is steep and rugged, with several large drainages located north of the quarry (Fig. 3). Elevations in the APE range between 4,850 feet and 6,600 feet above mean sea level. A number of large bedrock outcrops and boulders are situated along the slopes and within the drainages. Vegetation within the APE includes Joshua trees, pines, oaks, cactus, chollas, tumbleweeds, junipers, and Manzanita bushes, along with the typical amalgamation of small desert grasses and low-lying shrubs (Fig. 3).

Figure 3. Typical landscapes within the APE. *Clockwise from upper left*: steep hillside being quarried; rugged hillside terrain and drainage; haul road leading to the quarry; dense, low-lying vegetation and rolling terrain (facing northeast). (Photos taken on October 2, 2008)

METHODS AND PROCEDURES

RECORD SEARCHES

The records search service was provided by the Regional Paleontologic Locality Inventory located at the San Bernardino County Museum in Redlands and by the Natural History

Museum of Los Angeles County in Los Angeles. These institutions maintain files of regional paleontological localities as well as supporting maps and documents. The records search results identify geological exposures and formations, as well as known paleontological localities within the vicinity of the study area.

LITERATURE REVIEW

In addition to the records searches, a literature search was conducted using materials in the CRM TECH library, including unpublished reports produced during surveys of other properties in the area, and the personal library of CRM TECH geologist/paleontologist Harry M. Quinn, California Professional Geologist #3477 (see App. 1 for qualifications).

FIELD SURVEY

On October 2 and 3, 2008, CRM TECH paleontological surveyors Daniel Ballester, Robert Porter, and Andrea Stella (see App. 1 for qualifications) carried out the pedestrian field survey of the APE under the direction of Harry M. Quinn. The relatively level areas of the APE were surveyed intensively by walking parallel north-south transects spaced 15 meters (approx. 50 feet) apart. Since such regular transects were impracticable on the steep slopes, the more rugged terrain in the APE was surveyed by inspecting all areas accessible or demonstrating the potential for sediments suitable for fossil preservation. In this way, the entire APE was examined systematically to determine the soil types, to verify the geological formations, and to look for any indications of paleontological remains. Ground visibility ranged from poor (25%) to fair (70%) depending upon the density of the vegetation.

RESULTS AND FINDINGS

RECORDS SEARCHES

The Natural History Museum of Los Angeles County (NHMLAC) found no known paleontological localities within the APE or nearby from similar sediment lithologies to that occurring within the APE (McLeod 2008). A review of the Regional Paleontologic Locality Inventory by the San Bernardino County Museum (SBCM) indicates that no paleontological localities are recorded within the APE and no localities are recorded within several miles of the APE in any direction (Scott 2008).

According to the NHMLAC, in the lowest portion of the APE and along many of the drainages there are surficial deposits of older Quaternary alluvium. These deposits, which are primarily fan deposits from the surrounding elevated terrain, will typically not contain significant vertebrate fossils, at least not in the uppermost layers (McLeod 2008). Geologic mapping indicates there are exposures of the Mississippian (early Carboniferous) Furnace Limestone within the central portion of the APE. Despite this limestone being somewhat metamorphosed, it does contain recognizable invertebrate fossils and could potentially contain the remains of vertebrate fossils (*ibid.*). The remainder of the APE contains Paleozoic metamorphic rocks and Mesozoic plutonic igneous rocks, both of which will be devoid of fossils.

The NHMLAC has determined that excavations that will penetrate into the Paleozoic metamorphic and the Mesozoic igneous bedrock found throughout the majority of the APE will not encounter any vertebrate fossils. In addition, surface grading or shallow excavations into the older Quaternary alluvium found in the northeastern portion of the APE are also unlikely to uncover significant vertebrate fossils since this older alluvium is shallow and underlain by igneous bedrock exposed in the surrounding terrain. Because of its lithology, it is unlikely to yield any significant vertebrate fossils. McLeod (2008) goes on to note that excavations within the Furnace Limestone Formation within the central portion of the APE, and not within BLM land, could potentially yield highly significant vertebrate fossils of late Paleozoic age that are otherwise poorly known in California.

The results of the records search conducted by the SBCM indicate that the APE contains a number of rock units from several different geological ages. From oldest to youngest, these rock units include metamorphosed limestone and marble from the later Paleozoic Era; quartz monzonite from the Jurassic or Cretaceous Period; Quaternary older fan deposits, and gneiss of indeterminate age (Scott 2008). None of these geologic formations has the potential to contain significant nonrenewable fossil resources, particularly the Paleozoic and Mesozoic metamorphic and granitic rocks, as well as the gneiss. The Quaternary fan deposits were laid down in a depositional environment that is not conducive to the process of fossilization. As a result, the SBCM has assigned all the geologic formations present within the APE a low sensitivity for yielding significant nonrenewable paleontological resources (*ibid.*).

LITERATURE REVIEW

Metamorphosed limestone and dolomite in the San Bernardino Mountains were first studied by Vaughan (1922), who grouped them within his **Of** classification, or Furnace limestone of Upper Cambrian and Ordovician age. The type location can be found on the northeast side of Horse Thief Flat, where it conformably overlies the Arrastre quartzite. Vaughn's geologic mapping, however, does not extend into the current APE.

Jahns (1954) mapped the surface geology within the APE as **gr**, or Plutonic rocks, mainly of granitic to quartz diorite composition of Mesozoic age and **gn**, or gneiss and other metamorphic rocks, mainly of complex origin from the Mesozoic to Precambrian age. Bortugno and Spittler (1986) mapped the surface geology for the APE as **Pzls**, **KJqm**, **Trmz**, **Jhd**, **Qod**, and **Q**. The **Pzls** is defined as Upper Paleozoic limestone and marble, the **KJqm** as Cretaceous or Jurassic quartz monzonite Quartz Monzonite of Pleasant View Ridge, the **Trmz** as Triassic monzonite, the **Jhd** as Jurassic hornblende diorite and minor gabbro, the **Qod** as well dissected alluvial fans of Pleistocene age, and the **Q** as alluvium (*Undifferentiated*) of Holocene age. The **Qod** is limited to the upper part of the canyon in the northeast portion of the APE, where the road comes in from Lucerne Valley.

The limestone and marble mining that has taken place along the base of the San Bernardino Mountains began in the early 1950s when Kaiser constructed a railroad spur line connecting the area to their Cushenbury Quarry, located south of Lucerne Valley (Fife 1988:176). Quarrying of limestone and marble along the north flank of the San Bernardino Mountains not only has continued to the present, but also has been expanding during much of that time. This mining activity has contributed to the amount of detailed geologic mapping that has occurred in the area.

Fife (1982:550) details a map of the prospects and mines for carbonate resources within the White Mountain carbonate deposits, including those in the APE. He identified three claims within the APE: the White Knob (Engrlhard) in Section 7, the White Ridge (Kaiser Steel) in Section 8, and the Guilixon (Pfizer) also in Section 8. A core sample drawn from the White Knob claim yielded a coarse crystalline calcite marble with no limestone present (*ibid.*:559).

According to Harms (1996:170), approximately three-quarters of the rocks exposed are granites, between 70 and 85 million years old. Fossiliferous limestones dated to approximately 300 million years ago occur on the north and east slopes of the San Bernardino Mountains. Evidence of a few lava flows that occurred approximately five million years ago is visible on the north and east slopes, in addition to relatively recent alluvial deposits.

Gantenbein (1986:101; 1990:19) mapped the geology at the Cushenbury Quarry in great detail and determined that the limestone in the quarry had been metamorphosed by both regional and contact metamorphism, transforming the it into various metamorphic grades of calcite marble. Earlier mapping had apparently included the marbles at the Cushenbury quarry with the Furnace Limestone (*ibid.*). Gantenbein (*ibid.*) indicates the upper portion of the Furnace Limestone is Mississippian and Pennsylvanian in age, based on the analysis of the megafossils found in the formation. Hollenbaugh (1968) asserts it is Permian. Brown (1986:109; 1990:12) identified areas of weak metamorphism, and disclosed several fossil locations. Carboniferous megafossils have been reported by Richmond (1960), and conodont[1] studies by Ozanich (1982) and Wardlaw (1984) indicated Pennsylvanian (Morrowan) strata are present.

Brown (1986:105-109; 1990:8-12) identified rocks of Precambrian through upper Paleozoic age along the north flank of the San Bernardino Mountains, correlating them with similarly aged rocks in the Eastern Mojave Desert region. His detailed mapping identified several Upper Paleozoic formations and their members including the Devonian-age Sultan Limestone, Mississippian Monte Cristo Limestone, and the Pennsylvanian through Permian Bird Springs Formation (*ibid.*). A stratigraphic chart for the northern San Bernardino Mountains is shown as Table 1 (Brown 1986:110; 1990:13), and the correlation of this sequence with sequences in other areas are shown as Figure 5 (Brown 1986:112; 1990:15) and Figure 6 (Brown 1986:113; 1990:16). Brown (1986; 1990) no longer uses the terminology "Mississippian Furnace Limestone" for any of the rocks that he mapped.

Note that the Devonian Sultan Limestone contains a dark colored dolomite of the Ironsides Member, a white to buff colored laminated and texturally massive dolomite of the Valentine Member, and a white limestone of the Crystal Pass Member. The Mississippian Monte Cristo Limestone consists of an interlayered dark- and light-gray limestone of the Dawn and Anchor Members, a white limestone of the Bullion Member, and heterogeneous limestone and dolomite of the Yellowpine Member. The Mississippian and Pennsylvanian Bird Spring Formation consists of a basal member of quartzite, siltstone, and impure limestone; a lower member of white coarsely crystalline limestone; a middle member of medium- and dark-gray, quartz-sand and chert-bearing limestone, and an upper member of light- and medium-gray limestone.

[1] Conodonts are the most widespread Paleozoic microfossils and are important for biostratigraphic indexing.

Brown (1994:7) notes that the "Mississippian Monte Cristo Limestone Bullion member is exposed in the White Knob quarry area and forms the orebody." He further notes that the "Conodont color index measurements indicate metamorphic temperatures of over 430°C." (*ibid.*). Based on his temperature findings, there must be conodonts, or fossils, present somewhere within the quarry area. Note that the "White Knob quarry produces high-purity limestone used for numerous commercial and industrial applications, including foods, pharmaceuticals, and paints. The high-purity limestone deposits required for these applications are typically white in color. The more common gray limestone deposits are not considered suitable for such applications" (Davis 2008:3).

Brown (1994:7) also indicates that the "Bird Springs Formation in the quarry area is a dark grey to black impure limestone and dips gently toward the south." He remarks that "Formations or members which have been recrystallized and bleached to white calcite marble include Devonian Sultan Limestone, Crystal Pass Member, Mississippian Monte Cristo Limestone Bullion Member, and portions of the Bird Springs Formation of Pennsylvanian-Permian age" (*ibid.*:3). The fact that the Bird Springs Formation in the quarry area is a gray limestone (Brown 1994:7; Brown 2008:363; Davis 2008:3), suggests that it has not been completely metamorphosed to marble. While the gray limestone of the Bird Springs Formation is not the main orebody, portions of it may be disturbed to get at the main, high-purity, white limestone orebody.

Dibblee (2008) mapped the surface geology within the APE as **hqm, mqm, qm, fl, sq, Qoa, Qof,** and possibly a minor amount of **hdg**. The **hqm** is described as hornblende quartz monzonite of Jurassic age, the **mqm** as migmatite of Jurassic age, the **qm** as quartz monzonite of Cretaceous age, the **fl** as Furnace Limestone of Mississippian age, the **sq** as Saragossa Quartzite of Paleozoic age, the **Qoa** as older alluvium of Pleistocene age, the **Qof** as older fanglomerates of Pleistocene age, and the **hdg** as hornblende diorite and gabbro of Cetaceous age (*ibid.*). The Furnace Limestone Formation, or the Furnace Formation (Richmond 1960), is described as mostly marble, locally conformable on Sarsgossa Quartzite, and elsewhere intruded by igneous rocks of Mississippian age, as suggested by crinoid and bryozoan fossils (Richmond 1960) (cf., Vaughan 1922).

Miller et al. (n.d.) mapped the geology within the APE as **Qc** or Modern colluvial deposits from the late Holocene, **Qs** or surficial deposits undifferentiated from the late Holocene, **Qof** or old deposits of alluvial fans from the late to middle Pleistocene, **Mzu** or undivided Mesozoic granitic rocks, **KJdg** or mixed diorite and gabbro from the Cretaceous and Jurassic age, **Trf** Monzonite of Fawnskin from the Triassic, **PPbs** or the Bird Spring Formation from the Pennsylvanian age, and **Mm** or Monte Cristo Limestone from the Mississippian age (Fig. 4).

Mapping by the National Resources Conservation Service (NRCS 2008) lists several soil types and rock outcrops within the APE, including the Arrastre rock outcrop complex **[101]**, the Bryman-Cajon association **[110]**, the Crafton-Sheephead rock outcrop association **[121]**, Yermo gravelly sandy loam **[176]**, and the Wapi-Pacifico dry rock outcrop complex **[DxF** and **DxG]** (Fig. 5).

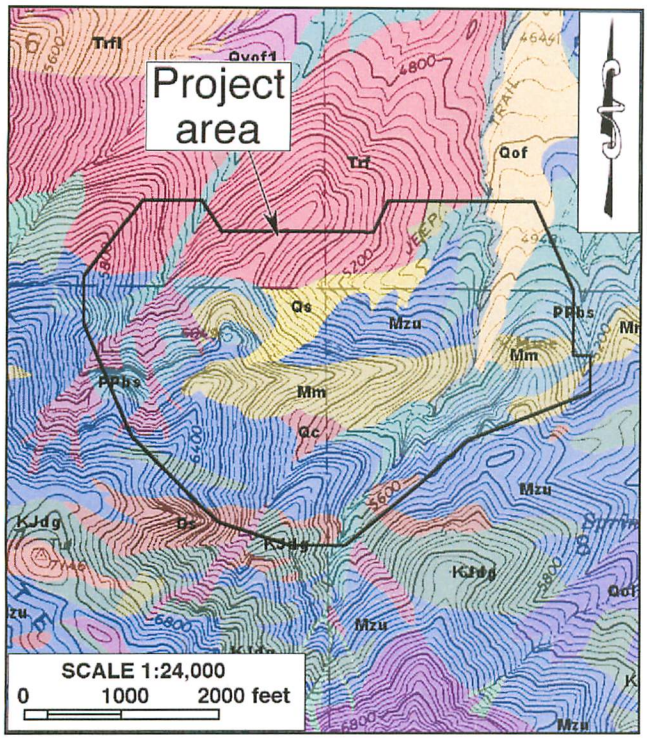

Figure 4. Geologic formations within the APE. (Source: Miller et al. n.d.)

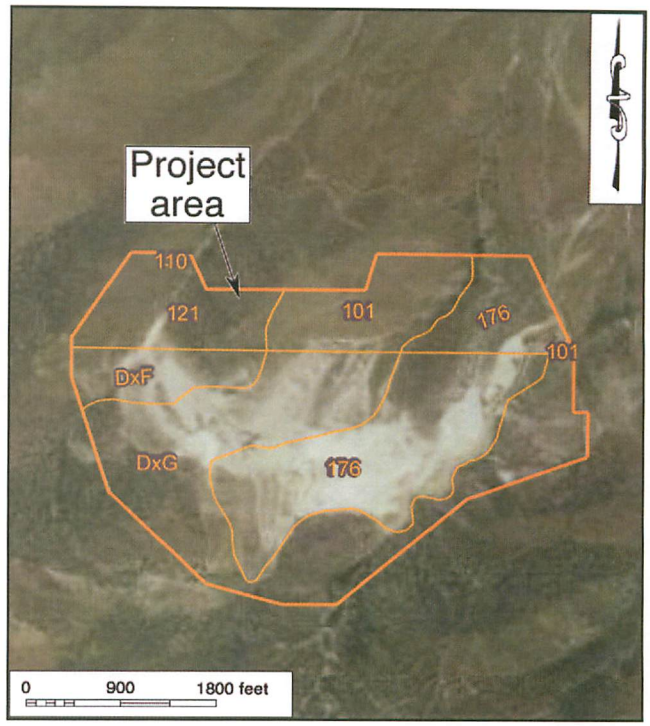

Figure 5. Soil types and rock outcrops in the APE. (Source: NRCS n.d.)

FIELD SURVEY

The field survey produced negative results for any surface indications of paleontological resources within or adjacent to the APE. Surface soils were confirmed in the field as representing a gravelly, sandy loam matrix. Much of the APE has been disturbed by the on-going mining activities and the construction of access roads, and large piles of quartz mining refuse are scattered throughout the area.

However, OMYA California's geologist Howard Brown, who is intimately familiar with the White Knob quarry has supplied additional observations regarding the quarry site. He notes that "Although rocks correlative with the Monte Cristo Limestone Formation are present in the APE they have been metamorphosed by repeated regional and contact metamorphism to upper amphibolite grade and granulite grade (high temp high pressure) and ALL of the limestone has been metamorphosed to marble, there is no remaining limestone that has not been metamorphosed. Based on 20 years of mining it can be stated with certainty the potential for virtually any paleontological resources in igneous and metamorphosed rocks at the APE is nil" (Brown 2009). Brown also notes that rocks at the quarry are highly metamorphosed, coarse grained calcite marble and—based on detailed field observations, sampling, drilling, and 20 years of mining—are not known to contain any fossils (Brown 2009). He states that the possibility of finding non-metamorphosed fossiliferous limestones at the quarry is non-existent.

Apparently there are pockets of non-metamorphosed limestone at the quarry. It is possible, then, that some of these limestone pockets might contain remnant fossils, since fossils have been recovered from such limestone deposits in other portions of the metamorphic belt along the north flank of the San Bernardino Mountains (Richmond 1960; Hollenbaugh 1968; Gantenbein 1986:101; 1990:19; Brown 1994). Note, however, that the Monte Cristo Limestone Formation, within which pockets of non-metamorphosed limestone are likely to be found, are present in the center of the APE and not within BLM lands.

DISCUSSION

The primary ore being quarried at this location is a very coarse crystalline marble with portions containing some very large calcite crystals. The Furnace Limestone, as mapped in the project area by Dibblee and now referred to as the Monte Cristo Limestone Formation, contains a significant amount of marble, which has a low potential for containing any paleontological resources. However, scattered small pockets of moderate to slightly metamorphosed limestone have been found within these large deposits of marble, and it is possible that this limestone may contain fossil remains, given that fossils have been recovered from limestone deposits found elsewhere in the area. These limestone pockets, though, appear to constitute a small percentage of the Monte Cristo Limestone and, since the higher-grade marble is the target ore for the mining operation, continuous monitoring would not be appropriate from a paleontologic, economic, or safety standpoint.

The presence of the relatively small and infrequent pockets of potentially fossil-bearing limestone my account for the discrepancy in the sensitivity assessments between the SBCM and the NHMLAC. While the SBCM has assigned a low paleontological sensitivity for the Monte Cristo Limestone because "the Paleozoic and Mesozoic metamorphic and granitic rocks…do not preserve fossils" (Scott 2008:1), the NHMLAC notes that "excavations in the Furnace Limestone exposed in the central portion of the proposed project area could potentially recover highly significant vertebrate fossils of late Paleozoic age" (McLeod 2008:2). McLeod is presumably referring to the moderate to slightly metamorphosed limestone that appears to constitute a very small percentage of the Monte Cristo Limestone Formation.

CONCLUSION AND RECOMMENDATIONS

Based on the research results discussed above, the proposed project's potential to impact significant nonrenewable paleontological resources appears to range from low to indeterminate, depending upon the type of rock encountered during mining operations. The surficial deposits of older Quaternary alluvium found within the drainages and in the lowest portion of the APE are unlikely to contain significant fossils, at least in the uppermost layers, and are considered to have a low potential. The Paleozoic metamorphic rocks and Mesozoic plutonic igneous rocks in the balance of the APE are also considered to have a low potential for significant fossil remains. Therefore, no paleontological monitoring of earth-moving activities is recommended within the alluvial soils, the highly metamorphosed rock, or the igneous rock.

However, there is the possibility that pockets of lesser metamorphosed limestones could be encountered within the areas of marble. Fossils have been found in similar formations in the area. Therefore, this limestone has to be assigned an undetermined potential for containing significant nonrenewable paleontological remains, primarily invertebrate fossils. Based on long-term, first hand observations, though, the possibility of finding non-metamorphosed fossiliferous limestones at the quarry is very low.

Thus, it is recommended that in the extremely unlikely and remote possibility that non-metamorphosed fossiliferous limestones are encountered during the mining activities, they would be set aside for examination by a qualified paleontologist. If any fossil bearing materials are encountered, a program to mitigate impacts to such resources that might be exposed or unearthed, is recommended. The program should be developed in accordance with the proposed guidelines of the Society of Vertebrate Paleontology, and should include, but not be limited to, the following:

- All non-metamorphosed fossiliferous limestones that are encountered during mining should be stockpiled for examination by a qualified paleontologist. The monitor should be prepared to quickly salvage any fossils that might be present. The monitor should also remove samples of sediments that are likely to contain the remains of small fossil vertebrates and invertebrates.
- Collected samples of sediments should be processed to recover small invertebrate and vertebrate fossils. Recovered specimens should be prepared so that they can be identified and permanently preserved.
- Any specimens should be identified, curated, and placed into a repository with permanent retrievable storage.
- A report of findings, including an itemized inventory of recovered specimens, should be prepared upon completion of the steps outlined above. The report should include a discussion of the significance of all recovered specimens. The report and inventory, when submitted to the appropriate Lead Agency, would signify completion of the program to mitigate impacts to paleontological resources.

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APPENDIX 1

PERSONNEL QUALIFICATIONS

PROJECT GEOLOGIST/PALEONTOLOGIST
Harry M. Quinn, M.S.

Education

1968 M.S., Geology, University of Southern California, Los Angeles, California.
1964 B.S, Geology, Long Beach State College, Long Beach.
1962 A.A., Los Angeles Harbor College, Wilmington, California.

- Graduate work oriented toward invertebrate paleontology; M.S. thesis completed as a stratigraphic paleontology project on the Precambrian and Lower Cambrian rocks of Eastern California.

Professional Experience

2000- Project Paleontologist, CRM TECH, Riverside/Colton, California.
1998- Project Archaeologist, CRM TECH, Riverside/Colton, California.
1992-1998 Independent Geological/Geoarchaeological/Environmental Consultant, Pinyon Pines, California.
1994-1996 Environmental Geologist, E.C E.S., Inc, Redlands, California.
1988-1992 Project Geologist/Director of Environmental Services, STE, San Bernardino, California.
1987-1988 Senior Geologist, Jirsa Environmental Services, Norco, California.
1986 Consulting Petroleum Geologist, LOCO Exploration, Inc. Aurora, Colorado.
1978-1986 Senior Exploration Geologist, Tenneco Oil E & P, Englewood, Colorado.
1965-1978 Exploration and Development Geologist, Texaco, Inc., Los Angeles, California.

Previous Work Experience in Paleontology

1969-1973 Attended Texaco company-wide seminars designed to acquaint all paleontological laboratories with the capability of one another and the procedures of mutual assistance in solving correlation and paleo-environmental reconstruction problems.
1967-1968 Attended Texaco seminars on Carboniferous coral zonation techniques and Carboniferous smaller foraminifera zonation techniques for Alaska and Nevada.
1966-1972, 1974, 1975 Conducted stratigraphic section measuring and field paleontological identification in Alaska for stratigraphic controls. Pursued more detailed fossil identification in the paleontological laboratory to establish closer stratigraphic controls, mainly with Paleozoic and Mesozoic rocks and some Tertiary rocks, including both megafossil and microfossil identification, as well as fossil plant identification.
1965 Conducted stratigraphic section measuring and field paleontological identification in Nevada for stratigraphic controls. Pursued more detailed fossil identification in the paleontological laboratory to establish closer stratigraphic controls, mainly with Paleozoic rocks and some Mesozoic and Tertiary rocks. The Tertiary work included identification of ostracods from the Humboldt and Sheep Pass Formations and vertebrate and plant remains from Miocene alluvial sediments.

Memberships

Society of Vertebrate Paleontology; American Association of Petroleum Geologists; Canadian Society of Petroleum Geologists; Rocky Mountain Association of Geologists, Pacific Section; Society of Economic Paleontologists and Mineralogists; San Bernardino County Museum.

Publications in Geology

Five publications in Geology concerning an oil field study, a ground water and earthquake study, a report on the geology of the Santa Rosa Mountain area, and papers on vertebrate and invertebrate Holocene Lake Cahuilla faunas.

PALEONTOLOGICAL SURVEYOR/FIELD DIRECTOR
Daniel Ballester, B.A.

Education

1998 B.A., Anthropology, California State University, San Bernardino.
1997 Archaeological Field School, University of Las Vegas and University of California, Riverside.
1994 University of Puerto Rico, Rio Piedras, Puerto Rico.

- Cross-trained in paleontological field procedures and identifications by CRM TECH Geologist/Paleontologist Harry M. Quinn.

Professional Experience

2002- Field Director, CRM TECH, Riverside/Colton, California.
- Report writing, site record preparation, and supervisory responsibilities over all aspects of fieldwork and field crew.

1999-2002 Project Archaeologist/Field Paleontologist, CRM TECH, Riverside, California.
- Survey, testing, data recovery, monitoring, and mapping.

1998-1999 Field Crew, K.E.A. Environmental, San Diego, California.
- Two and a half months of excavations on Topomai village site, Marine Corp Air Station, Camp Pendleton.

1998 Field Crew, A.S.M. Affiliates, Encinitas, California.
- Two weeks of excavations on a site on Red Beach, Camp Pendleton, and two weeks of survey in Camp Pendleton, Otay Mesa, and Encinitas.

1998 Field Crew, Archaeological Research Unit, University of California, Riverside.
- Two weeks of survey in Anza Borrego Desert State Park and Eureka Valley, Death Valley National Park.

PALEONTOLOGICAL SURVEYOR
Andrea Stella, B.S.

Education

2003 B.S., Anthropology, University of California, Riverside.

Professional Experience

2002- Project Archaeologist, CRM TECH, Riverside/Colton, California.

PALEONTOLOGICAL SURVEYOR
Robert Allen Porter, B.A.

Education

2000 B.A., Anthropology, California State University, San Bernardino.

Professional Experience

2001- Project Archaeologist, CRM TECH, Riverside/Colton, California.
- Trained in survey, excavation, and construction monitoring; experienced in field recording and reporting on cultural resources.

2000 Archaeological field class under the direction of Claude Warren. Excavated units at Soda Lake in the Mojave Desert and produced lake bottom stratigraphic profiles and carbon sample collections.

Honors and Awards

Spring 2000 Dean's Honors List (G.P.A. of 4.0 in 15 units).
Fall 2000 Dean's Honors List (G.P.A. of 3.9 in 12 units).

REPORT WRITER
Clarence Bodmer, B.A.

Education

2000-2002 Graduate Program in Archaeology, University of Kentucky, Lexington.
1996 B.A., Archaeology, University of California, Santa Barbara.

Professional Experience

2006- Archaeologist/Report Writer, CRM TECH, Riverside/Colton, California.
2006 Archaeologist, Tetra Tech, San Bernardino, California.
2005-2006 Archaeologist, Discovery Works, Long Beach, California.
2004-2005 Archaeological Technician, Statistical Research, Inc., Redlands, California.
2003 Archaeological Technician, Wilbur Smith & Associates, Lexington, Kentucky.
2000-2004 Archaeologist, Kentucky Archaeological Survey, Lexington, Kentucky.

Honors and Awards

2001-2002 Research Assistant, Department of Anthropology, University of Kentucky.
1995-1996 Grant, University of California, Santa Barbara.
1995-1996 Dean's Honor List, University of California, Santa Barbara.

Memberships

Society for American Archaeology.
Society for California Archaeology.

APPENDIX 2

RECORDS SEARCHES RESULTS

Natural History Museum of Los Angeles County

900 Exposition Boulevard • Los Angeles, CA 90007

Vertebrate Paleontology Section
Telephone: (213) 763-3325
FAX: (213) 746-7431
e-mail: smcleod@nhm.org

24 September 2008

CRM Tech
1016 East Cooley Drive, Suite B
Colton, CA 92324

Attn: Nina Gallardo

re: Paleontological resources for the proposed White Knob Quarry Revision Project, CRM Tech # 2280-P (White Knob Expansion Paleo), near Lucerne Valley, San Bernardino County, project area

Dear Nina:

I have conducted a thorough search of our paleontology collection records for the locality and specimen data for the proposed White Knob Quarry Revision Project, CRM Tech # 2280-P (White Knob Expansion Paleo), near Lucerne Valley, San Bernardino County, project area as outlined on the section of the Butler Peak USGS topographic quadrangle map that you sent to me via fax on 22 September 2008. We do not have any vertebrate fossil localities that lie directly within the proposed project boundaries, nor do we have any localities anywhere nearby from rocks similar to those that occur in the proposed project area.

In the lowest lying portion of the proposed project area, along the drainage in the very northeastern portion, there are surficial deposits of older Quaternary Alluvium, primarily as fan deposits from the surrounding elevated terrain. These deposits typically do not contain significant vertebrate fossils, at least in the uppermost layers, and we have no vertebrate fossil localities anywhere nearby from these or similar deposits. Geologic mapping indicates there are exposures of the Mississippian (early Carboniferous) Furnace Limestone in the central portion of the proposed project area. Although the Furnace Limestone is somewhat metamorphosed, it does contain recognizable invertebrate fossils and potentially could also contain vertebrate fossils. Otherwise, bedrock in the proposed project area consists of Paleozoic metamorphic rocks and Mesozoic plutonic igneous rocks that, of course, will be devoid of fossils.

Excavations in the Paleozoic metamorphic and Mesozoic igneous bedrock found throughout most of the proposed project area will not encounter any vertebrate fossils. Surface grading or shallow excavations in the older Quaternary Alluvium in the very northeastern portion of the

REC... 26 2008

proposed project area are unlikely to uncover significant vertebrate fossils. Because these Quaternary deposits are probably quite shallow and underlain by the igneous bedrock exposed in the surrounding elevated terrain, it is unlikely that any significant vertebrate fossils would be encountered during excavations in that portion of the proposed project area. Excavations in the Furnace Limestone exposed in the central portion of the proposed project area could potentially recover highly significant vertebrate fossils of late Paleozoic age that are otherwise very poorly known in California. Any substantial excavations in the Furnace Limestone exposures in the proposed project area, therefore, should be monitored closely to quickly and professionally recover any fossil remains discovered while not impeding development. Any fossil materials uncovered during mitigation activities should be deposited in an accredited and permanent scientific institution for the benefit of current and future generations.

This records search covers only the vertebrate paleontology records of the Natural History Museum of Los Angeles County. It is not intended to be a thorough paleontological survey of the proposed project area covering other institutional records, a literature survey, or any potential on-site survey.

Sincerely,

Samuel A. McLeod

Samuel A. McLeod, Ph.D.
Vertebrate Paleontology

enclosure: draft invoice

ACCREDITED by the AMERICAN ASSOCIATION OF MUSEUMS

SAN BERNARDINO COUNTY MUSEUM

2024 Orange Tree Lane • Redlands, California USA 92374-4560
(909) 307-2669 • Fax (909) 307-0539 • www.sbcountymuseum.org
TDD (909) 792-1462

COUNTY OF SAN BERNARDINO
PUBLIC AND SUPPORT
SERVICES GROUP

ROBERT L. McKERNAN
Director

12 November 2008

CRM Tech
attn: Nina Gallardo
1016 E. Cooley Drive, Suite "B"
Colton, CA 92324

re: **PALEONTOLOGY LITERATURE / RECORDS REVIEW, WHITE KNOB QUARRY REVISION PROJECT, LUCERNE VALLEY REGION, SAN BERNARDINO COUNTY, CALIFORNIA**

Dear Ms. Gallardo,

The Division of Geological Sciences of the San Bernardino County Museum (SBCM) has completed a literature review and records search for the above-named development in the Apple Valley region of San Bernardino County, California. Specifically, the property is located in portions of sections 5, 6, 7, and 8, Township 3 North, Range 1 West, San Bernardino Base and Meridian, as seen on the Butler Peak, California 7.5' United States Geological Survey topographic quadrangle map (1971 edition).

Previous geologic mapping (Bortugno and Spittler, 1986) indicates that excavation within the boundaries of the study area will incise rock units of several different geologic ages. These include, from oldest to youngest: metamorphosed limestone and marble dating to the later Paleozoic Era (= unit **$P_z$ls**); quartz monzonite dating to the Jurassic or the Cretaceous Period (= **KJqm**); and Quaternary older fan deposits (= **Qod**), as well as gneiss of indeterminate age (= **m_1**). Of these geologic formations, none have the potential to contain significant nonrenewable paleontologic resources. The Paleozoic and Mesozoic metamorphic and granitic rocks, as well as the gneiss of indeterminate age, do not preserve fossils. The Quaternary fan deposits were laid down in a depositional environment that is not conducive to the process of fossilization. For this reason, all of the rock units present within the boundaries of the proposed study area are assigned low paleontologic sensitivity.

For this review, I conducted a search of the Regional Paleontologic Locality Inventory (RPLI) at the SBCM. The results of this search indicate that no previously known paleontologic resource localities are recorded by the SBCM from within the boundaries of the proposed study area, nor from within several miles in any direction. The nearest recorded paleontologic resource localities (SBCM 1.94.4 - 1.94.5 and 1.94.10) are situated approximately 5½ miles to the northeast of the proposed study area; these localities were identified from sediments not present in the study area.

MARK H. UFFER
County Administrative Officer
NORMAN A. KANOLD
Assistant County Administrator
Public and Support
Services Group

Board of Supervisors
BRAD MITZELFELT ..... First District
PAUL BIANE ..... Second District
JOSIE GONZALES ..... Fifth District
NEIL DERRY ..... Third District
GARY C. OVITT ..... Fourth District

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Recommendations

The results of the literature review and the check of the RPLI at the SBCM demonstrate that excavation in Paleozoic, Mesozoic, and Quaternary deposits has low potential to adversely impact significant nonrenewable paleontologic resources. These sediments have low paleontologic sensitivity. *No program to mitigate adverse impacts to nonrenewable paleontologic resources is recommended at this time.*

References

Bortugno, E.J. and T. E. Spittler, 1986. Geologic map of California, San Bernardino sheet, scale 1:250,000. California Division of Mines and Geology Regional Geologic Map Series, Map 3A.

Please do not hesitate to contact us with any additional questions you may have.

Sincerely,

Eric Scott, Curator of Paleontology
Division of Geological Sciences
San Bernardino County Museum

APPENDIX F
GEOLOGICAL RESOURCES

CHJ Consultants
1355 E. Cooley Drive, Suite C, Colton, CA 92324 ◆ Phone (909) 824-7311 ◆ Fax (909) 503-1136
15345 Anacapa Road, Suite D, Victorville, CA 92392 ◆ Phone (760) 243-0506 ◆ Fax (760) 243-1225
77-564A Country Club Drive, Suite 122, Palm Desert, CA 92211 ◆ Phone (760) 772-8234 ◆ Fax (909) 503-1136

August 21, 2013

Omya California
A Division of Omya, Incorporated
7225 Crystal Creek Road
Lucerne Valley, California 92356
Attention: Mr. Howard Brown

Job No. 12121-8

Dear Mr. Brown:

This letter transmits two copies of the geotechnical consultation services report for the northwest slope of White Knob quarry, prepared for a proposed Amended Plan of Operations for the Omya California, White Knob quarry, located south of Lucerne Valley, California.

We appreciate this opportunity to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact this firm at your convenience.

Respectfully submitted,
CHJ CONSULTANTS

John S. McKeown

John S. McKeown, E.G. 2396
Project Geologist

JMc/JJM:jm/tlw

Distribution: OMYA California, Inc. (2)

UPDATE TO SLOPE STABILITY INVESTIGATION
PROPOSED AMENDED PLAN OF OPERATIONS
FOR THE
WHITE KNOB QUARRY
LUCERNE VALLEY, CALIFORNIA
PREPARED FOR
OMYA CALIFORNIA
A DIVISION OF OMYA, INC.
JOB NO. 12121-8

CHJ Consultants
1355 E. Cooley Drive, Suite C, Colton, CA 92324 ◆ Phone (909) 824-7311 ◆ Fax (909) 503-1136
15345 Anacapa Road, Suite D, Victorville, CA 92392 ◆ Phone (760) 243-0506 ◆ Fax (760) 243-1225
77-564A Country Club Drive, Suite 122, Palm Desert, CA 92211 ◆ Phone (760) 772-8234 ◆ Fax (909) 503-1136

November 21, 2012

Omya California
A Division of Omya, Incorporated
7225 Crystal Creek Road
Lucerne Valley, California 92356
Attention: Mr. Howard Brown

Job No. 12121-8

Dear Mr. Brown:

Attached herewith is the geotechnical consultation services report for the northwest slope of White Knob quarry, prepared for a proposed Amended Plan of Operations for the Omya California, White Knob quarry, located south of Lucerne Valley, California.

This report was based upon a scope of services generally outlined in our proposal, dated September 26, 2012 and other written and verbal communications.

We appreciate this opportunity to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact this firm at your convenience.

Respectfully submitted,
CHJ CONSULTANTS

John S. McKeown

John S. McKeown, E.G.
Project Geologist

JMc/JJM:tlw

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UPDATE TO SLOPE STABILITY INVESTIGATION
PROPOSED AMENDED PLAN OF OPERATIONS
FOR THE
WHITE KNOB QUARRY
LUCERNE VALLEY, CALIFORNIA
PREPARED FOR
OMYA CALIFORNIA
A DIVISION OF OMYA, INC.
JOB NO. 12121-8

INTRODUCTION

From March to October of 2012, this firm provided geotechnical consultation for an Amended Plan of Operations for the Omya Incorporated White Knob quarry located in the Lucerne Valley area of San Bernardino County, California. Our services included evaluation of an area located northwest of the White Knob quarry area referred to herein as the northwest slope. The purpose of our evaluation is to characterize the stability and condition of the northwest slope and to provide geotechnical recommendations for possible incorporation into the mining plan with regard to mitigation of fines sediment transport within the Western Drainage located below the northwest slope. Future mining operations are planned in the White Knob Annex area, located adjacent to the northwest slope and the White Ridge deposit to the east, and mitigation strategies to limit boulder roll down and fines transport are desired prior to operations in the Annex and White Ridge quarries.

To orient our investigation, we reviewed the following documents:

- Detailed Geologic Map of the White Knob White Ridge area San Bernardino Mountains by Howard Brown, dated June 1989, scale 1" = 50', contour interval = 10 feet
- Topographic map by Digital Mapping, Incorporated from aerial survey dated 2009, scale 1" = 50', 5-foot contour interval
- Draft 1 - Talus Slope Impact on Ruby Springs, Western Drainage, OMYA White Knob Quarry, Lucerne Valley, California, by DCI (Dean Consulting, Incorporated), dated September 12, 2011
- White Knob Haul Road Drainage Study and Plan of Development by Stantec, dated August 2011

- Orthophoto-based contour map - White Knob Placer Claim by American Aerial Surveys, dated June 24, 1983; scale 1" = 100', 25-foot contour interval
- Orthophoto-based contour map - White Knob area, untitled, dated November 7, 1988
- CHJ, Incorporated, Slope Stability Investigation, Proposed South and West Quarry Expansion, OMYA California, Inc. Sentinel Quarry, Lucerne Valley, California, CHJ Job No. 03475-8, report dated July 8, 2003.
- CHJ, Incorporated, Debris Slope at OMYA White Knob Quarry, Lucerne Valley, San Bernardino County, California, CHJ Job No. 051117-8, letter report dated January 5, 2006.
- CHJ, Incorporate, Revised Slope Stability Investigation, Proposed Amended Plan of Operations, for the White Knob Quarry, OMYA California, Inc., Lucerne Valley, California, CHJ Job No. 07539-8, report dated April 30, 2008.

The approximate location of the quarry area is shown on the attached Index Map (Enclosure "A-1").

The results of our evaluation, together with our conclusions and recommendations, are presented in this report.

SCOPE OF SERVICES

The scope of services provided during this geotechnical consultation included the following:

- Review of published and unpublished literature and maps including geologic mapping by Mr. Howard Brown, Omya's geologist
- Review aerial imagery dated 1983, 1988, 2002, 2003, 2005, 2006, 2007 and 2009
- Review of OMYA mine plans
- Review of previous CHJ studies
- Geologic mapping of the northwest slope area

- Geologic evaluation and slope stability calculations of the existing talus rock slopes under static and seismic conditions
- Evaluation of rockfall potential based on field observations and use of a simulation program to estimate velocities and bounce heights
- Evaluation of the geologic data and the results of our slope stability and rockfall evaluations to develop recommendations for mitigation of potential hazards and sedimentation.
- Evaluation of future slopes and embankments

NORTHWEST SLOPE PROJECT CONSIDERATIONS

As we observed during a site visit on December 20, 2012, an approximately 700-foot-high slope on the northwesterly side of the White Knob quarry includes talus created by inadvertent boulder roll down during blasting and excavation in the White Knob quarry area. A formal stability analysis was performed to evaluate the stability conditions of the slope. Potential solutions were suggested to address the slope conditions with regard to rockfall and sediment movement into the Western Drainage from existing talus and during future mining activity at White Knob and White Knob Annex. Enclosure "A-2.1" depicts the geologic conditions in the northwest slope area and general site features. Enclosures "A-2.2" and "A-2.3" present representative cross sections of the northwest slope.

PRIOR INVESTIGATIONS - WHITE KNOB QUARRY:

In a letter report, dated January 5, 2006, we summarized observations made in June 2006 of the northwest slope at the White Knob quarry and provided suggestions for reduction of sediment to the channel located at the toe of the slope. Our suggestions at the time included: (1) containing the debris with gabion-type wire mesh such as those used on rock slopes, (2) the construction of a berm along the toe of the debris or (3) the construction of a debris basin within the channel. As part of the current scope of services, we have re-evaluated these items as discussed herein.

In a reports dated 2006, 2007 and 2008, we presented slope stability studies for a proposed amended plan of operation for the White Knob quarry. The 2007/2008 investigation included geologic mapping, a review and discussion of geologic hazards, including faulting and seismicity, and a review of groundwater conditions. In addition, kinematic evaluation of proposed rock slopes and slope stability calculations and evaluation of proposed rock and fill slopes, were performed.

In the area northwest of the White Knob deposit, a natural talus slope mantled with boulder talus descends to a northeast-trending ephemeral drainage channel (Western Drainage). Inadvertent boulder roll down of white rock materials has occurred on this slope face and is of concern to downstream features. We previously evaluated the conditions of the slope and provided options for mitigation of the boulder roll down in a letter dated January 5, 2006. A modified blasting and mining procedure has been implemented in the area above the talus slope to help mitigate further addition of quarry material on to the talus slope.

Proposed mining plan amendments, general geology and geologic hazards including faulting, seismicity and slope stability for the White Knob quarry were discussed in our prior report dated April 30, 2008. Based on previously-presented stability calculations performed for bedrock slopes at the site, the underlying bedrock is considered grossly stable to landsliding; therefore, our stability evaluation for the northwest slope is limited to the colluvium/talus forming a surficial veneer on the bedrock surface.

SITE DESCRIPTION

The White Knob quarry is located in the northern San Bernardino Mountains, approximately 6 miles southwest of the town of Lucerne Valley. The quarry occupies portions of Sections 7 and 8, Township 3 North, Range 1 West, of San Bernardino Base & Meridian (SBB&M). Access to the quarry is by a haul road extending 6 miles west-southwesterly from the Omya Incorporated processing plant located on Crystal Creek Road. The White Knob quarry produces high-purity calcium carbonate limestone used for numerous commercial and industrial applications, including plastics and paints. The high-purity calcium carbonate limestone deposits required for these applications are typically white in color. The more common gray limestone deposits are not

considered suitable for such applications. The White Knob quarry area includes mining areas designated White Knob and White Knob Annex and a future mining area designated as White Ridge. The White Ridge area is not mined at this time.

REGIONAL GEOLOGIC SETTING:

The Omya Incorporated White Knob quarry lies in the northern portion of the San Bernardino Mountains. The San Bernardino Mountains are part of the Transverse Ranges Geomorphic Province. The San Bernardino Mountains are characterized by remnants of a relatively flat, uplifted geomorphic surface as old as Miocene in age. These discontinuous geomorphic remnants are separated by steep-walled canyons and prominent peaks. The White Knob quarry is located on the north flank of the mountains. The Mojave Desert Geomorphic Province is located to the north of the site. The general geologic structure and lithology of the site region are shown on Enclosure "A-3", Geologic Index Map adapted from Miller et al. (2000).

The following with regard to the regional geology of the mine area is adapted from information provided by Mr. Howard Brown, Exploration and Mining Geologist with Omya Incorporated.

> Brown (1984a, 1984b, 1985a, 1985b, 1986, 1991a, 1991b, 2008a) has presented numerous reports, presentations and papers regarding the regional geologic setting of the San Bernardino Mountains and Mojave Desert area as summarized below. A variety of rocks of Precambrian to recent age are exposed within the San Bernardino Mountains and the White Knob/White Ridge quarry area. Late Precambrian and Paleozoic metasedimentary rocks unconformably overlie older 1.8 b.y. Baldwin Gneiss Precambrian basement.
>
> Late Proterozoic and Paleozoic sequences in the San Bernardino Mountains contain elements of both cratonal and miogeoclinal affinity. The lower part of the sequence is dominated by quartzite of the Stirling Quartzite, Wood Canyon Formation, and Zabriskie quartzite. The Cambrian Carrara Formation contains both clastic and carbonate members. Cambrian strata are dominated by dolomite of the Bonanza King and Nopah Formations. A major unconformity is present between Upper Cambrian and Devonian strata throughout the Mojave region and San Bernardino Mountains. In the San Bernardino Mountains, Upper Precambrian and Lower Cambrian rocks are of miogeoclinal aspect, middle Cambrian strata are of cratonal aspect, and upper Paleozoic rocks are identical to inner miogeoclinal facies of the central and eastern Mojave region.

Upper Paleozoic rocks including upper Devonian, Mississippian and Pennsylvanian through Permian are dominated by limestone. High brightness, high purity crystalline limestone deposits occur in upper Paleozoic miogeoclinal limestone formations in the San Bernardino Mountains and at White Knob quarry. The Mississippian Monte Cristo Limestone is mined for high brightness, high purity calcium carbonate, and the Pennsylvanian Bird Spring Formation is extensively mined for cement grade limestone. Fluorescent minerals at the White Knob quarry occur in the Monte Cristo Limestone.

Several varieties of Permo-Triassic and Mesozoic age intrusive rocks are present in the San Bernardino Mountains, and include Permo-Triassic monzonites, quartz monzonite and granodiorite, Jurassic quartz monzonite, hornblende diorite and gabbro, and leucocratic batholithic quartz monzonites of Cretaceous age. Plutonic rocks form the majority of the mountain range, and the Paleozoic rocks described above were intruded by the plutonic rocks and form roof pendants. At the White Knob quarry, several generations of intrusive rocks are present and cross cutting relationships can be observed.

The Late Proterozoic and Paleozoic rocks have been affected by both regional and contact metamorphism. Regional metamorphism ranges from upper Greenschist to upper Amphibolite facies. At the White Knob quarry the metasedimentary rocks have been metamorphosed to upper amphibolite facies based on the presence of diopside, vesuvianite, wollastonite and garnet bearing calc-silicate minerals. Contact metamorphism is widespread, and numerous small skarn deposits are present along some contacts between metasedimentary and intrusive rocks.

Several major intrusive, metamorphic and tectonic events have been recognized in the San Bernardino Mountains. These include complex multi-phase Permo-Triassic and Mesozoic age folding and thrust faulting, contact and regional metamorphism, and intrusive events.

Cenozoic activity includes several generations of high and low angle faults, and mild folding. The San Bernardino Mountains area continues to be seismically active as evidenced by the significant earthquakes in the area during the last 15 years.

The Old Woman Sandstone consists of massive to weakly bedded arkosic and locally conglomeratic sandstone that crops out discontinuously in the northern San Bernardino Mountains and Mojave Desert region. Shreve (1959) suggests northward deposition of this sandstone in an alluvial-fan environment from an early San Bernardino Mountains highland. Quaternary deposits mapped by Miller et al. (2000) include alluvial fan, axial valley, talus, colluvial, surficial, and landslide deposits ranging in age from very old (Pleistocene) to recent (Holocene) age. Sediments within the mining area are primarily comprised of colluvium and surficial sediments as thin slope mantling soils and in drainage channels as thin veneers on bedrock channels.

At the White Knob Quarry, rocks have been multiply metamorphosed to amphibolite and locally granulite facies, forming exceedingly coarse-grained, very white translucent calcite marble. Individual calcite rhombs are commonly over 1 inch across. The steeply dipping deposit is over 1,500 feet along strike, and is exposed over 1,200 feet vertically.

The complex geologic history of the San Bernardino Mountains has allowed the formation of several large high brightness, high purity limestone deposits which are currently being mined or will be mined in the future.

LOCAL GEOLOGIC SETTING:

The White Knob quarry occupies an east-west oriented resistant and rugged limestone ridge formed in the very steep north-sloping topography of the northern San Bernardino Mountains. Natural slopes descend to the north and northwest from the ridge of the White Knob quarry. Satellite ore deposits occur to the east of the main quarry on an adjacent north-trending ridge (White Ridge area) that appears to be structurally related to the main quarry ridge. Natural slopes descend to the north and northwest from the ridge of the White Knob quarry. The area of the White Ridge deposit located to the east is not mined at this time, and adjacent slopes are in a natural state. An active overburden placement site (OB-1) is located near the east end of White Knob quarry in the Central Drainage area. Existing mine cut-slopes in the quarry are inclined overall at approximately 1(h):1(v) and up to approximately 600 feet in height. The overall inclination of the quarry slopes is controlled by a geologic structure (primarily joints) and locally by pre-splitting blasting.

Prior to mining, metamorphosed limestone outcrops formed very steep to vertical cliffs up to 100 feet high. During blasting and mining activities, rocks and boulders have inadvertently rolled onto the mountain side covering portions of the natural slope to form the existing 'northwest slope'.

FIELD INVESTIGATION:

Mapping and observations of the slope conditions were performed to provide information for slope stability analysis of the northwest slope. The area was accessed on foot via an unmaintained road that traverses westward to the slope below mid-height. The existing northwest slope is approximately 700 feet high and consists of two main areas/chutes of talus separated by a bedrock ridge that bisects the slope along the fall-line axis. The toe of the slope forms the southern flank of a drainage that

trends northeastward through dissected upland terrain. This drainage was the subject of the 2011 Ruby Springs study by DCI. Enclosure "B-1" presents a photo-collage of the northwest slope.

Native slopes in the area of the northwest slope consist of granitic bedrock slopes mantled by a thin veneer of colluvium and locally small talus. Limestone/marble outcrops form cliffs and steep slopes at the top of the northwest slope. Native talus is typically light gray to gray hued matrix-supported talus of small boulder to gravel size in a matrix of fine- to medium-grained silty sand. Talus generated by mining is typically white-colored small to large boulder size, clast-supported talus with a smaller fraction of gravel-to-cobble-size clasts. The mining talus is generally more angular than native talus and exhibits rounded to less common tabular forms were it occurs on the slope face.

SUMMARY OF FIELD OBSERVATIONS - 2012

During observation of the northwest slope we observed the following features that characterize the condition of the existing slope:

- Bedrock of carbonate and granitic compositions underlies the northwest slope and adjacent native slopes at shallow depths. A thin veneer of colluvium is present on slopes where surface outcrops are present and thicker accumulations of colluvium/talus occur below natural cliff faces and in topographic bedrock hollows.

- Where the mid-height road meets the east side of the talus slope, an isolated, approximately 6 x 6 x 3 foot thick boulder of white marble was observed in a furrow line approximately 40 feet long (Enclosure "B-3"). An accumulation of soil and small plants was plowed up at the downhill end of the boulder. New growth of vegetation was not present in the furrow above the boulder indicating relatively recent sliding movement of this isolated clast. The material upon which the boulder rested is a native colluvium present as an approximately 12-inch-thick veneer on underlying bedrock (Location 1 - "A-2.1"). It was evident that the slope angle steepened immediately below the prior resting place of this clast suggesting that the recent movement may have been caused by downhill creep of the underlying soils. This boulder occurs as an outlier to the talus field.

- Inspection of the lower portion of the east half of the northwest slope indicates that this area is in the fall line of rolling boulders and clasts that reach a point on the slope where a slight increase in slope angle causes continued travel to the slope toe (Location 2 - "A-2.1"). Several bounce marks (large hollows or divots) were observed in this fall line. The relatively-recent occurrence of single boulder roll down was indicated by the

presence of crushed small plants within individual bounce marks. The slope and toe of the northwest slope is currently an area of high rock fall occurrence and hazard.

- Isolated patches of native talus/colluvium **(tn)** are present along the slope toe. The presence of grasses and weeds and lack of large clasts on a silty gravelly sand material within these patches suggests a relatively stable substrate condition. Larger shrubs occur where bedrock is exposed in the talus slope face.

- The boulders and matrix of the mining talus unit **(tm)** accumulate to form convex talus cones on either side of a slope parallel bedrock ridge. Where individual clasts achieve a critical momentum during rolling, they accumulate within the head of the Western Drainage at the toe of the northwest slope. Some large boulders were observed to be located up to 40 feet higher than the drainage thalweg elevation on the west side of the drainage indicating uphill rolling or bounding. A topographic terrace formed in very old alluvium (Qvof) is located along the west side of the Western Drainage—several large boulders and associated small angular clasts (possibly collision-generated fly rock) have come to rest on this surface (Location 3 - "A-2.1").

- A debris flow chute is visible on the west side of the northwest slope (Enclosure "B-2"). This chute extends to the area of accumulation of boulders at the bottom of the slope. A gray-hued alluvium consisting of silty gravelly sand was observed as a veneer overlying boulder surfaces in the boulder accumulation zone at the toe of the slope. Some boulders were entirely covered by the alluvium veneer and progressive down-gradient filling and movement of alluvium in flat-lying accumulations was noted. This suggests the active and on-going formation of a step pool system within the boulder accumulation zone (Enclosure "B-4").

- A continuous animal trail traverses from Location 1 across the mid-height of the talus slope to a point up canyon. This suggests a relatively stable slope condition in the northwest slope.

From these observations, we conclude that:

1. Movement of individual boulders may occur where the underlying substrate is subject to downhill creep. Downhill creep is an ongoing natural process in colluvial slope environments and is expected to occur at natural rates in the northwest slope. Where boulders have come to rest on talus deposits, we expect that the interlocking force of the angular materials is sufficient to result in retention of most clasts within the talus fields. Addition of boulders to the talus or undermining by headward erosion may perturb some clasts to induce rolling or sliding movement in the future.

2. Individual boulder roll down by movement of an existing clast located on the slope face has occurred in the recent past—within the last 6 months (no material has been introduced to the northwest slope for several years). The most likely location (fall line) for long run out roll down is at the east flank of the slope where boulder-poor colluvium is exposed. The source area of this fall line is the slope on the west side of the White Knob Annex. The existing boulder fields act as a catchment area for large clasts.

3. Progressive down-gradient filling and movement of alluvium, generated by slope creep and debris flow into flat-lying accumulations between and upon boulders, were noted in the accumulation zone at the toe of the slope. This indicates the active and ongoing formation of a step pool system within the boulder accumulation zone that can act as a sediment/fines filtering area.

4. In the past, some boulders have traveled with sufficient momentum to carry partly up the toe of the opposing slope and generate flying debris from collision. The presence of a few boulders on the topographic terrace surface indicates that rock fall hazard is present in this area as well as at the toe of the northwest slope.

5. Natural slopes in the site area have been subjected to many more precipitation and seismic shaking events than the geologically-young talus slope formed from recent mining of the White Knob area. It is expected that within a relatively-short time, the northwest slope will achieve a state of stability that mimics the erosion/rock fall rate of surrounding natural slopes. The presence of a continuous trail traversing the slope indicates a relatively stable condition at this time. For undisturbed talus slopes, weathering and incremental gravity-induced shifting of boulders to a more stable position will increase boulder stability with time.

SLOPE STABILITY

The term "landslide", as used in this report, refers to deep-seated slope failures with a rupture surface at least 50 feet deep. Landslides are typically related to the underlying structure of the parent material. Surficial failures refer to shallow failures that affect the upper weathered or colluvial horizon of overlying material. Evidence for deep-seated landsliding was not observed in the White Knob quarry walls or on the aerial photographs reviewed during our previous 2007 and 2008 evaluations.

The susceptibility of a geologic unit to landsliding is dependent upon various factors that primarily include: 1) the presence and orientation of weak structures, such as fractures, faults, and/or clay

seams; 2) the height and steepness of the natural and/or cut slope; 3) the presence and quantity of groundwater; and 4) the potential/occurrence of strong seismic shaking.

The coarse-grained calcite marble ore at the site is relatively strong from a slope stability standpoint, with no weak clay or schist interbeds observed in natural or mined exposures. Natural cliffs formed in the calcite material stand vertically near the quarry site. The majority of joints are oriented favorably with respect to the planned quarry wall configuration and the geologic structure was carefully considered in planning the quarry slopes.

The granitic rocks on the margins of the ore body exhibit a similar orientation and spacing of joint sets as observed in the calcite marble. As described in the reclamation plan, road cuts formed in the granitic rocks exhibit joint control of north-south striking faces at inclinations of approximately 57 degrees. Most joints dip at steep angles (between 70 and 90 degrees) as measured during geologic mapping of the existing road cuts in the granitic rock slopes and thus form stable slope configurations at the existing slope angle.

STABILITY OF THE NORTHWEST SLOPE:

The slope-forming bedrock units that underlie the northwest slope consist of strong and grossly stable crystalline rock types that are shown by the overall angle of quarry slopes and calculations performed for our 2007 and 2008 studies to be stable at gradients steeper than that exhibited in the existing slope. In addition, evidence of deep-seated landsliding is not present in the existing terrain or on historic aerial imagery of the site. Therefore, the gross bedrock stability of the slope is not addressed further in this evaluation. Our evaluation is focused on the surficial stability of overlying colluvium/talus materials.

Natural talus slopes are commonly interpreted to exist at angle-of-repose gradients interpreted to indicate static factors of safety near unity (1.0). This may be true for a very limited slope area where applying a point load (a footfall) results in localized shifting of surficial material down slope. However, as a whole unit, the colluvium/talus mantle exhibits higher factors of safety—estimated to range from 1.1 to 1.4 based on the following factors that suggest higher-than-unity FS for talus slopes in the site area:

- Talus slopes in the seismically-active site lack evidence of whole-mantle, long-distance sliding movement. Individual blocks may shift or roll where FS is very close to unity during a seismic event and leave no discernable evidence in a talus field, but large head scarps or exposed bedrock slabs suggestive of large volume slope failures are not evident in the site slope.

- Based on the seismic history and proximity of faults capable of producing strong shaking at the site, it is clear that slopes in the region have been subjected to forces that perturb slope mantling/forming materials at geologically short time intervals.

- A Holocene to late-Pleistocene age landslide deposit is mapped less than 1/3 mile west of the subject slope on a slope of similar aspect but with different rock type. This deposit is formed in granitic rock types that are more susceptible to deep weathering than the limestone and marble underlying the subject talus slope. Landslides of this type are not anticipated for the very durable carbonate rock types in the site area.

- If the seismic FS of talus mantle were close to unity, one would expect widespread evidence of landslides in carbonate rock units in the site region, which is not evident.

As described previously, the northwest slope consists of a relatively thin veneer of very coarse- to coarse-grained mining-generated talus overlying a native colluvium/talus mantle in turn overlying stable bedrock at relatively shallow depths. The colluvium/talus material present on the northwest slope consists of a matrix-supported native colluvium/talus in contact with the underlying bedrock overlain by a predominantly clast-supported to transitional angular cobble-boulder talus layer. Based on the relative age of the native colluvium and presence of vegetation growing upon it prior to mining, as evidenced in aerial imagery from 1988, the native colluvium is expected to range from a thin veneer (1 foot thick) up to 15-feet thick locally in topographic swales and bedrock hollows. It is expected that the thickness of colluvium increases to form a wedge near the slope toe. The bedrock/native colluvium contact is interpreted to exist as an undulating, relatively rough surface that includes abundant asperities formed by weathering processes (rough bedrock projections). The mining talus is observed at the surface to consist of a coarse- to very coarse-grained (cobble to boulder size) talus accumulation forming a system of interlocking angular blocks. Locally isolated blocks comprise a very small fraction of boulders that are present outside the talus field and rest on finer-grained native colluvium.

The susceptibility of a residual geologic unit to landsliding is dependent upon various factors that primarily include: 1) the height and steepness of the slope, 2) the shear strength and cohesiveness of the material, 3) the presence and quantity of groundwater and 4) the potential for or occurrence of strong seismic shaking.

NORTHWEST SLOPE PROPERTIES AND MODEL:

The subject slope is approximately 700 feet high and exhibits an overall slope angle of approximately 36 degrees with short steeper portions locally exhibiting angles up to 43 degrees. The slope is estimated to have an ultimate finished height of approximately 630 feet based on the Mining Plan dated April 4, 2007. Seeps or springs are not present in the slope face or within the head of the Western Drainage at the toe of the slope. The surficial, coarse-grained colluvium/talus mantling the slope is interpreted to be free draining; therefore long-term hydrostatic conditions are not anticipated to occur.

The North Frontal fault zone (NFFZ) is located approximately 1 mile (1.6 kilometers) north of the slope. Based on the attenuation relations for earthquake shaking by Boore and Atkinson (2008), Campbell and Bozorgnia (2008) and Chiou and Youngs (2008) for magnitude 7 and 1.6 kilometer distance, the NFFZ is capable of producing peak ground acceleration at the site of 0.52g. The seismic stability calculations were performed using a lateral pseudo static coefficient "*k*" of 0.20 due to the proximity of the NFFZ. Based on proximity to a fault zone capable of producing strong ground shaking on a geologically-short time scale and observations of nearby native slope exposures, we interpret the slope to exhibit good stability characteristics with respect to deep-seated and surficial failures. The strength parameters of the slope-forming materials are discussed in a following section.

SLOPE STABILITY CALCULATIONS:

The stability of the talus slope (Cross-Section A-A') was analyzed for static and seismic conditions for non-circular failures utilizing the SLIDE computer program, version 6.0 (Rocscience, Inc., 2011). The seismic stability calculations were performed using a lateral pseudostatic coefficient "k" of 0.20 due to the proximity of the NFFZ. The factor of safety was calculated by Spencer's method which is considered the most conservative of the available methods. We utilized the 'auto-refine' feature to

search for failure surfaces with the lowest factors of safety (FS). Assessment of strength parameters of coarse-grained materials, including gravity-generated talus, for use in slope stability analyses is problematic due to the large grain size relative to the size of typical sampling and testing equipment. Therefore, alternatives to direct measurement of shear strength were required. During this evaluation, we utilized back-calculation/sensitivity analysis to estimate the cohesive strength of the mining talus and native talus materials.

PRE-MINING TALUS SLOPE:

A very steep to vertical cliff up to 100 feet high was present at the head of the northwest slope prior to mining. The presence of this feature in this relatively active seismic region attests to the stability of steep slopes formed in the limestone of the region. We first analyzed the surficial stability of the pre-mining slope based on the geometry of the 1988 contours and modeled thickness of native colluvium/talus varying from 5 feet to 15 feet. We utilized the sensitivity analysis feature of SLIDE to evaluate the range of materials strengths for the native colluvium/talus that resulted in reasonable FS for natural slopes in the site region based on anticipated seismic loading and lack of evidence for large-scale slope failures in the Western Drainage watershed (i.e., straight thalweg with no deflection and consistent stream gradient; lack of waterfalls). For the geologic unit **(Tn)**, our analysis resulted in a range of cohesion values from 160 psf to 355 psf (FS = 1.0 to 1.5, respectively).

Existing Talus Slope

Analysis of the existing slope using the 2009 topography overlain on the 1998 contours, as depicted in section A-A' was used to estimate the existing slope conditions. The material properties were modeled utilizing the Mohr-Coulomb criteria as summarized in the following table.

Table 1: Summary of Materials Properties			
Geologic Unit		**Value**	
		Static	**Seismic†**
(tn) Native Colluvium/Talus	Unit Weight (pcf*)	135	135
	Phi Angle	38	41
	Cohesion (psf)	355	355
(tm) Mining Talus	Unit Weight (pcf*)	130	130
	Phi Angle	40	40
	Cohesion (psf)	350	375
(brx) Bedrock Units	Unit Weight (pcf*)	165	165
	Phi Angle	65	65
	Cohesion (psf)	1500	1500

* pcf = pounds per cubic foot † peak strengths
** psf = pounds per square foot

The above parameters were estimated from the following:

- Published and unpublished results of remolded shear testing of colluvial matrix materials
- Estimates and back calculation of shear strength and cohesion of interlocked angular blocks in talus accumulations
- Assumption of infinite strength in the bedrock unit to force potential failure planes into overlying residuum

The results of our slope stability analyses are summarized in Table 2. Details of stability calculation results including soil type boundaries, strength parameters, sensitivity analysis, and the minimum factor of safety and critical slip surface are included in Enclosures "C-1" through "C-4".

Table 2: Slope Stability Summary		
Cross Section	**Static F.S.**	**Seismic F.S. (k=0.2)**
A-A' pre-mining	--	1.26*
A-A' existing	1.34	1.07

* Sensitivity analysis

As summarized in Table 2, static and seismic factors of safety that mimic the estimated FS for natural slopes in the site region were exhibited in the slope model of the northwest slope. The seismic FS less than unity indicates a potential for seismically induced landslides within the surficial slope material along Section A-A'. However, the lack of evidence for landslides in the Northwest Drainage and interpreted seismic history of the site region imply that seismic FS < 1.0 is not the actual case for this slope and that the actual FS is greater than 1.0 based on field evidence. The length of the slide area identified by the SLIDE program occurs in the thickest area of surficial material and is about 240 feet in length. It may be that features of this small extent are reworked/masked by erosion or slope creep processes and so are not expressed in the contemporary geologic record. However, a scenario in which a strong seismic event causes a failure of this size is consistent with expected natural events for the seismically-active and mountainous region of the site. Based on the results of the slope stability calculations, observations of the existing slope conditions and observations of surrounding terrain and nearby natural slopes, we interpret the current northwest slope configuration to be grossly stable and surficially-stable compared with the expected natural conditions of slopes in the area.

ROCKFALL POTENTIAL AND ANALYSIS:

Rockfall is a type of mass wasting in which blocks of intact rock become mobilized by toppling or falling then roll, bounce or free fall downhill. Rockfall is generally limited to natural slopes steeper than 33 degrees. Rockfall behavior is controlled by slope angle, type of substrate, and rock size and material. The limestone/marble bedrock of the quarry is considered very durable. Site observations

and review of aerial imagery indicate that an accumulation of boulders has formed on the subject slope since mining began at the top of the slope in approximately 1996.

The earliest aerial imagery showing mining talus deposition is dated May 28, 2002. In this image, talus is present as a boulder field at the toe of the slope and as talus fields on the west and east portions of the slope. The extent of talus fields at the time of the 2002 imagery is consistent with the extents that were observed at the time of our field observations indicating little addition to the area of deposition during the past 10 years. Outlier boulders (Location 3 - Enclosure "A-2.1") located beyond the boulder field appear to have been deposited soon after commencement of roll-down activity as the number of clasts in this field is unchanged after 2002. This indicates that the boulder field acts as a catchment for material reaching the field and that future deposition of material beyond the current boulder field is not likely.

In comparing images dated May 28, 2002, June 27, 2003, and October 20, 2003, it is evident that a large boulder (Boulder A - Enclosure "A-2.1") located in the western talus field shifted position approximately 120 feet down-slope during this 17-month time period. This boulder was observed to be at the 2003 location during our field observations in March 2012 - a time period of about 100 months since its position in 2003. The behavior of this boulder suggests that the larger boulders deposited on to the talus slope are initially subject to creep movement then achieve a more stable state of repose relatively rapidly.

For our analysis of the northwest slope, we utilized the Colorado Rockfall Simulation Program (CRSP) - version 4.0 by Jones, et al. (2000) to model the behavior of rolling boulders calibrated to the observed site conditions. The existing slope includes fall lines with different substrate properties. We evaluated Cross Section A-A' for a combined talus and soft soil substrate to model rocks falling along the east side of the subject slope. We evaluated Cross Section B-B' with a soft soil substrate and relatively-smooth surface condition to model rocks falling along the west side of the subject slope. Rock size was varied for each of the two fall lines and 'calibrated' to existing conditions observed during field mapping. Cross Section A-A' includes a talus field comprised of angular boulder-size clasts that form a rough surface compared to the fall line along Cross Section B-B'. Analysis Points (APs) along the slope profile were selected in the program to coincide with

accumulation features observed in the field. The slope models, materials and slope parameters utilized in, and results of the rockfall analysis are presented in Appendix "D". Rockfall simulation results are summarized in Tables 3.1 and 3.2.

Table 3.1: Summary of Rockfall Analysis - Cross Section A-A'

No. of Simulations for Each Rock Size: 500

	No. Passing	Max./Avg. Velocity (ft./sec.)	Max./Avg. Bounce Height (ft.)	Max./Avg. Kinetic Energy (ft.-lb.)	Comments
Boulder Size = 1ft.					
AP1	7	69.3 / 40.5	7.8 / 3.4	7,769 / 3,475	Most rocks retained in zone from 140 to 300 feet along fall line
AP2	0	--	--	--	
AP3	0	--	--	--	
Boulder Size = 2ft.					
AP1	50	76.4 / 38.3	20.3 / 5.5	77,024 / 24,006	A majority retained in zone from 140 to 400 feet along fall line. Few reach as far as 880 feet.
AP2	0	--	--	--	
AP3	0	--	--	--	
Boulder Size = 4ft.					
AP1	489	94.4 / 44.7	30.5 / 6.9	927,278 / 192,886	Few rocks retained before 850 feet, most retained between 870 feet and 1100 feet
AP2	319	88.3 / 34.4	19.9 / 4.1	871,183 / 167,855	
AP3	0	--	--	--	
Boulder Size = 6ft.					
AP1	500	106.9 / 81.3	26.8 / 9.1	3,850,679 / 2,494,354	All rocks reached the toe of the slope
AP2	500	76.9 / 39.9	11.7 / 2.5	2,101,702 / 643,794	
AP3	0	--	--	--	
Boulder Size = 10ft.					
AP1	500	109.1 / 84.9	32.1 / 10.4	18,642,521 / 12,627,327	All rocks reached the toe of the slope
AP2	500	123.9 / 75.9	25.5 / 7.9	24,568,824 / 10,561,619	
AP3	0	--	--	--	

Table 3.2: Summary of Rockfall Analysis - Cross Section B-B'					
No. of Simulations for Each Rock Size: 500					
	No. Passing	Max./Avg. Velocity (ft./sec.)	Max./Avg. Bounce Height (ft.)	Max./Avg. Kinetic Energy (ft.-lb.)	Comments
Boulder Size = 2ft.					
AP1	394	47.7/19.1	6.1/1.1	29,219/5,725	Most rocks retained in zone from 680 to 900 feet along fall line
AP2	143	34.5/15.1	5.0/0.8	15,719/3,852	
AP3	0	--	--	--	
Boulder Size = 4ft.					
AP1	500	58.3/43.8	7.1/2.5	356,924/214,144	All rocks reached the toe of the slope
AP2	500	56.3/40.6	5.3/1.8	338,903/187,113	
AP3	0	--	--	--	
Boulder Size = 10ft.					
AP1	199	59.4/42.0	0.66/0.12	6,187,159/3,315,388	Rocks retained in zone from 100 feet to 700 feet; clustering from 230 feet to 350 feet; few reach bottom of slope
AP2	60	56.8/36.9	0.81/0.16	5,732,076/2,573,235	
AP3	0	--	--	--	

The results of the rockfall simulation indicate the following:

- For talus substrate, larger boulders travel farther down slope and smaller clasts are retained within the talus field
- For soft soil substrate, medium-size boulders tend to travel farther while small and large sizes are retained in the soft slope soils
- Kinetic energy increases rapidly with increase in rock size
- The talus field acts as a catchment for small to medium size clasts
- The soft soil slope acts as a catchment for small and large boulders

With regard to rockfall hazard from existing material on the northwest slope, it is apparent, based on evidence for individual shifted boulders and fresh-appearing bounce marks, that rockfall hazard from

existing individual clasts is high at this time compared with natural rates on adjacent slopes in this area. Therefore, we recommend that personnel be precluded from occupying the northwest slope until such time as protective measures can be emplaced (by remote means) and/or the rate of rockfall from existing material is suitably lower.

It should be noted that boulders bounding down the slope have been estimated to travel at maximum velocities up to approximately 115 feet/second. This rate of travel indicates about 10 seconds for a person to relocate from the path of a rolling boulder on the approximately 1,200 foot-long slope. The likelihood of witnessing a rolling boulder under current slope conditions appears low. However, given the anticipated outcome of a human/boulder interaction, it would be prudent to exercise caution when performing tasks at the base of the western slope. Because of the remote location of the Western Drainage the probability of such an occurrence is very low.

If access to the Western Drainage is necessary, it may be feasible to utilize a dedicated spotter with two-way radio (or other direct means of communication) and selection of "safe" zones for personnel in the rock-fall zone. "Safe" zones may include areas at the base of the slope that lack white-colored boulders indicating no previous accumulation, or are "shielded" by existing large boulders or by elevation (located above the accumulation area). While access to the rockfall zone by the casual traveler is not likely in this remote area, we recommend conspicuous signs warning of rockfall hazard within the Western Drainage be placed on the approach road and in other potential paths of access.

FUTURE MINING CONSIDERATIONS

Future mining is planned in the White Knob Annex area adjacent to the northwest slope. If mining practices similar to those used for the White Knob area are employed in the Annex, some boulder roll down and talus deposition is expected to occur and result in similar rockfall hazard and sedimentation conditions as observed for the northwest slope.

Several potential mitigation or remediation options for the existing or future conditions, including rockfall and sediment control, may include:

1. Scaling or stabilizing individual clasts or talus accumulations in place using rockfall mitigation methods such as rock bolts, dowels, shear pins, steel netting, injectable resin/epoxy, grouting or use of catchment fences or berms.

2. Removing slope materials and boulders to a more stable location.

3. Erecting rockfall barriers or berms at locations along suspected rock fall lines to preclude the largest anticipated boulder from passing. Feasibility of this option would depend on location/cost in conjunction with use of silt fence or sedimentation basins (item no. 5).

4. Relying on natural processes, including creep and weathering and step pool formation in the boulder field (observed and ongoing), to mitigate rockfall and sediment transport while monitoring the Western Drainage sediment transport rates/conditions.

5. Establishing debris control basin(s) in the Western Drainage within the mining boundary, if warranted based on sediment monitoring results.

6. Precluding activity that contributes additional material onto the slope.

7. Placement of signs warning of rockfall hazard within the Western Drainage on the approach road and in other potential paths of access.

Options 1 and 2 are considered impractical due to the low slope angle compared to typical rockfall hazard zones, constructability, aesthetics and life safety issues. If the results of a rock falling do not cause a hazard or damage to public lands, then mitigation may not be necessary. Use of remote methods to dislodge individual boulders or talus accumulations considered hazardous may be feasible but may act to exacerbate movement of already-stable clasts and contribute to sediment transport. Use of remote methods does not appear necessary at this time due to the remoteness of the talus slope area and very limited exposure of the area to the general public. Gravity can perform the function of rockfall mitigation with the passage of time. The overall slope stability of the surficial materials is considered suitable compared to natural stability of talus and colluvium in the site area.

Option 3 is feasible however the need for disturbance of existing native vegetation and terrain should be weighed against the perceived benefit.

Option 4 requires no action but should include monitoring of sediment transport to evaluate the need for debris basin installations.

Option 5 may be feasible if rockfall hazard is determined to be low in the outlier boulder field (Location 3 - Enclosure "A-2.1"). Option 5 may be unnecessary depending on the need for sediment reduction in the Western Drainage. The hydrologic monitoring report by DCI (2011) indicates that no sediment transport was observed between 2005 and 2009 and concludes that under non-catastrophic storm conditions, the conditions within the talus slope and Western Drainage should reduce the amount of bed load that may be transported within the Western Drainage toward downstream features. This suggests that sediment flux in the Western Drainage has established a more stable rate. However, it should be noted that periodic debris flows (discussed in a following section) may introduce sediment loads into the Western Drainage that temporarily increase the sediment input rate.

Option 6 is related to mining practices and may include alteration of the mining plan, use of continuous mining equipment, modification of blasting practices near daylighted cliff faces, use of rockfall mitigation installations or some combination thereof.

Option 7—limiting access to the rock fall zone—is feasible. The remote location of the site and difficulty of access provide a passive boundary to access. The placement of conspicuous signs warning of potential rockfall hazard adds an additional measure of protection. The use of two-way communication, dedicated spotter and selection of "safe" zones may safely allow transient occupation of the Western Drainage below the northwest slope by authorized persons for monitoring purposes. Because of the remote locations, movement of individual boulders or small talus movements on fee land are not expected to damage adjacent public or private land and potential for such damage is very limited.

DEBRIS FLOW POTENTIAL:

Debris flows are a surficial type of mass wasting that may occur in mountainous regions during localized high precipitation events. A debris flow chute was observed on the west side of the northwest slope. The chute extends from the upper slope down to the slope toe, includes a zone of

depletion near its head and zone of accumulation at its lower end and is approximately 2 feet deep. This feature was formed between June 27 and October 20, 2003, based on review of aerial imagery. This time period coincides with the 'early August 2003' intense storm event described in the hydrologic monitoring report by DCI (2011). The source area is located along the contact between the **Tmw** (boulder talus) and **Tmg** units (Enclosure "A-2.1). This feature is formed in the finer-grained gray-colored portion of the talus slope. The 'snout' of the chute merges into the boulder field at the base of the slope. Material shed by this debris flow and the talus slope in general appear to be contributing material to formation of step pools within the boulder field at the base of the slope. Future debris flows may occur on the northwest slope during heavy precipitation events. These types of events are typically associated with localized monsoonal moisture patterns during the summer and early fall months in the Lucerne Valley area. To aid in mitigation of future debris flows, water flow lines should be directed away from the top of the northwest slope. Mitigation measures to prevent formation of debris flows may include grading of top-of-slope areas to direct runoff away from the slope face and maintaining berms along the top of the slope. Mitigation of sediment transport in the Western Drainage as result of debris flows includes Options 4 and 5 as discussed on page 22.

GROUNDWATER

No evidence for springs or perched groundwater conditions was observed at the site during the geologic mapping or on the aerial photographs reviewed.

Depth-to-groundwater data are not available for the site vicinity from the California Department of Water Resources (2007) or the U. S. Geological Survey (2007). The closest data available are from wells in the town of Lucerne Valley, located at a significantly lower elevation north of the site.

Groundwater has not been encountered in exploratory borings drilled to 550 feet bgs (Howard Brown, personal communication). The current depth to groundwater at the site is not known but is expected to be greater than 550 feet bgs. Based on the planned mining excavation depths, the anticipated depth of groundwater and the presence of non-liquefiable bedrock, no potential for liquefaction and other shallow groundwater-related hazards is anticipated.

Mine slopes should continue to be protected with berms and/or levees as necessary to prevent slope erosion in the areas where natural slopes drain onto the reclaimed slopes.

CONCLUSIONS FOR NORTHWEST SLOPE AREA

Based upon our geologic field observations, the results of our slope stability calculations, and rockfall analysis, it is the opinion of this firm that the continued mining in the White Knob quarry above the northwest slope and mining of the White Knob Annex is feasible, provided that suitable conditions can be established to limit addition of material or access to the existing and proposed slopes.

Based upon our prior gross slope stability analyses for limestone/marble mining and our current surficial slope stability analysis, the existing talus/colluvium slopes are considered suitably stable to mass movement with respect to the stability of adjacent natural slopes and anticipated final reclamation condition. It is anticipated that the talus slope will trend toward a more stable condition and achieve a natural state of stability with the passage of time. Additional evaluation of slopes above the Western Drainage may be warranted at the completion of mining and prior to final reclamation.

Based on review of aerial imagery and field observations, a potential rockfall hazard is apparent in the western slope area. Placement of conspicuous signs and/or barriers in the Western Drainage approach, warning of potential rockfall, is warranted based on observation of recent bounce marks and shifted boulders in the northwest slope. Mitigation of rockfall for individual clasts present on the slope by direct means is not considered practical with regard to human life safety at this time. Remote methods may be feasible; however, these may act to exacerbate movement of already stable clasts and contribute to sediment transport.

There is a potential for debris flow activity during localized intense storm activity in the western slope area. Monitoring of sediment transport in the Western Drainage if future debris flow occurs may provide information with regard to sediment transport rates and potential effects on downstream features.

Removal of slope materials or boulders to a more stable configuration is considered impractical at this time due to the potential hazard to human life, constructability, aesthetics and cost.

No evidence of active faulting was observed on the site during this investigation. Several inactive faults traverse the quarry areas. No groundwater barriers are known in this area.

RECOMMENDATIONS

ROCKFALL HAZARD:

Indications of recent rockfall events related to existing slope materials were noted in the northwest tailing slope area - rockfall hazard is considered potentially high relative to adjoining natural slopes. Material has not been added to the northwest slope for several years. The area is remote from developed roadways and not easily accessible; however, we recommend that conspicuous signs or other indicators of rockfall hazard be placed beyond the slope toe to preclude casual entry to this area. Authorized persons accessing the base of the western slope should employ a spotter system to warn of boulder movement should this occur during occupation of the area. Rockfall hazard is expected to decrease with passage of time. Additional measures for life safety are not considered necessary at this time.

SEISMIC SHAKING HAZARDS:

Moderate to severe seismic shaking of the site can be expected to occur during the lifetime of the proposed mining and reclamation. This potential has been considered in our analyses and evaluation of slope stability.

SLOPE AND STREAM PROTECTION:

Monitoring of sediment transport in the Western Drainage is expected to continue. Additional monitoring for debris flow may provide information with regard to sediment transport rates and potential effects on downstream features. Construction of debris basins appears feasible in the area downstream from the northwest slope. Design of such improvements is not within our area of engineering practice. Guidelines for design and construction of debris basins may be available from the jurisdictional flood control agency.

LIMITATIONS

CHJ Consultants has striven to perform our services within the limits prescribed by our client, and in a manner consistent with the usual thoroughness and competence of reputable geotechnical engineers and engineering geologists practicing under similar circumstances. No other representation, expressed or implied, and no warranty or guarantee is included or intended by virtue of the services performed or reports, opinion, documents, or otherwise supplied.

This report reflects the testing and observations conducted on the site as the site existed during the investigation, which is the subject of this report. However, changes in the conditions of a property can occur with the passage of time, due to natural processes or the works of man on this or adjacent properties. Changes in applicable or appropriate standards may also occur whether as a result of legislation, application, or the broadening of knowledge. Therefore, this report is indicative of only those conditions tested and/or observed at the time of the subject investigation, and the findings of this report may be invalidated fully or partially by changes outside of the control of CHJ Consultants. This report is therefore subject to review and should not be relied upon after a period of one year.

The conclusions and recommendations in this report are based upon observations performed and data collected at separate locations, and interpolation between these locations, carried out for the project and the scope of services described. It is assumed and expected that the conditions between locations observed and/or sampled are similar to those encountered at the individual locations where observation and sampling was performed. However, conditions between these locations may vary significantly. Should conditions be encountered in the field, by the client or any firm performing services for the client or the client's assign, that appear different than those described herein, this firm should be contacted immediately in order that we might evaluate their effect.

If this report or portions thereof are provided to contractors or included in specifications, it should be understood by all parties that they are provided for information only and should be used as such.

The report and its contents resulting from this investigation are not intended or represented to be suitable for reuse on extensions or modifications of the project, or for use on any other project.

CLOSURE

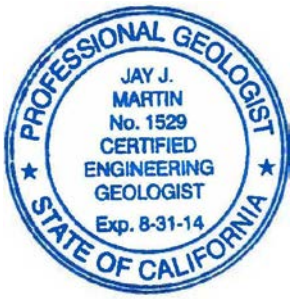
We appreciate this opportunity to be of service and trust this report provides the information desired at this time. Should questions arise, please do not hesitate to contact this firm at your convenience.

Respectfully submitted,

CHJ CONSULTANTS

John S. McKeown, E.G. 2396
Project Geologist

Jay J. Martin, E.G. 1529
Vice President



JMc/JJM:tlw

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AERIAL PHOTOGRAPHS REVIEWED

Google Earth web-based software application, aerial imagery dated October 1, 1995; May 28, 2002; June 27, 2003, October 20, 2003; December 30, 2005; January 30, 2006; January 29, 2007; June 5, 2009.

San Bernardino County Flood Control District, November 18, 1972, black and white aerial photograph No. 30.

U.S.D.A., February 22, 1953, black and white aerial photograph Nos. AXL-47K-117 and -118.

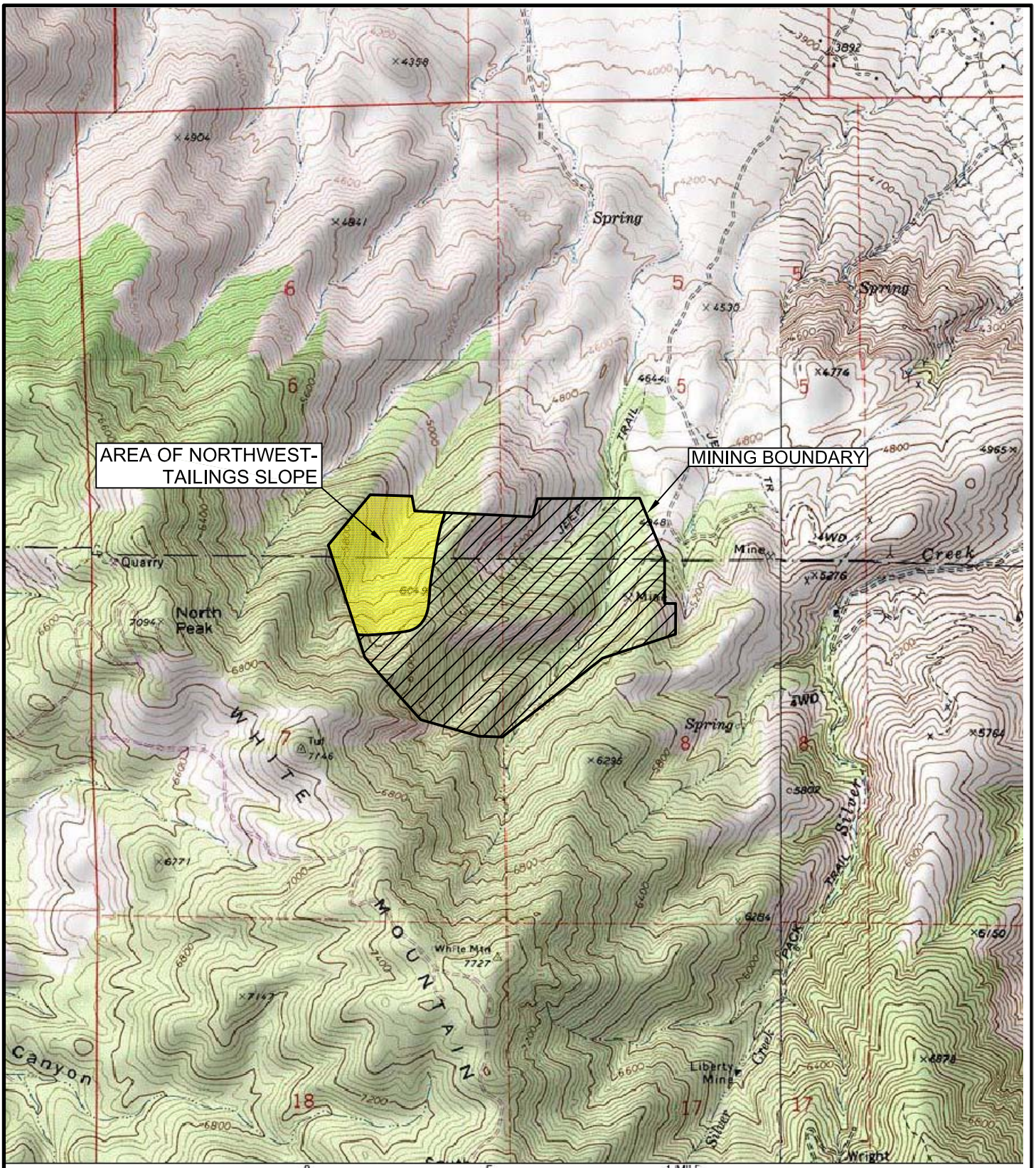
U.S.D.A., February 16, 1953, black and white aerial photograph Nos. AXL-42K-60 and -61.

Orthophoto-based contour map - White Knob Placer Claim by American Aerial Surveys, dated June 24, 1983; scale 1" = 100', 25-foot contour interval.

Orthophoto-based contour map - White Knob area, untitled, dated November 7, 1988.

APPENDIX "A"

GEOLOGIC MAPS



N

SCALE: 1" = 2,000'

INDEX MAP

FOR: OMYA	GEOTECHNICAL CONSULTATION PROPOSED AMENDED PLAN OF OPERATIONS FOR THE WHITE KNOB QUARRY OMYA CALIFORNIA, INC. LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "A-1"
DATE: APRIL 2012		JOB NUMBER 12121-8

CHJ Consultants

WHITE KNOB ANNEX CLAIM - UNPATENTED
PATENTED WHITE KNOB CLAIM

LOCATION 3
LOCATION 4
LOCATION 2
LOCATION 1

AP-AA-3
AP-BB-3
AP-AA-2
AP-BB-2
AP-AA-1
AP-BB-1

Tmw
Tn
Tn/brx
Tm/Tn
brx
Tmg
boulder A
BEDROCK RIDGE
WHITE KNOB ANNEX
EXISTING TALUS SLOPE
WHITE KNOB QUARRY

A
A'
B
B'
C
C'
D
D'
E
E'
F
F'

N

SCALE: 1"=100'
0 100 200

GEOLOGIC UNITS:

Tm - mining talus, w = whitish hue, g = grayish hue
rock debris consisting of cobble to large boulder size clasts, fresh appearing surfaces, form clast-supported depris cone on native surfaces & boulder field at head of Western drainage

Tn - native talus/colluvium: silty gravelly sand underlies mining talus

brx - bedrock outcrop: limestone, marble, & granitic rocks of White Knob area

Tn/brx - mixed native talus/colluvium & bedrock

Tm/Tn - area of mining talus (whitish) as vaneere on native talus/colluvium

AP-AA-1 - Approximate location of analysis point used in CRSP rockfall evaluation

Approximate Claim Boundary

B B'
Location of Geologic Cross Section

NORTHWEST SLOPE MAP

FOR: OMYA CALIFORNIA

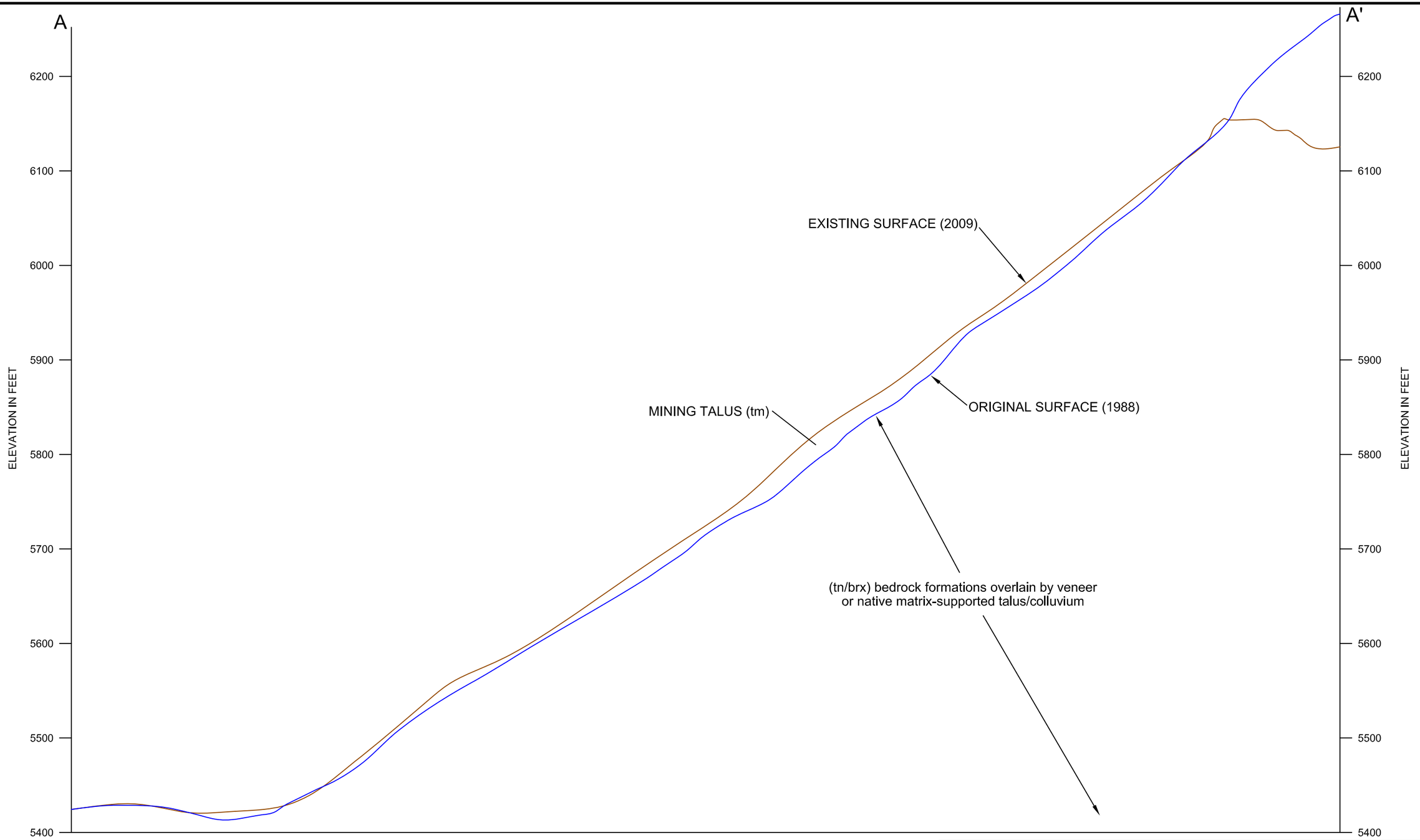
DATE: APRIL 2012

GEOTECHNICAL CONSULTATION
PROPOSED AMENDED PLAN OF OPERATIONS
FOR THE WHITE KNOB QUARRY
OMYA CALIFORNIA
LUCERNE VALLEY, CALIFORNIA

ENCLOSURE "A-2.1"

JOB NUMBER 12121-8

CHJ Consultants

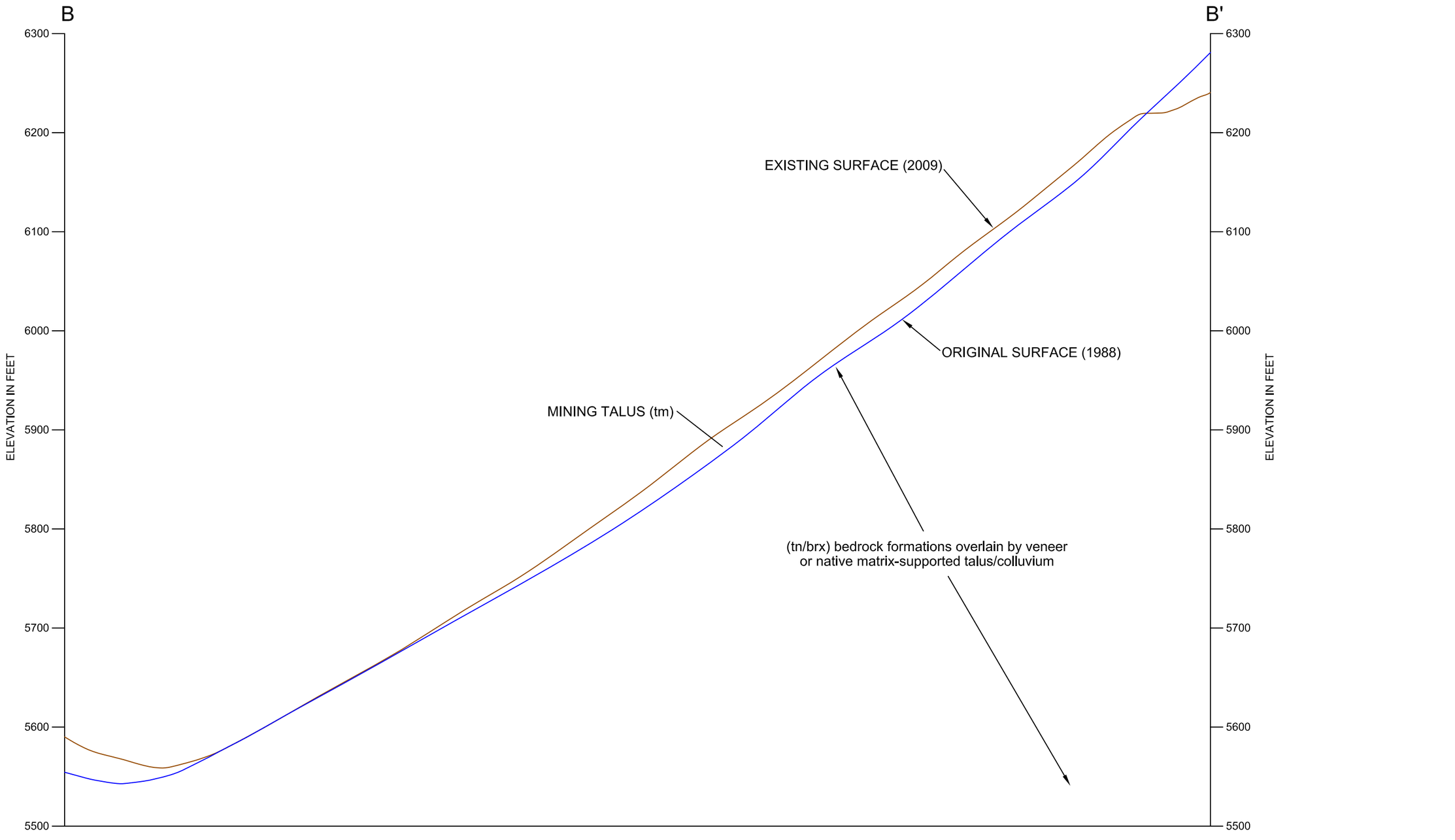


SCALE: 1" = 100'

CROSS SECTION A-A'

FOR: OMYA	GEOTECHNICAL CONSULTATION PROPOSED AMENDED PLAN OF OPERATIONS FOR THE WHITE KNOB QUARRY OMYA CALIFORNIA, INC. LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "A-2.2"
DATE: APRIL 2012		JOB NUMBER 12121-8

CHJ Consultants

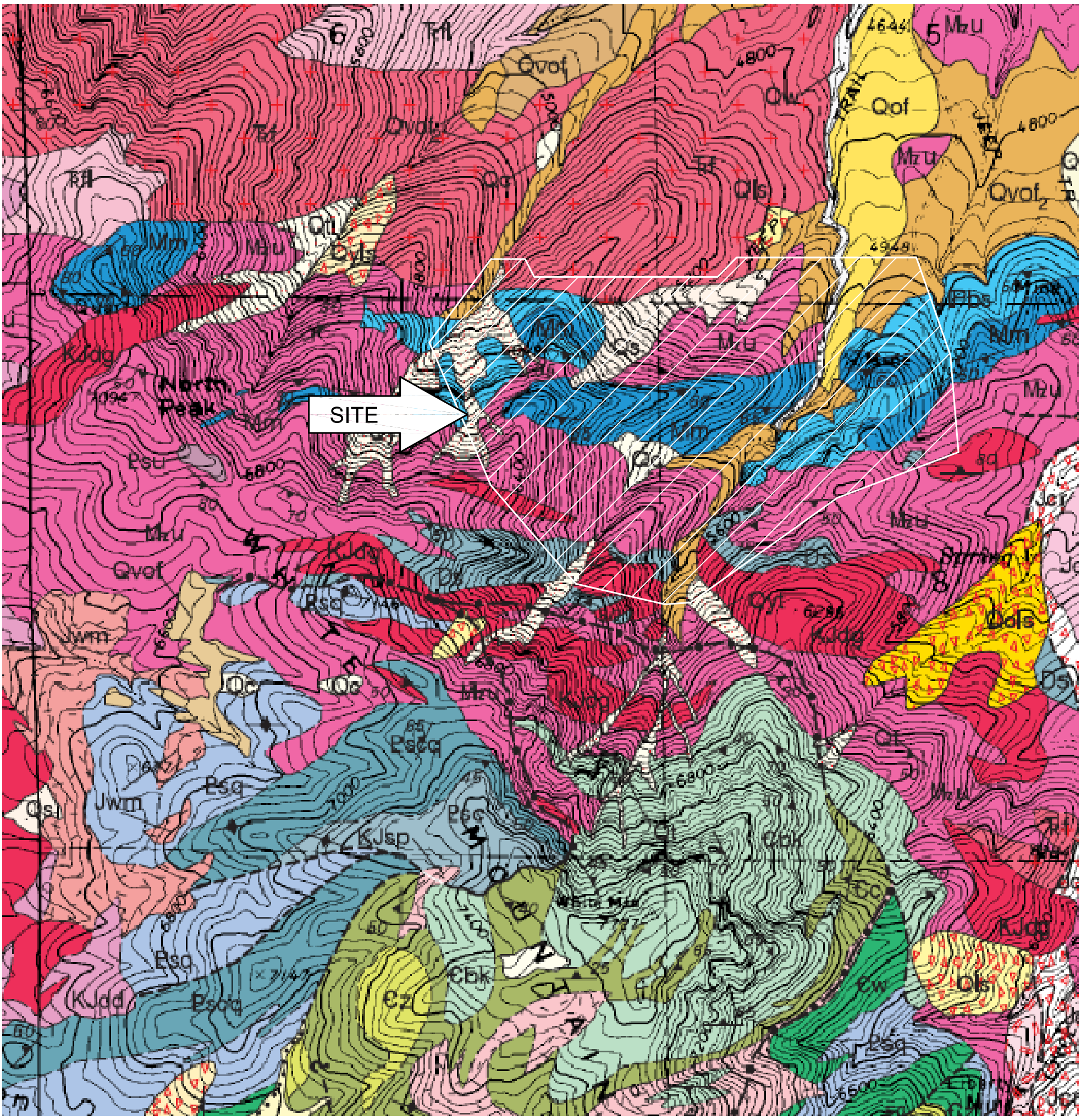


SCALE: 1" = 100'

CROSS SECTION B-B'

FOR: OMYA	GEOTECHNICAL CONSULTATION PROPOSED AMENDED PLAN OF OPERATIONS FOR THE WHITE KNOB QUARRY OMYA CALIFORNIA, INC. LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "A-2.3"
DATE: APRIL 2012		JOB NUMBER 12121-8

CHJ Consultants



(Base Map: Miller et al., 2000)

GEOLOGIC UNITS:

Holocene sediments

Qc modern colluvial deposits

Qs undifferentiated surficial deposits

Qyt young talus deposits

$Qvof_2$ very old alluvial fan deposits

Crystalline Rocks

Mzu Mesozoic granitic rocks, undivided. Monzogranite to diorite, including small areas of monzonite. Includes heterogeneous, nondistinctive granitic rocks that cannot be assigned to larger granitic units in Butler Peak quadrangle. Fine- to coarse-grained; massive to foliate and lineate.

KJdg Mixed diorite and gabbro (Cretaceous and Jurassic). Biotite-hornblende diorite and quartz diorite, hornblende-biotite diorite and quartz diorite, pyroxenehornblende gabbro, and hornblende gabbro. Fine- to coarse-grained. Dioritic rocks appear to have possible spatial relation to Paleozoic carbonate rocks and intermediate composition Mesozoic plutons.

Pbs Bird Spring Formation (Pennsylvanian). Upper part of Furnace Limestone of Vaughan (1922) as mapped by Guillou (1953), Richmond (1960); correlated with Bird Spring Formation of southern Great Basin by Cameron (1981) and Brown (1991). Generally light-colored, medium- to thick-bedded, medium to coarsely crystalline calcite marble. Degree of recrystallization in quadrangle precludes confident subdivision of formation, but in Fawnskin quadrangle to east, typical lithologies include white, gray, or mottled marble and cherty, silicified marble. Some chert-bearing calcite marble contains lenses and thin layers of quartz silt and fine sand. Intermittent layers of minor brownweathering dolomite marble, siliceous marble horizons, and dark-gray calcite marble. In Butler Peak quadrangle, due to extreme recrystallization and deformation, layering in much of formation may or may not represent bedding.

Mm Monte Cristo Limestone (Mississippian). Upper part of Furnace Limestone of Vaughan (1922) as mapped by Richmond (1960). Correlated with the Monte Cristo Limestone of the southern Great Basin by Cameron (1981), and mapped by Brown (1984, 1987, and 1991) who recognized several formal stratigraphic members named originally by Hewitt (1931). Degree of recrystallization in quadrangle precludes recognition of detailed subdivisions, but includes heterogeneous, interlayered, light- and dark-gray, calcite and dolomite marble characteristic of Yellowpine Member, and thick-layered, light-gray to white, texturally massive, very pure calcite marble characteristic of Bullion Member.

Ds Sultan Limestone (Devonian). Middle part of Furnace Limestone of Vaughan (1922) as mapped by Richmond (1960); Brown (1991) correlated rocks in this interval with members of Sultan Limestone of Hewitt (1931) in southern Great Basin. Includes: (1) thin- to thick-layered, white calcite marble containing sparse thin layers of dark-gray calcite and dolomite marble characteristic of Crystal Pass Member; in part irregularly dolomitized. (2) Laminated to massive, light-gray, brown, and white, finely crystalline, locally chert-bearing metadolomite characteristic of Valentine Limestone Member.

geologic contact

–N–

SCALE: 1" = 1,000'

GEOLOGIC INDEX MAP

FOR: OMYA	GEOTECHNICAL CONSULTATION PROPOSED AMENDED PLAN OF OPERATIONS FOR THE WHITE KNOB QUARRY OMYA CALIFORNIA LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "A-3"
DATE: APRIL 2012		JOB NUMBER 12121-8

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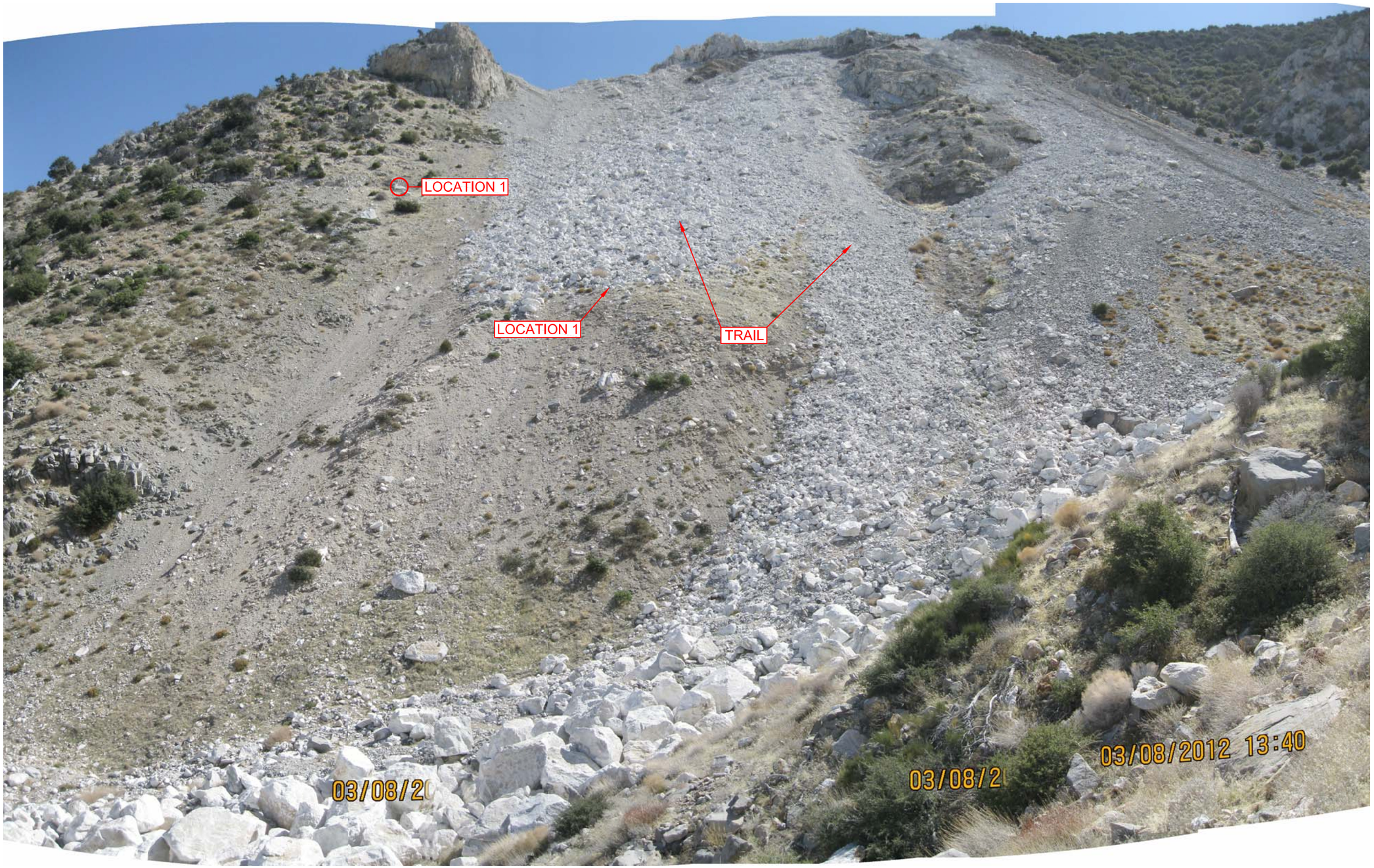
APPENDIX "B"

SITE PHOTOGRAPHS



NORTHWEST TAILINGS SLOPE

FOR: OMYA CALIFORNIA	GEOTECHNICAL CONSULTATION PROPOSED AMENDED PLAN OF OPERATIONS FOR THE WHITE KNOB QUARRY OMYA CALIFORNIA, INC. LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "B-1"
DATE: APRIL 2012		JOB NUMBER 12121-8

CHJ Consultants

DEBRIS FLOW CHUTE

FOR: OMYA CALIFORNIA	GEOTECHNICAL CONSULTATION PROPOSED AMENDED PLAN OF OPERATIONS FOR THE WHITE KNOB QUARRY OMYA CALIFORNIA, INC. LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "B-2"
DATE: APRIL 2012		JOB NUMBER 12121-8

CHJ Consultants

BOULDER AT LOCATION 1

FOR: OMYA CALIFORNIA	GEOTECHNICAL CONSULTATION PROPOSED AMENDED PLAN OF OPERATIONS FOR THE WHITE KNOB QUARRY OMYA CALIFORNIA, INC. LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "B-3"
DATE: APRIL 2012		JOB NUMBER 12121-8

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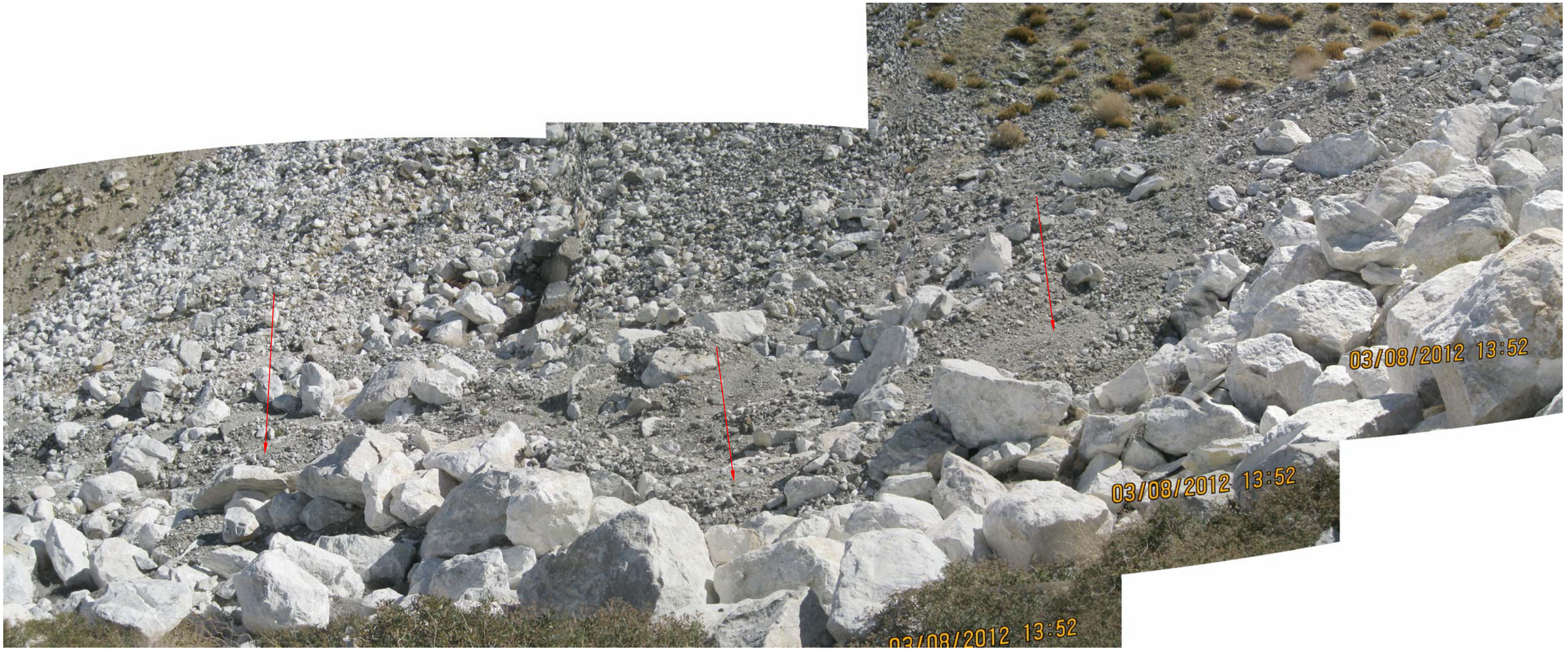


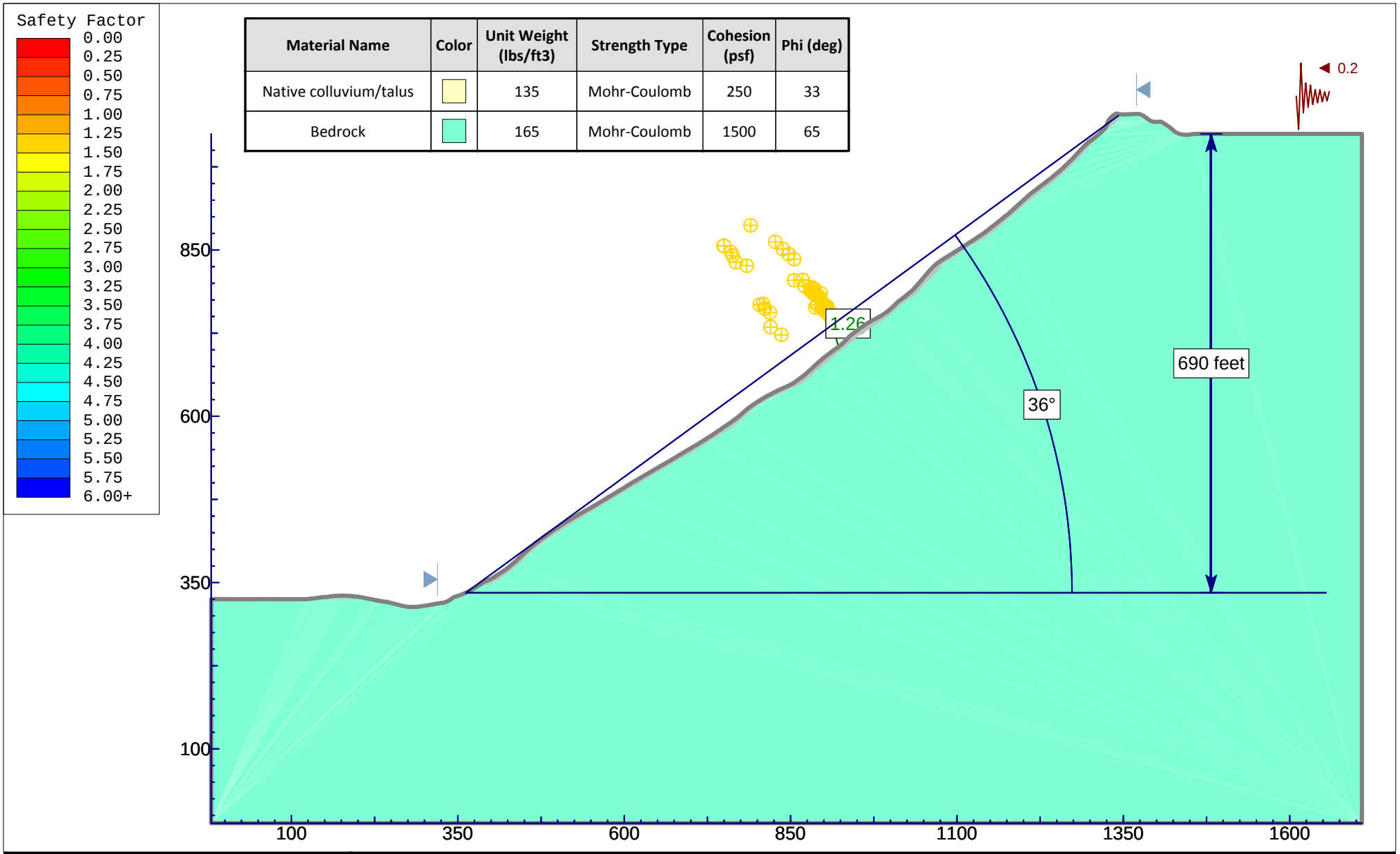
STEP POOLS

FOR: OMYA CALIFORNIA	GEOTECHNICAL CONSULTATION PROPOSED AMENDED PLAN OF OPERATIONS FOR THE WHITE KNOB QUARRY OMYA CALIFORNIA, INC. LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "B-4"
DATE: APRIL 2012		JOB NUMBER 12121-8

CHJ Consultants

APPENDIX "C"

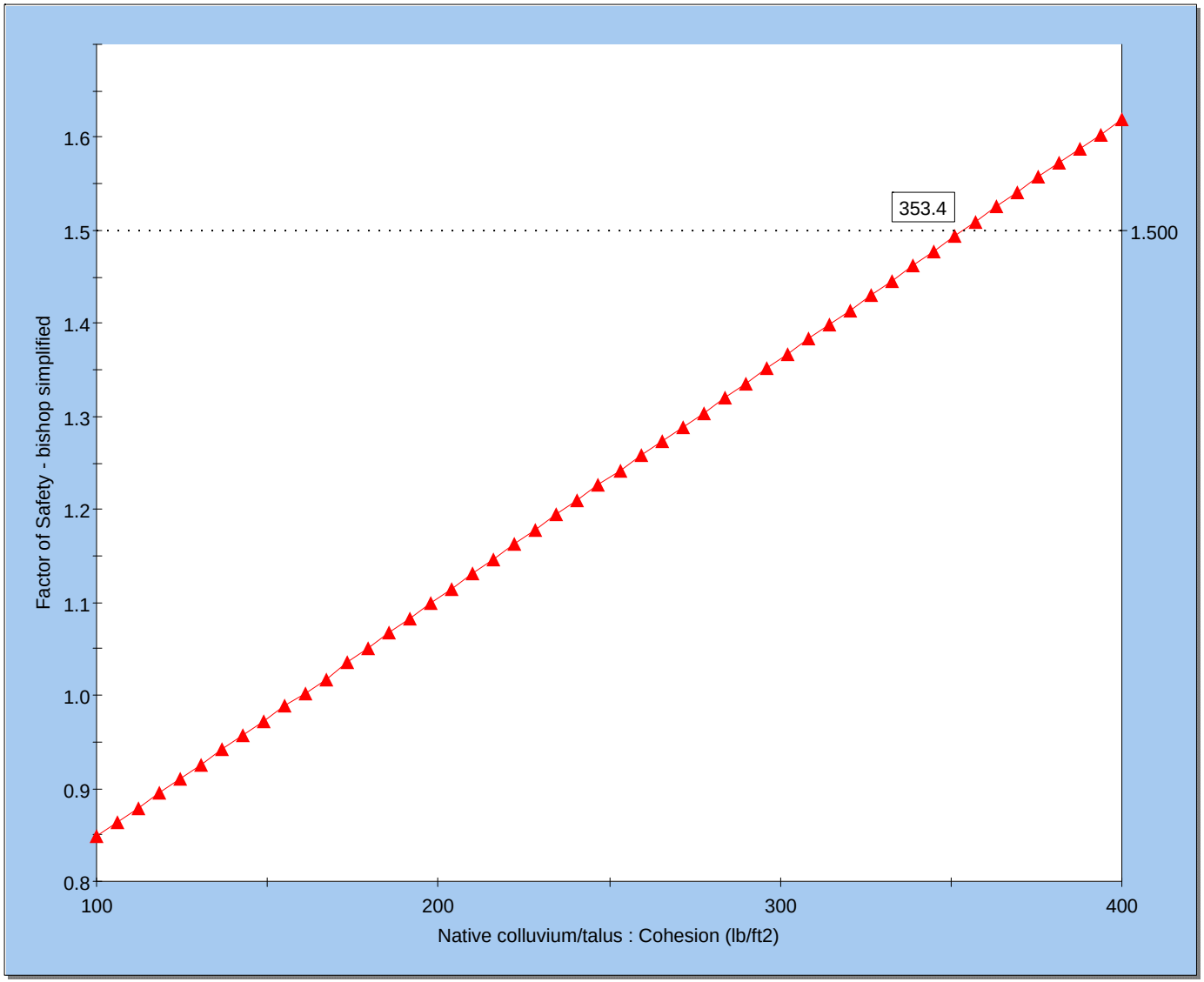
GLOBAL STABILITY CALCULATIONS



OMYA - White Knob Talus Slope

Analysis Description	Section A - A' 1988 Topo				
Drawn By	CHJ	*Author*	JMc	*Scale*	1:2391
File Name	NW talus slope 1988 seis 02.slim	*Date*	4/11/2012	*Enclosure*	C-1

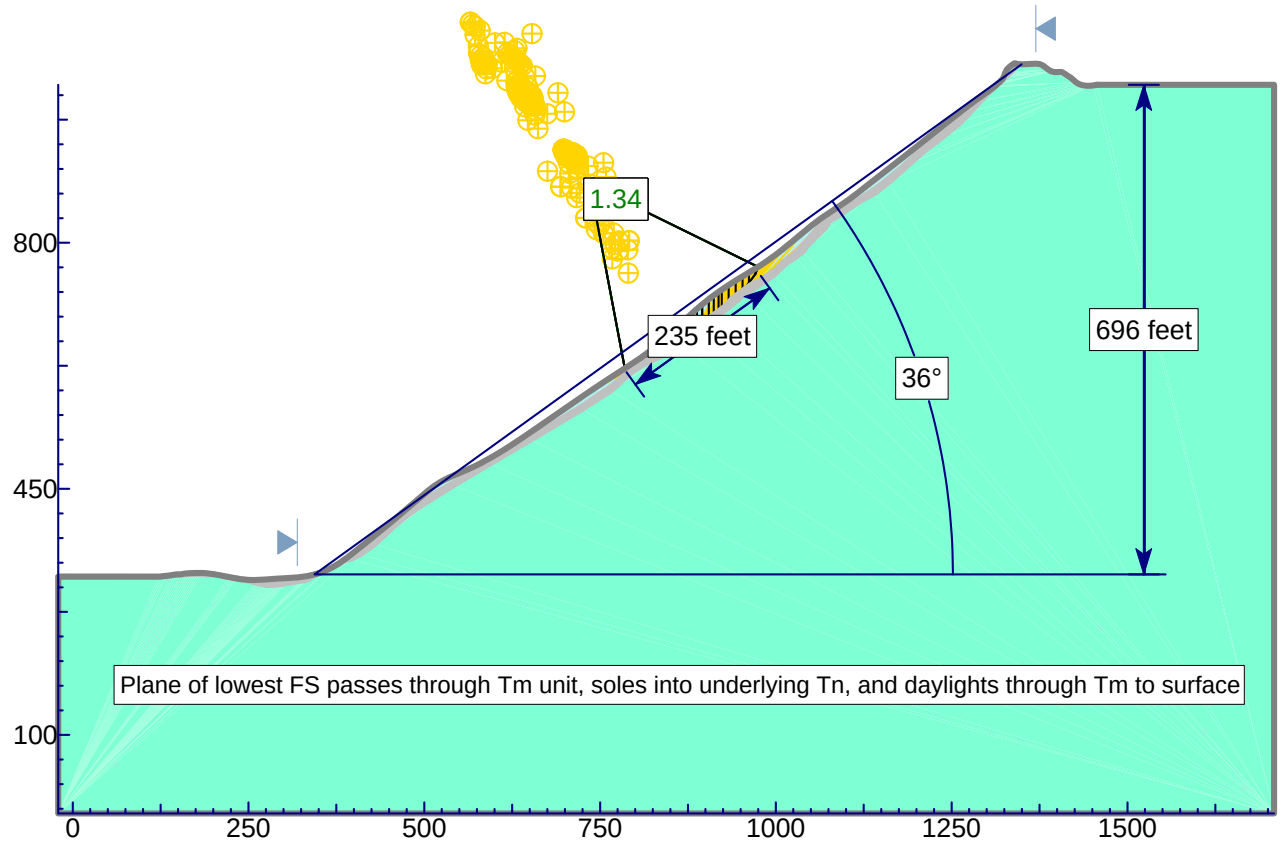
SLIDEINTERPRET 6.015



SLIDEINTERPRET 6.015	OMYA - White Knob Talus Slope		
	Analysis Description Section A - A' 1988 Topo		
	Drawn By CHJ	*Author* JMc	*Scale*
	File Name NW talus slope 1988 seis 02.slim	*Date* 4/11/2012	*Enclosure* C-2

Safety Factor
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
2.25
2.50
2.75
3.00
3.25
3.50
3.75
4.00
4.25
4.50
4.75
5.00
5.25
5.50
5.75
6.00+

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Native colluvium/talus		135	355	38
Mining talus		130	350	40
contact Nat/mine		130	300	40
Bedrock		165	1500	65



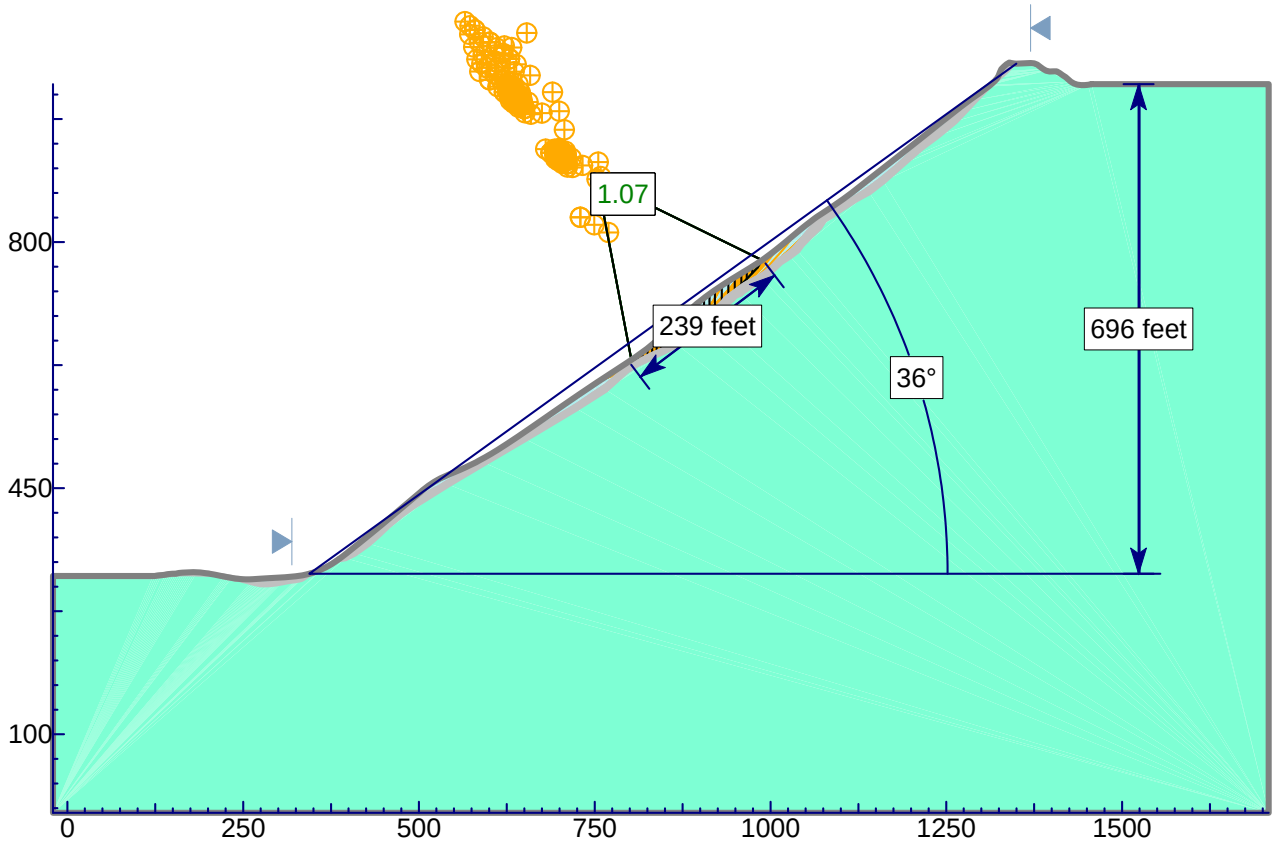
SLIDEINTERPRET 6.015

OMYA - White Knob Talus Slope

Analysis Description	Section A - A'				
Drawn By	CHJ	Author	JMc	Scale	1:3277
File Name	NW talus slope stat.slim	Date	4/11/2012	Enclosure	C-3

Safety Factor
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
2.25
2.50
2.75
3.00
3.25
3.50
3.75
4.00
4.25
4.50
4.75
5.00
5.25
5.50
5.75
6.00+

Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
Native colluvium/talus		135	355	41
Mining talus		130	375	40
contact Nat/mine		130	340	41
Bedrock		165	1500	65



SLIDEINTERPRET 6.015

OMYA - White Knob Talus Slope

Analysis Description	Section A - A'				
Drawn By	CHJ	*Author*	JMc	*Scale*	1:3277
File Name	NW talus slope seis 02.slim	*Date*	4/11/2012	*Enclosure*	C-4

APPENDIX "D"

ROCKFALL HAZARD ANALYSIS

CRSP Input File -C:\Program Files\Crsp\WKAA 1fta.DAT

Input File Specifications

Units of Measure: U.S.
Total Number of Cells: 13
Analysis Point 1 X-Coordinate: 560
Analysis Point 2 X-Coordinate: 940
Analysis Point 3 X-Coordinate: 1400
Initial Y-Top Starting Zone Coordinate: 749
Initial Y-Base Starting Zone Coordinate: 730

Remarks: a-a' 1ft bldr on talus & soft slope

Cell Data

Cell No.	S.R.	Tang. C.	Norm. C.	Begin X	Begin Y	End X	End Y
1	.18	.8	.5	0	752	120	750
2	.35	.8	.5	120	750	140	730
3	3	.8	.5	140	730	360	560
4	3	.8	.4	360	560	560	420
5	3	.8	.2	560	420	620	358
6	3	.8	.2	620	358	870	190
7	4	.8	.2	870	190	940	158
8	1	.65	.65	940	158	1070	50
9	.1	.6	.65	1070	50	1110	30
10	.15	.75	.65	1110	30	1130	25
11	4	.8	.25	1130	25	1215	20
12	4	.8	.25	1215	20	1300	30
13	5	.8	.25	1300	30	1400	50

CRSP Simulation Specifications: Used with C:\Program Files\Crsp\WKAA 1fta.DAT

Total Number of Rocks Simulated: 500
Starting Velocity in X-Direction: 1 ft/sec
Starting Velocity in Y-Direction: -1 ft/sec
Starting Cell Number: 1
Ending Cell Number: 13
Rock Density: 165 lb/ft^3
Rock Shape: Spherical
Diameter: 1 ft

CRSP Analysis Point 1 Data - C:\Program Files\Crsp\WKAA 1fta.DAT

Analysis Point 1: X = 560, Y = 420

Total Rocks Passing Analysis Point: 7

Cumulative Probability	Velocity (ft/sec)	Energy (ft-lb)	Bounce Ht. (ft)
50%	40.54	3475	1.48
75%	54.64	5435	5.95
90%	67.32	7198	9.97
95%	74.93	8256	12.39
98%	83.48	9444	15.1

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 69.25	Maximum: 7.78	Maximum: 7769
Average: 40.54	Average: 3.44	Average: 3475
Minimum: 9.96	G. Mean: 1.48	Std. Dev.: 2902
Std. Dev.: 20.88	Std. Dev.: 6.63	

Remarks: a-a' 1ft bldr on talus & soft slope

CRSP Analysis Point 2 Data - C:\Program Files\Crsp\WKAA 1fta.DAT

Analysis Point 2: X = 940, Y = 158

NO ROCKS PAST ANALSYSIS POINT 2

CRSP Analysis Point 3 Data - C:\Program Files\Crsp\WKAA 1fta.DAT

Analysis Point 3: X = 1400, Y = 50

NO ROCKS PAST ANALSYSIS POINT 3

CRSP Data Collected at End of Each Cell - C:\Program Files\Crsp\WKAA 1fta.DAT

Velocity Units: ft/sec Bounce Height Units: ft

Cell #	Max. Vel.	Avg. Vel.	S.D. Vel.	Max. Bounce Ht.	Avg. Bounce Ht.
1	No rocks past end of cell				

2	31	17	5.98	5	1
3	73	44	17.59	20	7
4	69	41	20.88	8	3
5	80	61	17.72	26	14
6	33	33	0	3	2
7	No rocks	past end of cell			
8	No rocks	past end of cell			
9	No rocks	past end of cell			
10	No rocks	past end of cell			
11	No rocks	past end of cell			
12	No rocks	past end of cell			
13	No rocks	past end of cell			

CRSP Rocks Stopped Data - C:\Program Files\Crsp\WKAA 1fta.DAT

X Interval	Rocks Stopped
0 To 10 ft	0
10 To 20 ft	0
20 To 30 ft	0
30 To 40 ft	0
40 To 50 ft	0
50 To 60 ft	0
60 To 70 ft	0
70 To 80 ft	0
80 To 90 ft	0
90 To 100 ft	0
100 To 110 ft	0
110 To 120 ft	0
120 To 130 ft	0
130 To 140 ft	0
140 To 150 ft	130
150 To 160 ft	67
160 To 170 ft	45
170 To 180 ft	34
180 To 190 ft	29
190 To 200 ft	28
200 To 210 ft	18
210 To 220 ft	18
220 To 230 ft	10
230 To 240 ft	13
240 To 250 ft	8
250 To 260 ft	2
260 To 270 ft	14
270 To 280 ft	6
280 To 290 ft	6
290 To 300 ft	8
300 To 310 ft	4
310 To 320 ft	2
320 To 330 ft	2
330 To 340 ft	4
340 To 350 ft	1
350 To 360 ft	4
360 To 370 ft	3

370 To	380 ft	3
380 To	390 ft	3
390 To	400 ft	4
400 To	410 ft	3
410 To	420 ft	0
420 To	430 ft	3
430 To	440 ft	5
440 To	450 ft	0
450 To	460 ft	2
460 To	470 ft	3
470 To	480 ft	2
480 To	490 ft	0
490 To	500 ft	2
500 To	510 ft	1
510 To	520 ft	1
520 To	530 ft	3
530 To	540 ft	1
540 To	550 ft	1
550 To	560 ft	0
560 To	570 ft	1
570 To	580 ft	1
580 To	590 ft	0
590 To	600 ft	0
600 To	610 ft	0
610 To	620 ft	0
620 To	630 ft	0
630 To	640 ft	1
640 To	650 ft	0
650 To	660 ft	1
660 To	670 ft	0
670 To	680 ft	0
680 To	690 ft	0
690 To	700 ft	0
700 To	710 ft	0
710 To	720 ft	0
720 To	730 ft	0
730 To	740 ft	1
740 To	750 ft	1
750 To	760 ft	0
760 To	770 ft	0
770 To	780 ft	0
780 To	790 ft	0
790 To	800 ft	0
800 To	810 ft	0
810 To	820 ft	0
820 To	830 ft	0
830 To	840 ft	0
840 To	850 ft	0
850 To	860 ft	0
860 To	870 ft	0
870 To	880 ft	1
880 To	890 ft	0
890 To	900 ft	0
900 To	910 ft	0
910 To	920 ft	0
920 To	930 ft	0
930 To	940 ft	0

940 To 950 ft	0
950 To 960 ft	0
960 To 970 ft	0
970 To 980 ft	0
980 To 990 ft	0
990 To 1000 ft	0
1000 To 1010 ft	0
1010 To 1020 ft	0
1020 To 1030 ft	0
1030 To 1040 ft	0
1040 To 1050 ft	0
1050 To 1060 ft	0
1060 To 1070 ft	0
1070 To 1080 ft	0
1080 To 1090 ft	0
1090 To 1100 ft	0
1100 To 1110 ft	0
1110 To 1120 ft	0
1120 To 1130 ft	0
1130 To 1140 ft	0
1140 To 1150 ft	0
1150 To 1160 ft	0
1160 To 1170 ft	0
1170 To 1180 ft	0
1180 To 1190 ft	0
1190 To 1200 ft	0
1200 To 1210 ft	0
1210 To 1220 ft	0
1220 To 1230 ft	0
1230 To 1240 ft	0
1240 To 1250 ft	0
1250 To 1260 ft	0
1260 To 1270 ft	0
1270 To 1280 ft	0
1280 To 1290 ft	0
1290 To 1300 ft	0
1300 To 1310 ft	0
1310 To 1320 ft	0
1320 To 1330 ft	0
1330 To 1340 ft	0
1340 To 1350 ft	0
1350 To 1360 ft	0
1360 To 1370 ft	0
1370 To 1380 ft	0
1380 To 1390 ft	0
1390 To 1400 ft	0

CRSP Input File -C:\Program Files\Crsp\WKAA 2fta.DAT

Input File Specifications

Units of Measure: U.S.
Total Number of Cells: 13
Analysis Point 1 X-Coordinate: 560
Analysis Point 2 X-Coordinate: 940
Analysis Point 3 X-Coordinate: 1400
Initial Y-Top Starting Zone Coordinate: 749
Initial Y-Base Starting Zone Coordinate: 730

Remarks: a-a' 2ft bldr on talus & soft slope

Cell Data

Cell No.	S.R.	Tang. C.	Norm. C.	Begin X	Begin Y	End X	End Y
1	.18	.8	.5	0	752	120	750
2	.35	.8	.5	120	750	140	730
3	3	.8	.5	140	730	360	560
4	3	.8	.4	360	560	560	420
5	3	.8	.2	560	420	620	358
6	3	.8	.2	620	358	870	190
7	4	.8	.2	870	190	940	158
8	1	.65	.65	940	158	1070	50
9	.1	.6	.65	1070	50	1110	30
10	.15	.75	.65	1110	30	1130	25
11	4	.8	.25	1130	25	1215	20
12	4	.8	.25	1215	20	1300	30
13	5	.8	.25	1300	30	1400	50

CRSP Simulation Specifications: Used with C:\Program Files\Crsp\WKAA 2fta.DAT

Total Number of Rocks Simulated: 500
Starting Velocity in X-Direction: 1 ft/sec
Starting Velocity in Y-Direction: -1 ft/sec
Starting Cell Number: 1
Ending Cell Number: 13
Rock Density: 165 lb/ft^3
Rock Shape: Spherical
Diameter: 2 ft

CRSP Analysis Point 1 Data - C:\Program Files\Crsp\WKAA 2fta.DAT

Analysis Point 1: X = 560, Y = 420

Total Rocks Passing Analysis Point: 50

Cumulative Probability	Velocity (ft/sec)	Energy (ft-lb)	Bounce Ht. (ft)
50%	38.33	24006	3.74
75%	50.03	37788	5.68
90%	60.55	50184	7.42
95%	66.87	57627	8.47
98%	73.96	65979	9.65

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 76.41	Maximum: 20.32	Maximum: 77024
Average: 38.33	Average: 5.46	Average: 24006
Minimum: 15.84	G. Mean: 3.74	Std. Dev.: 20411
Std. Dev.: 17.33	Std. Dev.: 2.87	

Remarks: a-a' 2ft bldr on talus & soft slope

CRSP Analysis Point 2 Data - C:\Program Files\Crsp\WKAA 2fta.DAT

Analysis Point 2: X = 940, Y = 158

NO ROCKS PAST ANALSYSIS POINT 2

CRSP Analysis Point 3 Data - C:\Program Files\Crsp\WKAA 2fta.DAT

Analysis Point 3: X = 1400, Y = 50

NO ROCKS PAST ANALSYSIS POINT 3

CRSP Data Collected at End of Each Cell - C:\Program Files\Crsp\WKAA 2fta.DAT

Velocity Units: ft/sec Bounce Height Units: ft

Cell #	Max. Vel.	Avg. Vel.	S.D. Vel.	Max. Bounce Ht.	Avg. Bounce Ht.
1	No rocks past end of cell				

2	31	19	6.13	3	0
3	80	41	17.08	26	6
4	76	38	17.33	20	5
5	99	50	21.84	32	7
6	22	21	0	5	2
7	No rocks	past end of cell			
8	No rocks	past end of cell			
9	No rocks	past end of cell			
10	No rocks	past end of cell			
11	No rocks	past end of cell			
12	No rocks	past end of cell			
13	No rocks	past end of cell			

CRSP Rocks Stopped Data - C:\Program Files\Crsp\WKAA 2fta.DAT

X Interval	Rocks Stopped
0 To 10 ft	0
10 To 20 ft	0
20 To 30 ft	0
30 To 40 ft	0
40 To 50 ft	0
50 To 60 ft	0
60 To 70 ft	0
70 To 80 ft	0
80 To 90 ft	0
90 To 100 ft	0
100 To 110 ft	0
110 To 120 ft	0
120 To 130 ft	0
130 To 140 ft	0
140 To 150 ft	62
150 To 160 ft	46
160 To 170 ft	39
170 To 180 ft	45
180 To 190 ft	22
190 To 200 ft	25
200 To 210 ft	18
210 To 220 ft	20
220 To 230 ft	9
230 To 240 ft	7
240 To 250 ft	12
250 To 260 ft	15
260 To 270 ft	11
270 To 280 ft	10
280 To 290 ft	8
290 To 300 ft	4
300 To 310 ft	3
310 To 320 ft	4
320 To 330 ft	6
330 To 340 ft	6
340 To 350 ft	7
350 To 360 ft	5
360 To 370 ft	4

370	To 380 ft	4
380	To 390 ft	2
390	To 400 ft	6
400	To 410 ft	5
410	To 420 ft	3
420	To 430 ft	4
430	To 440 ft	1
440	To 450 ft	3
450	To 460 ft	1
460	To 470 ft	2
470	To 480 ft	4
480	To 490 ft	6
490	To 500 ft	4
500	To 510 ft	2
510	To 520 ft	3
520	To 530 ft	3
530	To 540 ft	5
540	To 550 ft	2
550	To 560 ft	2
560	To 570 ft	0
570	To 580 ft	0
580	To 590 ft	0
590	To 600 ft	1
600	To 610 ft	1
610	To 620 ft	0
620	To 630 ft	4
630	To 640 ft	4
640	To 650 ft	2
650	To 660 ft	3
660	To 670 ft	6
670	To 680 ft	1
680	To 690 ft	3
690	To 700 ft	2
700	To 710 ft	5
710	To 720 ft	2
720	To 730 ft	2
730	To 740 ft	0
740	To 750 ft	5
750	To 760 ft	0
760	To 770 ft	0
770	To 780 ft	2
780	To 790 ft	0
790	To 800 ft	0
800	To 810 ft	0
810	To 820 ft	1
820	To 830 ft	0
830	To 840 ft	0
840	To 850 ft	1
850	To 860 ft	2
860	To 870 ft	0
870	To 880 ft	0
880	To 890 ft	3
890	To 900 ft	0
900	To 910 ft	0
910	To 920 ft	0
920	To 930 ft	0
930	To 940 ft	0

940 To 950 ft	0
950 To 960 ft	0
960 To 970 ft	0
970 To 980 ft	0
980 To 990 ft	0
990 To 1000 ft	0
1000 To 1010 ft	0
1010 To 1020 ft	0
1020 To 1030 ft	0
1030 To 1040 ft	0
1040 To 1050 ft	0
1050 To 1060 ft	0
1060 To 1070 ft	0
1070 To 1080 ft	0
1080 To 1090 ft	0
1090 To 1100 ft	0
1100 To 1110 ft	0
1110 To 1120 ft	0
1120 To 1130 ft	0
1130 To 1140 ft	0
1140 To 1150 ft	0
1150 To 1160 ft	0
1160 To 1170 ft	0
1170 To 1180 ft	0
1180 To 1190 ft	0
1190 To 1200 ft	0
1200 To 1210 ft	0
1210 To 1220 ft	0
1220 To 1230 ft	0
1230 To 1240 ft	0
1240 To 1250 ft	0
1250 To 1260 ft	0
1260 To 1270 ft	0
1270 To 1280 ft	0
1280 To 1290 ft	0
1290 To 1300 ft	0
1300 To 1310 ft	0
1310 To 1320 ft	0
1320 To 1330 ft	0
1330 To 1340 ft	0
1340 To 1350 ft	0
1350 To 1360 ft	0
1360 To 1370 ft	0
1370 To 1380 ft	0
1380 To 1390 ft	0
1390 To 1400 ft	0

CRSP Input File -C:\Program Files\Crsp\WKAA4ft.DAT

Input File Specifications

Units of Measure: U.S.
Total Number of Cells: 13
Analysis Point 1 X-Coordinate: 560
Analysis Point 2 X-Coordinate: 940
Analysis Point 3 X-Coordinate: 1400
Initial Y-Top Starting Zone Coordinate: 749
Initial Y-Base Starting Zone Coordinate: 730

Remarks: a-a' 4ft bldr on talus & soft slope

Cell Data

Cell No.	S.R.	Tang. C.	Norm. C.	Begin X	Begin Y	End X	End Y
1	.2	.8	.5	0	752	120	750
2	.5	.8	.5	120	750	140	730
3	2	.8	.5	140	730	360	560
4	3	.8	.4	360	560	560	420
5	2.5	.8	.4	560	420	620	358
6	3	.8	.4	620	358	870	190
7	3	.8	.4	870	190	940	158
8	.2	.65	.2	940	158	1070	50
9	.1	.6	.2	1070	50	1110	30
10	.2	.75	.2	1110	30	1130	25
11	3.5	.8	.35	1130	25	1215	20
12	3.5	.8	.35	1215	20	1300	30
13	3	.8	.35	1300	30	1400	50

CRSP Simulation Specifications: Used with C:\Program Files\Crsp\WKAA4ft.DAT

Total Number of Rocks Simulated: 500
Starting Velocity in X-Direction: 5 ft/sec
Starting Velocity in Y-Direction: -5 ft/sec
Starting Cell Number: 1
Ending Cell Number: 13
Rock Density: 165 lb/ft^3
Rock Shape: Spherical
Diameter: 4 ft

CRSP Analysis Point 1 Data - C:\Program Files\Crsp\WKAA4ft.DAT

Analysis Point 1: X = 560, Y = 420

Total Rocks Passing Analysis Point: 489

Cumulative Probability	Velocity (ft/sec)	Energy (ft-lb)	Bounce Ht. (ft)
50%	44.68	255272	3.55
75%	57.77	385508	7.1
90%	69.54	502648	10.3
95%	76.61	572974	12.21
98%	84.54	651903	14.37

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 94.11	Maximum: 30.48	Maximum: 927278
Average: 44.68	Average: 6.9	Average: 255272
Minimum: 4.94	G. Mean: 3.55	Std. Dev.: 192886
Std. Dev.: 19.39	Std. Dev.: 5.26	

Remarks: a-a' 4ft bldr on talus & soft slope

CRSP Analysis Point 2 Data - C:\Program Files\Crsp\WKAA4ft.DAT

Analysis Point 2: X = 940, Y = 158

Total Rocks Passing Analysis Point: 319

Cumulative Probability	Velocity (ft/sec)	Energy (ft-lb)	Bounce Ht. (ft)
50%	34.44	167855	1.93
75%	46.22	275312	5.73
90%	56.81	371964	9.15
95%	63.17	429990	11.2
98%	70.31	495113	13.5

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 88.29	Maximum: 19.93	Maximum: 871183
Average: 34.44	Average: 4.06	Average: 167855
Minimum: 3.85	G. Mean: 1.93	Std. Dev.: 159149
Std. Dev.: 17.45	Std. Dev.: 5.63	

Remarks: a-a' 4ft bldr on talus & soft slope

CRSP Analysis Point 3 Data - C:\Program Files\Crsp\WKAA4ft.DAT

Analysis Point 3: X = 1400, Y = 50

NO ROCKS PAST ANALSYSIS POINT 3

CRSP Data Collected at End of Each Cell - C:\Program Files\Crsp\WKAA4ft.DAT

Velocity Units: ft/sec Bounce Height Units: ft

Cell #	Max. Vel.	Avg. Vel.	S.D. Vel.	Max. Bounce Ht.	Avg. Bounce Ht.
1	No rocks	past end of cell			
2	32	21	5.66	2	0
3	86	53	12.32	27	8
4	94	45	19.39	30	6
5	115	59	18.94	51	12
6	104	41	19.48	34	6
7	88	34	17.45	20	4
8	108	55	12.55	64	1
9	110	56	19.45	54	2
10	114	53	14.48	40	1
11	40	26	10.23	9	4
12	No rocks	past end of cell			
13	No rocks	past end of cell			

CRSP Rocks Stopped Data - C:\Program Files\Crsp\WKAA4ft.DAT

X Interval	Rocks Stopped
0 To 10 ft	0
10 To 20 ft	0
20 To 30 ft	0
30 To 40 ft	0
40 To 50 ft	0
50 To 60 ft	0
60 To 70 ft	0
70 To 80 ft	0
80 To 90 ft	0
90 To 100 ft	0
100 To 110 ft	0
110 To 120 ft	0
120 To 130 ft	0
130 To 140 ft	0
140 To 150 ft	0
150 To 160 ft	0
160 To 170 ft	0
170 To 180 ft	0

180	To 190 ft	0
190	To 200 ft	0
200	To 210 ft	0
210	To 220 ft	0
220	To 230 ft	0
230	To 240 ft	0
240	To 250 ft	0
250	To 260 ft	0
260	To 270 ft	0
270	To 280 ft	0
280	To 290 ft	0
290	To 300 ft	0
300	To 310 ft	0
310	To 320 ft	0
320	To 330 ft	0
330	To 340 ft	0
340	To 350 ft	0
350	To 360 ft	0
360	To 370 ft	0
370	To 380 ft	0
380	To 390 ft	1
390	To 400 ft	1
400	To 410 ft	0
410	To 420 ft	1
420	To 430 ft	1
430	To 440 ft	0
440	To 450 ft	1
450	To 460 ft	0
460	To 470 ft	1
470	To 480 ft	0
480	To 490 ft	0
490	To 500 ft	0
500	To 510 ft	1
510	To 520 ft	2
520	To 530 ft	0
530	To 540 ft	1
540	To 550 ft	1
550	To 560 ft	0
560	To 570 ft	0
570	To 580 ft	0
580	To 590 ft	0
590	To 600 ft	0
600	To 610 ft	0
610	To 620 ft	0
620	To 630 ft	0
630	To 640 ft	0
640	To 650 ft	0
650	To 660 ft	1
660	To 670 ft	1
670	To 680 ft	0
680	To 690 ft	0
690	To 700 ft	2
700	To 710 ft	2
710	To 720 ft	0
720	To 730 ft	2
730	To 740 ft	2
740	To 750 ft	3

750 To 760 ft	1
760 To 770 ft	2
770 To 780 ft	1
780 To 790 ft	0
790 To 800 ft	1
800 To 810 ft	2
810 To 820 ft	3
820 To 830 ft	0
830 To 840 ft	3
840 To 850 ft	1
850 To 860 ft	3
860 To 870 ft	0
870 To 880 ft	20
880 To 890 ft	19
890 To 900 ft	20
900 To 910 ft	25
910 To 920 ft	21
920 To 930 ft	16
930 To 940 ft	19
940 To 950 ft	20
950 To 960 ft	9
960 To 970 ft	6
970 To 980 ft	4
980 To 990 ft	3
990 To 1000 ft	2
1000 To 1010 ft	3
1010 To 1020 ft	2
1020 To 1030 ft	0
1030 To 1040 ft	0
1040 To 1050 ft	0
1050 To 1060 ft	0
1060 To 1070 ft	0
1070 To 1080 ft	38
1080 To 1090 ft	106
1090 To 1100 ft	73
1100 To 1110 ft	25
1110 To 1120 ft	2
1120 To 1130 ft	0
1130 To 1140 ft	0
1140 To 1150 ft	1
1150 To 1160 ft	3
1160 To 1170 ft	4
1170 To 1180 ft	3
1180 To 1190 ft	4
1190 To 1200 ft	3
1200 To 1210 ft	1
1210 To 1220 ft	1
1220 To 1230 ft	2
1230 To 1240 ft	1
1240 To 1250 ft	1
1250 To 1260 ft	1
1260 To 1270 ft	0
1270 To 1280 ft	1
1280 To 1290 ft	0
1290 To 1300 ft	0
1300 To 1310 ft	0
1310 To 1320 ft	0

1320 To 1330 ft		0
1330 To 1340 ft		0
1340 To 1350 ft		0
1350 To 1360 ft		0
1360 To 1370 ft		0
1370 To 1380 ft		0
1380 To 1390 ft		0
1390 To 1400 ft		0

CRSP Input File -C:\Program Files\Crsp\WKAA 6fta.DAT

Input File Specifications

Units of Measure: U.S.
Total Number of Cells: 13
Analysis Point 1 X-Coordinate: 560
Analysis Point 2 X-Coordinate: 940
Analysis Point 3 X-Coordinate: 1400
Initial Y-Top Starting Zone Coordinate: 749
Initial Y-Base Starting Zone Coordinate: 730

Remarks: a-a' 6ft bldr on talus & soft slope

Cell Data

Cell No.	S.R.	Tang. C.	Norm. C.	Begin X	Begin Y	End X	End Y
1	.18	.8	.5	0	752	120	750
2	.35	.8	.5	120	750	140	730
3	1	.8	.5	140	730	360	560
4	1.5	.8	.4	360	560	560	420
5	2.25	.8	.2	560	420	620	358
6	2	.8	.2	620	358	870	190
7	2	.8	.2	870	190	940	158
8	.2	.65	.65	940	158	1070	50
9	.1	.6	.65	1070	50	1110	30
10	.15	.75	.65	1110	30	1130	25
11	3	.8	.25	1130	25	1215	20
12	3	.8	.25	1215	20	1300	30
13	3	.8	.25	1300	30	1400	50

CRSP Simulation Specifications: Used with C:\Program Files\Crsp\WKAA 6fta.DAT

Total Number of Rocks Simulated: 500
Starting Velocity in X-Direction: 1 ft/sec
Starting Velocity in Y-Direction: -1 ft/sec
Starting Cell Number: 1
Ending Cell Number: 13
Rock Density: 165 lb/ft^3
Rock Shape: Spherical
Diameter: 6 ft

CRSP Analysis Point 1 Data - C:\Program Files\Crsp\WKAA 6fta.DAT

Analysis Point 1: X = 560, Y = 420

Total Rocks Passing Analysis Point: 500

Cumulative Probability	Velocity (ft/sec)	Energy (ft-lb)	Bounce Ht. (ft)
50%	81.26	2494354	5.4
75%	87.99	2841144	8.83
90%	94.05	3153059	11.91
95%	97.68	3340322	13.76
98%	101.76	3550491	15.84

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 106.92	Maximum: 26.76	Maximum: 3850679
Average: 81.26	Average: 9.1	Average: 2494354
Minimum: 57.3	G. Mean: 5.4	Std. Dev.: 513610
Std. Dev.: 9.97	Std. Dev.: 5.08	

Remarks: a-a' 6ft bldr on talus & soft slope

CRSP Analysis Point 2 Data - C:\Program Files\Crsp\WKAA 6fta.DAT

Analysis Point 2: X = 940, Y = 158

Total Rocks Passing Analysis Point: 500

Cumulative Probability	Velocity (ft/sec)	Energy (ft-lb)	Bounce Ht. (ft)
50%	39.86	643794	1.21
75%	46.71	859969	5.4
90%	52.86	1054404	9.17
95%	56.56	1171136	11.44
98%	60.71	1302147	13.98

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 76.85	Maximum: 11.66	Maximum: 2101702
Average: 39.86	Average: 2.51	Average: 643794
Minimum: 15.49	G. Mean: 1.21	Std. Dev.: 320163
Std. Dev.: 10.14	Std. Dev.: 6.21	

Remarks: a-a' 6ft bldr on talus & soft slope

CRSP Analysis Point 3 Data - C:\Program Files\Crsp\WKAA 6fta.DAT

Analysis Point 3: X = 1400, Y = 50

NO ROCKS PAST ANALSYSIS POINT 3

CRSP Data Collected at End of Each Cell - C:\Program Files\Crsp\WKAA 6fta.DAT

Velocity Units: ft/sec Bounce Height Units: ft

Cell #	Max. Vel.	Avg. Vel.	S.D. Vel.	Max. Bounce Ht.	Avg. Bounce Ht.
1	No rocks	past end of cell			
2	31	21	5.65	3	0
3	88	73	5.76	16	5
4	107	81	9.97	27	9
5	120	91	15.22	48	20
6	84	52	11.89	19	4
7	77	40	10.14	12	2
8	103	66	7.96	5	1
9	83	67	6.06	2	0
10	77	64	4.38	2	1
11	61	31	13.02	10	2
12	27	17	8.7	5	0
13	No rocks	past end of cell			

CRSP Rocks Stopped Data - C:\Program Files\Crsp\WKAA 6fta.DAT

X Interval	Rocks Stopped
0 To 10 ft	0
10 To 20 ft	0
20 To 30 ft	0
30 To 40 ft	0
40 To 50 ft	0
50 To 60 ft	0
60 To 70 ft	0
70 To 80 ft	0
80 To 90 ft	0
90 To 100 ft	0
100 To 110 ft	0
110 To 120 ft	0
120 To 130 ft	0
130 To 140 ft	0
140 To 150 ft	0
150 To 160 ft	0
160 To 170 ft	0
170 To 180 ft	0

180 To 190 ft	0
190 To 200 ft	0
200 To 210 ft	0
210 To 220 ft	0
220 To 230 ft	0
230 To 240 ft	0
240 To 250 ft	0
250 To 260 ft	0
260 To 270 ft	0
270 To 280 ft	0
280 To 290 ft	0
290 To 300 ft	0
300 To 310 ft	0
310 To 320 ft	0
320 To 330 ft	0
330 To 340 ft	0
340 To 350 ft	0
350 To 360 ft	0
360 To 370 ft	0
370 To 380 ft	0
380 To 390 ft	0
390 To 400 ft	0
400 To 410 ft	0
410 To 420 ft	0
420 To 430 ft	0
430 To 440 ft	0
440 To 450 ft	0
450 To 460 ft	0
460 To 470 ft	0
470 To 480 ft	0
480 To 490 ft	0
490 To 500 ft	0
500 To 510 ft	0
510 To 520 ft	0
520 To 530 ft	0
530 To 540 ft	0
540 To 550 ft	0
550 To 560 ft	0
560 To 570 ft	0
570 To 580 ft	0
580 To 590 ft	0
590 To 600 ft	0
600 To 610 ft	0
610 To 620 ft	0
620 To 630 ft	0
630 To 640 ft	0
640 To 650 ft	0
650 To 660 ft	0
660 To 670 ft	0
670 To 680 ft	0
680 To 690 ft	0
690 To 700 ft	0
700 To 710 ft	0
710 To 720 ft	0
720 To 730 ft	0
730 To 740 ft	0
740 To 750 ft	0

750 To 760 ft	0
760 To 770 ft	0
770 To 780 ft	0
780 To 790 ft	0
790 To 800 ft	0
800 To 810 ft	0
810 To 820 ft	0
820 To 830 ft	0
830 To 840 ft	0
840 To 850 ft	0
850 To 860 ft	0
860 To 870 ft	0
870 To 880 ft	0
880 To 890 ft	0
890 To 900 ft	0
900 To 910 ft	0
910 To 920 ft	0
920 To 930 ft	0
930 To 940 ft	0
940 To 950 ft	0
950 To 960 ft	0
960 To 970 ft	0
970 To 980 ft	0
980 To 990 ft	0
990 To 1000 ft	0
1000 To 1010 ft	0
1010 To 1020 ft	0
1020 To 1030 ft	0
1030 To 1040 ft	0
1040 To 1050 ft	0
1050 To 1060 ft	0
1060 To 1070 ft	0
1070 To 1080 ft	0
1080 To 1090 ft	7
1090 To 1100 ft	6
1100 To 1110 ft	8
1110 To 1120 ft	0
1120 To 1130 ft	0
1130 To 1140 ft	0
1140 To 1150 ft	0
1150 To 1160 ft	0
1160 To 1170 ft	0
1170 To 1180 ft	5
1180 To 1190 ft	25
1190 To 1200 ft	26
1200 To 1210 ft	43
1210 To 1220 ft	62
1220 To 1230 ft	68
1230 To 1240 ft	71
1240 To 1250 ft	64
1250 To 1260 ft	46
1260 To 1270 ft	31
1270 To 1280 ft	19
1280 To 1290 ft	11
1290 To 1300 ft	2
1300 To 1310 ft	3
1310 To 1320 ft	3

1320 To	1330 ft	0
1330 To	1340 ft	0
1340 To	1350 ft	0
1350 To	1360 ft	0
1360 To	1370 ft	0
1370 To	1380 ft	0
1380 To	1390 ft	0
1390 To	1400 ft	0

CRSP Input File -C:\Program Files\Crsp\AA 10ftb out.doc

Input File Specifications

Units of Measure: U.S.
Total Number of Cells: 13
Analysis Point 1 X-Coordinate: 560
Analysis Point 2 X-Coordinate: 940
Analysis Point 3 X-Coordinate: 1400
Initial Y-Top Starting Zone Coordinate: 749
Initial Y-Base Starting Zone Coordinate: 730

Remarks: a-a' 10ft bldr on talus & soft slope

Cell Data

Cell No.	S.R.	Tang. C.	Norm. C.	Begin X	Begin Y	End X	End Y
1	.2	.8	.5	0	752	120	750
2	.4	.8	.5	120	750	140	730
3	.8	.8	.5	140	730	360	560
4	2.75	.8	.4	360	560	560	420
5	3	.8	.4	560	420	620	358
6	2.75	.8	.4	620	358	870	190
7	3	.8	.4	870	190	940	158
8	1	.65	.2	940	158	1070	50
9	1	.6	.2	1070	50	1110	30
10	1	.75	.2	1110	30	1130	25
11	3	.8	.35	1130	25	1215	20
12	3	.8	.35	1215	20	1300	30
13	3	.8	.35	1300	30	1400	50

CRSP Simulation Specifications: Used with C:\Program Files\Crsp\AA 10ftb out.doc

Total Number of Rocks Simulated: 500
Starting Velocity in X-Direction: 5 ft/sec
Starting Velocity in Y-Direction: -5 ft/sec
Starting Cell Number: 1
Ending Cell Number: 13
Rock Density: 165 lb/ft^3
Rock Shape: Spherical
Diameter: 10 ft

CRSP Analysis Point 1 Data - C:\Program Files\Crsp\AA 10ftb out.doc

Analysis Point 1: X = 560, Y = 420

Total Rocks Passing Analysis Point: 500

Cumulative Probability	Velocity (ft/sec)	Energy (ft-lb)	Bounce Ht. (ft)
50%	84.9	12627327	6.33
75%	92.65	14574311	9.14
90%	99.61	16325501	11.67
95%	103.8	17376850	13.18
98%	108.49	18556805	14.89

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 109.07	Maximum: 32.14	Maximum: 18642521
Average: 84.9	Average: 10.37	Average: 12627327
Minimum: 56.89	G. Mean: 6.33	Std. Dev.: 2883566
Std. Dev.: 11.47	Std. Dev.: 4.16	

Remarks: a-a' 10ft bldr on talus & soft slope

CRSP Analysis Point 2 Data - C:\Program Files\Crsp\AA 10ftb out.doc

Analysis Point 2: X = 940, Y = 158

Total Rocks Passing Analysis Point: 500

Cumulative Probability	Velocity (ft/sec)	Energy (ft-lb)	Bounce Ht. (ft)
50%	75.86	10561619	4.82
75%	85.29	12989044	7.82
90%	93.78	15172360	10.52
95%	98.88	16483140	12.14
98%	104.6	17954263	13.96

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 123.86	Maximum: 25.5	Maximum: 24568824
Average: 75.86	Average: 7.94	Average: 10561619
Minimum: 45.04	G. Mean: 4.82	Std. Dev.: 3595119
Std. Dev.: 13.98	Std. Dev.: 4.44	

Remarks: a-a' 10ft bldr on talus & soft slope

CRSP Analysis Point 3 Data - C:\Program Files\Crsp\AA 10ftb out.doc

Analysis Point 3: X = 1400, Y = 50

NO ROCKS PAST ANALSYSIS POINT 3

CRSP Data Collected at End of Each Cell - C:\Program Files\Crsp\AA 10ftb out.doc

Velocity Units: ft/sec Bounce Height Units: ft

Cell #	Max. Vel.	Avg. Vel.	S.D. Vel.	Max. Bounce Ht.	Avg. Bounce Ht.
1	No rocks	past end of cell			
2	33	23	5.57	5	0
3	87	77	3.88	7	2
4	109	85	11.47	32	10
5	123	98	11.82	54	21
6	119	88	13.33	36	11
7	124	76	13.98	26	7
8	133	91	18.91	73	14
9	130	73	22.25	64	4
10	129	59	17.93	51	2
11	64	33	11.22	13	2
12	40	17	7.96	6	1
13	No rocks	past end of cell			

CRSP Rocks Stopped Data - C:\Program Files\Crsp\AA 10ftb out.doc

X Interval	Rocks Stopped
0 To 10 ft	0
10 To 20 ft	0
20 To 30 ft	0
30 To 40 ft	0
40 To 50 ft	0
50 To 60 ft	0
60 To 70 ft	0
70 To 80 ft	0
80 To 90 ft	0
90 To 100 ft	0
100 To 110 ft	0
110 To 120 ft	0
120 To 130 ft	0
130 To 140 ft	0
140 To 150 ft	0
150 To 160 ft	0
160 To 170 ft	0

170	To	180 ft	0
180	To	190 ft	0
190	To	200 ft	0
200	To	210 ft	0
210	To	220 ft	0
220	To	230 ft	0
230	To	240 ft	0
240	To	250 ft	0
250	To	260 ft	0
260	To	270 ft	0
270	To	280 ft	0
280	To	290 ft	0
290	To	300 ft	0
300	To	310 ft	0
310	To	320 ft	0
320	To	330 ft	0
330	To	340 ft	0
340	To	350 ft	0
350	To	360 ft	0
360	To	370 ft	0
370	To	380 ft	0
380	To	390 ft	0
390	To	400 ft	0
400	To	410 ft	0
410	To	420 ft	0
420	To	430 ft	0
430	To	440 ft	0
440	To	450 ft	0
450	To	460 ft	0
460	To	470 ft	0
470	To	480 ft	0
480	To	490 ft	0
490	To	500 ft	0
500	To	510 ft	0
510	To	520 ft	0
520	To	530 ft	0
530	To	540 ft	0
540	To	550 ft	0
550	To	560 ft	0
560	To	570 ft	0
570	To	580 ft	0
580	To	590 ft	0
590	To	600 ft	0
600	To	610 ft	0
610	To	620 ft	0
620	To	630 ft	0
630	To	640 ft	0
640	To	650 ft	0
650	To	660 ft	0
660	To	670 ft	0
670	To	680 ft	0
680	To	690 ft	0
690	To	700 ft	0
700	To	710 ft	0
710	To	720 ft	0
720	To	730 ft	0
730	To	740 ft	0

740 To 750 ft	0
750 To 760 ft	0
760 To 770 ft	0
770 To 780 ft	0
780 To 790 ft	0
790 To 800 ft	0
800 To 810 ft	0
810 To 820 ft	0
820 To 830 ft	0
830 To 840 ft	0
840 To 850 ft	0
850 To 860 ft	0
860 To 870 ft	0
870 To 880 ft	0
880 To 890 ft	0
890 To 900 ft	0
900 To 910 ft	0
910 To 920 ft	0
920 To 930 ft	0
930 To 940 ft	0
940 To 950 ft	0
950 To 960 ft	0
960 To 970 ft	0
970 To 980 ft	0
980 To 990 ft	0
990 To 1000 ft	0
1000 To 1010 ft	0
1010 To 1020 ft	0
1020 To 1030 ft	0
1030 To 1040 ft	0
1040 To 1050 ft	0
1050 To 1060 ft	0
1060 To 1070 ft	0
1070 To 1080 ft	0
1080 To 1090 ft	0
1090 To 1100 ft	0
1100 To 1110 ft	0
1110 To 1120 ft	0
1120 To 1130 ft	0
1130 To 1140 ft	0
1140 To 1150 ft	0
1150 To 1160 ft	0
1160 To 1170 ft	0
1170 To 1180 ft	2
1180 To 1190 ft	1
1190 To 1200 ft	4
1200 To 1210 ft	11
1210 To 1220 ft	17
1220 To 1230 ft	38
1230 To 1240 ft	67
1240 To 1250 ft	66
1250 To 1260 ft	75
1260 To 1270 ft	60
1270 To 1280 ft	49
1280 To 1290 ft	32
1290 To 1300 ft	22
1300 To 1310 ft	27

1310 To	1320 ft	15
1320 To	1330 ft	10
1330 To	1340 ft	2
1340 To	1350 ft	1
1350 To	1360 ft	1
1360 To	1370 ft	0
1370 To	1380 ft	0
1380 To	1390 ft	0
1390 To	1400 ft	0

CRSP Input File -C:\Program Files\Crsp\WK BB 2ft.dat

Input File Specifications

Units of Measure: U.S.
Total Number of Cells: 11
Analysis Point 1 X-Coordinate: 480
Analysis Point 2 X-Coordinate: 780
Analysis Point 3 X-Coordinate: 1140
Initial Y-Top Starting Zone Coordinate: 716
Initial Y-Base Starting Zone Coordinate: 710

Remarks: B-B' soft soil slope w SM matrix surface - no talus

Cell Data

Cell No.	S.R.	Tang. C.	Norm. C.	Begin X	Begin Y	End X	End Y
1	1	.55	.15	0	740	70	720
2	1.35	.55	.15	70	720	298	540
3	1.35	.55	.15	298	540	355	500
4	1.3	.55	.15	355	500	439	438
5	1.35	.55	.15	439	438	510	388
6	1.3	.55	.15	510	388	560	350
7	1.35	.55	.15	560	350	678	263
8	1.25	.55	.15	678	263	850	160
9	1.3	.55	.15	850	160	1008	70
10	1	.55	.15	1008	70	1060	58
11	1	.55	.15	1060	58	1200	100

CRSP Simulation Specifications: Used with C:\Program Files\Crsp\WK BB 2ft.dat

Total Number of Rocks Simulated: 500
Starting Velocity in X-Direction: 5 ft/sec
Starting Velocity in Y-Direction: -5 ft/sec
Starting Cell Number: 1
Ending Cell Number: 11
Rock Density: 165 lb/ft^3
Rock Shape: Spherical
Diameter: 2 ft

CRSP Analysis Point 1 Data - C:\Program Files\Crsp\WK BB 2ft.dat

Analysis Point 1: X = 480, Y = 409

Total Rocks Passing Analysis Point: 394

Cumulative Probability	Velocity (ft/sec)	Energy (ft-lb)	Bounce Ht. (ft)
50%	19.05	5725	0.48
75%	24.47	8829	4.98
90%	29.34	11620	9.03
95%	32.26	13296	11.46
98%	35.54	15177	14.19

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 47.66	Maximum: 6.08	Maximum: 29219
Average: 19.05	Average: 1.12	Average: 5725
Minimum: 2.67	G. Mean: .48 Std. Dev.:	4596
Std. Dev.: 8.02	Std. Dev.: 6.67	

Remarks: B-B' soft soil slope w SM matrix surface - no talus

CRSP Analysis Point 2 Data - C:\Program Files\Crsp\WK BB 2ft.dat

Analysis Point 2: X = 780, Y = 202

Total Rocks Passing Analysis Point: 143

Cumulative Probability	Velocity (ft/sec)	Energy (ft-lb)	Bounce Ht. (ft)
50%	15.07	3852	0.26
75%	19.97	6180	5.7
90%	24.37	8274	10.59
95%	27.01	9531	13.53
98%	29.98	10942	16.83

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 34.54	Maximum: 5.01	Maximum: 15719
Average: 15.07	Average: .78 Average:	3852
Minimum: 2.05	G. Mean: .26 Std. Dev.:	3447
Std. Dev.: 7.25	Std. Dev.: 8.06	

Remarks: B-B' soft soil slope w SM matrix surface - no talus

CRSP Analysis Point 3 Data - C:\Program Files\Crsp\WK BB 2ft.dat

Analysis Point 3: X = 1140, Y = 82

NO ROCKS PAST ANALSYSIS POINT 3

CRSP Data Collected at End of Each Cell - C:\Program Files\Crsp\WK BB 2ft.dat

Velocity Units: ft/sec Bounce Height Units: ft

Cell #	Max. Vel.	Avg. Vel.	S.D. Vel.	Max. Bounce Ht.	Avg. Bounce Ht.
1	No rocks	past end of cell			
2	56	23	8.59	8	1
3	48	20	8.87	5	1
4	50	21	7.99	6	1
5	41	19	7.7	6	1
6	51	21	7.94	7	1
7	46	19	8.81	8	1
8	34	14	6.75	5	0
9	20	20	0	1	0
10	No rocks	past end of cell			
11	No rocks	past end of cell			

CRSP Rocks Stopped Data - C:\Program Files\Crsp\WK BB 2ft.dat

X Interval	Rocks Stopped
0 To 10 ft	0
10 To 20 ft	0
20 To 30 ft	0
30 To 40 ft	0
40 To 50 ft	0
50 To 60 ft	0
60 To 70 ft	0
70 To 80 ft	4
80 To 90 ft	8
90 To 100 ft	4
100 To 110 ft	1
110 To 120 ft	1
120 To 130 ft	1
130 To 140 ft	1
140 To 150 ft	1
150 To 160 ft	0
160 To 170 ft	0
170 To 180 ft	3
180 To 190 ft	1
190 To 200 ft	1
200 To 210 ft	1

210 To 220 ft	2
220 To 230 ft	2
230 To 240 ft	2
240 To 250 ft	1
250 To 260 ft	1
260 To 270 ft	0
270 To 280 ft	1
280 To 290 ft	0
290 To 300 ft	1
300 To 310 ft	7
310 To 320 ft	4
320 To 330 ft	4
330 To 340 ft	5
340 To 350 ft	8
350 To 360 ft	4
360 To 370 ft	4
370 To 380 ft	1
380 To 390 ft	2
390 To 400 ft	0
400 To 410 ft	2
410 To 420 ft	0
420 To 430 ft	2
430 To 440 ft	2
440 To 450 ft	4
450 To 460 ft	5
460 To 470 ft	5
470 To 480 ft	10
480 To 490 ft	8
490 To 500 ft	8
500 To 510 ft	10
510 To 520 ft	1
520 To 530 ft	2
530 To 540 ft	1
540 To 550 ft	0
550 To 560 ft	0
560 To 570 ft	0
570 To 580 ft	2
580 To 590 ft	2
590 To 600 ft	1
600 To 610 ft	1
610 To 620 ft	1
620 To 630 ft	2
630 To 640 ft	1
640 To 650 ft	1
650 To 660 ft	2
660 To 670 ft	3
670 To 680 ft	6
680 To 690 ft	16
690 To 700 ft	26
700 To 710 ft	19
710 To 720 ft	24
720 To 730 ft	26
730 To 740 ft	15
740 To 750 ft	17
750 To 760 ft	16
760 To 770 ft	20
770 To 780 ft	20

780 To 790 ft	15
790 To 800 ft	13
800 To 810 ft	17
810 To 820 ft	13
820 To 830 ft	9
830 To 840 ft	7
840 To 850 ft	6
850 To 860 ft	12
860 To 870 ft	7
870 To 880 ft	6
880 To 890 ft	9
890 To 900 ft	4
900 To 910 ft	2
910 To 920 ft	3
920 To 930 ft	3
930 To 940 ft	3
940 To 950 ft	3
950 To 960 ft	3
960 To 970 ft	2
970 To 980 ft	1
980 To 990 ft	0
990 To 1000 ft	3
1000 To 1010 ft	1
1010 To 1020 ft	0
1020 To 1030 ft	1
1030 To 1040 ft	0
1040 To 1050 ft	0
1050 To 1060 ft	0
1060 To 1070 ft	0
1070 To 1080 ft	0
1080 To 1090 ft	0
1090 To 1100 ft	0
1100 To 1110 ft	0
1110 To 1120 ft	0
1120 To 1130 ft	0
1130 To 1140 ft	0
1140 To 1150 ft	0
1150 To 1160 ft	0
1160 To 1170 ft	0
1170 To 1180 ft	0
1180 To 1190 ft	0
1190 To 1200 ft	0

CRSP Input File -C:\Program Files\Crsp\WK BB 4ft.dat

Input File Specifications

Units of Measure: U.S.
Total Number of Cells: 11
Analysis Point 1 X-Coordinate: 480
Analysis Point 2 X-Coordinate: 780
Analysis Point 3 X-Coordinate: 1140
Initial Y-Top Starting Zone Coordinate: 716
Initial Y-Base Starting Zone Coordinate: 710

Remarks: B-B' soft soil slope w SM matrix surface - no talus

Cell Data

Cell No.	S.R.	Tang. C.	Norm. C.	Begin X	Begin Y	End X	End Y
1	.75	.55	.15	0	740	70	720
2	1	.55	.15	70	720	298	540
3	1	.55	.15	298	540	355	500
4	.95	.55	.15	355	500	439	438
5	1	.55	.15	439	438	510	388
6	.95	.55	.15	510	388	560	350
7	1	.55	.15	560	350	678	263
8	.9	.55	.15	678	263	850	160
9	.95	.55	.15	850	160	1008	70
10	.75	.55	.15	1008	70	1060	58
11	.75	.55	.15	1060	58	1200	100

CRSP Simulation Specifications: Used with C:\Program Files\Crsp\WK BB 2ft.dat

Total Number of Rocks Simulated: 500
Starting Velocity in X-Direction: 5 ft/sec
Starting Velocity in Y-Direction: -5 ft/sec
Starting Cell Number: 1
Ending Cell Number: 11
Rock Density: 165 lb/ft^3
Rock Shape: Spherical
Diameter: 4 ft

CRSP Analysis Point 1 Data - C:\Program Files\Crsp\WK BB 2ft.dat

Analysis Point 1: X = 480, Y = 409

Total Rocks Passing Analysis Point: 500

Cumulative Probability	Velocity (ft/sec)	Energy (ft-lb)	Bounce Ht. (ft)
50%	43.81	214144	1.42
75%	47.89	248090	4.58
90%	51.55	278622	7.43
95%	53.75	296953	9.14
98%	56.22	317526	11.06

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 58.3	Maximum: 7.09	Maximum: 356924
Average: 43.81	Average: 2.46	Average: 214144
Minimum: 29.25	G. Mean: 1.42	Std. Dev.: 50275
Std. Dev.: 6.03	Std. Dev.: 4.69	

Remarks: B-B' soft soil slope w SM matrix surface - no talus

CRSP Analysis Point 2 Data - C:\Program Files\Crsp\WK BB 2ft.dat

Analysis Point 2: X = 780, Y = 202

Total Rocks Passing Analysis Point: 500

Cumulative Probability	Velocity (ft/sec)	Energy (ft-lb)	Bounce Ht. (ft)
50%	40.6	187113	0.89
75%	43.96	214174	5.34
90%	46.98	238513	9.35
95%	48.8	253126	11.75
98%	50.83	269526	14.45

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 56.25	Maximum: 5.3	Maximum: 338903
Average: 40.6	Average: 1.77	Average: 187113
Minimum: 29.13	G. Mean: .89	Std. Dev.: 40078
Std. Dev.: 4.98	Std. Dev.: 6.6	

Remarks: B-B' soft soil slope w SM matrix surface - no talus

CRSP Analysis Point 3 Data - C:\Program Files\Crsp\WK BB 2ft.dat

Analysis Point 3: X = 1140, Y = 82

NO ROCKS PAST ANALSYSIS POINT 3

CRSP Data Collected at End of Each Cell - C:\Program Files\Crsp\WK BB 2ft.dat

Velocity Units: ft/sec Bounce Height Units: ft

Cell #	Max. Vel.	Avg. Vel.	S.D. Vel.	Max. Bounce Ht.	Avg. Bounce Ht.
1	No rocks	past end of cell			
2	60	44	5.95	8	2
3	58	42	5.7	7	2
4	64	44	5.86	7	2
5	63	44	6.08	8	2
6	63	45	5.88	7	2
7	63	45	6.04	8	2
8	55	40	4.61	5	1
9	51	37	4.69	5	1
10	35	23	3.94	2	0
11	No rocks	past end of cell			

CRSP Rocks Stopped Data - C:\Program Files\Crsp\WK BB 2ft.dat

X Interval	Rocks Stopped
0 To 10 ft	0
10 To 20 ft	0
20 To 30 ft	0
30 To 40 ft	0
40 To 50 ft	0
50 To 60 ft	0
60 To 70 ft	0
70 To 80 ft	0
80 To 90 ft	0
90 To 100 ft	0
100 To 110 ft	0
110 To 120 ft	0
120 To 130 ft	0
130 To 140 ft	0
140 To 150 ft	0
150 To 160 ft	0
160 To 170 ft	0
170 To 180 ft	0
180 To 190 ft	0
190 To 200 ft	0
200 To 210 ft	0

210 To	220 ft	0
220 To	230 ft	0
230 To	240 ft	0
240 To	250 ft	0
250 To	260 ft	0
260 To	270 ft	0
270 To	280 ft	0
280 To	290 ft	0
290 To	300 ft	0
300 To	310 ft	0
310 To	320 ft	0
320 To	330 ft	0
330 To	340 ft	0
340 To	350 ft	0
350 To	360 ft	0
360 To	370 ft	0
370 To	380 ft	0
380 To	390 ft	0
390 To	400 ft	0
400 To	410 ft	0
410 To	420 ft	0
420 To	430 ft	0
430 To	440 ft	0
440 To	450 ft	0
450 To	460 ft	0
460 To	470 ft	0
470 To	480 ft	0
480 To	490 ft	0
490 To	500 ft	0
500 To	510 ft	0
510 To	520 ft	0
520 To	530 ft	0
530 To	540 ft	0
540 To	550 ft	0
550 To	560 ft	0
560 To	570 ft	0
570 To	580 ft	0
580 To	590 ft	0
590 To	600 ft	0
600 To	610 ft	0
610 To	620 ft	0
620 To	630 ft	0
630 To	640 ft	0
640 To	650 ft	0
650 To	660 ft	0
660 To	670 ft	0
670 To	680 ft	0
680 To	690 ft	0
690 To	700 ft	0
700 To	710 ft	0
710 To	720 ft	0
720 To	730 ft	0
730 To	740 ft	0
740 To	750 ft	0
750 To	760 ft	0
760 To	770 ft	0
770 To	780 ft	0

780 To 790 ft	0
790 To 800 ft	0
800 To 810 ft	0
810 To 820 ft	0
820 To 830 ft	0
830 To 840 ft	0
840 To 850 ft	0
850 To 860 ft	0
860 To 870 ft	0
870 To 880 ft	0
880 To 890 ft	0
890 To 900 ft	0
900 To 910 ft	0
910 To 920 ft	0
920 To 930 ft	0
930 To 940 ft	0
940 To 950 ft	0
950 To 960 ft	0
960 To 970 ft	0
970 To 980 ft	0
980 To 990 ft	0
990 To 1000 ft	0
1000 To 1010 ft	0
1010 To 1020 ft	0
1020 To 1030 ft	0
1030 To 1040 ft	0
1040 To 1050 ft	0
1050 To 1060 ft	0
1060 To 1070 ft	273
1070 To 1080 ft	227
1080 To 1090 ft	0
1090 To 1100 ft	0
1100 To 1110 ft	0
1110 To 1120 ft	0
1120 To 1130 ft	0
1130 To 1140 ft	0
1140 To 1150 ft	0
1150 To 1160 ft	0
1160 To 1170 ft	0
1170 To 1180 ft	0
1180 To 1190 ft	0
1190 To 1200 ft	0

CRSP Input File -C:\Program Files\Crsp\WK BB 10ft.dat

Input File Specifications

Units of Measure: U.S.
Total Number of Cells: 11
Analysis Point 1 X-Coordinate: 480
Analysis Point 2 X-Coordinate: 780
Analysis Point 3 X-Coordinate: 1140
Initial Y-Top Starting Zone Coordinate: 888
Initial Y-Base Starting Zone Coordinate: 880

Remarks: B-B' soft soil slope w SM matrix surface - no talus

Cell Data

Cell No.	S.R.	Tang. C.	Norm. C.	Begin X	Begin Y	End X	End Y
1	.5	.55	.15	0	900	70	720
2	.5	.55	.15	70	720	298	540
3	.5	.55	.15	298	540	355	500
4	.6	.55	.15	355	500	439	438
5	.5	.55	.15	439	438	510	388
6	.5	.55	.15	510	388	560	350
7	.5	.55	.15	560	350	678	263
8	.6	.55	.15	678	263	850	160
9	.5	.55	.15	850	160	1008	70
10	.5	.55	.15	1008	70	1060	58
11	.5	.55	.15	1060	58	1200	100

CRSP Simulation Specifications: Used with C:\Program Files\Crsp\WK BB 10ft.dat

Total Number of Rocks Simulated: 500
Starting Velocity in X-Direction: 10 ft/sec
Starting Velocity in Y-Direction: -10 ft/sec
Starting Cell Number: 1
Ending Cell Number: 11
Rock Density: 165 lb/ft^3
Rock Shape: Spherical
Diameter: 10 ft

CRSP Analysis Point 1 Data - C:\Program Files\Crsp\WK BB 10ft.dat

Analysis Point 1: X = 480, Y = 409

Total Rocks Passing Analysis Point: 199

Cumulative Probability	Velocity (ft/sec)	Energy (ft-lb)	Bounce Ht. (ft)
50%	42.01	3315388	0.04
75%	47.34	4111715	6.07
90%	52.13	4827961	11.5
95%	55	5257968	14.76
98%	58.23	5740576	18.42

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 59.35	Maximum: .66	Maximum: 6187159
Average: 42.01	Average: .12	Average: 3315388
Minimum: 21.56	G. Mean: .04	Std. Dev.: 1179393
Std. Dev.: 7.88	Std. Dev.: 8.94	

Remarks: B-B' soft soil slope w SM matrix surface - no talus

CRSP Analysis Point 2 Data - C:\Program Files\Crsp\WK BB 10ft.dat

Analysis Point 2: X = 780, Y = 202

Total Rocks Passing Analysis Point: 60

Cumulative Probability	Velocity (ft/sec)	Energy (ft-lb)	Bounce Ht. (ft)
50%	36.86	2573235	0.05
75%	42.19	3291559	7.17
90%	46.98	3937647	13.57
95%	49.86	4325533	17.41
98%	53.09	4760868	21.73

Velocity (ft/sec)	Bounce Height (ft)	Kinetic Energy (ft-lb)
Maximum: 56.82	Maximum: .81	Maximum: 5732076
Average: 36.86	Average: .16	Average: 2573235
Minimum: 19.13	G. Mean: .05	Std. Dev.: 1063868
Std. Dev.: 7.89	Std. Dev.: 10.54	

Remarks: B-B' soft soil slope w SM matrix surface - no talus

CRSP Analysis Point 3 Data - C:\Program Files\Crsp\WK BB 10ft.dat

Analysis Point 3: X = 1140, Y = 82

NO ROCKS PAST ANALSYSIS POINT 3

CRSP Data Collected at End of Each Cell - C:\Program Files\Crsp\WK BB 10ft.dat

Velocity Units: ft/sec Bounce Height Units: ft

Cell #	Max. Vel.	Avg. Vel.	S.D. Vel.	Max. Bounce Ht.	Avg. Bounce Ht.
1	79	63	10.21	5	1
2	61	43	8.34	1	0
3	61	41	8.37	1	0
4	60	44	8.11	1	0
5	57	41	8.92	1	0
6	59	42	8.63	1	0
7	60	40	8.79	1	0
8	53	36	7.41	1	0
9	46	36	7.28	0	0
10	35	35	0	0	-1
11	No rocks past end of cell				

CRSP Rocks Stopped Data - C:\Program Files\Crsp\WK BB 10ft.dat

X Interval	Rocks Stopped
0 To 10 ft	0
10 To 20 ft	0
20 To 30 ft	0
30 To 40 ft	0
40 To 50 ft	0
50 To 60 ft	0
60 To 70 ft	0
70 To 80 ft	1
80 To 90 ft	6
90 To 100 ft	5
100 To 110 ft	4
110 To 120 ft	4
120 To 130 ft	5
130 To 140 ft	4
140 To 150 ft	6
150 To 160 ft	6
160 To 170 ft	8
170 To 180 ft	13
180 To 190 ft	9
190 To 200 ft	7
200 To 210 ft	11

210 To 220 ft	8
220 To 230 ft	12
230 To 240 ft	12
240 To 250 ft	7
250 To 260 ft	9
260 To 270 ft	7
270 To 280 ft	12
280 To 290 ft	6
290 To 300 ft	13
300 To 310 ft	14
310 To 320 ft	15
320 To 330 ft	13
330 To 340 ft	18
340 To 350 ft	13
350 To 360 ft	9
360 To 370 ft	5
370 To 380 ft	4
380 To 390 ft	1
390 To 400 ft	1
400 To 410 ft	2
410 To 420 ft	1
420 To 430 ft	2
430 To 440 ft	1
440 To 450 ft	8
450 To 460 ft	6
460 To 470 ft	4
470 To 480 ft	9
480 To 490 ft	9
490 To 500 ft	5
500 To 510 ft	9
510 To 520 ft	12
520 To 530 ft	7
530 To 540 ft	7
540 To 550 ft	7
550 To 560 ft	4
560 To 570 ft	5
570 To 580 ft	9
580 To 590 ft	8
590 To 600 ft	5
600 To 610 ft	3
610 To 620 ft	2
620 To 630 ft	6
630 To 640 ft	7
640 To 650 ft	7
650 To 660 ft	3
660 To 670 ft	5
670 To 680 ft	3
680 To 690 ft	0
690 To 700 ft	3
700 To 710 ft	2
710 To 720 ft	1
720 To 730 ft	1
730 To 740 ft	1
740 To 750 ft	1
750 To 760 ft	3
760 To 770 ft	2
770 To 780 ft	2

780 To 790 ft	1
790 To 800 ft	3
800 To 810 ft	1
810 To 820 ft	1
820 To 830 ft	0
830 To 840 ft	2
840 To 850 ft	3
850 To 860 ft	9
860 To 870 ft	3
870 To 880 ft	5
880 To 890 ft	7
890 To 900 ft	5
900 To 910 ft	3
910 To 920 ft	3
920 To 930 ft	3
930 To 940 ft	0
940 To 950 ft	1
950 To 960 ft	3
960 To 970 ft	1
970 To 980 ft	0
980 To 990 ft	0
990 To 1000 ft	1
1000 To 1010 ft	0
1010 To 1020 ft	0
1020 To 1030 ft	2
1030 To 1040 ft	1
1040 To 1050 ft	0
1050 To 1060 ft	1
1060 To 1070 ft	0
1070 To 1080 ft	1
1080 To 1090 ft	0
1090 To 1100 ft	0
1100 To 1110 ft	0
1110 To 1120 ft	0
1120 To 1130 ft	0
1130 To 1140 ft	0
1140 To 1150 ft	0
1150 To 1160 ft	0
1160 To 1170 ft	0
1170 To 1180 ft	0
1180 To 1190 ft	0
1190 To 1200 ft	0

CHJ Consultants
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15345 Anacapa Road, Suite D, Victorville, CA 92392 ◆ Phone (760) 243-0506 ◆ Fax (760) 243-1225
77-564A Country Club Drive, Suite 122, Palm Desert, CA 92211 ◆ Phone (760) 772-8234 ◆ Fax (909) 503-1136

January 14, 2013

Omya California
a Division of Omya, Incorporated
7225 Crystal Creek Road
Lucerne Valley, California 92356
Attention: Mr. Howard Brown

Job No. 12715-8

Dear Mr. Brown:

This letter transmits six copies of the slope stability investigation report for the Amended Plan of Operations for the Omya Incorporated White Knob quarry located south of Lucerne Valley, California.

We appreciate this opportunity to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact this firm at your convenience.

Respectfully submitted,
CHJ CONSULTANTS

John S. McKeown

John S. McKeown, E.G. 2396
Project Geologist

JMc/JJM:jm/lb

Distribution: OMYA Inc. (6)

SLOPE STABILITY INVESTIGATION
PROPOSED AMENDED PLAN OF OPERATIONS
WHITE KNOB QUARRY MINING AND RECLAMATION PLAN
LUCERNE VALLEY, CALIFORNIA
PREPARED FOR
OMYA CALIFORNIA
A DIVISION OF OMYA, INC.
JOB NO. 12715-8

CHJ Consultants
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January 14, 2013

Omya California
a Division of Omya, Incorporated
7225 Crystal Creek Road
Lucerne Valley, California 92356
Attention: Mr. Howard Brown

Job No. 12715-8

Dear Mr. Brown:

Attached herewith is the slope stability investigation report for the Amended Plan of Operations for the Omya Incorporated White Knob quarry located in the Lucerne Valley area of San Bernardino County, California.

This revised report was based upon a scope of services generally outlined in our proposal, dated September 26, 2012, and other written and verbal communications.

We appreciate this opportunity to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact this firm at your convenience.

Respectfully submitted,
CHJ CONSULTANTS

John S. McKeown

John S. McKeown, E.G.
Project Geologist

JMc/JJM:lb

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SLOPE STABILITY INVESTIGATION
PROPOSED AMENDED PLAN OF OPERATIONS
WHITE KNOB QUARRY MINING AND RECLAMATION PLAN
LUCERNE VALLEY, CALIFORNIA
PREPARED FOR
OMYA CALIFORNIA
A DIVISION OF OMYA, INC.
JOB NO. 12715-8

INTRODUCTION

This firm provided geotechnical consultation for an Amended Plan of Operations for the Omya Incorporated White Knob quarry located in the Lucerne Valley area of San Bernardino County, California. Our services included evaluation of kinematic and global slope stability for existing and future cut and embankment slopes. The purpose of our evaluation is to characterize the stability and condition of future quarry and embankment slopes. Future mining operations are planned in the White Knob area, White Knob Annex area, and White Ridge quarries. Overburden stockpiles are planned northwest and northeast of the White Ridge area and south of the White Knob area. Information from our prior investigations of the White Knob quarry conducted in 2007 and 2008 including field mapping and laboratory testing were utilized in this evaluation.

To orient our investigation, we reviewed the following documents:

- Omya California White Knob Mining Plan, dated September 22, 2012 (preliminary design)
- Omya California White Knob Mining Plan, dated October 15, 2012
- Omya California White Knob Reclamation Plan, dated October 10, 2012
- Detailed Geologic Map of the White Knob White Ridge area San Bernardino Mountains by Howard Brown, dated June 1989, scale 1" = 50', contour interval = 10 feet
- Topographic map by Digital Mapping, Incorporated from aerial survey dated 2009, scale 1" = 50', 5-foot contour interval
- White Knob Haul Road Drainage Study and Plan of Development by Stantec, dated August 2011

- Orthophoto-based contour map - White Knob Placer Claim by American Aerial Surveys, dated June 24, 1983; scale 1" = 100', 25-foot contour interval
- Orthophoto-based contour map - White Knob area, untitled, dated November 7, 1988
- C.H.J., Incorporated, Revised Slope Stability Investigation, Proposed Amended Plan of Operations, for the White Knob Quarry, OMYA California, Inc., Lucerne Valley, California, CHJ Job No. 07539-8, report dated April 30, 2008.

The approximate location of the quarry area is shown on the attached Index Map (Enclosure "A-1").

The results of our evaluation, together with our conclusions and recommendations, are presented in this report.

SCOPE OF SERVICES

The scope of services provided during this geotechnical consultation included the following:

- Review of published and unpublished literature and maps including geologic mapping by Mr. Howard Brown, Omya's geologist
- Review of aerial imagery dated 1983, 1988, 2002, 2003, 2005, 2006, 2007 and 2009
- Review of OMYA mine and reclamation plans
- Review of previous studies by C.H.J., Incorporated and this firm
- Evaluation of future slopes and overburden stockpiles

PRIOR INVESTIGATIONS

In reports dated 2007 and 2008, C.H.J. Incorporated presented slope stability studies for a proposed amended plan of operation for the White Knob quarry. The prior investigation included geologic

mapping, a review and discussion of geologic hazards, including faulting and seismicity, and a review of groundwater conditions. In addition, kinematic evaluation of proposed rock slopes and slope stability calculations and evaluation of proposed rock and overburden slopes were performed. The results of those investigations indicated that the then-proposed overall approximate 50-degree mine cut slopes up to approximately 450 feet in height formed in limestone and granitic rock are suitably stable against gross failure for the anticipated long-term conditions, including the effects of seismic shaking and that proposed 2(h):1(v) fill slopes meet the factor of safety criteria for static and seismic conditions. This update addresses modifications to the mine plan that include slope configurations and geometry and height of overburden stockpiles.

SITE DESCRIPTION

The White Knob quarry is located in the northern San Bernardino Mountains, approximately 6 miles southwest of the town of Lucerne Valley. The quarry occupies portions of Sections 7 and 8, Township 3 North, Range 1 West, of San Bernardino Base & Meridian (SBB&M). Access to the quarry is by a haul road extending 6 miles west-southwesterly from the Omya Incorporated processing plant located on Crystal Creek Road. Elevations in the quarry area range from approximately 4,800 feet above mean sea level (elevation values listed in this report assume amsl) to 6,300 feet. The White Knob quarry produces high-purity calcium carbonate limestone used for numerous commercial and industrial applications, including plastics and paints. The high-purity calcium carbonate limestone deposits required for these applications are typically white in color. The more common gray limestone deposits are not considered suitable for such applications. The White Knob quarry area includes mining areas designated White Knob and White Knob Annex and a future mining area designated as White Ridge. The White Ridge area is not mined at this time. Enclosure "A-2.1", Geologic Map and Site Plan depicts the topographic and geologic conditions in the quarry areas and general site configuration.

MINING AND RECLAMATION PLANS

According to the Mining Plan dated October 2012, it is proposed to continue mining in the White Knob and White Knob Annex areas to bottom elevations of 5,300 feet and 5,575 feet, respectively. A bottom elevation of approximately 5,050 feet is proposed for the White Ridge quarry. The geometry of final mined slopes is planned to include overall heights up to 975 feet in the White Knob quarry (including the section of natural slope above the mined slope) and 750 feet in the White Ridge quarry. Mined slope angles are planned at approximately 50 degrees overall utilizing 45 foot high intra-bench faces cut at 70 degrees with intervening 25-foot wide safety benches. These slopes will be formed in crystalline rock materials.

Overburden stockpiles currently include materials placed at OB-1 located east of White Knob quarry and west of proposed White Ridge quarry. These materials were previously sampled and tested by C.H.J., Incorporated in 2007. Future stockpile areas are planned south of White Knob quarry (OB-2) and northeast of White Ridge quarry (OB-3). Stockpile fills are planned with intra-bench slope gradients of 2 horizontal (h) to 1 vertical (v) to maximum intra-bench heights of approximately 100 feet. The planned slope angle and bench configuration will result in stockpile slopes that exhibit gradients flatter than 2(h):1(v) overall.

The slope configuration and geometry of selected mine and overburden stockpile slopes, depicted along section lines A-A', B-B' and C-C', is presented in Appendix C. The location of individual section lines is shown on the Mining Plan (Enclosure "A-2.2").

REGIONAL GEOLOGIC SETTING:

The Omya Incorporated White Knob quarry lies in the northern portion of the San Bernardino Mountains. The San Bernardino Mountains are part of the Transverse Ranges Geomorphic Province. The San Bernardino Mountains are characterized by remnants of a relatively flat, uplifted geomorphic surface as old as Miocene in age. These discontinuous geomorphic remnants are

separated by steep-walled canyons and prominent peaks. The White Knob quarry is located on the north flank of the mountains. The Mojave Desert Geomorphic Province is located to the north of the site. The general geologic structure and lithology of the site region are shown on Enclosure "A-3", Geologic Index Map adapted from Miller et al. (2000).

The following with regard to the regional geology of the mine area is adapted from information provided by Mr. Howard Brown, Exploration and Mining Geologist with Omya Incorporated.

Brown (1984a, 1984b, 1985a, 1985b, 1986, 1991a, 1991b, 2008a) has presented numerous reports, presentations and papers regarding the regional geologic setting of the San Bernardino Mountains and Mojave Desert area as summarized below. A variety of rocks of Precambrian to recent age are exposed within the San Bernardino Mountains and the White Knob/White Ridge quarry area. Late Precambrian and Paleozoic metasedimentary rocks unconformably overlie older 1.8 b.y. Baldwin Gneiss Precambrian basement.

Late Proterozoic and Paleozoic sequences in the San Bernardino Mountains contain elements of both cratonal and miogeoclinal affinity. The lower part of the sequence is dominated by quartzite of the Stirling Quartzite, Wood Canyon Formation, and Zabriskie quartzite. The Cambrian Carrara Formation contains both clastic and carbonate members. Cambrian strata are dominated by dolomite of the Bonanza King and Nopah Formations. A major unconformity is present between Upper Cambrian and Devonian strata throughout the Mojave region and San Bernardino Mountains. In the San Bernardino Mountains, Upper Precambrian and Lower Cambrian rocks are of miogeoclinal aspect, middle Cambrian strata are of cratonal aspect, and upper Paleozoic rocks are identical to inner miogeoclinal facies of the central and eastern Mojave region.

Upper Paleozoic rocks including upper Devonian, Mississippian and Pennsylvanian through Permian are dominated by limestone. High brightness, high purity crystalline limestone deposits occur in upper Paleozoic miogeoclinal limestone formations in the San Bernardino Mountains and at White Knob quarry. The Mississippian Monte Cristo Limestone is mined for high brightness, high purity calcium carbonate, and the Pennsylvanian Bird Spring Formation is extensively mined for cement grade limestone. Fluorescent minerals at the White Knob quarry occur in the Monte Cristo Limestone.

Several varieties of Permo-Triassic and Mesozoic age intrusive rocks are present in the San Bernardino Mountains, and include Permo-Triassic monzonites, quartz monzonite and granodiorite, Jurassic quartz monzonite, hornblende diorite and gabbro, and leucocratic batholithic quartz monzonites of Cretaceous age. Plutonic rocks form the majority of the

mountain range, and the Paleozoic rocks described above were intruded by the plutonic rocks and form roof pendants. At the White Knob quarry, several generations of intrusive rocks are present and cross cutting relationships can be observed.

The Late Proterozoic and Paleozoic rocks have been affected by both regional and contact metamorphism. Regional metamorphism ranges from upper Greenschist to upper Amphibolite facies. At the White Knob quarry the metasedimentary rocks have been metamorphosed to upper amphibolite facies based on the presence of diopside, vesuvianite, wollastonite and garnet bearing calc-silicate minerals. Contact metamorphism is widespread, and numerous small skarn deposits are present along some contacts between metasedimentary and intrusive rocks.

Several major intrusive, metamorphic and tectonic events have been recognized in the San Bernardino Mountains. These include complex multi-phase Permo-Triassic and Mesozoic age folding and thrust faulting, contact and regional metamorphism, and intrusive events.

Cenozoic activity includes several generations of high and low angle faults, and mild folding. The San Bernardino Mountains area continues to be seismically active as evidenced by the significant earthquakes in the area during the last 15 years.

The Old Woman Sandstone consists of massive to weakly bedded arkosic and locally conglomeratic sandstone that crops out discontinuously in the northern San Bernardino Mountains and Mojave Desert region. Shreve (1959) suggests northward deposition of this sandstone in an alluvial-fan environment from an early San Bernardino Mountains highland. Quaternary deposits mapped by Miller et al. (2000) include alluvial fan, axial valley, talus, colluvial, surficial, and landslide deposits ranging in age from very old (Pleistocene) to recent (Holocene) age. Sediments within the mining area are primarily comprised of colluvium and surficial sediments as thin slope mantling soils and in drainage channels as thin veneers on bedrock channels.

At the White Knob Quarry, rocks have been multiply metamorphosed to amphibolite and locally granulite facies, forming exceedingly coarse-grained, very white translucent calcite marble. Individual calcite rhombs are commonly over 1 inch across. The steeply dipping deposit is over 1,500 feet along strike, and is exposed over 1,200 feet vertically.

The complex geologic history of the San Bernardino Mountains has allowed the formation of several large high brightness, high purity limestone deposits which are currently being mined or will be mined in the future.

GEOLOGIC STRUCTURE:

The southern and northern margins of the White Knob ore deposit are formed by contact with steeply south-dipping intrusive rocks that include granitic and foliated schistose rocks. Foliation (bedding) measured within and along the ore body margin generally strikes east-west and dips southward at steep inclinations.

Major contacts between the lithologic (mapping) units include faults as mapped by Mr. Howard Brown. High-angle faults are also mapped trending perpendicular to the east-west trend of the ore body (cross faults).

The bedrock geologic materials observed in the quarry walls exhibit well-developed joint sets and systems, localized shear zones, and localized foliation that were measured with a geologic compass and recorded on a 100-scale topographic map. These data are shown on the Geologic Map and Site Plan (Enclosure "A-2.1"). The discontinuity data was evaluated with a stereonet plotting program as dip vectors and analyzed for kinematic stability based on the anticipated final quarry geometries. Within individual quarry exposures, at least two orthogonal high-angle joint sets were observed. Throughout the quarry area these high-angle joint sets are aligned near north-south and east-west, reflecting the trend of major bedrock faults and contacts. A third joint set exhibiting more shallow dips was locally present. Joint sets are typically widely spaced (12 to 36 inches) and joints are discontinuous (less than 3 feet) to slightly continuous (3 to 10 feet). All joints (fractures) were dry, tight, and lacked infilling. The ore rock is fresh and unstained in the majority of quarry exposures. The potential effect of the geometry of discontinuities on slope stability is addressed later in this report.

An east-northeast trending canyon descends from the current crusher site and contains a haul road that passes between OB-1 and the future White Ridge quarry area. Twenty-year-old cut slopes along the haul road locally expose thick deposits of colluvial sediment derived from natural erosion and down slope migration of coarse clastic (cobble size) debris and silty sand matrix material. Raveling

and/or sloughing was not apparent in these materials that locally stand at steep gradients due to a relatively high degree of cementation and are primarily clast supported. Not all occurrences of colluvium are shown on the Geologic Map and Site Plan (Enclosure "A-2.1").

Fill observed at the site is associated with process material and overburden stockpiles in the area of quarrying, as well as with roadways. The larger areas of fill are shown on the Geologic Map and Site Plan (Enclosure "A-2.1").

LOCAL GEOLOGIC SETTING:

The White Knob quarry occupies an east-west oriented resistant and rugged limestone ridge formed in the very steep north-sloping topography of the northern San Bernardino Mountains. Natural slopes descend to the north and northwest from the ridge of the White Knob quarry. Satellite ore deposits occur to the east of the main quarry on an adjacent north-trending ridge (White Ridge area) that appears to be structurally related to the main quarry ridge. The area of the White Ridge deposit located to the east is not mined at this time, and adjacent slopes are in a natural state. Future mining is planned in this area. An active overburden placement site (OB-1) is located near the east end of White Knob quarry in the Central Drainage area. Existing mine cut-slopes in the quarry are inclined overall at approximately 1(h):1(v) and up to approximately 600 feet in height. The overall inclination of the quarry slopes is controlled by geologic structure (primarily joints) and locally by pre-splitting blasting.

FAULTING AND SEISMICITY

REGIONAL FAULTS:

The tectonics of the Southern California area are dominated by the interaction of the North American and Pacific tectonic plates, which are sliding past each other in transform motion. Although some of the motion may be accommodated by rotation of crustal blocks such as the western Transverse Ranges (Dickinson, 1996), the San Andreas fault zone is thought to represent the major surface

expression of the tectonic boundary and to be accommodating most of the transform slip between the Pacific Plate and the North American Plate. Some of the plate slip is accommodated by other northwest-trending strike-slip faults that are related to the San Andreas system, such as the San Jacinto fault and the Elsinore fault. Local compressional or extensional strain resulting from the transform motion along this boundary is accommodated by left-lateral, reverse and normal faults such as the Cucamonga fault and the nearby North Frontal fault zone (NFFZ).

The most significant fault to the site from a ground shaking standpoint is the North Frontal fault zone, exposed approximately 1 mile north of the site along the range front of the San Bernardino Mountains. This fault is a complex zone of left-lateral, thrust and reverse faults and forms the boundary between the Mojave Desert Geomorphic Province on the north and the Transverse Ranges Geomorphic Province on the south. Since this fault dips at a moderate angle to the south (approximately 49° according to Petersen et al., 2008), the fault plane is about 1 mile beneath the site.

The Eastern California Shear Zone (ECSZ) is a zone of regional deformation traversing the Mojave Desert that includes a system of predominantly northwest-trending strike-slip faults. The ECSZ accommodates strain along the Pacific/North American Plate boundary across a zone approximately 65 miles wide and is thought to transfer as much as 15 percent of the total plate boundary shear into the Great Basin area (Shermer and others, 1996). A number of faults of this system ruptured in combination during the 1992 Landers earthquake east of the site. Rupture of that event extended within approximately 25 miles of the mine area and included several faults (Hauksson, 1993). An earthquake of M 6.4, known as the Big Bear earthquake, occurred a few hours later. The Big Bear quake and its aftershocks occurred along a northeast-trending alignment located approximately 12 miles southeast of the site. The Hector Mine earthquake of 1999 occurred on the Lavic Lake and Bullion faults of the ECSZ. The Helendale fault, Lenwood-Lockhart fault, and Johnson Valley fault of this system are located approximately 4.9 miles northeast, 15-1/2 miles northeast, and 19 miles east-northeast of the site, respectively. These faults are major components of the ECSZ and are considered Holocene active.

The northwest-trending San Andreas fault is located approximately 18 miles southwest of the White Knob quarry site. The toe of the mountain front in the San Bernardino area roughly demarcates the presently active trace of the San Bernardino mountains segment. Youthful fault scarps, vegetational lineaments, springs and offset drainages, characterizes both segments. The Working Group on California Earthquake Probabilities (1995) tentatively assigned a 28 percent (±13 percent) probability to a major earthquake occurring on the San Bernardino Mountains segment of the San Andreas Fault between 1994 and 2024. Enclosure "A-5" depicts faults and their associated status of activity within the site region.

LOCAL FAULTS:

No evidence of active faulting traversing the mine area was found during our review of published and unpublished literature and maps, during our review of stereoscopic aerial photographs, or during prior field mapping. Ground rupture due to active faulting in the quarry area is not anticipated.

Faults (localized shear zones) and folds were observed in existing quarry exposures, and Mr. Howard Brown mapped regional and local high-angle faults that form contacts between geologic formations/units and/or cut oblique to the trend of the east-west oriented ore body axis across the White Knob and White Ridge areas. These faults and folds are typical of the rocks of the northern San Bernardino Mountains, and most or all of these structures are likely to predate or be associated with Cenozoic uplift of the San Bernardino Mountains, or folding of the Paleozoic age rocks during Mesozoic time. Quaternary activity appears to be concentrated on faults along the south margin of the modern mountain range and potential activity along locally mapped faults is considered very low.

Various high-angle faults are mapped in the existing quarry area. These faults strike primarily north and south. It is anticipated that additional high-angle faults may be exposed/mapped during future quarry operations.

REGIONAL SEISMICITY:

Numerous small earthquakes have occurred in the site region in the historic time period. A map of recorded earthquake epicenters is included as Enclosure "A-4" (Epi Software, 2000). The epicenters and magnitudes that are shown are based on data from recording instruments in a California Institute of Technology - Southern California Earthquake Data Center catalogue. This enclosure presents circles as epicenters of earthquakes with magnitude equal to or greater than 4.0 that were recorded from 1932 through 2011. The cluster of small earthquakes in the site area may be partially attributable to quarry blasts.

The most significant fault to the site from a ground shaking standpoint is the NFFZ, mapped approximately 1 mile north of the site along the range front of the San Bernardino Mountains. This fault is a complex zone of left-lateral, thrust, and reverse faults and forms the boundary between the Mojave Desert Geomorphic Province and the Transverse Ranges Geomorphic Province to the south. Since this fault dips at a moderate angle to the south, the projected fault plane is about 1 mile from the site as measured perpendicular to the fault plane.

The regional structure of the Mojave Desert includes major northwest-trending, strike-slip fault zones. Jennings (1994) indicated several of these fault zones with evidence for Holocene fault displacement. Geomorphic evidence for Holocene fault displacement includes sag ponds, fresh fault scarps, or the following features in Holocene deposits: offset drainages, linear scarps, shutter ridges, and faceted spurs. The Helendale fault is the closest of these Holocene active faults and is located approximately 8 miles northeast of the site. Jennings also indicates the Old Woman Springs, Lockhart, Harper, and Camp Rock faults, located at greater distances from the site, as having Holocene fault displacement. Surface rupture occurred on the southeastern end of the Camp Rock fault during the magnitude 7.3 Landers earthquake of June 28, 1992. An earthquake of magnitude 6.4, known as the Big Bear earthquake, occurred a few hours later. The Big Bear quake and its aftershocks occurred along a northeast-trending alignment located approximately 15 miles southeast of the site.

The northwest-trending San Andreas fault is located approximately 14 miles southwest of the site. The toe of the mountain front in the San Bernardino area roughly demarcates the presently active trace of the San Bernardino Mountains segment. Youthful fault scarps, vegetational lineaments, springs and offset drainages characterizes both segments. The Working Group on California Earthquake Probabilities (1995) tentatively assigned a 28 percent (±13 percent) probability to a major earthquake occurring on the San Bernardino Mountains segment of the San Andreas fault between 1994 and 2024.

GROUND-SHAKING HAZARD

SEISMIC DESIGN PARAMETERS:

The 2010 California Building Code (CBC) Design Acceleration Parameters for structures were determined from latitude/longitude coordinates N34.3629, W117.012 using the web-based U.S. Geologic Survey application - http://earthquake.usgs.gov/hazards/designmaps/javacalc.php - and are summarized in the following table. These data are provided for reference only since no CBC structures are addressed by this report. The corresponding value of peak ground acceleration (PGA) from the design acceleration spectrum according to the 2010 CBC is 0.52g.

TABLE 1

2010 CBC - Seismic Parameters	
Mapped Spectral Acceleration Parameters	S_s = 1.96 and S_1 = 0.75
Site Coefficients (Class B)	F_a = 1.0 and F_v = 1.0
Adjusted Maximum Considered Earthquake (MCE) Spectral Response Parameters	S_{MS} = 1.96 and S_{M1} = 0.75
Design Spectral Acceleration Parameters	S_{DS} = 1.30 and S_{D1} = 0.50

DETERMINISTIC SEISMIC HAZARD ANALYSIS:

A deterministic evaluation of seismic hazard was calculated for the North Frontal fault zone using the attenuation relations of Boore and Atkinson (2008), Campbell and Bozorgnia (2008), and Chiou and

Youngs (2008) and magnitude 7.1 at a distance of 1 mile. A peak ground acceleration of 0.56g is estimated by the deterministic method.

SLOPE STABILITY

The term "landslide", as used in this report, refers to deep-seated slope failures with a rupture surface at least 50 feet deep. Landslides are typically related to the underlying structure of the parent material. Surficial failures refer to shallow failures that affect the upper weathered or colluvial horizon of overlying material. Evidence for deep-seated landsliding was not observed in the White Knob quarry walls or in natural exposures of the White Ridge area during our previous 2007 and 2008 evaluations or on the aerial photographs reviewed.

The susceptibility of a geologic unit to landsliding is dependent upon various factors that primarily include: 1) the degree of continuity and orientation of potentially weak structures, such as fractures, faults, and/or clay seams; 2) the height and steepness of the natural and/or cut slope; 3) the presence and quantity of groundwater; and 4) the potential/occurrence of strong seismic shaking.

The coarse-grained calcite marble ore at the site is relatively strong from a global slope stability standpoint, with no weak clay or schist interbeds observed in natural or mined exposures. Natural cliffs formed in the calcite material stand vertically near the quarry site. The majority of joints are oriented favorably with respect to the planned quarry wall configurations and are typically discontinuous relative to global stability. The geologic structure was carefully considered in planning the quarry slopes.

The granitic rocks on the margins of the ore body exhibit a similar orientation and spacing of joint sets as observed in the calcite marble. As described in the reclamation plan, road cuts formed in the granitic rocks exhibit joint control of north-south striking faces at inclinations of approximately 57 degrees. Most joints dip at steep angles (between 70 and 90 degrees) as measured during geologic mapping of the existing road cuts in the granitic rock slopes and thus form stable slope configurations at existing slope angles.

KINEMATIC SLOPE STABILITY ANALYSIS:

Stereonet analysis for representative mine slopes was performed utilizing the data from mapped geologic structures at the site. During field mapping, the orientation and relative continuity of joints, foliation, dikes, and shear zones were measured and recorded and are shown on the attached Geologic Map (Enclosure "A-2.1"). Kinematic data for the White Knob and White Ridge areas are summarized in Tables "B-1.1" and "B-1.2". The representative rock slopes were evaluated using Markland's Test for both wedge and plane failure types. As previously described, jointing of the exposed bedrock was the predominant structure throughout the mine area. The joints exposed within the quarry exhibited little to no lining and were tight and dry. Additionally, the exposed jointing was widely spaced and non-continuous per Hoek-Brown criteria. The results of our kinematic slope stability analyses are included as Appendix "B". Materials strength parameters utilized in our kinematic analysis were obtained from field and laboratory tests and published data (Hoek, 2000; and Graselli, 2001).

Based on stereonet analysis of the measured joint orientations, a small percentage of joints exhibit a potential to form surfaces that dip out of slope at angles between 35 and 40 degrees. Although factors of safety lower than 1.0 were calculated for planar failures along some joints, the limited continuity of joints in the ore body and wall rocks, relative roughness of surfaces formed in the coarse-grained calcite marble, and lack of empirical evidence for large failures on joints with this orientation indicate that the potential for large failures along such joint features is low. The inclusion of catch benches in cut slope design provides mitigation of potential small, intra-bench scale rock fall debris, which is anticipated to be the primary mode of slope debris generation. In addition, subsequent to blasting of new walls, quarry operations include the use of a large scaling chain to assist in removal of loose or precarious blocks during removal of the ore. Therefore, it appears that consideration of the geologic structure of the ore body and surrounding wall rocks in the planning and practice of quarry operations has resulted in formation of grossly stable slopes within the existing quarry. Future mining in the White Ridge area is anticipated to provide mine slopes similar to that achieved in the White Knob area based on the continuity of the ore body and associated structural character between the existing and planned mine areas. Adherence to the slope benching plan and

consideration of newly-exposed adverse structural features (if present) during future quarry excavation work can result in stable slopes during mining and after completion of quarry reclamation.

The arid environment of the site precludes significant groundwater in the proposed slopes, except on a very sporadic basis where water may be concentrated along geologic structures such as faults following periods of precipitation. Groundwater has not been encountered in exploratory borings drilled to at least 550 feet bgs (Howard Brown, personal communication).

Given the steepness of natural slopes at the site and vicinity and the close proximity to the active NFFZ, the geologic materials at the site display a remarkably low susceptibility to deep-seated landsliding. Due to the purity of the calcite marble, no significant clay seams were observed in existing cut slopes nor are they expected to be exposed in the proposed cut slopes. In general, fracturing/jointing effectively reduces the strength of an overall rock mass by forming discontinuities between individual blocks of rock in the natural and cut slopes; however, the "widely-spaced and non-continuous" joint density, joint roughness, moderate to total healing, and favorable joint orientations exhibited in the White Knob quarry exposures also effectively limit the depth and areal extent of potential slope failures. Based on these data and the results of our investigation, deep-seated landsliding is not anticipated in the proposed slopes. Further analysis of the proposed slopes is presented later in global slope stability calculations.

A few potentially unstable blocks/boulders were observed on the natural slopes above the existing and proposed slopes. These boulders could be mobilized during a major seismic event and roll down slope; however, this rockfall hazard is not affected by the proposed mining.

Raveling processes during quarry operations will result in talus on the benches. This process has already occurred along older existing mine slopes. The talus will be left on the benches to facilitate revegetation and to give the reclaimed slopes a more natural appearance. It is anticipated that any resulting boulders will be angular and relatively resistant to rolling. Large, unstable, rounded blocks/boulders on slopes steeper than approximately 2(h):1(v) within the active mining areas should be removed or stabilized.

GLOBAL SLOPE STABILITY CALCULATIONS:

The global stability of the proposed final mine slopes and reclaimed slopes as depicted in the Mining Plan and Reclamation Plan documents (Cross-Sections A-A', B-B', and C-C') were analyzed under both static and seismic conditions for rotational failures utilizing the SLIDE computer program, version 6.02 (Rocscience, Inc., 2012). The analysis considered the highest and steepest slope sections proposed for the mine. The seismic stability calculations were performed using a lateral pseudostatic coefficient "k" of 0.20 due to the proximity of the NFFZ. The factors of safety were calculated by Spencer's method.

The rock strengths were modeled utilizing the Generalized Hoek-Brown criteria (Hoek, 2000 and Hoek, Carranza-Torres & Corkum, 2002), and the program's built-in parameter calculator with the following conservatively estimated input values:

TABLE 2: MARBLE TYPE ROCKS

	Value	Description
Unit Weight (pcf*)	160	
Intact UCS[1] (psf**)	1,500,000	Specimen requires more than one blow of a geological hammer to fracture it
Geological Strength Index	65	Blocky with good surface conditions
Intact Rock Constant (mi***)	9	Marble
Disturbance Factor	1	Production blasting

* pcf = pounds per cubic foot
** psf = pounds per square foot
*** mi = unitless constant

TABLE 3: GRANITE TYPE ROCKS

	Value	Description
Unit Weight (pcf)	155	
Intact UCS[1] (psf)	1,500,000	Specimen requires more than one blow of a geological hammer to fracture it
Geological Strength Index	55	Very blocky with good surface conditions
Intact Rock Constant (mi)	32	Granite
Disturbance Factor	1	Production blasting

[1] Uniaxial Compressive Strength

The parameters listed above were obtained from testing of hand samples and large exposures of the existing quarry slopes. The Hoek-Brown criteria allows for estimation of rock mass properties based on field criteria such as how easily a specimen can be broken with a rock hammer and mining methods as well as other methods.

The strength of overburden stockpile materials was estimated based on our direct shear testing results performed on samples remolded to 85 percent relative compaction. An internal frictional angle of φ=39 degrees, a cohesive strength of C=150 psf and a unit weight of 125 pcf were utilized to model the shear strength of overburden stockpile materials.

The results of the global slope stability analyses are summarized in Table 4. Details of stability calculation results including material type boundaries, strength parameters, and the minimum factors of safety and critical slip surface are included in Enclosures "C-1" through "C-6" for static and seismic conditions.

TABLE 4: SLOPE STABILITY SUMMARY

Cross Section	Material	Static F.S.	Seismic F.S. (k=0.2)
A-A'	Rock slope	2.33	1.73
B-B'	Fill-over-rock slope	1.93	1.27
C-C'	Rock slope	2.37	1.83

As shown in Table 4, sufficient static factors of safety in excess of 1.5 and seismic factors of safety in excess of 1.1 were calculated for the remaining slope configurations presented and satisfy San Bernardino County and State SMARA Guidelines. Based on the global stability analysis and observations of existing quarry and overburden stockpile slopes, it is anticipated that current and future mining practices will produce final mining and reclaimed quarry and overburden stockpile slopes that are suitably stable with regard to large-scale or deep-seated slope failure.

GROUNDWATER

No evidence for springs or perched groundwater conditions was observed at the site during the geologic mapping or on the aerial photographs reviewed.

Depth-to-groundwater data are not available for the site vicinity from the California Department of Water Resources (2012) or the U. S. Geological Survey (2012). The closest data available are from wells in the town of Lucerne Valley, located at significantly lower elevations in alluvial sediments north of the site.

Groundwater has not been encountered in exploratory borings drilled to 550 feet bgs (Howard Brown, personal communication). The current depth to groundwater at the site is not known but is expected to be greater than 550 feet bgs. Based on the planned mining excavation depths, the anticipated depth of groundwater and the presence of non-liquefiable bedrock, no potential for liquefaction and other shallow groundwater-related hazards is anticipated.

Mine slopes should continue to be protected with berms and/or levees as necessary to prevent slope erosion in the areas where natural slopes drain onto the reclaimed slopes.

RECOMMENDATIONS

SEISMIC SHAKING HAZARDS:

Moderate to severe seismic shaking of the site can be expected to occur during the lifetime of the proposed mining and reclamation. This potential has been considered in our analyses and evaluation of slope stability.

CUT SLOPE CONSTRUCTION:

Overall final cut slopes in the granite and calcite marble should be approximately 1(h):1(v) up to the maximum heights proposed in the mining and reclamation plans. If encountered during future mining, geologic structures that exhibit exceptional continuity and adverse geometry with regard to planned slope aspects or contain significant clay linings, water seepage or other potentially deleterious conditions should be evaluated for potential impacts to reclaimed slopes. Slope design may require adjustment of bench geometry to mitigate potential instability if such features are encountered. Large, unstable boulders on mine slopes should be removed or stabilized prior to the end of reclamation.

FILL SLOPE CONSTRUCTION:

Final reclaimed fill slopes composed of overburden materials and proposed as OB-1, OB-2, and OB-3, should be no steeper than 2(h):1(v) to the maximum proposed heights.

SLOPE PROTECTION:

Slopes should be protected with berms and/or levees as necessary to prevent slope erosion in the areas where natural slopes drain onto the reclaimed slopes.

LIMITATIONS

CHJ Consultants has striven to perform our services within the limits prescribed by our client, and in a manner consistent with the usual thoroughness and competence of reputable geotechnical engineers and engineering geologists practicing under similar circumstances. No other representation, expressed or implied, and no warranty or guarantee is included or intended by virtue of the services performed or reports, opinion, documents, or otherwise supplied.

This report reflects the testing and observations conducted on the site as the site existed during the investigation, which is the subject of this report. However, changes in the conditions of a property can occur with the passage of time, due to natural processes or the works of man on this or adjacent properties. Changes in applicable or appropriate standards may also occur whether as a result of legislation, application, or the broadening of knowledge. Therefore, this report is indicative of only those conditions tested and/or observed at the time of the subject investigation, and the findings of this report may be invalidated fully or partially by changes outside of the control of CHJ Consultants. This report is therefore subject to review and should not be relied upon after a period of one year.

The conclusions and recommendations in this report are based upon observations performed and data collected at separate locations, and interpolation between these locations, carried out for the project and the scope of services described. It is assumed and expected that the conditions between locations observed and/or sampled are similar to those encountered at the individual locations where observation and sampling was performed. However, conditions between these locations may vary significantly. Should conditions be encountered in the field, by the client or any firm performing services for the client or the client's assign, that appear different than those described herein, this firm should be contacted immediately in order that we might evaluate their effect.

If this report or portions thereof are provided to contractors or included in specifications, it should be understood by all parties that they are provided for information only and should be used as such.

The report and its contents resulting from this investigation are not intended or represented to be suitable for reuse on extensions or modifications of the project, or for use on any other project.

CLOSURE

We appreciate this opportunity to be of service and trust this report provides the information desired at this time. Should questions arise, please do not hesitate to contact this firm at your convenience.

Respectfully submitted,

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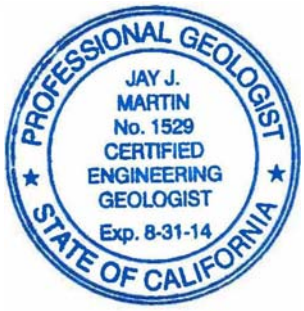

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AERIAL PHOTOGRAPHS REVIEWED

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U.S.D.A., February 22, 1953, black and white aerial photograph Nos. AXL-47K-117 and -118.

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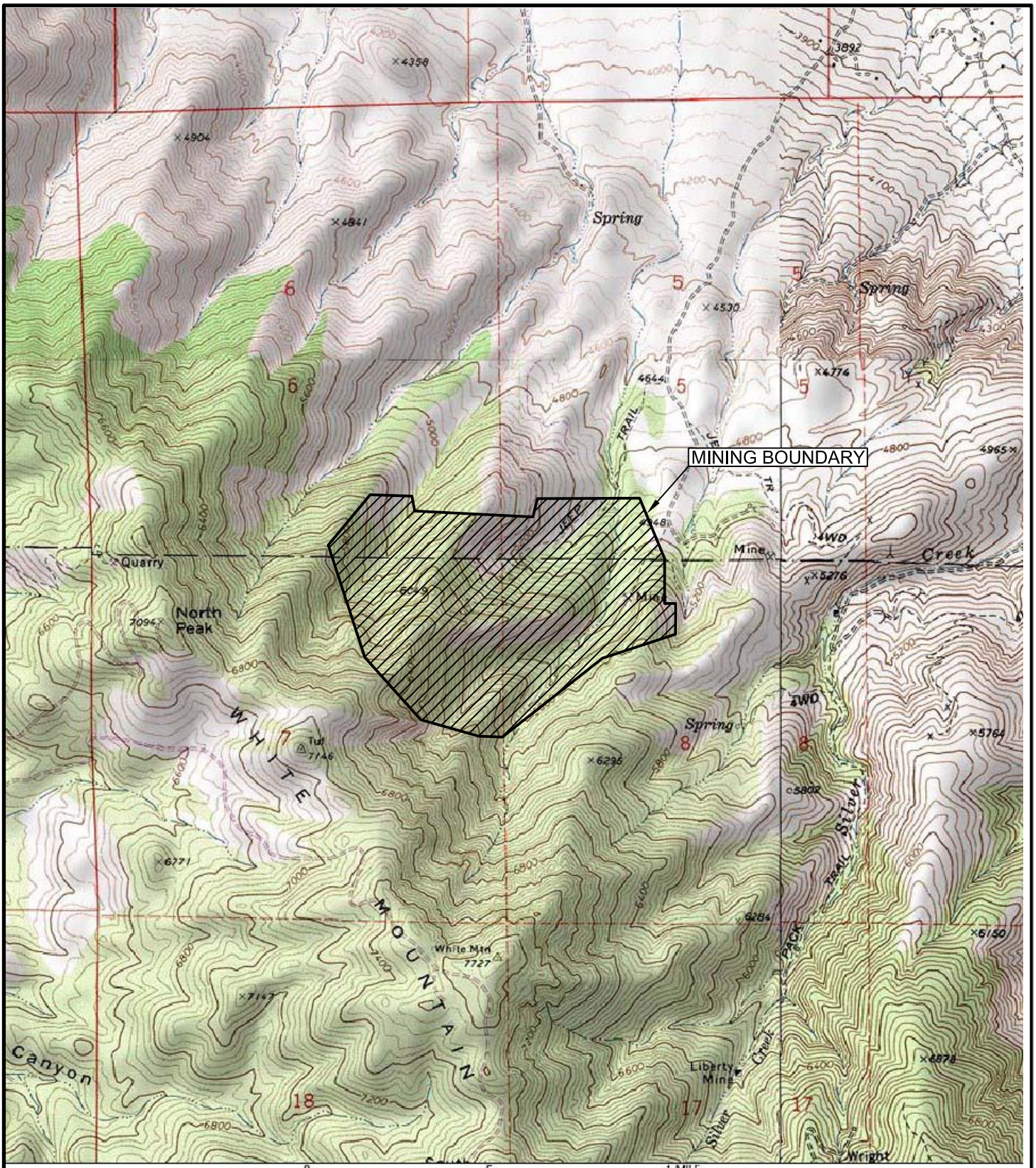
Orthophoto-based contour map - White Knob Placer Claim by American Aerial Surveys, dated June 24, 1983; scale 1" = 100', 25-foot contour interval.

Orthophoto-based contour map - White Knob area, untitled, dated November 7, 1988.

APPENDIX "A"

GEOLOGIC MAPS



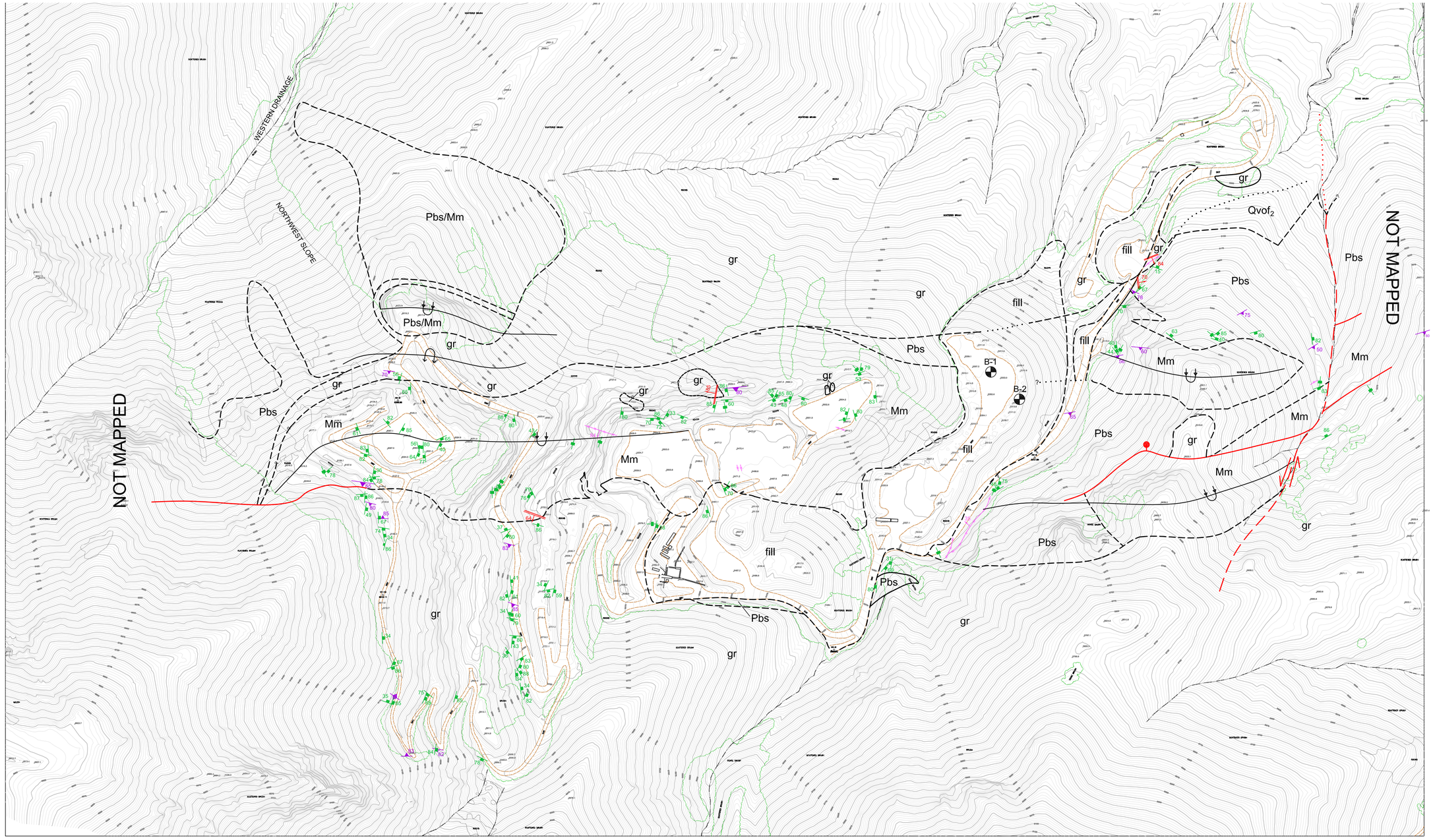
-N-

SCALE: 1" = 2,000'

INDEX MAP

FOR: OMYA CALIFORNIA A DIVISION OF OMYA, INC.	SLOPE STABILITY INVESTIGATION PROPOSED AMENDED PLAN OF OPERATIONS WHITE KNOB QUARRY MINING AND RECLAMATION PLAN LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "A-1"
DATE: JANUARY 2013		JOB NUMBER 12715-8

CHJ Consultants



SCALE 1"= 200'

GEOLOGIC UNITS:

f - fill
Qvof - very old alluvial fan deposits (Holocene)
gr - undifferentiated granitic rocks (Mesozoic)
Pbs - Bird Spring Formation (Pennsylvanian)
Mm - Monte Cristo Limestone (Mississippian)

B-2 Location of exploratory boring

overturned synform/antiform

fault

? approximate geologic contact - modified from Miller et al. (2000) based on field mapping

mafic dike

strike of vertical foliation

88 strike and dip of foliation

94 strike and dip of joint

strike and dip of vertical joint

85 strike and dip of shear zone

GEOLOGIC MAP AND SITE PLAN

FOR: OMYA CALIFORNIA
A DIVISION OF OMYA, INC.

DATE: JANUARY 2013

SLOPE STABILITY INVESTIGATION
PROPOSED AMENDED PLAN OF OPERATIONS
WHITE KNOB QUARRY MINING AND RECLAMATION PLAN
LUCERNE VALLEY, CALIFORNIA

ENCLOSURE "A-2.1"

JOB NUMBER 12715-8

CHJ Consultants

Omya California

White Knob Mining Plan

October 2012

Basin / Access Rd
north and west of expanded OB-1

Basin designed by Stantec

Basin and access rd above spring

New haul rd and overburden site east of White Ridge

White Knob Annex Quarry

White Knob Quarry

Overburden Site / Access Rd Fill

White Ridge Quarry

White Ridge Access Rd
approximate location shown

Major facilities

- White Knob Quarry
- Annex Quarry
- White Ridge Quarry
- OB 1
- OB 2
- OB 3

Proposed Disturbance Limit

Omya California

White Knob Reclamation Plan

October 2012

Basin / Access Rd
north and west of expanded OB-1

Basin designed by Stantec

Basin and access rd above spring

New haul rd and overburden site east of White Ridge

Areas to be added
to ROW

White Knob Annex Quarry

White Knob Quarry

Overburden Site / Access Rd Fill

White Ridge Quarry

White Ridge Access Rd
approximate location shown

Area designated for access roads. Specific designs will not be shown to allow for field engineering

Property Lines

- 70 Acres to be purchased from BLM
- ROW
- Patented Mining Claims Controlled by Omya

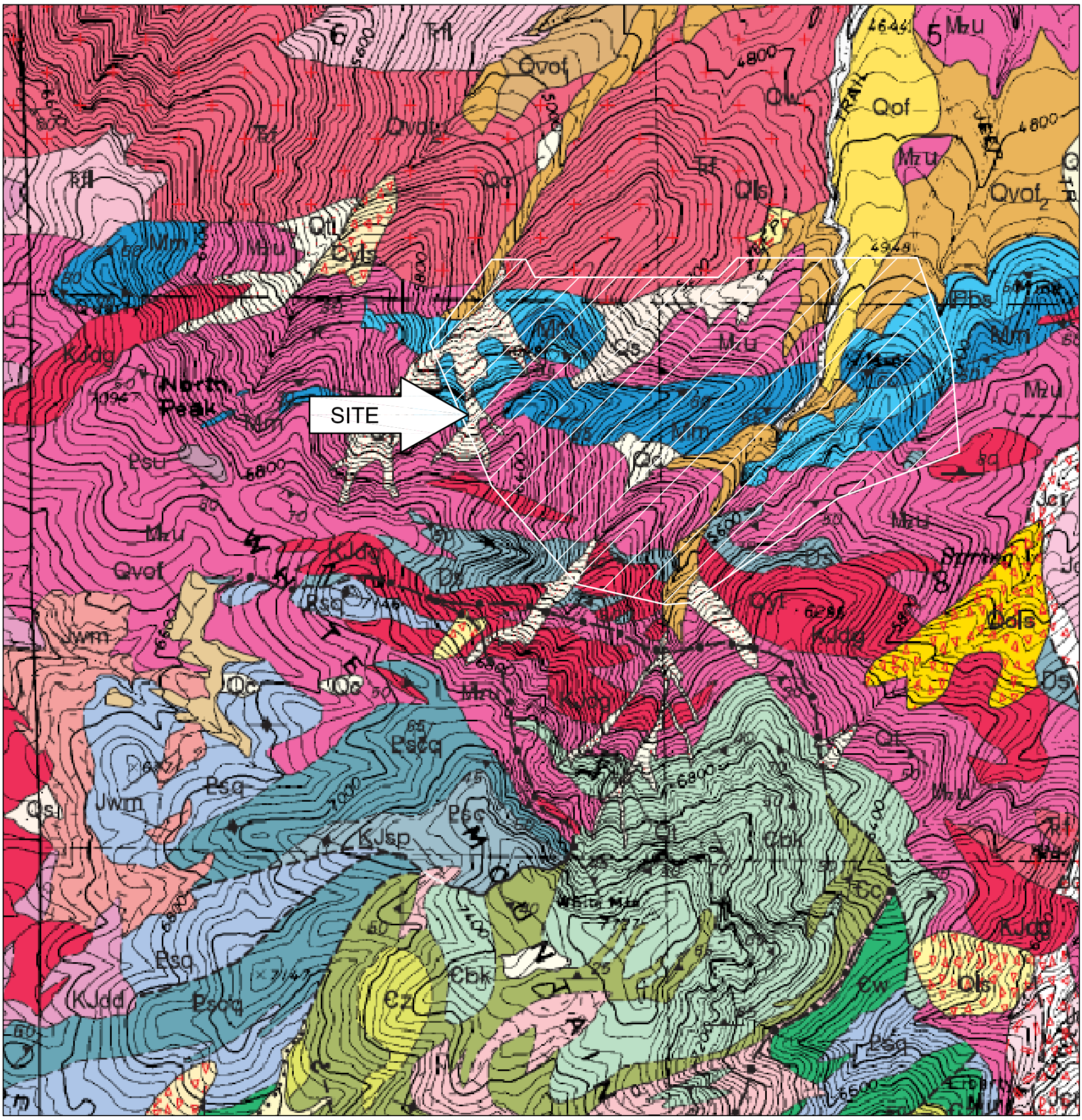
N

SCALE 1"= 250'

MINING AND RECLAMATION PLANS

FOR: OMYA CALIFORNIA A DIVISION OF OMYA, INC.	SLOPE STABILITY INVESTIGATION PROPOSED AMENDED PLAN OF OPERATIONS WHITE KNOB QUARRY MINING AND RECLAMATION PLAN LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "A-2.2"
DATE: JANUARY 2013		JOB NUMBER 12715-8

CHJ Consultants



(Base Map: Miller et al., 2000)

GEOLOGIC UNITS:

Holocene sediments

Qc modern colluvial deposits

Qs undifferentiated surficial deposits

Qyt young talus deposits

$Qvof_2$ very old alluvial fan deposits

Crystalline Rocks

Mzu Mesozoic granitic rocks, undivided. Monzogranite to diorite, including small areas of monzonite. Includes heterogeneous, nondistinctive granitic rocks that cannot be assigned to larger granitic units in Butler Peak quadrangle. Fine- to coarse-grained; massive to foliate and lineate.

KJdg Mixed diorite and gabbro (Cretaceous and Jurassic). Biotite-hornblende diorite and quartz diorite, hornblende-biotite diorite and quartz diorite, pyroxenehornblende gabbro, and hornblende gabbro. Fine- to coarse-grained. Dioritic rocks appear to have possible spatial relation to Paleozoic carbonate rocks and intermediate composition Mesozoic plutons.

Pbs Bird Spring Formation (Pennsylvanian). Upper part of Furnace Limestone of Vaughan (1922) as mapped by Guillou (1953), Richmond (1960); correlated with Bird Spring Formation of southern Great Basin by Cameron (1981) and Brown (1991). Generally light-colored, medium- to thick-bedded, medium to coarsely crystalline calcite marble. Degree of recrystallization in quadrangle precludes confident subdivision of formation, but in Fawnskin quadrangle to east, typical lithologies include white, gray, or mottled marble and cherty, silicified marble. Some chert-bearing calcite marble contains lenses and thin layers of quartz silt and fine sand. Intermittent layers of minor brownweathering dolomite marble, siliceous marble horizons, and dark-gray calcite marble. In Butler Peak quadrangle, due to extreme recrystallization and deformation, layering in much of formation may or may not represent bedding.

Mm Monte Cristo Limestone (Mississippian). Upper part of Furnace Limestone of Vaughan (1922) as mapped by Richmond (1960). Correlated with the Monte Cristo Limestone of the southern Great Basin by Cameron (1981), and mapped by Brown (1984, 1987, and 1991) who recognized several formal stratigraphic members named originally by Hewitt (1931). Degree of recrystallization in quadrangle precludes recognition of detailed subdivisions, but includes heterogeneous, interlayered, light- and dark-gray, calcite and dolomite marble characteristic of Yellowpine Member, and thick-layered, light-gray to white, texturally massive, very pure calcite marble characteristic of Bullion Member.

Ds Sultan Limestone (Devonian). Middle part of Furnace Limestone of Vaughan (1922) as mapped by Richmond (1960); Brown (1991) correlated rocks in this interval with members of Sultan Limestone of Hewitt (1931) in southern Great Basin. Includes: (1) thin- to thick-layered, white calcite marble containing sparse thin layers of dark-gray calcite and dolomite marble characteristic of Crystal Pass Member; in part irregularly dolomitized. (2) Laminated to massive, light-gray, brown, and white, finely crystalline, locally chert-bearing metadolomite characteristic of Valentine Limestone Member.

geologic contact

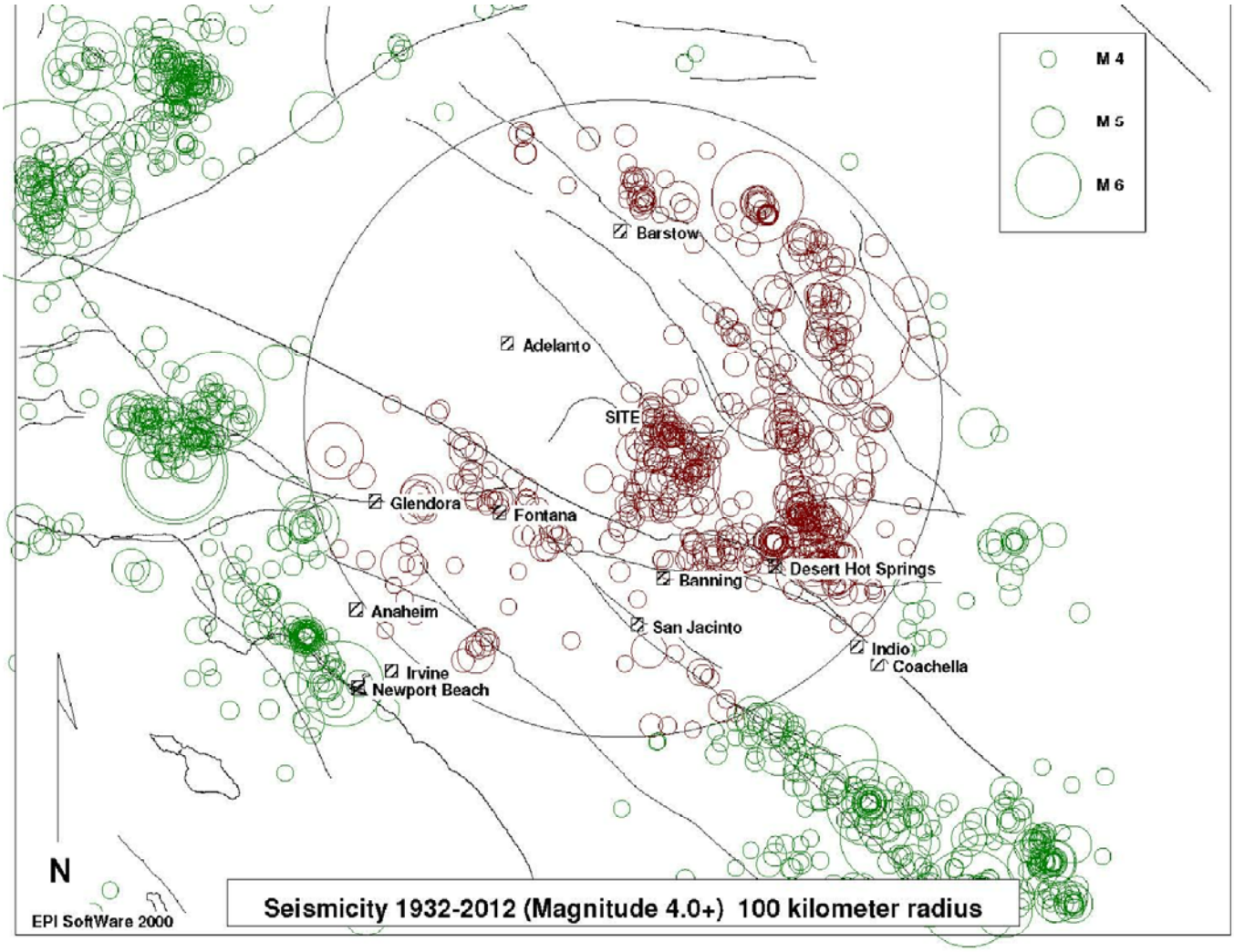
−N−

SCALE: 1" = 1,000'

GEOLOGIC INDEX MAP

FOR: OMYA CALIFORNIA A DIVISION OF OMYA, INC.	SLOPE STABILITY INVESTIGATION PROPOSED AMENDED PLAN OF OPERATIONS WHITE KNOB QUARRY MINING AND RECLAMATION PLAN LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "A-3"
DATE: JANUARY 2013		JOB NUMBER 12715-8

CHJ Consultants



SITE LOCATION: 34.3629 LAT. -117.012 LONG.

MINIMUM LOCATION QUALITY: C

TOTAL # OF EVENTS ON PLOT: 1461

TOTAL # OF EVENTS WITHIN SEARCH RADIUS: 587

0 50 100
KILOMETERS

MAGNITUDE DISTRIBUTION OF SEARCH RADIUS EVENTS:

4.0- 4.9 : 529
5.0- 5.9 : 52
6.0- 6.9 : 4
7.0- 7.9 : 2
8.0- 8.9 : 0

CLOSEST EVENT: 4.0 ON FRIDAY, FEBRUARY 27, 1942 LOCATED APPROX. 3 KILOMETERS SOUTH OF THE SITE

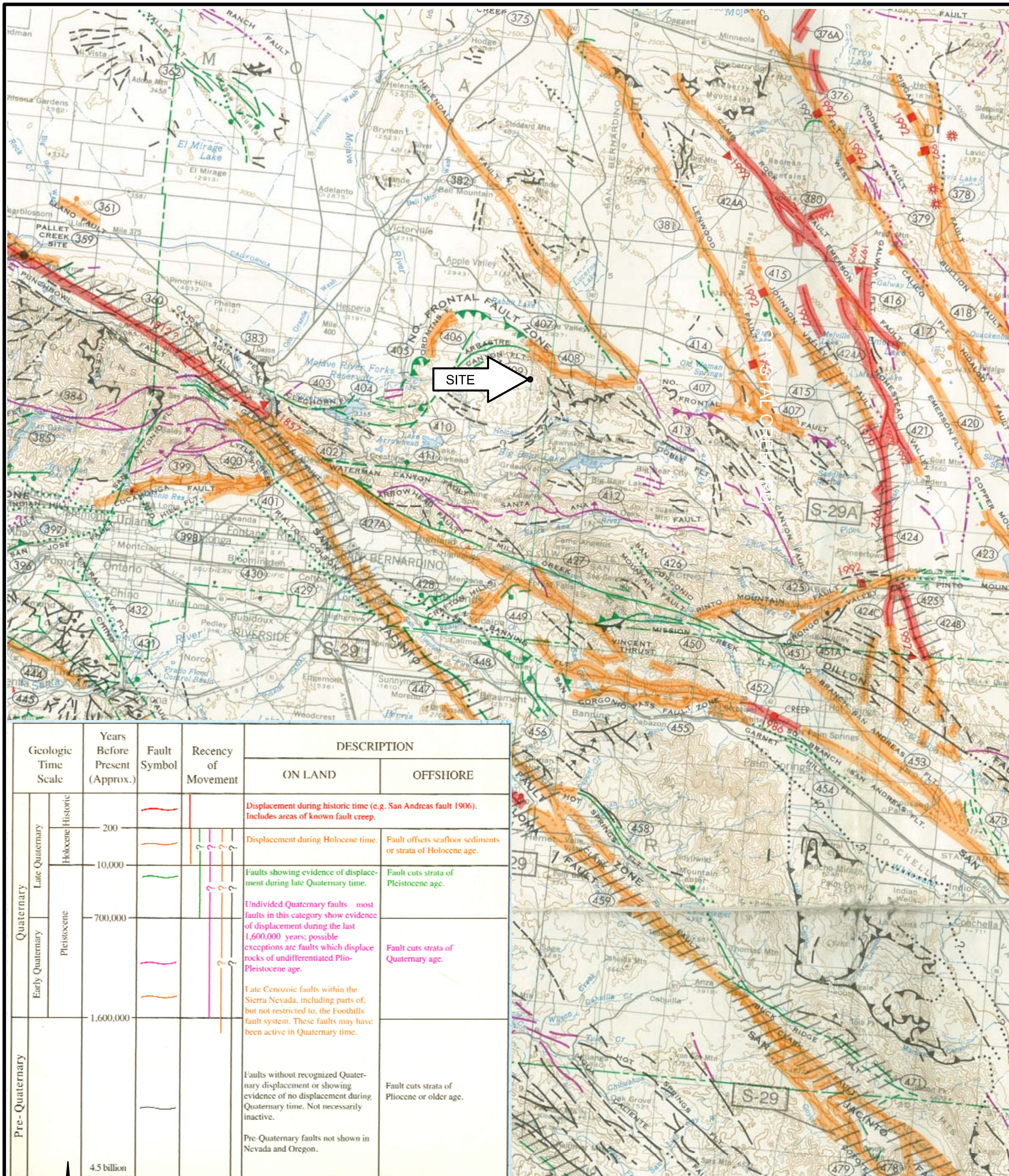
LARGEST 5 EVENTS:

7.3 ON SUNDAY, JUNE 28, 1992 LOCATED APPROX. 55 KILOMETERS EAST OF THE SITE
7.1 ON SATURDAY, OCTOBER 16, 1999 LOCATED APPROX. 72 KILOMETERS NORTHEAST OF THE SITE
6.5 ON THURSDAY, APRIL 10, 1947 LOCATED APPROX. 80 KILOMETERS NORTHEAST OF THE SITE
6.4 ON SUNDAY, JUNE 28, 1992 LOCATED APPROX. 24 KILOMETERS SOUTHEAST OF THE SITE
6.1 ON THURSDAY, APRIL 23, 1992 LOCATED APPROX. 78 KILOMETERS SOUTHEAST OF THE SITE

EARTHQUAKE EPICENTER MAP

FOR: OMYA CALIFORNIA A DIVISION OF OMYA, INC.	SLOPE STABILITY INVESTIGATION PROPOSED AMENDED PLAN OF OPERATIONS WHITE KNOB QUARRY MINING AND RECLAMATION PLAN LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "A-4"
DATE: JANUARY 2013		JOB NUMBER 12715-8

CHJ Consultants



Geologic Time Scale			Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION ON LAND	DESCRIPTION OFFSHORE
Quaternary	Late Quaternary	Historic	200			Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
		Holocene	10,000		? ? ?	Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
		Pleistocene	700,000		? ? ?	Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Pleistocene age.
	Early Quaternary		1,600,000		?	Undivided Quaternary faults – most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age. Late Cenozoic faults within the Sierra Nevada, including parts of, but not restricted to, the Foothills fault system. These faults may have been active in Quaternary time.	Fault cuts strata of Quaternary age.
Pre-Quaternary			4.5 billion (Age of earth)			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive. Pre-Quaternary faults not shown in Nevada and Oregon.	Fault cuts strata of Pliocene or older age.

N

SCALE: 1:750,000

FAULT MAP

FOR: OMYA CALIFORNIA
A DIVISION OF OMYA, INC.

DATE: JANUARY 2013

SLOPE STABILITY INVESTIGATION
PROPOSED AMENDED PLAN OF OPERATIONS
WHITE KNOB QUARRY MINING AND RECLAMATION PLAN
LUCERNE VALLEY, CALIFORNIA

ENCLOSURE "A-5"

JOB NUMBER 12715-8

CHJ Consultants

APPENDIX "B"

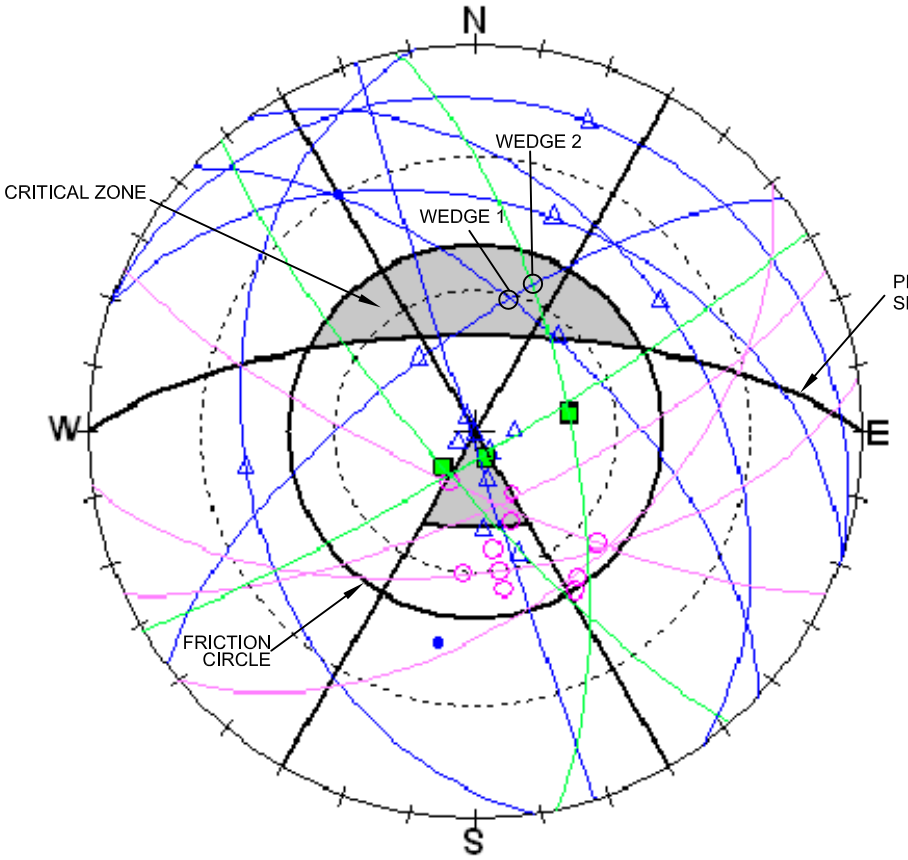
KINEMATIC STABILITY CALCULATIONS

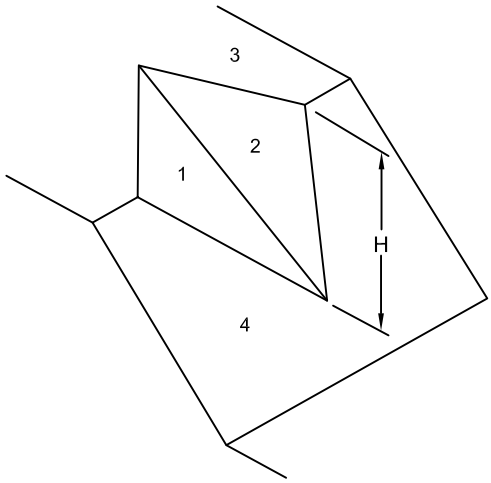
White Knob - Discontinuity Measurements				
Discontinuity No.	**Geologic Unit**	**Structure Type**	**Dip Direction**	**Dip Value**
1	gr	Joint	148	58
2	gr	Joint	253	86
3	gr	Joint	90	90
4	Mm	Joint	75	80
5	Mm	Joint	75	82
6	Mm	Joint	80	90
7	Mm	Joint	220	83
8	Mm	Joint	162	53
9	Mm	Joint	100	79
10	Mm	Joint	45	90
11	Mm	Joint	200	80
12	Mm	Joint	285	80
13	Mm	Joint	160	48
14	Mm	Joint	162	43
15	Mm	Joint	50	85
16	Mm	Joint	115	85
17	Mm	Joint	260	86
18	Mm	Joint	175	60
19	Mm	Joint	10	90
20	Mm	Joint	285	86
21	gr/Mm	Shear	280	85
22	Mm	Joint	200	62
23	Mm	Joint	120	33
24	Mm	Joint	200	86
25	Mm	Joint	230	72
26	Mm	Joint	180	70
27	Mm	Joint	100	80
28	gr	Dike	200	84
29	Mm	Joint	20	90
30	Mm	Joint	15	90
31	Mm	Joint	300	76
32	Mm	Joint	185	79
33	Mm	Shear	200	64
34	gr	Joint	15	86
35	gr	Joint	295	34
36	gr	Joint	170	82
37	gr	Joint	103	59
38	gr	Joint	282	31
39	gr	Joint	130	66
40	gr	Joint	275	80
41	gr	Joint	25	90
42	gr	Dike	285	34
43	gr	Joint	25	90

Job No. 12715.3
Enclosure "B-1.1"

44	gr	Joint	330	48
45	gr	Joint	105	75
White Ridge - Discontinuity Measurements				
Discontinuity No.	**Geologic Unit**	**Structure Type**	**Dip Direction**	**Dip Value**
1	gr	Joint	330	86
2	gr	Joint	325	90
3	Mm/Pbs	Joint	160	63
4	Pbs	Joint	275	90
5	Pbs	Dike	330	30
6	gr	Foliation	170	60
7	Pbs	Foliation	148	50
8	Pbs	Foliation	145	52
9	Pbs	Joint	85	82
10	Pbs	Foliation	158	70
11	Pbs	Joint	165	80
12	Pbs	Foliation	150	75
13	Pbs	Joint	240	86
14	Pbs	Joint	50	90
15	Pbs	Joint	140	85
16	Pbs	Joint	20	40
17	Pbs	Joint	40	63
18	Mm	Shear	80	70
19	Mm	Joint	262	40
20	Mm	Joint	54	41
21	Mm	Joint	30	90
22	Mm	Foliation	170	56
23	Mm	Foliation	185	60
24	Pbs	Foliation	172	65
25	Pbs	Dike	190	44
26	Pbs	Shear	158	84
27	Pbs	Foliation	132	55
28	Pbs	Joint	20	15
29	Pbs	Shear	222	80
30	Pbs	Shear	78	70
31	Pbs	Joint	323	70
32	Pbs	Foliation	208	78
33	Pbs	Joint	175	70

Job No. 12715.3
Enclosure "B-1.2"





Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 150 lb(f)/ft ³
(H) Height of Crest Above Intersection = 60 ft

Plane 1 : (D1) Dip Value = 70 °
(E1) Dip Direction = 323 °
Plane 2 : (D2) Dip Value = 63 °
(E2) Dip Direction = 40 °
Plane 3 : (D3) Dip Value = 1 °
(E3) Dip Direction = 0 °
Plane 4 : (D4) Dip Value = 70 °
(E4) Dip Direction = 0 °

Plane 1 : (C1) Cohesion = 800 lb(f)/ft ²
(P1) Friction Angle = 50 °
Plane 2 : (C2) Cohesion = 800 lb(f)/ft ²
(P2) Friction Angle = 50 °

Water Pressure : Cracks Completely Filled (Free Draining)

(GW) Density of Water = 62.4 lb(f)/ft ³

(HW) Overall Vertical Height of Wedge = 0 ft

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 3.06
Water Pressure on both planes = 0 lb(f)/ft ²

THERE IS CONTACT ON BOTH PLANES.

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 150 lb(f)/ft ³
(H) Height of Crest Above Intersection = 60 ft

Plane 1 : (D1) Dip Value = 70 °
(E1) Dip Direction = 323 °
Plane 2 : (D2) Dip Value = 70 °
(E2) Dip Direction = 78 °
Plane 3 : (D3) Dip Value = 1 °
(E3) Dip Direction = 0 °
Plane 4 : (D4) Dip Value = 70 °
(E4) Dip Direction = 0 °

Plane 1 : (C1) Cohesion = 800 lb(f)/ft ²
(P1) Friction Angle = 50 °
Plane 2 : (C2) Cohesion = 800 lb(f)/ft ²
(P2) Friction Angle = 50 °

Water Pressure : Cracks Completely Filled (Free Draining)

(GW) Density of Water = 62.4 lb(f)/ft ³

(HW) Overall Vertical Height of Wedge = 0 ft

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 3.53
Water Pressure on both planes = 0 lb(f)/ft ²

THERE IS CONTACT ON BOTH PLANES.

KEY:
△ 1-Small Joints
■ 2- Faults
○ 3- Follations
● 4- Dikes

KINEMATIC ANALYSIS

FOR: OMYA CALIFORNIA
A DIVISION OF OMYA, INC.

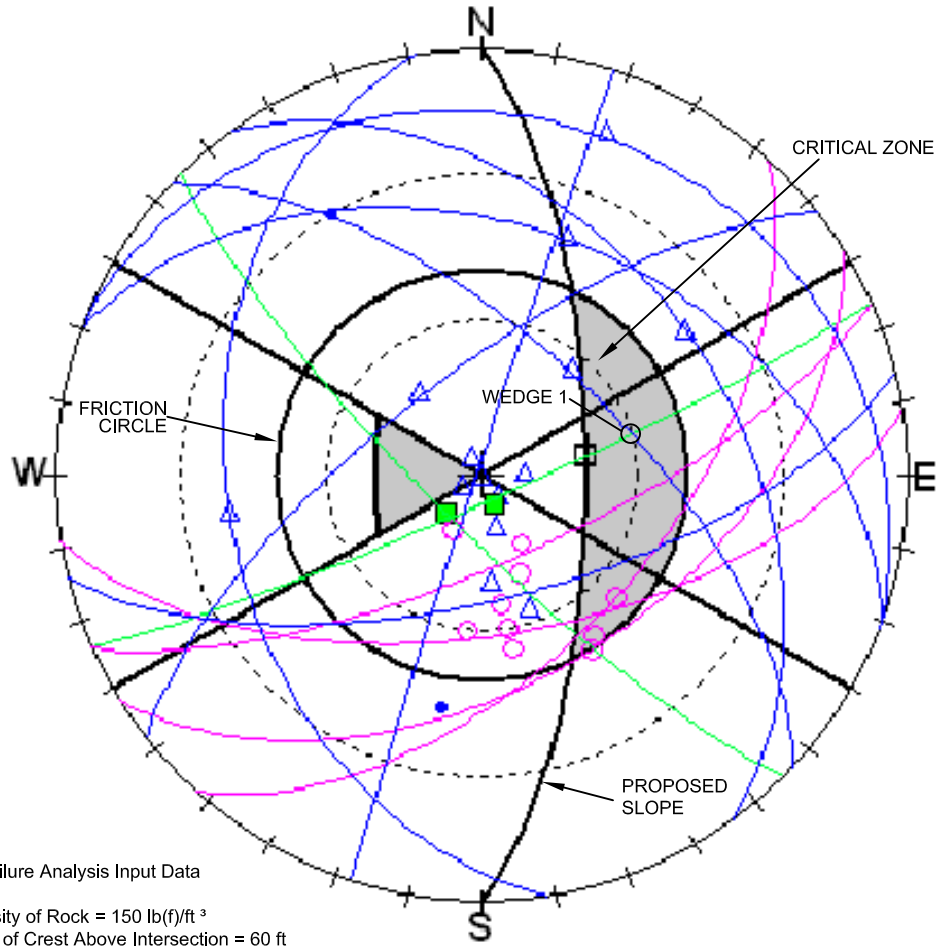
DATE: JANUARY 2013

SLOPE STABILITY INVESTIGATION
PROPOSED AMENDED PLAN OF OPERATIONS
WHITE KNOB QUARRY MINING AND RECLAMATION PLAN
LUCERNE VALLEY, CALIFORNIA

ENCLOSURE "B-2.0"

JOB NUMBER 12715-8

CHJ Consultants



Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 150 lb(f)/ft ³
(H) Height of Crest Above Intersection = 60 ft

Plane 1 : (D1) Dip Value = 84 °
(E1) Dip Direction = 158 °
Plane 2 : (D2) Dip Value = 63 °
(E2) Dip Direction = 40 °
Plane 3 : (D3) Dip Value = 1 °
(E3) Dip Direction = 90 °
Plane 4 : (D4) Dip Value = 70 °
(E4) Dip Direction = 90 °

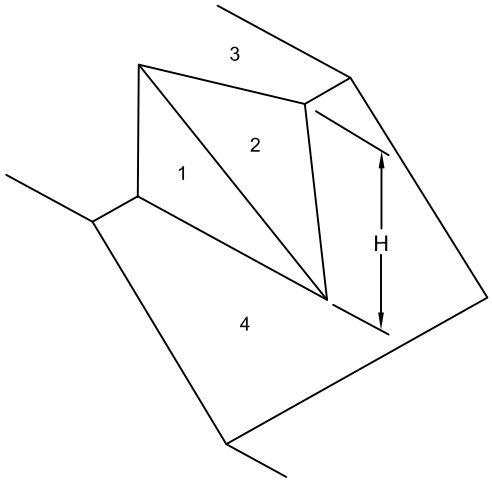
Plane 1 : (C1) Cohesion = 800 lb(f)/ft ²
(P1) Friction Angle = 50 °
Plane 2 : (C2) Cohesion = 800 lb(f)/ft ²
(P2) Friction Angle = 50 °

Water Pressure : Cracks Completely Filled (Free Draining)

(GW) Density of Water = 62.4 lb(f)/ft ³

(HW) Overall Vertical Height of Wedge = 0 ft

The slope face DOES NOT hang over the toe of the slope.



Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 3.73
Water Pressure on both planes = 0 lb(f)/ft ²

THERE IS CONTACT ON BOTH PLANES.

KEY:
△ 1-Small Joints
■ 2- Faults
○ 3- Follations
● 4- Dikes

KINEMATIC ANALYSIS

FOR: OMYA CALIFORNIA A DIVISION OF OMYA, INC.	SLOPE STABILITY INVESTIGATION PROPOSED AMENDED PLAN OF OPERATIONS WHITE KNOB QUARRY MINING AND RECLAMATION PLAN LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "B-3.0"
DATE: JANUARY 2013		JOB NUMBER 12715-8

CHJ Consultants

Plane Failure Analysis Input Data

(H) Height = 60 ft
(SF) Inclination of Slope Face = 70 °
(SS) Inclination of Upper Slope = 1 °
(SP) Inclination of Failure Plane = 63 °
(CO) Cohesive Strength of Failure Surface = 800 lb(f)
(PH) Friction Angle of Failure Surface = 50 °
(GR) Density of Rock = 150 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AB) Starting Rock Bolt Angle = 0 °
(AR) Ending Rock Bolt Angle = 0 °
(AA) Bolt Angle Increment = 0 °
(T1) Starting Bolt Tension = 0 lb(f)
(T2) Ending Bolt Tension = 0 lb(f)
(T3) Bolt Tension Increment = 0 lb(f)
(AC) Horizontal Acceleration = 0 G
(TZ) Amount of Discontinuity = 0 decimal%
(VSUR) Vertical Surcharge = 0 lb(f)
(HSUR) Horizontal Surcharge = 0 lb(f)

Tension Crack Location Unknown: Dry Slope

Plane Failure Analysis Output Data

(A) Contact Area = 56.91 ft ²
(W) Weight of Slice = 36023.43 lb(f)
(U) Water Force Normal to Failure Plane = 0 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Worst Location, Horizontal Distance = 4 ft
(Z) Tension Crack Depth = 9.36 ft
(ZW) Depth of Water in Crack = 0 ft
(TH) Bolt Angle = 0 °
(T) Tension = 0 lb(f)
(F) Factor of Safety = 2.03

Plane Failure Analysis Input Data

(H) Height = 60 ft
(SF) Inclination of Slope Face = 70 °
(SS) Inclination of Upper Slope = 1 °
(SP) Inclination of Failure Plane = 60 °
(CO) Cohesive Strength of Failure Surface = 800 lb(f)
(PH) Friction Angle of Failure Surface = 50 °
(GR) Density of Rock = 150 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AB) Starting Rock Bolt Angle = 0 °
(AR) Ending Rock Bolt Angle = 0 °
(AA) Bolt Angle Increment = 0 °
(T1) Starting Bolt Tension = 0 lb(f)
(T2) Ending Bolt Tension = 0 lb(f)
(T3) Bolt Tension Increment = 0 lb(f)
(AC) Horizontal Acceleration = 0.38 G
(TZ) Amount of Discontinuity = 0 decimal%
(VSUR) Vertical Surcharge = 0 lb(f)
(HSUR) Horizontal Surcharge = 0 lb(f)

Tension Crack Location Unknown: Dry Slope

Plane Failure Analysis Output Data

(A) Contact Area = 55.01 ft ²
(W) Weight of Slice = 51038.68 lb(f)
(U) Water Force Normal to Failure Plane = 0 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Worst Location, Horizontal Distance = 5.67 ft
(Z) Tension Crack Depth = 12.46 ft
(ZW) Depth of Water in Crack = 0 ft
(TH) Bolt Angle = 0 °
(T) Tension = 0 lb(f)
(F) Factor of Safety = 1.01

Plane Failure Analysis Input Data

(H) Height = 60 ft
(SF) Inclination of Slope Face = 70 °
(SS) Inclination of Upper Slope = 1 °
(SP) Inclination of Failure Plane = 63 °
(CO) Cohesive Strength of Failure Surface = 800 lb(f)
(PH) Friction Angle of Failure Surface = 50 °
(GR) Density of Rock = 150 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AB) Starting Rock Bolt Angle = 0 °
(AR) Ending Rock Bolt Angle = 0 °
(AA) Bolt Angle Increment = 0 °
(T1) Starting Bolt Tension = 0 lb(f)
(T2) Ending Bolt Tension = 0 lb(f)
(T3) Bolt Tension Increment = 0 lb(f)
(AC) Horizontal Acceleration = 0.38 G
(TZ) Amount of Discontinuity = 0 decimal%
(VSUR) Vertical Surcharge = 0 lb(f)
(HSUR) Horizontal Surcharge = 0 lb(f)

Tension Crack Location Unknown: Dry Slope

Plane Failure Analysis Output Data

(A) Contact Area = 56.91 ft ²
(W) Weight of Slice = 36023.43 lb(f)
(U) Water Force Normal to Failure Plane = 0 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Worst Location, Horizontal Distance = 4 ft
(Z) Tension Crack Depth = 9.36 ft
(ZW) Depth of Water in Crack = 0 ft
(TH) Bolt Angle = 0 °
(T) Tension = 0 lb(f)
(F) Factor of Safety = 1.32

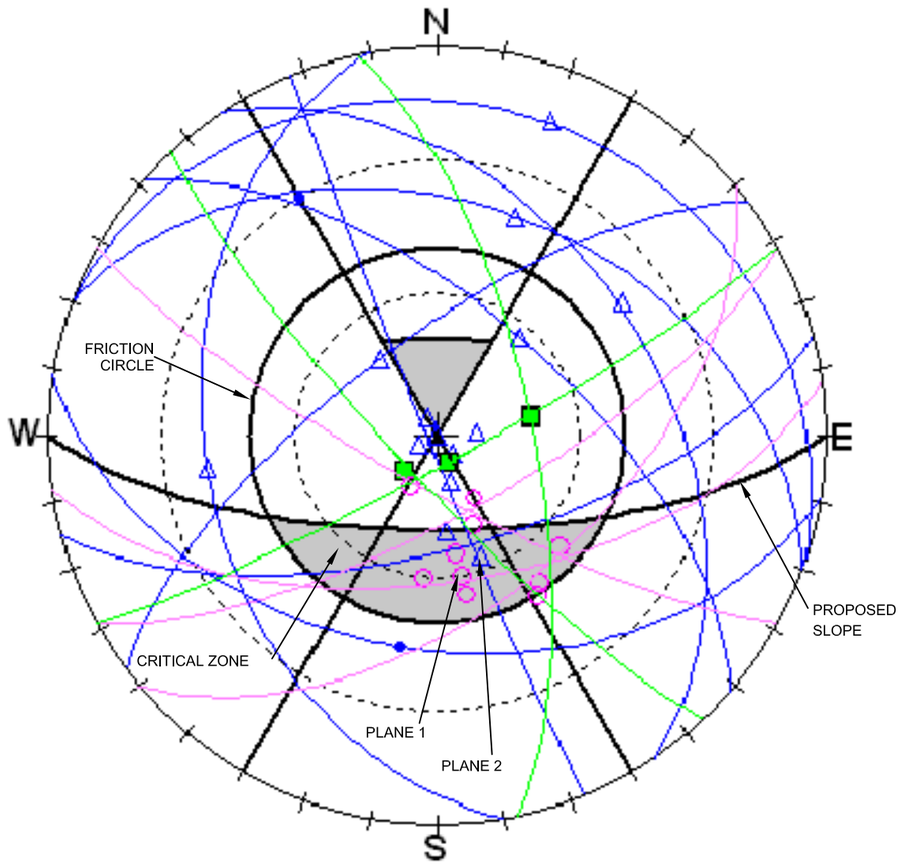
Plane Failure Analysis Input Data

(H) Height = 60 ft
(SF) Inclination of Slope Face = 70 °
(SS) Inclination of Upper Slope = 1 °
(SP) Inclination of Failure Plane = 60 °
(CO) Cohesive Strength of Failure Surface = 800 lb(f)
(PH) Friction Angle of Failure Surface = 50 °
(GR) Density of Rock = 150 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AB) Starting Rock Bolt Angle = 0 °
(AR) Ending Rock Bolt Angle = 0 °
(AA) Bolt Angle Increment = 0 °
(T1) Starting Bolt Tension = 0 lb(f)
(T2) Ending Bolt Tension = 0 lb(f)
(T3) Bolt Tension Increment = 0 lb(f)
(AC) Horizontal Acceleration = 0 G
(TZ) Amount of Discontinuity = 0 decimal%
(VSUR) Vertical Surcharge = 0 lb(f)
(HSUR) Horizontal Surcharge = 0 lb(f)

Tension Crack Location Unknown: Dry Slope

Plane Failure Analysis Output Data

(A) Contact Area = 55.01 ft ²
(W) Weight of Slice = 51038.68 lb(f)
(U) Water Force Normal to Failure Plane = 0 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Worst Location, Horizontal Distance = 5.67 ft
(Z) Tension Crack Depth = 12.46 ft
(ZW) Depth of Water in Crack = 0 ft
(TH) Bolt Angle = 0 °
(T) Tension = 0 lb(f)
(F) Factor of Safety = 1.68



KEY:
△ 1-Small Joints
2- Faults
○ 3- Follations
4- Dikes

KINEMATIC ANALYSIS

FOR: OMYA CALIFORNIA
A DIVISION OF OMYA, INC.

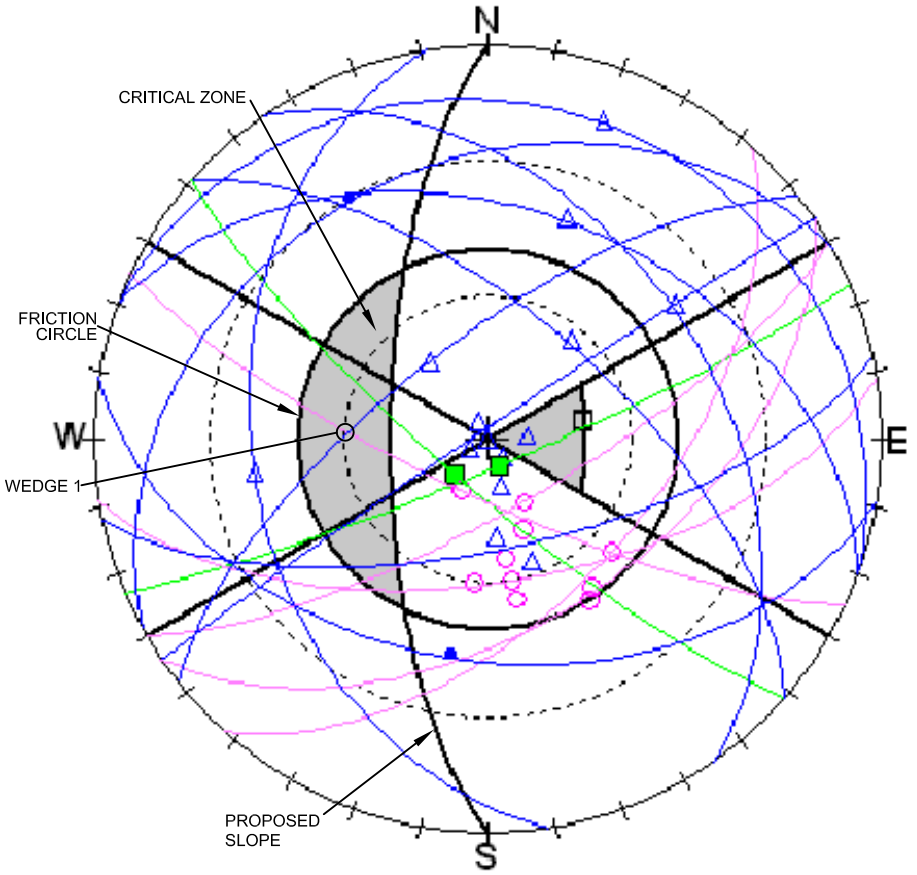
DATE: JANUARY 2013

SLOPE STABILITY INVESTIGATION
PROPOSED AMENDED PLAN OF OPERATIONS
WHITE KNOB QUARRY MINING AND RECLAMATION PLAN
LUCERNE VALLEY, CALIFORNIA

ENCLOSURE "B-4.0"

JOB NUMBER 12715-8

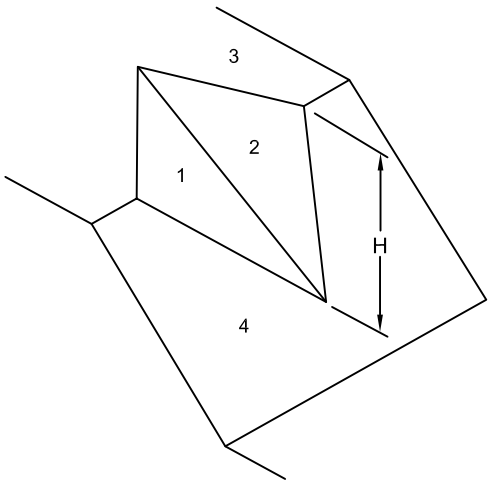
CHJ Consultants



Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 150 lb(f)/ft ³
(H) Height of Crest Above Intersection = 60 ft

Plane 1 : (D1) Dip Value = 70 °
(E1) Dip Direction = 323 °
Plane 2 : (D2) Dip Value = 78 °
(E2) Dip Direction = 208 °
Plane 3 : (D3) Dip Value = 1 °
(E3) Dip Direction = 270 °
Plane 4 : (D4) Dip Value = 70 °
(E4) Dip Direction = 270 °



Plane 1 : (C1) Cohesion = 800 lb(f)/ft ²
(P1) Friction Angle = 50 °
Plane 2 : (C2) Cohesion = 800 lb(f)/ft ²
(P2) Friction Angle = 50 °

Water Pressure : Cracks Completely Filled (Free Draining)

(GW) Density of Water = 62.4 lb(f)/ft ³

(HW) Overall Vertical Height of Wedge = 0 ft

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 4.4
Water Pressure on both planes = 0 lb(f)/ft ²

THERE IS CONTACT ON BOTH PLANES.

KEY:
△ 1-Small Joints
2- Faults
○ 3- Follations
4- Dikes

KINEMATIC ANALYSIS

FOR: OMYA CALIFORNIA
A DIVISION OF OMYA, INC.

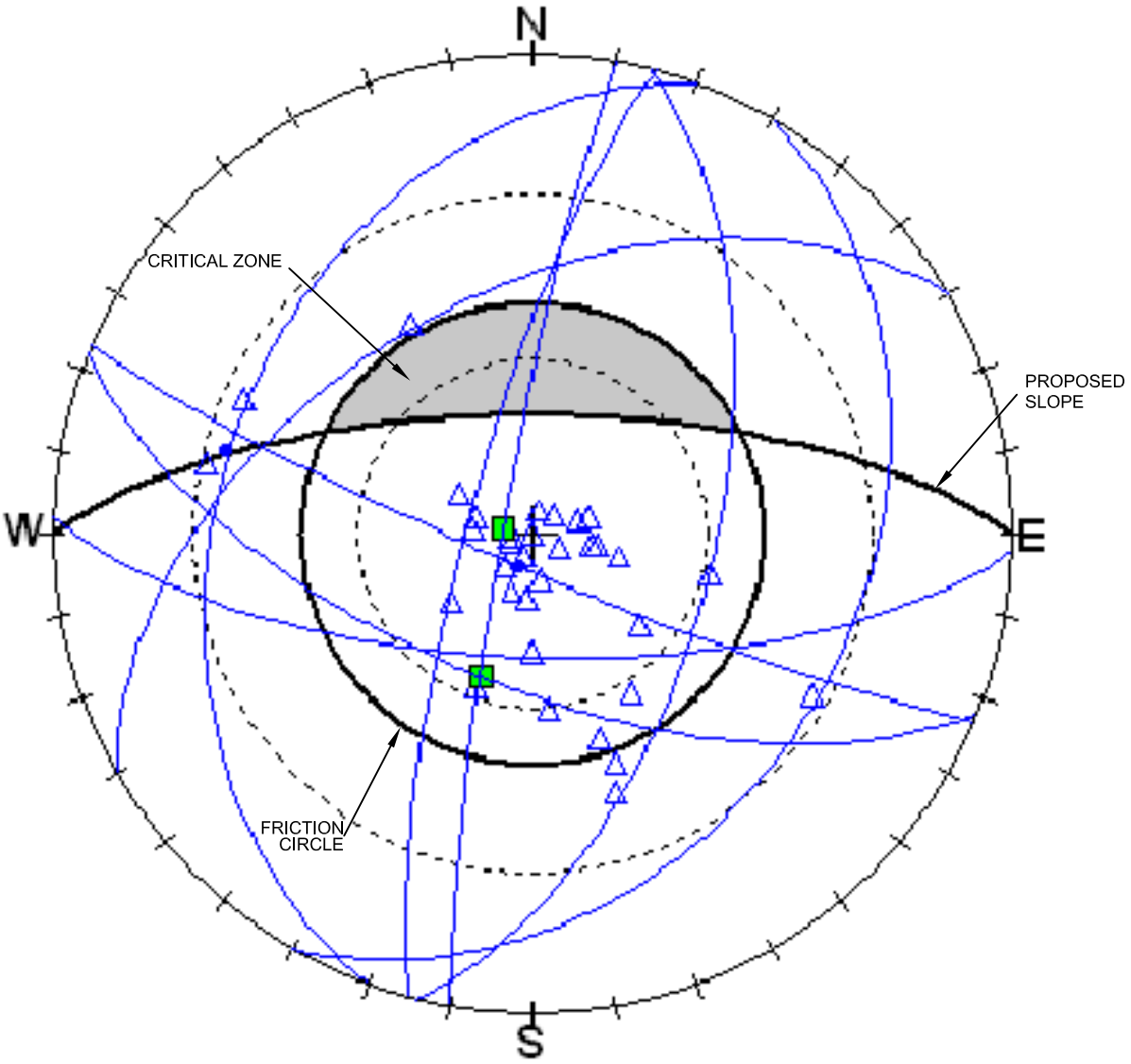
DATE: JANUARY 2013

SLOPE STABILITY INVESTIGATION
PROPOSED AMENDED PLAN OF OPERATIONS
WHITE KNOB QUARRY MINING AND RECLAMATION PLAN
LUCERNE VALLEY, CALIFORNIA

ENCLOSURE "B-5.0"

JOB NUMBER 12715-8

CHJ Consultants



Note: potential failure modes not observed.

KEY:
- △ 1-Small Joints
- 2- Faults
- ○ 3- Follations
- 4- Dikes

KINEMATIC ANALYSIS

FOR: OMYA CALIFORNIA A DIVISION OF OMYA, INC.	SLOPE STABILITY INVESTIGATION PROPOSED AMENDED PLAN OF OPERATIONS WHITE KNOB QUARRY MINING AND RECLAMATION PLAN LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "B-6.0"
DATE: JANUARY 2013		JOB NUMBER 12715-8

CHJ Consultants

Plane Failure Analysis Input Data

(H) Height = 60 ft
(SF) Inclination of Slope Face = 70 °
(SS) Inclination of Upper Slope = 1 °
(SP) Inclination of Failure Plane = 59 °
(CO) Cohesive Strength of Failure Surface = 800 lb(f)
(PH) Friction Angle of Failure Surface = 50 °
(GR) Density of Rock = 150 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AB) Starting Rock Bolt Angle = 0 °
(AR) Ending Rock Bolt Angle = 0 °
(AA) Bolt Angle Increment = 0 °
(T1) Starting Bolt Tension = 0 lb(f)
(T2) Ending Bolt Tension = 0 lb(f)
(T3) Bolt Tension Increment = 0 lb(f)
(AC) Horizontal Acceleration = 0.38 G
(TZ) Amount of Discontinuity = 0 decimal%
(VSUR) Vertical Surcharge = 0 lb(f)
(HSUR) Horizontal Surcharge = 0 lb(f)

Tension Crack Location Unknown: Dry Slope

Plane Failure Analysis Output Data

(A) Contact Area = 54.48 ft ²
(W) Weight of Slice = 56037.08 lb(f)
(U) Water Force Normal to Failure Plane = 0 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Worst Location, Horizontal Distance = 6.22 ft
(Z) Tension Crack Depth = 13.41 ft
(ZW) Depth of Water in Crack = 0 ft
(TH) Bolt Angle = 0 °
(T) Tension = 0 lb(f)
(F) Factor of Safety = 0.95

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 150 lb(f)/ft ³
(H) Height of Crest Above Intersection = 60 ft

Plane 1 : (D1) Dip Value = 66 °
(E1) Dip Direction = 130 °
Plane 2 : (D2) Dip Value = 59 °
(E2) Dip Direction = 103 °
Plane 3 : (D3) Dip Value = 1 °
(E3) Dip Direction = 65 °
Plane 4 : (D4) Dip Value = 70 °
(E4) Dip Direction = 65 °

Plane 1 : (C1) Cohesion = 800 lb(f)/ft ²
(P1) Friction Angle = 50 °
Plane 2 : (C2) Cohesion = 800 lb(f)/ft ²
(P2) Friction Angle = 50 °

Water Pressure : Cracks Completely Filled
(Free Draining)

(GW) Density of Water = 0 lb(f)/ft ³

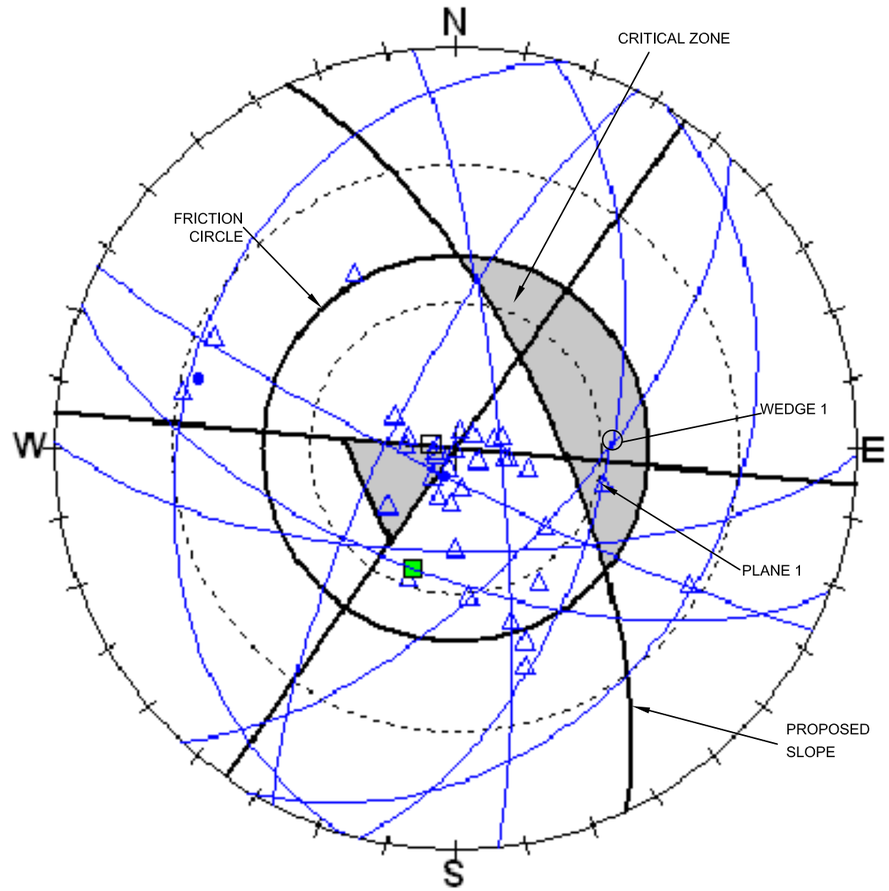
(HW) Overall Vertical Height of Wedge = 0 ft

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 6.84
Water Pressure on both planes = 0 lb(f)/ft ²

THERE IS CONTACT ON BOTH PLANES.



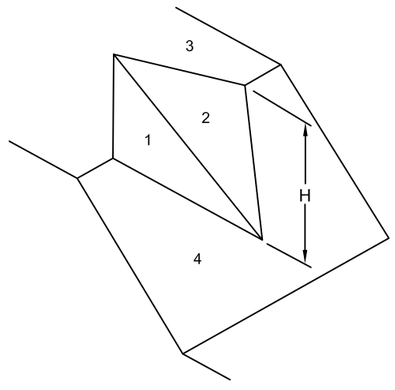
Plane Failure Analysis Input Data

(H) Height = 60 ft
(SF) Inclination of Slope Face = 70 °
(SS) Inclination of Upper Slope = 1 °
(SP) Inclination of Failure Plane = 59 °
(CO) Cohesive Strength of Failure Surface = 800 lb(f)
(PH) Friction Angle of Failure Surface = 50 °
(GR) Density of Rock = 150 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AB) Starting Rock Bolt Angle = 0 °
(AR) Ending Rock Bolt Angle = 0 °
(AA) Bolt Angle Increment = 0 °
(T1) Starting Bolt Tension = 0 lb(f)
(T2) Ending Bolt Tension = 0 lb(f)
(T3) Bolt Tension Increment = 0 lb(f)
(AC) Horizontal Acceleration = 0 G
(TZ) Amount of Discontinuity = 0 decimal%
(VSUR) Vertical Surcharge = 0 lb(f)
(HSUR) Horizontal Surcharge = 0 lb(f)

Tension Crack Location Unknown: Dry Slope

Plane Failure Analysis Output Data

(A) Contact Area = 54.48 ft ²
(W) Weight of Slice = 56037.08 lb(f)
(U) Water Force Normal to Failure Plane = 0 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Worst Location, Horizontal Distance = 6.22 ft
(Z) Tension Crack Depth = 13.41 ft
(ZW) Depth of Water in Crack = 0 ft
(TH) Bolt Angle = 0 °
(T) Tension = 0 lb(f)
(F) Factor of Safety = 1.62



KEY:
△ 1-Small Joints
2- Faults
○ 3- Follations
4- Dikes

KINEMATIC ANALYSIS

FOR: OMYA CALIFORNIA
A DIVISION OF OMYA, INC.

DATE: JANUARY 2013

SLOPE STABILITY INVESTIGATION
PROPOSED AMENDED PLAN OF OPERATIONS
WHITE KNOB QUARRY MINING AND RECLAMATION PLAN
LUCERNE VALLEY, CALIFORNIA

ENCLOSURE "B-7.0"

JOB NUMBER 12715-8

CHJ Consultants

Plane Failure Analysis Input Data

(H) Height = 60 ft
(SF) Inclination of Slope Face = 70 °
(SS) Inclination of Upper Slope = 1 °
(SP) Inclination of Failure Plane = 60 °
(CO) Cohesive Strength of Failure Surface = 800 lb(f)
(PH) Friction Angle of Failure Surface = 50 °
(GR) Density of Rock = 150 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AB) Starting Rock Bolt Angle = 0 °
(AR) Ending Rock Bolt Angle = 0 °
(AA) Bolt Angle Increment = 0 °
(T1) Starting Bolt Tension = 0 lb(f)
(T2) Ending Bolt Tension = 0 lb(f)
(T3) Bolt Tension Increment = 0 lb(f)
(AC) Horizontal Acceleration = 0.38 G
(TZ) Amount of Discontinuity = 0 decimal%
(VSUR) Vertical Surcharge = 0 lb(f)
(HSUR) Horizontal Surcharge = 0 lb(f)

Tension Crack Location Unknown: Dry Slope

Plane Failure Analysis Output Data

(A) Contact Area = 55.01 ft ²
(W) Weight of Slice = 51038.68 lb(f)
(U) Water Force Normal to Failure Plane = 0 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Worst Location, Horizontal Distance = 5.67 ft
(Z) Tension Crack Depth = 12.46 ft
(ZW) Depth of Water in Crack = 0 ft
(TH) Bolt Angle = 0 °
(T) Tension = 0 lb(f)
(F) Factor of Safety = 1.01

Plane Failure Analysis Input Data

(H) Height = 60 ft
(SF) Inclination of Slope Face = 70 °
(SS) Inclination of Upper Slope = 1 °
(SP) Inclination of Failure Plane = 58 °
(CO) Cohesive Strength of Failure Surface = 800 lb(f)
(PH) Friction Angle of Failure Surface = 50 °
(GR) Density of Rock = 150 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AB) Starting Rock Bolt Angle = 0 °
(AR) Ending Rock Bolt Angle = 0 °
(AA) Bolt Angle Increment = 0 °
(T1) Starting Bolt Tension = 0 lb(f)
(T2) Ending Bolt Tension = 0 lb(f)
(T3) Bolt Tension Increment = 0 lb(f)
(AC) Horizontal Acceleration = 0.38 G
(TZ) Amount of Discontinuity = 0 decimal%
(VSUR) Vertical Surcharge = 0 lb(f)
(HSUR) Horizontal Surcharge = 0 lb(f)

Tension Crack Location Unknown: Dry Slope

Plane Failure Analysis Output Data

(A) Contact Area = 54 ft ²
(W) Weight of Slice = 61042.31 lb(f)
(U) Water Force Normal to Failure Plane = 0 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Worst Location, Horizontal Distance = 6.78 ft
(Z) Tension Crack Depth = 14.33 ft
(ZW) Depth of Water in Crack = 0 ft
(TH) Bolt Angle = 0 °
(T) Tension = 0 lb(f)
(F) Factor of Safety = 0.91

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 150 lb(f)/ft ³
(H) Height of Crest Above Intersection = 60 ft

Plane 1 : (D1) Dip Value = 58 °
(E1) Dip Direction = 148 °
Plane 2 : (D2) Dip Value = 59 °
(E2) Dip Direction = 103 °
Plane 3 : (D3) Dip Value = 1 °
(E3) Dip Direction = 160 °
Plane 4 : (D4) Dip Value = 70 °
(E4) Dip Direction = 160 °

Plane 1 : (C1) Cohesion = 800 lb(f)/ft ²
(P1) Friction Angle = 50 °
Plane 2 : (C2) Cohesion = 800 lb(f)/ft ²
(P2) Friction Angle = 50 °

Water Pressure : Cracks Completely Filled (Free Draining)

(GW) Density of Water = 62.4 lb(f)/ft ³

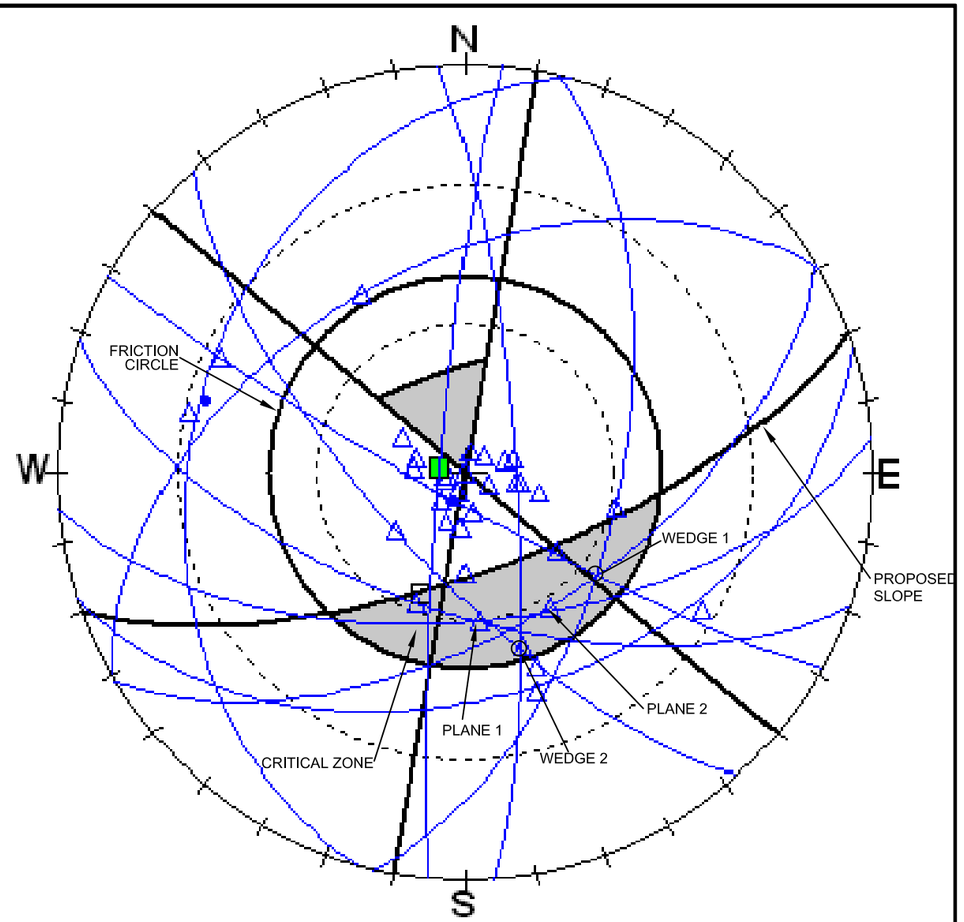
(HW) Overall Vertical Height of Wedge = 0 ft

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 2.94
Water Pressure on both planes = 0 lb(f)/ft ²

THERE IS CONTACT ON PLANE 1 ONLY.



Plane Failure Analysis Input Data

(H) Height = 60 ft
(SF) Inclination of Slope Face = 70 °
(SS) Inclination of Upper Slope = 1 °
(SP) Inclination of Failure Plane = 60 °
(CO) Cohesive Strength of Failure Surface = 800 lb(f)
(PH) Friction Angle of Failure Surface = 50 °
(GR) Density of Rock = 150 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AB) Starting Rock Bolt Angle = 0 °
(AR) Ending Rock Bolt Angle = 0 °
(AA) Bolt Angle Increment = 0 °
(T1) Starting Bolt Tension = 0 lb(f)
(T2) Ending Bolt Tension = 0 lb(f)
(T3) Bolt Tension Increment = 0 lb(f)
(AC) Horizontal Acceleration = 0 G
(TZ) Amount of Discontinuity = 0 decimal%
(VSUR) Vertical Surcharge = 0 lb(f)
(HSUR) Horizontal Surcharge = 0 lb(f)

Tension Crack Location Unknown: Dry Slope

Plane Failure Analysis Output Data

(A) Contact Area = 55.01 ft ²
(W) Weight of Slice = 51038.68 lb(f)
(U) Water Force Normal to Failure Plane = 0 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Worst Location, Horizontal Distance = 5.67 ft
(Z) Tension Crack Depth = 12.46 ft
(ZW) Depth of Water in Crack = 0 ft
(TH) Bolt Angle = 0 °
(T) Tension = 0 lb(f)
(F) Factor of Safety = 1.68

Plane Failure Analysis Input Data

(H) Height = 60 ft
(SF) Inclination of Slope Face = 70 °
(SS) Inclination of Upper Slope = 1 °
(SP) Inclination of Failure Plane = 58 °
(CO) Cohesive Strength of Failure Surface = 800 lb(f)
(PH) Friction Angle of Failure Surface = 50 °
(GR) Density of Rock = 150 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AB) Starting Rock Bolt Angle = 0 °
(AR) Ending Rock Bolt Angle = 0 °
(AA) Bolt Angle Increment = 0 °
(T1) Starting Bolt Tension = 0 lb(f)
(T2) Ending Bolt Tension = 0 lb(f)
(T3) Bolt Tension Increment = 0 lb(f)
(AC) Horizontal Acceleration = 0 G
(TZ) Amount of Discontinuity = 0 decimal%
(VSUR) Vertical Surcharge = 0 lb(f)
(HSUR) Horizontal Surcharge = 0 lb(f)

Tension Crack Location Unknown: Dry Slope

Plane Failure Analysis Output Data

(A) Contact Area = 54 ft ²
(W) Weight of Slice = 61042.31 lb(f)
(U) Water Force Normal to Failure Plane = 0 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Worst Location, Horizontal Distance = 6.78 ft
(Z) Tension Crack Depth = 14.33 ft
(ZW) Depth of Water in Crack = 0 ft
(TH) Bolt Angle = 0 °
(T) Tension = 0 lb(f)
(F) Factor of Safety = 1.58

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 150 lb(f)/ft ³
(H) Height of Crest Above Intersection = 60 ft

Plane 1 : (D1) Dip Value = 72 °
(E1) Dip Direction = 230 °
Plane 2 : (D2) Dip Value = 79 °
(E2) Dip Direction = 100 °
Plane 3 : (D3) Dip Value = 1 °
(E3) Dip Direction = 160 °
Plane 4 : (D4) Dip Value = 70 °
(E4) Dip Direction = 160 °

Plane 1 : (C1) Cohesion = 800 lb(f)/ft ²
(P1) Friction Angle = 50 °
Plane 2 : (C2) Cohesion = 800 lb(f)/ft ²
(P2) Friction Angle = 50 °

Water Pressure : Cracks Completely Filled (Free Draining)

(GW) Density of Water = 62.4 lb(f)/ft ³

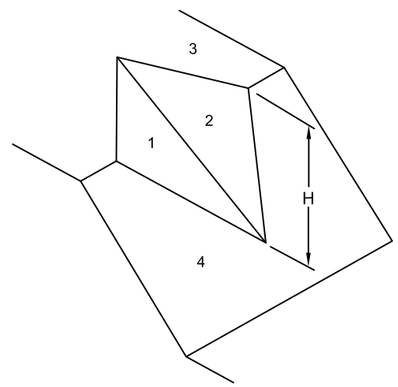
(HW) Overall Vertical Height of Wedge = 0 ft

The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 4.69
Water Pressure on both planes = 0 lb(f)/ft ²

THERE IS CONTACT ON BOTH PLANES.



KEY:
1-Small Joints
2- Faults
3- Follations
4- Dikes

KINEMATIC ANALYSIS

FOR: OMYA CALIFORNIA
A DIVISION OF OMYA, INC.

DATE: JANUARY 2013

SLOPE STABILITY INVESTIGATION
PROPOSED AMENDED PLAN OF OPERATIONS
WHITE KNOB QUARRY MINING AND RECLAMATION PLAN
LUCERNE VALLEY, CALIFORNIA

ENCLOSURE "B-8.0"

JOB NUMBER 12715-8

CHJ Consultants

Plane Failure Analysis Input Data

(H) Height = 60 ft
(SF) Inclination of Slope Face = 70 °
(SS) Inclination of Upper Slope = 1 °
(SP) Inclination of Failure Plane = 64 °
(CO) Cohesive Strength of Failure Surface = 800 lb(f)
(PH) Friction Angle of Failure Surface = 50 °
(GR) Density of Rock = 150 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AB) Starting Rock Bolt Angle = 0 °
(AR) Ending Rock Bolt Angle = 0 °
(AA) Bolt Angle Increment = 0 °
(T1) Starting Bolt Tension = 0 lb(f)
(T2) Ending Bolt Tension = 0 lb(f)
(T3) Bolt Tension Increment = 0 lb(f)
(AC) Horizontal Acceleration = 0.38 G
(TZ) Amount of Discontinuity = 0 decimal%
(VSUR) Vertical Surcharge = 0 lb(f)
(HSUR) Horizontal Surcharge = 0 lb(f)

Tension Crack Location Unknown: Dry Slope

Plane Failure Analysis Output Data

(A) Contact Area = 57.67 ft ²
(W) Weight of Slice = 30990.53 lb(f)
(U) Water Force Normal to Failure Plane = 0 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Worst Location, Horizontal Distance = 3.44 ft
(Z) Tension Crack Depth = 8.23 ft
(ZW) Depth of Water in Crack = 0 ft
(TH) Bolt Angle = 0 °
(T) Tension = 0 lb(f)
(F) Factor of Safety = 1.51

Plane Failure Analysis Input Data

(H) Height = 60 ft
(SF) Inclination of Slope Face = 70 °
(SS) Inclination of Upper Slope = 1 °
(SP) Inclination of Failure Plane = 60 °
(CO) Cohesive Strength of Failure Surface = 800 lb(f)
(PH) Friction Angle of Failure Surface = 50 °
(GR) Density of Rock = 150 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AB) Starting Rock Bolt Angle = 0 °
(AR) Ending Rock Bolt Angle = 0 °
(AA) Bolt Angle Increment = 0 °
(T1) Starting Bolt Tension = 0 lb(f)
(T2) Ending Bolt Tension = 0 lb(f)
(T3) Bolt Tension Increment = 0 lb(f)
(AC) Horizontal Acceleration = 0.38 G
(TZ) Amount of Discontinuity = 0 decimal%
(VSUR) Vertical Surcharge = 0 lb(f)
(HSUR) Horizontal Surcharge = 0 lb(f)

Tension Crack Location Unknown: Dry Slope

Plane Failure Analysis Output Data

(A) Contact Area = 55.01 ft ²
(W) Weight of Slice = 51038.68 lb(f)
(U) Water Force Normal to Failure Plane = 0 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Worst Location, Horizontal Distance = 5.67 ft
(Z) Tension Crack Depth = 12.46 ft
(ZW) Depth of Water in Crack = 0 ft
(TH) Bolt Angle = 0 °
(T) Tension = 0 lb(f)
(F) Factor of Safety = 1.01

Plane Failure Analysis Input Data

(H) Height = 60 ft
(SF) Inclination of Slope Face = 70 °
(SS) Inclination of Upper Slope = 1 °
(SP) Inclination of Failure Plane = 64 °
(CO) Cohesive Strength of Failure Surface = 800 lb(f)
(PH) Friction Angle of Failure Surface = 50 °
(GR) Density of Rock = 150 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AB) Starting Rock Bolt Angle = 0 °
(AR) Ending Rock Bolt Angle = 0 °
(AA) Bolt Angle Increment = 0 °
(T1) Starting Bolt Tension = 0 lb(f)
(T2) Ending Bolt Tension = 0 lb(f)
(T3) Bolt Tension Increment = 0 lb(f)
(AC) Horizontal Acceleration = 0 G
(TZ) Amount of Discontinuity = 0 decimal%
(VSUR) Vertical Surcharge = 0 lb(f)
(HSUR) Horizontal Surcharge = 0 lb(f)

Tension Crack Location Unknown: Dry Slope

Plane Failure Analysis Output Data

(A) Contact Area = 57.67 ft ²
(W) Weight of Slice = 30990.53 lb(f)
(U) Water Force Normal to Failure Plane = 0 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Worst Location, Horizontal Distance = 3.44 ft
(Z) Tension Crack Depth = 8.23 ft
(ZW) Depth of Water in Crack = 0 ft
(TH) Bolt Angle = 0 °
(T) Tension = 0 lb(f)
(F) Factor of Safety = 2.24

Plane Failure Analysis Input Data

(H) Height = 60 ft
(SF) Inclination of Slope Face = 70 °
(SS) Inclination of Upper Slope = 1 °
(SP) Inclination of Failure Plane = 60 °
(CO) Cohesive Strength of Failure Surface = 800 lb(f)
(PH) Friction Angle of Failure Surface = 50 °
(GR) Density of Rock = 150 lb(f)/ft ³
(GW) Density of Water = 62.4 lb(f)/ft ³
(AB) Starting Rock Bolt Angle = 0 °
(AR) Ending Rock Bolt Angle = 0 °
(AA) Bolt Angle Increment = 0 °
(T1) Starting Bolt Tension = 0 lb(f)
(T2) Ending Bolt Tension = 0 lb(f)
(T3) Bolt Tension Increment = 0 lb(f)
(AC) Horizontal Acceleration = 0 G
(TZ) Amount of Discontinuity = 0 decimal%
(VSUR) Vertical Surcharge = 0 lb(f)
(HSUR) Horizontal Surcharge = 0 lb(f)

Tension Crack Location Unknown: Dry Slope

Plane Failure Analysis Output Data

(A) Contact Area = 55.01 ft ²
(W) Weight of Slice = 51038.68 lb(f)
(U) Water Force Normal to Failure Plane = 0 lb(f)
(V) Horizontal Water Force on Tension Crack = 0 lb(f)
(B) Worst Location, Horizontal Distance = 5.67 ft
(Z) Tension Crack Depth = 12.46 ft
(ZW) Depth of Water in Crack = 0 ft
(TH) Bolt Angle = 0 °
(T) Tension = 0 lb(f)
(F) Factor of Safety = 1.68

Rapid Wedge Failure Analysis Input Data

(GR) Density of Rock = 150 lb(f)/ft ³
(H) Height of Crest Above Intersection = 60 ft

Plane 1 : (D1) Dip Value = 72 °
(E1) Dip Direction = 230 °
Plane 2 : (D2) Dip Value = 75 °
(E2) Dip Direction = 105 °
Plane 3 : (D3) Dip Value = 1 °
(E3) Dip Direction = 210 °
Plane 4 : (D4) Dip Value = 70 °
(E4) Dip Direction = 210 °

Plane 1 : (C1) Cohesion = 800 lb(f)/ft ²
(P1) Friction Angle = 50 °
Plane 2 : (C2) Cohesion = 800 lb(f)/ft ²
(P2) Friction Angle = 50 °

Water Pressure : Cracks Completely Filled (Free Draining)

(GW) Density of Water = 62.4 lb(f)/ft ³

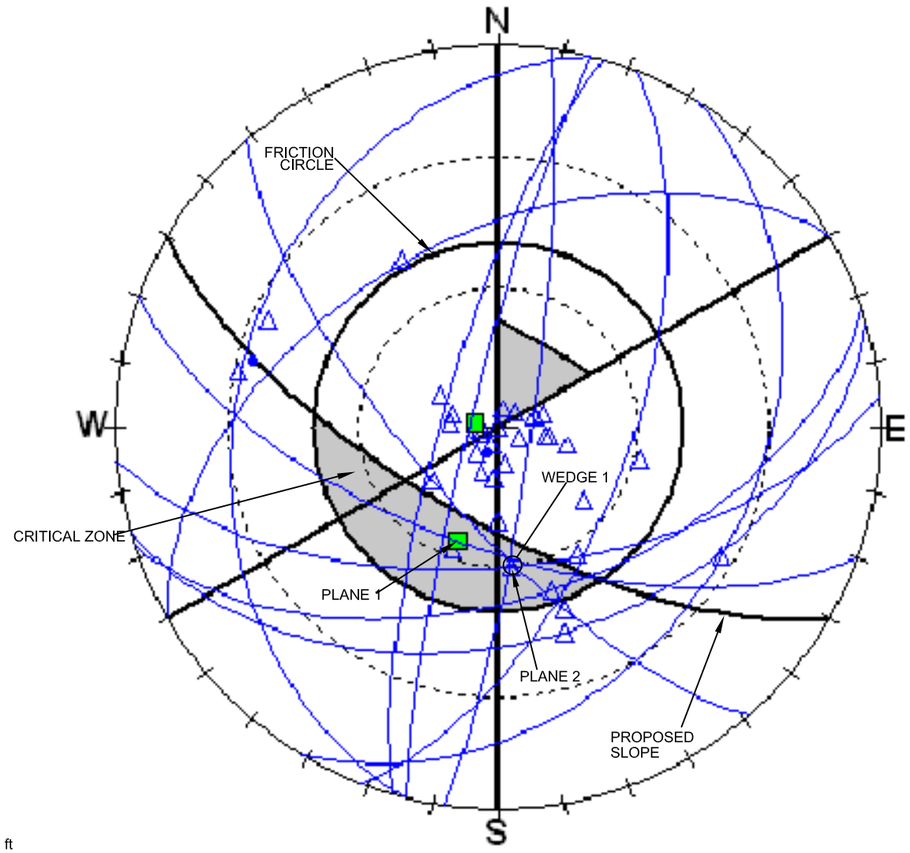
(HW) Overall Vertical Height of Wedge = 0 ft

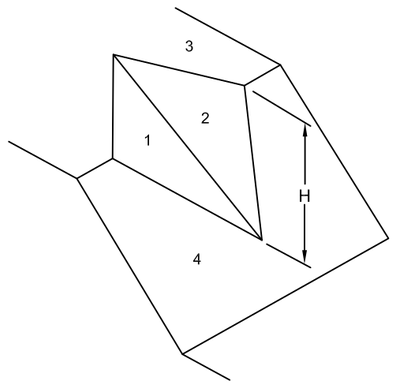
The slope face DOES NOT hang over the toe of the slope.

Rapid Wedge Failure Analysis Output Data

(F) Factor of Safety = 5.5
Water Pressure on both planes = 0 lb(f)/ft ²

THERE IS CONTACT ON BOTH PLANES.





KEY:
△ 1-Small Joints
■ 2- Faults
○ 3- Follations
● 4- Dikes

KINEMATIC ANALYSIS

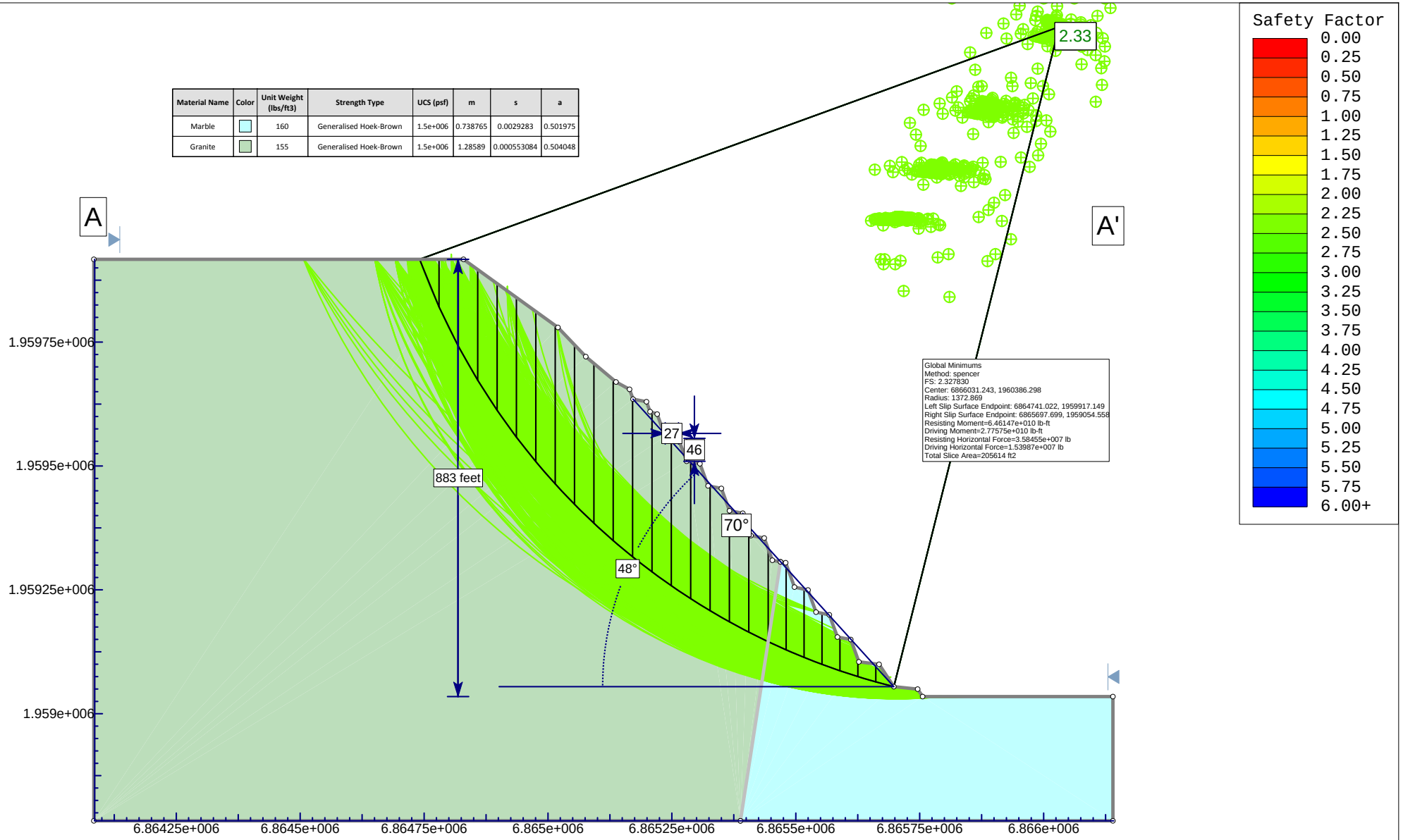
FOR: OMYA CALIFORNIA A DIVISION OF OMYA, INC.	SLOPE STABILITY INVESTIGATION PROPOSED AMENDED PLAN OF OPERATIONS WHITE KNOB QUARRY MINING AND RECLAMATION PLAN LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "B-9.0"
DATE: JANUARY 2013		JOB NUMBER 12715-8

CHJ Consultants

APPENDIX "C"

GLOBAL STABILITY CALCULATIONS

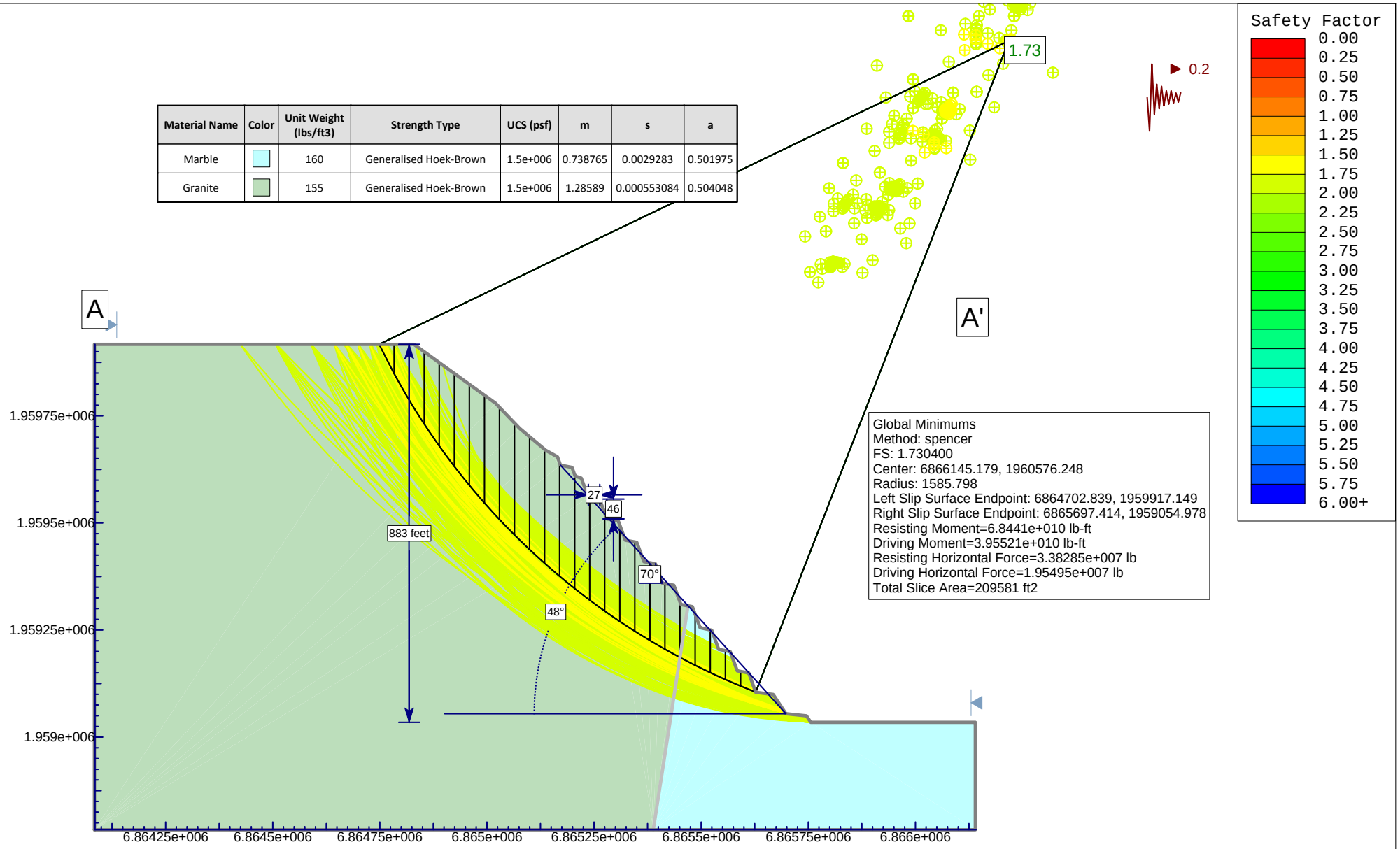
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)	m	s	a
Marble		160	Generalised Hoek-Brown	1.5e+006	0.738765	0.0029283	0.501975
Granite		155	Generalised Hoek-Brown	1.5e+006	1.28589	0.000553084	0.504048



Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	White Knob/Ridge Quarries		
Drawn By	CHJ Consultants	Author: J. McKeown	Scale: 1:3277
File Name	A stat.slim	Date: 11/1/2012	Enclosure: C-1

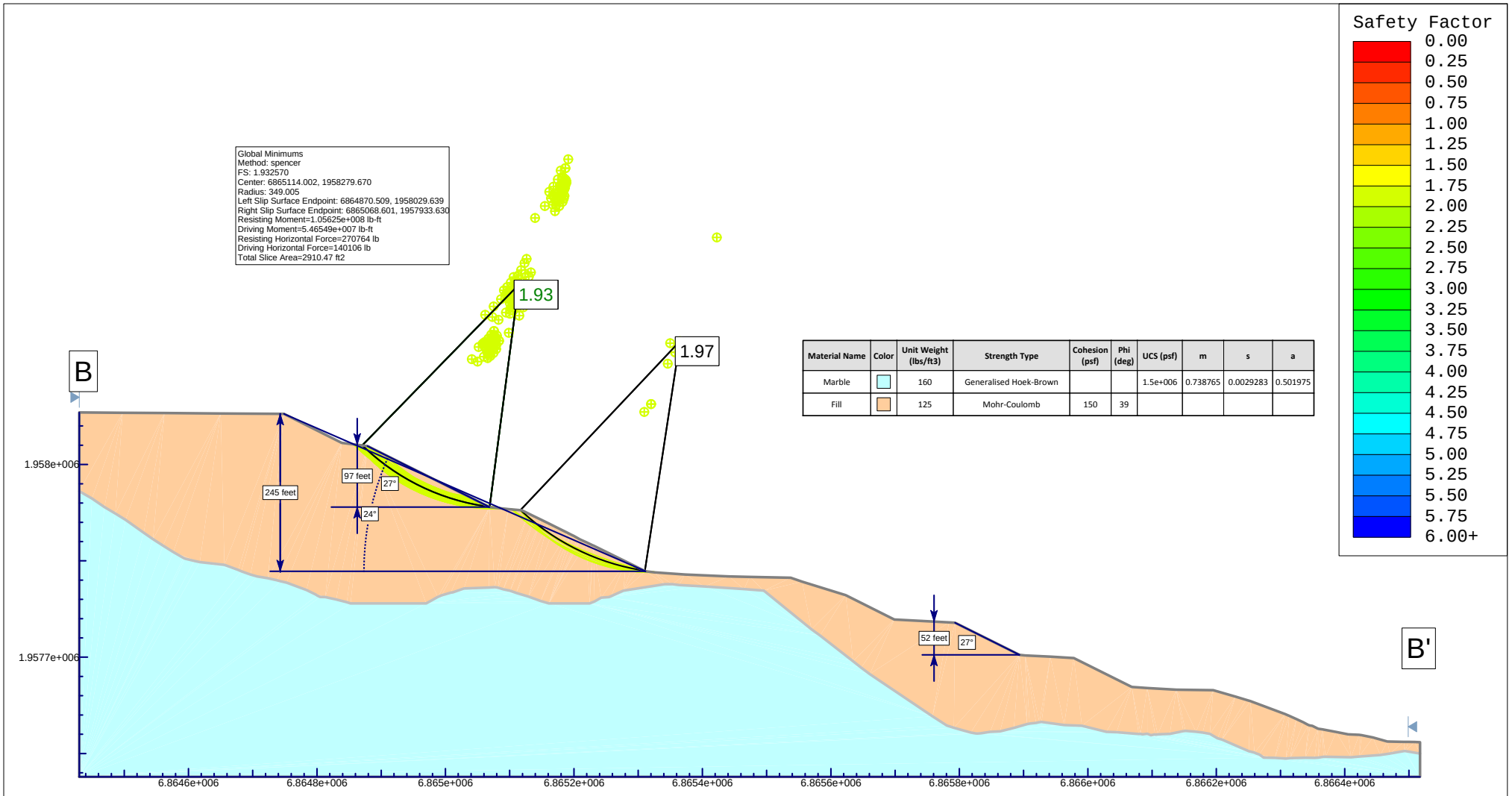
SLIDEINTERPRET 6.019

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)	m	s	a
Marble		160	Generalised Hoek-Brown	1.5e+006	0.738765	0.0029283	0.501975
Granite		155	Generalised Hoek-Brown	1.5e+006	1.28589	0.000553084	0.504048



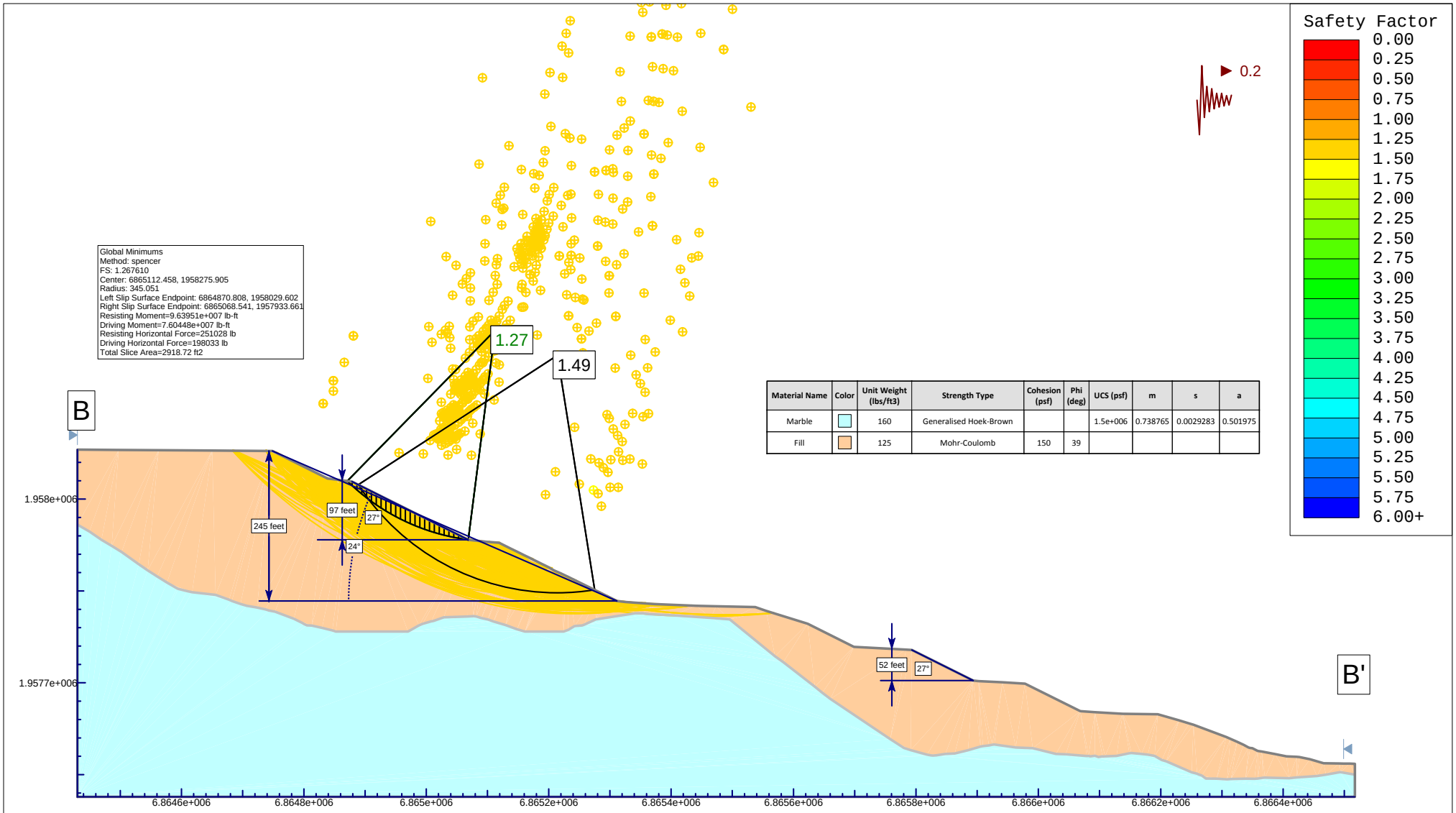
Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description	White Knob/Ridge Quarries		
Drawn By	CHJ Consultants	Author: J. McKeown	Scale: 1:3762
File Name	A seis.slim	Date: 11/1/2012	Enclosure: C-2

SLIDEINTERPRET 6.019



	Project SLIDE - An Interactive Slope Stability Program		
	Analysis Description		
Drawn By CHJ Consultants		*Author* J. McKeown	*Scale* 1:2675
File Name B stat.slim		*Date* 10/31/2012	*Enclosure* C-3

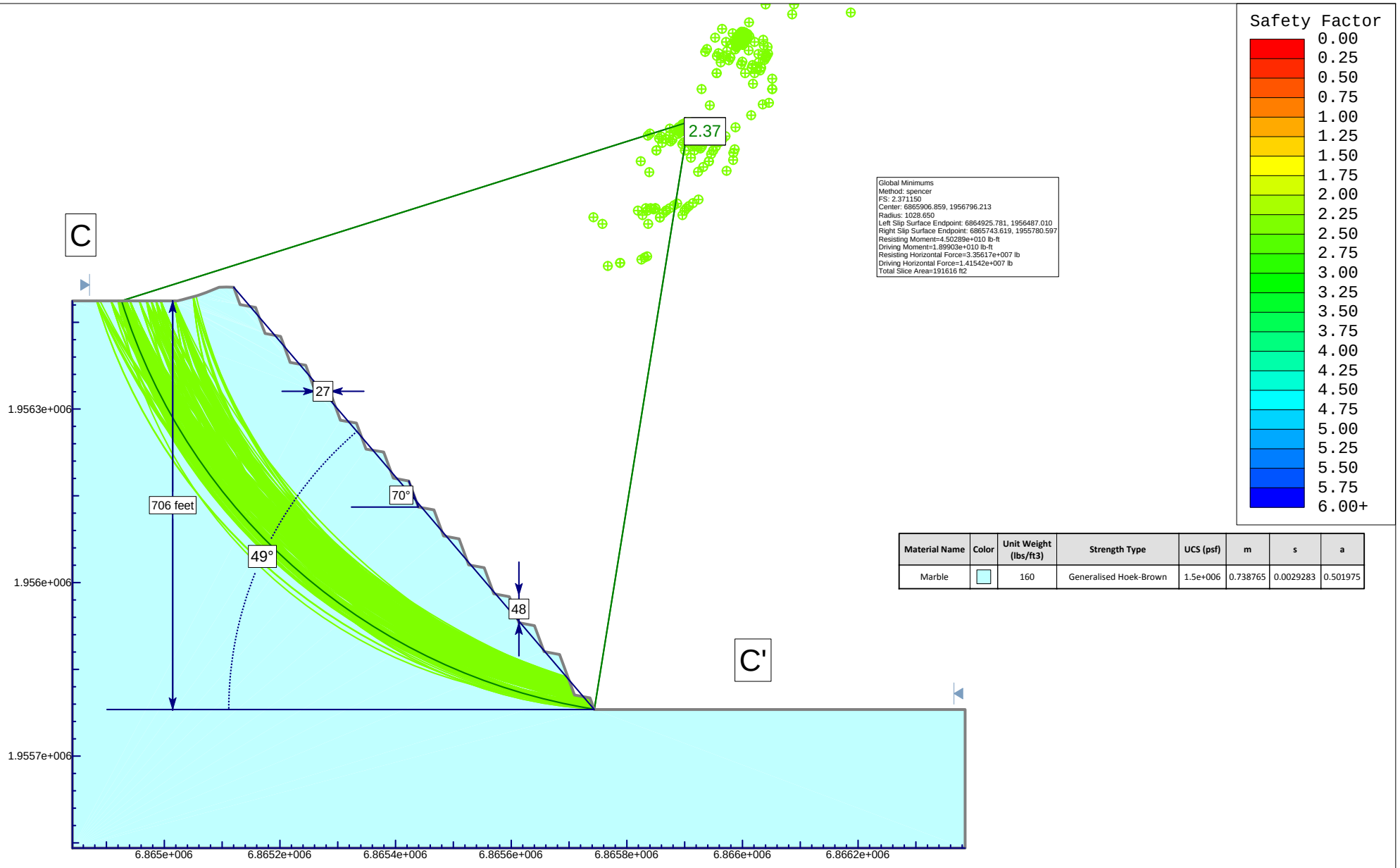
SLIDEINTERPRET 6.019



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	UCS (psf)	m	s	a
Marble		160	Generalised Hoek-Brown			1.5e+006	0.738765	0.0029283	0.501975
Fill		125	Mohr-Coulomb	150	39				

Project: SLIDE - An Interactive Slope Stability Program			
Analysis Description:			
Drawn By: CHJ Consultants	Author: J. McKeown	Scale: 1:2705	
File Name: B seis.slim	Date: 10/31/2012	Enclosure: C-4	

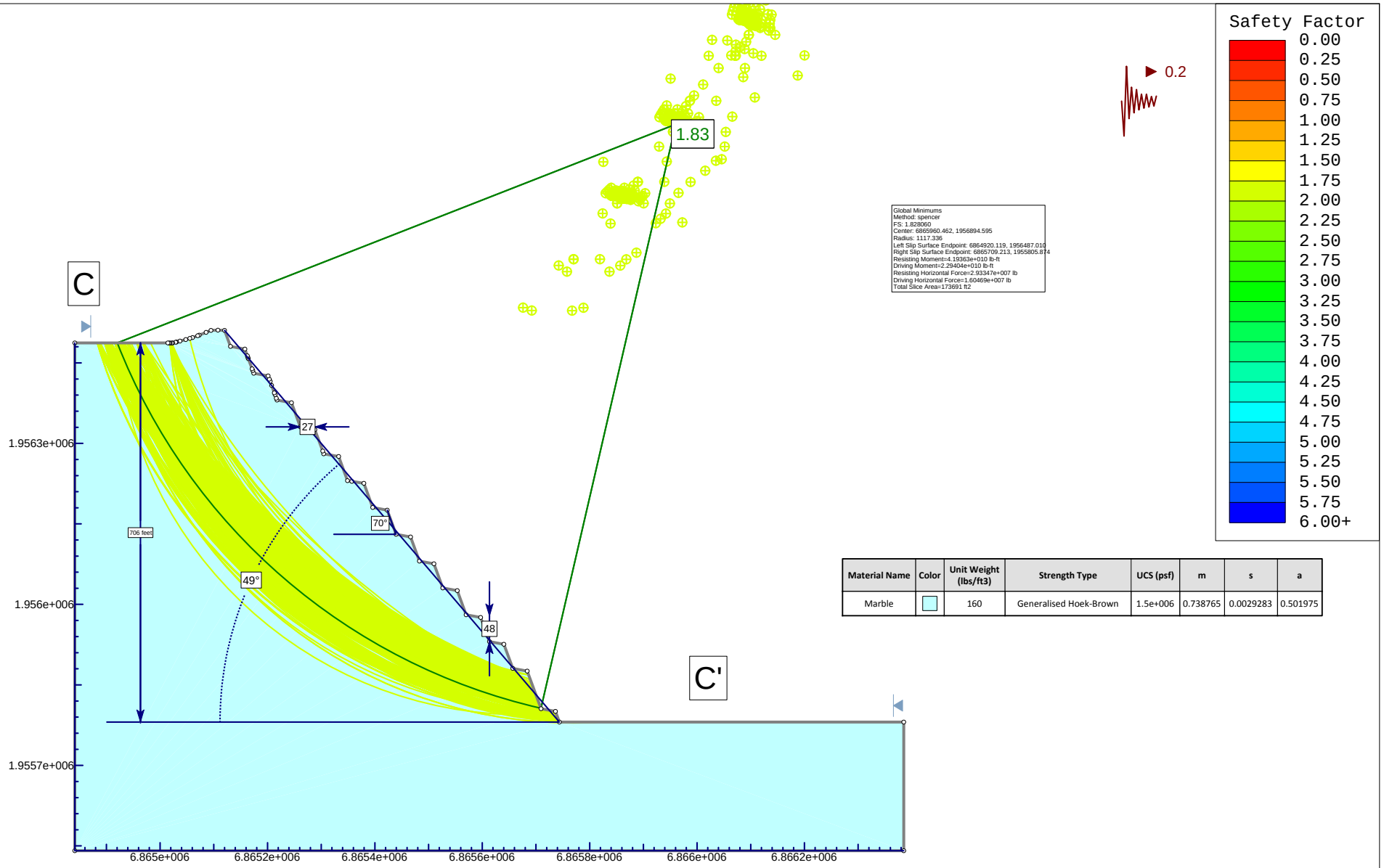
SLIDEINTERPRET 6.019



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)	m	s	a
Marble		160	Generalised Hoek-Brown	1.5e+006	0.738765	0.0029283	0.501975

SLIDEINTERPRET 6.019

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By	CHJ Consultants	Author: J. McKeown	Scale: 1:2806
File Name	C stat.slim	Date: 11/1/2012	Enclosure: C-5



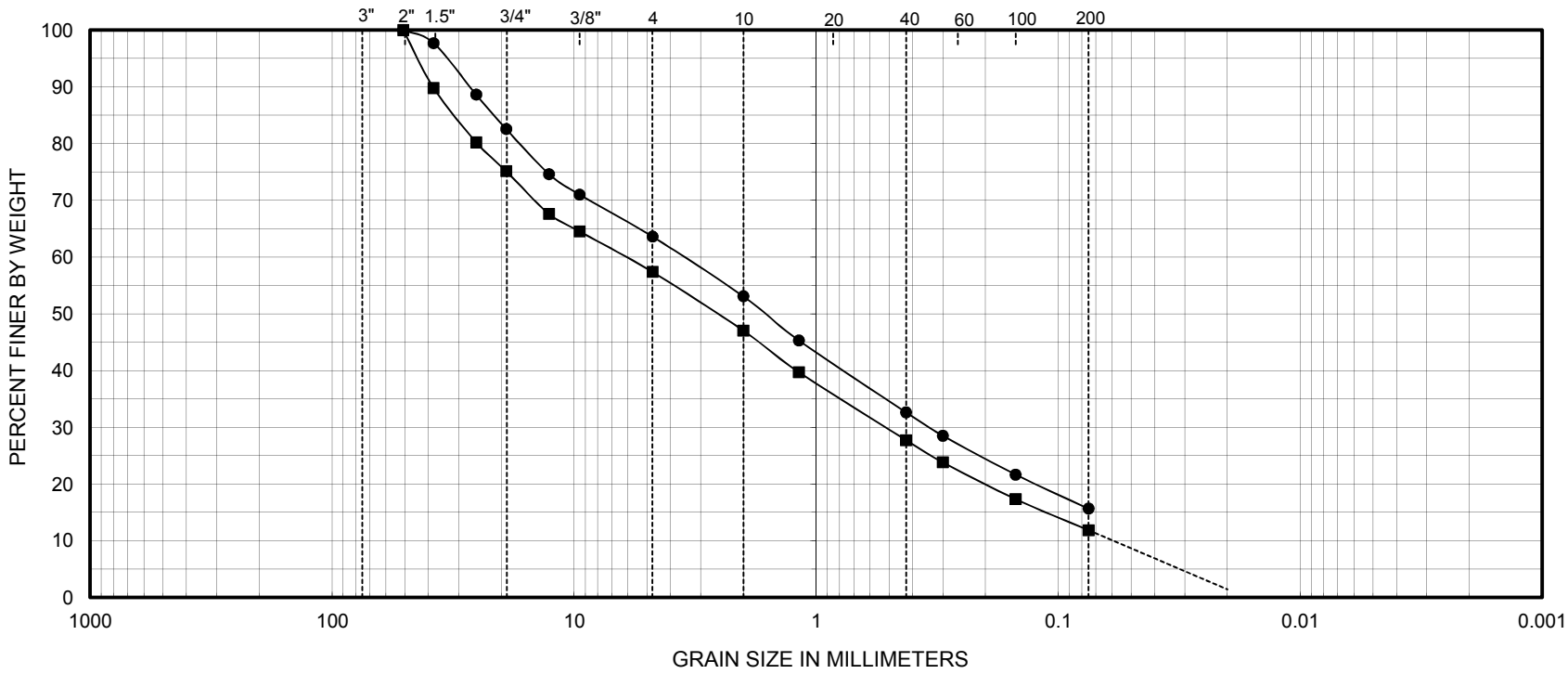
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)	m	s	a
Marble		160	Generalised Hoek-Brown	1.5e+006	0.738765	0.0029283	0.501975

SLIDEINTERPRET 6.019

Project	SLIDE - An Interactive Slope Stability Program		
Analysis Description			
Drawn By CHJ Consultants		*Author* J. McKeown	*Scale* 1:3116
File Name C seis.slim		*Date* 11/1/2012	*Enclosure* C-6

APPENDIX "D"

BORING LOGS AND LABORATORY TEST DATA



Cobbles & Boulders	Gravel		Sand			Silt	Clay
	Coarse	Fine	Coarse	Medium	Fine		

Symbol	Boring No.	Depth (ft)	Classification	D_{10} (mm)	D_{30} (mm)	D_{50} (mm)	D_{60} (mm)	C_u	C_c	SE
●	1	0	(SM) Silty sand, fine to gravel to 2"		0.340	1.622	3.529			
■	2	0	(SP-SM) Sand with silt, fine to gravel to 2"	0.0592	0.516	2.563	6.123	103.492	0.735	

CHJ Consultants

GRAIN SIZE DISTRIBUTION

Project:	Slope Stability Investigation - White Knob Quarry		
Location:	Lucerne Valley, San Bernardino County, California		
Job Number:	12715-3	Enclosure:	D-1

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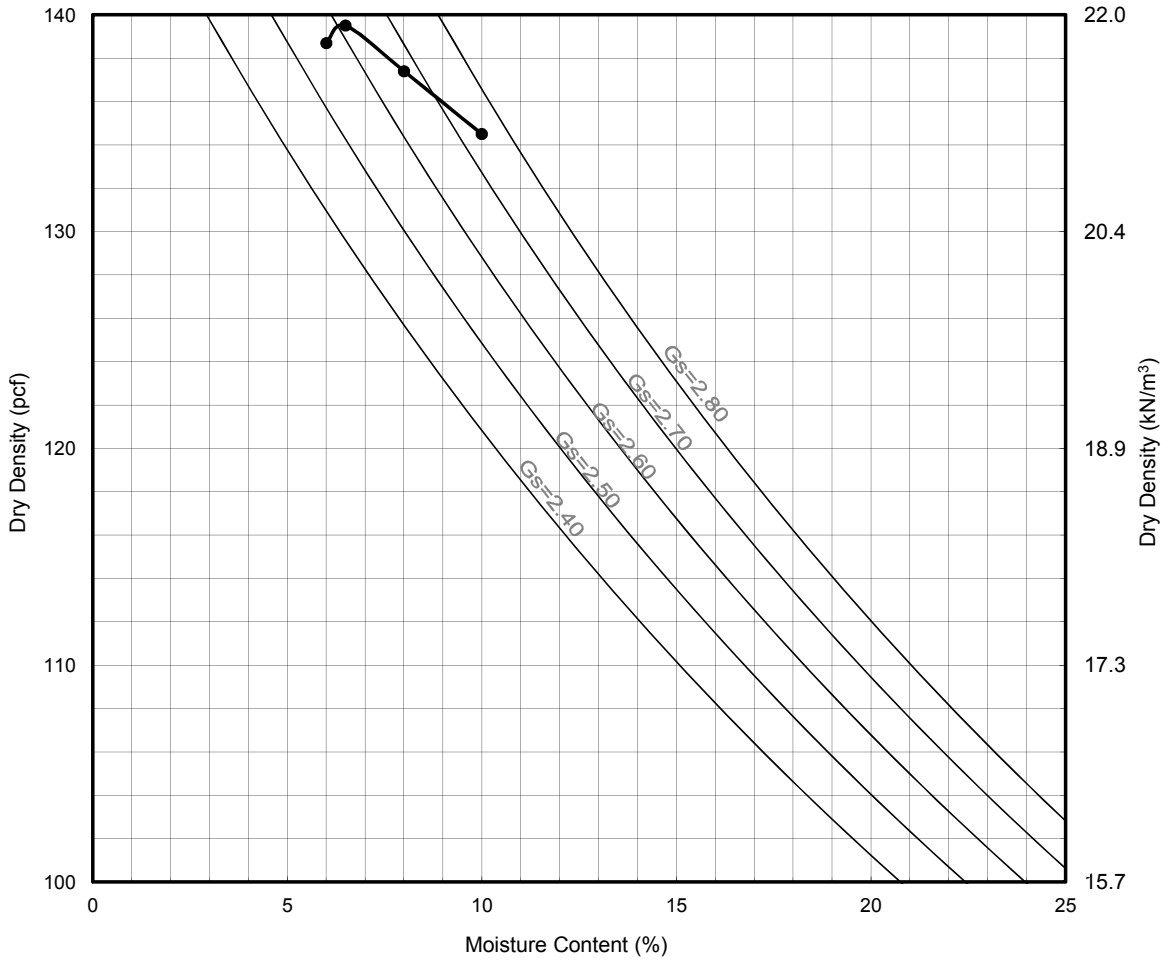
Optimum Moisture - Maximum Density Determination Test (ASTM D 1557)



Sample No.		Depth (ft)	Soil/Sample Type	γ_{max} (pcf)	w_{opt} (%)
●	1A+2A	0	(SM) Silty sand, fine to gravel	139.5	6.5

CHJ Consultants

MOISTURE-DENSITY RELATIONSHIP			
Project:	Slope Stability Investigation - White Knob Quarry		
Location:	Lucerne Valley, San Bernardino County, California		
Job No.:	12715-3	Enclosure:	D-2

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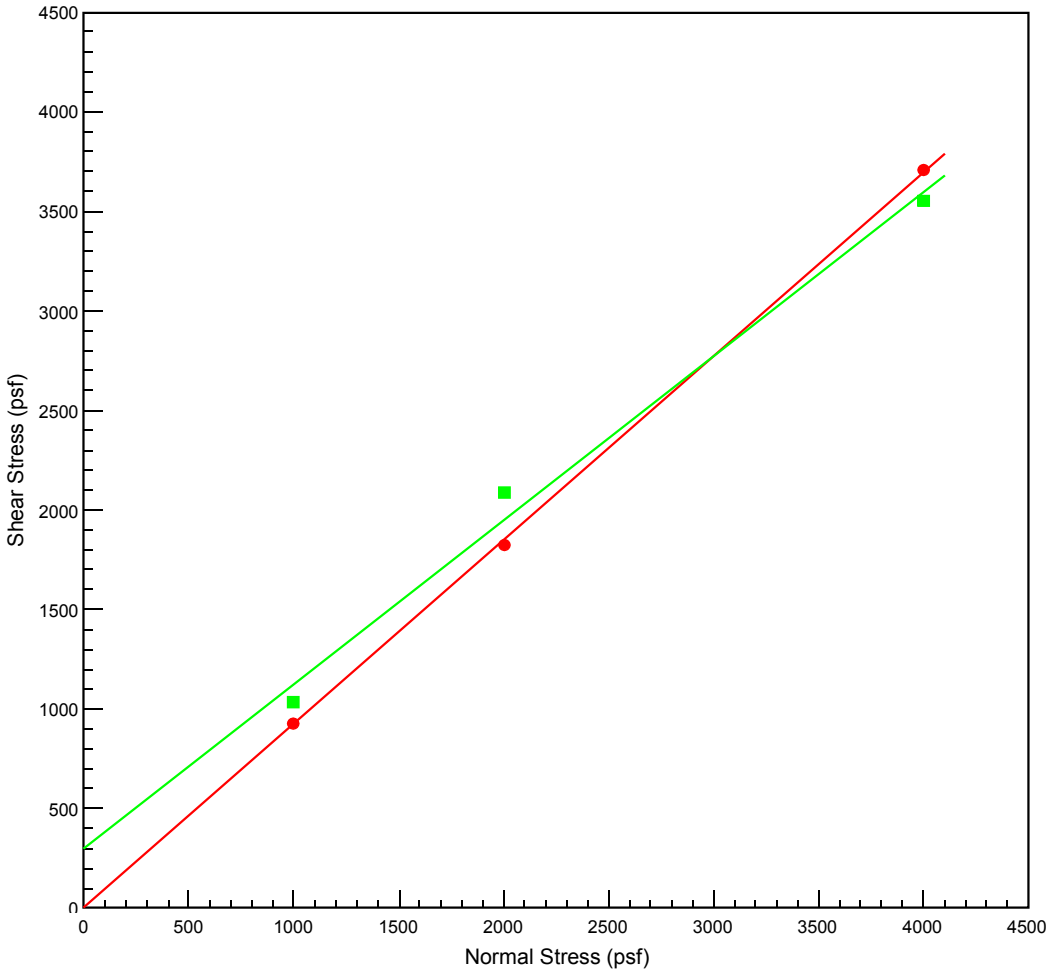
Direct Shear Test (ASTM D 3080)



Boring No.		Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC(%)	C (psf)	φ(°)
●	1	5	(SM) Silty sand, fine to gravel / 85% RC	118	7.5	0	42.7
■	2	5	(SP-SM) Sand with silt, fine to gravel / 85% RC	118	7.5	300	39.5

CHJ Consultants

DIRECT SHEAR TEST			
Project:	Slope Stability Investigation - White Knob Quarry		
Location:	Lucerne Valley, San Bernardino County, California		
Job No.:	12715-3	Enclosure:	D-3

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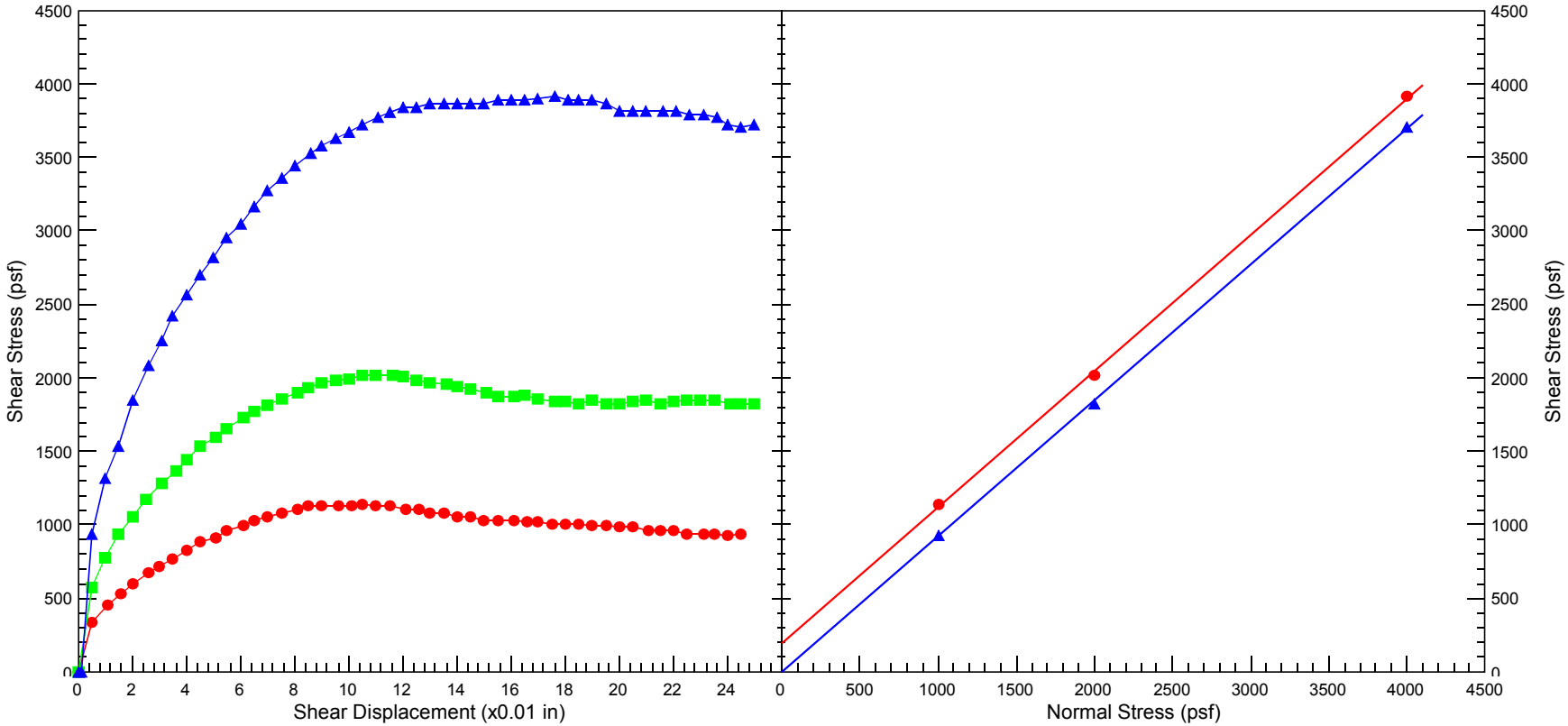

Boring No.		Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC (%)	C_{peak} (psf)	φ_{peak} (°)	C_{res} (psf)	φ_{res} (°)
●	1	5	(SM) Silty sand, fine to gravel / 85% RC	118.2	7.5	192	42.8	0	42.7

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DIRECT SHEAR TEST

Project:	Slope Stability Investigation - White Knob Quarry		
Location	Lucerne Valley, San Bernardino County, California		
Job Number	12715-3	Enclosure	D-4

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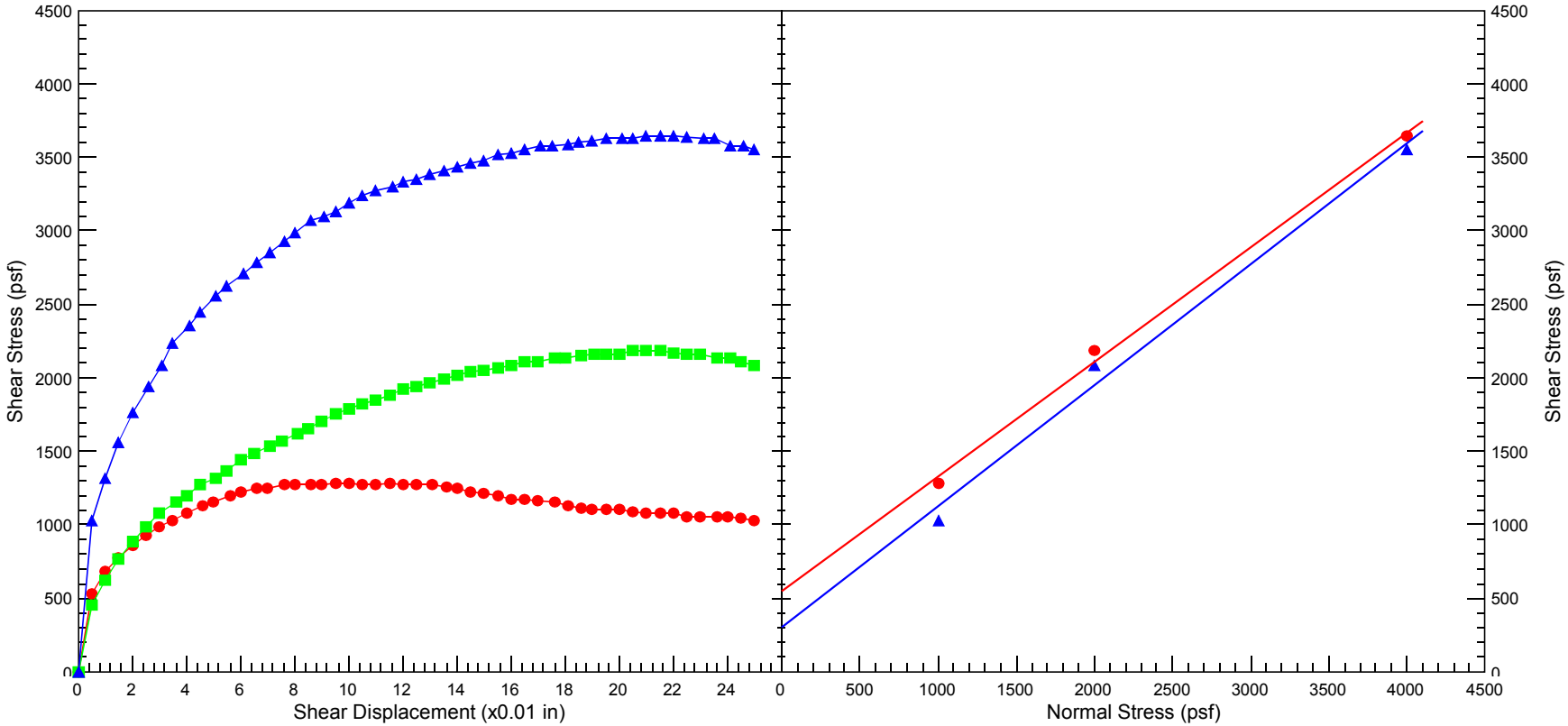

Boring No.		Depth (ft)	Soil/Sample Type	γ_d (pcf)	MC (%)	C_{peak} (psf)	φ_{peak} (°)	C_{res} (psf)	φ_{res} (°)
●	2	5	(SP-SM) Sand with silt, fine to gravel / 85% RC	118.2	7.5	552	38.0	300	39.5

CHJ Consultants

DIRECT SHEAR TEST			
Project:	Slope Stability Investigation - White Knob Quarry		
Location	Lucerne Valley, San Bernardino County, California		
Job Number	12715-3	Enclosure	D-5

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EXPLORATORY BORING NO. 1

Date Drilled: 7/13/07 Client: Webber & Webber Mining Consultants, Inc.

Equipment: B61 Mobile Drill Rig Driving Weight / Drop: 140 lbs./30 in.

Surface Elevation(ft): Logged by: JMZ Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
		(SM) Silty Sand, fine with medium to coarse, gravel and cobbles to 12", very light gray	Fill		▨		1.0		
5				☒		15 18 40	2.6	126	Ring
10				☒		7 10 13	2.1	130	Ring
15				☒		4 16 12	N.R.	N.R.	Ring
20				☒		11 7 10	2.6	117	Ring, DS
25				☒		10 11 10	2.5	116	Ring
30				☒		10 12 12	2.9	119	Ring

BORING LOG - NO EQUIV & BLOW PER 6 IN 07539-3.GPJ CHJ.GDT 8/15/07

C.H.J.

OMYA WHITE KNOB QUARRY
LUCERNE VALLEY, CALIFORNIA

Job No. 07539-8

Enclosure

EXPLORATORY BORING NO. 1

Date Drilled: 7/13/07 Client: Webber & Webber Mining Consultants, Inc.

Equipment: B61 Mobile Drill Rig Driving Weight / Drop: 140 lbs./30 in.

Surface Elevation(ft): Logged by: JMZ Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
		(SM) Silty Sand, fine with medium to coarse, gravel and cobbles to 4", light gray		X		10 11 16	2.9	113	Ring, DS
40				X		9 13 22	2.6	124	Ring
45				X		9 12 19	2.3	118	Ring
50				X		10 13 32	2.9	123	Ring
		END OF BORING NO BEDROCK, NO REFUSAL FILL TO 51.5', SLIGHT CAVING NO FREE GROUNDWATER							
55									
60									
65									

BORING LOG - NO EQUIV & BLOW PER 6 IN 07539-3.GPJ CHJ.GDT 8/15/07

C.H.J.

OMYA WHITE KNOB QUARRY
LUCERNE VALLEY, CALIFORNIA

Job No. 07539-8

Enclosure

EXPLORATORY BORING NO. 2

Date Drilled: 7/13/07 Client: Webber & Webber Mining Consultants, Inc.

Equipment: B61 Mobile Drill Rig Driving Weight / Drop: 140 lbs./30 in.

Surface Elevation(ft): Logged by: JMZ Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
		(SM) Silty Sand, fine with medium to coarse, gravel and cobbles to 4", light gray	Fill		▨		1.1		SA, MDC
5				☒		6 7 9	2.2	115	Ring
10				☒		7 5 6	2.4	Dist.	Ring
15				☒		3 4 8	1.9	114	Ring, DS
20				☒		6 10 25	1.7	128	Ring
25				☒		9 6 4	1.9	104	Ring, DS
30				☒		21 22 19	N.R.	N.R.	Ring

BORING LOG - NO EQUIV & BLOW PER 6 IN 07539-3.GPJ CHJ.GDT 8/15/07

C.H.J.

OMYA WHITE KNOB QUARRY
LUCERNE VALLEY, CALIFORNIA

Job No. 07539-8 Enclosure

EXPLORATORY BORING NO. 2

Date Drilled: 7/13/07 Client: Webber & Webber Mining Consultants, Inc.

Equipment: B61 Mobile Drill Rig Driving Weight / Drop: 140 lbs./30 in.

Surface Elevation(ft): Logged by: JMZ Measured Depth to Water(ft): N/A

DEPTH (ft)	GRAPHIC LOG	VISUAL CLASSIFICATION	REMARKS	SAMPLES DRIVE	SAMPLES BULK	BLOWS/6 IN.	FIELD MOISTURE (%)	DRY UNIT WT. (pcf)	LAB/FIELD TESTS
		(SM) Silty Sand, fine with medium to coarse, gravel and cobbles to 4", light gray		X		9 9 8	1.7	Dist.	Ring
40				X		8 8 28	0.8	121	Ring
45				X		10 12 38	2.9	114	Ring, DS
50				X		37 33 10	N.R.	N.R.	Ring
		END OF BORING NO BEDROCK, NO REFUSAL FILL TO 51.5', SLIGHT CAVING NO FREE GROUNDWATER							
55									
60									
65									

BORING LOG - NO EQUIV & BLOW PER 6 IN 07539-3.GPJ CHJ.GDT 8/15/07

C.H.J.

OMYA WHITE KNOB QUARRY
LUCERNE VALLEY, CALIFORNIA

Job No. 07539-8

Enclosure

APPENDIX G
HYDROLOGY AND WATER QUALITY

White Knob Haul Road Drainage Study and Plan of Development

Prepared for: Omya Incorporated

August 2011

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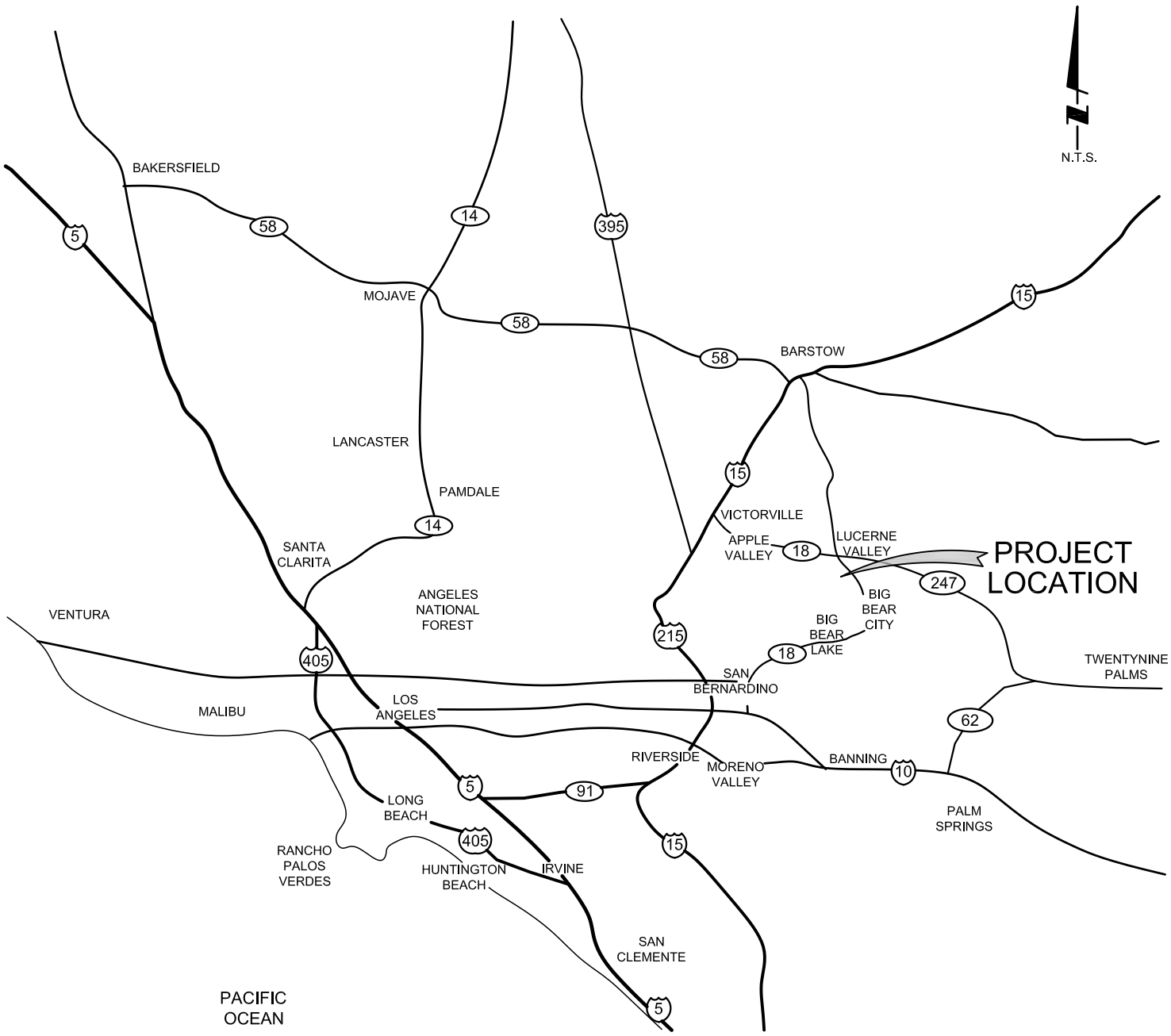
1.0 Background

Omya Incorporated operates a calcium carbonate mining and processing operation in San Bernardino County, south of the town of Lucerne Valley. Omya's plant is on Crystal Creek Road approximately 4 miles south of State Highway 18 (see Figure 1). The White Knob Quarry, where calcium carbonate is mined, is southwest of the plant in the San Bernardino National Forest. The haul road to bring materials mined at the White Knob Quarry to the plant is 5.1 miles long, going westerly from the plant for approximately 3.5 miles then turning southerly to climb at a 14% grade up to the quarry site (see Figure 2). Once in the quarry, the access road varies in grade from 12% to 18%.

The first 4.4 miles of the haul road crosses land managed by the US Department of Interior, Bureau of Land Management (BLM). Use and occupation of the haul road is authorized under a Federal Land Policy Management Act (FLPMA) right-of-way. On April 20, 2011 a Settlement Agreement was entered into by and between BLM and Omya regarding Omya's activities at the White Knob Quarry.

The Settlement Agreement has six separate remediation components (Parts A-F). Part B of the agreement is titled: "Repair, Remediate, and Monitor Improvements to the White Knob Quarry Right-Of-Way Access Road and Associated Facilities to Protect Drainages." The purpose of this Drainage Report and Plan of Development is to analyze the existing drainage conditions at the quarry and along the haul road and provide recommendations for facilities to control stormwater and sediment runoff and provide protection for the surrounding drainages. This report is intended to specifically comply with items 15 through 17 of part B of the agreement.



Project:	WHITE KNOB QUARRY
Description:	LOCATION MAP

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FIGURE 1

Job No.: 2042484500 Date: 07-29-2011

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TURNOUT 64

EXPLOSIVES STORAGE FACILITY

QUARRY

HAUL ROAD

PLANT SITE

SAN BERNARDINO NATIONAL FOREST

LEGEND

DRAINAGE AREA BOUNDARY

HAUL ROAD

GRAPHIC SCALE

1250 0 625 1250 2500 5000

(IN FEET)
1 inch = 2500ft.

Project:	WHITE KNOB QUARRY
Description:	SITE MAP

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FIGURE 2

Job No.: 2042484500 Date: 07-29-2011

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2.0 Drainage Study

2.1 EXISTING CONDITIONS

As stated above, the White Knob Quarry Haul Road is a 5.1 mile long roadway trending westerly and southerly from the Omya plant to the White Knob Quarry. The roadway averages 35 feet in width and is surfaced with aggregate base. Numbered turnouts are provided at about 1,000 foot intervals. The roadway is used primarily by large off-highway rock hauling trucks such as the Caterpillar 777D, which has a total width of 20 feet, and a maximum payload capacity of 100 tons. In compliance with Mine Safety and Health Administration protocols, earthen berms have been constructed on each side of the roadway at least as high as the axle of the largest trucks using the roadway (or about 4 feet for the Caterpillar 777D).

For about the first 2.5 miles going westerly from the plant, the haul road crosses an alluvial fan from three significant canyons with drainage areas of 2 to 8 square miles as shown on the USGS quadrangles for this area: Dry Canyon, Deep Canyon, and Silver Creek (see Site Map, Figure 2). Where the roadway crosses the major drainages, the road dips down to near the stream elevation and flow is allowed to go over the roadway, with no culverts provided. These types of crossings, commonly referred to as “Arizona Crossings,” are typically provided where the cost of raising the roadway and providing culverts/bridges is greater than the benefit of keeping the roadway open and lowering maintenance costs. These dip crossings have not been identified as areas of concern, and further investigation of these crossings is outside of the scope of this report.

In this stretch of the roadway, nine minor drainages are crossed where the roadway does not dip, and corrugated metal culverts ranging from 24 to 48 inches in diameter have been provided. The tributary area of these crossings is difficult to determine because of the nature of the alluvial fan. While a distinct drainage course is evident at the roadway, the drainage course, and the divide between drainage courses, tends to disappear within one or two thousand feet upstream of the roadway. This is very typical of alluvial fans in undeveloped areas, where there are several shallow drainage courses, and storm water from the main drainage can spread across a wide floodplain, entering the shallow drainages. While traditional hydrology methods would yield only minor amounts of runoff, overflow from the main drainage can result in significantly higher flows. That being said, these nine culverts have been in place for 24 years and according to quarry staff, there have not been capacity issues with these culverts. Based on this experience, as well as the nature of alluvial fans, the flows identified on the haul road improvement plans prepared in 1987 by Morrison Knudsen Engineers (see Appendix F) will be accepted for design of outlet riprap protection.

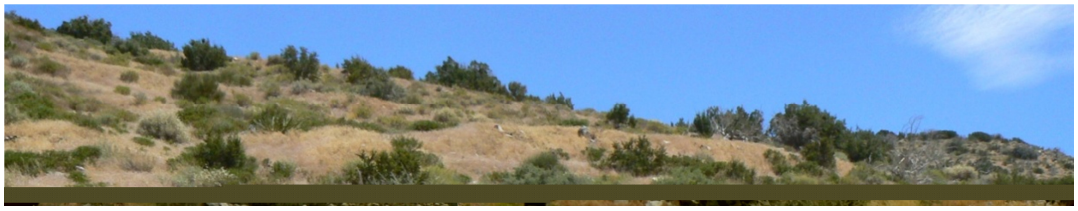
After crossing the main Silver Creek drainage, the roadway leaves the alluvial fan and starts to climb up to the quarry. Over the next mile of roadway five drainages are crossed. The first four drainages (nodes 30, 120, 230, and 330 as shown on the Hydrology Map in Appendix A) have

relatively small tributary areas ranging from 14 to 60 acres, and have existing 36 inch corrugated metal culverts to pass the storm flows under the haul road.

2.1.1 Turnout 64 Drainage

The fifth drainage is near the location mentioned in the background section where the haul road turns southerly to climb up to the quarry (see also node 465 on the Hydrology Map in Appendix A). The turnout just south of this crossing is number 64, which is used as a common identifier of this crossing. The tributary area at this crossing is 191.37 acres, and an existing 84 inch corrugated metal culvert is in place to pass storm flows under the haul road.

While this culvert primarily carries runoff from natural areas, it also carries runoff from about 0.8 miles of the haul road, accounting for 30.13 acres of the total drainage. Alongside this stretch of haul road are four debris catchment basins intended to remove sediment and debris from the storm flow before leaving the roadway. All four of these basins have existing spillway structures, two of them comprising of left over truck scale parts, and the other two being constructed of half pipes set in concrete.



Half pipe spillway structure

The invert of the 84 inch culvert is approximately 50 feet below the grade of the roadway, and storm flow leaving the roadway appraoching the culvert inlet has eroded a channel that is eight feet below the surrounding grade in some locations with a portion of the sidewalls being nearly vertical.

Erosion in channel from roadway to culvert inlet near turnout 64

Material that has eroded from this channel is evident in the area around the culvert inlet.

Inlet of 84 inch CMP near turnout 64

2.1.2 Quarry Drainage

The final drainage area in this report is that which includes the majority of the quarry itself as well as the upper portion of the haul road (Drainage to node 750 on Hydrology Map in Appendix A). The operation of the quarry over the years has led the natural drainage on to the haul road at the south-central portion of the quarry. Storm water then flows in the road for about 0.6 miles until it is able to leave the roadway in the vicinity of the existing explosives storage facility (at node 440 on the Hydrology Map). The tributary drainage area at this point is 350.81 acres; of which approximately 25.4 acres is disturbed (haul road and a portion of the quarry).

As with the turnout 64 drainage, there are four existing debris catchment basins intended to remove sediment and debris from the storm flow before leaving the roadway. However none of the basins in this drainage have been provided with spillways. Quarry staff indicates that overflow and failure of the basins has occurred, sending the sediment and debris downstream to the next basin or on to the natural stream course.

The northerly portion of the quarry is tributary to a natural stream that confluences with the flow from the roadway at a point (node 750 on the Hydrology Map in Appendix A) about 0.6 miles downstream of the roadway. The total area at this confluence is 638.31 acres. This northerly portion of the quarry is also the area where active mining is taking place, resulting in a depressed area that does not contribute to surface flows from the site. While this area will be included in the overall hydrology calculations, sediment and debris flow offsite from this part of the quarry is assumed to be negligible.

2.2 HYDROLOGY CALCULATIONS

All hydrologic calculations were performed in accordance with the latest version of the San Bernardino County Hydrology Manual. Since all drainages studied are smaller than 640 acres in size, the rational method was used for all calculations. CIVILDESIGN engineering software (Version 7.0) was utilized for the project hydrology analyses.

2.2.1 Rational Method

The Rational Method is applicable when the rainfall intensity can be assumed to be uniformly distributed over the entire drainage area. Beyond the 640 acre limit, rainfall data may vary considerably from one point to another and the use of the Rational Method will yield inappropriate results (San Bernardino County Hydrology Manual Section D.2 “Limitations of Rational Method”).

The Rational Method equation relates rainfall intensity, a runoff coefficient, and drainage area size to the peak runoff from the drainage area. This relationship is expressed by the equation:

$$Q = CIA$$

Where,

Q = the peak discharge in cubic feet per second (cfs)

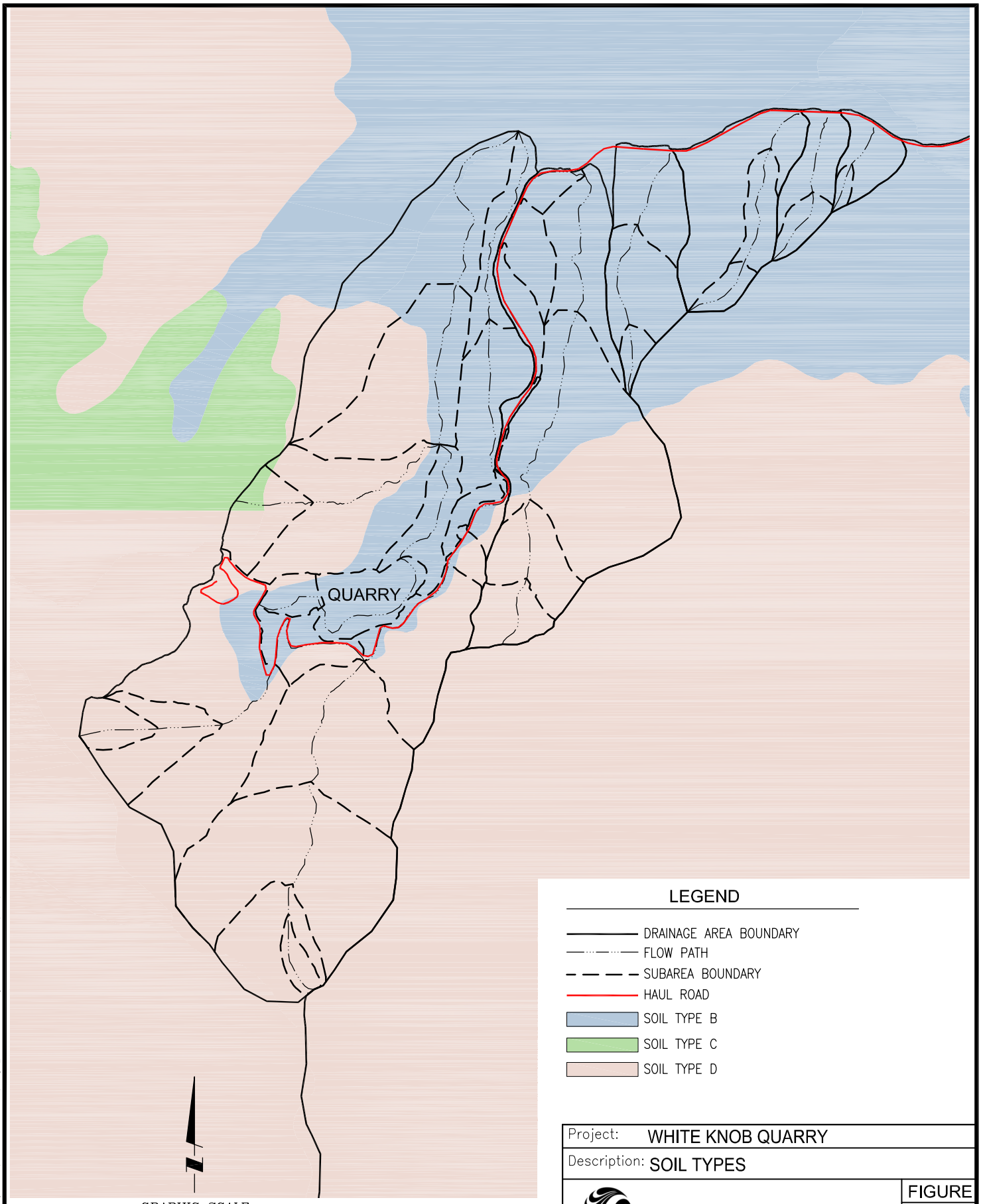
C = a runoff coefficient representing the ratio of runoff depth to rainfall depth (dimensionless)

I = the time-averaged rainfall intensity for a storm duration equal to the time of concentration (inches/hour)

A = drainage area (acres)

The runoff coefficient is based on soil types, type of ground cover, and the Antecedent Moisture Condition (AMC). Soil types for this study were obtained from the US Department of Agriculture Natural Resources Conservation Service’s Web Soil Survey (http://websoilsurvey.nrcs.usda.gov /app/WebSoilSurvey.aspx). Soil types used in the drainage calculations include Type B, C and D (the dominant soil types used were Type B and D). Hydrologic soil classifications range from Type A to Type D, where D is the least pervious. Figure 3 shows the soil types from the Web Soil Survey overlain by the project drainage areas.

The land use for the study area is undeveloped with no appreciable impervious areas. The only disturbed areas in the drainages are the quarry and the haul road. For areas above the quarry, the ground cover was assumed to be average, while the ground cover in the quarry and downstream of the quarry was assumed to be poor. Based on the recommendations in the San Bernardino Hydrology Manual AMC II was used for 2-year, 10-year, and 25-year calculations and AMC III was used for the 100-year calculation.



Project: WHITE KNOB QUARRY

Description: SOIL TYPES

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FIGURE 3

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Rainfall intensity was based on the National Oceanic and Atmospheric Administration's Precipitation Frequency Data Server Atlas 14 (http://hdsc.nws.noaa.gov/hdsc/pfds/). A point near the centroid of the drainage area was selected and one hour rainfall rates entered into the CIVILDESIGN software. Rainfall intensities for other time periods are then based on the slope of the intensity duration graph. For desert and mountain areas in San Bernardino County a value of 0.7 is used for the slope of this graph. Two different locations were selected for rainfall intensities, one for the quarry and turnout 64 drainages, and another for the four smaller culverts east of turnout 64. The intensities used are summarized below:

	One Hour Rainfall Depth	
Return Frequency (years)	**Quarry and Turnout 64 Drainages**	**Smaller Culvert Drainages**
2	0.491	0.45
10	0.811	0.745
25	1.03	0.944
100	1.39	1.28

Tributary drainage areas were determined from topographical maps of the area. A hydrology map was prepared to show the overall drainage areas, subareas, and nodes. This map is included in Appendix A of this report. This Hydrology Map shows the drainages for which detailed calculations were prepared. As mentioned in Section 2.1, the flows identified on the 1987 improvement plans in Appendix F will be accepted as the design flows for the first nine culverts heading easterly from the Plant Site.

2.2.2 Results

Hydrology calculations were performed using the CIVILDESIGN software for the drainages shown on the hydrology map for return frequencies of 2-, 10-, 25-, and 100-year storms. Following is a summary of results at key nodes in the study:

Node	Description	Tributary Area (Ac)	2-year Flow (cfs)	10-year Flow (cfs)	25-year Flow (cfs)	100-year Flow (cfs)
30	Culvert Crossing at Station 144+70	14.26	14.8	28.6	37.9	57.1
120	Culvert Crossing at Station 150+40	21.41	17.9	35.8	48.0	73.9
230	Culvert Crossing at Station 154+20	59.56	35.2	76.6	104.8	167.4
330	Culvert Crossing at Station 170+50	50.27	28.9	63.4	86.9	139.2
420	Flow From Offsite at Southernmost Basin	173.90	146.9	283.1	377.3	570.5
420	Flow From Quarry Road at Southernmost Basin	124.97	98.3	185.9	246.3	379.1
425	Flow in Haul Road	336.02	244.3	471.1	636.9	983.6
440	Flow Exiting Haul Road Near Explosives Storage	350.81	244.3	471.1	636.9	983.6
445	Flow in Haul Road Just North of Explosives Storage	0.53	0.7	1.3	1.7	2.4
455	Flow in Haul Road	11.85	3.2	10.7	16.0	28.4
465	Flow in Haul Road Near Culvert at Station 182+00	30.13	5.5	21.9	34.0	63.2
465	Culvert Crossing at Station 182+00	191.37	128.0	262.8	358.6	559.8
750	Downstream Confluence	638.31	399.6	774.9	1046.9	1609.1

Full results of the hydrology calculations are in Appendix B of this report.

2.3 DEBRIS PRODUCTION CALCULATIONS

Debris production calculations for this report utilize the methods outlined in the Los Angeles County Department of Public Works Sedimentation Manual, 2nd Edition. This method determines the debris production for a Design Debris Event, which is defined as the quantity of sediment produced by a saturated watershed significantly recovered from a burn (after four years) as a result of a 50-year, 24-hour rainfall amount. The project is on the north facing slope of the San Bernardino mountain range above the Lucerne Valley. For purposes of debris production, this area is assumed to be similar to the north facing slope of the San Gabriel mountain range above Antelope Valley.

The first step in calculating the expected debris potential is to determine the Debris Production Area (DPA) zones covered by the drainage. Using the Valyermo and Mescal Creek quadrangle maps in Appendix A of the LA County Sedimentation Manual, upper slope areas are in DPA zones 3 and 5, and the lower elevations are in DPA zones 8 and 9. The delineation between upper slopes and lower elevations varies from elevation 4500 to 5000.

Based on field observations and comments from quarry staff, the undisturbed land surrounding the quarry and haul road has relatively light debris production. Because of this, undisturbed areas will be assumed to be in DPA zone 9 and disturbed areas (quarry and haul road) will be assumed to be in DPA zone 5.

There are eight existing debris basins along the haul road from the quarry site to the drainage near turnout 64. According to quarry staff, the upper basins, from the quarry to the area near the explosives storage facility, routinely fill up with debris, fail, and allow debris to flow down to the next basin. These four basins are not provided with overflow spillways, which seem to be the primary cause of these failures. The four basins between the explosives storage facility and turnout 64 have not experienced failure, and are provided with spillway structures.

Because of this experience, the debris production calculations will be performed for two major areas, the entire area tributary to the two basins near the explosives storage facility, and the area between these two basins and turnout 64. The location of the explosives storage facility is also a logical breaking point in the study because at this point the drainage can easily leave the roadway and return to its natural drainage course.

The drainage tributary to the basins near the explosives storage facility is 350.81 acres, of which 25.40 acres is disturbed (a portion of the quarry and the haul road). Using the above assumptions for Debris Production Areas, this drainage area can be expected to produce 7,729 cubic yards of debris and sediment (3,254 cubic yards from the disturbed area and 4,475 from the undisturbed area).

The drainage tributary to the haul road from the explosives storage facility to turnout 64 is 30.13 acres, of which 3.62 acres is disturbed. Debris production from this area is expected to be 1,147 cubic yards of debris and sediment (464 cubic yards from the disturbed area and 683 from the undisturbed area).

Backup for the debris production calculations is included in Appendix C of this report.

2.4 CULVERT HYDRAULICS

Culvert capacities were checked using the Federal Highway Administration's HY-8 computer program (version 7.2). All of the culverts have sufficient capacity to pass the design storm (10 year return frequency) with one exception. Stationing callouts are based on the roadway stationing as shown on the Haul and Access Road Improvement Plans in Appendix F. The existing culvert at haul road station 54+35 has minimal cover, and overtops the roadway in the 10 year return frequency storm.

Following is a summary of the culvert data:

Station	CMP Culvert Size (in)	10 Yr. Flow (cfs)	Headwater Depth (ft.)	Outlet Velocity (fps)	Overtopping?
17+70	24	20	3.27	8.63	No
19+00	48	90	5.02	15.21	No
43+50	24	20	3.27	8.46	No
49+35	36	50	4.35	12.93	No
54+35	36	50	3.29	11.5	Yes
57+75	48	90	5.02	10.03	No
62+30	24	20	3.27	9.07	No
88+15	24	20	3.27	10.49	No
90+00	24	20	3.27	10.06	No
144+70	36	28.6	2.63	15.06	No
150+40	36	35.8	3.11	14.21	No
154+20	36	76.6	7.73	20.61	No
170+50	36	63.4	5.91	17.95	No
182+00	84	262.8	6.59	26.27	No

Full HY-8 results are included in Appendix D.

2.5 ROADWAY FLOW HYDRAULICS

Similar to the debris production calculations, roadway flow hydraulics were checked for two distinct sections of the haul route roadway. For both sections, a roadway width of 35 feet was assumed, with a constant cross fall of 2%. As stated earlier, Mine Safety and Health Administration protocols require that earthen berms be provided on each side of the roadway at least as high as the axle of the largest trucks using the roadway (or about 4 feet for the Caterpillar 777D). This berming was included in the typical section used for the calculations (see Figure 4). The irregular channel analysis option in the CIVILDESIGN program was used to determine the normal depth and velocities of flow for the 2-, 10-, 25-, and 100-year return frequencies.

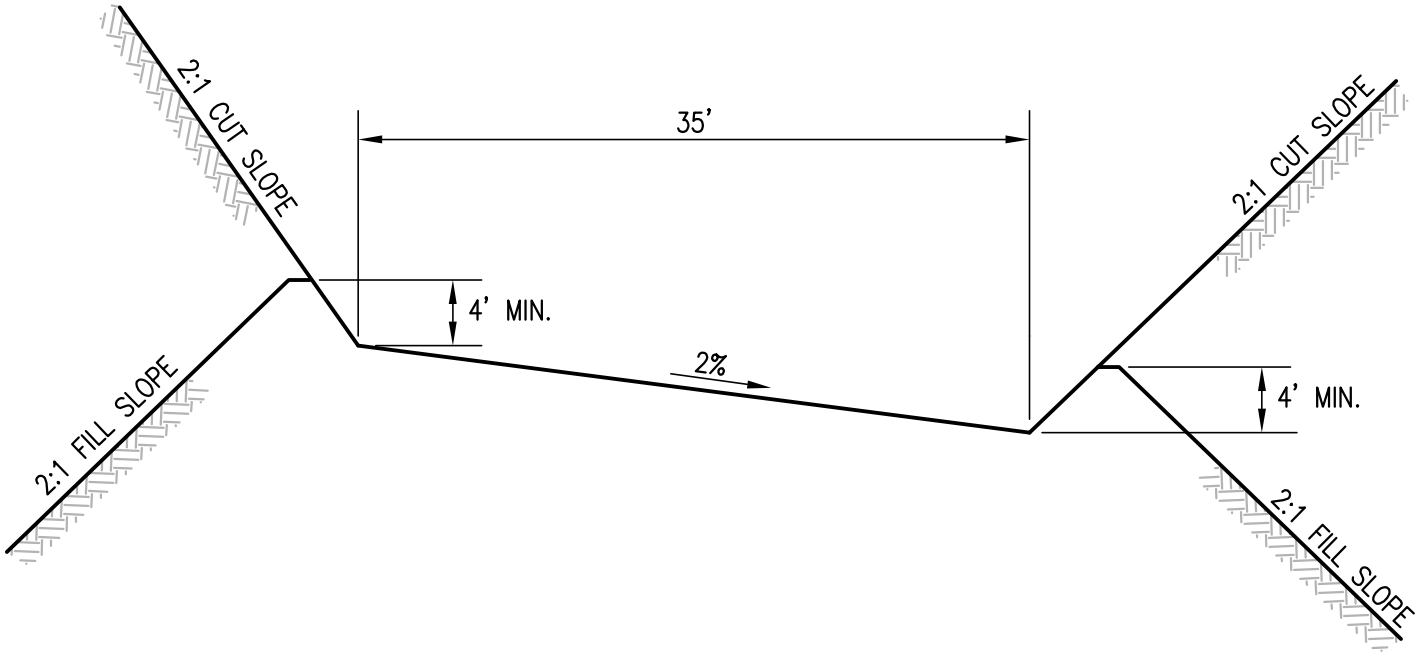
The first section is the upper haul road, from the quarry to the explosives storage site. This section of roadway carries significant flow from upstream as well as runoff from the quarry site and the haul road itself. The hydrology calculations indicate that, because of the size of the drainage, the predicted flow rates are fairly constant along this stretch of roadway. Following is a summary of results from the hydraulic calculations for this stretch of roadway:

Return Frequency (years)	Flow (cfs)	Depth (feet)	Velocity (fps)
2	244.3	0.96	10.91
10	471.1	1.26	14.00
25	636.9	1.44	15.66
100	983.6	1.76	18.37

The second section of haul route roadway continues downhill from the explosives storage site to the culvert near turnout 64. Major offsite flows upstream are allowed to flow through the basins near the explosive storage site, and then continue offsite. So for this section of roadway the majority of the flow comes from the road itself. The hydrology calculations indicate that the flow is constantly increasing along the length of this roadway. Because of that the design flows will be taken at the downstream end of this stretch of roadway. Following is a summary of results from the hydraulic calculations for this stretch of roadway:

Return Frequency (years)	Flow (cfs)	Depth (feet)	Velocity (fps)
2	5.5	0.23	3.78
10	21.9	0.40	5.33
25	34.0	0.47	5.95
100	63.2	0.59	6.95

Full CIVILDESIGN roadway hydraulic calculations results are included in Appendix E.



STREET TYPICAL FLOW SECTION

NOT TO SCALE

Project:	WHITE KNOB QUARRY
Description:	STREET TYPICAL FLOW SECTION

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FIGURE 4

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3.0 Plan of Development

The Settlement Agreement between BLM and Omya, Sections 15, 16, and 17 require the following:

15. Plan of Development. In connection with such right-of-way application, OMYA shall prepare a Plan of Development ("Plan of Development") that implements measures to assure that run-off and sediment accumulated in catchment basins do not enter into or adversely affect wildlife habitat within any active stream drainage. At a minimum, these measures are to include:

    a) The road surface shall be graded and sloped into the inside margin of the right-of-way. No carbonate materials shall be used to surface the road.

    b) Along the inside margin, a drainage ditch shall be constructed to an adequate capacity to concentrate and allow free flow of drain water from both road surface and slope wash from adjacent upland areas.

    c) The ditch shall be maintained to assure free flow of water and debris along its length. A catchment basin system shall be constructed of earthen materials and located immediately above (upslope) of an active drainage within the inside margin of the road. The basin system shall be designed to prevent discharge of sediment into the drainages and shall be incorporated into the Right-of-Way Plan of Development. All catchment basin system earthwork structures located on the downstream side of the structure shall have a concrete weir, or tile or steel culvert imbedded in the structure to assure that rain water overflow will pass through the catchment basin without eroding earthworks and emptying earthwork materials or aggregated debris into drainages. The catchment basin system will be cleaned of accumulated debris whenever the volume remaining cannot contain the sediment load.

16. The Plan of Development shall also contain measures to assure that free flow of water is maintained within drainage channels and erosion is maintained at or near a natural level which at a minimum are to include:

    a) Rip-rap shall be placed at the outflow end of each culvert where the road crosses an active drainage.

    b) Rip-rap shall be of a size and shape and distributed over an adequate area to an adequate depth down drainage from the outflow end of each culvert to assure adequate armor and protection during periods of high rainfall.

17. The Plan of Development shall also contain measures to assure that the use and occupation of public land for rights of way purposes related to the transport of equipment, ore, and personnel to the mine site from the mill and administration site are limited to those authorized on public land and at a minimum are to include:

a) A clear definition of the area of use and occupation, and such technical standards as are likely to assure that use and occupation is consistent with best business practices and will prevent unnecessary or undue degradation to public lands and drainages.

b) Measures and action items to reclaim the unoccupied or unauthorized areas of the right of way as nearly as practicable to the condition that existed prior to construction.

The discussion that follows is intended to comply with these requirements through analysis of the data provided in the Drainage Study and making recommendations regarding features to be constructed or revised in order to meet the intent of the Settlement Agreement.

3.1 ROADWAY GRADING AND DITCH

3.1.1 Analysis

As shown in Section 2.5 of this report, the existing roadway section has adequate capacity to carry the 100-year return flow within the roadway section. This capacity is based on the section shown in Figure 4, which includes the 4 foot high berms on each side of the roadway as required by Mine Safety and Health Administration protocols. In the upper portion of the haul road, the 10-year design flow is 1.26 feet deep, which allows for 2.76 feet of freeboard.

With the amount of debris being carried in the flow, some turbulence is to be expected. However given the shallow depth of flow relative to the width, a full hydraulic jump is not likely. Because of this, freeboard above the conjugate depth would not be a concern for flow in the roadway. Conjugate depths refer to the depths upstream and downstream of the hydraulic jump whose momentum functions are equal for a given flow. The subcritical depth downstream of a hydraulic jump is often significantly greater than the supercritical depth upstream.

The Settlement Agreement requires construction of a ditch along the side of the roadway to "concentrate and allow free flow of drain water from both road surface and slope wash from adjacent upland areas."

Using the 10-year design flow of 471.1 cfs, a riprap lined channel to carry this flow would need to be a trapezoidal channel with a 5-foot base width and 2:1 side slopes. Normal flow in this channel would be supercritical with a depth of 2.36 feet, and the normal velocity is 20.6 feet per second. Because of the narrower channel, a hydraulic jump caused by debris in the channel is more likely, so freeboard would need to be provided from the conjugate depth. The conjugate depth at the design flow is approximately 5.8 feet, meaning the channel would need to be 7 feet deep to contain the design flow. The total top width of this channel would then be 33 feet. Lining the ditch with concrete increases the velocity of flow to over 40 feet per second, and results in a conjugate depth of 9.8 feet.

3.1.2 Recommendations

Because of the large quantity of flow in the upper haul road, providing a separate channel to convey storm water would require essentially doubling the width of the road surface, with 35 feet for the road and 33 feet for the drainage ditch. Since there would be a steep drop off into the ditch from the roadway, Mine Safety and Health Administration protocols would require that an earthen berm at least as high as the axle of the largest trucks using the roadway be provided to prevent trucks from running into the ditch. This would also prevent runoff from the roadway surface from entering the ditch. Further complicating matters, for the upper portion of the haul road, sediment catchment basins are on both sides of the roadway, so this deep channel would need to be able to cross from one side of the roadway to the other.

Because of the above discussion, we do not recommend that a separate roadside ditch be constructed for this roadway. Quarry staff has stated that they are aware of the potential for storm damage to the roadway surface, and that they have adequate equipment on site to make repairs as needed. The earthen berms that are required for truck safety are adequate to contain both the design flow and the 100-year flow within the roadway with over two feet of freeboard.

Our recommendation is that the road be graded with a 2% cross fall. Which side of the road would be the low side of the roadway would be predicated on which side the next downstream catchment basin is on. The road surface should be an aggregate base course, free of calcium carbonate materials such as is currently being used by quarry staff. The four foot high earthen berms should continue to be provided, with the exception of breaks in the berms at the sediment catchment basins to allow stormwater and debris to flow in to the basins. A typical cross section of the roadway should be as shown on Figure 4 in Section 2.5 of this report.

3.2 SEDIMENT CATCHMENT BASINS

3.2.1 Analysis

In Section 2.3 of this report, the expected debris production volumes were identified as 7,759 cubic yards in the portion of the roadway tributary to the explosive storage site and 1,169 cubic yards for the roadway between this point and the culvert near turnout 64. There are eight existing sediment catchment basins intended to capture this volume of debris.

The locations of these basins, as well as two locations identified in a site visit as potential basin locations, are shown on a key map on Figure 5. On this map, basins 2 and 10 are the potential new basin locations, and the rest are existing basin locations. Figures 6 through 13 show the existing conditions at the eight existing basins. Each figure includes the depth and volume of the basin in its current configuration.

The upper portion of the haul route, between the quarry and the explosive storage site, currently passes through existing basins 1, 3, 4, and 5. The depths and volumes for these basins are summarized below:

Basin	Depth (ft)	Volume (CY)
1	5	280
3	14	840
4	14	1,690
5	10	470
Total Volume		3,280

The total volume of these basins of 3,280 cubic yards is less than half of the predicted debris generation volume of 7,729 cubic yards. This agrees with the experience of quarry staff that these basins routinely fill up and see failure of the basins.

The lower portion of the haul route, between the explosive storage site and the culvert at turnout 64, currently passes through basins 6, 7, 8, and 9. The depths and volumes for these basins are summarized below:

Basin	Depth (ft)	Volume (CY)
6	12	520
7	12	490
8	7	200
9	8	240
Total Volume		1,450

The total volume of these basins of 1,450 cubic yards compares favorably with the predicted debris generation volume of 1,147 cubic yards. This confirms the experience quarry staff that these basins have not experienced problems with capacity or failure.

3.2.2 Recommendations

As mentioned above, capacity problems are apparent for the basins servicing the upper portion of the haul road. Because of this we are recommending revisions to all four of the existing basins as well as grading to provide a fifth basin. Four of the basins should be provided with a concrete spillway sized to allow for overflow of the 10-year design storm without failure of the basin embankment. A typical spillway with preliminary sizing for these basins is shown in Figure 14.

Basin 1 is in a confined location with steep slopes and the existing roadway bordering the basin. This makes any expansion of the basin very difficult. Some additional volume may be possible by excavating deeper in this location, but the volume to be gained would be minimal, and maintenance of the basin would be more difficult. Because of this, our only recommendation for this basin is to provide a spillway as shown on Figure 15.

Basin 2 is a new recommended basin with the configuration as shown on Figure 16. The bottom of the basin is kept at a maximum grade of 10% to make maintenance of the basin easier. The basin is situated so that flow will enter the basin until the basin is full. At this point the flow will cease to enter the basin and remain in the roadway. Because of this Basin 2 will not be provided with a spillway. The volume of Basin 2 is 960 cubic yards.

Basin 3 is in a confined location similar to Basin 1. The bottom of the basin is already steeper than 20%, so deepening of the basin in place is not an option. Because of this, our only recommendation for this basin is to provide a spillway as shown on Figure 17.

Basins 4 and 5 are located in an area with the greatest opportunity to gain additional volume. These basins are located at the explosive storage site, and are adjacent to areas that are planned to be abandoned and reclaimed to their pre-disturbed state. These basins are close enough together that their grading will be combined in to a single grading operation as shown on Figure 18. A bench for continued access to the reclaimed area is provided on the west side of Basin 4. A spillway from Basin 4 drains directly to the bottom of Basin 5. The spillway for Basin 5 returns flow to the natural stream course. The new volume for Basin 4 is 2,420 cubic yards and the new volume for Basin 5 is 3,690 cubic yards. As with Basin 2, the bottoms of both of these basins are kept at a maximum grade of 10% to make maintenance of the basins easier. Detailed grading of basin 4 is shown on Figure 19 and detailed grading of Basin 5 is shown on Figure 20.

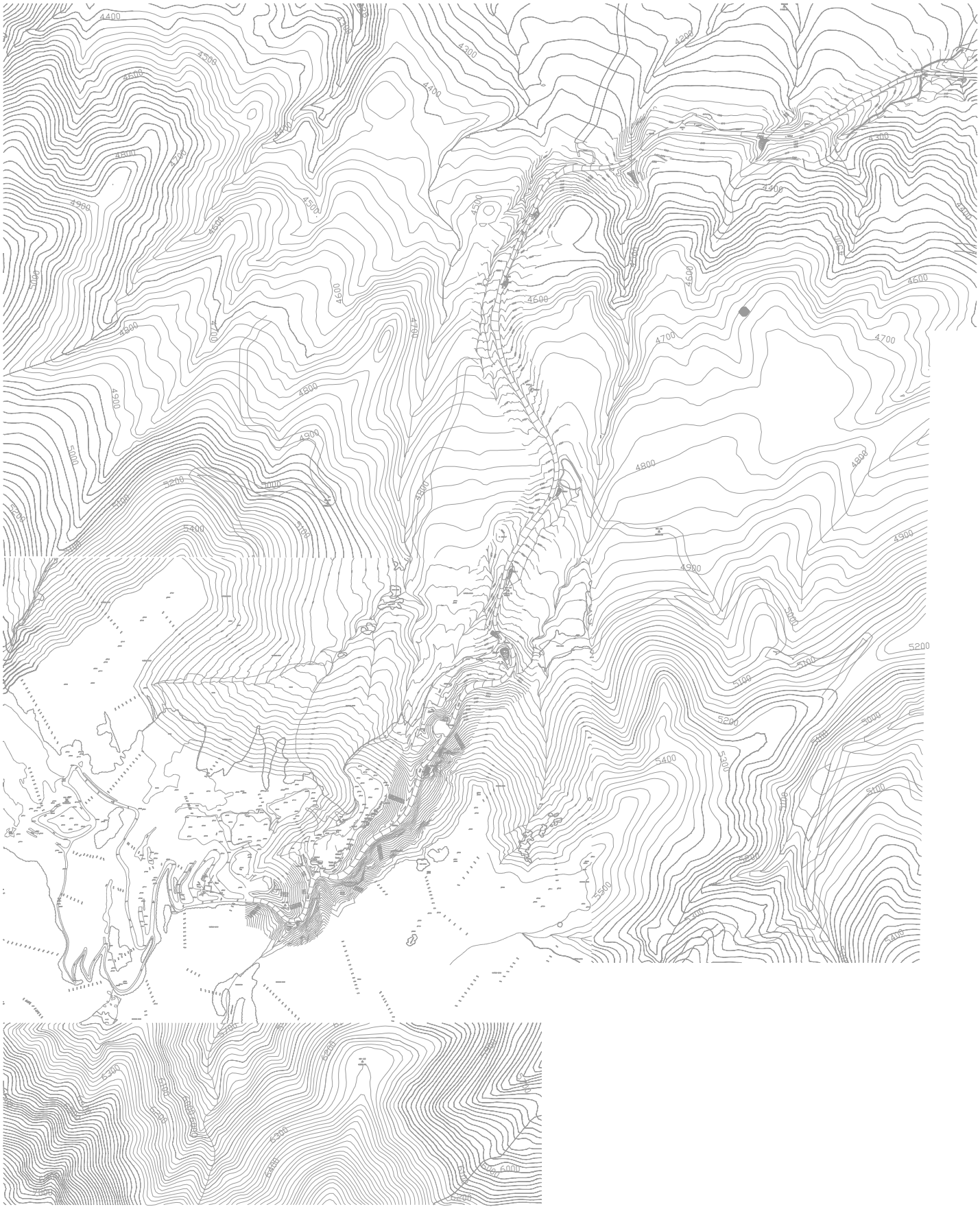
After the recommended improvements, the basins in the upper portion of the haul route can be summarized as follows:

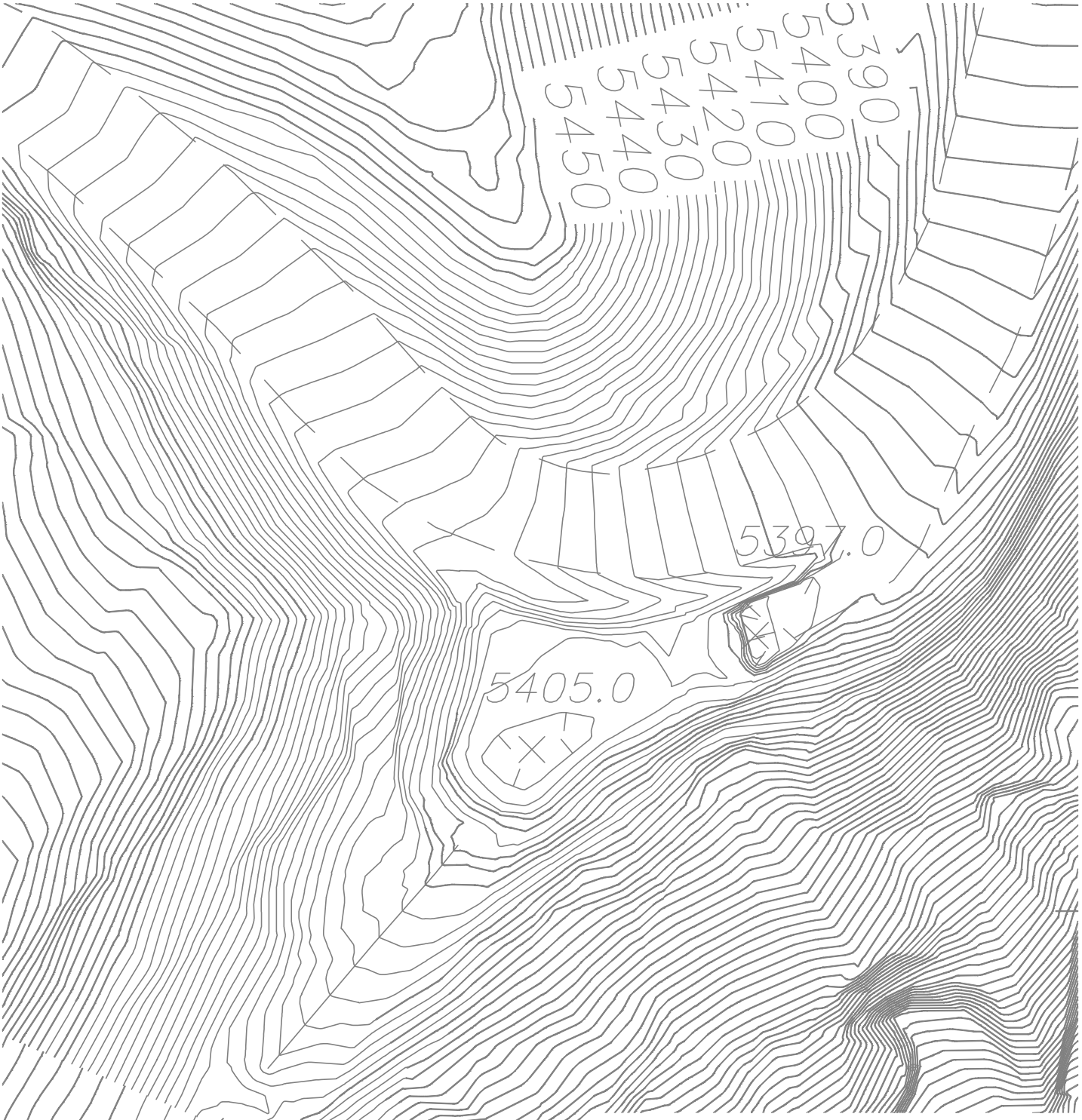
Basin	Spillway Crest	Proposed Volume
1	5410	280
2	N/A	960
3	5163	840
4	5007.5	2,420
5	4974.5	3,690
Total Volume		8,190

The total volume of these basins of 8,190 cubic yards compares favorably with the predicted debris generation volume of 7,729 cubic yards.

Since Basins 6 through 9 already have sufficient capacity as well as spillway protection, we do not recommend any changes to these basins. However we do recommend that a new basin be constructed at location 10. Basin 9 is about 1,000 upstream from where the flow would leave the roadway toward the inlet to the 84 inch pipe near turnout 64. Since the flow can pick up additional debris in this stretch, we recommend that Basin 10 be graded as shown on Figure 21. In addition to debris capture, the spillway from this basin along with some riprap protection will help to stabilize the slope area that is mentioned in Section 2.1.1 of this report.

The proposed grading shown on Figures 15 through 21 is intended to show the intended locations and configurations of the basins. The finished basins may vary from these configurations based on field conditions as long as the volume of the basins are the same or larger, the relationship between the basin inlet and the spillway crest are the same, the spillway size is at least as large as shown, and the proposed grading is within the Right of Way.





BASIN NO. 1

DEPTH = 5 FT.

VOLUME = 280 C.Y.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 40 ft.

Project:	WHITE KNOB QUARRY
Description:	EXISTING SEDIMENTATION BASIN NO. 1

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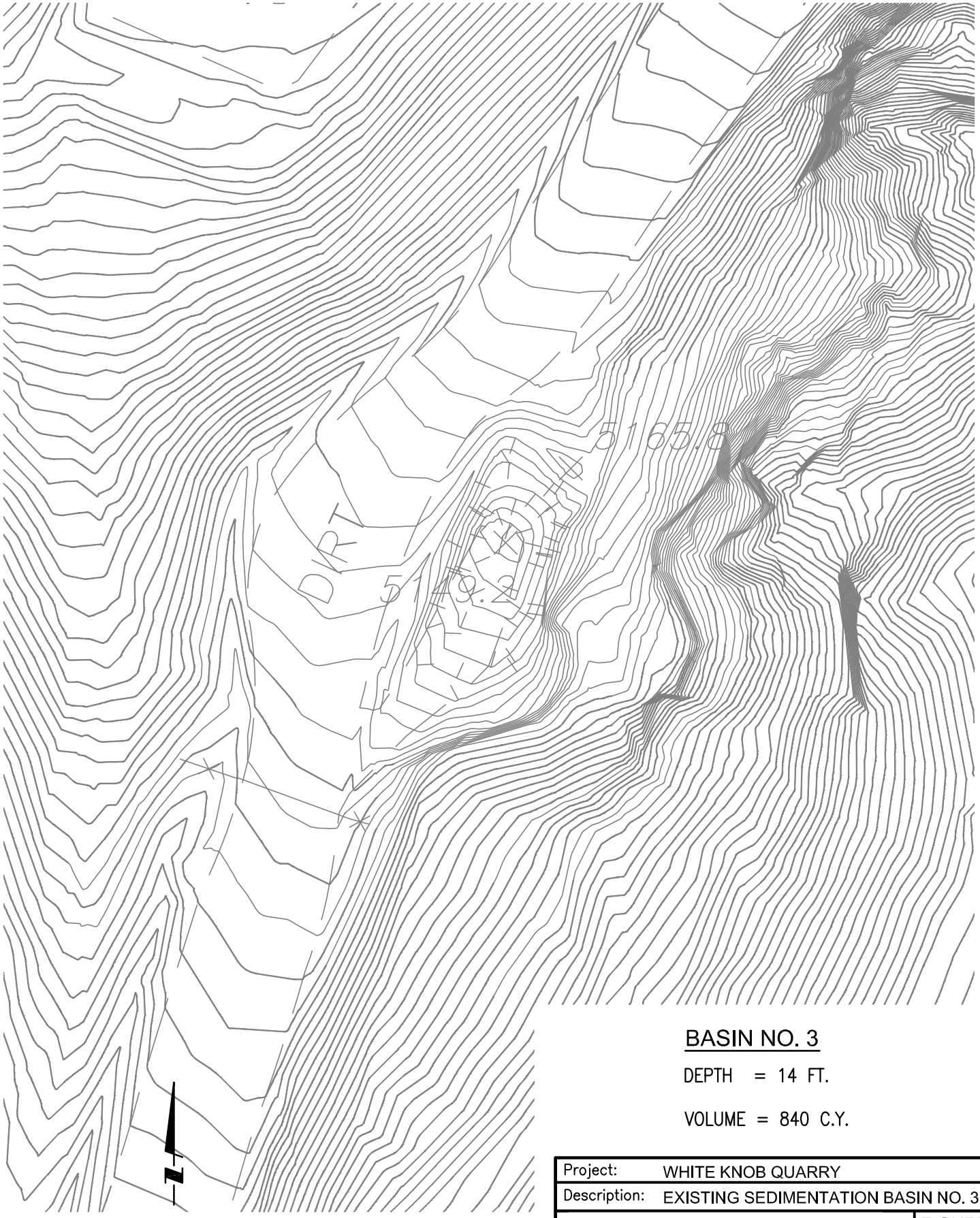
FIGURE 6

Job No.: 2042484500 Date: 07-29-2011

DRAWING: v:\projects\2042484500\dwg\prex0005.dwg PLOTTED: 7/29/2011 9:02 AM BY: Uribe Gonzales, Martha



BASIN NO. 3

DEPTH = 14 FT.

VOLUME = 840 C.Y.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 40 ft.

Project:	WHITE KNOB QUARRY
Description:	EXISTING SEDIMENTATION BASIN NO. 3

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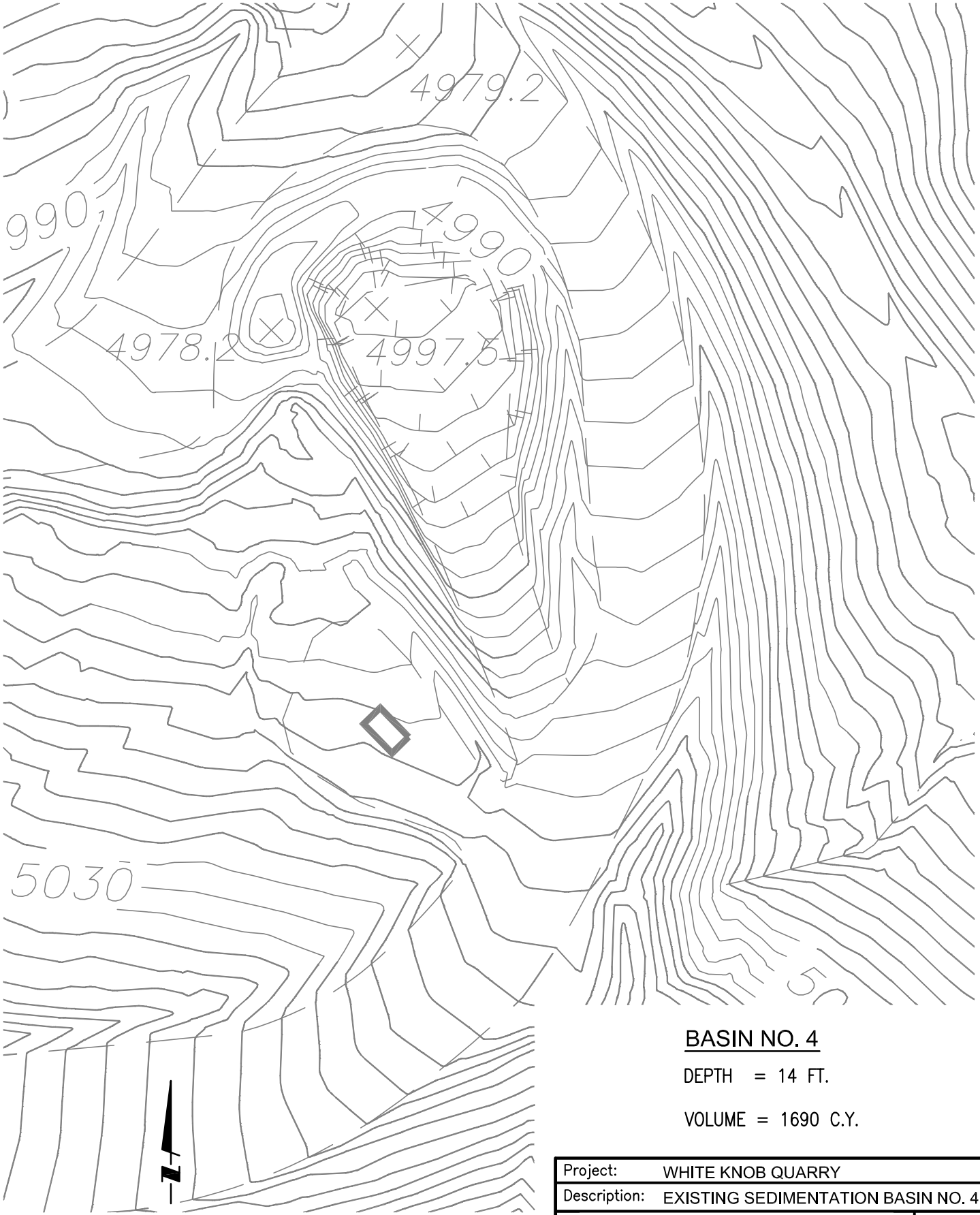
FIGURE 7

Job No.: 2042484500 | Date: 07-29-2011

DRAWING: v:\projects\2042484500\dwg\prex0006.dwg PLOTTED: 7/29/2011 9:03 AM BY: Uribe Gonzales, Martha



BASIN NO. 4

DEPTH = 14 FT.

VOLUME = 1690 C.Y.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 40 ft.

Project:	WHITE KNOB QUARRY
Description:	EXISTING SEDIMENTATION BASIN NO. 4

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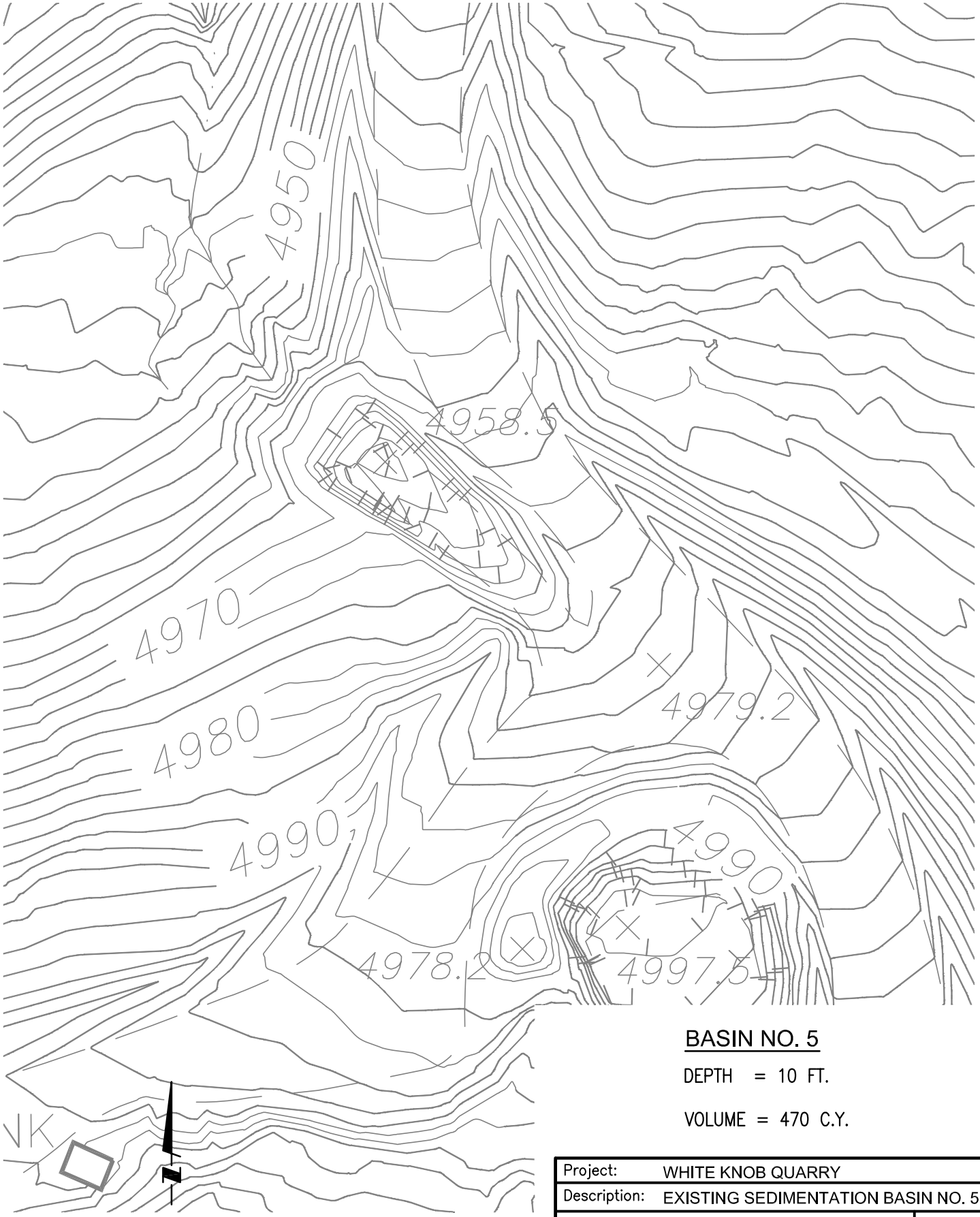
FIGURE 8

Job No.: 2042484500 Date: 07-29-2011

DRAWING: v:\projects\2042484500\dwg\prex0007.dwg PLOTTED: 7/29/2011 9:04 AM BY: Uribe Gonzales, Martha



BASIN NO. 5

DEPTH = 10 FT.

VOLUME = 470 C.Y.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 40 ft.

Project:	WHITE KNOB QUARRY
Description:	EXISTING SEDIMENTATION BASIN NO. 5

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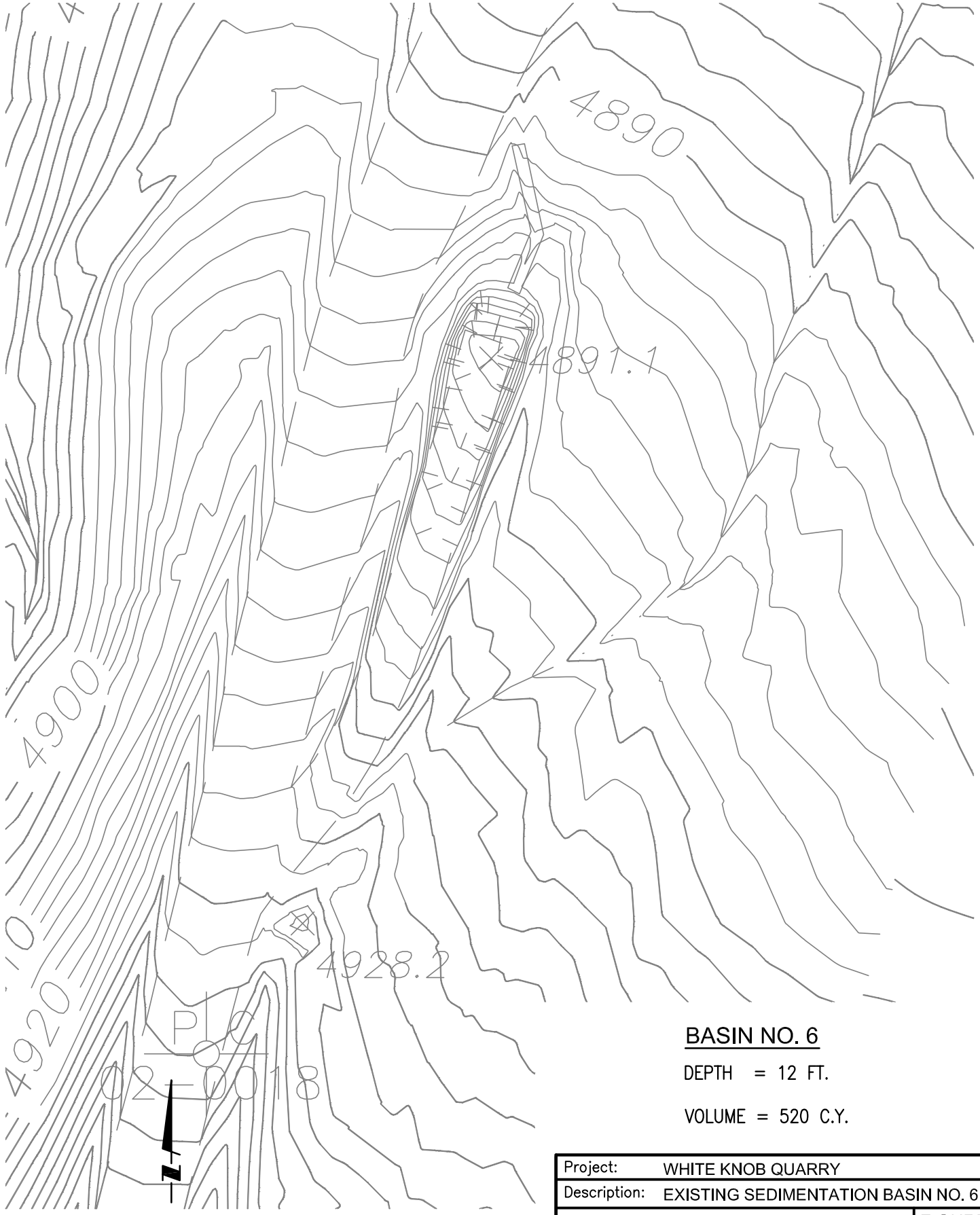
FIGURE 9

Job No.: 2042484500 Date: 07-29-2011

DRAWING: v:\projects\2042484500\dwg\prex0008.dwg PLOTTED: 7/29/2011 9:06 AM BY: Uribe Gonzales, Martha



BASIN NO. 6

DEPTH = 12 FT.

VOLUME = 520 C.Y.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 40 ft.

Project:	WHITE KNOB QUARRY
Description:	EXISTING SEDIMENTATION BASIN NO. 6

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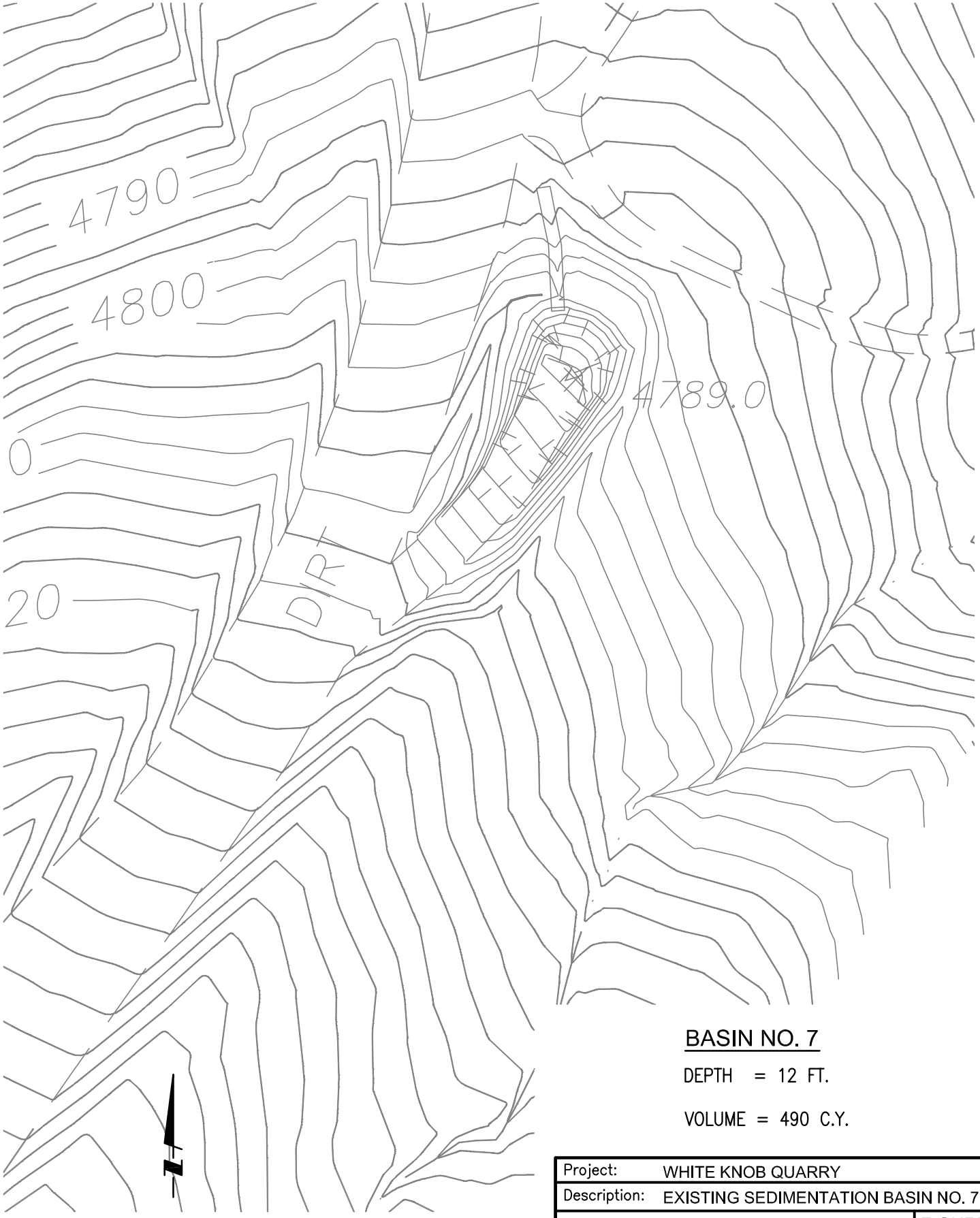
FIGURE 10

Job No.: 2042484500 Date: 07-29-2011

DRAWING: v:\projects\2042484500\dwg\prex0009.dwg PLOTTED: 7/29/2011 9:07 AM BY: Uribe Gonzales, Martha



BASIN NO. 7

DEPTH = 12 FT.

VOLUME = 490 C.Y.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)

1 inch = 40 ft.

Project:	WHITE KNOB QUARRY
Description:	EXISTING SEDIMENTATION BASIN NO. 7

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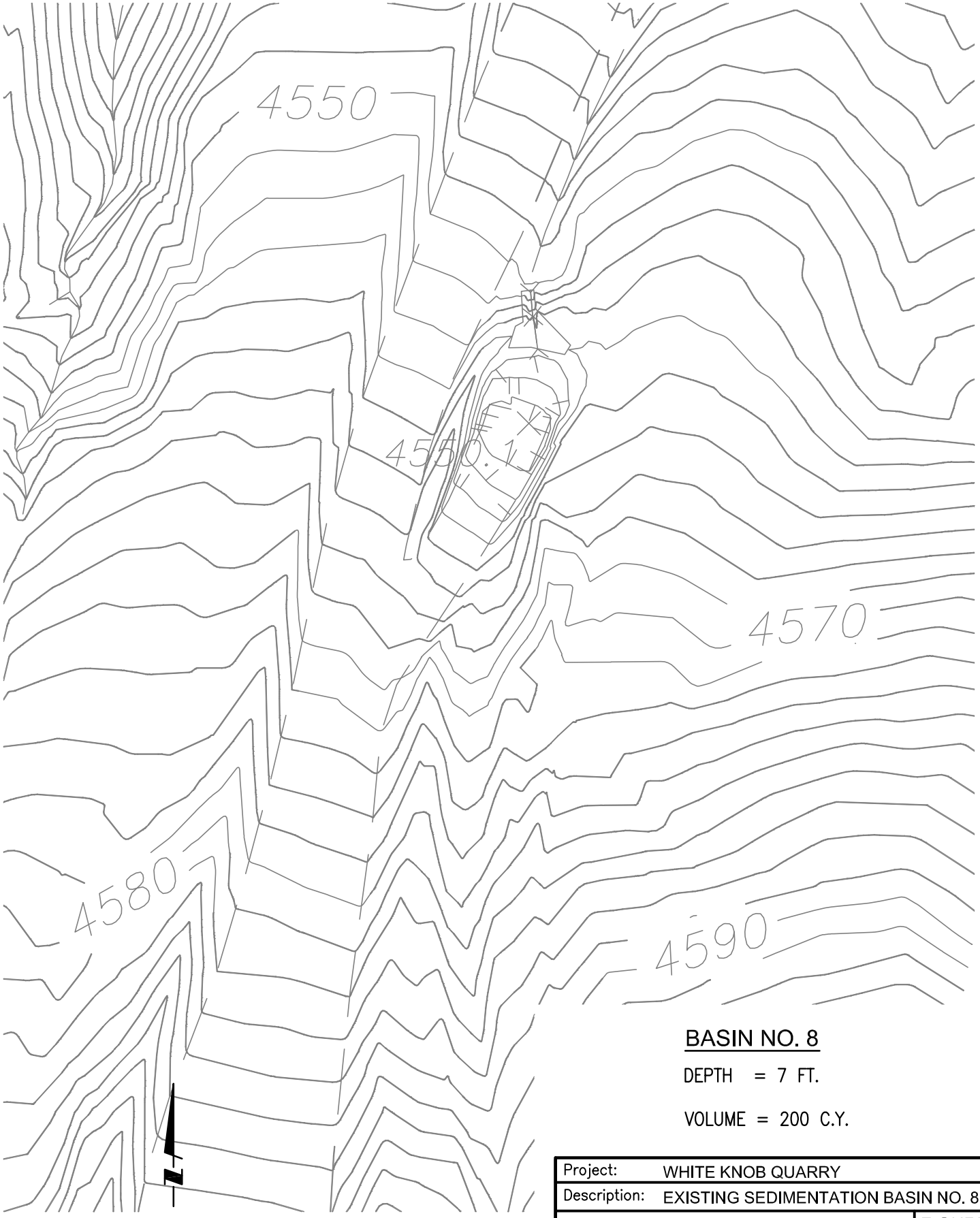
FIGURE 11

Job No.: 2042484500 Date: 07-29-2011

DRAWING: v:\projects\2042484500\dwg\prex0010.dwg PLOTTED: 7/29/2011 9:08 AM BY: Uribe Gonzales, Martha



BASIN NO. 8

DEPTH = 7 FT.

VOLUME = 200 C.Y.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 40 ft.

Project:	WHITE KNOB QUARRY
Description:	EXISTING SEDIMENTATION BASIN NO. 8

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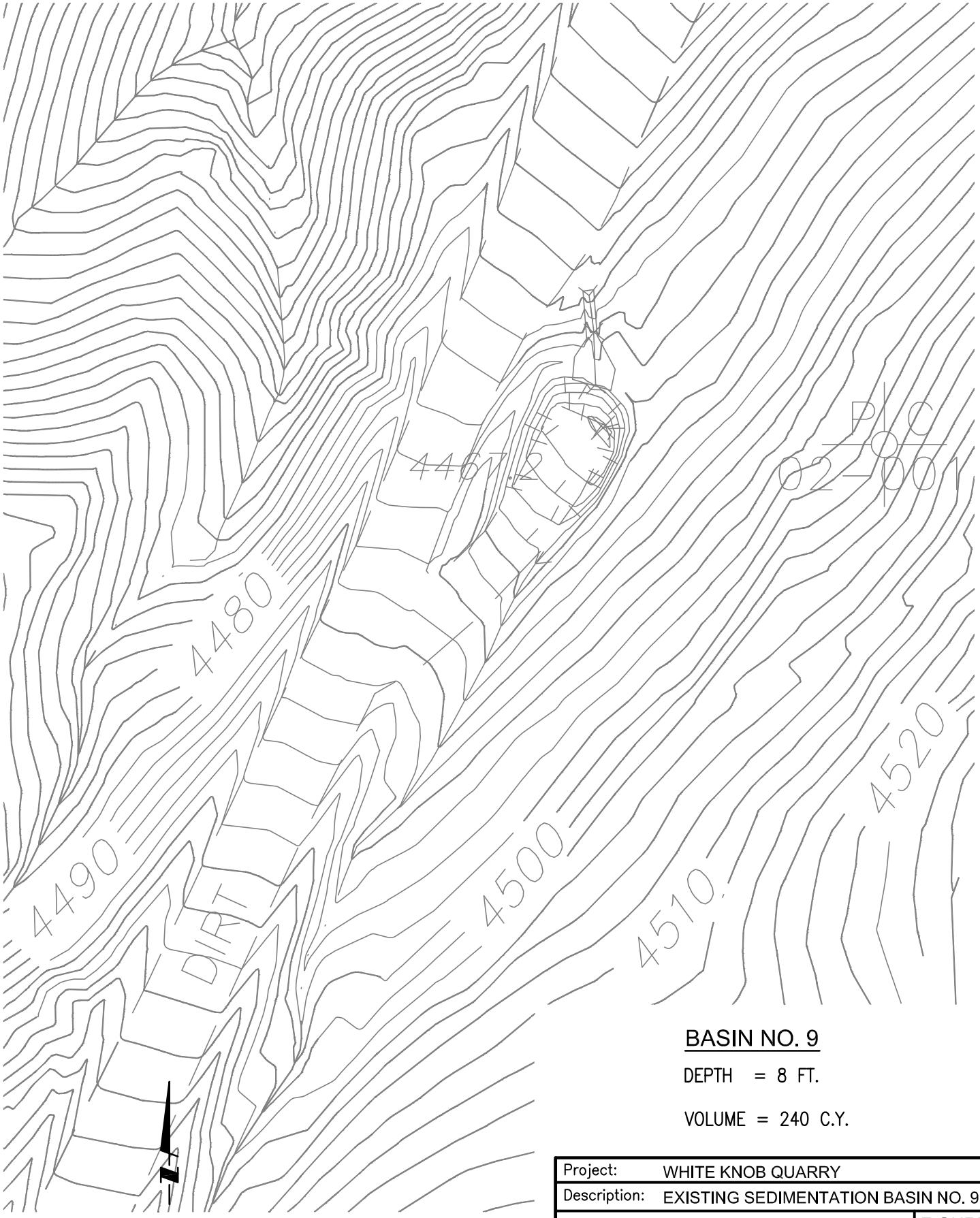
FIGURE 12

Job No.: 2042484500 Date: 07-29-2011

DRAWING: v:\projects\2042484500\dwg\prex0011.dwg PLOTTED: 7/29/2011 9:09 AM BY: Uribe Gonzales, Martha



GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 40 ft.

BASIN NO. 9

DEPTH = 8 FT.

VOLUME = 240 C.Y.

Project:	WHITE KNOB QUARRY
Description:	EXISTING SEDIMENTATION BASIN NO. 9

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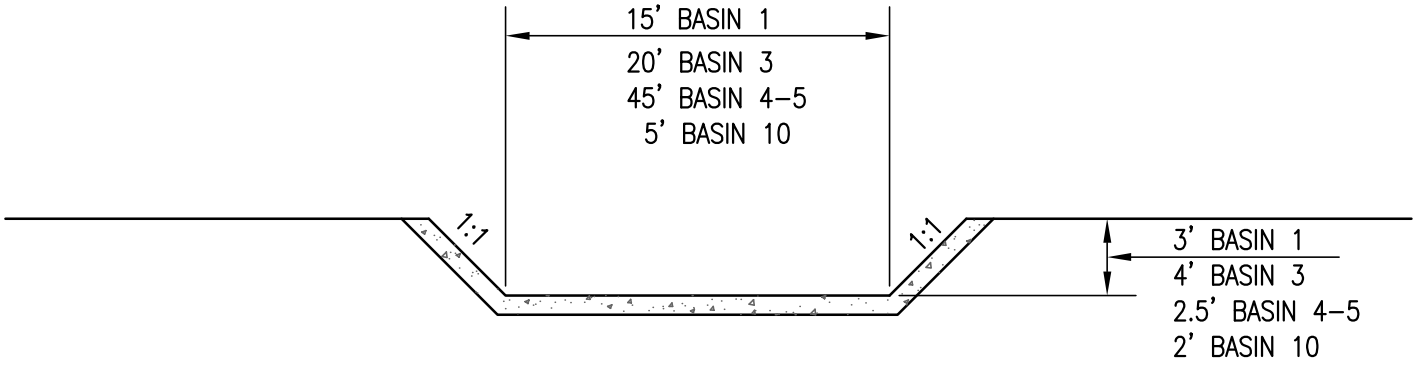
FIGURE
13

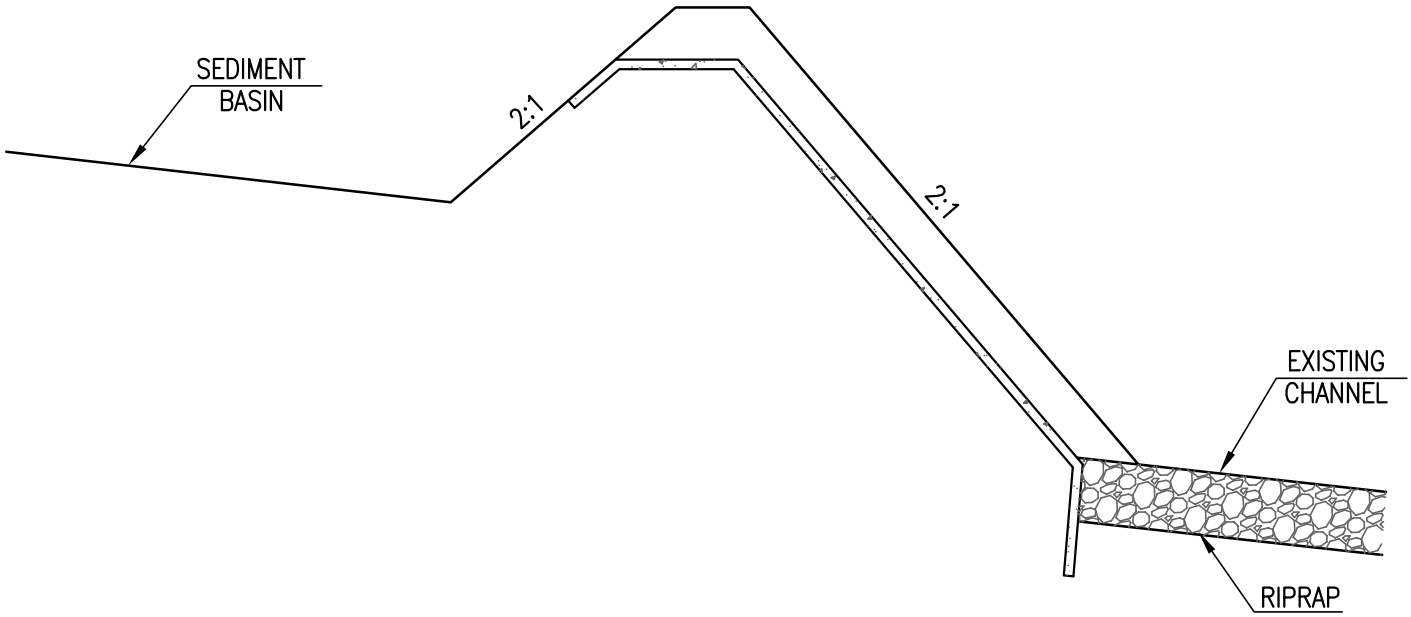
Job No.: 2042484500 | Date: 07-29-2011

DRAWING: v:\projects\2042484500\dwg\prex0012.dwg PLOTTED: 7/29/2011 9:10 AM BY: Uribe Gonzales, Martha



SPILLWAY CROSS SECTION

NOT TO SCALE



SPILLWAY PROFILE

NOT TO SCALE

Project:	WHITE KNOB QUARRY
Description:	SPILLWAY DETAILS

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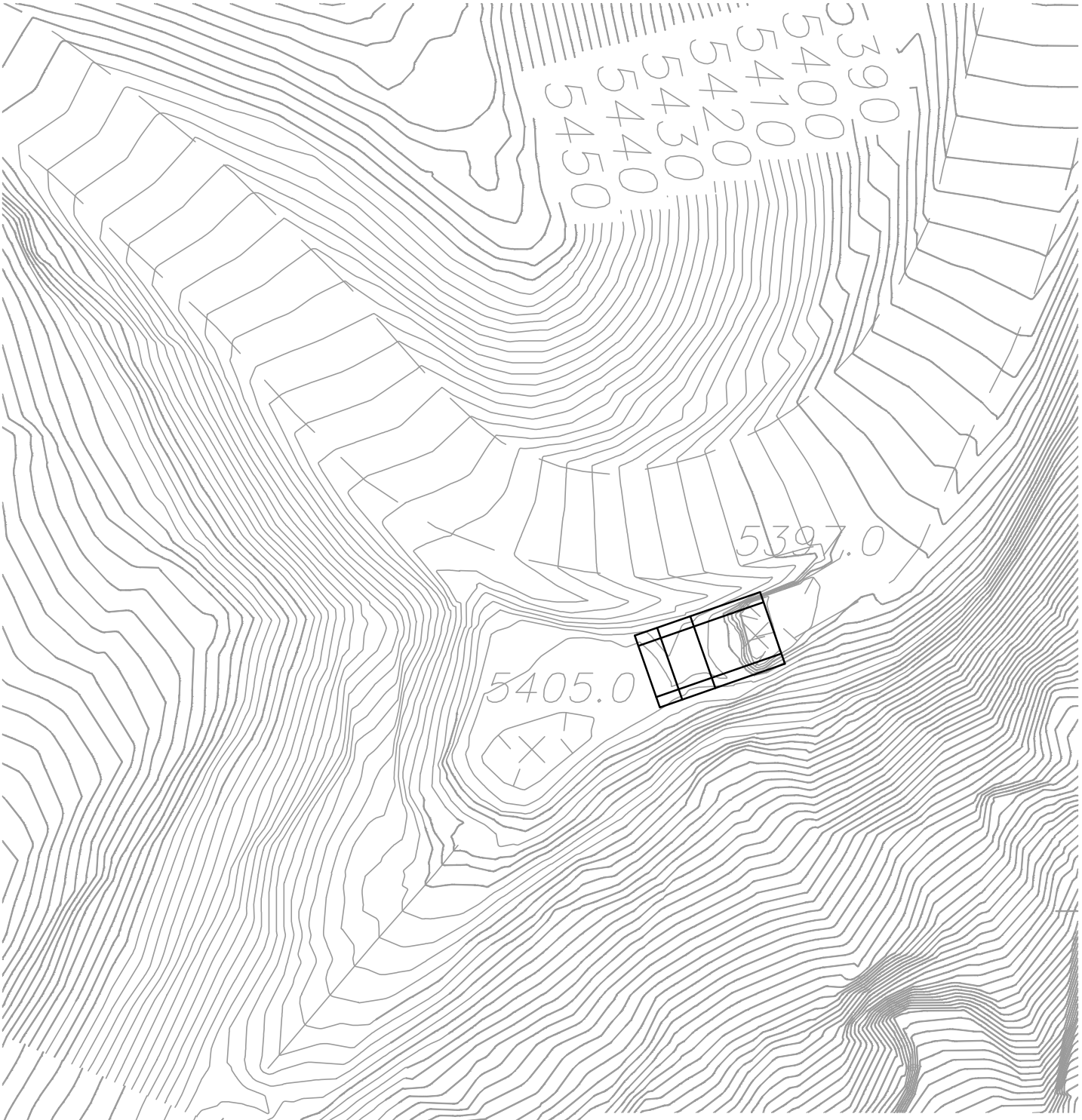
FIGURE 14

Job No.: 2042484500 Date: 07–29–2011

DRAWING: v:\projects\2042484500\dwg\prdt0002.dwg PLOTTED: 8/11/2011 4:36 PM BY: Carey, Paul



BASIN NO. 1

SPILLWAY CREST ELEV. = 5410

VOLUME = 280 C.Y.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 40 ft.

Project:	WHITE KNOB QUARRY
Description:	PROPOSED SEDIMENTATION BASIN NO. 1

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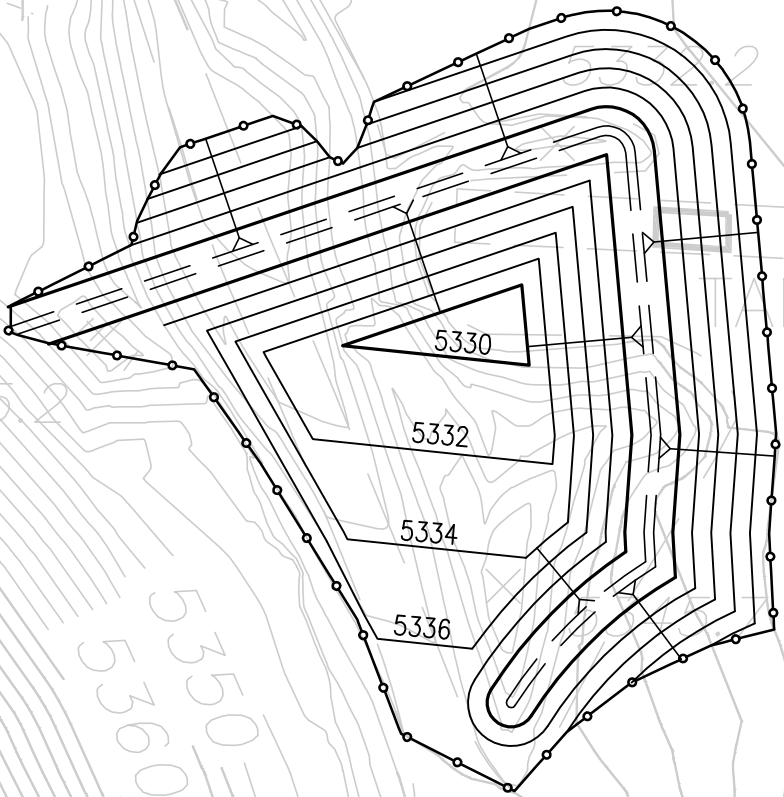
FIGURE 15

Job No.: 2042484500 Date: 07-29-2011

DRAWING: v:\projects\2042484500\dwg\prex0013.dwg PLOTTED: 7/29/2011 9:12 AM BY: Uribe Gonzales, Martha



BASIN NO. 2

VOLUME = 960 C.Y.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 40 ft.

Project:	WHITE KNOB QUARRY
Description:	PROPOSED SEDIMENTATION BASIN NO. 2

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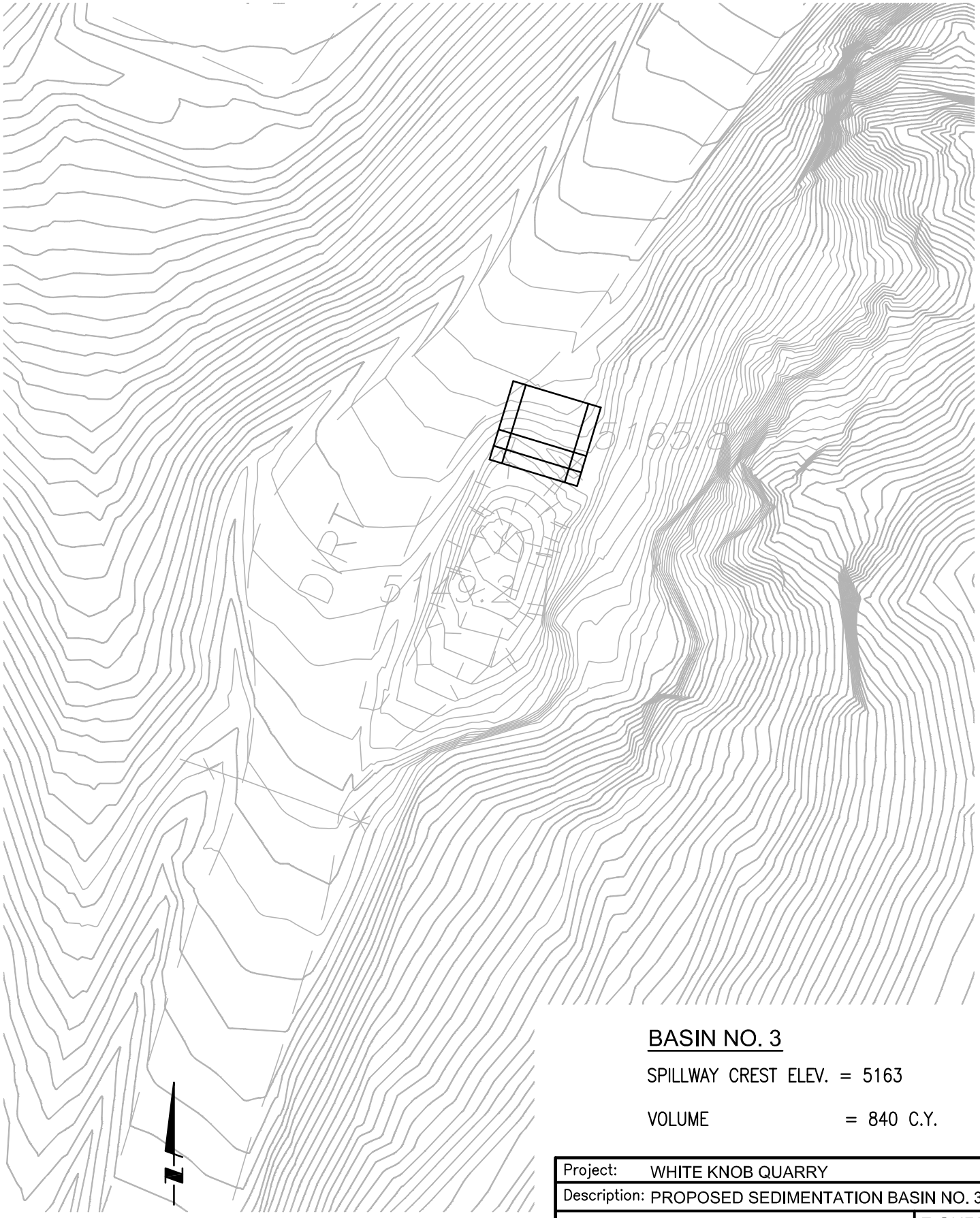
FIGURE 16

Job No.: 2042484500 Date: 08-11-2011

DRAWING: v:\projects\2042484500\dwg\prex0014.dwg PLOTTED: 8/11/2011 11:15 AM BY: Carey, Paul



BASIN NO. 3

SPILLWAY CREST ELEV. = 5163

VOLUME = 840 C.Y.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 40 ft.

Project:	WHITE KNOB QUARRY
Description:	PROPOSED SEDIMENTATION BASIN NO. 3

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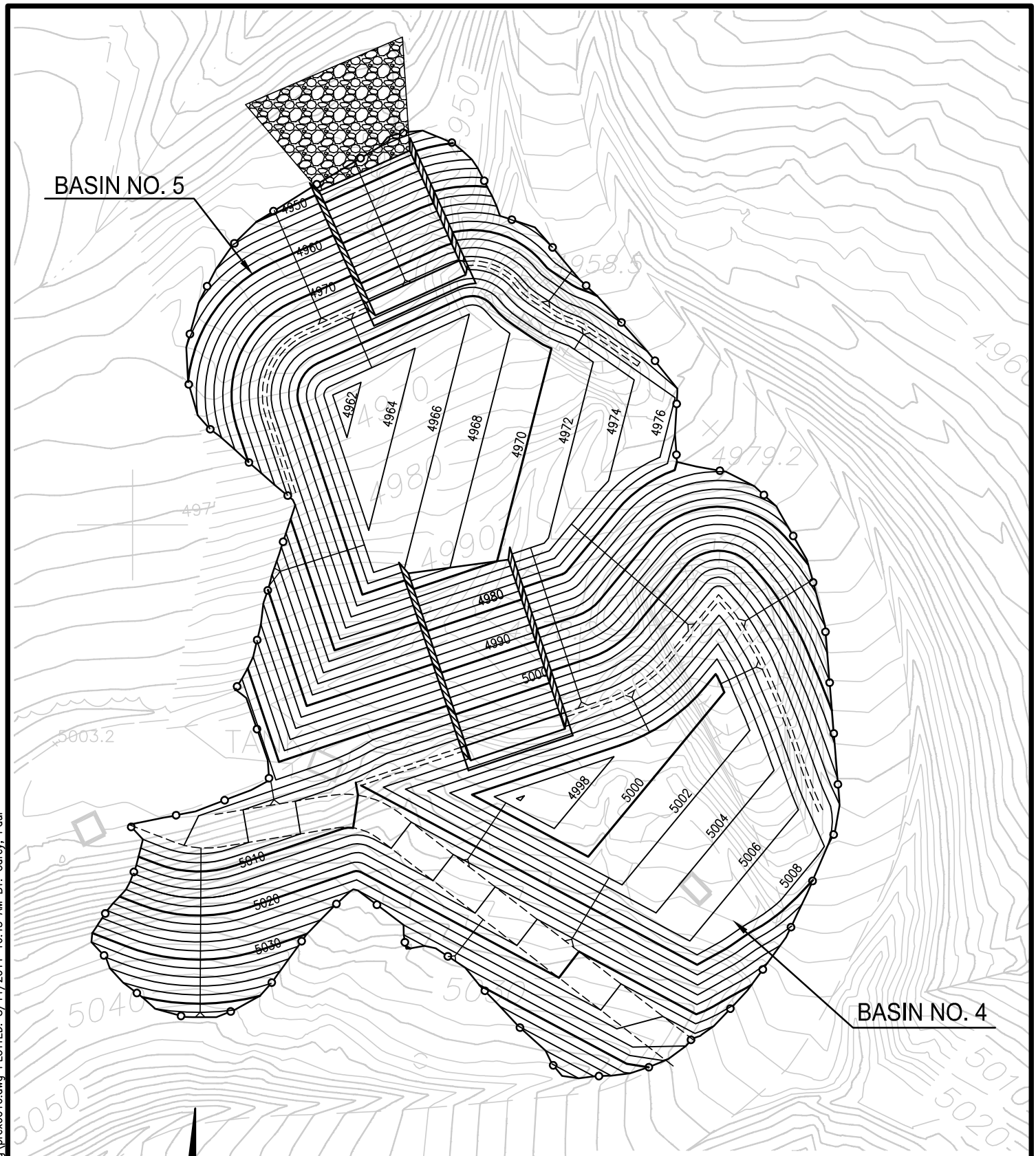
FIGURE 17

Job No.: 2042484500 Date: 07-29-2011

DRAWING: v:\projects\2042484500\dwg\prex0015.dwg PLOTTED: 7/29/2011 9:15 AM BY: Uribe Gonzales, Martha



GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 60 ft.

Project:	WHITE KNOB QUARRY
Description:	PROPOSED SEDIMENTATION BASINS NO. 4 & 5

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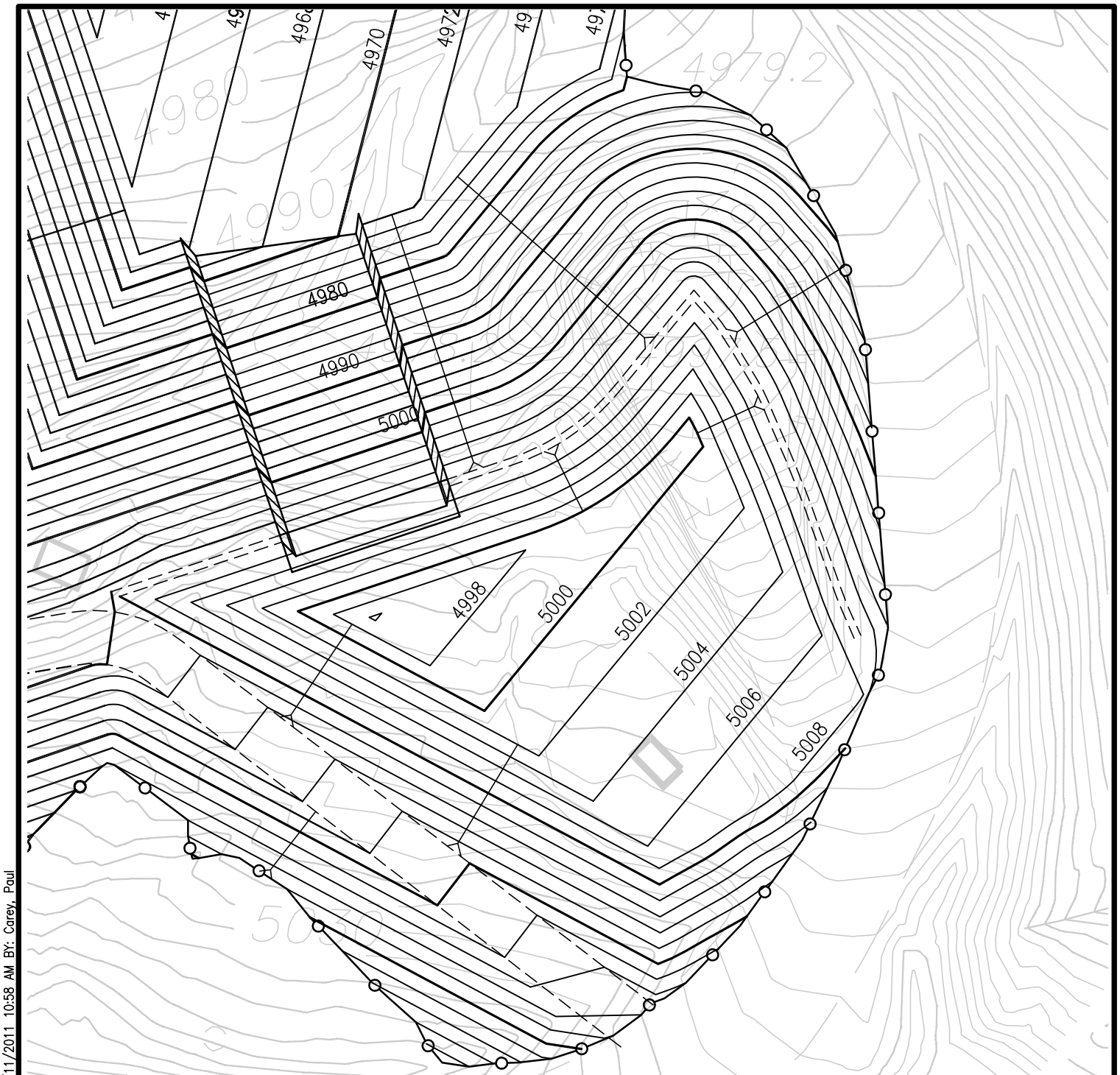
FIGURE
18

Job No.: 2042484500 | Date: 08-11-2011

DRAWING: v:\projects\2042484500\dwg\prex0016.dwg PLOTTED: 8/11/2011 10:45 AM BY: Carey, Paul



BASIN NO. 4

SPILLWAY CREST ELEV. = 5007.5

VOLUME = 2420 C.Y.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 40 ft.

Project:	WHITE KNOB QUARRY
Description:	PROPOSED SEDIMENTATION BASIN NO. 4

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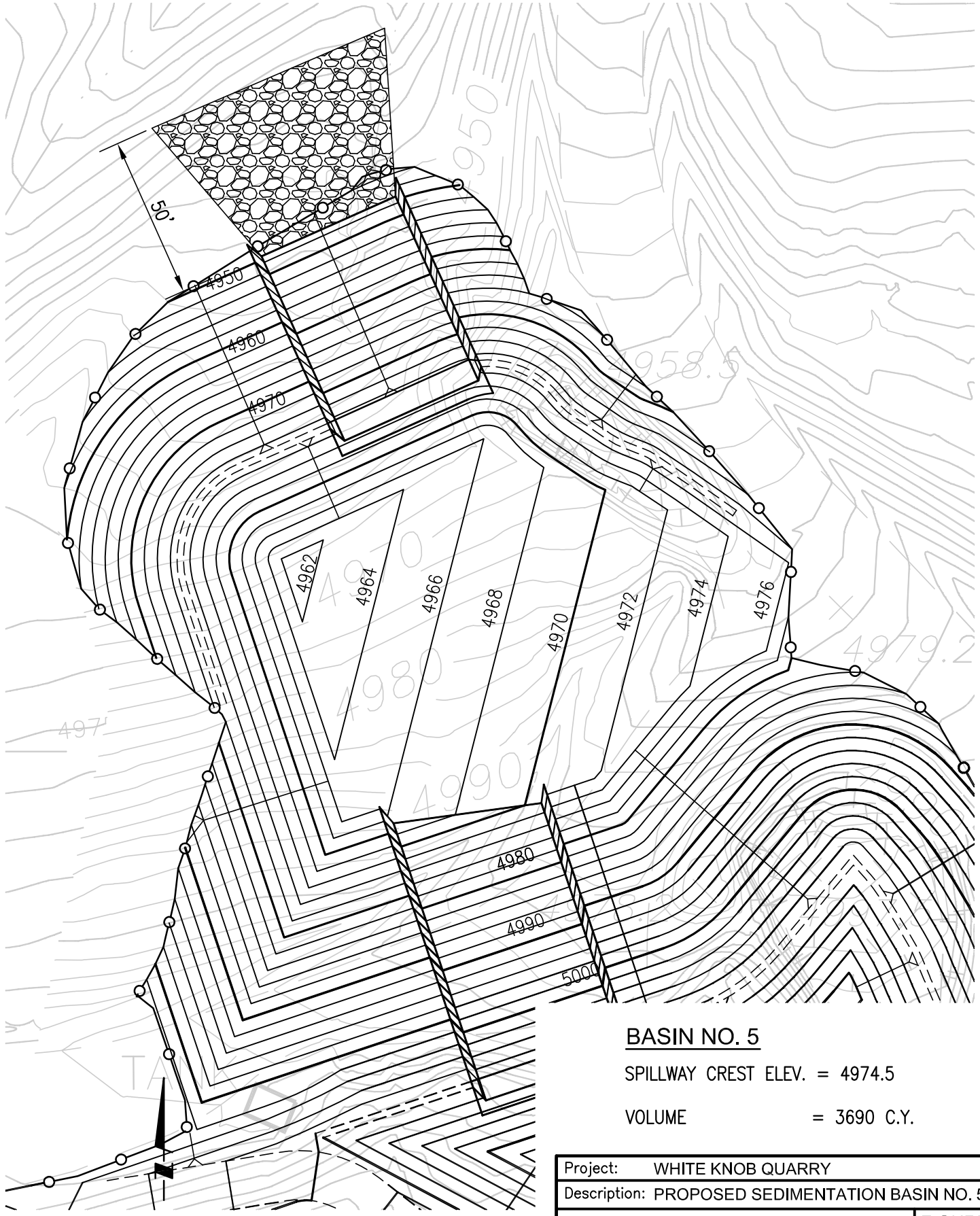
FIGURE
19

Job No.: 2042484500 Date: 08-11-2011

DRAWING: v:\projects\2042484500\dwg\prex0019.dwg PLOTTED: 8/11/2011 10:58 AM BY: Carey, Paul



BASIN NO. 5

SPILLWAY CREST ELEV. = 4974.5

VOLUME = 3690 C.Y.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)

1 inch = 40 ft.

Project:	WHITE KNOB QUARRY
Description:	PROPOSED SEDIMENTATION BASIN NO. 5

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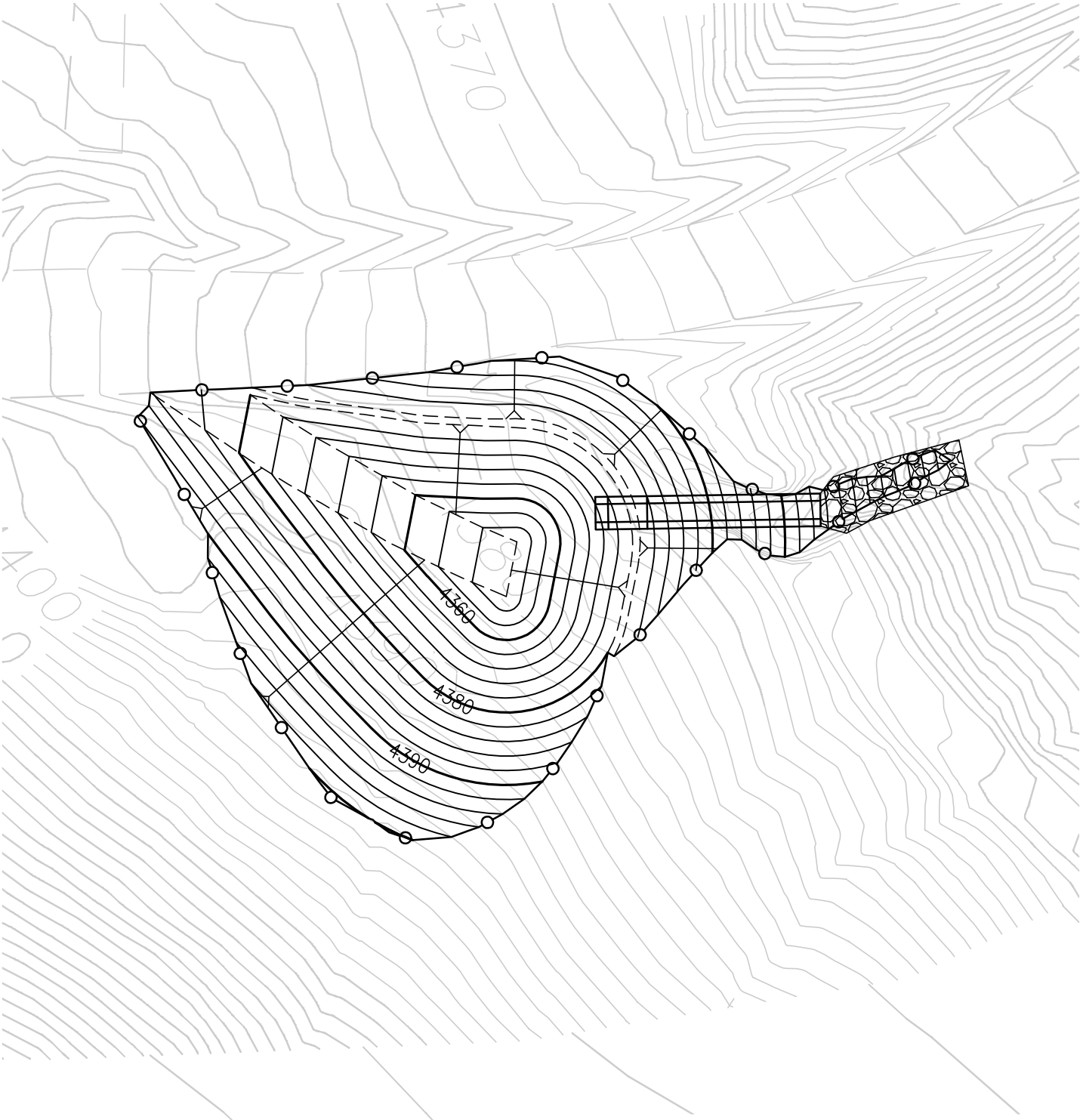
FIGURE 20

Job No.: 2042484500 Date: 08-11-2011

DRAWING: v:\projects\2042484500\dwg\prex0017.dwg PLOTTED: 8/11/2011 10:55 AM BY: Carey, Paul



BASIN NO. 10

SPILLWAY CREST ELEV. = 4398

VOLUME = 200 C.Y.

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 40 ft.

Project:	WHITE KNOB QUARRY
Description:	PROPOSED SEDIMENTATION BASIN NO. 10

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FIGURE 21

Job No.: 2042484500 Date: 08-11-2011

DRAWING: v:\projects\2042484500\dwg\prex0018.dwg PLOTTED: 8/11/2011 11:12 AM BY: Carey, Paul

3.3 CULVERT RIPRAP

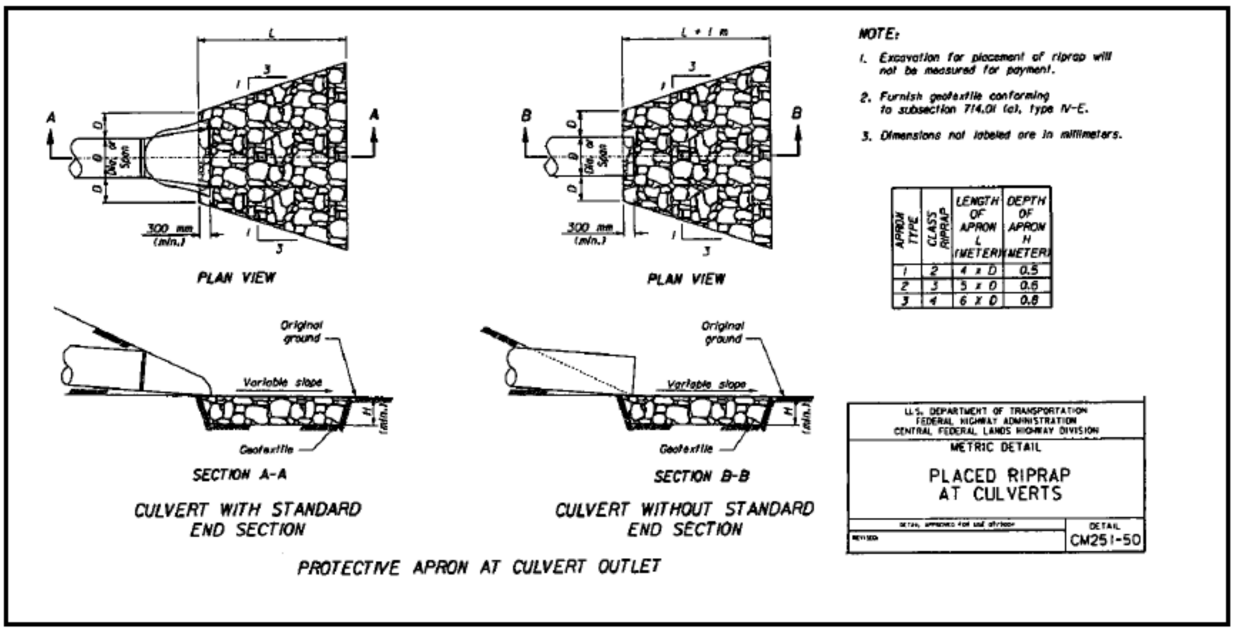
3.3.1 Analysis

In Section 2.4 of this report, the capacities of the existing haul road culverts were checked relative to the predicted 10-year stormwater flow. All culverts had adequate capacity with the exception of the 36 inch corrugated metal pipe at haul road station 54+35. Because of the difficult nature of predicting flows in an alluvial fan as mentioned in Section 2.1 of this report, we do not feel that this location is a concern. The pipe has limited capacity because it is in a very shallow channel, and hence there is very little allowable headwater depth related to the other culverts. Furthermore, the pipe has been in place for 24 years without reported problems. This leads us to believe that the actual 10-year flow at this culvert is somewhat less than that reported on the 1987 Morrison-Knudsen improvement plans (a copy of these plans is included in Appendix F).

The culverts appear to have been provided with outlet riprap protection in accordance with the 1987 plans. The design at that time was for a 2-foot thick riprap apron extending four pipe diameters downstream of the culvert outlet. While we have not seen the actual specifications for the riprap, both the thickness called out and our field observations indicate that it is equivalent to a Caltrans Light Class riprap gradation. The picture below shows a typical culvert outlet at haul road station 90+00:

Culvert Outlet at Station 90+00

To check the adequacy of the culvert outlet protection, we utilized the methods outlined in Section 10.2 of the Federal Highway Administration's Hydraulic Engineering Circular 14, Third Edition (HEC-14). This method sizes a riprap apron with the following configuration:



The required riprap rock size is determined based on the design discharge, culvert diameter, and tail water depth. All of the culverts are steep enough to have supercritical flow, so the culvert diameter used in the equation is adjusted based on the normal flow depth in the culvert. Once the rock size is determined, the apron dimensions are determined from the following table found in HEC-14:

Class	D_{50} (mm)	D_{50} (in)	Apron Length[1]	Apron Depth
1	125	5	4D	$3.5D_{50}$
2	150	6	4D	$3.3D_{50}$
3	250	10	5D	$2.4D_{50}$
4	350	14	6D	$2.2D_{50}$
5	500	20	7D	$2.0D_{50}$
6	550	22	8D	$2.0D_{50}$

[1]D is the culvert rise.

Calculations for the individual culvert locations are included in Appendix G, and are summarized below. The Riprap class and required thickness are based on Caltrans Standard Specifications:

	Pipe Size	Apron Class	Apron Length	Required Riprap D_{50} Size (ft)	Required Riprap D_{50} Weight (lbs)	Specified Riprap Class	Riprap Thickness (ft)
Station 17+70	24" CMP	3	10	0.67	25.5	Light	2.5
Station 19+00	48" CMP	4	24	1.17	140.0	Light	2.5
Station 43+50	24" CMP	3	10	0.66	24.6	Light	2.5
Station 49+35	36" CMP	5	21	1.31	193.0	Light	2.5
Station 54+35	36" CMP	4	18	1.05	100.2	Light	2.5
Station 57+75	48" CMP	4	24	1.00	85.3	Light	2.5
Station 62+30	24" CMP	3	10	0.68	27.4	Light	2.5
Station 88+15	24" CMP	3	10	0.73	33.0	Light	2.5
Station 90+00	24" CMP	3	10	0.71	31.4	Light	2.5
Station 144+70	36" CMP	3	15	0.80	45.1	Light	2.5
Station 150+40	36" CMP	4	18	1.02	90.7	Light	2.5
Station 154+20	36" CMP	6	24	2.66	1634.2	1 Ton	5.4
Station 170+50	36" CMP	6	24	1.96	652.1	1/4 Ton	3.3
Station 182+00	84" CMP	5	49	1.56	330.6	1/4 Ton	3.3

3.3.2 Recommendations

With the exception of the culverts at Stations 154+20, 170+50, and 182+00, the riprap size provided in the 1987 Morrison-Knudsen plans are adequate. However the length of protection downstream of the culvert outlet should be extended in all locations to provide the length of protection shown in the table above. The culverts at Stations 154+20, 170+50, and 182+00 should have the existing outlet riprap protection removed and replaced with the appropriate riprap class and apron dimension shown in the table above.

4.0 Right Of Way Recommendations

The current Right of Way for the White Knob Quarry Haul Road is as described in the Amendment of Right of Way Grant from the Bureau of Land Management dated July 15, 1988 (see Appendix I). Exhibit C of this document describes the Right of Way in three pieces:

1. From the beginning at Station 0+00 to Station 117+00, a constant Right of Way width of 75 feet. This yields a total area of 20.145 acres.

2. From Station 117+00 to Station 245+00, a variable width Right of Way with an average width of 125 feet. This yields a total area of 36.731 acres.

3. A separate construction/maintenance yard with the dimensions of 660 feet by 660 feet. The area of this yard is 10 acres.

The total Right of Way area is stated as 66.876 acres.

In the past there has been some confusion concerning what areas are included within the Right of Way, particularly in the stretch of roadway that was given a variable width. Because of this, the quarry staff desires that a more formal Right of Way boundary be established. To accomplish this task, we have reviewed the existing topography along with aerial photos to determine the existing disturbed areas that will need to remain in a permanent Right of Way. We also reviewed the recommended improvements in this report, and came up with an overall extent of Right of Way to include both existing and proposed improvements.

Appendix H contains seven exhibits showing this proposed Right of Way delineation at a scale of 1" = 100'. Following is a summary of the areas to compare to the values in the existing Grant:

1. From the beginning at station 0+00 to station 117+00, an area of 38.601 acres. This includes the area being used for construction/maintenance purposes as mentioned in item three above.

2. From station 117+00 to Station 237+73, an area of 48.684 acres. The ending station reflects the public/private property line where the haul road enters Omya's patent property.

The total proposed Right of Way is 87.285 acres.

5.0 References

1. County of San Bernardino Hydrology Manual, published August 1986
2. County of San Bernardino Hydrology Manual Addendum for Arid Regions, published April 2010
3. Los Angeles County Department of Public Works Sedimentation Manual, published March 2006
4. Federal Highway Administration Hydraulic Engineering Circular No. 14, Third Edition, published July 2006

Appendix A – Hydrology Map

				Percent Subarea Soil Type				
Node	Elev	Subarea	Total Area	Type B	Type C	Type D	Flow Length	Comments
10	4442							Initial Subarea
20	4220	2.18	2.18	100%			651	
30	4106	12.08	14.26	100%			527	End of Study
100	4654							Initial Subarea
110	4300	6.84	6.84	100%			1000	
120	4110	14.57	21.41	100%			964	End of Study
200	4770							Initial Subarea
210	4640	5.8	5.8	100%			990	
220	4220	11.98	17.78	100%			1468	
230	4128	41.78	59.56	100%			587	End of Study
300	4848							Initial Subarea
310	4760	4.4	4.4	100%			880	
320	4480	23.15	27.55	100%			1304	
330	4286	22.72	50.27	100%			982	End of Study
400	7705							Initial Subarea
405	6940	5.25	5.25			100%	1000	
410	6700	24.82	30.07			100%	435	
415	5900	83.66	113.73			100%	1352	
420	5405	60.17	173.9			100%	1764	Confluence
500	7120							Initial Subarea
510	6600	9.61	9.61			100%	970	
520	6100	21.24	30.85			100%	776	
530	5710	79.05	109.9	15%		85%	1052	
420	5405	15.07	124.97	50%		50%	1954	Confluence
420	5405		298.87					After Confluence
425	5169	37.15	336.02	17%		83%	1734	
430	5109	4.73	340.75	30%		70%	451	
435	5010	4.75	345.5	57%		43%	749	
440	4978	5.31	350.81	100%			241	
441	4700	27.26	378.07	100%			1878	
750	4300	15.77	393.84	100%			2527	Confluence
700	5851							Initial Subarea
710	5495	6.97	6.97	79%		21%	929	
720	5315	20.2	27.17	98%		2%	2034	
730	4829	16.25	43.42	100%			1756	Confluence
800	5664							Initial Subarea
810	5225	10	10		18%	82%	964	
730	4829	60.66	70.66	24%	1%	75%	1949	Confluence
730	4829		114.08					After Confluence
740	4580	55.13	169.21	38%		62%	2018	
750	4300	75.26	244.47	66%		34%	2432	Confluence
750	4300		638.31					After Confluence
442	4978							Initial Subarea
445	4918	0.53	0.53	100%			441	
450	4810	2.01	2.54	100%			804	
455	4562	9.31	11.85	100%			1778	
460	4482	12.86	24.71	100%			584	
465	4319	5.42	30.13	100%			1005	Confluence
600	5633							Initial Subarea
610	5200	10	10			100%	911	
620	4975	24.73	34.73			100%	984	
630	4640	97.45	132.18	46%		54%	2578	
465	4319	29.06	161.24	100%			1875	Confluence
465	4319		191.37				400	After Confluence

LEGEND

- DRAINAGE AREA BOUNDARY
- FLOW PATH
- SUBAREA BOUNDARY
- (123) NODE DESIGNATION

GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch = 300 ft.

PREPARED BY:

Stantec

STANTEC CONSULTING INC.
19 TECHNOLOGY DRIVE
IRVINE, CA 92618
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WHITE KNOB QUARRY HAUL ROAD HYDROLOGY MAP

PROJECT NO. 2042484500
DATE: 07-29-2011
SHEET 1 OF 1

DRAWING: v:\projects\2042484500\dwg\prsd0001.dwg PLOTTED: 7/29/2011 9:32 AM BY: Uribe Gonzales, Martha

Appendix B – Hydrology Calculations

Minor Culvert Crossings

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 144
2 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.450 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++

Process from Point/Station 10.000 to Point/Station 20.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 651.000(Ft.)
Top (of initial area) elevation = 4442.000(Ft.)
Bottom (of initial area) elevation = 4220.000(Ft.)
Difference in elevation = 222.000(Ft.)
Slope = 0.34101 s(%)= 34.10
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.690 min.
Rainfall intensity = 1.740(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.691
Subarea runoff = 2.623(CFS)
Total initial stream area = 2.180(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++

Process from Point/Station 20.000 to Point/Station 30.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.240(Ft.), Average velocity =   5.899(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =      8.761(CFS)
  '     '    flow top width =      7.396(Ft.)
  '     '    velocity=    5.899(Ft/s)
  '     '    area =      1.485(Sq.Ft)
  '     '    Froude number =     2.320

Upstream point elevation =  4220.000(Ft.)
Downstream point elevation =  4106.000(Ft.)
Flow length =   527.000(Ft.)
Travel time  =    1.49 min.
Time of concentration =   10.18 min.
Depth of flow =   0.240(Ft.)
Average velocity =   5.899(Ft/s)
Total irregular channel flow =     8.761(CFS)
Irregular channel normal depth above invert elev. =   0.240(Ft.)
Average velocity of channel(s) =   5.899(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.558(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.667
Subarea runoff =     12.192(CFS) for   12.080(Ac.)
Total runoff =     14.814(CFS)
Effective area this stream =       14.26(Ac.)
Total Study Area (Main Stream No. 1) =       14.26(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.321(Ft.), Average velocity =   6.976(Ft/s)
End of computations, Total Study Area =           14.26 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 144
10 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.745 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 10.000 to Point/Station 20.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 651.000(Ft.)
Top (of initial area) elevation = 4442.000(Ft.)
Bottom (of initial area) elevation = 4220.000(Ft.)
Difference in elevation = 222.000(Ft.)
Slope = 0.34101 s(%)= 34.10
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.690 min.
Rainfall intensity = 2.881(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.774
Subarea runoff = 4.861(CFS)
Total initial stream area = 2.180(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++
Process from Point/Station 20.000 to Point/Station 30.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.344(Ft.), Average velocity =   7.246(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     16.742(CFS)
  '     '    flow top width =      8.438(Ft.)
  '     '    velocity=    7.246(Ft/s)
  '     '    area =      2.310(Sq.Ft)
  '     '    Froude number =     2.441

Upstream point elevation =  4220.000(Ft.)
Downstream point elevation =  4106.000(Ft.)
Flow length =   527.000(Ft.)
Travel time  =    1.21 min.
Time of concentration =    9.90 min.
Depth of flow =   0.344(Ft.)
Average velocity =   7.246(Ft/s)
Total irregular channel flow =    16.742(CFS)
Irregular channel normal depth above invert elev. =   0.344(Ft.)
Average velocity of channel(s) =   7.246(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      2.629(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.762
Subarea runoff =     23.705(CFS) for   12.080(Ac.)
Total runoff =     28.566(CFS)
Effective area this stream =       14.26(Ac.)
Total Study Area (Main Stream No. 1) =       14.26(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.460(Ft.), Average velocity =   8.519(Ft/s)
End of computations, Total Study Area =           14.26 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 144
25 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 0.944 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 10.000 to Point/Station 20.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 651.000(Ft.)
Top (of initial area) elevation = 4442.000(Ft.)
Bottom (of initial area) elevation = 4220.000(Ft.)
Difference in elevation = 222.000(Ft.)
Slope = 0.34101 s(%)= 34.10
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.690 min.
Rainfall intensity = 3.650(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.801
Subarea runoff = 6.371(CFS)
Total initial stream area = 2.180(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++
Process from Point/Station 20.000 to Point/Station 30.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.401(Ft.), Average velocity =   7.895(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     22.160(CFS)
  '     '    flow top width =      9.008(Ft.)
  '     '    velocity=    7.895(Ft/s)
  '     '    area =      2.807(Sq.Ft)
  '     '    Froude number =     2.493

Upstream point elevation =  4220.000(Ft.)
Downstream point elevation =  4106.000(Ft.)
Flow length =   527.000(Ft.)
Travel time  =    1.11 min.
Time of concentration =    9.80 min.
Depth of flow =   0.401(Ft.)
Average velocity =   7.895(Ft/s)
Total irregular channel flow =    22.160(CFS)
Irregular channel normal depth above invert elev. =   0.401(Ft.)
Average velocity of channel(s) =   7.895(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      3.355(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.792
Subarea runoff =     31.513(CFS) for   12.080(Ac.)
Total runoff =     37.883(CFS)
Effective area this stream =       14.26(Ac.)
Total Study Area (Main Stream No. 1) =       14.26(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.534(Ft.), Average velocity =   9.254(Ft/s)
End of computations, Total Study Area =           14.26 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 144
100 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.280 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 10.000 to Point/Station 20.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.140(In/Hr)
Initial subarea data:
Initial area flow distance = 651.000(Ft.)
Top (of initial area) elevation = 4442.000(Ft.)
Bottom (of initial area) elevation = 4220.000(Ft.)
Difference in elevation = 222.000(Ft.)
Slope = 0.34101 s(%)= 34.10
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.690 min.
Rainfall intensity = 4.950(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.875
Subarea runoff = 9.437(CFS)
Total initial stream area = 2.180(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.140(In/Hr)

++

```
Process from Point/Station       20.000 to Point/Station       30.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.499(Ft.), Average velocity =   8.914(Ft/s)
      ******* Irregular Channel Data ***********
-------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-------------------------------------------------------------------
Sub-Channel flow  =     33.322(CFS)
  '     '    flow top width =      9.988(Ft.)
  '     '    velocity=    8.914(Ft/s)
  '     '    area =      3.738(Sq.Ft)
  '     '    Froude number =     2.568

Upstream point elevation =  4220.000(Ft.)
Downstream point elevation =  4106.000(Ft.)
Flow length =   527.000(Ft.)
Travel time  =    0.99 min.
Time of concentration =    9.68 min.
Depth of flow =   0.499(Ft.)
Average velocity =   8.914(Ft/s)
Total irregular channel flow =    33.322(CFS)
Irregular channel normal depth above invert elev. =   0.499(Ft.)
Average velocity of channel(s) =   8.914(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      4.591(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.873
Subarea runoff =     47.691(CFS) for   12.080(Ac.)
Total runoff =     57.128(CFS)
Effective area this stream =       14.26(Ac.)
Total Study Area (Main Stream No. 1) =       14.26(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   0.661(Ft.), Average velocity =  10.408(Ft/s)
End of computations, Total Study Area =           14.26 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 150
2 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.450 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 100.000 to Point/Station 110.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 4654.000(Ft.)
Bottom (of initial area) elevation = 4300.000(Ft.)
Difference in elevation = 354.000(Ft.)
Slope = 0.35400 s(%)= 35.40
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.241 min.
Rainfall intensity = 1.551(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.666
Subarea runoff = 7.065(CFS)
Total initial stream area = 6.840(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++
Process from Point/Station 110.000 to Point/Station 120.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.300(Ft.), Average velocity =   6.407(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
--------------------------------------------------------------------
Sub-Channel flow  =     12.507(CFS)
  '     '    flow top width =      8.003(Ft.)
  '     '    velocity=    6.407(Ft/s)
  '     '    area =      1.952(Sq.Ft)
  '     '    Froude number =     2.286

Upstream point elevation =  4300.000(Ft.)
Downstream point elevation =  4110.000(Ft.)
Flow length =   964.000(Ft.)
Travel time  =    2.51 min.
Time of concentration =   12.75 min.
Depth of flow =   0.300(Ft.)
Average velocity =   6.407(Ft/s)
Total irregular channel flow =    12.507(CFS)
Irregular channel normal depth above invert elev. =   0.300(Ft.)
Average velocity of channel(s) =   6.407(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.331(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.627
Subarea runoff =     10.801(CFS) for   14.570(Ac.)
Total runoff =     17.866(CFS)
Effective area this stream =       21.41(Ac.)
Total Study Area (Main Stream No. 1) =       21.41(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.366(Ft.), Average velocity =   7.159(Ft/s)
End of computations, Total Study Area =           21.41 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 150
10 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.745 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 100.000 to Point/Station 110.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 4654.000(Ft.)
Bottom (of initial area) elevation = 4300.000(Ft.)
Difference in elevation = 354.000(Ft.)
Slope = 0.35400 s(%)= 35.40
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.241 min.
Rainfall intensity = 2.568(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.759
Subarea runoff = 13.325(CFS)
Total initial stream area = 6.840(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++
Process from Point/Station 110.000 to Point/Station 120.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.435(Ft.), Average velocity =   7.886(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     24.594(CFS)
  '     '    flow top width =      9.348(Ft.)
  '     '    velocity=    7.886(Ft/s)
  '     '    area =      3.119(Sq.Ft)
  '     '    Froude number =     2.406

Upstream point elevation =  4300.000(Ft.)
Downstream point elevation =  4110.000(Ft.)
Flow length =   964.000(Ft.)
Travel time  =    2.04 min.
Time of concentration =   12.28 min.
Depth of flow =   0.435(Ft.)
Average velocity =   7.886(Ft/s)
Total irregular channel flow =    24.594(CFS)
Irregular channel normal depth above invert elev. =   0.435(Ft.)
Average velocity of channel(s) =   7.886(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      2.262(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.739
Subarea runoff =     22.482(CFS) for   14.570(Ac.)
Total runoff =     35.807(CFS)
Effective area this stream =       21.41(Ac.)
Total Study Area (Main Stream No. 1) =       21.41(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.531(Ft.), Average velocity =   8.808(Ft/s)
End of computations, Total Study Area =           21.41 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 150
25 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 0.944 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 100.000 to Point/Station 110.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 4654.000(Ft.)
Bottom (of initial area) elevation = 4300.000(Ft.)
Difference in elevation = 354.000(Ft.)
Slope = 0.35400 s(%)= 35.40
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.241 min.
Rainfall intensity = 3.254(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.788
Subarea runoff = 17.548(CFS)
Total initial stream area = 6.840(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++
Process from Point/Station 110.000 to Point/Station 120.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.507(Ft.), Average velocity =   8.586(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     32.795(CFS)
  '     '    flow top width =     10.069(Ft.)
  '     '    velocity=    8.586(Ft/s)
  '     '    area =      3.820(Sq.Ft)
  '     '    Froude number =     2.457

Upstream point elevation =  4300.000(Ft.)
Downstream point elevation =  4110.000(Ft.)
Flow length =   964.000(Ft.)
Travel time  =    1.87 min.
Time of concentration =   12.11 min.
Depth of flow =   0.507(Ft.)
Average velocity =   8.586(Ft/s)
Total irregular channel flow =    32.795(CFS)
Irregular channel normal depth above invert elev. =   0.507(Ft.)
Average velocity of channel(s) =   8.586(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      2.893(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.774
Subarea runoff =     30.430(CFS) for   14.570(Ac.)
Total runoff =     47.978(CFS)
Effective area this stream =       21.41(Ac.)
Total Study Area (Main Stream No. 1) =       21.41(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.619(Ft.), Average velocity =   9.581(Ft/s)
End of computations, Total Study Area =           21.41 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 150
100 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.280 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 100.000 to Point/Station 110.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.140(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 4654.000(Ft.)
Bottom (of initial area) elevation = 4300.000(Ft.)
Difference in elevation = 354.000(Ft.)
Slope = 0.35400 s(%)= 35.40
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 10.241 min.
Rainfall intensity = 4.412(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.871
Subarea runoff = 26.300(CFS)
Total initial stream area = 6.840(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.140(In/Hr)

++

```
Process from Point/Station      110.000 to Point/Station      120.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.633(Ft.), Average velocity =   9.700(Ft/s)
      ******* Irregular Channel Data ***********
-------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-------------------------------------------------------------------
Sub-Channel flow  =     50.114(CFS)
  '     '    flow top width =     11.328(Ft.)
  '     '    velocity=    9.700(Ft/s)
  '     '    area =      5.166(Sq.Ft)
  '     '    Froude number =     2.531

Upstream point elevation =  4300.000(Ft.)
Downstream point elevation =  4110.000(Ft.)
Flow length =   964.000(Ft.)
Travel time  =    1.66 min.
Time of concentration =   11.90 min.
Depth of flow =   0.633(Ft.)
Average velocity =   9.700(Ft/s)
Total irregular channel flow =    50.114(CFS)
Irregular channel normal depth above invert elev. =   0.633(Ft.)
Average velocity of channel(s) =   9.700(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      3.973(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.868
Subarea runoff =     47.553(CFS) for   14.570(Ac.)
Total runoff =     73.853(CFS)
Effective area this stream =       21.41(Ac.)
Total Study Area (Main Stream No. 1) =       21.41(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   0.771(Ft.), Average velocity =  10.813(Ft/s)
End of computations, Total Study Area =           21.41 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 154
2 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.450 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 200.000 to Point/Station 210.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 990.000(Ft.)
Top (of initial area) elevation = 4770.000(Ft.)
Bottom (of initial area) elevation = 4640.000(Ft.)
Difference in elevation = 130.000(Ft.)
Slope = 0.13131 s(%)= 13.13
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.438 min.
Rainfall intensity = 1.354(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.632
Subarea runoff = 4.961(CFS)
Total initial stream area = 5.800(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++
Process from Point/Station 210.000 to Point/Station 220.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.214(Ft.), Average velocity =   6.356(Ft/s)
      ******* Irregular Channel Data ***********
---------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
---------------------------------------------------------------------
Sub-Channel flow  =      8.260(CFS)
  '     '    flow top width =      7.141(Ft.)
  '     '    velocity=    6.356(Ft/s)
  '     '    area =      1.300(Sq.Ft)
  '     '    Froude number =     2.626

Upstream point elevation =  4640.000(Ft.)
Downstream point elevation =  4220.000(Ft.)
Flow length =  1468.000(Ft.)
Travel time  =    3.85 min.
Time of concentration =   16.29 min.
Depth of flow =   0.214(Ft.)
Average velocity =   6.356(Ft/s)
Total irregular channel flow =     8.260(CFS)
Irregular channel normal depth above invert elev. =   0.214(Ft.)
Average velocity of channel(s) =   6.356(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.121(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.576
Subarea runoff =      6.521(CFS) for   11.980(Ac.)
Total runoff =     11.482(CFS)
Effective area this stream =       17.78(Ac.)
Total Study Area (Main Stream No. 1) =       17.78(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.258(Ft.), Average velocity =   7.078(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      220.000 to Point/Station      230.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.450(Ft.), Average velocity =   7.165(Ft/s)
      ******* Irregular Channel Data ***********
---------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              10.00
      2             50.00               0.00
      3             55.00               0.00
      4            105.00              10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     23.354(CFS)
  '     '    flow top width =      9.497(Ft.)
  '     '    velocity=    7.165(Ft/s)
  '     '    area =      3.259(Sq.Ft)
  '     '    Froude number =     2.155

Upstream point elevation =  4220.000(Ft.)
Downstream point elevation =  4128.000(Ft.)
Flow length =   587.000(Ft.)
Travel time  =    1.37 min.
Time of concentration =   17.65 min.
Depth of flow =   0.450(Ft.)
Average velocity =   7.165(Ft/s)
Total irregular channel flow =    23.354(CFS)
Irregular channel normal depth above invert elev. =   0.450(Ft.)
Average velocity of channel(s) =   7.165(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.060(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.557
Subarea runoff =     23.688(CFS) for   41.780(Ac.)
Total runoff =     35.170(CFS)
Effective area this stream =       59.56(Ac.)
Total Study Area (Main Stream No. 1) =       59.56(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.559(Ft.), Average velocity =   8.077(Ft/s)
End of computations, Total Study Area =           59.56 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 154
10 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.745 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 200.000 to Point/Station 210.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 990.000(Ft.)
Top (of initial area) elevation = 4770.000(Ft.)
Bottom (of initial area) elevation = 4640.000(Ft.)
Difference in elevation = 130.000(Ft.)
Slope = 0.13131 s(%)= 13.13
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.438 min.
Rainfall intensity = 2.241(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.738
Subarea runoff = 9.594(CFS)
Total initial stream area = 5.800(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++
Process from Point/Station 210.000 to Point/Station 220.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.321(Ft.), Average velocity =   8.017(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
--------------------------------------------------------------------
Sub-Channel flow  =     16.997(CFS)
  '     '    flow top width =      8.210(Ft.)
  '     '    velocity=    8.017(Ft/s)
  '     '    area =      2.120(Sq.Ft)
  '     '    Froude number =     2.780

Upstream point elevation =  4640.000(Ft.)
Downstream point elevation =  4220.000(Ft.)
Flow length =  1468.000(Ft.)
Travel time  =    3.05 min.
Time of concentration =   15.49 min.
Depth of flow =   0.321(Ft.)
Average velocity =   8.017(Ft/s)
Total irregular channel flow =    16.997(CFS)
Irregular channel normal depth above invert elev. =   0.321(Ft.)
Average velocity of channel(s) =   8.017(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.922(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.711
Subarea runoff =     14.710(CFS) for   11.980(Ac.)
Total runoff =     24.304(CFS)
Effective area this stream =       17.78(Ac.)
Total Study Area (Main Stream No. 1) =       17.78(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.391(Ft.), Average velocity =   8.950(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      220.000 to Point/Station      230.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.674(Ft.), Average velocity =   8.954(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              10.00
      2             50.00               0.00
      3             55.00               0.00
      4            105.00              10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     50.499(CFS)
  '     '    flow top width =     11.739(Ft.)
  '     '    velocity=    8.954(Ft/s)
  '     '    area =      5.640(Sq.Ft)
  '     '    Froude number =     2.277

Upstream point elevation =  4220.000(Ft.)
Downstream point elevation =  4128.000(Ft.)
Flow length =   587.000(Ft.)
Travel time  =    1.09 min.
Time of concentration =   16.58 min.
Depth of flow =   0.674(Ft.)
Average velocity =   8.954(Ft/s)
Total irregular channel flow =    50.499(CFS)
Irregular channel normal depth above invert elev. =   0.674(Ft.)
Average velocity of channel(s) =   8.954(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.833(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.702
Subarea runoff =     52.309(CFS) for   41.780(Ac.)
Total runoff =     76.613(CFS)
Effective area this stream =       59.56(Ac.)
Total Study Area (Main Stream No. 1) =       59.56(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.832(Ft.), Average velocity =  10.053(Ft/s)
End of computations, Total Study Area =           59.56 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 154
25 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 0.944 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 200.000 to Point/Station 210.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 990.000(Ft.)
Top (of initial area) elevation = 4770.000(Ft.)
Bottom (of initial area) elevation = 4640.000(Ft.)
Difference in elevation = 130.000(Ft.)
Slope = 0.13131 s(%)= 13.13
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.438 min.
Rainfall intensity = 2.840(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.772
Subarea runoff = 12.720(CFS)
Total initial stream area = 5.800(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++
Process from Point/Station 210.000 to Point/Station 220.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.378(Ft.), Average velocity =   8.788(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
--------------------------------------------------------------------
Sub-Channel flow  =     22.888(CFS)
  '     '    flow top width =      8.780(Ft.)
  '     '    velocity=    8.788(Ft/s)
  '     '    area =      2.604(Sq.Ft)
  '     '    Froude number =     2.844

Upstream point elevation =  4640.000(Ft.)
Downstream point elevation =  4220.000(Ft.)
Flow length =  1468.000(Ft.)
Travel time  =    2.78 min.
Time of concentration =   15.22 min.
Depth of flow =   0.378(Ft.)
Average velocity =   8.788(Ft/s)
Total irregular channel flow =    22.888(CFS)
Irregular channel normal depth above invert elev. =   0.378(Ft.)
Average velocity of channel(s) =   8.788(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      2.466(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.753
Subarea runoff =     20.280(CFS) for   11.980(Ac.)
Total runoff =     33.000(CFS)
Effective area this stream =       17.78(Ac.)
Total Study Area (Main Stream No. 1) =       17.78(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.461(Ft.), Average velocity =   9.810(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      220.000 to Point/Station      230.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.789(Ft.), Average velocity =   9.765(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              10.00
      2             50.00               0.00
      3             55.00               0.00
      4            105.00              10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     68.935(CFS)
  '     '    flow top width =     12.891(Ft.)
  '     '    velocity=    9.765(Ft/s)
  '     '    area =      7.059(Sq.Ft)
  '     '    Froude number =     2.326

Upstream point elevation =  4220.000(Ft.)
Downstream point elevation =  4128.000(Ft.)
Flow length =   587.000(Ft.)
Travel time  =    1.00 min.
Time of concentration =   16.22 min.
Depth of flow =   0.789(Ft.)
Average velocity =   9.765(Ft/s)
Total irregular channel flow =    68.935(CFS)
Irregular channel normal depth above invert elev. =   0.789(Ft.)
Average velocity of channel(s) =   9.765(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      2.358(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.746
Subarea runoff =     71.776(CFS) for   41.780(Ac.)
Total runoff =    104.776(CFS)
Effective area this stream =       59.56(Ac.)
Total Study Area (Main Stream No. 1) =       59.56(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.971(Ft.), Average velocity =  10.947(Ft/s)
End of computations, Total Study Area =           59.56 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 154
100 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.280 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 200.000 to Point/Station 210.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.140(In/Hr)
Initial subarea data:
Initial area flow distance = 990.000(Ft.)
Top (of initial area) elevation = 4770.000(Ft.)
Bottom (of initial area) elevation = 4640.000(Ft.)
Difference in elevation = 130.000(Ft.)
Slope = 0.13131 s(%)= 13.13
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.438 min.
Rainfall intensity = 3.851(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.867
Subarea runoff = 19.372(CFS)
Total initial stream area = 5.800(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.140(In/Hr)

++

```
Process from Point/Station      210.000 to Point/Station      220.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.481(Ft.), Average velocity =  10.048(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     35.787(CFS)
  '     '    flow top width =      9.810(Ft.)
  '     '    velocity=   10.048(Ft/s)
  '     '    area =      3.562(Sq.Ft)
  '     '    Froude number =     2.939

Upstream point elevation =  4640.000(Ft.)
Downstream point elevation =  4220.000(Ft.)
Flow length =  1468.000(Ft.)
Travel time  =    2.43 min.
Time of concentration =   14.87 min.
Depth of flow =   0.481(Ft.)
Average velocity =  10.048(Ft/s)
Total irregular channel flow =    35.787(CFS)
Irregular channel normal depth above invert elev. =   0.481(Ft.)
Average velocity of channel(s) =  10.048(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      3.398(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.863
Subarea runoff =     32.764(CFS) for   11.980(Ac.)
Total runoff =     52.136(CFS)
Effective area this stream =       17.78(Ac.)
Total Study Area (Main Stream No. 1) =       17.78(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   0.586(Ft.), Average velocity =  11.208(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      220.000 to Point/Station      230.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.994(Ft.), Average velocity =  11.087(Ft/s)
```

```
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    109.820(CFS)
  '     '    flow top width =     14.937(Ft.)
  '     '    velocity=   11.087(Ft/s)
  '     '    area =      9.905(Sq.Ft)
  '     '    Froude number =     2.399

Upstream point elevation =  4220.000(Ft.)
Downstream point elevation =  4128.000(Ft.)
Flow length =   587.000(Ft.)
Travel time  =    0.88 min.
Time of concentration =   15.76 min.
Depth of flow =   0.994(Ft.)
Average velocity =  11.087(Ft/s)
Total irregular channel flow =   109.819(CFS)
Irregular channel normal depth above invert elev. =   0.994(Ft.)
Average velocity of channel(s) =  11.087(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      3.264(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.861
Subarea runoff =    115.308(CFS) for   41.780(Ac.)
Total runoff =    167.444(CFS)
Effective area this stream =       59.56(Ac.)
Total Study Area (Main Stream No. 1) =       59.56(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   1.217(Ft.), Average velocity =  12.408(Ft/s)
End of computations, Total Study Area =           59.56 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 171
2 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.450 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 300.000 to Point/Station 310.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 880.000(Ft.)
Top (of initial area) elevation = 4848.000(Ft.)
Bottom (of initial area) elevation = 4760.000(Ft.)
Difference in elevation = 88.000(Ft.)
Slope = 0.10000 s(%)= 10.00
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.530 min.
Rainfall intensity = 1.347(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.630
Subarea runoff = 3.736(CFS)
Total initial stream area = 4.400(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++
Process from Point/Station 310.000 to Point/Station 320.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.273(Ft.), Average velocity =   6.331(Ft/s)
      ******* Irregular Channel Data ***********
---------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
---------------------------------------------------------------------
Sub-Channel flow  =     10.989(CFS)
  '     '    flow top width =      7.727(Ft.)
  '     '    velocity=    6.331(Ft/s)
  '     '    area =      1.736(Sq.Ft)
  '     '    Froude number =     2.354

Upstream point elevation =  4760.000(Ft.)
Downstream point elevation =  4480.000(Ft.)
Flow length =  1304.000(Ft.)
Travel time  =    3.43 min.
Time of concentration =   15.96 min.
Depth of flow =   0.273(Ft.)
Average velocity =   6.331(Ft/s)
Total irregular channel flow =    10.990(CFS)
Irregular channel normal depth above invert elev. =   0.273(Ft.)
Average velocity of channel(s) =   6.331(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.137(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.581
Subarea runoff =     14.450(CFS) for   23.150(Ac.)
Total runoff =     18.186(CFS)
Effective area this stream =       27.55(Ac.)
Total Study Area (Main Stream No. 1) =       27.55(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.361(Ft.), Average velocity =   7.415(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      320.000 to Point/Station      330.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.425(Ft.), Average velocity =   7.794(Ft/s)
      ******* Irregular Channel Data ***********
---------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     23.591(CFS)
  '     '    flow top width =      9.248(Ft.)
  '     '    velocity=    7.794(Ft/s)
  '     '    area =      3.027(Sq.Ft)
  '     '    Froude number =     2.401

Upstream point elevation =  4480.000(Ft.)
Downstream point elevation =  4286.000(Ft.)
Flow length =   982.000(Ft.)
Travel time  =    2.10 min.
Time of concentration =   18.06 min.
Depth of flow =   0.425(Ft.)
Average velocity =   7.794(Ft/s)
Total irregular channel flow =    23.591(CFS)
Irregular channel normal depth above invert elev. =   0.425(Ft.)
Average velocity of channel(s) =   7.794(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.043(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.552
Subarea runoff =     10.735(CFS) for   22.720(Ac.)
Total runoff =     28.920(CFS)
Effective area this stream =       50.27(Ac.)
Total Study Area (Main Stream No. 1) =       50.27(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.474(Ft.), Average velocity =   8.281(Ft/s)
End of computations, Total Study Area =           50.27 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 171
10 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.745 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 300.000 to Point/Station 310.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 880.000(Ft.)
Top (of initial area) elevation = 4848.000(Ft.)
Bottom (of initial area) elevation = 4760.000(Ft.)
Difference in elevation = 88.000(Ft.)
Slope = 0.10000 s(%)= 10.00
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.530 min.
Rainfall intensity = 2.230(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.737
Subarea runoff = 7.233(CFS)
Total initial stream area = 4.400(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++
Process from Point/Station 310.000 to Point/Station 320.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.407(Ft.), Average velocity =   7.935(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
--------------------------------------------------------------------
Sub-Channel flow  =     22.722(CFS)
  '     '    flow top width =      9.070(Ft.)
  '     '    velocity=    7.935(Ft/s)
  '     '    area =      2.864(Sq.Ft)
  '     '    Froude number =     2.489

Upstream point elevation =  4760.000(Ft.)
Downstream point elevation =  4480.000(Ft.)
Flow length =  1304.000(Ft.)
Travel time  =    2.74 min.
Time of concentration =   15.27 min.
Depth of flow =   0.407(Ft.)
Average velocity =   7.935(Ft/s)
Total irregular channel flow =    22.722(CFS)
Irregular channel normal depth above invert elev. =   0.407(Ft.)
Average velocity of channel(s) =   7.935(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.942(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.713
Subarea runoff =     30.908(CFS) for   23.150(Ac.)
Total runoff =     38.141(CFS)
Effective area this stream =       27.55(Ac.)
Total Study Area (Main Stream No. 1) =       27.55(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.537(Ft.), Average velocity =   9.248(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      320.000 to Point/Station      330.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.637(Ft.), Average velocity =   9.746(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              10.00
      2             50.00               0.00
      3             55.00               0.00
      4            105.00              10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     50.800(CFS)
  '     '    flow top width =     11.369(Ft.)
  '     '    velocity=    9.746(Ft/s)
  '     '    area =      5.212(Sq.Ft)
  '     '    Froude number =     2.537

Upstream point elevation =  4480.000(Ft.)
Downstream point elevation =  4286.000(Ft.)
Flow length =   982.000(Ft.)
Travel time  =    1.68 min.
Time of concentration =   16.95 min.
Depth of flow =   0.637(Ft.)
Average velocity =   9.746(Ft/s)
Total irregular channel flow =    50.800(CFS)
Irregular channel normal depth above invert elev. =   0.637(Ft.)
Average velocity of channel(s) =   9.746(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.805(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.699
Subarea runoff =     25.266(CFS) for   22.720(Ac.)
Total runoff =     63.406(CFS)
Effective area this stream =       50.27(Ac.)
Total Study Area (Main Stream No. 1) =       50.27(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.713(Ft.), Average velocity =  10.373(Ft/s)
End of computations, Total Study Area =           50.27 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 171
25 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 0.944 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 300.000 to Point/Station 310.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 880.000(Ft.)
Top (of initial area) elevation = 4848.000(Ft.)
Bottom (of initial area) elevation = 4760.000(Ft.)
Difference in elevation = 88.000(Ft.)
Slope = 0.10000 s(%)= 10.00
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.530 min.
Rainfall intensity = 2.826(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.771
Subarea runoff = 9.591(CFS)
Total initial stream area = 4.400(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++
Process from Point/Station 310.000 to Point/Station 320.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.478(Ft.), Average velocity =   8.677(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
--------------------------------------------------------------------
Sub-Channel flow  =     30.668(CFS)
  '     '    flow top width =      9.782(Ft.)
  '     '    velocity=    8.677(Ft/s)
  '     '    area =      3.534(Sq.Ft)
  '     '    Froude number =     2.544

Upstream point elevation =  4760.000(Ft.)
Downstream point elevation =  4480.000(Ft.)
Flow length =  1304.000(Ft.)
Travel time  =    2.50 min.
Time of concentration =   15.03 min.
Depth of flow =   0.478(Ft.)
Average velocity =   8.677(Ft/s)
Total irregular channel flow =    30.668(CFS)
Irregular channel normal depth above invert elev. =   0.478(Ft.)
Average velocity of channel(s) =   8.677(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      2.487(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.754
Subarea runoff =     42.073(CFS) for   23.150(Ac.)
Total runoff =     51.665(CFS)
Effective area this stream =       27.55(Ac.)
Total Study Area (Main Stream No. 1) =       27.55(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.629(Ft.), Average velocity =  10.089(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      320.000 to Point/Station      330.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.746(Ft.), Average velocity =  10.633(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              10.00
      2             50.00               0.00
      3             55.00               0.00
      4            105.00              10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     69.289(CFS)
  '     '    flow top width =     12.463(Ft.)
  '     '    velocity=   10.633(Ft/s)
  '     '    area =      6.517(Sq.Ft)
  '     '    Froude number =     2.591

Upstream point elevation =  4480.000(Ft.)
Downstream point elevation =  4286.000(Ft.)
Flow length =   982.000(Ft.)
Travel time  =    1.54 min.
Time of concentration =   16.57 min.
Depth of flow =   0.746(Ft.)
Average velocity =  10.633(Ft/s)
Total irregular channel flow =    69.289(CFS)
Irregular channel normal depth above invert elev. =   0.746(Ft.)
Average velocity of channel(s) =  10.633(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      2.323(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.744
Subarea runoff =     35.185(CFS) for   22.720(Ac.)
Total runoff =     86.850(CFS)
Effective area this stream =       50.27(Ac.)
Total Study Area (Main Stream No. 1) =       50.27(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.836(Ft.), Average velocity =  11.317(Ft/s)
End of computations, Total Study Area =           50.27 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/19/11

White Knob Haul Road
Culvert Crossing at Station 171
100 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.280 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 300.000 to Point/Station 310.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.140(In/Hr)
Initial subarea data:
Initial area flow distance = 880.000(Ft.)
Top (of initial area) elevation = 4848.000(Ft.)
Bottom (of initial area) elevation = 4760.000(Ft.)
Difference in elevation = 88.000(Ft.)
Slope = 0.10000 s(%)= 10.00
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 12.530 min.
Rainfall intensity = 3.831(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.867
Subarea runoff = 14.618(CFS)
Total initial stream area = 4.400(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.140(In/Hr)

++

```
Process from Point/Station      310.000 to Point/Station      320.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.605(Ft.), Average velocity =   9.882(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
--------------------------------------------------------------------
Sub-Channel flow  =     48.035(CFS)
  '     '    flow top width =     11.055(Ft.)
  '     '    velocity=    9.882(Ft/s)
  '     '    area =      4.861(Sq.Ft)
  '     '    Froude number =     2.626

Upstream point elevation =  4760.000(Ft.)
Downstream point elevation =  4480.000(Ft.)
Flow length =  1304.000(Ft.)
Travel time  =    2.20 min.
Time of concentration =   14.73 min.
Depth of flow =   0.605(Ft.)
Average velocity =   9.882(Ft/s)
Total irregular channel flow =    48.035(CFS)
Irregular channel normal depth above invert elev. =   0.605(Ft.)
Average velocity of channel(s) =   9.882(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      3.421(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.863
Subarea runoff =     66.742(CFS) for   23.150(Ac.)
Total runoff =     81.359(CFS)
Effective area this stream =       27.55(Ac.)
Total Study Area (Main Stream No. 1) =       27.55(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   0.792(Ft.), Average velocity =  11.456(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      320.000 to Point/Station      330.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.941(Ft.), Average velocity =  12.079(Ft/s)
```

```
      ******* Irregular Channel Data ***********
-------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-------------------------------------------------------------------
Sub-Channel flow  =    110.322(CFS)
  '     '    flow top width =     14.410(Ft.)
  '     '    velocity=   12.079(Ft/s)
  '     '    area =      9.133(Sq.Ft)
  '     '    Froude number =     2.674

Upstream point elevation =  4480.000(Ft.)
Downstream point elevation =  4286.000(Ft.)
Flow length =   982.000(Ft.)
Travel time  =    1.35 min.
Time of concentration =   16.08 min.
Depth of flow =   0.941(Ft.)
Average velocity =  12.079(Ft/s)
Total irregular channel flow =   110.322(CFS)
Irregular channel normal depth above invert elev. =   0.941(Ft.)
Average velocity of channel(s) =  12.079(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      3.217(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.861
Subarea runoff =     57.848(CFS) for   22.720(Ac.)
Total runoff =    139.207(CFS)
Effective area this stream =       50.27(Ac.)
Total Study Area (Main Stream No. 1) =       50.27(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   1.054(Ft.), Average velocity =  12.860(Ft/s)
End of computations, Total Study Area =           50.27 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  78.0
```

Quarry Drainage

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/21/11

White Knob Haul Road
Quarry Drainage
2 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.491 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 400.000 to Point/Station 405.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.301(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 7705.000(Ft.)
Bottom (of initial area) elevation = 6940.000(Ft.)
Difference in elevation = 765.000(Ft.)
Slope = 0.76500 s(%)= 76.50
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.805 min.
Rainfall intensity = 1.532(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.723
Subarea runoff = 5.820(CFS)
Total initial stream area = 5.250(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.301(In/Hr)

++
Process from Point/Station 405.000 to Point/Station 410.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.283(Ft.), Average velocity =  10.359(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
--------------------------------------------------------------------
Sub-Channel flow  =     18.784(CFS)
  '     '    flow top width =      7.827(Ft.)
  '     '    velocity=   10.359(Ft/s)
  '     '    area =      1.813(Sq.Ft)
  '     '    Froude number =     3.793

Upstream point elevation =  6940.000(Ft.)
Downstream point elevation =  6700.000(Ft.)
Flow length =   435.000(Ft.)
Travel time  =    0.70 min.
Time of concentration =   12.51 min.
Depth of flow =   0.283(Ft.)
Average velocity =  10.359(Ft/s)
Total irregular channel flow =    18.784(CFS)
Irregular channel normal depth above invert elev. =   0.283(Ft.)
Average velocity of channel(s) =  10.359(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      1.472(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.716
Subarea runoff =     25.875(CFS) for   24.820(Ac.)
Total runoff =     31.695(CFS)
Effective area this stream =       30.07(Ac.)
Total Study Area (Main Stream No. 1) =       30.07(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   0.377(Ft.), Average velocity =  12.194(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      410.000 to Point/Station      415.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.567(Ft.), Average velocity =  15.827(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     70.357(CFS)
  '     '    flow top width =     10.673(Ft.)
  '     '    velocity=   15.827(Ft/s)
  '     '    area =      4.445(Sq.Ft)
  '     '    Froude number =     4.322

Upstream point elevation =  6700.000(Ft.)
Downstream point elevation =  5900.000(Ft.)
Flow length =  1352.000(Ft.)
Travel time  =    1.42 min.
Time of concentration =   13.93 min.
Depth of flow =   0.567(Ft.)
Average velocity =  15.827(Ft/s)
Total irregular channel flow =    70.357(CFS)
Irregular channel normal depth above invert elev. =   0.567(Ft.)
Average velocity of channel(s) =  15.827(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      1.365(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.702
Subarea runoff =     77.229(CFS) for   83.660(Ac.)
Total runoff =    108.924(CFS)
Effective area this stream =      113.73(Ac.)
Total Study Area (Main Stream No. 1) =      113.73(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   0.711(Ft.), Average velocity =  17.915(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      415.000 to Point/Station      420.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.929(Ft.), Average velocity =  14.291(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
```

```
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    127.963(CFS)
  '     '    flow top width =     14.286(Ft.)
  '     '    velocity=   14.291(Ft/s)
  '     '    area =      8.954(Sq.Ft)
  '     '    Froude number =     3.181

Upstream point elevation =  5900.000(Ft.)
Downstream point elevation =  5405.000(Ft.)
Flow length =  1764.000(Ft.)
Travel time  =    2.06 min.
Time of concentration =   15.99 min.
Depth of flow =   0.929(Ft.)
Average velocity =  14.291(Ft/s)
Total irregular channel flow =   127.963(CFS)
Irregular channel normal depth above invert elev. =   0.929(Ft.)
Average velocity of channel(s) =  14.291(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      1.239(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.682
Subarea runoff =     37.992(CFS) for   60.170(Ac.)
Total runoff =    146.915(CFS)
Effective area this stream =      173.90(Ac.)
Total Study Area (Main Stream No. 1) =      173.90(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   0.994(Ft.), Average velocity =  14.834(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      415.000 to Point/Station      420.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    173.900(Ac.)
Runoff from this stream =    146.915(CFS)
Time of concentration =   15.99 min.
Rainfall intensity =     1.239(In/Hr)
Area averaged loss rate (Fm) =    0.3006(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      500.000 to Point/Station      510.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
```

```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Initial subarea data:
Initial area flow distance =   970.000(Ft.)
Top (of initial area) elevation =  7120.000(Ft.)
Bottom (of initial area) elevation =  6600.000(Ft.)
Difference in elevation =   520.000(Ft.)
Slope =    0.53608  s(%)=      53.61
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.522 min.
Rainfall intensity =      1.470(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.716
Subarea runoff =     10.117(CFS)
Total initial stream area =        9.610(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.301(In/Hr)


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Process from Point/Station      510.000 to Point/Station      520.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.281(Ft.), Average velocity =  11.162(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     20.113(CFS)
  '     '    flow top width =      7.813(Ft.)
  '     '    velocity=   11.162(Ft/s)
  '     '    area =      1.802(Sq.Ft)
  '     '    Froude number =     4.096

Upstream point elevation =  6600.000(Ft.)
Downstream point elevation =  6100.000(Ft.)
Flow length =   776.000(Ft.)
Travel time  =    1.16 min.
Time of concentration =   13.68 min.
Depth of flow =   0.281(Ft.)
Average velocity =  11.162(Ft/s)
Total irregular channel flow =    20.113(CFS)
Irregular channel normal depth above invert elev. =   0.281(Ft.)
Average velocity of channel(s) =  11.162(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
```

```
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      1.382(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.704
Subarea runoff =     19.909(CFS) for   21.240(Ac.)
Total runoff =     30.026(CFS)
Effective area this stream =       30.85(Ac.)
Total Study Area (Main Stream No. 1) =      204.75(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   0.351(Ft.), Average velocity =  12.656(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      520.000 to Point/Station      530.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.611(Ft.), Average velocity =  13.048(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     64.195(CFS)
  '     '    flow top width =     11.108(Ft.)
  '     '    velocity=   13.048(Ft/s)
  '     '    area =      4.920(Sq.Ft)
  '     '    Froude number =     3.455

Upstream point elevation =  6100.000(Ft.)
Downstream point elevation =  5710.000(Ft.)
Flow length =  1052.000(Ft.)
Travel time  =    1.34 min.
Time of concentration =   15.02 min.
Depth of flow =   0.611(Ft.)
Average velocity =  13.048(Ft/s)
Total irregular channel flow =    64.195(CFS)
Irregular channel normal depth above invert elev. =   0.611(Ft.)
Average velocity of channel(s) =  13.048(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      1.294(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.691
```

```
Subarea runoff =     68.262(CFS) for   79.050(Ac.)
Total runoff =     98.288(CFS)
Effective area this stream =      109.90(Ac.)
Total Study Area (Main Stream No. 1) =      283.80(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   0.760(Ft.), Average velocity =  14.707(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      530.000 to Point/Station      420.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.393(Ft.), Average velocity =   8.121(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     98.314(CFS)
  '     '    flow top width =     31.573(Ft.)
  '     '    velocity=    8.121(Ft/s)
  '     '    area =     12.106(Sq.Ft)
  '     '    Froude number =     2.311

Upstream point elevation =  5710.000(Ft.)
Downstream point elevation =  5405.000(Ft.)
Flow length =  1764.000(Ft.)
Travel time  =    3.62 min.
Time of concentration =   18.64 min.
Depth of flow =   0.393(Ft.)
Average velocity =   8.121(Ft/s)
Total irregular channel flow =    98.314(CFS)
Irregular channel normal depth above invert elev. =   0.393(Ft.)
Average velocity of channel(s) =   8.121(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2)  = 83.50
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.309(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =     91.229(CFS)
therefore the upstream flow rate of Q =     98.288(CFS) is being used
Rainfall intensity =      1.113(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.656
Subarea runoff =      0.000(CFS) for   15.070(Ac.)
Total runoff =     98.288(CFS)
Effective area this stream =      124.97(Ac.)
```

```
Total Study Area (Main Stream No. 1) =      298.87(Ac.)
Area averaged Fm value =    0.302(In/Hr)
Depth of flow =   0.393(Ft.), Average velocity =   8.120(Ft/s)


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Process from Point/Station      530.000 to Point/Station      420.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    124.970(Ac.)
Runoff from this stream =     98.288(CFS)
Time of concentration =   18.64 min.
Rainfall intensity =     1.113(In/Hr)
Area averaged loss rate (Fm) =    0.3016(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1    146.92   173.900     15.99    0.301      1.239
2     98.29   124.970     18.64    0.302      1.113
Qmax(1) =
         1.000 *    1.000 *   146.915) +
         1.156 *    0.857 *    98.288) + =     244.334
Qmax(2) =
         0.865 *    1.000 *   146.915) +
         1.000 *    1.000 *    98.288) + =     225.402

Total of 2 streams to confluence:
Flow rates before confluence point:
     146.915      98.288
Maximum flow rates at confluence using above data:
      244.334      225.402
Area of streams before confluence:
      173.900      124.970
Effective area values after confluence:
      281.051      298.870
Results of confluence:
Total flow rate =    244.334(CFS)
Time of concentration =    15.986 min.
Effective stream area after confluence =    281.051(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.301(In/Hr)
Study area total (this main stream) =     298.87(Ac.)


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Process from Point/Station      420.000 to Point/Station      425.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.727(Ft.), Average velocity =  10.681(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    244.366(CFS)
  '     '    flow top width =     32.909(Ft.)
  '     '    velocity=   10.681(Ft/s)
  '     '    area =     22.878(Sq.Ft)
  '     '    Froude number =     2.258

Upstream point elevation =  5405.000(Ft.)
Downstream point elevation =  5169.000(Ft.)
Flow length =  1734.000(Ft.)
Travel time  =    2.71 min.
Time of concentration =   18.69 min.
Depth of flow =   0.727(Ft.)
Average velocity =  10.681(Ft/s)
Total irregular channel flow =   244.365(CFS)
Irregular channel normal depth above invert elev. =   0.727(Ft.)
Average velocity of channel(s) =  10.681(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.170
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.830
SCS curve number for soil(AMC 2)  = 87.13
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.245(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    233.782(CFS)
therefore the upstream flow rate of Q =    244.334(CFS) is being used
Rainfall intensity =      1.111(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.661
Subarea runoff =      0.000(CFS) for   37.150(Ac.)
Total runoff =    244.334(CFS)
Effective area this stream =      318.20(Ac.)
Total Study Area (Main Stream No. 1) =      336.02(Ac.)
Area averaged Fm value =    0.294(In/Hr)
Depth of flow =   0.727(Ft.), Average velocity =  10.681(Ft/s)


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Process from Point/Station      425.000 to Point/Station      430.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.732(Ft.), Average velocity =  10.606(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
```

```
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    244.362(CFS)
  '     '    flow top width =     32.929(Ft.)
  '     '    velocity=   10.606(Ft/s)
  '     '    area =     23.041(Sq.Ft)
  '     '    Froude number =     2.234

Upstream point elevation =  5169.000(Ft.)
Downstream point elevation =  5109.000(Ft.)
Flow length =   451.000(Ft.)
Travel time  =    0.71 min.
Time of concentration =   19.40 min.
Depth of flow =   0.732(Ft.)
Average velocity =  10.606(Ft/s)
Total irregular channel flow =   244.362(CFS)
Irregular channel normal depth above invert elev. =   0.732(Ft.)
Average velocity of channel(s) =  10.606(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.300
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.700
SCS curve number for soil(AMC 2)  = 85.70
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.270(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    229.058(CFS)
therefore the upstream flow rate of Q =    244.334(CFS) is being used
Rainfall intensity =      1.082(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.655
Subarea runoff =      0.000(CFS) for    4.730(Ac.)
Total runoff =    244.334(CFS)
Effective area this stream =      322.93(Ac.)
Total Study Area (Main Stream No. 1) =      340.75(Ac.)
Area averaged Fm value =    0.294(In/Hr)
Depth of flow =   0.732(Ft.), Average velocity =  10.605(Ft/s)


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Process from Point/Station      430.000 to Point/Station      435.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.734(Ft.), Average velocity =  10.584(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              10.00
      2             20.00               0.00
      3             50.00               0.00
      4             70.00              10.00
```

```
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    244.362(CFS)
  '     '    flow top width =     32.935(Ft.)
  '     '    velocity=   10.584(Ft/s)
  '     '    area =     23.088(Sq.Ft)
  '     '    Froude number =     2.228

Upstream point elevation =  5109.000(Ft.)
Downstream point elevation =  5010.000(Ft.)
Flow length =   749.000(Ft.)
Travel time  =    1.18 min.
Time of concentration =   20.58 min.
Depth of flow =   0.734(Ft.)
Average velocity =  10.584(Ft/s)
Total irregular channel flow =   244.362(CFS)
Irregular channel normal depth above invert elev. =   0.734(Ft.)
Average velocity of channel(s) =  10.584(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.570
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.430
SCS curve number for soil(AMC 2)  = 82.73
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.323(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    219.388(CFS)
therefore the upstream flow rate of Q =    244.334(CFS) is being used
Rainfall intensity =      1.038(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.645
Subarea runoff =      0.000(CFS) for    4.750(Ac.)
Total runoff =    244.334(CFS)
Effective area this stream =      327.68(Ac.)
Total Study Area (Main Stream No. 1) =      345.50(Ac.)
Area averaged Fm value =    0.295(In/Hr)
Depth of flow =   0.734(Ft.), Average velocity =  10.584(Ft/s)


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Process from Point/Station      435.000 to Point/Station      440.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.733(Ft.), Average velocity =  10.599(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    244.365(CFS)
```

```
  '     '    flow top width =     32.931(Ft.)
  '     '    velocity=   10.599(Ft/s)
  '     '    area =     23.055(Sq.Ft)
  '     '    Froude number =     2.232

Upstream point elevation =  5010.000(Ft.)
Downstream point elevation =  4978.000(Ft.)
Flow length =   241.000(Ft.)
Travel time  =    0.38 min.
Time of concentration =   20.96 min.
Depth of flow =   0.733(Ft.)
Average velocity =  10.599(Ft/s)
Total irregular channel flow =   244.364(CFS)
Irregular channel normal depth above invert elev. =   0.733(Ft.)
Average velocity of channel(s) =  10.599(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.570
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.430
SCS curve number for soil(AMC 2)  = 82.73
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.323(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    218.858(CFS)
therefore the upstream flow rate of Q =    244.334(CFS) is being used
Rainfall intensity =      1.025(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.641
Subarea runoff =      0.000(CFS) for    5.310(Ac.)
Total runoff =    244.334(CFS)
Effective area this stream =      332.99(Ac.)
Total Study Area (Main Stream No. 1) =      350.81(Ac.)
Area averaged Fm value =    0.295(In/Hr)
Depth of flow =   0.733(Ft.), Average velocity =  10.599(Ft/s)


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Process from Point/Station      440.000 to Point/Station      441.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.473(Ft.), Average velocity =  13.419(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    244.373(CFS)
  '     '    flow top width =     19.729(Ft.)
  '     '    velocity=   13.419(Ft/s)
  '     '    area =     18.211(Sq.Ft)
```

```
  '     '    Froude number =     2.461

Upstream point elevation =  4978.000(Ft.)
Downstream point elevation =  4700.000(Ft.)
Flow length =  1878.000(Ft.)
Travel time  =    2.33 min.
Time of concentration =   23.29 min.
Depth of flow =   1.473(Ft.)
Average velocity =  13.419(Ft/s)
Total irregular channel flow =   244.373(CFS)
Irregular channel normal depth above invert elev. =   1.473(Ft.)
Average velocity of channel(s) =  13.419(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    210.442(CFS)
therefore the upstream flow rate of Q =    244.334(CFS) is being used
Rainfall intensity =      0.952(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.613
Subarea runoff =      0.000(CFS) for   27.260(Ac.)
Total runoff =    244.334(CFS)
Effective area this stream =      360.25(Ac.)
Total Study Area (Main Stream No. 1) =      378.07(Ac.)
Area averaged Fm value =    0.303(In/Hr)
Depth of flow =   1.473(Ft.), Average velocity =  13.418(Ft/s)


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Process from Point/Station      441.000 to Point/Station      750.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.450(Ft.), Average velocity =  13.755(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    244.375(CFS)
  '     '    flow top width =     19.502(Ft.)
  '     '    velocity=   13.755(Ft/s)
  '     '    area =     17.766(Sq.Ft)
  '     '    Froude number =     2.540

Upstream point elevation =  4700.000(Ft.)
```

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Downstream point elevation =  4300.000(Ft.)
Flow length =  2527.000(Ft.)
Travel time  =    3.06 min.
Time of concentration =   26.35 min.
Depth of flow =   1.450(Ft.)
Average velocity =  13.755(Ft/s)
Total irregular channel flow =   244.375(CFS)
Irregular channel normal depth above invert elev. =   1.450(Ft.)
Average velocity of channel(s) =  13.755(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    191.540(CFS)
therefore the upstream flow rate of Q =    244.334(CFS) is being used
Rainfall intensity =      0.873(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.583
Subarea runoff =      0.000(CFS) for   15.770(Ac.)
Total runoff =    244.334(CFS)
Effective area this stream =      376.02(Ac.)
Total Study Area (Main Stream No. 1) =      393.84(Ac.)
Area averaged Fm value =    0.307(In/Hr)
Depth of flow =   1.450(Ft.), Average velocity =  13.755(Ft/s)


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Process from Point/Station      441.000 to Point/Station      750.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    376.021(Ac.)
Runoff from this stream =    244.334(CFS)
Time of concentration =   26.35 min.
Rainfall intensity =     0.873(In/Hr)
Area averaged loss rate (Fm) =    0.3074(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      700.000 to Point/Station      710.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.790
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.210
SCS curve number for soil(AMC 2)  = 80.31
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.365(In/Hr)
```

```
Initial subarea data:
Initial area flow distance =   929.000(Ft.)
Top (of initial area) elevation =  5851.000(Ft.)
Bottom (of initial area) elevation =  5495.000(Ft.)
Difference in elevation =   356.000(Ft.)
Slope =    0.38321  s(%)=      38.32
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.788 min.
Rainfall intensity =      1.747(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.712
Subarea runoff =      8.673(CFS)
Total initial stream area =        6.970(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.365(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      710.000 to Point/Station      720.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.405(Ft.), Average velocity =   5.079(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     14.449(CFS)
  '     '    flow top width =      9.049(Ft.)
  '     '    velocity=    5.079(Ft/s)
  '     '    area =      2.845(Sq.Ft)
  '     '    Froude number =     1.597

Upstream point elevation =  5495.000(Ft.)
Downstream point elevation =  5315.000(Ft.)
Flow length =  2034.000(Ft.)
Travel time  =    6.67 min.
Time of concentration =   16.46 min.
Depth of flow =   0.405(Ft.)
Average velocity =   5.079(Ft/s)
Total irregular channel flow =    14.449(CFS)
Irregular channel normal depth above invert elev. =   0.405(Ft.)
Average velocity of channel(s) =   5.079(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.980
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.020
SCS curve number for soil(AMC 2)  = 78.22
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.400(In/Hr)
Rainfall intensity =      1.214(In/Hr) for a     2.0 year storm
```

```
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.610
Subarea runoff =     11.460(CFS) for   20.200(Ac.)
Total runoff =     20.133(CFS)
Effective area this stream =       27.17(Ac.)
Total Study Area (Main Stream No. 2) =      421.01(Ac.)
Area averaged Fm value =    0.391(In/Hr)
Depth of flow =   0.484(Ft.), Average velocity =   5.607(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      720.000 to Point/Station      730.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.384(Ft.), Average velocity =   8.723(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              10.00
      2             50.00               0.00
      3             55.00               0.00
      4            105.00              10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     23.200(CFS)
  '     '    flow top width =      8.843(Ft.)
  '     '    velocity=    8.723(Ft/s)
  '     '    area =      2.659(Sq.Ft)
  '     '    Froude number =     2.803

Upstream point elevation =  5315.000(Ft.)
Downstream point elevation =  4829.000(Ft.)
Flow length =  1756.000(Ft.)
Travel time  =    3.35 min.
Time of concentration =   19.82 min.
Depth of flow =   0.384(Ft.)
Average velocity =   8.723(Ft/s)
Total irregular channel flow =    23.200(CFS)
Irregular channel normal depth above invert elev. =   0.384(Ft.)
Average velocity of channel(s) =   8.723(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.066(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.566
Subarea runoff =      6.078(CFS) for   16.250(Ac.)
Total runoff =     26.210(CFS)
Effective area this stream =       43.42(Ac.)
Total Study Area (Main Stream No. 2) =      437.26(Ac.)
```

```
Area averaged Fm value =    0.396(In/Hr)
Depth of flow =   0.411(Ft.), Average velocity =   9.052(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      720.000 to Point/Station      730.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =     43.420(Ac.)
Runoff from this stream =     26.210(CFS)
Time of concentration =   19.82 min.
Rainfall intensity =     1.066(In/Hr)
Area averaged loss rate (Fm) =    0.3955(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      800.000 to Point/Station      810.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.180
Decimal fraction soil group D = 0.820
SCS curve number for soil(AMC 2)  = 88.46
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.221(In/Hr)
Initial subarea data:
Initial area flow distance =   964.000(Ft.)
Top (of initial area) elevation =  5664.000(Ft.)
Bottom (of initial area) elevation =  5225.000(Ft.)
Difference in elevation =   439.000(Ft.)
Slope =    0.45539  s(%)=      45.54
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.596 min.
Rainfall intensity =      1.771(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.788
Subarea runoff =     13.957(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.221(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      810.000 to Point/Station      730.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.590(Ft.), Average velocity =   9.476(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
```

```
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     44.427(CFS)
  '     '    flow top width =     10.898(Ft.)
  '     '    velocity=    9.476(Ft/s)
  '     '    area =      4.689(Sq.Ft)
  '     '    Froude number =     2.546

Upstream point elevation =  5225.000(Ft.)
Downstream point elevation =  4829.000(Ft.)
Flow length =  1949.000(Ft.)
Travel time  =    3.43 min.
Time of concentration =   13.02 min.
Depth of flow =   0.590(Ft.)
Average velocity =   9.476(Ft/s)
Total irregular channel flow =    44.427(CFS)
Irregular channel normal depth above invert elev. =   0.590(Ft.)
Average velocity of channel(s) =   9.476(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.240
Decimal fraction soil group C = 0.010
Decimal fraction soil group D = 0.750
SCS curve number for soil(AMC 2)  = 86.33
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.259(In/Hr)
Rainfall intensity =      1.430(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.740
Subarea runoff =     60.871(CFS) for   60.660(Ac.)
Total runoff =     74.828(CFS)
Effective area this stream =       70.66(Ac.)
Total Study Area (Main Stream No. 2) =      507.92(Ac.)
Area averaged Fm value =    0.254(In/Hr)
Depth of flow =   0.770(Ft.), Average velocity =  10.973(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      810.000 to Point/Station      730.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =     70.660(Ac.)
Runoff from this stream =     74.828(CFS)
Time of concentration =   13.02 min.
Rainfall intensity =     1.430(In/Hr)
Area averaged loss rate (Fm) =    0.2537(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     26.21    43.420     19.82    0.396      1.066
2     74.83    70.660     13.02    0.254      1.430
```

```
Qmax(1) =
         1.000 *    1.000 *    26.210) +
         0.691 *    1.000 *    74.828) + =      77.882
Qmax(2) =
         1.543 *    0.657 *    26.210) +
         1.000 *    1.000 *    74.828) + =     101.407

Total of 2 streams to confluence:
Flow rates before confluence point:
      26.210      74.828
Maximum flow rates at confluence using above data:
       77.882      101.407
Area of streams before confluence:
       43.420       70.660
Effective area values after confluence:
      114.080       99.198
Results of confluence:
Total flow rate =    101.407(CFS)
Time of concentration =    13.025 min.
Effective stream area after confluence =     99.198(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.308(In/Hr)
Study area total (this main stream) =     114.08(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      730.000 to Point/Station      740.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.076(Ft.), Average velocity =  10.280(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    114.807(CFS)
  '     '    flow top width =     15.759(Ft.)
  '     '    velocity=   10.280(Ft/s)
  '     '    area =     11.168(Sq.Ft)
  '     '    Froude number =     2.152

Upstream point elevation =  4829.000(Ft.)
Downstream point elevation =  4580.000(Ft.)
Flow length =  2018.000(Ft.)
Travel time  =    3.27 min.
Time of concentration =   16.30 min.
Depth of flow =   1.076(Ft.)
Average velocity =  10.280(Ft/s)
Total irregular channel flow =   114.807(CFS)
Irregular channel normal depth above invert elev. =   1.076(Ft.)
Average velocity of channel(s) =  10.280(Ft/s)
```

```
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.380
Decimal fraction soil group C = 0.010
Decimal fraction soil group D = 0.610
SCS curve number for soil(AMC 2)  = 84.79
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.287(In/Hr)
Rainfall intensity =      1.223(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.679
Subarea runoff =     26.729(CFS) for   55.130(Ac.)
Total runoff =    128.136(CFS)
Effective area this stream =      154.33(Ac.)
Total Study Area (Main Stream No. 2) =      563.05(Ac.)
Area averaged Fm value =    0.300(In/Hr)
Depth of flow =   1.134(Ft.), Average velocity =  10.586(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      740.000 to Point/Station      750.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.206(Ft.), Average velocity =  10.579(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    140.701(CFS)
  '     '    flow top width =     17.058(Ft.)
  '     '    velocity=   10.579(Ft/s)
  '     '    area =     13.300(Sq.Ft)
  '     '    Froude number =     2.111

Upstream point elevation =  4580.000(Ft.)
Downstream point elevation =  4300.000(Ft.)
Flow length =  2432.000(Ft.)
Travel time  =    3.83 min.
Time of concentration =   20.13 min.
Depth of flow =   1.206(Ft.)
Average velocity =  10.579(Ft/s)
Total irregular channel flow =   140.701(CFS)
Irregular channel normal depth above invert elev. =   1.206(Ft.)
Average velocity of channel(s) =  10.579(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.660
Decimal fraction soil group C = 0.010
Decimal fraction soil group D = 0.330
```

```
SCS curve number for soil(AMC 2)  = 81.71
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.340(In/Hr)
Rainfall intensity =      1.055(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.633
Subarea runoff =     25.042(CFS) for   75.260(Ac.)
Total runoff =    153.177(CFS)
Effective area this stream =      229.59(Ac.)
Total Study Area (Main Stream No. 2) =      638.31(Ac.)
Area averaged Fm value =    0.313(In/Hr)
Depth of flow =   1.255(Ft.), Average velocity =  10.820(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      740.000 to Point/Station      750.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =    229.588(Ac.)
Runoff from this stream =    153.177(CFS)
Time of concentration =   20.13 min.
Rainfall intensity =     1.055(In/Hr)
Area averaged loss rate (Fm) =    0.3134(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1    244.33   376.021     26.35    0.307      0.873
2    153.18   229.588     20.13    0.313      1.055
Qmax(1) =
         1.000 *    1.000 *   244.334) +
         0.755 *    1.000 *   153.177) + =     360.043
Qmax(2) =
         1.320 *    0.764 *   244.334) +
         1.000 *    1.000 *   153.177) + =     399.576

Total of 2 main streams to confluence:
Flow rates before confluence point:
     245.334     154.177
Maximum flow rates at confluence using above data:
      360.043      399.576
Area of streams before confluence:
      376.021      229.588
Effective area values after confluence:
      605.609      516.779


Results of confluence:
Total flow rate =    399.576(CFS)
Time of concentration =    20.128 min.
Effective stream area after confluence  =    516.779(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.310(In/Hr)
```

Study area total = 605.61(Ac.)
End of computations, Total Study Area = 638.31 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 83.5

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/21/11

White Knob Haul Road
Quarry Drainage
10 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.811 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 400.000 to Point/Station 405.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.301(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 7705.000(Ft.)
Bottom (of initial area) elevation = 6940.000(Ft.)
Difference in elevation = 765.000(Ft.)
Slope = 0.76500 s(%)= 76.50
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.805 min.
Rainfall intensity = 2.531(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.793
Subarea runoff = 10.538(CFS)
Total initial stream area = 5.250(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.301(In/Hr)

++
Process from Point/Station 405.000 to Point/Station 410.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.394(Ft.), Average velocity =  12.496(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
--------------------------------------------------------------------
Sub-Channel flow  =     34.355(CFS)
  '     '    flow top width =      8.943(Ft.)
  '     '    velocity=   12.496(Ft/s)
  '     '    area =      2.749(Sq.Ft)
  '     '    Froude number =     3.972

Upstream point elevation =  6940.000(Ft.)
Downstream point elevation =  6700.000(Ft.)
Flow length =   435.000(Ft.)
Travel time  =    0.58 min.
Time of concentration =   12.39 min.
Depth of flow =   0.394(Ft.)
Average velocity =  12.496(Ft/s)
Total irregular channel flow =    34.354(CFS)
Irregular channel normal depth above invert elev. =   0.394(Ft.)
Average velocity of channel(s) =  12.496(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      2.447(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.789
Subarea runoff =     47.559(CFS) for   24.820(Ac.)
Total runoff =     58.097(CFS)
Effective area this stream =       30.07(Ac.)
Total Study Area (Main Stream No. 1) =       30.07(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   0.523(Ft.), Average velocity =  14.606(Ft/s)


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Process from Point/Station      410.000 to Point/Station      415.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.781(Ft.), Average velocity =  18.863(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    131.131(CFS)
  '     '    flow top width =     12.808(Ft.)
  '     '    velocity=   18.863(Ft/s)
  '     '    area =      6.952(Sq.Ft)
  '     '    Froude number =     4.512

Upstream point elevation =  6700.000(Ft.)
Downstream point elevation =  5900.000(Ft.)
Flow length =  1352.000(Ft.)
Travel time  =    1.19 min.
Time of concentration =   13.58 min.
Depth of flow =   0.781(Ft.)
Average velocity =  18.863(Ft/s)
Total irregular channel flow =   131.131(CFS)
Irregular channel normal depth above invert elev. =   0.781(Ft.)
Average velocity of channel(s) =  18.863(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      2.295(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.782
Subarea runoff =    146.000(CFS) for   83.660(Ac.)
Total runoff =    204.097(CFS)
Effective area this stream =      113.73(Ac.)
Total Study Area (Main Stream No. 1) =      113.73(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   0.972(Ft.), Average velocity =  21.286(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      415.000 to Point/Station      420.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.267(Ft.), Average velocity =  16.975(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
```

```
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    243.647(CFS)
  '     '    flow top width =     17.665(Ft.)
  '     '    velocity=   16.975(Ft/s)
  '     '    area =     14.353(Sq.Ft)
  '     '    Froude number =     3.319

Upstream point elevation =  5900.000(Ft.)
Downstream point elevation =  5405.000(Ft.)
Flow length =  1764.000(Ft.)
Travel time  =    1.73 min.
Time of concentration =   15.31 min.
Depth of flow =   1.267(Ft.)
Average velocity =  16.975(Ft/s)
Total irregular channel flow =   243.648(CFS)
Irregular channel normal depth above invert elev. =   1.267(Ft.)
Average velocity of channel(s) =  16.975(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      2.110(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.772
Subarea runoff =     79.038(CFS) for   60.170(Ac.)
Total runoff =    283.135(CFS)
Effective area this stream =      173.90(Ac.)
Total Study Area (Main Stream No. 1) =      173.90(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   1.359(Ft.), Average velocity =  17.659(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      415.000 to Point/Station      420.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    173.900(Ac.)
Runoff from this stream =    283.135(CFS)
Time of concentration =   15.31 min.
Rainfall intensity =     2.110(In/Hr)
Area averaged loss rate (Fm) =    0.3006(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      500.000 to Point/Station      510.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
```

```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Initial subarea data:
Initial area flow distance =   970.000(Ft.)
Top (of initial area) elevation =  7120.000(Ft.)
Bottom (of initial area) elevation =  6600.000(Ft.)
Difference in elevation =   520.000(Ft.)
Slope =    0.53608  s(%)=      53.61
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.522 min.
Rainfall intensity =      2.429(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.789
Subarea runoff =     18.405(CFS)
Total initial stream area =        9.610(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.301(In/Hr)


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Process from Point/Station      510.000 to Point/Station      520.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.394(Ft.), Average velocity =  13.499(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     37.078(CFS)
  '     '    flow top width =      8.941(Ft.)
  '     '    velocity=   13.499(Ft/s)
  '     '    area =      2.747(Sq.Ft)
  '     '    Froude number =     4.292

Upstream point elevation =  6600.000(Ft.)
Downstream point elevation =  6100.000(Ft.)
Flow length =   776.000(Ft.)
Travel time  =    0.96 min.
Time of concentration =   13.48 min.
Depth of flow =   0.394(Ft.)
Average velocity =  13.499(Ft/s)
Total irregular channel flow =    37.078(CFS)
Irregular channel normal depth above invert elev. =   0.394(Ft.)
Average velocity of channel(s) =  13.499(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
```

```
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      2.306(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.783
Subarea runoff =     37.288(CFS) for   21.240(Ac.)
Total runoff =     55.693(CFS)
Effective area this stream =       30.85(Ac.)
Total Study Area (Main Stream No. 1) =      204.75(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   0.490(Ft.), Average velocity =  15.241(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      520.000 to Point/Station      530.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.843(Ft.), Average velocity =  15.569(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    120.844(CFS)
  '     '    flow top width =     13.425(Ft.)
  '     '    velocity=   15.569(Ft/s)
  '     '    area =      7.762(Sq.Ft)
  '     '    Froude number =     3.608

Upstream point elevation =  6100.000(Ft.)
Downstream point elevation =  5710.000(Ft.)
Flow length =  1052.000(Ft.)
Travel time  =    1.13 min.
Time of concentration =   14.61 min.
Depth of flow =   0.843(Ft.)
Average velocity =  15.569(Ft/s)
Total irregular channel flow =   120.844(CFS)
Irregular channel normal depth above invert elev. =   0.843(Ft.)
Average velocity of channel(s) =  15.569(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      2.180(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.776
```

```
Subarea runoff =    130.248(CFS) for   79.050(Ac.)
Total runoff =    185.941(CFS)
Effective area this stream =      109.90(Ac.)
Total Study Area (Main Stream No. 1) =      283.80(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   1.041(Ft.), Average velocity =  17.498(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      530.000 to Point/Station      420.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.576(Ft.), Average velocity =  10.374(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    185.991(CFS)
  '     '    flow top width =     32.302(Ft.)
  '     '    velocity=   10.374(Ft/s)
  '     '    area =     17.928(Sq.Ft)
  '     '    Froude number =     2.454

Upstream point elevation =  5710.000(Ft.)
Downstream point elevation =  5405.000(Ft.)
Flow length =  1764.000(Ft.)
Travel time  =    2.83 min.
Time of concentration =   17.44 min.
Depth of flow =   0.576(Ft.)
Average velocity =  10.374(Ft/s)
Total irregular channel flow =   185.991(CFS)
Irregular channel normal depth above invert elev. =   0.576(Ft.)
Average velocity of channel(s) =  10.374(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2)  = 83.50
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.309(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    182.691(CFS)
therefore the upstream flow rate of Q =    185.941(CFS) is being used
Rainfall intensity =      1.926(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.759
Subarea runoff =      0.000(CFS) for   15.070(Ac.)
Total runoff =    185.941(CFS)
Effective area this stream =      124.97(Ac.)
```

```
Total Study Area (Main Stream No. 1) =      298.87(Ac.)
Area averaged Fm value =    0.302(In/Hr)
Depth of flow =   0.575(Ft.), Average velocity =  10.373(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      530.000 to Point/Station      420.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    124.970(Ac.)
Runoff from this stream =    185.941(CFS)
Time of concentration =   17.44 min.
Rainfall intensity =     1.926(In/Hr)
Area averaged loss rate (Fm) =    0.3016(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1    283.13   173.900     15.31    0.301      2.110
2    185.94   124.970     17.44    0.302      1.926
Qmax(1) =
         1.000 *    1.000 *   283.135) +
         1.113 *    0.878 *   185.941) + =     464.848
Qmax(2) =
         0.898 *    1.000 *   283.135) +
         1.000 *    1.000 *   185.941) + =     440.327

Total of 2 streams to confluence:
Flow rates before confluence point:
     283.135     185.941
Maximum flow rates at confluence using above data:
      464.848      440.327
Area of streams before confluence:
      173.900      124.970
Effective area values after confluence:
      283.621      298.870
Results of confluence:
Total flow rate =    464.848(CFS)
Time of concentration =    15.312 min.
Effective stream area after confluence =    283.621(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.301(In/Hr)
Study area total (this main stream) =     298.87(Ac.)


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Process from Point/Station      420.000 to Point/Station      425.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.070(Ft.), Average velocity =  13.604(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    467.990(CFS)
  '     '    flow top width =     34.281(Ft.)
  '     '    velocity=   13.604(Ft/s)
  '     '    area =     34.401(Sq.Ft)
  '     '    Froude number =     2.393

Upstream point elevation =  5405.000(Ft.)
Downstream point elevation =  5169.000(Ft.)
Flow length =  1734.000(Ft.)
Travel time  =    2.12 min.
Time of concentration =   17.44 min.
Depth of flow =   1.070(Ft.)
Average velocity =  13.604(Ft/s)
Total irregular channel flow =   467.990(CFS)
Irregular channel normal depth above invert elev. =   1.070(Ft.)
Average velocity of channel(s) =  13.604(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.170
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.830
SCS curve number for soil(AMC 2)  = 87.13
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.245(In/Hr)
Rainfall intensity =      1.926(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.762
Subarea runoff =      6.220(CFS) for   37.150(Ac.)
Total runoff =    471.068(CFS)
Effective area this stream =      320.77(Ac.)
Total Study Area (Main Stream No. 1) =      336.02(Ac.)
Area averaged Fm value =    0.295(In/Hr)
Depth of flow =   1.075(Ft.), Average velocity =  13.637(Ft/s)


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Process from Point/Station      425.000 to Point/Station      430.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.082(Ft.), Average velocity =  13.539(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
```

```
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    471.096(CFS)
  '     '    flow top width =     34.327(Ft.)
  '     '    velocity=   13.539(Ft/s)
  '     '    area =     34.795(Sq.Ft)
  '     '    Froude number =     2.370

Upstream point elevation =  5169.000(Ft.)
Downstream point elevation =  5109.000(Ft.)
Flow length =   451.000(Ft.)
Travel time  =    0.56 min.
Time of concentration =   17.99 min.
Depth of flow =   1.082(Ft.)
Average velocity =  13.539(Ft/s)
Total irregular channel flow =   471.095(CFS)
Irregular channel normal depth above invert elev. =   1.082(Ft.)
Average velocity of channel(s) =  13.539(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.300
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.700
SCS curve number for soil(AMC 2)  = 85.70
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.270(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    465.871(CFS)
therefore the upstream flow rate of Q =    471.068(CFS) is being used
Rainfall intensity =      1.884(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.760
Subarea runoff =      0.000(CFS) for    4.730(Ac.)
Total runoff =    471.068(CFS)
Effective area this stream =      325.50(Ac.)
Total Study Area (Main Stream No. 1) =      340.75(Ac.)
Area averaged Fm value =    0.294(In/Hr)
Depth of flow =   1.082(Ft.), Average velocity =  13.539(Ft/s)


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Process from Point/Station      430.000 to Point/Station      435.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.084(Ft.), Average velocity =  13.511(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    471.096(CFS)
```

```
  '     '    flow top width =     34.336(Ft.)
  '     '    velocity=   13.511(Ft/s)
  '     '    area =     34.867(Sq.Ft)
  '     '    Froude number =     2.363

Upstream point elevation =  5109.000(Ft.)
Downstream point elevation =  5010.000(Ft.)
Flow length =   749.000(Ft.)
Travel time  =    0.92 min.
Time of concentration =   18.92 min.
Depth of flow =   1.084(Ft.)
Average velocity =  13.511(Ft/s)
Total irregular channel flow =   471.095(CFS)
Irregular channel normal depth above invert elev. =   1.084(Ft.)
Average velocity of channel(s) =  13.511(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.570
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.430
SCS curve number for soil(AMC 2)  = 82.73
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.323(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    453.253(CFS)
therefore the upstream flow rate of Q =    471.068(CFS) is being used
Rainfall intensity =      1.820(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.754
Subarea runoff =      0.000(CFS) for    4.750(Ac.)
Total runoff =    471.068(CFS)
Effective area this stream =      330.25(Ac.)
Total Study Area (Main Stream No. 1) =      345.50(Ac.)
Area averaged Fm value =    0.295(In/Hr)
Depth of flow =   1.084(Ft.), Average velocity =  13.511(Ft/s)


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Process from Point/Station      435.000 to Point/Station      440.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.082(Ft.), Average velocity =  13.531(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    471.098(CFS)
  '     '    flow top width =     34.330(Ft.)
  '     '    velocity=   13.531(Ft/s)
  '     '    area =     34.817(Sq.Ft)
```

```
  '     '    Froude number =     2.368

Upstream point elevation =  5010.000(Ft.)
Downstream point elevation =  4978.000(Ft.)
Flow length =   241.000(Ft.)
Travel time  =    0.30 min.
Time of concentration =   19.21 min.
Depth of flow =   1.082(Ft.)
Average velocity =  13.531(Ft/s)
Total irregular channel flow =   471.098(CFS)
Irregular channel normal depth above invert elev. =   1.082(Ft.)
Average velocity of channel(s) =  13.531(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.570
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.430
SCS curve number for soil(AMC 2)  = 82.73
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.323(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    454.448(CFS)
therefore the upstream flow rate of Q =    471.068(CFS) is being used
Rainfall intensity =      1.800(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.752
Subarea runoff =      0.000(CFS) for    5.310(Ac.)
Total runoff =    471.068(CFS)
Effective area this stream =      335.56(Ac.)
Total Study Area (Main Stream No. 1) =      350.81(Ac.)
Area averaged Fm value =    0.295(In/Hr)
Depth of flow =   1.082(Ft.), Average velocity =  13.531(Ft/s)


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Process from Point/Station      440.000 to Point/Station      441.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.985(Ft.), Average velocity =  15.903(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    471.106(CFS)
  '     '    flow top width =     24.849(Ft.)
  '     '    velocity=   15.903(Ft/s)
  '     '    area =     29.624(Sq.Ft)
  '     '    Froude number =     2.567

Upstream point elevation =  4978.000(Ft.)
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Downstream point elevation =  4700.000(Ft.)
Flow length =  1878.000(Ft.)
Travel time  =    1.97 min.
Time of concentration =   21.18 min.
Depth of flow =   1.985(Ft.)
Average velocity =  15.903(Ft/s)
Total irregular channel flow =   471.106(CFS)
Irregular channel normal depth above invert elev. =   1.985(Ft.)
Average velocity of channel(s) =  15.903(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    449.920(CFS)
therefore the upstream flow rate of Q =    471.068(CFS) is being used
Rainfall intensity =      1.681(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.738
Subarea runoff =      0.000(CFS) for   27.260(Ac.)
Total runoff =    471.068(CFS)
Effective area this stream =      362.82(Ac.)
Total Study Area (Main Stream No. 1) =      378.07(Ac.)
Area averaged Fm value =    0.303(In/Hr)
Depth of flow =   1.985(Ft.), Average velocity =  15.903(Ft/s)


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Process from Point/Station      441.000 to Point/Station      750.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.955(Ft.), Average velocity =  16.304(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    471.109(CFS)
  '     '    flow top width =     24.554(Ft.)
  '     '    velocity=   16.304(Ft/s)
  '     '    area =     28.895(Sq.Ft)
  '     '    Froude number =     2.649

Upstream point elevation =  4700.000(Ft.)
Downstream point elevation =  4300.000(Ft.)
Flow length =  2527.000(Ft.)
Travel time  =    2.58 min.
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Time of concentration =   23.76 min.
Depth of flow =   1.955(Ft.)
Average velocity =  16.304(Ft/s)
Total irregular channel flow =   471.108(CFS)
Irregular channel normal depth above invert elev. =   1.955(Ft.)
Average velocity of channel(s) =  16.304(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    423.721(CFS)
therefore the upstream flow rate of Q =    471.068(CFS) is being used
Rainfall intensity =      1.551(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.722
Subarea runoff =      0.000(CFS) for   15.770(Ac.)
Total runoff =    471.068(CFS)
Effective area this stream =      378.59(Ac.)
Total Study Area (Main Stream No. 1) =      393.84(Ac.)
Area averaged Fm value =    0.307(In/Hr)
Depth of flow =   1.955(Ft.), Average velocity =  16.304(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      441.000 to Point/Station      750.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    378.591(Ac.)
Runoff from this stream =    471.068(CFS)
Time of concentration =   23.76 min.
Rainfall intensity =     1.551(In/Hr)
Area averaged loss rate (Fm) =    0.3074(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      700.000 to Point/Station      710.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.790
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.210
SCS curve number for soil(AMC 2)  = 80.31
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.365(In/Hr)
Initial subarea data:
Initial area flow distance =   929.000(Ft.)
Top (of initial area) elevation =  5851.000(Ft.)
```

```
Bottom (of initial area) elevation =  5495.000(Ft.)
Difference in elevation =   356.000(Ft.)
Slope =    0.38321  s(%)=      38.32
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.788 min.
Rainfall intensity =      2.886(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.786
Subarea runoff =     15.815(CFS)
Total initial stream area =        6.970(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.365(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      710.000 to Point/Station      720.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.587(Ft.), Average velocity =   6.238(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     29.060(CFS)
  '     '    flow top width =     10.871(Ft.)
  '     '    velocity=    6.238(Ft/s)
  '     '    area =      4.659(Sq.Ft)
  '     '    Froude number =     1.679

Upstream point elevation =  5495.000(Ft.)
Downstream point elevation =  5315.000(Ft.)
Flow length =  2034.000(Ft.)
Travel time  =    5.43 min.
Time of concentration =   15.22 min.
Depth of flow =   0.587(Ft.)
Average velocity =   6.238(Ft/s)
Total irregular channel flow =    29.060(CFS)
Irregular channel normal depth above invert elev. =   0.587(Ft.)
Average velocity of channel(s) =   6.238(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.980
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.020
SCS curve number for soil(AMC 2)  = 78.22
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.400(In/Hr)
Rainfall intensity =      2.118(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.734
Subarea runoff =     26.428(CFS) for   20.200(Ac.)
```

```
Total runoff =     42.243(CFS)
Effective area this stream =       27.17(Ac.)
Total Study Area (Main Stream No. 2) =      421.01(Ac.)
Area averaged Fm value =    0.391(In/Hr)
Depth of flow =   0.712(Ft.), Average velocity =   6.934(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      720.000 to Point/Station      730.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.581(Ft.), Average velocity =  10.969(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     50.398(CFS)
  '     '    flow top width =     10.812(Ft.)
  '     '    velocity=   10.969(Ft/s)
  '     '    area =      4.594(Sq.Ft)
  '     '    Froude number =     2.965

Upstream point elevation =  5315.000(Ft.)
Downstream point elevation =  4829.000(Ft.)
Flow length =  1756.000(Ft.)
Travel time  =    2.67 min.
Time of concentration =   17.89 min.
Depth of flow =   0.581(Ft.)
Average velocity =  10.969(Ft/s)
Total irregular channel flow =    50.398(CFS)
Irregular channel normal depth above invert elev. =   0.581(Ft.)
Average velocity of channel(s) =  10.969(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.892(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.712
Subarea runoff =     16.230(CFS) for   16.250(Ac.)
Total runoff =     58.473(CFS)
Effective area this stream =       43.42(Ac.)
Total Study Area (Main Stream No. 2) =      437.26(Ac.)
Area averaged Fm value =    0.396(In/Hr)
Depth of flow =   0.628(Ft.), Average velocity =  11.445(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      720.000 to Point/Station      730.000
**** CONFLUENCE OF MINOR STREAMS ****
_____________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =     43.420(Ac.)
Runoff from this stream =     58.473(CFS)
Time of concentration =   17.89 min.
Rainfall intensity =     1.892(In/Hr)
Area averaged loss rate (Fm) =    0.3955(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      800.000 to Point/Station      810.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.180
Decimal fraction soil group D = 0.820
SCS curve number for soil(AMC 2)  = 88.46
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.221(In/Hr)
Initial subarea data:
Initial area flow distance =   964.000(Ft.)
Top (of initial area) elevation =  5664.000(Ft.)
Bottom (of initial area) elevation =  5225.000(Ft.)
Difference in elevation =   439.000(Ft.)
Slope =    0.45539  s(%)=      45.54
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.596 min.
Rainfall intensity =      2.926(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.832
Subarea runoff =     24.347(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.221(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      810.000 to Point/Station      730.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.804(Ft.), Average velocity =  11.235(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
```

```
Sub-Channel flow  =     81.521(CFS)
  '     '    flow top width =     13.043(Ft.)
  '     '    velocity=   11.235(Ft/s)
  '     '    area =      7.256(Sq.Ft)
  '     '    Froude number =     2.655

Upstream point elevation =  5225.000(Ft.)
Downstream point elevation =  4829.000(Ft.)
Flow length =  1949.000(Ft.)
Travel time  =    2.89 min.
Time of concentration =   12.49 min.
Depth of flow =   0.804(Ft.)
Average velocity =  11.235(Ft/s)
Total irregular channel flow =    81.521(CFS)
Irregular channel normal depth above invert elev. =   0.804(Ft.)
Average velocity of channel(s) =  11.235(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.240
Decimal fraction soil group C = 0.010
Decimal fraction soil group D = 0.750
SCS curve number for soil(AMC 2)  = 86.33
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.259(In/Hr)
Rainfall intensity =      2.433(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.806
Subarea runoff =    114.259(CFS) for   60.660(Ac.)
Total runoff =    138.606(CFS)
Effective area this stream =       70.66(Ac.)
Total Study Area (Main Stream No. 2) =      507.92(Ac.)
Area averaged Fm value =    0.254(In/Hr)
Depth of flow =   1.045(Ft.), Average velocity =  12.978(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      810.000 to Point/Station      730.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =     70.660(Ac.)
Runoff from this stream =    138.606(CFS)
Time of concentration =   12.49 min.
Rainfall intensity =     2.433(In/Hr)
Area averaged loss rate (Fm) =    0.2537(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     58.47    43.420     17.89    0.396      1.892
2    138.61    70.660     12.49    0.254      2.433
Qmax(1) =
         1.000 *    1.000 *    58.473) +
         0.752 *    1.000 *   138.606) + =     162.649
```

```
Qmax(2) =
         1.362 *    0.698 *    58.473) +
         1.000 *    1.000 *   138.606) + =     194.188

Total of 2 streams to confluence:
Flow rates before confluence point:
      58.473     138.606
Maximum flow rates at confluence using above data:
      162.649      194.188
Area of streams before confluence:
       43.420       70.660
Effective area values after confluence:
      114.080      100.967
Results of confluence:
Total flow rate =    194.188(CFS)
Time of concentration =    12.488 min.
Effective stream area after confluence =    100.967(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.308(In/Hr)
Study area total (this main stream) =     114.08(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      730.000 to Point/Station      740.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.478(Ft.), Average velocity =  12.275(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    224.791(CFS)
  '     '    flow top width =     19.780(Ft.)
  '     '    velocity=   12.275(Ft/s)
  '     '    area =     18.313(Sq.Ft)
  '     '    Froude number =     2.248

Upstream point elevation =  4829.000(Ft.)
Downstream point elevation =  4580.000(Ft.)
Flow length =  2018.000(Ft.)
Travel time  =    2.74 min.
Time of concentration =   15.23 min.
Depth of flow =   1.478(Ft.)
Average velocity =  12.275(Ft/s)
Total irregular channel flow =   224.791(CFS)
Irregular channel normal depth above invert elev. =   1.478(Ft.)
Average velocity of channel(s) =  12.275(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
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```
Decimal fraction soil group B = 0.380
Decimal fraction soil group C = 0.010
Decimal fraction soil group D = 0.610
SCS curve number for soil(AMC 2)  = 84.79
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.287(In/Hr)
Rainfall intensity =      2.118(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.772
Subarea runoff =     61.153(CFS) for   55.130(Ac.)
Total runoff =    255.341(CFS)
Effective area this stream =      156.10(Ac.)
Total Study Area (Main Stream No. 2) =      563.05(Ac.)
Area averaged Fm value =    0.300(In/Hr)
Depth of flow =   1.567(Ft.), Average velocity =  12.689(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      740.000 to Point/Station      750.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.683(Ft.), Average velocity =  12.763(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    288.185(CFS)
  '     '    flow top width =     21.831(Ft.)
  '     '    velocity=   12.763(Ft/s)
  '     '    area =     22.581(Sq.Ft)
  '     '    Froude number =     2.211

Upstream point elevation =  4580.000(Ft.)
Downstream point elevation =  4300.000(Ft.)
Flow length =  2432.000(Ft.)
Travel time  =    3.18 min.
Time of concentration =   18.40 min.
Depth of flow =   1.683(Ft.)
Average velocity =  12.763(Ft/s)
Total irregular channel flow =   288.185(CFS)
Irregular channel normal depth above invert elev. =   1.683(Ft.)
Average velocity of channel(s) =  12.763(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.660
Decimal fraction soil group C = 0.010
Decimal fraction soil group D = 0.330
SCS curve number for soil(AMC 2)  = 81.71
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.340(In/Hr)
Rainfall intensity =      1.855(In/Hr) for a    10.0 year storm
```

```
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.748
Subarea runoff =     65.621(CFS) for   75.260(Ac.)
Total runoff =    320.962(CFS)
Effective area this stream =      231.36(Ac.)
Total Study Area (Main Stream No. 2) =      638.31(Ac.)
Area averaged Fm value =    0.313(In/Hr)
Depth of flow =   1.768(Ft.), Average velocity =  13.123(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      740.000 to Point/Station      750.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =    231.357(Ac.)
Runoff from this stream =    320.962(CFS)
Time of concentration =   18.40 min.
Rainfall intensity =     1.855(In/Hr)
Area averaged loss rate (Fm) =    0.3133(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1    471.07   378.591     23.76    0.307      1.551
2    320.96   231.357     18.40    0.313      1.855
Qmax(1) =
         1.000 *    1.000 *   471.068) +
         0.803 *    1.000 *   320.962) + =     728.756
Qmax(2) =
         1.244 *    0.774 *   471.068) +
         1.000 *    1.000 *   320.962) + =     774.924

Total of 2 main streams to confluence:
Flow rates before confluence point:
     472.068     321.962
Maximum flow rates at confluence using above data:
      728.756      774.924
Area of streams before confluence:
      378.591      231.357
Effective area values after confluence:
      609.948      524.554


Results of confluence:
Total flow rate =    774.924(CFS)
Time of concentration =    18.404 min.
Effective stream area after confluence  =    524.554(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.310(In/Hr)
Study area total =     609.95(Ac.)
End of computations, Total Study Area =          638.31 (Ac.)
The following figures may
```

be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 83.5

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/21/11

White Knob Haul Road
Quarry Drainage
25 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 1.030 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 400.000 to Point/Station 405.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 84.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.301(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 7705.000(Ft.)
Bottom (of initial area) elevation = 6940.000(Ft.)
Difference in elevation = 765.000(Ft.)
Slope = 0.76500 s(%)= 76.50
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.805 min.
Rainfall intensity = 3.214(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.816
Subarea runoff = 13.768(CFS)
Total initial stream area = 5.250(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.301(In/Hr)

++
Process from Point/Station 405.000 to Point/Station 410.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.456(Ft.), Average velocity =  13.552(Ft/s)
      ******* Irregular Channel Data ***********
---------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
---------------------------------------------------------------------
Sub-Channel flow  =     45.026(CFS)
  '     '    flow top width =      9.563(Ft.)
  '     '    velocity=   13.552(Ft/s)
  '     '    area =      3.322(Sq.Ft)
  '     '    Froude number =     4.052

Upstream point elevation =  6940.000(Ft.)
Downstream point elevation =  6700.000(Ft.)
Flow length =   435.000(Ft.)
Travel time  =    0.53 min.
Time of concentration =   12.34 min.
Depth of flow =   0.456(Ft.)
Average velocity =  13.552(Ft/s)
Total irregular channel flow =    45.026(CFS)
Irregular channel normal depth above invert elev. =   0.456(Ft.)
Average velocity of channel(s) =  13.552(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      3.116(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.813
Subarea runoff =     62.430(CFS) for   24.820(Ac.)
Total runoff =     76.198(CFS)
Effective area this stream =       30.07(Ac.)
Total Study Area (Main Stream No. 1) =       30.07(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   0.602(Ft.), Average velocity =  15.794(Ft/s)


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Process from Point/Station      410.000 to Point/Station      415.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.896(Ft.), Average velocity =  20.350(Ft/s)
      ******* Irregular Channel Data ***********
---------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    172.926(CFS)
  '     '    flow top width =     13.962(Ft.)
  '     '    velocity=   20.351(Ft/s)
  '     '    area =      8.497(Sq.Ft)
  '     '    Froude number =     4.597

Upstream point elevation =  6700.000(Ft.)
Downstream point elevation =  5900.000(Ft.)
Flow length =  1352.000(Ft.)
Travel time  =    1.11 min.
Time of concentration =   13.45 min.
Depth of flow =   0.896(Ft.)
Average velocity =  20.350(Ft/s)
Total irregular channel flow =   172.926(CFS)
Irregular channel normal depth above invert elev. =   0.896(Ft.)
Average velocity of channel(s) =  20.350(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      2.934(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.808
Subarea runoff =    193.376(CFS) for   83.660(Ac.)
Total runoff =    269.574(CFS)
Effective area this stream =      113.73(Ac.)
Total Study Area (Main Stream No. 1) =      113.73(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   1.113(Ft.), Average velocity =  22.935(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      415.000 to Point/Station      420.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.446(Ft.), Average velocity =  18.286(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
```

```
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    323.468(CFS)
  '     '    flow top width =     19.462(Ft.)
  '     '    velocity=   18.286(Ft/s)
  '     '    area =     17.689(Sq.Ft)
  '     '    Froude number =     3.380

Upstream point elevation =  5900.000(Ft.)
Downstream point elevation =  5405.000(Ft.)
Flow length =  1764.000(Ft.)
Travel time  =    1.61 min.
Time of concentration =   15.06 min.
Depth of flow =   1.446(Ft.)
Average velocity =  18.286(Ft/s)
Total irregular channel flow =   323.468(CFS)
Irregular channel normal depth above invert elev. =   1.446(Ft.)
Average velocity of channel(s) =  18.286(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      2.711(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.800
Subarea runoff =    107.714(CFS) for   60.170(Ac.)
Total runoff =    377.287(CFS)
Effective area this stream =      173.90(Ac.)
Total Study Area (Main Stream No. 1) =      173.90(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   1.553(Ft.), Average velocity =  19.035(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      415.000 to Point/Station      420.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    173.900(Ac.)
Runoff from this stream =    377.287(CFS)
Time of concentration =   15.06 min.
Rainfall intensity =     2.711(In/Hr)
Area averaged loss rate (Fm) =    0.3006(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      500.000 to Point/Station      510.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
```

```
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Initial subarea data:
Initial area flow distance =   970.000(Ft.)
Top (of initial area) elevation =  7120.000(Ft.)
Bottom (of initial area) elevation =  6600.000(Ft.)
Difference in elevation =   520.000(Ft.)
Slope =    0.53608  s(%)=      53.61
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.522 min.
Rainfall intensity =      3.084(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.812
Subarea runoff =     24.078(CFS)
Total initial stream area =        9.610(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.301(In/Hr)


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Process from Point/Station      510.000 to Point/Station      520.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.457(Ft.), Average velocity =  14.651(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     48.725(CFS)
  '     '    flow top width =      9.566(Ft.)
  '     '    velocity=   14.651(Ft/s)
  '     '    area =      3.326(Sq.Ft)
  '     '    Froude number =     4.379

Upstream point elevation =  6600.000(Ft.)
Downstream point elevation =  6100.000(Ft.)
Flow length =   776.000(Ft.)
Travel time  =    0.88 min.
Time of concentration =   13.40 min.
Depth of flow =   0.457(Ft.)
Average velocity =  14.651(Ft/s)
Total irregular channel flow =    48.725(CFS)
Irregular channel normal depth above invert elev. =   0.457(Ft.)
Average velocity of channel(s) =  14.651(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
```

```
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      2.941(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.808
Subarea runoff =     49.228(CFS) for   21.240(Ac.)
Total runoff =     73.306(CFS)
Effective area this stream =       30.85(Ac.)
Total Study Area (Main Stream No. 1) =      204.75(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   0.567(Ft.), Average velocity =  16.509(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      520.000 to Point/Station      530.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.967(Ft.), Average velocity =  16.799(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    159.821(CFS)
  '     '    flow top width =     14.672(Ft.)
  '     '    velocity=   16.799(Ft/s)
  '     '    area =      9.513(Sq.Ft)
  '     '    Froude number =     3.677

Upstream point elevation =  6100.000(Ft.)
Downstream point elevation =  5710.000(Ft.)
Flow length =  1052.000(Ft.)
Travel time  =    1.04 min.
Time of concentration =   14.45 min.
Depth of flow =   0.967(Ft.)
Average velocity =  16.799(Ft/s)
Total irregular channel flow =   159.820(CFS)
Irregular channel normal depth above invert elev. =   0.967(Ft.)
Average velocity of channel(s) =  16.799(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.301(In/Hr)
Rainfall intensity =      2.790(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.803
```

```
Subarea runoff =    172.966(CFS) for   79.050(Ac.)
Total runoff =    246.272(CFS)
Effective area this stream =      109.90(Ac.)
Total Study Area (Main Stream No. 1) =      283.80(Ac.)
Area averaged Fm value =    0.301(In/Hr)
Depth of flow =   1.192(Ft.), Average velocity =  18.859(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      530.000 to Point/Station      420.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.680(Ft.), Average velocity =  11.542(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    246.307(CFS)
  '     '    flow top width =     32.722(Ft.)
  '     '    velocity=   11.542(Ft/s)
  '     '    area =     21.340(Sq.Ft)
  '     '    Froude number =     2.519

Upstream point elevation =  5710.000(Ft.)
Downstream point elevation =  5405.000(Ft.)
Flow length =  1764.000(Ft.)
Travel time  =    2.55 min.
Time of concentration =   17.00 min.
Depth of flow =   0.680(Ft.)
Average velocity =  11.542(Ft/s)
Total irregular channel flow =   246.307(CFS)
Irregular channel normal depth above invert elev. =   0.680(Ft.)
Average velocity of channel(s) =  11.542(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2)  = 83.50
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.309(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    246.202(CFS)
therefore the upstream flow rate of Q =    246.272(CFS) is being used
Rainfall intensity =      2.491(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.791
Subarea runoff =      0.000(CFS) for   15.070(Ac.)
Total runoff =    246.272(CFS)
Effective area this stream =      124.97(Ac.)
```

```
Total Study Area (Main Stream No. 1) =      298.87(Ac.)
Area averaged Fm value =    0.302(In/Hr)
Depth of flow =   0.680(Ft.), Average velocity =  11.541(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      530.000 to Point/Station      420.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    124.970(Ac.)
Runoff from this stream =    246.272(CFS)
Time of concentration =   17.00 min.
Rainfall intensity =     2.491(In/Hr)
Area averaged loss rate (Fm) =    0.3016(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1    377.29   173.900     15.06    0.301      2.711
2    246.27   124.970     17.00    0.302      2.491
Qmax(1) =
         1.000 *    1.000 *   377.287) +
         1.101 *    0.886 *   246.272) + =     617.426
Qmax(2) =
         0.908 *    1.000 *   377.287) +
         1.000 *    1.000 *   246.272) + =     589.036

Total of 2 streams to confluence:
Flow rates before confluence point:
     377.287     246.272
Maximum flow rates at confluence using above data:
      617.426      589.036
Area of streams before confluence:
      173.900      124.970
Effective area values after confluence:
      284.603      298.870
Results of confluence:
Total flow rate =    617.426(CFS)
Time of concentration =    15.055 min.
Effective stream area after confluence =    284.603(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.301(In/Hr)
Study area total (this main stream) =     298.87(Ac.)


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Process from Point/Station      420.000 to Point/Station      425.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.273(Ft.), Average velocity =  15.138(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    627.181(CFS)
  '     '    flow top width =     35.092(Ft.)
  '     '    velocity=   15.138(Ft/s)
  '     '    area =     41.432(Sq.Ft)
  '     '    Froude number =     2.455

Upstream point elevation =  5405.000(Ft.)
Downstream point elevation =  5169.000(Ft.)
Flow length =  1734.000(Ft.)
Travel time  =    1.91 min.
Time of concentration =   16.96 min.
Depth of flow =   1.273(Ft.)
Average velocity =  15.138(Ft/s)
Total irregular channel flow =   627.181(CFS)
Irregular channel normal depth above invert elev. =   1.273(Ft.)
Average velocity of channel(s) =  15.138(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.170
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.830
SCS curve number for soil(AMC 2)  = 87.13
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.245(In/Hr)
Rainfall intensity =      2.494(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.794
Subarea runoff =     19.442(CFS) for   37.150(Ac.)
Total runoff =    636.868(CFS)
Effective area this stream =      321.75(Ac.)
Total Study Area (Main Stream No. 1) =      336.02(Ac.)
Area averaged Fm value =    0.295(In/Hr)
Depth of flow =   1.285(Ft.), Average velocity =  15.222(Ft/s)


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Process from Point/Station      425.000 to Point/Station      430.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.293(Ft.), Average velocity =  15.112(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
```

```
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    636.905(CFS)
  '     '    flow top width =     35.173(Ft.)
  '     '    velocity=   15.112(Ft/s)
  '     '    area =     42.146(Sq.Ft)
  '     '    Froude number =     2.433

Upstream point elevation =  5169.000(Ft.)
Downstream point elevation =  5109.000(Ft.)
Flow length =   451.000(Ft.)
Travel time  =    0.50 min.
Time of concentration =   17.46 min.
Depth of flow =   1.293(Ft.)
Average velocity =  15.112(Ft/s)
Total irregular channel flow =   636.904(CFS)
Irregular channel normal depth above invert elev. =   1.293(Ft.)
Average velocity of channel(s) =  15.112(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.300
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.700
SCS curve number for soil(AMC 2)  = 85.70
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.270(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    631.658(CFS)
therefore the upstream flow rate of Q =    636.868(CFS) is being used
Rainfall intensity =      2.444(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.792
Subarea runoff =      0.000(CFS) for    4.730(Ac.)
Total runoff =    636.868(CFS)
Effective area this stream =      326.48(Ac.)
Total Study Area (Main Stream No. 1) =      340.75(Ac.)
Area averaged Fm value =    0.294(In/Hr)
Depth of flow =   1.293(Ft.), Average velocity =  15.112(Ft/s)


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Process from Point/Station      430.000 to Point/Station      435.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.296(Ft.), Average velocity =  15.081(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    636.904(CFS)
```

```
  '     '    flow top width =     35.183(Ft.)
  '     '    velocity=   15.081(Ft/s)
  '     '    area =     42.233(Sq.Ft)
  '     '    Froude number =     2.426

Upstream point elevation =  5109.000(Ft.)
Downstream point elevation =  5010.000(Ft.)
Flow length =   749.000(Ft.)
Travel time  =    0.83 min.
Time of concentration =   18.29 min.
Depth of flow =   1.296(Ft.)
Average velocity =  15.081(Ft/s)
Total irregular channel flow =   636.904(CFS)
Irregular channel normal depth above invert elev. =   1.296(Ft.)
Average velocity of channel(s) =  15.081(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.570
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.430
SCS curve number for soil(AMC 2)  = 82.73
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.323(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    617.485(CFS)
therefore the upstream flow rate of Q =    636.868(CFS) is being used
Rainfall intensity =      2.366(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.788
Subarea runoff =      0.000(CFS) for    4.750(Ac.)
Total runoff =    636.868(CFS)
Effective area this stream =      331.23(Ac.)
Total Study Area (Main Stream No. 1) =      345.50(Ac.)
Area averaged Fm value =    0.295(In/Hr)
Depth of flow =   1.296(Ft.), Average velocity =  15.080(Ft/s)


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Process from Point/Station      435.000 to Point/Station      440.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.294(Ft.), Average velocity =  15.103(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    636.908(CFS)
  '     '    flow top width =     35.176(Ft.)
  '     '    velocity=   15.103(Ft/s)
  '     '    area =     42.172(Sq.Ft)
```

```
  '     '    Froude number =     2.431

Upstream point elevation =  5010.000(Ft.)
Downstream point elevation =  4978.000(Ft.)
Flow length =   241.000(Ft.)
Travel time  =    0.27 min.
Time of concentration =   18.56 min.
Depth of flow =   1.294(Ft.)
Average velocity =  15.103(Ft/s)
Total irregular channel flow =   636.908(CFS)
Irregular channel normal depth above invert elev. =   1.294(Ft.)
Average velocity of channel(s) =  15.103(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.570
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.430
SCS curve number for soil(AMC 2)  = 82.73
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.323(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    620.043(CFS)
therefore the upstream flow rate of Q =    636.868(CFS) is being used
Rainfall intensity =      2.342(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.787
Subarea runoff =      0.000(CFS) for    5.310(Ac.)
Total runoff =    636.868(CFS)
Effective area this stream =      336.54(Ac.)
Total Study Area (Main Stream No. 1) =      350.81(Ac.)
Area averaged Fm value =    0.295(In/Hr)
Depth of flow =   1.294(Ft.), Average velocity =  15.102(Ft/s)


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Process from Point/Station      440.000 to Point/Station      441.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   2.268(Ft.), Average velocity =  17.180(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    636.893(CFS)
  '     '    flow top width =     27.685(Ft.)
  '     '    velocity=   17.180(Ft/s)
  '     '    area =     37.073(Sq.Ft)
  '     '    Froude number =     2.616

Upstream point elevation =  4978.000(Ft.)
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Downstream point elevation =  4700.000(Ft.)
Flow length =  1878.000(Ft.)
Travel time  =    1.82 min.
Time of concentration =   20.38 min.
Depth of flow =   2.268(Ft.)
Average velocity =  17.180(Ft/s)
Total irregular channel flow =   636.893(CFS)
Irregular channel normal depth above invert elev. =   2.268(Ft.)
Average velocity of channel(s) =  17.180(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    618.940(CFS)
therefore the upstream flow rate of Q =    636.868(CFS) is being used
Rainfall intensity =      2.194(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.776
Subarea runoff =      0.000(CFS) for   27.260(Ac.)
Total runoff =    636.868(CFS)
Effective area this stream =      363.80(Ac.)
Total Study Area (Main Stream No. 1) =      378.07(Ac.)
Area averaged Fm value =    0.303(In/Hr)
Depth of flow =   2.268(Ft.), Average velocity =  17.179(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      441.000 to Point/Station      750.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   2.235(Ft.), Average velocity =  17.614(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    636.895(CFS)
  '     '    flow top width =     27.353(Ft.)
  '     '    velocity=   17.614(Ft/s)
  '     '    area =     36.159(Sq.Ft)
  '     '    Froude number =     2.700

Upstream point elevation =  4700.000(Ft.)
Downstream point elevation =  4300.000(Ft.)
Flow length =  2527.000(Ft.)
Travel time  =    2.39 min.
```

```
Time of concentration =   22.77 min.
Depth of flow =   2.235(Ft.)
Average velocity =  17.614(Ft/s)
Total irregular channel flow =   636.895(CFS)
Irregular channel normal depth above invert elev. =   2.235(Ft.)
Average velocity of channel(s) =  17.614(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    588.349(CFS)
therefore the upstream flow rate of Q =    636.868(CFS) is being used
Rainfall intensity =      2.030(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.764
Subarea runoff =      0.000(CFS) for   15.770(Ac.)
Total runoff =    636.868(CFS)
Effective area this stream =      379.57(Ac.)
Total Study Area (Main Stream No. 1) =      393.84(Ac.)
Area averaged Fm value =    0.307(In/Hr)
Depth of flow =   2.235(Ft.), Average velocity =  17.613(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      441.000 to Point/Station      750.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    379.573(Ac.)
Runoff from this stream =    636.868(CFS)
Time of concentration =   22.77 min.
Rainfall intensity =     2.030(In/Hr)
Area averaged loss rate (Fm) =    0.3073(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      700.000 to Point/Station      710.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.790
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.210
SCS curve number for soil(AMC 2)  = 80.31
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.365(In/Hr)
Initial subarea data:
Initial area flow distance =   929.000(Ft.)
Top (of initial area) elevation =  5851.000(Ft.)
```

```
Bottom (of initial area) elevation =  5495.000(Ft.)
Difference in elevation =   356.000(Ft.)
Slope =    0.38321  s(%)=      38.32
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.788 min.
Rainfall intensity =      3.665(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.810
Subarea runoff =     20.704(CFS)
Total initial stream area =        6.970(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.365(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      710.000 to Point/Station      720.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.685(Ft.), Average velocity =   6.789(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     39.187(CFS)
  '     '    flow top width =     11.850(Ft.)
  '     '    velocity=    6.789(Ft/s)
  '     '    area =      5.772(Sq.Ft)
  '     '    Froude number =     1.714

Upstream point elevation =  5495.000(Ft.)
Downstream point elevation =  5315.000(Ft.)
Flow length =  2034.000(Ft.)
Travel time  =    4.99 min.
Time of concentration =   14.78 min.
Depth of flow =   0.685(Ft.)
Average velocity =   6.789(Ft/s)
Total irregular channel flow =    39.187(CFS)
Irregular channel normal depth above invert elev. =   0.685(Ft.)
Average velocity of channel(s) =   6.789(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.980
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.020
SCS curve number for soil(AMC 2)  = 78.22
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.400(In/Hr)
Rainfall intensity =      2.746(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.772
Subarea runoff =     36.897(CFS) for   20.200(Ac.)
```

```
Total runoff =     57.601(CFS)
Effective area this stream =       27.17(Ac.)
Total Study Area (Main Stream No. 2) =      421.01(Ac.)
Area averaged Fm value =    0.391(In/Hr)
Depth of flow =   0.832(Ft.), Average velocity =   7.555(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      720.000 to Point/Station      730.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.685(Ft.), Average velocity =  12.009(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     69.344(CFS)
  '     '    flow top width =     11.853(Ft.)
  '     '    velocity=   12.009(Ft/s)
  '     '    area =      5.774(Sq.Ft)
  '     '    Froude number =     3.032

Upstream point elevation =  5315.000(Ft.)
Downstream point elevation =  4829.000(Ft.)
Flow length =  1756.000(Ft.)
Travel time  =    2.44 min.
Time of concentration =   17.22 min.
Depth of flow =   0.685(Ft.)
Average velocity =  12.009(Ft/s)
Total irregular channel flow =    69.344(CFS)
Irregular channel normal depth above invert elev. =   0.685(Ft.)
Average velocity of channel(s) =  12.009(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      2.468(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.756
Subarea runoff =     23.390(CFS) for   16.250(Ac.)
Total runoff =     80.991(CFS)
Effective area this stream =       43.42(Ac.)
Total Study Area (Main Stream No. 2) =      437.26(Ac.)
Area averaged Fm value =    0.396(In/Hr)
Depth of flow =   0.742(Ft.), Average velocity =  12.541(Ft/s)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      720.000 to Point/Station      730.000
**** CONFLUENCE OF MINOR STREAMS ****
_____________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =     43.420(Ac.)
Runoff from this stream =     80.991(CFS)
Time of concentration =   17.22 min.
Rainfall intensity =     2.468(In/Hr)
Area averaged loss rate (Fm) =    0.3955(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      800.000 to Point/Station      810.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.180
Decimal fraction soil group D = 0.820
SCS curve number for soil(AMC 2)  = 88.46
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.221(In/Hr)
Initial subarea data:
Initial area flow distance =   964.000(Ft.)
Top (of initial area) elevation =  5664.000(Ft.)
Bottom (of initial area) elevation =  5225.000(Ft.)
Difference in elevation =   439.000(Ft.)
Slope =    0.45539  s(%)=      45.54
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.596 min.
Rainfall intensity =      3.716(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.847
Subarea runoff =     31.457(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.221(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      810.000 to Point/Station      730.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.921(Ft.), Average velocity =  12.106(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
```

```
Sub-Channel flow  =    107.113(CFS)
  '     '    flow top width =     14.211(Ft.)
  '     '    velocity=   12.106(Ft/s)
  '     '    area =      8.848(Sq.Ft)
  '     '    Froude number =     2.704

Upstream point elevation =  5225.000(Ft.)
Downstream point elevation =  4829.000(Ft.)
Flow length =  1949.000(Ft.)
Travel time  =    2.68 min.
Time of concentration =   12.28 min.
Depth of flow =   0.921(Ft.)
Average velocity =  12.106(Ft/s)
Total irregular channel flow =   107.113(CFS)
Irregular channel normal depth above invert elev. =   0.921(Ft.)
Average velocity of channel(s) =  12.106(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.240
Decimal fraction soil group C = 0.010
Decimal fraction soil group D = 0.750
SCS curve number for soil(AMC 2)  = 86.33
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.259(In/Hr)
Rainfall intensity =      3.127(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.827
Subarea runoff =    151.258(CFS) for   60.660(Ac.)
Total runoff =    182.716(CFS)
Effective area this stream =       70.66(Ac.)
Total Study Area (Main Stream No. 2) =      507.92(Ac.)
Area averaged Fm value =    0.254(In/Hr)
Depth of flow =   1.193(Ft.), Average velocity =  13.970(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      810.000 to Point/Station      730.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =     70.660(Ac.)
Runoff from this stream =    182.716(CFS)
Time of concentration =   12.28 min.
Rainfall intensity =     3.127(In/Hr)
Area averaged loss rate (Fm) =    0.2537(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     80.99    43.420     17.22    0.396      2.468
2    182.72    70.660     12.28    0.254      3.127
Qmax(1) =
         1.000 *    1.000 *    80.991) +
         0.771 *    1.000 *   182.716) + =     221.810
```

```
Qmax(2) =
         1.318 *    0.713 *    80.991) +
         1.000 *    1.000 *   182.716) + =     258.839

Total of 2 streams to confluence:
Flow rates before confluence point:
      80.991     182.716
Maximum flow rates at confluence using above data:
      221.810      258.839
Area of streams before confluence:
       43.420       70.660
Effective area values after confluence:
      114.080      101.627
Results of confluence:
Total flow rate =    258.839(CFS)
Time of concentration =    12.280 min.
Effective stream area after confluence =    101.627(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.308(In/Hr)
Study area total (this main stream) =     114.08(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      730.000 to Point/Station      740.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.692(Ft.), Average velocity =  13.250(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    301.657(CFS)
  '     '    flow top width =     21.916(Ft.)
  '     '    velocity=   13.250(Ft/s)
  '     '    area =     22.766(Sq.Ft)
  '     '    Froude number =     2.291

Upstream point elevation =  4829.000(Ft.)
Downstream point elevation =  4580.000(Ft.)
Flow length =  2018.000(Ft.)
Travel time  =    2.54 min.
Time of concentration =   14.82 min.
Depth of flow =   1.692(Ft.)
Average velocity =  13.250(Ft/s)
Total irregular channel flow =   301.657(CFS)
Irregular channel normal depth above invert elev. =   1.692(Ft.)
Average velocity of channel(s) =  13.250(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
```

```
Decimal fraction soil group B = 0.380
Decimal fraction soil group C = 0.010
Decimal fraction soil group D = 0.610
SCS curve number for soil(AMC 2)  = 84.79
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.287(In/Hr)
Rainfall intensity =      2.742(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.801
Subarea runoff =     85.571(CFS) for   55.130(Ac.)
Total runoff =    344.410(CFS)
Effective area this stream =      156.76(Ac.)
Total Study Area (Main Stream No. 2) =      563.05(Ac.)
Area averaged Fm value =    0.300(In/Hr)
Depth of flow =   1.796(Ft.), Average velocity =  13.712(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      740.000 to Point/Station      750.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.933(Ft.), Average velocity =  13.815(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    391.764(CFS)
  '     '    flow top width =     24.335(Ft.)
  '     '    velocity=   13.815(Ft/s)
  '     '    area =     28.358(Sq.Ft)
  '     '    Froude number =     2.255

Upstream point elevation =  4580.000(Ft.)
Downstream point elevation =  4300.000(Ft.)
Flow length =  2432.000(Ft.)
Travel time  =    2.93 min.
Time of concentration =   17.75 min.
Depth of flow =   1.933(Ft.)
Average velocity =  13.815(Ft/s)
Total irregular channel flow =   391.764(CFS)
Irregular channel normal depth above invert elev. =   1.933(Ft.)
Average velocity of channel(s) =  13.815(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.660
Decimal fraction soil group C = 0.010
Decimal fraction soil group D = 0.330
SCS curve number for soil(AMC 2)  = 81.71
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.340(In/Hr)
Rainfall intensity =      2.416(In/Hr) for a    25.0 year storm
```

```
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.783
Subarea runoff =     94.626(CFS) for   75.260(Ac.)
Total runoff =    439.036(CFS)
Effective area this stream =      232.02(Ac.)
Total Study Area (Main Stream No. 2) =      638.31(Ac.)
Area averaged Fm value =    0.313(In/Hr)
Depth of flow =   2.034(Ft.), Average velocity =  14.225(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      740.000 to Point/Station      750.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =    232.017(Ac.)
Runoff from this stream =    439.036(CFS)
Time of concentration =   17.75 min.
Rainfall intensity =     2.416(In/Hr)
Area averaged loss rate (Fm) =    0.3133(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1    636.87   379.573     22.77    0.307      2.030
2    439.04   232.017     17.75    0.313      2.416
Qmax(1) =
         1.000 *    1.000 *   636.868) +
         0.816 *    1.000 *   439.036) + =     995.249
Qmax(2) =
         1.224 *    0.780 *   636.868) +
         1.000 *    1.000 *   439.036) + =    1046.948

Total of 2 main streams to confluence:
Flow rates before confluence point:
     637.868     440.036
Maximum flow rates at confluence using above data:
      995.249     1046.948
Area of streams before confluence:
      379.573      232.017
Effective area values after confluence:
      611.590      527.961


Results of confluence:
Total flow rate =   1046.948(CFS)
Time of concentration =    17.752 min.
Effective stream area after confluence  =    527.961(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.310(In/Hr)
Study area total =     611.59(Ac.)
End of computations, Total Study Area =          638.31 (Ac.)
The following figures may
```

be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 83.5

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/21/11

White Knob Haul Road
Quarry Drainage
100 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.390 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++
Process from Point/Station 400.000 to Point/Station 405.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2) = 84.00
Adjusted SCS curve number for AMC 3 = 96.40
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.071(In/Hr)
Initial subarea data:
Initial area flow distance = 1000.000(Ft.)
Top (of initial area) elevation = 7705.000(Ft.)
Bottom (of initial area) elevation = 6940.000(Ft.)
Difference in elevation = 765.000(Ft.)
Slope = 0.76500 s(%)= 76.50
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 11.805 min.
Rainfall intensity = 4.338(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.885
Subarea runoff = 20.161(CFS)
Total initial stream area = 5.250(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.071(In/Hr)

++

```
Process from Point/Station      405.000 to Point/Station      410.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.560(Ft.), Average velocity =  15.172(Ft/s)
      ******* Irregular Channel Data ***********
-------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-------------------------------------------------------------------
Sub-Channel flow  =     66.235(CFS)
  '     '    flow top width =     10.598(Ft.)
  '     '    velocity=   15.172(Ft/s)
  '     '    area =      4.366(Sq.Ft)
  '     '    Froude number =     4.166

Upstream point elevation =  6940.000(Ft.)
Downstream point elevation =  6700.000(Ft.)
Flow length =   435.000(Ft.)
Travel time  =    0.48 min.
Time of concentration =   12.28 min.
Depth of flow =   0.560(Ft.)
Average velocity =  15.172(Ft/s)
Total irregular channel flow =    66.235(CFS)
Irregular channel normal depth above invert elev. =   0.560(Ft.)
Average velocity of channel(s) =  15.172(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Adjusted SCS curve number for AMC 3 = 96.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.071(In/Hr)
Rainfall intensity =      4.219(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.885
Subarea runoff =     92.096(CFS) for   24.820(Ac.)
Total runoff =    112.257(CFS)
Effective area this stream =       30.07(Ac.)
Total Study Area (Main Stream No. 1) =       30.07(Ac.)
Area averaged Fm value =    0.071(In/Hr)
Depth of flow =   0.735(Ft.), Average velocity =  17.616(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      410.000 to Point/Station      415.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.087(Ft.), Average velocity =  22.645(Ft/s)
```

```
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    257.005(CFS)
  '     '    flow top width =     15.874(Ft.)
  '     '    velocity=   22.645(Ft/s)
  '     '    area =     11.349(Sq.Ft)
  '     '    Froude number =     4.720

Upstream point elevation =  6700.000(Ft.)
Downstream point elevation =  5900.000(Ft.)
Flow length =  1352.000(Ft.)
Travel time  =    1.00 min.
Time of concentration =   13.28 min.
Depth of flow =   1.087(Ft.)
Average velocity =  22.645(Ft/s)
Total irregular channel flow =   257.005(CFS)
Irregular channel normal depth above invert elev. =   1.087(Ft.)
Average velocity of channel(s) =  22.645(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Adjusted SCS curve number for AMC 3 = 96.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.071(In/Hr)
Rainfall intensity =      3.995(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.884
Subarea runoff =    289.400(CFS) for   83.660(Ac.)
Total runoff =    401.657(CFS)
Effective area this stream =      113.73(Ac.)
Total Study Area (Main Stream No. 1) =      113.73(Ac.)
Area averaged Fm value =    0.071(In/Hr)
Depth of flow =   1.344(Ft.), Average velocity =  25.487(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      415.000 to Point/Station      420.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.743(Ft.), Average velocity =  20.328(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
```

```
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    486.127(CFS)
  '     '    flow top width =     22.434(Ft.)
  '     '    velocity=   20.328(Ft/s)
  '     '    area =     23.914(Sq.Ft)
  '     '    Froude number =     3.470

Upstream point elevation =  5900.000(Ft.)
Downstream point elevation =  5405.000(Ft.)
Flow length =  1764.000(Ft.)
Travel time  =    1.45 min.
Time of concentration =   14.72 min.
Depth of flow =   1.743(Ft.)
Average velocity =  20.328(Ft/s)
Total irregular channel flow =   486.127(CFS)
Irregular channel normal depth above invert elev. =   1.743(Ft.)
Average velocity of channel(s) =  20.328(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Adjusted SCS curve number for AMC 3 = 96.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.071(In/Hr)
Rainfall intensity =      3.716(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.883
Subarea runoff =    168.847(CFS) for   60.170(Ac.)
Total runoff =    570.504(CFS)
Effective area this stream =      173.90(Ac.)
Total Study Area (Main Stream No. 1) =      173.90(Ac.)
Area averaged Fm value =    0.071(In/Hr)
Depth of flow =   1.874(Ft.), Average velocity =  21.185(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      415.000 to Point/Station      420.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    173.900(Ac.)
Runoff from this stream =    570.504(CFS)
Time of concentration =   14.72 min.
Rainfall intensity =     3.716(In/Hr)
Area averaged loss rate (Fm) =    0.0710(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      500.000 to Point/Station      510.000
**** INITIAL AREA EVALUATION ****
```

```
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Adjusted SCS curve number for AMC 3 = 96.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.071(In/Hr)
Initial subarea data:
Initial area flow distance =   970.000(Ft.)
Top (of initial area) elevation =  7120.000(Ft.)
Bottom (of initial area) elevation =  6600.000(Ft.)
Difference in elevation =   520.000(Ft.)
Slope =    0.53608  s(%)=      53.61
TC = k(0.706)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.522 min.
Rainfall intensity =      4.162(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.885
Subarea runoff =     35.387(CFS)
Total initial stream area =        9.610(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.071(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      510.000 to Point/Station      520.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
------------------------------------------------------------------------
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.562(Ft.), Average velocity =  16.431(Ft/s)
      ******* Irregular Channel Data ***********
-------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-------------------------------------------------------------
Sub-Channel flow  =     72.119(CFS)
  '     '    flow top width =     10.620(Ft.)
  '     '    velocity=   16.431(Ft/s)
  '     '    area =      4.389(Sq.Ft)
  '     '    Froude number =     4.504

Upstream point elevation =  6600.000(Ft.)
Downstream point elevation =  6100.000(Ft.)
Flow length =   776.000(Ft.)
Travel time  =    0.79 min.
Time of concentration =   13.31 min.
Depth of flow =   0.562(Ft.)
Average velocity =  16.431(Ft/s)
Total irregular channel flow =    72.119(CFS)
Irregular channel normal depth above invert elev. =   0.562(Ft.)
Average velocity of channel(s) =  16.431(Ft/s)
```

```
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Adjusted SCS curve number for AMC 3 = 96.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.071(In/Hr)
Rainfall intensity =      3.989(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.884
Subarea runoff =     73.385(CFS) for   21.240(Ac.)
Total runoff =    108.772(CFS)
Effective area this stream =       30.85(Ac.)
Total Study Area (Main Stream No. 1) =      204.75(Ac.)
Area averaged Fm value =    0.071(In/Hr)
Depth of flow =   0.695(Ft.), Average velocity =  18.466(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      520.000 to Point/Station      530.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.175(Ft.), Average velocity =  18.710(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    238.994(CFS)
  '     '    flow top width =     16.747(Ft.)
  '     '    velocity=   18.710(Ft/s)
  '     '    area =     12.774(Sq.Ft)
  '     '    Froude number =     3.775

Upstream point elevation =  6100.000(Ft.)
Downstream point elevation =  5710.000(Ft.)
Flow length =  1052.000(Ft.)
Travel time  =    0.94 min.
Time of concentration =   14.25 min.
Depth of flow =   1.175(Ft.)
Average velocity =  18.710(Ft/s)
Total irregular channel flow =   238.994(CFS)
Irregular channel normal depth above invert elev. =   1.175(Ft.)
Average velocity of channel(s) =  18.710(Ft/s)
 Adding area flow to channel
UNDEVELOPED (average cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
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Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 84.00
Adjusted SCS curve number for AMC 3 = 96.40
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.071(In/Hr)
Rainfall intensity =      3.803(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.883
Subarea runoff =    260.367(CFS) for   79.050(Ac.)
Total runoff =    369.139(CFS)
Effective area this stream =      109.90(Ac.)
Total Study Area (Main Stream No. 1) =      283.80(Ac.)
Area averaged Fm value =    0.071(In/Hr)
Depth of flow =   1.441(Ft.), Average velocity =  20.979(Ft/s)


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Process from Point/Station      530.000 to Point/Station      420.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.873(Ft.), Average velocity =  13.504(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    374.190(CFS)
  '     '    flow top width =     33.492(Ft.)
  '     '    velocity=   13.504(Ft/s)
  '     '    area =     27.710(Sq.Ft)
  '     '    Froude number =     2.616

Upstream point elevation =  5710.000(Ft.)
Downstream point elevation =  5405.000(Ft.)
Flow length =  1764.000(Ft.)
Travel time  =    2.18 min.
Time of concentration =   16.42 min.
Depth of flow =   0.873(Ft.)
Average velocity =  13.504(Ft/s)
Total irregular channel flow =   374.189(CFS)
Irregular channel normal depth above invert elev. =   0.873(Ft.)
Average velocity of channel(s) =  13.504(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.500
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.500
SCS curve number for soil(AMC 2)  = 83.50
Adjusted SCS curve number for AMC 3 = 96.10
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.077(In/Hr)
Rainfall intensity =      3.443(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.881
Subarea runoff =     10.007(CFS) for   15.070(Ac.)
Total runoff =    379.147(CFS)
Effective area this stream =      124.97(Ac.)
Total Study Area (Main Stream No. 1) =      298.87(Ac.)
Area averaged Fm value =    0.072(In/Hr)
Depth of flow =   0.880(Ft.), Average velocity =  13.570(Ft/s)


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Process from Point/Station      530.000 to Point/Station      420.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    124.970(Ac.)
Runoff from this stream =    379.147(CFS)
Time of concentration =   16.42 min.
Rainfall intensity =     3.443(In/Hr)
Area averaged loss rate (Fm) =    0.0717(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1    570.50   173.900     14.72    0.071      3.716
2    379.15   124.970     16.42    0.072      3.443
Qmax(1) =
         1.000 *    1.000 *   570.504) +
         1.081 *    0.897 *   379.147) + =     938.006
Qmax(2) =
         0.925 *    1.000 *   570.504) +
         1.000 *    1.000 *   379.147) + =     906.852

Total of 2 streams to confluence:
Flow rates before confluence point:
     570.504     379.147
Maximum flow rates at confluence using above data:
      938.006      906.852
Area of streams before confluence:
      173.900      124.970
Effective area values after confluence:
      285.943      298.870
Results of confluence:
Total flow rate =    938.006(CFS)
Time of concentration =    14.724 min.
Effective stream area after confluence =    285.943(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.071(In/Hr)
Study area total (this main stream) =     298.87(Ac.)


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Process from Point/Station      420.000 to Point/Station      425.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
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_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.637(Ft.), Average velocity =  17.636(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    960.849(CFS)
  '     '    flow top width =     36.549(Ft.)
  '     '    velocity=   17.636(Ft/s)
  '     '    area =     54.481(Sq.Ft)
  '     '    Froude number =     2.546

Upstream point elevation =  5405.000(Ft.)
Downstream point elevation =  5169.000(Ft.)
Flow length =  1734.000(Ft.)
Travel time  =    1.64 min.
Time of concentration =   16.36 min.
Depth of flow =   1.637(Ft.)
Average velocity =  17.636(Ft/s)
Total irregular channel flow =   960.848(CFS)
Irregular channel normal depth above invert elev. =   1.637(Ft.)
Average velocity of channel(s) =  17.636(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.170
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.830
SCS curve number for soil(AMC 2)  = 87.13
Adjusted SCS curve number for AMC 3 = 97.43
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.051(In/Hr)
Rainfall intensity =      3.452(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.882
Subarea runoff =     45.600(CFS) for   37.150(Ac.)
Total runoff =    983.606(CFS)
Effective area this stream =      323.09(Ac.)
Total Study Area (Main Stream No. 1) =      336.02(Ac.)
Area averaged Fm value =    0.069(In/Hr)
Depth of flow =   1.660(Ft.), Average velocity =  17.783(Ft/s)


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Process from Point/Station      425.000 to Point/Station      430.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.671(Ft.), Average velocity =  17.653(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              10.00
      2             20.00               0.00
      3             50.00               0.00
      4             70.00              10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    983.634(CFS)
  '     '    flow top width =     36.685(Ft.)
  '     '    velocity=   17.653(Ft/s)
  '     '    area =     55.722(Sq.Ft)
  '     '    Froude number =     2.524

Upstream point elevation =  5169.000(Ft.)
Downstream point elevation =  5109.000(Ft.)
Flow length =   451.000(Ft.)
Travel time  =    0.43 min.
Time of concentration =   16.79 min.
Depth of flow =   1.671(Ft.)
Average velocity =  17.653(Ft/s)
Total irregular channel flow =   983.634(CFS)
Irregular channel normal depth above invert elev. =   1.671(Ft.)
Average velocity of channel(s) =  17.653(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.300
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.700
SCS curve number for soil(AMC 2)  = 85.70
Adjusted SCS curve number for AMC 3 = 97.14
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.057(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    979.909(CFS)
therefore the upstream flow rate of Q =    983.606(CFS) is being used
Rainfall intensity =      3.390(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.882
Subarea runoff =      0.000(CFS) for    4.730(Ac.)
Total runoff =    983.606(CFS)
Effective area this stream =      327.82(Ac.)
Total Study Area (Main Stream No. 1) =      340.75(Ac.)
Area averaged Fm value =    0.069(In/Hr)
Depth of flow =   1.671(Ft.), Average velocity =  17.652(Ft/s)


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Process from Point/Station      430.000 to Point/Station      435.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.674(Ft.), Average velocity =  17.616(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
```

```
      1             0.00            10.00
      2            20.00             0.00
      3            50.00             0.00
      4            70.00            10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    983.634(CFS)
  '     '    flow top width =     36.698(Ft.)
  '     '    velocity=   17.616(Ft/s)
  '     '    area =     55.839(Sq.Ft)
  '     '    Froude number =     2.517

Upstream point elevation =  5109.000(Ft.)
Downstream point elevation =  5010.000(Ft.)
Flow length =   749.000(Ft.)
Travel time  =    0.71 min.
Time of concentration =   17.50 min.
Depth of flow =   1.674(Ft.)
Average velocity =  17.616(Ft/s)
Total irregular channel flow =   983.634(CFS)
Irregular channel normal depth above invert elev. =   1.674(Ft.)
Average velocity of channel(s) =  17.616(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.570
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.430
SCS curve number for soil(AMC 2)  = 82.73
Adjusted SCS curve number for AMC 3 = 95.64
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.086(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    965.091(CFS)
therefore the upstream flow rate of Q =    983.606(CFS) is being used
Rainfall intensity =      3.293(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.881
Subarea runoff =      0.000(CFS) for    4.750(Ac.)
Total runoff =    983.606(CFS)
Effective area this stream =      332.57(Ac.)
Total Study Area (Main Stream No. 1) =      345.50(Ac.)
Area averaged Fm value =    0.069(In/Hr)
Depth of flow =   1.674(Ft.), Average velocity =  17.615(Ft/s)


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Process from Point/Station      435.000 to Point/Station      440.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.672(Ft.), Average velocity =  17.642(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1             0.00            10.00
      2            20.00             0.00
```

```
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    983.637(CFS)
  '     '    flow top width =     36.689(Ft.)
  '     '    velocity=   17.642(Ft/s)
  '     '    area =     55.757(Sq.Ft)
  '     '    Froude number =     2.522

Upstream point elevation =  5010.000(Ft.)
Downstream point elevation =  4978.000(Ft.)
Flow length =   241.000(Ft.)
Travel time  =    0.23 min.
Time of concentration =   17.73 min.
Depth of flow =   1.672(Ft.)
Average velocity =  17.642(Ft/s)
Total irregular channel flow =   983.637(CFS)
Irregular channel normal depth above invert elev. =   1.672(Ft.)
Average velocity of channel(s) =  17.642(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.570
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.430
SCS curve number for soil(AMC 2)  = 82.73
Adjusted SCS curve number for AMC 3 = 95.64
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.086(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    971.397(CFS)
therefore the upstream flow rate of Q =    983.606(CFS) is being used
Rainfall intensity =      3.264(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.881
Subarea runoff =      0.000(CFS) for    5.310(Ac.)
Total runoff =    983.606(CFS)
Effective area this stream =      337.88(Ac.)
Total Study Area (Main Stream No. 1) =      350.81(Ac.)
Area averaged Fm value =    0.069(In/Hr)
Depth of flow =   1.672(Ft.), Average velocity =  17.641(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      440.000 to Point/Station      441.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   2.741(Ft.), Average velocity =  19.191(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              10.00
      2             50.00               0.00
      3             55.00               0.00
      4            105.00              10.00
```

```
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    983.814(CFS)
  '     '    flow top width =     32.408(Ft.)
  '     '    velocity=   19.191(Ft/s)
  '     '    area =     51.264(Sq.Ft)
  '     '    Froude number =     2.689

Upstream point elevation =  4978.000(Ft.)
Downstream point elevation =  4700.000(Ft.)
Flow length =  1878.000(Ft.)
Travel time  =    1.63 min.
Time of concentration =   19.36 min.
Depth of flow =   2.741(Ft.)
Average velocity =  19.191(Ft/s)
Total irregular channel flow =   983.815(CFS)
Irregular channel normal depth above invert elev. =   2.741(Ft.)
Average velocity of channel(s) =  19.191(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      3.069(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.878
Subarea runoff =      0.336(CFS) for   27.260(Ac.)
Total runoff =    983.942(CFS)
Effective area this stream =      365.14(Ac.)
Total Study Area (Main Stream No. 1) =      378.07(Ac.)
Area averaged Fm value =    0.075(In/Hr)
Depth of flow =   2.741(Ft.), Average velocity =  19.192(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      441.000 to Point/Station      750.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   2.702(Ft.), Average velocity =  19.678(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =    983.983(CFS)
  '     '    flow top width =     32.017(Ft.)
  '     '    velocity=   19.678(Ft/s)
```

```
  '     '    area =     50.005(Sq.Ft)
  '     '    Froude number =     2.775

Upstream point elevation =  4700.000(Ft.)
Downstream point elevation =  4300.000(Ft.)
Flow length =  2527.000(Ft.)
Travel time  =    2.14 min.
Time of concentration =   21.50 min.
Depth of flow =   2.702(Ft.)
Average velocity =  19.678(Ft/s)
Total irregular channel flow =   983.983(CFS)
Irregular channel normal depth above invert elev. =   2.702(Ft.)
Average velocity of channel(s) =  19.678(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =    951.042(CFS)
therefore the upstream flow rate of Q =    983.942(CFS) is being used
Rainfall intensity =      2.851(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.876
Subarea runoff =      0.000(CFS) for   15.770(Ac.)
Total runoff =    983.942(CFS)
Effective area this stream =      380.91(Ac.)
Total Study Area (Main Stream No. 1) =      393.84(Ac.)
Area averaged Fm value =    0.077(In/Hr)
Depth of flow =   2.702(Ft.), Average velocity =  19.678(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      441.000 to Point/Station      750.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    380.913(Ac.)
Runoff from this stream =    983.942(CFS)
Time of concentration =   21.50 min.
Rainfall intensity =     2.851(In/Hr)
Area averaged loss rate (Fm) =    0.0773(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      700.000 to Point/Station      710.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
```

```
Decimal fraction soil group B = 0.790
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.210
SCS curve number for soil(AMC 2)  = 80.31
Adjusted SCS curve number for AMC 3 = 94.19
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.114(In/Hr)
Initial subarea data:
Initial area flow distance =   929.000(Ft.)
Top (of initial area) elevation =  5851.000(Ft.)
Bottom (of initial area) elevation =  5495.000(Ft.)
Difference in elevation =   356.000(Ft.)
Slope =    0.38321  s(%)=      38.32
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.788 min.
Rainfall intensity =      4.946(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.879
Subarea runoff =     30.313(CFS)
Total initial stream area =        6.970(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.114(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      710.000 to Point/Station      720.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.850(Ft.), Average velocity =   7.645(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     60.143(CFS)
  '     '    flow top width =     13.503(Ft.)
  '     '    velocity=    7.645(Ft/s)
  '     '    area =      7.867(Sq.Ft)
  '     '    Froude number =     1.765

Upstream point elevation =  5495.000(Ft.)
Downstream point elevation =  5315.000(Ft.)
Flow length =  2034.000(Ft.)
Travel time  =    4.43 min.
Time of concentration =   14.22 min.
Depth of flow =   0.850(Ft.)
Average velocity =   7.645(Ft/s)
Total irregular channel flow =    60.143(CFS)
Irregular channel normal depth above invert elev. =   0.850(Ft.)
Average velocity of channel(s) =   7.645(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
```

```
Decimal fraction soil group B = 0.980
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.020
SCS curve number for soil(AMC 2)  = 78.22
Adjusted SCS curve number for AMC 3 = 92.93
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.138(In/Hr)
Rainfall intensity =      3.808(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.869
Subarea runoff =     59.582(CFS) for   20.200(Ac.)
Total runoff =     89.895(CFS)
Effective area this stream =       27.17(Ac.)
Total Study Area (Main Stream No. 2) =      421.01(Ac.)
Area averaged Fm value =    0.131(In/Hr)
Depth of flow =   1.036(Ft.), Average velocity =   8.525(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      720.000 to Point/Station      730.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.864(Ft.), Average velocity =  13.638(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    109.774(CFS)
  '     '    flow top width =     13.638(Ft.)
  '     '    velocity=   13.638(Ft/s)
  '     '    area =      8.049(Sq.Ft)
  '     '    Froude number =     3.128

Upstream point elevation =  5315.000(Ft.)
Downstream point elevation =  4829.000(Ft.)
Flow length =  1756.000(Ft.)
Travel time  =    2.15 min.
Time of concentration =   16.37 min.
Depth of flow =   0.864(Ft.)
Average velocity =  13.638(Ft/s)
Total irregular channel flow =   109.774(CFS)
Irregular channel normal depth above invert elev. =   0.864(Ft.)
Average velocity of channel(s) =  13.638(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
```

```
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      3.451(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.865
Subarea runoff =     39.698(CFS) for   16.250(Ac.)
Total runoff =    129.592(CFS)
Effective area this stream =       43.42(Ac.)
Total Study Area (Main Stream No. 2) =      437.26(Ac.)
Area averaged Fm value =    0.135(In/Hr)
Depth of flow =   0.938(Ft.), Average velocity =  14.268(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      720.000 to Point/Station      730.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =     43.420(Ac.)
Runoff from this stream =    129.592(CFS)
Time of concentration =   16.37 min.
Rainfall intensity =     3.451(In/Hr)
Area averaged loss rate (Fm) =    0.1346(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      800.000 to Point/Station      810.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.180
Decimal fraction soil group D = 0.820
SCS curve number for soil(AMC 2)  = 88.46
Adjusted SCS curve number for AMC 3 = 97.69
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.046(In/Hr)
Initial subarea data:
Initial area flow distance =   964.000(Ft.)
Top (of initial area) elevation =  5664.000(Ft.)
Bottom (of initial area) elevation =  5225.000(Ft.)
Difference in elevation =   439.000(Ft.)
Slope =    0.45539  s(%)=      45.54
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.596 min.
Rainfall intensity =      5.015(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.892
Subarea runoff =     44.720(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.046(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      810.000 to Point/Station      730.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
```

```
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.109(Ft.), Average velocity =  13.416(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    156.925(CFS)
  '     '    flow top width =     16.092(Ft.)
  '     '    velocity=   13.416(Ft/s)
  '     '    area =     11.697(Sq.Ft)
  '     '    Froude number =     2.773

Upstream point elevation =  5225.000(Ft.)
Downstream point elevation =  4829.000(Ft.)
Flow length =  1949.000(Ft.)
Travel time  =    2.42 min.
Time of concentration =   12.02 min.
Depth of flow =   1.109(Ft.)
Average velocity =  13.416(Ft/s)
Total irregular channel flow =   156.925(CFS)
Irregular channel normal depth above invert elev. =   1.109(Ft.)
Average velocity of channel(s) =  13.416(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.240
Decimal fraction soil group C = 0.010
Decimal fraction soil group D = 0.750
SCS curve number for soil(AMC 2)  = 86.33
Adjusted SCS curve number for AMC 3 = 97.27
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.054(In/Hr)
Rainfall intensity =      4.284(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.889
Subarea runoff =    224.348(CFS) for   60.660(Ac.)
Total runoff =    269.068(CFS)
Effective area this stream =       70.66(Ac.)
Total Study Area (Main Stream No. 2) =      507.92(Ac.)
Area averaged Fm value =    0.053(In/Hr)
Depth of flow =   1.431(Ft.), Average velocity =  15.468(Ft/s)


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Process from Point/Station      810.000 to Point/Station      730.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 2 in normal stream number 2
Stream flow area =     70.660(Ac.)
Runoff from this stream =    269.068(CFS)
Time of concentration =   12.02 min.
Rainfall intensity =     4.284(In/Hr)
```

```
Area averaged loss rate (Fm) =    0.0529(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1    129.59    43.420     16.37    0.135      3.451
2    269.07    70.660     12.02    0.053      4.284
Qmax(1) =
         1.000 *    1.000 *   129.592) +
         0.803 *    1.000 *   269.068) + =     345.682
Qmax(2) =
         1.251 *    0.734 *   129.592) +
         1.000 *    1.000 *   269.068) + =     388.123

Total of 2 streams to confluence:
Flow rates before confluence point:
     129.592     269.068
Maximum flow rates at confluence using above data:
      345.682      388.123
Area of streams before confluence:
       43.420       70.660
Effective area values after confluence:
      114.080      102.541
Results of confluence:
Total flow rate =    388.123(CFS)
Time of concentration =    12.018 min.
Effective stream area after confluence =    102.541(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.084(In/Hr)
Study area total (this main stream) =     114.08(Ac.)


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Process from Point/Station      730.000 to Point/Station      740.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   2.041(Ft.), Average velocity =  14.754(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    457.848(CFS)
  '     '    flow top width =     25.410(Ft.)
  '     '    velocity=   14.754(Ft/s)
  '     '    area =     31.032(Sq.Ft)
  '     '    Froude number =     2.353
```

```
Upstream point elevation =  4829.000(Ft.)
Downstream point elevation =  4580.000(Ft.)
Flow length =  2018.000(Ft.)
Travel time  =    2.28 min.
Time of concentration =   14.30 min.
Depth of flow =   2.041(Ft.)
Average velocity =  14.754(Ft/s)
Total irregular channel flow =   457.848(CFS)
Irregular channel normal depth above invert elev. =   2.041(Ft.)
Average velocity of channel(s) =  14.754(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.380
Decimal fraction soil group C = 0.010
Decimal fraction soil group D = 0.610
SCS curve number for soil(AMC 2)  = 84.79
Adjusted SCS curve number for AMC 3 = 96.87
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.062(In/Hr)
Rainfall intensity =      3.794(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.882
Subarea runoff =    139.371(CFS) for   55.130(Ac.)
Total runoff =    527.494(CFS)
Effective area this stream =      157.67(Ac.)
Total Study Area (Main Stream No. 2) =      563.05(Ac.)
Area averaged Fm value =    0.076(In/Hr)
Depth of flow =   2.173(Ft.), Average velocity =  15.299(Ft/s)


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Process from Point/Station      740.000 to Point/Station      750.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   2.350(Ft.), Average velocity =  15.464(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    608.490(CFS)
  '     '    flow top width =     28.496(Ft.)
  '     '    velocity=   15.464(Ft/s)
  '     '    area =     39.350(Sq.Ft)
  '     '    Froude number =     2.319

Upstream point elevation =  4580.000(Ft.)
Downstream point elevation =  4300.000(Ft.)
Flow length =  2432.000(Ft.)
Travel time  =    2.62 min.
Time of concentration =   16.92 min.
```

```
Depth of flow =   2.350(Ft.)
Average velocity =  15.464(Ft/s)
Total irregular channel flow =   608.490(CFS)
Irregular channel normal depth above invert elev. =   2.350(Ft.)
Average velocity of channel(s) =  15.464(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.660
Decimal fraction soil group C = 0.010
Decimal fraction soil group D = 0.330
SCS curve number for soil(AMC 2)  = 81.71
Adjusted SCS curve number for AMC 3 = 95.03
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.098(In/Hr)
Rainfall intensity =      3.372(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.878
Subarea runoff =    161.941(CFS) for   75.260(Ac.)
Total runoff =    689.435(CFS)
Effective area this stream =      232.93(Ac.)
Total Study Area (Main Stream No. 2) =      638.31(Ac.)
Area averaged Fm value =    0.083(In/Hr)
Depth of flow =   2.481(Ft.), Average velocity =  15.964(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      740.000 to Point/Station      750.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =    232.931(Ac.)
Runoff from this stream =    689.435(CFS)
Time of concentration =   16.92 min.
Rainfall intensity =     3.372(In/Hr)
Area averaged loss rate (Fm) =    0.0831(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1    983.94   380.913     21.50    0.077      2.851
2    689.44   232.931     16.92    0.083      3.372
Qmax(1) =
         1.000 *    1.000 *   983.942) +
         0.842 *    1.000 *   689.435) + =    1564.282
Qmax(2) =
         1.188 *    0.787 *   983.942) +
         1.000 *    1.000 *   689.435) + =    1609.103

Total of 2 main streams to confluence:
Flow rates before confluence point:
     984.942     690.435
Maximum flow rates at confluence using above data:
     1564.282     1609.103
```

Area of streams before confluence:
380.913 232.931
Effective area values after confluence:
613.844 532.724

Results of confluence:
Total flow rate = 1609.103(CFS)
Time of concentration = 16.919 min.
Effective stream area after confluence = 532.724(Ac.)
Study area average Pervious fraction(Ap) = 1.000
Study area average soil loss rate(Fm) = 0.079(In/Hr)
Study area total = 613.84(Ac.)
End of computations, Total Study Area = 638.31 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 83.5

Haul Road and Drainage East of Quarry

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/22/11

White Knob Haul Road
Haul Road and Drainage East of Quarry
2 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 2.0
Computed rainfall intensity:
Storm year = 2.00 1 hour rainfall = 0.491 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 442.000 to Point/Station 445.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 441.000(Ft.)
Top (of initial area) elevation = 4978.000(Ft.)
Bottom (of initial area) elevation = 4918.000(Ft.)
Difference in elevation = 60.000(Ft.)
Slope = 0.13605 s(%)= 13.61
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.937 min.
Rainfall intensity = 1.862(In/Hr) for a 2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.705
Subarea runoff = 0.696(CFS)
Total initial stream area = 0.530(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++
Process from Point/Station 445.000 to Point/Station 450.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.030(Ft.), Average velocity =   1.311(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              10.00
      2             20.00               0.00
      3             50.00               0.00
      4             70.00              10.00
Manning's 'N' friction factor =   0.040
--------------------------------------------------------------------
Sub-Channel flow  =      1.180(CFS)
  '     '    flow top width =     30.120(Ft.)
  '     '    velocity=    1.311(Ft/s)
  '     '    area =      0.900(Sq.Ft)
  '     '    Froude number =     1.336

Upstream point elevation =  4918.000(Ft.)
Downstream point elevation =  4810.000(Ft.)
Flow length =   804.000(Ft.)
Travel time  =   10.22 min.
Time of concentration =   19.16 min.
Depth of flow =   0.030(Ft.)
Average velocity =   1.311(Ft/s)
Total irregular channel flow =     1.180(CFS)
Irregular channel normal depth above invert elev. =   0.030(Ft.)
Average velocity of channel(s) =   1.311(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.092(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.567
Subarea runoff =      0.878(CFS) for    2.010(Ac.)
Total runoff =      1.573(CFS)
Effective area this stream =        2.54(Ac.)
Total Study Area (Main Stream No. 1) =        2.54(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.036(Ft.), Average velocity =   1.470(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      450.000 to Point/Station      455.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.046(Ft.), Average velocity =   1.767(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =      2.425(CFS)
  '     '    flow top width =     30.182(Ft.)
  '     '    velocity=    1.767(Ft/s)
  '     '    area =      1.373(Sq.Ft)
  '     '    Froude number =     1.460

Upstream point elevation =  4810.000(Ft.)
Downstream point elevation =  4562.000(Ft.)
Flow length =  1778.000(Ft.)
Travel time  =   16.77 min.
Time of concentration =   35.93 min.
Depth of flow =   0.046(Ft.)
Average velocity =   1.767(Ft/s)
Total irregular channel flow =     2.425(CFS)
Irregular channel normal depth above invert elev. =   0.046(Ft.)
Average velocity of channel(s) =   1.767(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      0.703(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.383
Subarea runoff =      1.621(CFS) for    9.310(Ac.)
Total runoff =      3.194(CFS)
Effective area this stream =       11.85(Ac.)
Total Study Area (Main Stream No. 1) =       11.85(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.054(Ft.), Average velocity =   1.972(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      455.000 to Point/Station      460.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.065(Ft.), Average velocity =   2.221(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
```

```
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =      4.366(CFS)
  '     '    flow top width =     30.261(Ft.)
  '     '    velocity=    2.221(Ft/s)
  '     '    area =      1.966(Sq.Ft)
  '     '    Froude number =     1.535

Upstream point elevation =  4562.000(Ft.)
Downstream point elevation =  4482.000(Ft.)
Flow length =   584.000(Ft.)
Travel time  =    4.38 min.
Time of concentration =   40.31 min.
Depth of flow =   0.065(Ft.)
Average velocity =   2.221(Ft/s)
Total irregular channel flow =     4.366(CFS)
Irregular channel normal depth above invert elev. =   0.065(Ft.)
Average velocity of channel(s) =   2.221(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      0.649(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.340
Subarea runoff =      2.256(CFS) for   12.860(Ac.)
Total runoff =      5.450(CFS)
Effective area this stream =       24.71(Ac.)
Total Study Area (Main Stream No. 1) =       24.71(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.075(Ft.), Average velocity =   2.425(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      460.000 to Point/Station      465.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.071(Ft.), Average velocity =   2.559(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =      5.487(CFS)
  '     '    flow top width =     30.285(Ft.)
  '     '    velocity=    2.559(Ft/s)
  '     '    area =      2.144(Sq.Ft)
```

```
  '     '    Froude number =     1.695

Upstream point elevation =  4482.000(Ft.)
Downstream point elevation =  4319.000(Ft.)
Flow length =  1005.000(Ft.)
Travel time  =    6.55 min.
Time of concentration =   46.86 min.
Depth of flow =   0.071(Ft.)
Average velocity =   2.559(Ft/s)
Total irregular channel flow =     5.487(CFS)
Irregular channel normal depth above invert elev. =   0.071(Ft.)
Average velocity of channel(s) =   2.559(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
The area added to the existing stream causes a
a lower flow rate of Q =      4.887(CFS)
therefore the upstream flow rate of Q =      5.450(CFS) is being used
Rainfall intensity =      0.584(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.278
Subarea runoff =      0.000(CFS) for    5.420(Ac.)
Total runoff =      5.450(CFS)
Effective area this stream =       30.13(Ac.)
Total Study Area (Main Stream No. 1) =       30.13(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.071(Ft.), Average velocity =   2.552(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      460.000 to Point/Station      465.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     30.130(Ac.)
Runoff from this stream =      5.450(CFS)
Time of concentration =   46.86 min.
Rainfall intensity =     0.584(In/Hr)
Area averaged loss rate (Fm) =    0.4035(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      600.000 to Point/Station      610.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 89.00
```

```
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.211(In/Hr)
Initial subarea data:
Initial area flow distance =   911.000(Ft.)
Top (of initial area) elevation =  5633.000(Ft.)
Bottom (of initial area) elevation =  5200.000(Ft.)
Difference in elevation =   433.000(Ft.)
Slope =    0.47530  s(%)=      47.53
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.302 min.
Rainfall intensity =      1.810(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.795
Subarea runoff =     14.397(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.211(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      610.000 to Point/Station      620.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.455(Ft.), Average velocity =   8.708(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     28.805(CFS)
  '     '    flow top width =      9.548(Ft.)
  '     '    velocity=    8.708(Ft/s)
  '     '    area =      3.308(Sq.Ft)
  '     '    Froude number =     2.607

Upstream point elevation =  5200.000(Ft.)
Downstream point elevation =  4975.000(Ft.)
Flow length =   984.000(Ft.)
Travel time  =    1.88 min.
Time of concentration =   11.19 min.
Depth of flow =   0.455(Ft.)
Average velocity =   8.708(Ft/s)
Total irregular channel flow =    28.805(CFS)
Irregular channel normal depth above invert elev. =   0.455(Ft.)
Average velocity of channel(s) =   8.708(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 89.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.211(In/Hr)
```

```
Rainfall intensity =      1.591(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.781
Subarea runoff =     28.753(CFS) for   24.730(Ac.)
Total runoff =     43.150(CFS)
Effective area this stream =       34.73(Ac.)
Total Study Area (Main Stream No. 1) =       64.86(Ac.)
Area averaged Fm value =    0.211(In/Hr)
Depth of flow =   0.563(Ft.), Average velocity =   9.801(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      620.000 to Point/Station      630.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.889(Ft.), Average velocity =   9.497(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     79.721(CFS)
  '     '    flow top width =     13.888(Ft.)
  '     '    velocity=    9.497(Ft/s)
  '     '    area =      8.394(Sq.Ft)
  '     '    Froude number =     2.153

Upstream point elevation =  4975.000(Ft.)
Downstream point elevation =  4640.000(Ft.)
Flow length =  2576.000(Ft.)
Travel time  =    4.52 min.
Time of concentration =   15.71 min.
Depth of flow =   0.889(Ft.)
Average velocity =   9.497(Ft/s)
Total irregular channel flow =    79.721(CFS)
Irregular channel normal depth above invert elev. =   0.889(Ft.)
Average velocity of channel(s) =   9.497(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.460
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.540
SCS curve number for soil(AMC 2)  = 83.94
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.302(In/Hr)
Rainfall intensity =      1.255(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.701
Subarea runoff =     73.070(CFS) for   97.450(Ac.)
Total runoff =    116.220(CFS)
Effective area this stream =      132.18(Ac.)
```

```
Total Study Area (Main Stream No. 1) =      162.31(Ac.)
Area averaged Fm value =    0.278(In/Hr)
Depth of flow =   1.069(Ft.), Average velocity =  10.514(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      630.000 to Point/Station      465.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.007(Ft.), Average velocity =  11.672(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    117.902(CFS)
  '     '    flow top width =     15.068(Ft.)
  '     '    velocity=   11.672(Ft/s)
  '     '    area =     10.102(Sq.Ft)
  '     '    Froude number =     2.512

Upstream point elevation =  4640.000(Ft.)
Downstream point elevation =  4319.000(Ft.)
Flow length =  1875.000(Ft.)
Travel time  =    2.68 min.
Time of concentration =   18.38 min.
Depth of flow =   1.007(Ft.)
Average velocity =  11.672(Ft/s)
Total irregular channel flow =   117.902(CFS)
Irregular channel normal depth above invert elev. =   1.007(Ft.)
Average velocity of channel(s) =  11.672(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.124(In/Hr) for a     2.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.659
Subarea runoff =      3.266(CFS) for   29.060(Ac.)
Total runoff =    119.485(CFS)
Effective area this stream =      161.24(Ac.)
Total Study Area (Main Stream No. 1) =      191.37(Ac.)
Area averaged Fm value =    0.300(In/Hr)
Depth of flow =   1.013(Ft.), Average velocity =  11.714(Ft/s)


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```
Process from Point/Station      630.000 to Point/Station      465.000
**** CONFLUENCE OF MINOR STREAMS ****
____________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    161.240(Ac.)
Runoff from this stream =    119.485(CFS)
Time of concentration =   18.38 min.
Rainfall intensity =     1.124(In/Hr)
Area averaged loss rate (Fm) =    0.3004(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1      5.45    30.130     46.86    0.404      0.584
2    119.49   161.240     18.38    0.300      1.124
Qmax(1) =
         1.000 *    1.000 *     5.450) +
         0.344 *    1.000 *   119.485) + =      46.564
Qmax(2) =
         3.997 *    0.392 *     5.450) +
         1.000 *    1.000 *   119.485) + =     128.030

Total of 2 streams to confluence:
Flow rates before confluence point:
       5.450     119.485
Maximum flow rates at confluence using above data:
       46.564      128.030
Area of streams before confluence:
       30.130      161.240
Effective area values after confluence:
      191.370      173.060
Results of confluence:
Total flow rate =    128.030(CFS)
Time of concentration =    18.383 min.
Effective stream area after confluence =    173.060(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.317(In/Hr)
Study area total (this main stream) =     191.37(Ac.)
End of computations, Total Study Area =          191.37 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  83.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/22/11

White Knob Haul Road
Haul Road and Drainage East of Quarry
10 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 10.0
Computed rainfall intensity:
Storm year = 10.00 1 hour rainfall = 0.811 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 442.000 to Point/Station 445.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 441.000(Ft.)
Top (of initial area) elevation = 4978.000(Ft.)
Bottom (of initial area) elevation = 4918.000(Ft.)
Difference in elevation = 60.000(Ft.)
Slope = 0.13605 s(%)= 13.61
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.937 min.
Rainfall intensity = 3.075(In/Hr) for a 10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.782
Subarea runoff = 1.274(CFS)
Total initial stream area = 0.530(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++
Process from Point/Station 445.000 to Point/Station 450.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.047(Ft.), Average velocity =   1.766(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              10.00
      2             20.00               0.00
      3             50.00               0.00
      4             70.00              10.00
Manning's 'N' friction factor =   0.040
--------------------------------------------------------------------
Sub-Channel flow  =      2.494(CFS)
  '     '    flow top width =     30.188(Ft.)
  '     '    velocity=    1.767(Ft/s)
  '     '    area =      1.412(Sq.Ft)
  '     '    Froude number =     1.440

Upstream point elevation =  4918.000(Ft.)
Downstream point elevation =  4810.000(Ft.)
Flow length =   804.000(Ft.)
Travel time  =    7.59 min.
Time of concentration =   16.52 min.
Depth of flow =   0.047(Ft.)
Average velocity =   1.766(Ft/s)
Total irregular channel flow =     2.494(CFS)
Irregular channel normal depth above invert elev. =   0.047(Ft.)
Average velocity of channel(s) =   1.766(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      2.000(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.718
Subarea runoff =      2.376(CFS) for    2.010(Ac.)
Total runoff =      3.650(CFS)
Effective area this stream =        2.54(Ac.)
Total Study Area (Main Stream No. 1) =        2.54(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.059(Ft.), Average velocity =   2.056(Ft/s)


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Process from Point/Station      450.000 to Point/Station      455.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.088(Ft.), Average velocity =   2.724(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =      7.204(CFS)
  '     '    flow top width =     30.351(Ft.)
  '     '    velocity=    2.724(Ft/s)
  '     '    area =      2.644(Sq.Ft)
  '     '    Froude number =     1.627

Upstream point elevation =  4810.000(Ft.)
Downstream point elevation =  4562.000(Ft.)
Flow length =  1778.000(Ft.)
Travel time  =   10.88 min.
Time of concentration =   27.40 min.
Depth of flow =   0.088(Ft.)
Average velocity =   2.724(Ft/s)
Total irregular channel flow =     7.204(CFS)
Irregular channel normal depth above invert elev. =   0.088(Ft.)
Average velocity of channel(s) =   2.724(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.404(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.641
Subarea runoff =      7.018(CFS) for    9.310(Ac.)
Total runoff =     10.668(CFS)
Effective area this stream =       11.85(Ac.)
Total Study Area (Main Stream No. 1) =       11.85(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.111(Ft.), Average velocity =   3.183(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      455.000 to Point/Station      460.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.140(Ft.), Average velocity =   3.671(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
```

```
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     15.513(CFS)
  '     '    flow top width =     30.558(Ft.)
  '     '    velocity=    3.671(Ft/s)
  '     '    area =      4.225(Sq.Ft)
  '     '    Froude number =     1.740

Upstream point elevation =  4562.000(Ft.)
Downstream point elevation =  4482.000(Ft.)
Flow length =   584.000(Ft.)
Travel time  =    2.65 min.
Time of concentration =   30.05 min.
Depth of flow =   0.140(Ft.)
Average velocity =   3.671(Ft/s)
Total irregular channel flow =    15.513(CFS)
Irregular channel normal depth above invert elev. =   0.140(Ft.)
Average velocity of channel(s) =   3.671(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.316(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.624
Subarea runoff =      9.623(CFS) for   12.860(Ac.)
Total runoff =     20.291(CFS)
Effective area this stream =       24.71(Ac.)
Total Study Area (Main Stream No. 1) =       24.71(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.164(Ft.), Average velocity =   4.082(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      460.000 to Point/Station      465.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.160(Ft.), Average velocity =   4.365(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     21.126(CFS)
  '     '    flow top width =     30.639(Ft.)
  '     '    velocity=    4.365(Ft/s)
  '     '    area =      4.840(Sq.Ft)
```

```
  '     '    Froude number =     1.935

Upstream point elevation =  4482.000(Ft.)
Downstream point elevation =  4319.000(Ft.)
Flow length =  1005.000(Ft.)
Travel time  =    3.84 min.
Time of concentration =   33.89 min.
Depth of flow =   0.160(Ft.)
Average velocity =   4.365(Ft/s)
Total irregular channel flow =    21.126(CFS)
Irregular channel normal depth above invert elev. =   0.160(Ft.)
Average velocity of channel(s) =   4.365(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.210(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.600
Subarea runoff =      1.572(CFS) for    5.420(Ac.)
Total runoff =     21.862(CFS)
Effective area this stream =       30.13(Ac.)
Total Study Area (Main Stream No. 1) =       30.13(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.163(Ft.), Average velocity =   4.424(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      460.000 to Point/Station      465.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     30.130(Ac.)
Runoff from this stream =     21.862(CFS)
Time of concentration =   33.89 min.
Rainfall intensity =     1.210(In/Hr)
Area averaged loss rate (Fm) =    0.4035(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      600.000 to Point/Station      610.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 89.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.211(In/Hr)
Initial subarea data:
Initial area flow distance =   911.000(Ft.)
```

```
Top (of initial area) elevation =  5633.000(Ft.)
Bottom (of initial area) elevation =  5200.000(Ft.)
Difference in elevation =   433.000(Ft.)
Slope =    0.47530  s(%)=      47.53
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.302 min.
Rainfall intensity =      2.990(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.837
Subarea runoff =     25.017(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.211(In/Hr)


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Process from Point/Station      610.000 to Point/Station      620.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.615(Ft.), Average velocity =  10.287(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     51.095(CFS)
  '     '    flow top width =     11.151(Ft.)
  '     '    velocity=   10.287(Ft/s)
  '     '    area =      4.967(Sq.Ft)
  '     '    Froude number =     2.716

Upstream point elevation =  5200.000(Ft.)
Downstream point elevation =  4975.000(Ft.)
Flow length =   984.000(Ft.)
Travel time  =    1.59 min.
Time of concentration =   10.90 min.
Depth of flow =   0.615(Ft.)
Average velocity =  10.287(Ft/s)
Total irregular channel flow =    51.094(CFS)
Irregular channel normal depth above invert elev. =   0.615(Ft.)
Average velocity of channel(s) =  10.287(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 89.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.211(In/Hr)
Rainfall intensity =      2.677(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.829
```

```
Subarea runoff =     52.068(CFS) for   24.730(Ac.)
Total runoff =     77.084(CFS)
Effective area this stream =       34.73(Ac.)
Total Study Area (Main Stream No. 1) =       64.86(Ac.)
Area averaged Fm value =    0.211(In/Hr)
Depth of flow =   0.759(Ft.), Average velocity =  11.546(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      620.000 to Point/Station      630.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.212(Ft.), Average velocity =  11.276(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    151.162(CFS)
  '     '    flow top width =     17.121(Ft.)
  '     '    velocity=   11.276(Ft/s)
  '     '    area =     13.406(Sq.Ft)
  '     '    Froude number =     2.246

Upstream point elevation =  4975.000(Ft.)
Downstream point elevation =  4640.000(Ft.)
Flow length =  2576.000(Ft.)
Travel time  =    3.81 min.
Time of concentration =   14.70 min.
Depth of flow =   1.212(Ft.)
Average velocity =  11.276(Ft/s)
Total irregular channel flow =   151.162(CFS)
Irregular channel normal depth above invert elev. =   1.212(Ft.)
Average velocity of channel(s) =  11.276(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.460
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.540
SCS curve number for soil(AMC 2)  = 83.94
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.302(In/Hr)
Rainfall intensity =      2.170(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.785
Subarea runoff =    148.061(CFS) for   97.450(Ac.)
Total runoff =    225.145(CFS)
Effective area this stream =      132.18(Ac.)
Total Study Area (Main Stream No. 1) =      162.31(Ac.)
Area averaged Fm value =    0.278(In/Hr)
Depth of flow =   1.461(Ft.), Average velocity =  12.521(Ft/s)
```

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Process from Point/Station      630.000 to Point/Station      465.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.394(Ft.), Average velocity =  13.991(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    233.443(CFS)
  '     '    flow top width =     18.940(Ft.)
  '     '    velocity=   13.991(Ft/s)
  '     '    area =     16.686(Sq.Ft)
  '     '    Froude number =     2.627

Upstream point elevation =  4640.000(Ft.)
Downstream point elevation =  4319.000(Ft.)
Flow length =  1875.000(Ft.)
Travel time  =    2.23 min.
Time of concentration =   16.94 min.
Depth of flow =   1.394(Ft.)
Average velocity =  13.991(Ft/s)
Total irregular channel flow =   233.443(CFS)
Irregular channel normal depth above invert elev. =   1.394(Ft.)
Average velocity of channel(s) =  13.991(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.966(In/Hr) for a    10.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.762
Subarea runoff =     16.524(CFS) for   29.060(Ac.)
Total runoff =    241.669(CFS)
Effective area this stream =      161.24(Ac.)
Total Study Area (Main Stream No. 1) =      191.37(Ac.)
Area averaged Fm value =    0.300(In/Hr)
Depth of flow =   1.417(Ft.), Average velocity =  14.118(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      630.000 to Point/Station      465.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
```

```
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    161.240(Ac.)
Runoff from this stream =    241.669(CFS)
Time of concentration =   16.94 min.
Rainfall intensity =     1.966(In/Hr)
Area averaged loss rate (Fm) =    0.3004(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     21.86    30.130     33.89    0.404      1.210
2    241.67   161.240     16.94    0.300      1.966
Qmax(1) =
         1.000 *    1.000 *    21.862) +
         0.546 *    1.000 *   241.669) + =     153.817
Qmax(2) =
         1.938 *    0.500 *    21.862) +
         1.000 *    1.000 *   241.669) + =     262.843

Total of 2 streams to confluence:
Flow rates before confluence point:
      21.862     241.669
Maximum flow rates at confluence using above data:
      153.817      262.843
Area of streams before confluence:
       30.130      161.240
Effective area values after confluence:
      191.370      176.299
Results of confluence:
Total flow rate =    262.843(CFS)
Time of concentration =    16.937 min.
Effective stream area after confluence =    176.299(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.317(In/Hr)
Study area total (this main stream) =     191.37(Ac.)
End of computations, Total Study Area =          191.37 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  83.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/22/11

White Knob Haul Road
Haul Road and Drainage East of Quarry
25 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 25.0
Computed rainfall intensity:
Storm year = 25.00 1 hour rainfall = 1.030 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

++
Process from Point/Station 442.000 to Point/Station 445.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.404(In/Hr)
Initial subarea data:
Initial area flow distance = 441.000(Ft.)
Top (of initial area) elevation = 4978.000(Ft.)
Bottom (of initial area) elevation = 4918.000(Ft.)
Difference in elevation = 60.000(Ft.)
Slope = 0.13605 s(%)= 13.61
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.937 min.
Rainfall intensity = 3.906(In/Hr) for a 25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.807
Subarea runoff = 1.671(CFS)
Total initial stream area = 0.530(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.404(In/Hr)

++
Process from Point/Station 445.000 to Point/Station 450.000

```
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.057(Ft.), Average velocity =   2.005(Ft/s)
      ******* Irregular Channel Data ***********
---------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
---------------------------------------------------------------------
Sub-Channel flow  =      3.430(CFS)
  '     '    flow top width =     30.227(Ft.)
  '     '    velocity=    2.006(Ft/s)
  '     '    area =      1.710(Sq.Ft)
  '     '    Froude number =     1.486

Upstream point elevation =  4918.000(Ft.)
Downstream point elevation =  4810.000(Ft.)
Flow length =   804.000(Ft.)
Travel time  =    6.68 min.
Time of concentration =   15.62 min.
Depth of flow =   0.057(Ft.)
Average velocity =   2.005(Ft/s)
Total irregular channel flow =     3.430(CFS)
Irregular channel normal depth above invert elev. =   0.057(Ft.)
Average velocity of channel(s) =   2.005(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      2.642(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.763
Subarea runoff =      3.447(CFS) for    2.010(Ac.)
Total runoff =      5.118(CFS)
Effective area this stream =        2.54(Ac.)
Total Study Area (Main Stream No. 1) =        2.54(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.072(Ft.), Average velocity =   2.352(Ft/s)


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Process from Point/Station      450.000 to Point/Station      455.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.110(Ft.), Average velocity =   3.173(Ft/s)
      ******* Irregular Channel Data ***********
---------------------------------------------------------------------
```

```
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     10.586(CFS)
  '     '    flow top width =     30.442(Ft.)
  '     '    velocity=    3.173(Ft/s)
  '     '    area =      3.336(Sq.Ft)
  '     '    Froude number =     1.689

Upstream point elevation =  4810.000(Ft.)
Downstream point elevation =  4562.000(Ft.)
Flow length =  1778.000(Ft.)
Travel time  =    9.34 min.
Time of concentration =   24.96 min.
Depth of flow =   0.110(Ft.)
Average velocity =   3.173(Ft/s)
Total irregular channel flow =    10.585(CFS)
Irregular channel normal depth above invert elev. =   0.110(Ft.)
Average velocity of channel(s) =   3.173(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.903(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.709
Subarea runoff =     10.877(CFS) for    9.310(Ac.)
Total runoff =     15.995(CFS)
Effective area this stream =       11.85(Ac.)
Total Study Area (Main Stream No. 1) =       11.85(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.141(Ft.), Average velocity =   3.736(Ft/s)


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Process from Point/Station      455.000 to Point/Station      460.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.179(Ft.), Average velocity =   4.323(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
```

```
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     23.475(CFS)
  '     '    flow top width =     30.715(Ft.)
  '     '    velocity=    4.323(Ft/s)
  '     '    area =      5.430(Sq.Ft)
  '     '    Froude number =     1.812

Upstream point elevation =  4562.000(Ft.)
Downstream point elevation =  4482.000(Ft.)
Flow length =   584.000(Ft.)
Travel time  =    2.25 min.
Time of concentration =   27.21 min.
Depth of flow =   0.179(Ft.)
Average velocity =   4.323(Ft/s)
Total irregular channel flow =    23.475(CFS)
Irregular channel normal depth above invert elev. =   0.179(Ft.)
Average velocity of channel(s) =   4.323(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.792(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.697
Subarea runoff =     14.875(CFS) for   12.860(Ac.)
Total runoff =     30.871(CFS)
Effective area this stream =       24.71(Ac.)
Total Study Area (Main Stream No. 1) =       24.71(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.211(Ft.), Average velocity =   4.815(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      460.000 to Point/Station      465.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.206(Ft.), Average velocity =   5.168(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     32.448(CFS)
  '     '    flow top width =     30.826(Ft.)
  '     '    velocity=    5.168(Ft/s)
  '     '    area =      6.278(Sq.Ft)
```

```
  '     '    Froude number =     2.018

Upstream point elevation =  4482.000(Ft.)
Downstream point elevation =  4319.000(Ft.)
Flow length =  1005.000(Ft.)
Travel time  =    3.24 min.
Time of concentration =   30.45 min.
Depth of flow =   0.206(Ft.)
Average velocity =   5.168(Ft/s)
Total irregular channel flow =    32.448(CFS)
Irregular channel normal depth above invert elev. =   0.206(Ft.)
Average velocity of channel(s) =   5.168(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      1.656(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.681
Subarea runoff =      3.091(CFS) for    5.420(Ac.)
Total runoff =     33.962(CFS)
Effective area this stream =       30.13(Ac.)
Total Study Area (Main Stream No. 1) =       30.13(Ac.)
Area averaged Fm value =    0.404(In/Hr)
Depth of flow =   0.212(Ft.), Average velocity =   5.262(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      460.000 to Point/Station      465.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     30.130(Ac.)
Runoff from this stream =     33.962(CFS)
Time of concentration =   30.45 min.
Rainfall intensity =     1.656(In/Hr)
Area averaged loss rate (Fm) =    0.4035(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      600.000 to Point/Station      610.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 89.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.211(In/Hr)
Initial subarea data:
Initial area flow distance =   911.000(Ft.)
```

```
Top (of initial area) elevation =  5633.000(Ft.)
Bottom (of initial area) elevation =  5200.000(Ft.)
Difference in elevation =   433.000(Ft.)
Slope =    0.47530  s(%)=      47.53
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.302 min.
Rainfall intensity =      3.798(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.850
Subarea runoff =     32.284(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.211(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      610.000 to Point/Station      620.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
______________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.704(Ft.), Average velocity =  11.076(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     66.399(CFS)
  '     '    flow top width =     12.037(Ft.)
  '     '    velocity=   11.076(Ft/s)
  '     '    area =      5.995(Sq.Ft)
  '     '    Froude number =     2.766

Upstream point elevation =  5200.000(Ft.)
Downstream point elevation =  4975.000(Ft.)
Flow length =   984.000(Ft.)
Travel time  =    1.48 min.
Time of concentration =   10.78 min.
Depth of flow =   0.704(Ft.)
Average velocity =  11.076(Ft/s)
Total irregular channel flow =    66.399(CFS)
Irregular channel normal depth above invert elev. =   0.704(Ft.)
Average velocity of channel(s) =  11.076(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 89.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.211(In/Hr)
Rainfall intensity =      3.425(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.845
```

```
Subarea runoff =     68.177(CFS) for   24.730(Ac.)
Total runoff =    100.462(CFS)
Effective area this stream =       34.73(Ac.)
Total Study Area (Main Stream No. 1) =       64.86(Ac.)
Area averaged Fm value =    0.211(In/Hr)
Depth of flow =   0.867(Ft.), Average velocity =  12.419(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      620.000 to Point/Station      630.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.385(Ft.), Average velocity =  12.151(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    200.789(CFS)
  '     '    flow top width =     18.854(Ft.)
  '     '    velocity=   12.151(Ft/s)
  '     '    area =     16.524(Sq.Ft)
  '     '    Froude number =     2.287

Upstream point elevation =  4975.000(Ft.)
Downstream point elevation =  4640.000(Ft.)
Flow length =  2576.000(Ft.)
Travel time  =    3.53 min.
Time of concentration =   14.32 min.
Depth of flow =   1.385(Ft.)
Average velocity =  12.151(Ft/s)
Total irregular channel flow =   200.790(CFS)
Irregular channel normal depth above invert elev. =   1.385(Ft.)
Average velocity of channel(s) =  12.151(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.460
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.540
SCS curve number for soil(AMC 2)  = 83.94
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.302(In/Hr)
Rainfall intensity =      2.808(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.811
Subarea runoff =    200.599(CFS) for   97.450(Ac.)
Total runoff =    301.061(CFS)
Effective area this stream =      132.18(Ac.)
Total Study Area (Main Stream No. 1) =      162.31(Ac.)
Area averaged Fm value =    0.278(In/Hr)
Depth of flow =   1.670(Ft.), Average velocity =  13.504(Ft/s)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      630.000 to Point/Station      465.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.599(Ft.), Average velocity =  15.118(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    314.195(CFS)
  '     '    flow top width =     20.992(Ft.)
  '     '    velocity=   15.118(Ft/s)
  '     '    area =     20.783(Sq.Ft)
  '     '    Froude number =     2.677

Upstream point elevation =  4640.000(Ft.)
Downstream point elevation =  4319.000(Ft.)
Flow length =  1875.000(Ft.)
Travel time  =    2.07 min.
Time of concentration =   16.38 min.
Depth of flow =   1.599(Ft.)
Average velocity =  15.118(Ft/s)
Total irregular channel flow =   314.195(CFS)
Irregular channel normal depth above invert elev. =   1.599(Ft.)
Average velocity of channel(s) =  15.118(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.404(In/Hr)
Rainfall intensity =      2.555(In/Hr) for a    25.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.794
Subarea runoff =     26.182(CFS) for   29.060(Ac.)
Total runoff =    327.242(CFS)
Effective area this stream =      161.24(Ac.)
Total Study Area (Main Stream No. 1) =      191.37(Ac.)
Area averaged Fm value =    0.300(In/Hr)
Depth of flow =   1.629(Ft.), Average velocity =  15.278(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      630.000 to Point/Station      465.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
```

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Along Main Stream number: 1 in normal stream number 2
Stream flow area =    161.240(Ac.)
Runoff from this stream =    327.242(CFS)
Time of concentration =   16.38 min.
Rainfall intensity =     2.555(In/Hr)
Area averaged loss rate (Fm) =    0.3004(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     33.96    30.130     30.45    0.404      1.656
2    327.24   161.240     16.38    0.300      2.555
Qmax(1) =
         1.000 *    1.000 *    33.962) +
         0.601 *    1.000 *   327.242) + =     230.666
Qmax(2) =
         1.718 *    0.538 *    33.962) +
         1.000 *    1.000 *   327.242) + =     358.639

Total of 2 streams to confluence:
Flow rates before confluence point:
      33.962     327.242
Maximum flow rates at confluence using above data:
      230.666      358.639
Area of streams before confluence:
       30.130      161.240
Effective area values after confluence:
      191.370      177.451
Results of confluence:
Total flow rate =    358.639(CFS)
Time of concentration =    16.383 min.
Effective stream area after confluence =    177.451(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.317(In/Hr)
Study area total (this main stream) =     191.37(Ac.)
End of computations, Total Study Area =          191.37 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  83.0
```

San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 07/22/11

White Knob Haul Road
Haul Road and Drainage East of Quarry
100 Year Flow

Program License Serial Number 6026

********* Hydrology Study Control Information **********

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.390 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 3

++

Process from Point/Station 442.000 to Point/Station 445.000
**** INITIAL AREA EVALUATION ****

UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.140(In/Hr)
Initial subarea data:
Initial area flow distance = 441.000(Ft.)
Top (of initial area) elevation = 4978.000(Ft.)
Bottom (of initial area) elevation = 4918.000(Ft.)
Difference in elevation = 60.000(Ft.)
Slope = 0.13605 s(%)= 13.61
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.937 min.
Rainfall intensity = 5.271(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.876
Subarea runoff = 2.447(CFS)
Total initial stream area = 0.530(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.140(In/Hr)

++

```
Process from Point/Station      445.000 to Point/Station      450.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.075(Ft.), Average velocity =   2.401(Ft/s)
      ******* Irregular Channel Data ***********
--------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
--------------------------------------------------------------------
Sub-Channel flow  =      5.393(CFS)
  '     '    flow top width =     30.298(Ft.)
  '     '    velocity=    2.401(Ft/s)
  '     '    area =      2.246(Sq.Ft)
  '     '    Froude number =     1.554

Upstream point elevation =  4918.000(Ft.)
Downstream point elevation =  4810.000(Ft.)
Flow length =   804.000(Ft.)
Travel time  =    5.58 min.
Time of concentration =   14.52 min.
Depth of flow =   0.075(Ft.)
Average velocity =   2.401(Ft/s)
Total irregular channel flow =     5.393(CFS)
Irregular channel normal depth above invert elev. =   0.075(Ft.)
Average velocity of channel(s) =   2.401(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      3.753(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.866
Subarea runoff =      5.812(CFS) for    2.010(Ac.)
Total runoff =      8.259(CFS)
Effective area this stream =        2.54(Ac.)
Total Study Area (Main Stream No. 1) =        2.54(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   0.096(Ft.), Average velocity =   2.844(Ft/s)


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Process from Point/Station      450.000 to Point/Station      455.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
____________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.154(Ft.), Average velocity =   3.946(Ft/s)
```

```
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     18.363(CFS)
  '     '    flow top width =     30.614(Ft.)
  '     '    velocity=    3.946(Ft/s)
  '     '    area =      4.654(Sq.Ft)
  '     '    Froude number =     1.783

Upstream point elevation =  4810.000(Ft.)
Downstream point elevation =  4562.000(Ft.)
Flow length =  1778.000(Ft.)
Travel time  =    7.51 min.
Time of concentration =   22.03 min.
Depth of flow =   0.154(Ft.)
Average velocity =   3.946(Ft/s)
Total irregular channel flow =    18.363(CFS)
Irregular channel normal depth above invert elev. =   0.154(Ft.)
Average velocity of channel(s) =   3.946(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      2.803(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.855
Subarea runoff =     20.142(CFS) for    9.310(Ac.)
Total runoff =     28.401(CFS)
Effective area this stream =       11.85(Ac.)
Total Study Area (Main Stream No. 1) =       11.85(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   0.199(Ft.), Average velocity =   4.685(Ft/s)


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Process from Point/Station      455.000 to Point/Station      460.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
_________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.254(Ft.), Average velocity =   5.442(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
```

```
      2             20.00              0.00
      3             50.00              0.00
      4             70.00             10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
Sub-Channel flow  =     42.183(CFS)
  '     '    flow top width =     31.016(Ft.)
  '     '    velocity=    5.442(Ft/s)
  '     '    area =      7.752(Sq.Ft)
  '     '    Froude number =     1.918

Upstream point elevation =  4562.000(Ft.)
Downstream point elevation =  4482.000(Ft.)
Flow length =   584.000(Ft.)
Travel time  =    1.79 min.
Time of concentration =   23.82 min.
Depth of flow =   0.254(Ft.)
Average velocity =   5.442(Ft/s)
Total irregular channel flow =    42.183(CFS)
Irregular channel normal depth above invert elev. =   0.254(Ft.)
Average velocity of channel(s) =   5.442(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      2.654(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.853
Subarea runoff =     27.507(CFS) for   12.860(Ac.)
Total runoff =     55.908(CFS)
Effective area this stream =       24.71(Ac.)
Total Study Area (Main Stream No. 1) =       24.71(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   0.301(Ft.), Average velocity =   6.074(Ft/s)


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Process from Point/Station      460.000 to Point/Station      465.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.297(Ft.), Average velocity =   6.557(Ft/s)
      ******* Irregular Channel Data ***********
-----------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              10.00
      2             20.00               0.00
      3             50.00               0.00
      4             70.00              10.00
Manning's 'N' friction factor =   0.040
-----------------------------------------------------------------
```

```
Sub-Channel flow  =     59.605(CFS)
  '     '    flow top width =     31.188(Ft.)
  '     '    velocity=    6.557(Ft/s)
  '     '    area =      9.090(Sq.Ft)
  '     '    Froude number =     2.140

Upstream point elevation =  4482.000(Ft.)
Downstream point elevation =  4319.000(Ft.)
Flow length =  1005.000(Ft.)
Travel time  =    2.55 min.
Time of concentration =   26.37 min.
Depth of flow =   0.297(Ft.)
Average velocity =   6.557(Ft/s)
Total irregular channel flow =    59.604(CFS)
Irregular channel normal depth above invert elev. =   0.297(Ft.)
Average velocity of channel(s) =   6.557(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      2.471(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.849
Subarea runoff =      7.309(CFS) for    5.420(Ac.)
Total runoff =     63.217(CFS)
Effective area this stream =       30.13(Ac.)
Total Study Area (Main Stream No. 1) =       30.13(Ac.)
Area averaged Fm value =    0.140(In/Hr)
Depth of flow =   0.308(Ft.), Average velocity =   6.709(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      460.000 to Point/Station      465.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     30.130(Ac.)
Runoff from this stream =     63.217(CFS)
Time of concentration =   26.37 min.
Rainfall intensity =     2.471(In/Hr)
Area averaged loss rate (Fm) =    0.1400(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      600.000 to Point/Station      610.000
**** INITIAL AREA EVALUATION ****
________________________________________________________________________
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
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Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 89.00
Adjusted SCS curve number for AMC 3 = 97.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.044(In/Hr)
Initial subarea data:
Initial area flow distance =   911.000(Ft.)
Top (of initial area) elevation =  5633.000(Ft.)
Bottom (of initial area) elevation =  5200.000(Ft.)
Difference in elevation =   433.000(Ft.)
Slope =    0.47530  s(%)=      47.53
TC = k(0.525)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.302 min.
Rainfall intensity =      5.125(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.892
Subarea runoff =     45.735(CFS)
Total initial stream area =       10.000(Ac.)
Pervious area fraction = 1.000
Initial area Fm value =    0.044(In/Hr)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      610.000 to Point/Station      620.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   0.843(Ft.), Average velocity =  12.235(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =     95.115(CFS)
  '     '    flow top width =     13.434(Ft.)
  '     '    velocity=   12.235(Ft/s)
  '     '    area =      7.774(Sq.Ft)
  '     '    Froude number =     2.834

Upstream point elevation =  5200.000(Ft.)
Downstream point elevation =  4975.000(Ft.)
Flow length =   984.000(Ft.)
Travel time  =    1.34 min.
Time of concentration =   10.64 min.
Depth of flow =   0.843(Ft.)
Average velocity =  12.235(Ft/s)
Total irregular channel flow =    95.115(CFS)
Irregular channel normal depth above invert elev. =   0.843(Ft.)
Average velocity of channel(s) =  12.235(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
```
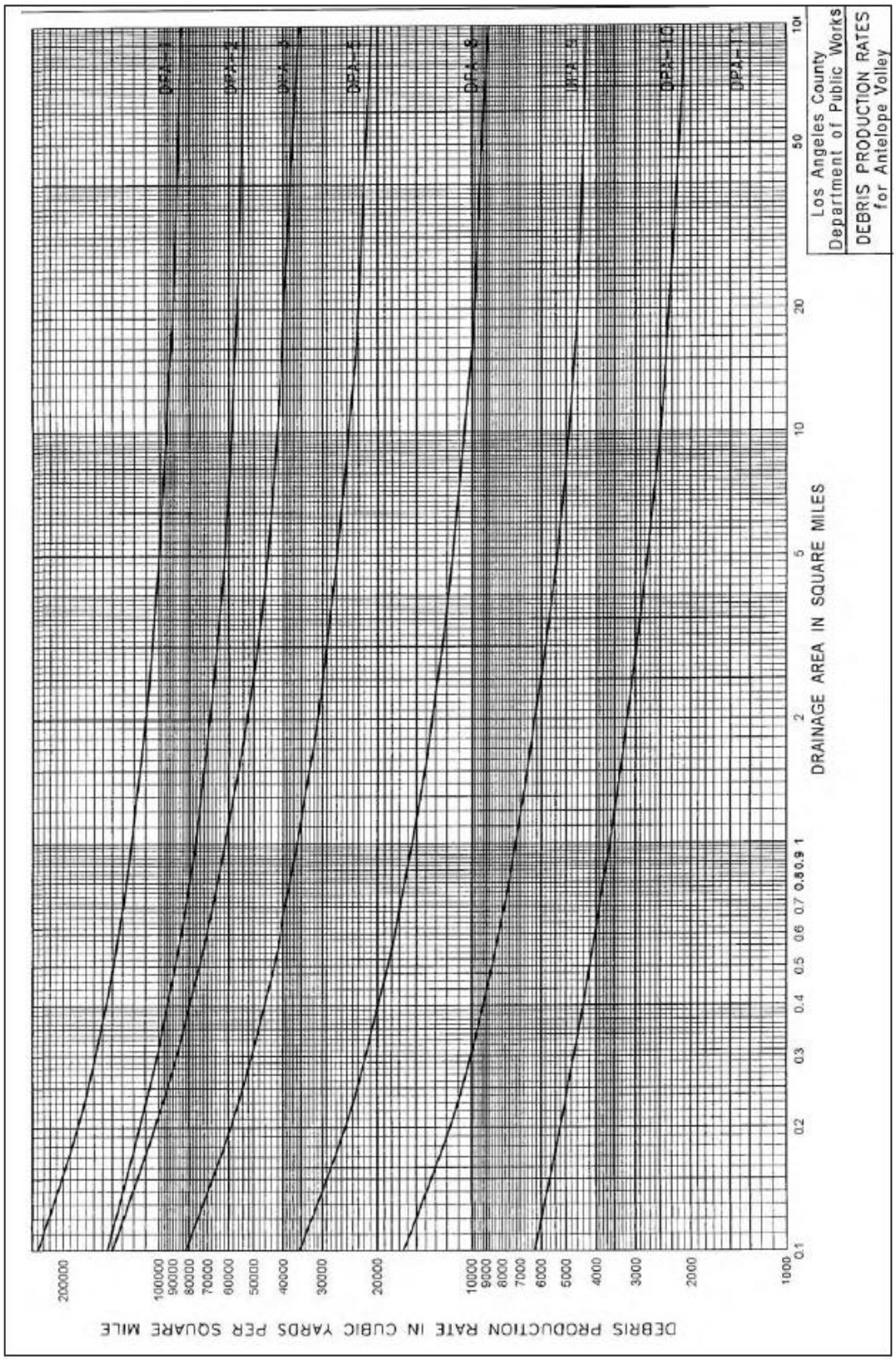

```
Decimal fraction soil group D = 1.000
SCS curve number for soil(AMC 2)  = 89.00
Adjusted SCS curve number for AMC 3 = 97.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.044(In/Hr)
Rainfall intensity =      4.664(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.892
Subarea runoff =     98.696(CFS) for   24.730(Ac.)
Total runoff =    144.431(CFS)
Effective area this stream =       34.73(Ac.)
Total Study Area (Main Stream No. 1) =       64.86(Ac.)
Area averaged Fm value =    0.044(In/Hr)
Depth of flow =   1.036(Ft.), Average velocity =  13.702(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      620.000 to Point/Station      630.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.666(Ft.), Average velocity =  13.485(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    299.418(CFS)
  '     '    flow top width =     21.658(Ft.)
  '     '    velocity=   13.485(Ft/s)
  '     '    area =     22.204(Sq.Ft)
  '     '    Froude number =     2.347

Upstream point elevation =  4975.000(Ft.)
Downstream point elevation =  4640.000(Ft.)
Flow length =  2576.000(Ft.)
Travel time  =    3.18 min.
Time of concentration =   13.83 min.
Depth of flow =   1.666(Ft.)
Average velocity =  13.485(Ft/s)
Total irregular channel flow =   299.418(CFS)
Irregular channel normal depth above invert elev. =   1.666(Ft.)
Average velocity of channel(s) =  13.485(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.460
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.540
SCS curve number for soil(AMC 2)  = 83.94
Adjusted SCS curve number for AMC 3 = 96.36
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.072(In/Hr)
Rainfall intensity =      3.884(In/Hr) for a   100.0 year storm
```

```
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.885
Subarea runoff =    309.911(CFS) for   97.450(Ac.)
Total runoff =    454.342(CFS)
Effective area this stream =      132.18(Ac.)
Total Study Area (Main Stream No. 1) =      162.31(Ac.)
Area averaged Fm value =    0.064(In/Hr)
Depth of flow =   2.010(Ft.), Average velocity =  15.015(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      630.000 to Point/Station      465.000
**** IRREGULAR CHANNEL FLOW TRAVEL TIME ****
________________________________________________________________________
Estimated mean flow rate at midpoint of channel =      0.000(CFS)
Depth of flow =   1.937(Ft.), Average velocity =  16.863(Ft/s)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00             10.00
      2             50.00              0.00
      3             55.00              0.00
      4            105.00             10.00
Manning's 'N' friction factor =   0.040
------------------------------------------------------------------
Sub-Channel flow  =    479.573(CFS)
  '     '    flow top width =     24.368(Ft.)
  '     '    velocity=   16.863(Ft/s)
  '     '    area =     28.440(Sq.Ft)
  '     '    Froude number =     2.751

Upstream point elevation =  4640.000(Ft.)
Downstream point elevation =  4319.000(Ft.)
Flow length =  1875.000(Ft.)
Travel time  =    1.85 min.
Time of concentration =   15.68 min.
Depth of flow =   1.937(Ft.)
Average velocity =  16.863(Ft/s)
Total irregular channel flow =   479.573(CFS)
Irregular channel normal depth above invert elev. =   1.937(Ft.)
Average velocity of channel(s) =  16.863(Ft/s)
 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2)  = 78.00
Adjusted SCS curve number for AMC 3 = 92.80
Pervious ratio(Ap) = 1.0000     Max loss rate(Fm)=     0.140(In/Hr)
Rainfall intensity =      3.556(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area,(total area with modified
rational method)(Q=KCIA) is C = 0.880
Subarea runoff =     50.409(CFS) for   29.060(Ac.)
Total runoff =    504.751(CFS)
Effective area this stream =      161.24(Ac.)
```

```
Total Study Area (Main Stream No. 1) =      191.37(Ac.)
Area averaged Fm value =    0.078(In/Hr)
Depth of flow =   1.982(Ft.), Average velocity =  17.086(Ft/s)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      630.000 to Point/Station      465.000
**** CONFLUENCE OF MINOR STREAMS ****
________________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    161.240(Ac.)
Runoff from this stream =    504.751(CFS)
Time of concentration =   15.68 min.
Rainfall intensity =     3.556(In/Hr)
Area averaged loss rate (Fm) =    0.0780(In/Hr)
Area averaged Pervious ratio (Ap) = 1.0000
Summary of stream data:

Stream Flow rate    Area    TC     Fm       Rainfall Intensity
 No.    (CFS)    (Ac.)       (min) (In/Hr)     (In/Hr)


1     63.22    30.130     26.37    0.140      2.471
2    504.75   161.240     15.68    0.078      3.556
Qmax(1) =
         1.000 *    1.000 *    63.217) +
         0.688 *    1.000 *   504.751) + =     410.529
Qmax(2) =
         1.465 *    0.595 *    63.217) +
         1.000 *    1.000 *   504.751) + =     559.830

Total of 2 streams to confluence:
Flow rates before confluence point:
      63.217     504.751
Maximum flow rates at confluence using above data:
      410.529      559.830
Area of streams before confluence:
       30.130      161.240
Effective area values after confluence:
      191.370      179.154
Results of confluence:
Total flow rate =    559.830(CFS)
Time of concentration =    15.679 min.
Effective stream area after confluence =    179.154(Ac.)
Study area average Pervious fraction(Ap) =  1.000
Study area average soil loss rate(Fm) =    0.088(In/Hr)
Study area total (this main stream) =     191.37(Ac.)
End of computations, Total Study Area =          191.37 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number =  83.0
```

Appendix C – Sedimentation Calculations


DEBRIS PRODUCTION RATE IN CUBIC YARDS PER SQUARE MILE
DRAINAGE AREA IN SQUARE MILES
Los Angeles County
Department of Public Works
DEBRIS PRODUCTION RATES
for Antelope Valley

White Knob Haul Road
Debris Production Calculations

At Node 440 (Basin 5)			
Total Area	=	350.81	Ac
Undisturbed Area	=	325.41	Ac
	=	0.508	Sq Mi
Debris Production Rate (DPA 9)	=	8,800	CY/Sq Mi
Debris Production	=	4,474	CY
Disturbed Area	=	25.4	Ac
	=	0.040	Sq Mi
Debris Production Rate (DPA 5)	=	82,000	CY/Sq Mi
Debris Production	=	3,254	CY
Total Debris Production	**=**	**7,729**	**CY**

Node 442 to 465			
Total Area	=	30.13	Ac
Undisturbed Area	=	26.51	Ac
	=	0.041	Sq Mi
Debris Production Rate (DPA 9)	=	16,500	CY/Sq Mi
Debris Production	=	683	CY
Disturbed Area	=	3.62	Ac
	=	0.006	Sq Mi
Debris Production Rate (DPA 5)	=	82,000	CY/Sq Mi
Debris Production	=	464	CY
Total Debris Production	**=**	**1,147**	**CY**

Appendix D – Culvert Hydraulic Calculations

HY-8 Culvert Analysis Report

Table 1 - Summary of Culvert Flows at Crossing: Station 17+70

Headwater Elevation (ft)	Total Discharge (cfs)	24 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
3998.74	5.00	5.00	0.00	1
3999.14	8.50	8.50	0.00	1
3999.55	12.00	12.00	0.00	1
4000.04	15.50	15.50	0.00	1
4000.67	19.00	19.00	0.00	1
4000.87	20.00	20.00	0.00	1
4002.01	26.00	24.94	0.83	26
4002.03	29.50	25.02	4.34	5
4002.05	33.00	25.08	7.80	4
4002.06	36.50	25.13	11.14	3
4002.07	40.00	25.18	14.66	3
4002.00	24.90	24.90	0.00	Overtopping

Rating Curve Plot for Crossing: Station 17+70

Table 2 - Culvert Summary Table: 24 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00	5.00	3998.74	1.141	0.0*	1-S2n	0.614	0.786	0.615	0.245	6.107	2.745
8.50	8.50	3999.14	1.545	0.0*	1-S2n	0.815	1.036	0.815	0.323	7.066	3.200
12.00	12.00	3999.55	1.947	0.0*	1-S2n	0.992	1.241	0.992	0.385	7.713	3.524
15.50	15.50	4000.04	2.442	0.0*	5-S2n	1.160	1.417	1.161	0.437	8.196	3.782
19.00	19.00	4000.67	3.067	0.0*	5-S2n	1.333	1.565	1.334	0.483	8.549	3.998
20.00	20.00	4000.87	3.270	0.0*	5-S2n	1.382	1.605	1.384	0.496	8.628	4.054
26.00	24.94	4002.01	4.410	0.0*	5-S2n	1.709	1.750	1.709	0.563	8.752	4.349
29.50	25.02	4002.03	4.432	0.0*	5-S2n	1.717	1.753	1.722	0.598	8.728	4.499
33.00	25.08	4002.05	4.447	0.0*	5-S2n	1.723	1.755	1.724	0.630	8.741	4.634
36.50	25.13	4002.06	4.460	0.0*	5-S2n	1.727	1.756	1.729	0.661	8.735	4.759
40.00	25.18	4002.07	4.472	0.0*	5-S2n	1.732	1.758	1.737	0.690	8.719	4.876

* theoretical depth is impractical. Depth reported is corrected.

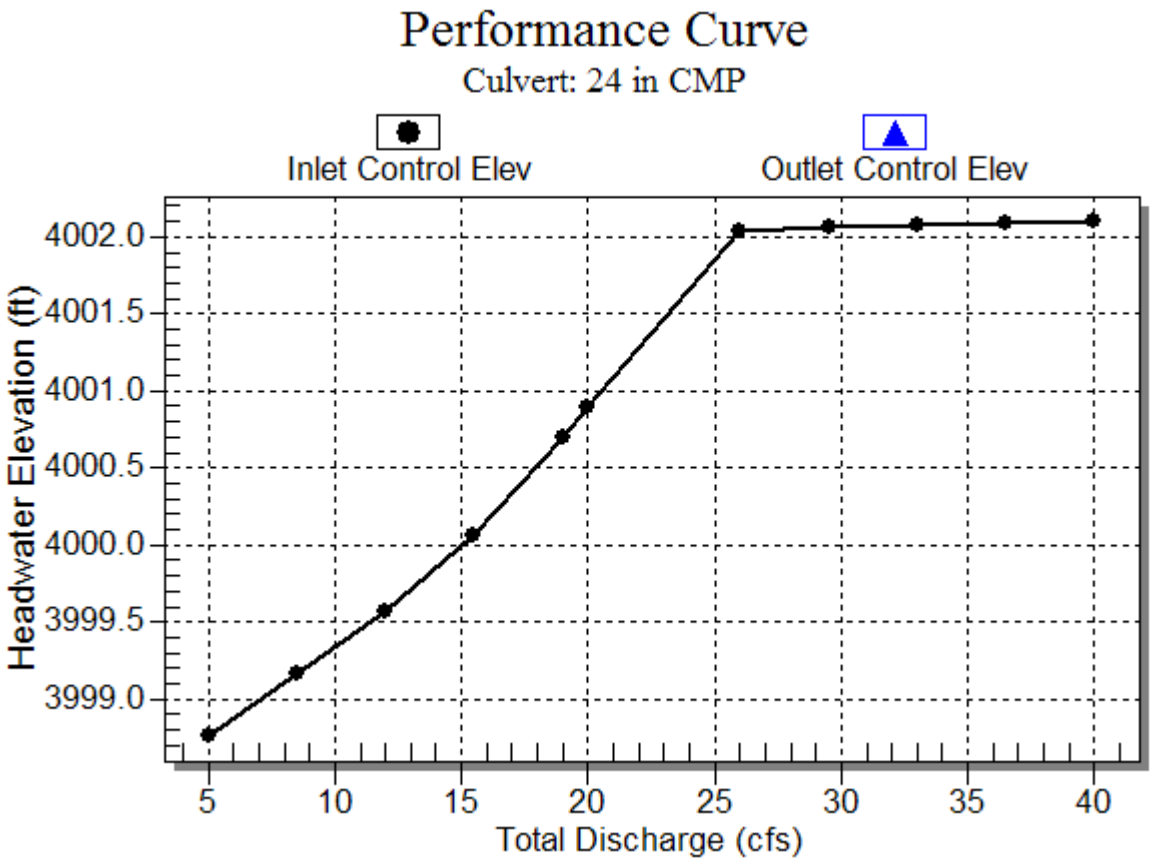
****

Inlet Elevation (invert): 3997.60 ft, Outlet Elevation (invert): 3994.62 ft

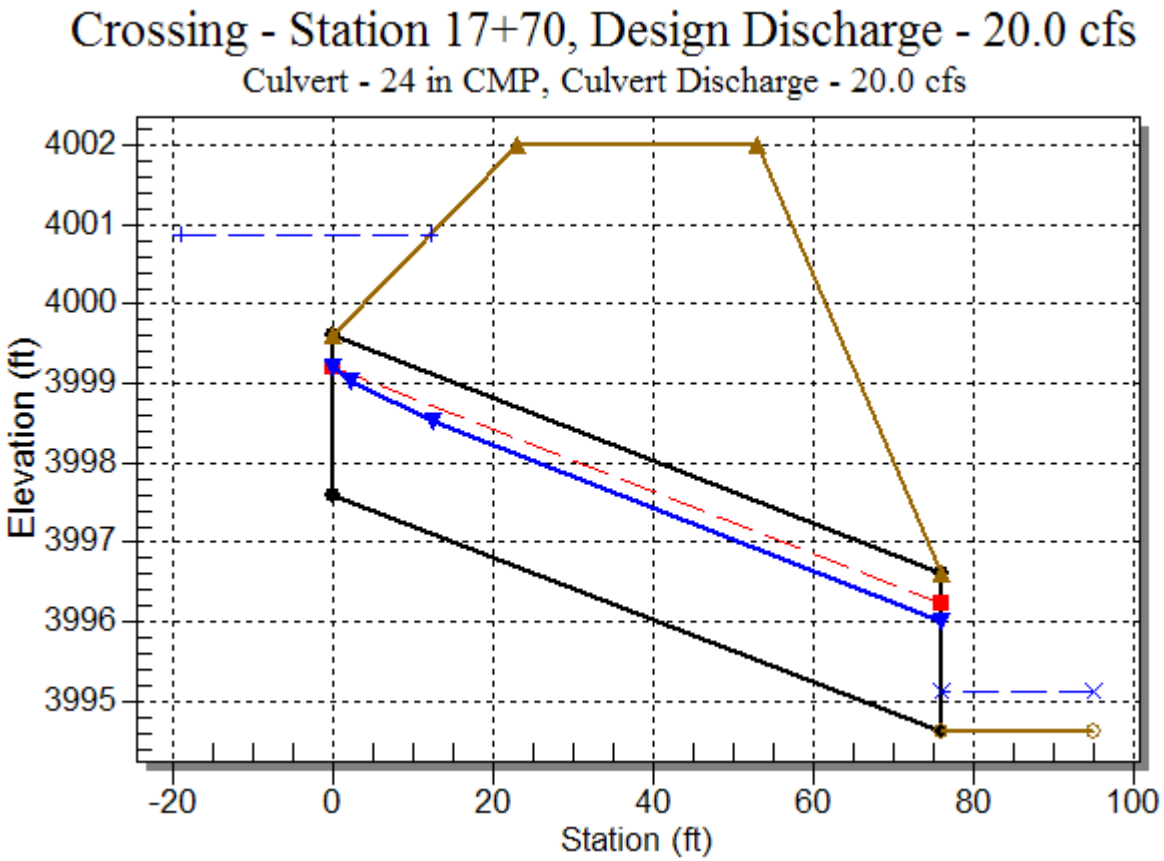
Culvert Length: 76.06 ft, Culvert Slope: 0.0392

****

Culvert Performance Curve Plot: 24 in CMP



Water Surface Profile Plot for Culvert: 24 in CMP



Site Data - 24 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 3997.60 ft

Outlet Station: 76.00 ft

Outlet Elevation: 3994.62 ft

Number of Barrels: 1

Culvert Data Summary - 24 in CMP

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Mitered to Conform to Slope

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Station 17+70)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	3994.86	0.24	2.75	0.61	1.13
8.50	3994.94	0.32	3.20	0.81	1.17
12.00	3995.00	0.38	3.52	0.96	1.20
15.50	3995.06	0.44	3.78	1.09	1.22
19.00	3995.10	0.48	4.00	1.21	1.24
20.00	3995.12	0.50	4.05	1.24	1.24
26.00	3995.18	0.56	4.35	1.40	1.26
29.50	3995.22	0.60	4.50	1.49	1.27
33.00	3995.25	0.63	4.63	1.57	1.28
36.50	3995.28	0.66	4.76	1.65	1.29
40.00	3995.31	0.69	4.88	1.72	1.30

Tailwater Channel Data - Station 17+70

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 3994.62 ft

Roadway Data for Crossing: Station 17+70

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4002.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Table 4 - Summary of Culvert Flows at Crossing: Station 19+00

Headwater Elevation (ft)	Total Discharge (cfs)	48 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4005.69	5.00	5.00	0.00	1
4006.64	19.50	19.50	0.00	1
4007.32	34.00	34.00	0.00	1
4007.90	48.50	48.50	0.00	1
4008.47	63.00	63.00	0.00	1
4009.14	77.50	77.50	0.00	1
4009.81	90.00	90.00	0.00	1
4010.06	106.50	94.30	11.89	11
4010.10	121.00	94.99	25.84	5
4010.14	135.50	95.54	39.74	4
4010.17	150.00	96.02	53.43	3
4010.00	93.25	93.25	0.00	Overtopping

Rating Curve Plot for Crossing: Station 19+00

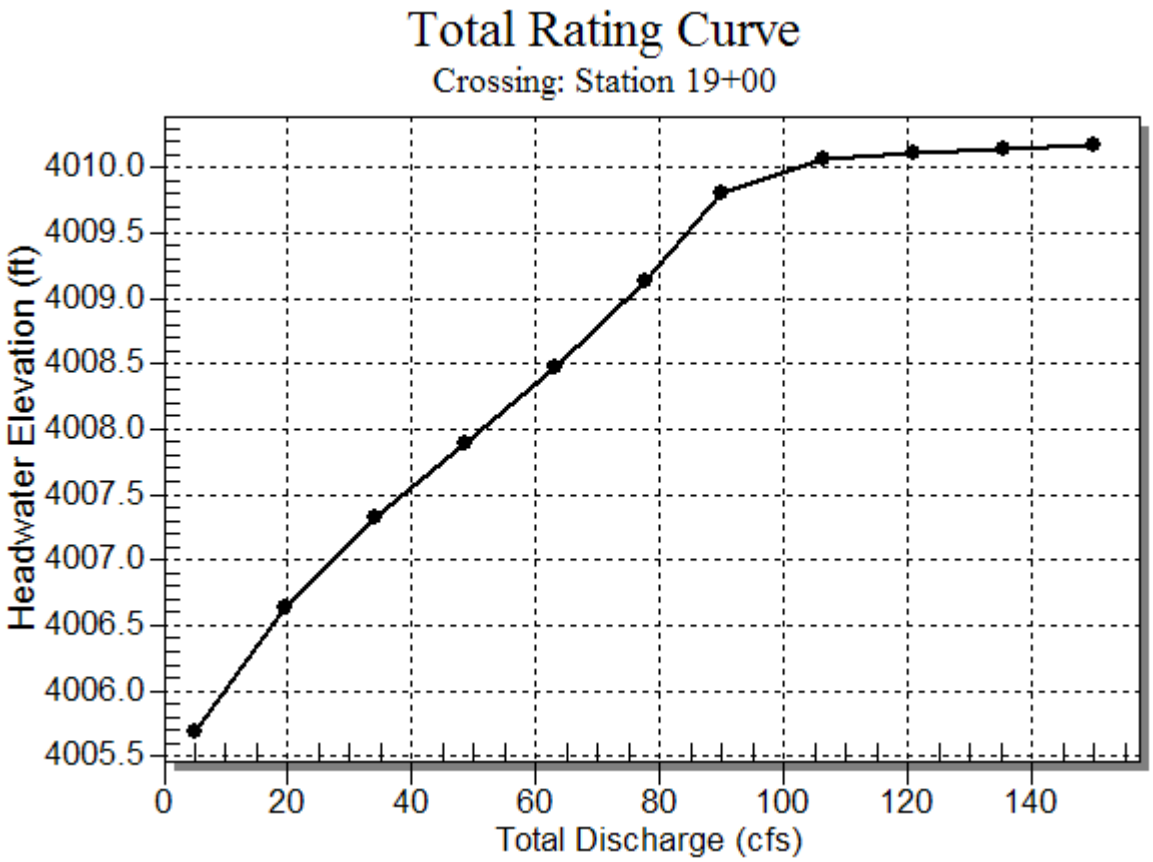


Table 5 - Culvert Summary Table: 48 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00	5.00	4005.69	0.901	0.0*	1-S2n	0.428	0.617	0.447	0.245	7.751	2.745
19.50	19.50	4006.64	1.853	0.0*	1-S2n	0.844	1.289	0.850	0.490	9.937	4.025
34.00	34.00	4007.32	2.531	0.0*	1-S2n	1.117	1.725	1.124	0.639	11.693	4.671
48.50	48.50	4007.90	3.105	0.0*	1-S2n	1.346	2.082	1.356	0.754	12.880	5.127
63.00	63.00	4008.47	3.684	0.0*	1-S2n	1.555	2.393	1.562	0.850	13.845	5.489
77.50	77.50	4009.14	4.346	0.0*	5-S2n	1.743	2.657	1.747	0.934	14.678	5.791
90.00	90.00	4009.81	5.017	0.0*	5-S2n	1.899	2.869	1.908	0.998	15.207	6.018
106.50	94.30	4010.06	5.273	0.0*	5-S2n	1.953	2.933	1.958	1.076	15.417	6.284
121.00	94.99	4010.10	5.314	0.0*	5-S2n	1.962	2.943	1.966	1.138	15.447	6.493
135.50	95.54	4010.14	5.348	0.0*	5-S2n	1.969	2.952	1.971	1.196	15.494	6.684
150.00	96.02	4010.17	5.378	0.0*	5-S2n	1.975	2.959	1.978	1.250	15.500	6.859

* theoretical depth is impractical. Depth reported is corrected.

****

Inlet Elevation (invert): 4004.79 ft, Outlet Elevation (invert): 3997.83 ft

Culvert Length: 110.22 ft, Culvert Slope: 0.0633

****

Culvert Performance Curve Plot: 48 in CMP

Water Surface Profile Plot for Culvert: 48 in CMP

Site Data - 48 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4004.79 ft

Outlet Station: 110.00 ft

Outlet Elevation: 3997.83 ft

Number of Barrels: 1

Culvert Data Summary - 48 in CMP

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Mitered to Conform to Slope

Inlet Depression: NONE

Table 6 - Downstream Channel Rating Curve (Crossing: Station 19+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	3998.07	0.24	2.75	0.61	1.13
19.50	3998.32	0.49	4.03	1.22	1.24
34.00	3998.47	0.64	4.67	1.60	1.29
48.50	3998.58	0.75	5.13	1.88	1.32
63.00	3998.68	0.85	5.49	2.12	1.34
77.50	3998.76	0.93	5.79	2.33	1.36
90.00	3998.83	1.00	6.02	2.49	1.37
106.50	3998.91	1.08	6.28	2.68	1.39
121.00	3998.97	1.14	6.49	2.84	1.40
135.50	3999.03	1.20	6.68	2.98	1.41
150.00	3999.08	1.25	6.86	3.12	1.42

Tailwater Channel Data - Station 19+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 3997.83 ft

Roadway Data for Crossing: Station 19+00

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4010.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Table 7 - Summary of Culvert Flows at Crossing: Station 43+50

Headwater Elevation (ft)	Total Discharge (cfs)	24 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4116.93	5.00	5.00	0.00	1
4117.33	8.50	8.50	0.00	1
4117.74	12.00	12.00	0.00	1
4118.23	15.50	15.50	0.00	1
4118.86	19.00	19.00	0.00	1
4119.06	20.00	20.00	0.00	1
4120.59	26.00	26.00	0.00	1
4122.01	29.50	28.05	1.20	38
4122.03	33.00	28.07	4.62	4
4122.05	36.50	28.10	8.29	4
4122.06	40.00	28.11	11.67	3
4122.00	28.03	28.03	0.00	Overtopping

Rating Curve Plot for Crossing: Station 43+50

Table 8 - Culvert Summary Table: 24 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00	5.00	4116.93	1.141	0.0*	1-S2n	0.621	0.786	0.625	0.245	5.981	2.745
8.50	8.50	4117.33	1.545	0.0*	1-S2n	0.826	1.036	0.826	0.323	6.945	3.200
12.00	12.00	4117.74	1.947	0.0*	1-S2n	1.007	1.241	1.007	0.385	7.569	3.524
15.50	15.50	4118.23	2.442	0.0*	5-S2n	1.178	1.417	1.179	0.437	8.043	3.782
19.00	19.00	4118.86	3.067	0.0*	5-S2n	1.356	1.565	1.358	0.483	8.376	3.998
20.00	20.00	4119.06	3.270	0.0*	5-S2n	1.408	1.605	1.408	0.496	8.458	4.054
26.00	26.00	4120.59	4.680	4.805	7-M2c	2.000	1.782	1.783	0.563	8.790	4.349
29.50	28.05	4122.01	5.219	6.223	7-M2c	2.000	1.842	1.832	0.598	9.301	4.499
33.00	28.07	4122.03	5.226	6.243	7-M2c	2.000	1.843	1.833	0.630	9.308	4.634
36.50	28.10	4122.05	5.232	6.259	7-M2c	2.000	1.843	1.833	0.661	9.313	4.759
40.00	28.11	4122.06	5.237	6.271	7-M2c	2.000	1.844	1.834	0.690	9.318	4.876

* theoretical depth is impractical. Depth reported is corrected.

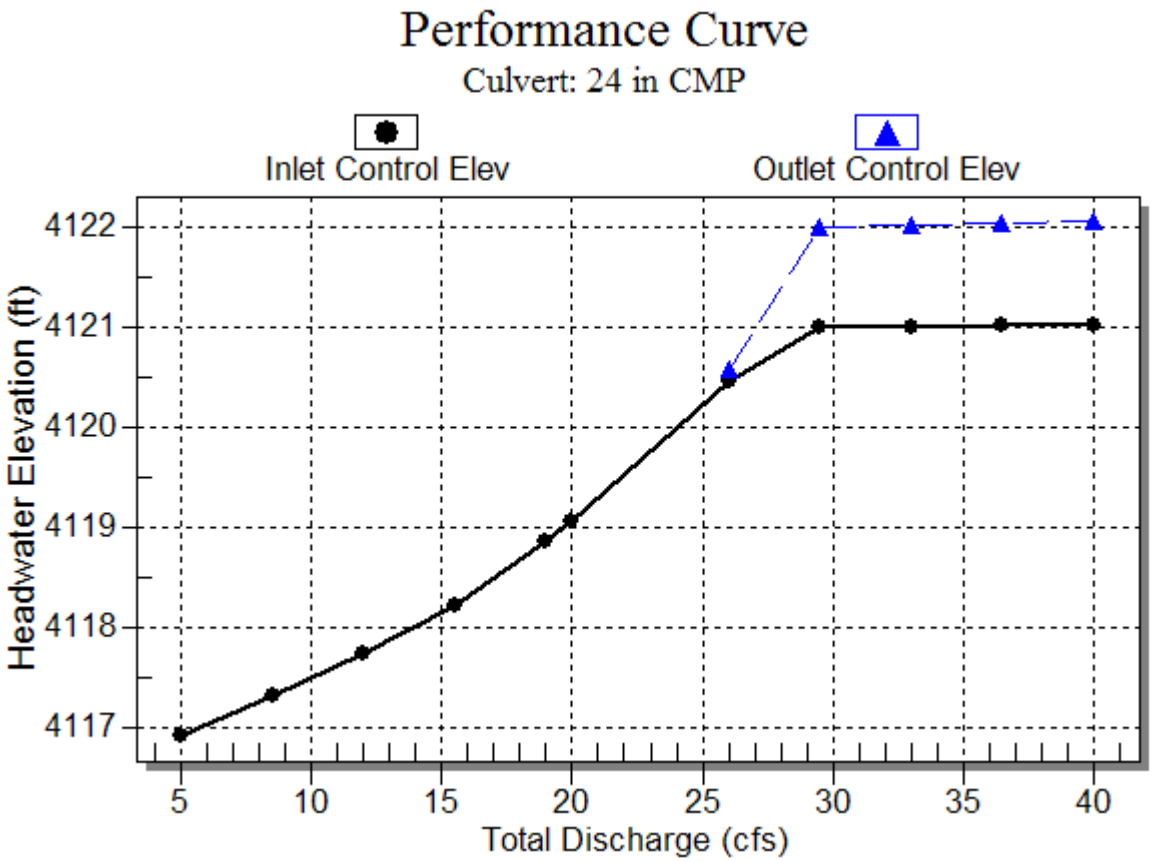
****

Inlet Elevation (invert): 4115.79 ft, Outlet Elevation (invert): 4110.19 ft

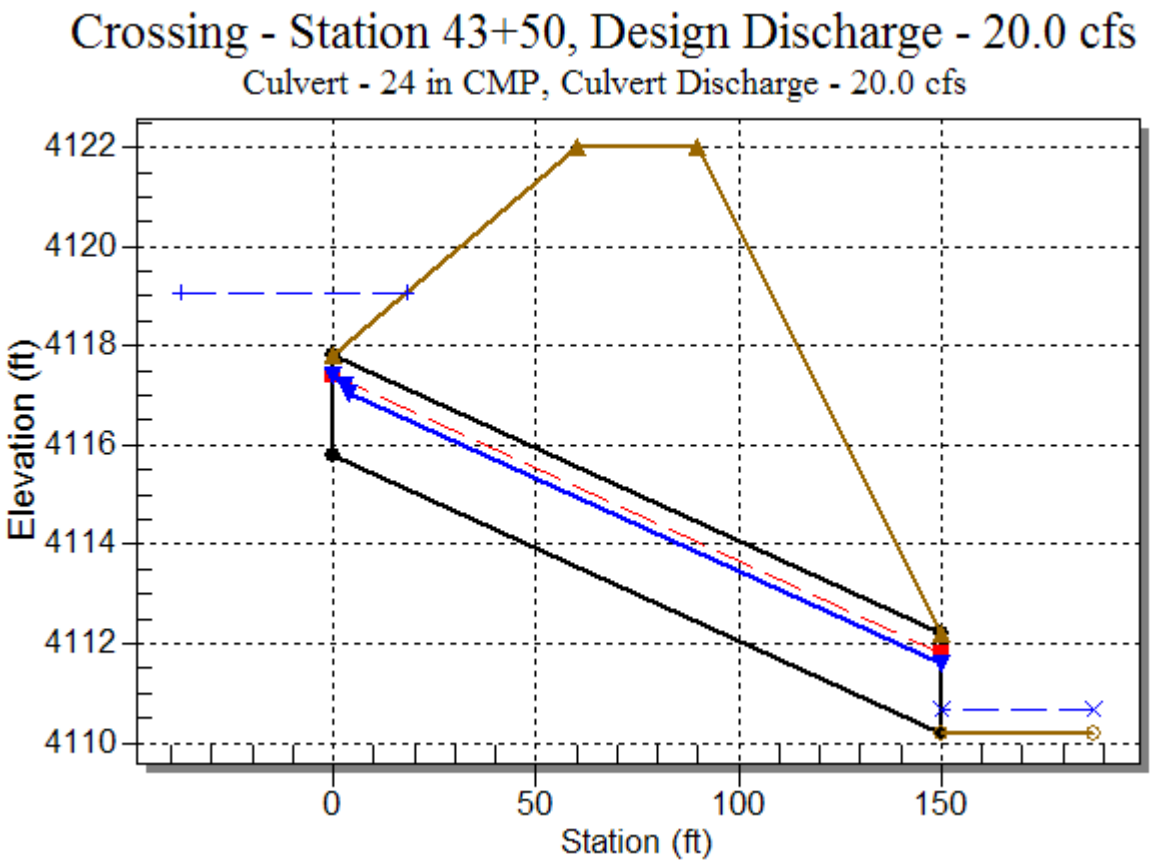
Culvert Length: 150.10 ft, Culvert Slope: 0.0373

****

Culvert Performance Curve Plot: 24 in CMP



Water Surface Profile Plot for Culvert: 24 in CMP



Site Data - 24 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4115.79 ft

Outlet Station: 150.00 ft

Outlet Elevation: 4110.19 ft

Number of Barrels: 1

Culvert Data Summary - 24 in CMP

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Mitered to Conform to Slope

Inlet Depression: NONE

Table 9 - Downstream Channel Rating Curve (Crossing: Station 43+50)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	4110.43	0.24	2.75	0.61	1.13
8.50	4110.51	0.32	3.20	0.81	1.17
12.00	4110.57	0.38	3.52	0.96	1.20
15.50	4110.63	0.44	3.78	1.09	1.22
19.00	4110.67	0.48	4.00	1.21	1.24
20.00	4110.69	0.50	4.05	1.24	1.24
26.00	4110.75	0.56	4.35	1.40	1.26
29.50	4110.79	0.60	4.50	1.49	1.27
33.00	4110.82	0.63	4.63	1.57	1.28
36.50	4110.85	0.66	4.76	1.65	1.29
40.00	4110.88	0.69	4.88	1.72	1.30

Tailwater Channel Data - Station 43+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4110.19 ft

Roadway Data for Crossing: Station 43+50

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4122.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Table 10 - Summary of Culvert Flows at Crossing: Station 49+35

Headwater Elevation (ft)	Total Discharge (cfs)	36 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4135.15	5.00	5.00	0.00	1
4135.92	14.50	14.50	0.00	1
4136.51	24.00	24.00	0.00	1
4137.11	33.50	33.50	0.00	1
4137.85	43.00	43.00	0.00	1
4138.51	50.00	50.00	0.00	1
4139.89	62.00	62.00	0.00	1
4140.05	71.50	63.23	8.02	10
4140.08	81.00	63.47	17.14	4
4140.11	90.50	63.68	26.65	4
4140.13	100.00	63.86	35.76	3
4140.00	62.85	62.85	0.00	Overtopping

Rating Curve Plot for Crossing: Station 49+35

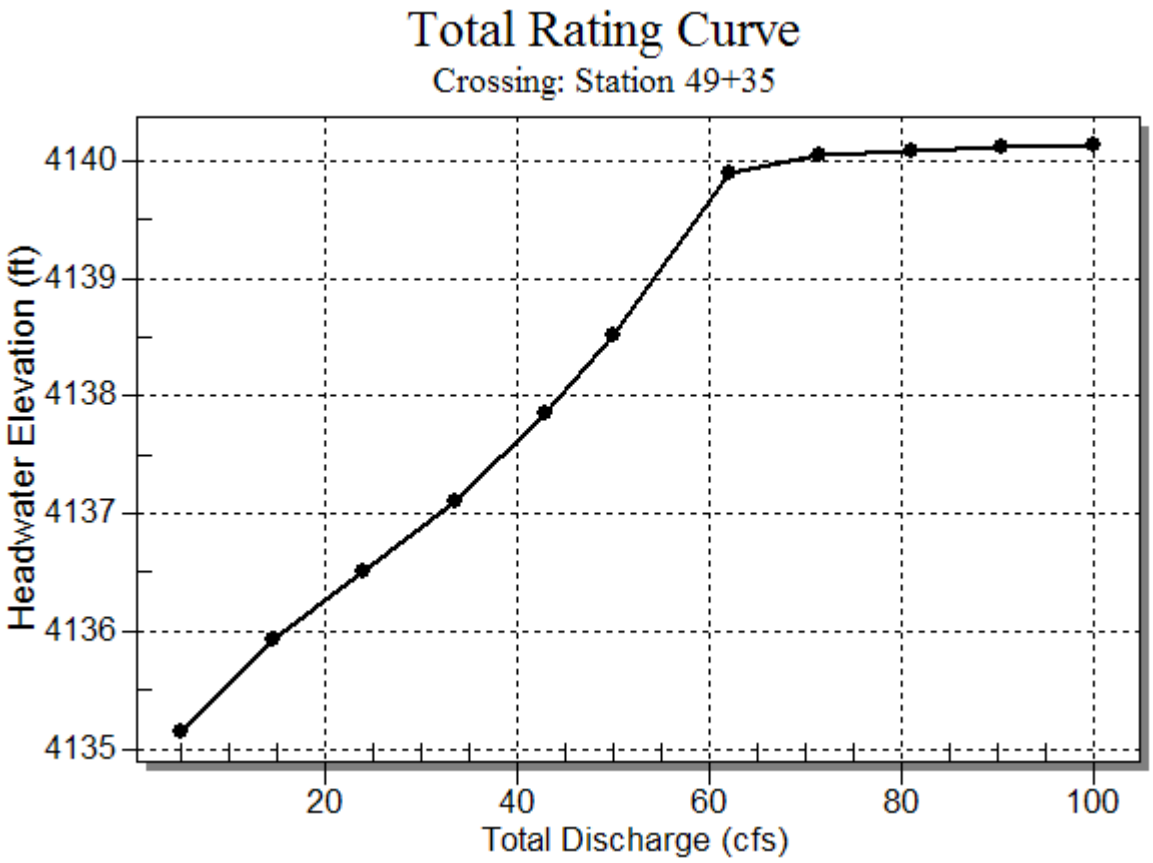


Table 11 - Culvert Summary Table: 36 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00	5.00	4135.15	0.988	0.0*	1-S2n	0.458	0.688	0.478	0.245	6.701	2.745
14.50	14.50	4135.92	1.761	0.0*	1-S2n	0.808	1.212	0.811	0.423	9.339	3.714
24.00	24.00	4136.51	2.351	0.0*	1-S2n	1.056	1.574	1.064	0.541	10.661	4.257
33.50	33.50	4137.11	2.951	0.0*	1-S2n	1.271	1.874	1.273	0.635	11.719	4.653
43.00	43.00	4137.85	3.688	0.0*	5-S2n	1.468	2.133	1.472	0.713	12.465	4.969
50.00	50.00	4138.51	4.353	0.0*	5-S2n	1.606	2.293	1.612	0.765	12.927	5.169
62.00	62.00	4139.89	5.732	0.0*	5-S2n	1.843	2.518	1.843	0.844	13.607	5.465
71.50	63.23	4140.05	5.888	0.0*	5-S2n	1.868	2.537	1.871	0.900	13.650	5.672
81.00	63.47	4140.08	5.919	0.0*	5-S2n	1.873	2.541	1.880	0.952	13.628	5.857
90.50	63.68	4140.11	5.946	0.0*	5-S2n	1.877	2.545	1.884	1.001	13.645	6.027
100.00	63.86	4140.13	5.969	0.0*	5-S2n	1.881	2.547	1.886	1.046	13.659	6.184

* theoretical depth is impractical. Depth reported is corrected.

****

Inlet Elevation (invert): 4134.16 ft, Outlet Elevation (invert): 4128.34 ft

Culvert Length: 96.18 ft, Culvert Slope: 0.0606

****

Culvert Performance Curve Plot: 36 in CMP

Water Surface Profile Plot for Culvert: 36 in CMP

Site Data - 36 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4134.16 ft

Outlet Station: 96.00 ft

Outlet Elevation: 4128.34 ft

Number of Barrels: 1

Culvert Data Summary - 36 in CMP

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Mitered to Conform to Slope

Inlet Depression: NONE

Table 12 - Downstream Channel Rating Curve (Crossing: Station 49+35)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	4128.58	0.24	2.75	0.61	1.13
14.50	4128.76	0.42	3.71	1.06	1.22
24.00	4128.88	0.54	4.26	1.35	1.26
33.50	4128.97	0.63	4.65	1.58	1.29
43.00	4129.05	0.71	4.97	1.78	1.31
50.00	4129.10	0.76	5.17	1.91	1.32
62.00	4129.18	0.84	5.47	2.11	1.34
71.50	4129.24	0.90	5.67	2.25	1.35
81.00	4129.29	0.95	5.86	2.38	1.36
90.50	4129.34	1.00	6.03	2.50	1.37
100.00	4129.39	1.05	6.18	2.61	1.38

Tailwater Channel Data - Station 49+35

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4128.34 ft

Roadway Data for Crossing: Station 49+35

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4140.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Table 13 - Summary of Culvert Flows at Crossing: Station 54+35

Headwater Elevation (ft)	Total Discharge (cfs)	36 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4136.56	5.00	5.00	0.00	1
4137.33	14.50	14.50	0.00	1
4137.92	24.00	24.00	0.00	1
4138.52	33.50	33.50	0.00	1
4138.84	43.00	37.83	4.96	17
4138.86	50.00	38.18	11.64	5
4138.90	62.00	38.63	23.10	4
4138.92	71.50	38.93	32.10	3
4138.94	81.00	39.21	41.48	3
4138.96	90.50	39.45	50.88	3
4138.98	100.00	39.69	60.23	3
4138.80	37.37	37.37	0.00	Overtopping

Rating Curve Plot for Crossing: Station 54+35

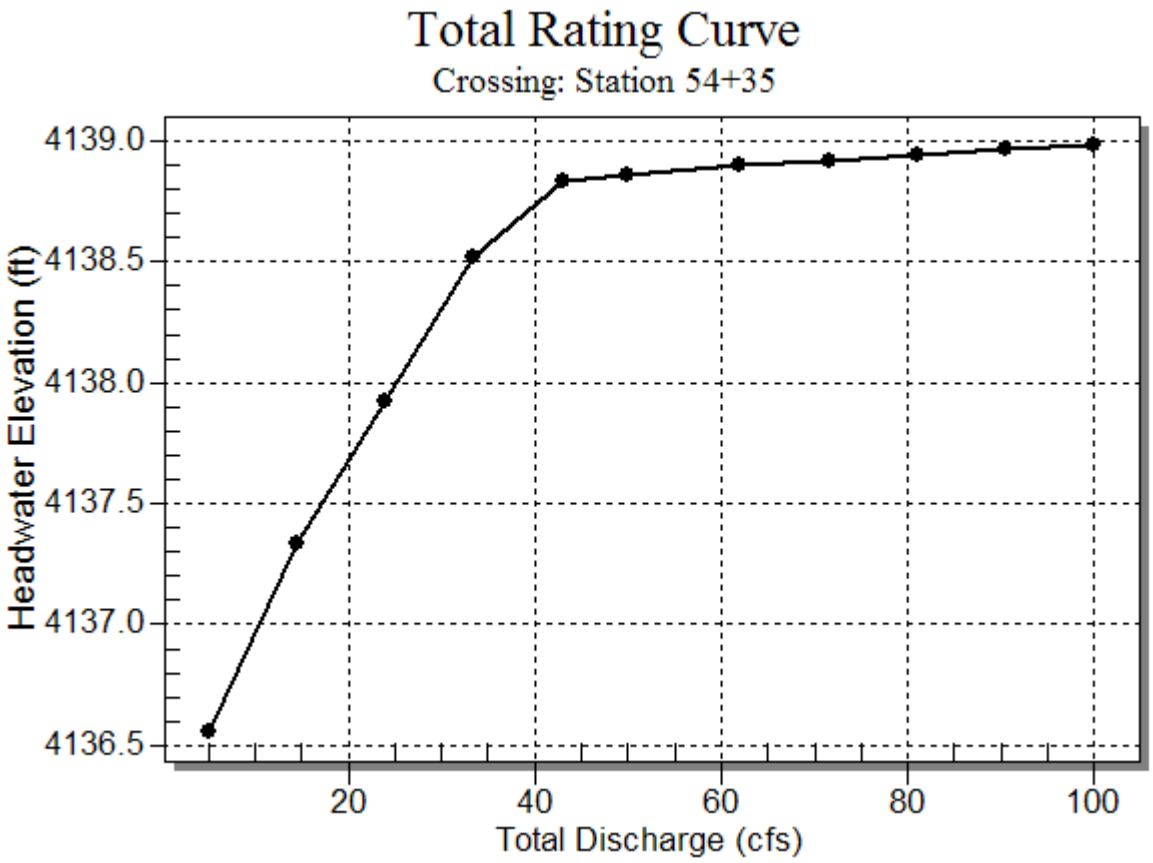


Table 14 - Culvert Summary Table: 36 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00	5.00	4136.56	0.988	0.0*	1-S2n	0.476	0.688	0.478	0.245	6.701	2.745
14.50	14.50	4137.33	1.761	0.0*	1-S2n	0.839	1.212	0.846	0.423	8.823	3.714
24.00	24.00	4137.92	2.351	0.0*	1-S2n	1.096	1.574	1.103	0.541	10.158	4.257
33.50	33.50	4138.52	2.951	0.0*	1-S2n	1.320	1.874	1.323	0.635	11.138	4.653
43.00	37.83	4138.84	3.265	0.0*	5-S2n	1.415	1.995	1.415	0.713	11.527	4.969
50.00	38.18	4138.86	3.292	0.0*	5-S2n	1.423	2.005	1.428	0.765	11.497	5.169
62.00	38.63	4138.90	3.327	0.0*	5-S2n	1.433	2.018	1.437	0.844	11.547	5.465
71.50	38.93	4138.92	3.350	0.0*	5-S2n	1.439	2.026	1.445	0.900	11.551	5.672
81.00	39.21	4138.94	3.372	0.0*	5-S2n	1.446	2.034	1.453	0.952	11.554	5.857
90.50	39.45	4138.96	3.392	0.0*	5-S2n	1.451	2.041	1.454	1.001	11.617	6.027
100.00	39.69	4138.98	3.411	0.0*	5-S2n	1.456	2.047	1.460	1.046	11.617	6.184

* theoretical depth is impractical. Depth reported is corrected.

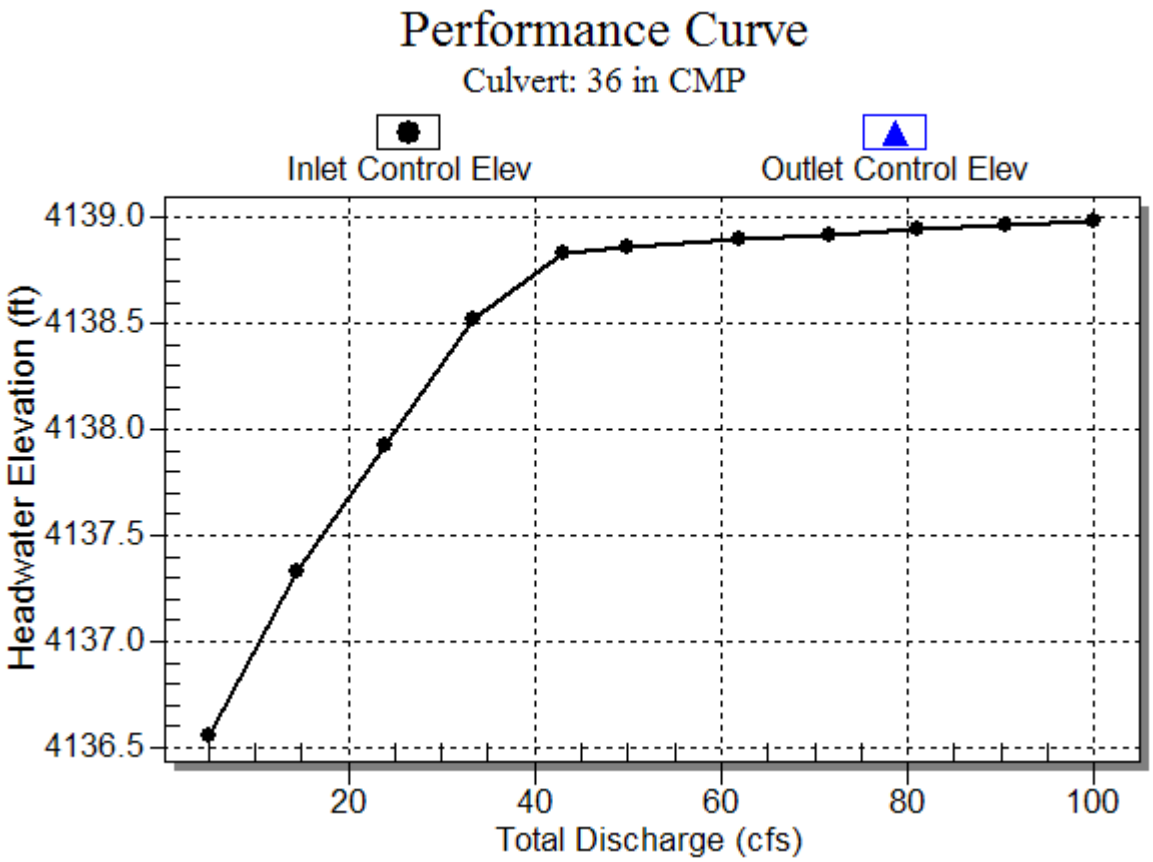
****

Inlet Elevation (invert): 4135.57 ft, Outlet Elevation (invert): 4131.86 ft

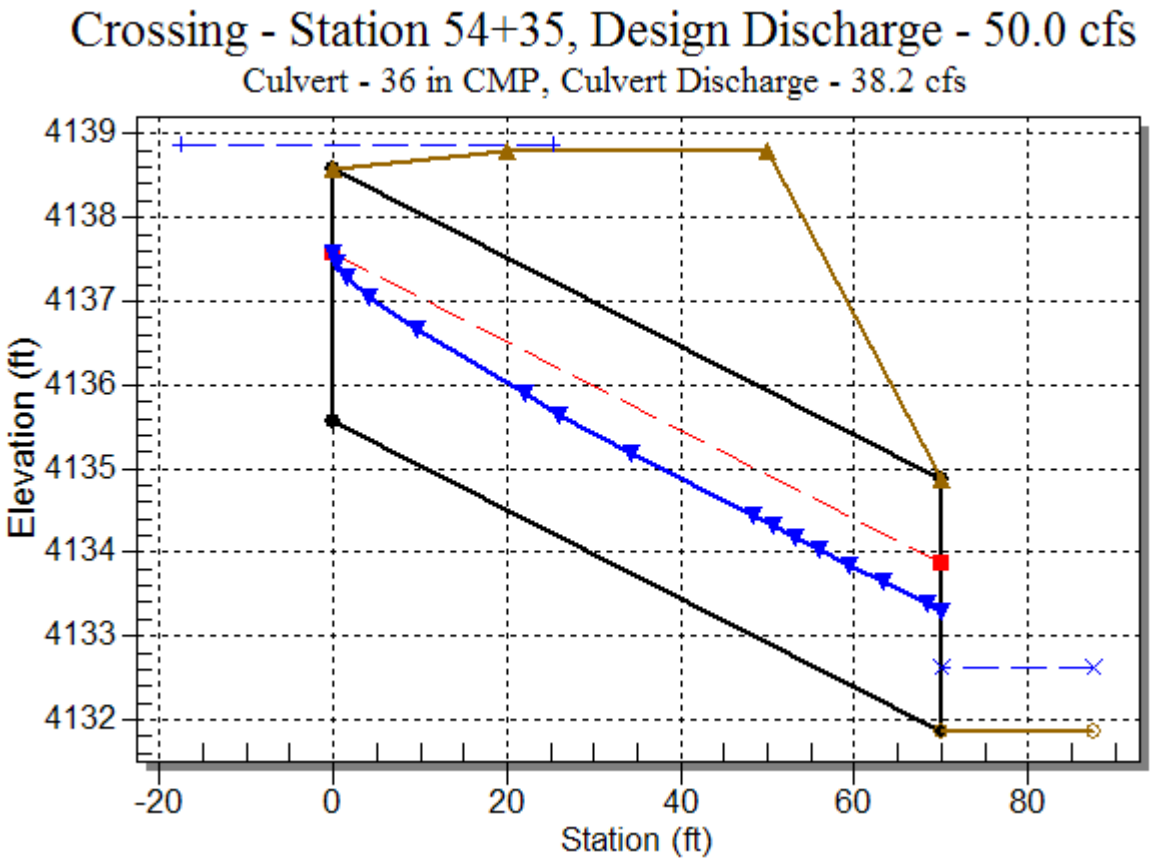
Culvert Length: 70.10 ft, Culvert Slope: 0.0530

****

Culvert Performance Curve Plot: 36 in CMP



Water Surface Profile Plot for Culvert: 36 in CMP



Site Data - 36 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4135.57 ft

Outlet Station: 70.00 ft

Outlet Elevation: 4131.86 ft

Number of Barrels: 1

Culvert Data Summary - 36 in CMP

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Mitered to Conform to Slope

Inlet Depression: NONE

Table 15 - Downstream Channel Rating Curve (Crossing: Station 54+35)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	4132.10	0.24	2.75	0.61	1.13
14.50	4132.28	0.42	3.71	1.06	1.22
24.00	4132.40	0.54	4.26	1.35	1.26
33.50	4132.49	0.63	4.65	1.58	1.29
43.00	4132.57	0.71	4.97	1.78	1.31
50.00	4132.62	0.76	5.17	1.91	1.32
62.00	4132.70	0.84	5.47	2.11	1.34
71.50	4132.76	0.90	5.67	2.25	1.35
81.00	4132.81	0.95	5.86	2.38	1.36
90.50	4132.86	1.00	6.03	2.50	1.37
100.00	4132.91	1.05	6.18	2.61	1.38

Tailwater Channel Data - Station 54+35

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4131.86 ft

Roadway Data for Crossing: Station 54+35

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4138.80 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Table 16 - Summary of Culvert Flows at Crossing: Station 57+75

Headwater Elevation (ft)	Total Discharge (cfs)	48 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4131.42	5.00	5.00	0.00	1
4132.37	19.50	19.50	0.00	1
4133.05	34.00	34.00	0.00	1
4133.63	48.50	48.50	0.00	1
4134.20	63.00	63.00	0.00	1
4134.87	77.50	77.50	0.00	1
4135.54	90.00	90.00	0.00	1
4136.59	106.50	106.50	0.00	1
4137.05	121.00	112.95	7.79	18
4137.09	135.50	113.57	21.66	5
4137.13	150.00	114.05	35.65	4
4137.00	112.30	112.30	0.00	Overtopping

Rating Curve Plot for Crossing: Station 57+75

Table 17 - Culvert Summary Table: 48 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00	5.00	4131.42	0.901	0.0*	1-S2n	0.538	0.617	0.557	0.245	4.551	2.745
19.50	19.50	4132.37	1.853	0.0*	1-S2n	1.110	1.289	1.118	0.490	6.752	4.025
34.00	34.00	4133.05	2.531	0.0*	1-S2n	1.492	1.725	1.495	0.639	7.919	4.671
48.50	48.50	4133.63	3.105	0.0*	1-S2n	1.819	2.082	1.822	0.754	8.699	5.127
63.00	63.00	4134.20	3.684	0.0*	1-S2n	2.125	2.393	2.132	0.850	9.253	5.489
77.50	77.50	4134.87	4.346	0.0*	5-S2n	2.423	2.657	2.423	0.934	9.730	5.791
90.00	90.00	4135.54	5.017	0.0*	5-S2n	2.689	2.869	2.689	0.998	10.029	6.018
106.50	106.50	4136.59	6.067	0.0*	5-S2n	3.083	3.115	3.084	1.076	10.264	6.284
121.00	112.95	4137.05	6.527	6.060	2-M2c	3.270	3.207	3.209	1.138	10.449	6.493
135.50	113.57	4137.09	6.572	6.077	2-M2c	3.295	3.214	3.217	1.196	10.480	6.684
150.00	114.05	4137.13	6.609	6.098	2-M2c	3.314	3.219	3.225	1.250	10.500	6.859

* theoretical depth is impractical. Depth reported is corrected.

****

Inlet Elevation (invert): 4130.52 ft, Outlet Elevation (invert): 4129.03 ft

Culvert Length: 70.02 ft, Culvert Slope: 0.0213

****

Culvert Performance Curve Plot: 48 in CMP

Water Surface Profile Plot for Culvert: 48 in CMP

Site Data - 48 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4130.52 ft

Outlet Station: 70.00 ft

Outlet Elevation: 4129.03 ft

Number of Barrels: 1

Culvert Data Summary - 48 in CMP

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Mitered to Conform to Slope

Inlet Depression: NONE

Table 18 - Downstream Channel Rating Curve (Crossing: Station 57+75)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	4129.27	0.24	2.75	0.61	1.13
19.50	4129.52	0.49	4.03	1.22	1.24
34.00	4129.67	0.64	4.67	1.60	1.29
48.50	4129.78	0.75	5.13	1.88	1.32
63.00	4129.88	0.85	5.49	2.12	1.34
77.50	4129.96	0.93	5.79	2.33	1.36
90.00	4130.03	1.00	6.02	2.49	1.37
106.50	4130.11	1.08	6.28	2.68	1.39
121.00	4130.17	1.14	6.49	2.84	1.40
135.50	4130.23	1.20	6.68	2.98	1.41
150.00	4130.28	1.25	6.86	3.12	1.42

Tailwater Channel Data - Station 57+75

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4129.03 ft

Roadway Data for Crossing: Station 57+75

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4137.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Table 19 - Summary of Culvert Flows at Crossing: Station 62+30

Headwater Elevation (ft)	Total Discharge (cfs)	24 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4124.82	5.00	5.00	0.00	1
4125.22	8.50	8.50	0.00	1
4125.63	12.00	12.00	0.00	1
4126.12	15.50	15.50	0.00	1
4126.75	19.00	19.00	0.00	1
4126.95	20.00	20.00	0.00	1
4128.01	26.00	24.63	1.22	15
4128.03	29.50	24.71	4.50	4
4128.05	33.00	24.77	8.11	4
4128.06	36.50	24.82	11.46	3
4128.07	40.00	24.87	14.98	3
4128.00	24.57	24.57	0.00	Overtopping

Rating Curve Plot for Crossing: Station 62+30

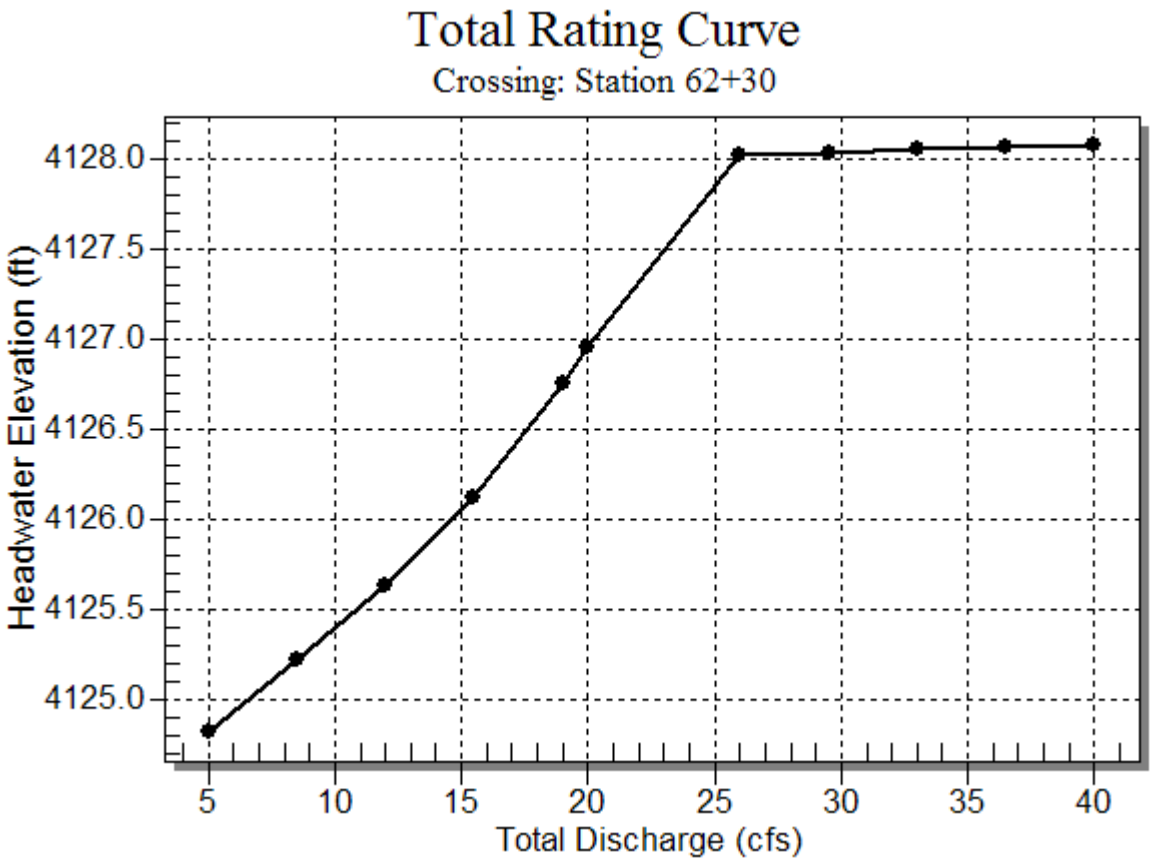


Table 20 - Culvert Summary Table: 24 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00	5.00	4124.82	1.141	0.0*	1-S2n	0.596	0.786	0.596	0.245	6.363	2.745
8.50	8.50	4125.22	1.545	0.0*	1-S2n	0.789	1.036	0.789	0.323	7.369	3.200
12.00	12.00	4125.63	1.947	0.0*	1-S2n	0.957	1.241	0.960	0.385	8.042	3.524
15.50	15.50	4126.12	2.442	0.0*	5-S2n	1.117	1.417	1.117	0.437	8.594	3.782
19.00	19.00	4126.75	3.067	0.0*	5-S2n	1.278	1.565	1.280	0.483	8.963	3.998
20.00	20.00	4126.95	3.270	0.0*	5-S2n	1.324	1.605	1.325	0.496	9.069	4.054
26.00	24.63	4128.01	4.333	0.0*	5-S2n	1.567	1.741	1.570	0.563	9.319	4.349
29.50	24.71	4128.03	4.352	0.0*	5-S2n	1.571	1.744	1.573	0.598	9.334	4.499
33.00	24.77	4128.05	4.368	0.0*	5-S2n	1.574	1.745	1.574	0.630	9.347	4.634
36.50	24.82	4128.06	4.381	0.0*	5-S2n	1.577	1.747	1.579	0.661	9.339	4.759
40.00	24.87	4128.07	4.393	0.0*	5-S2n	1.580	1.748	1.581	0.690	9.342	4.876

* theoretical depth is impractical. Depth reported is corrected.

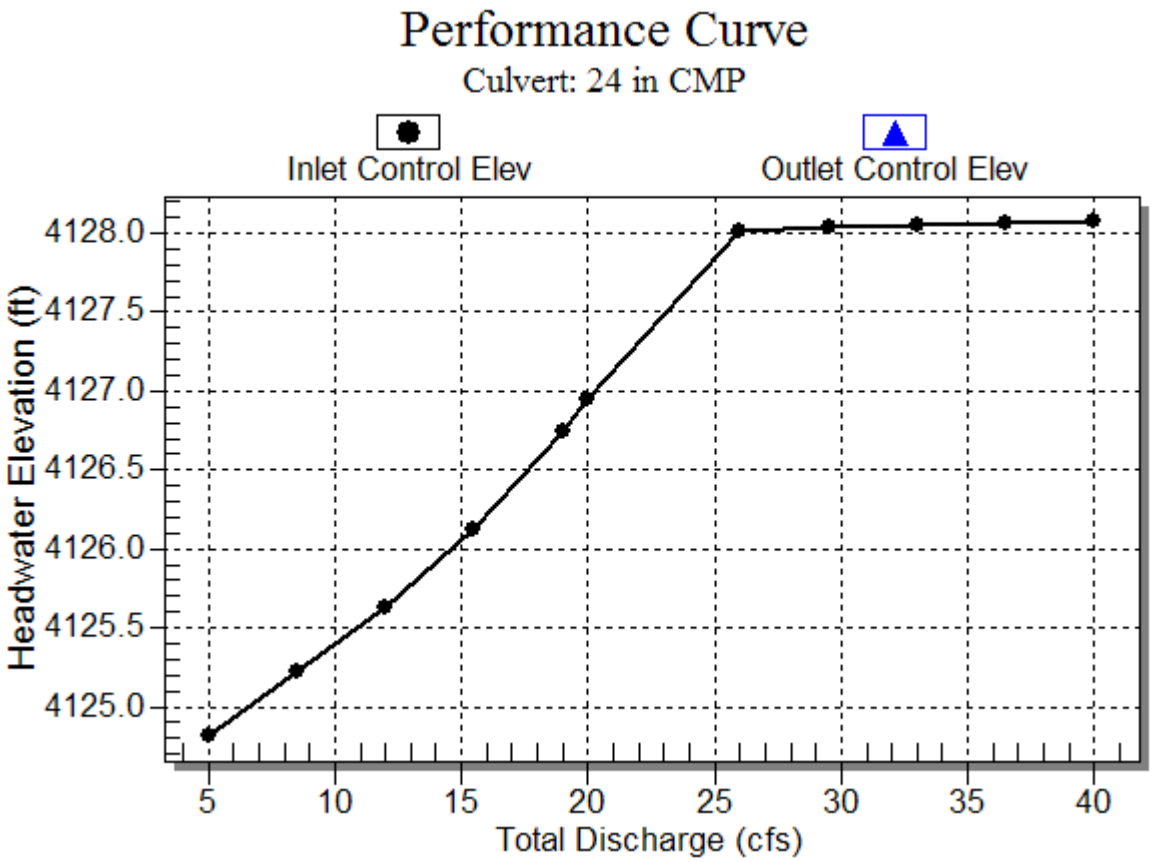
****

Inlet Elevation (invert): 4123.68 ft, Outlet Elevation (invert): 4120.32 ft

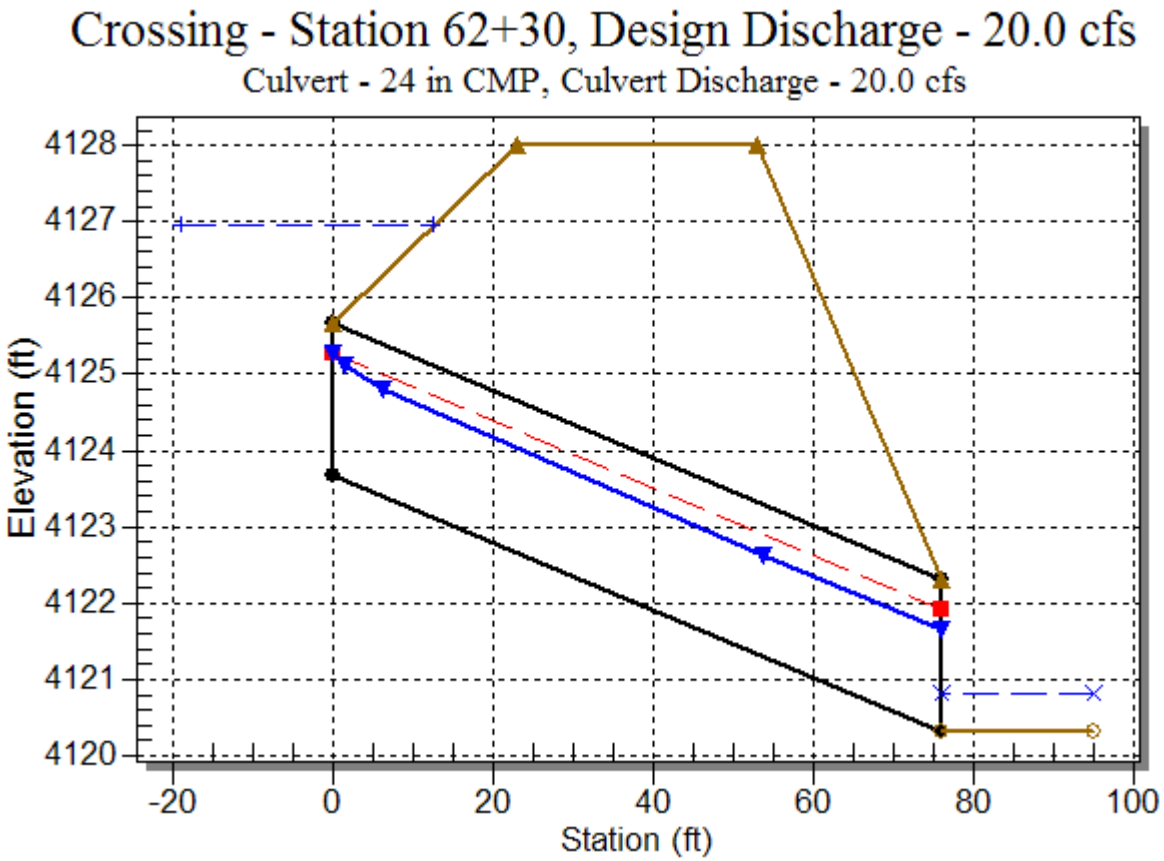
Culvert Length: 76.07 ft, Culvert Slope: 0.0442

****

Culvert Performance Curve Plot: 24 in CMP



Water Surface Profile Plot for Culvert: 24 in CMP



Site Data - 24 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4123.68 ft

Outlet Station: 76.00 ft

Outlet Elevation: 4120.32 ft

Number of Barrels: 1

Culvert Data Summary - 24 in CMP

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Mitered to Conform to Slope

Inlet Depression: NONE

Table 21 - Downstream Channel Rating Curve (Crossing: Station 62+30)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	4120.56	0.24	2.75	0.61	1.13
8.50	4120.64	0.32	3.20	0.81	1.17
12.00	4120.70	0.38	3.52	0.96	1.20
15.50	4120.76	0.44	3.78	1.09	1.22
19.00	4120.80	0.48	4.00	1.21	1.24
20.00	4120.82	0.50	4.05	1.24	1.24
26.00	4120.88	0.56	4.35	1.40	1.26
29.50	4120.92	0.60	4.50	1.49	1.27
33.00	4120.95	0.63	4.63	1.57	1.28
36.50	4120.98	0.66	4.76	1.65	1.29
40.00	4121.01	0.69	4.88	1.72	1.30

Tailwater Channel Data - Station 62+30

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4120.32 ft

Roadway Data for Crossing: Station 62+30

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4128.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Table 22 - Summary of Culvert Flows at Crossing: Station 88+15

Headwater Elevation (ft)	Total Discharge (cfs)	24 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4134.04	5.00	5.00	0.00	1
4134.44	8.50	8.50	0.00	1
4134.85	12.00	12.00	0.00	1
4135.34	15.50	15.50	0.00	1
4135.97	19.00	19.00	0.00	1
4136.17	20.00	20.00	0.00	1
4137.58	26.00	26.00	0.00	1
4138.52	29.50	29.50	0.00	1
4139.61	33.00	33.00	0.00	1
4140.88	36.50	36.50	0.00	1
4142.01	40.00	38.60	1.21	23
4142.00	38.58	38.58	0.00	Overtopping

Rating Curve Plot for Crossing: Station 88+15

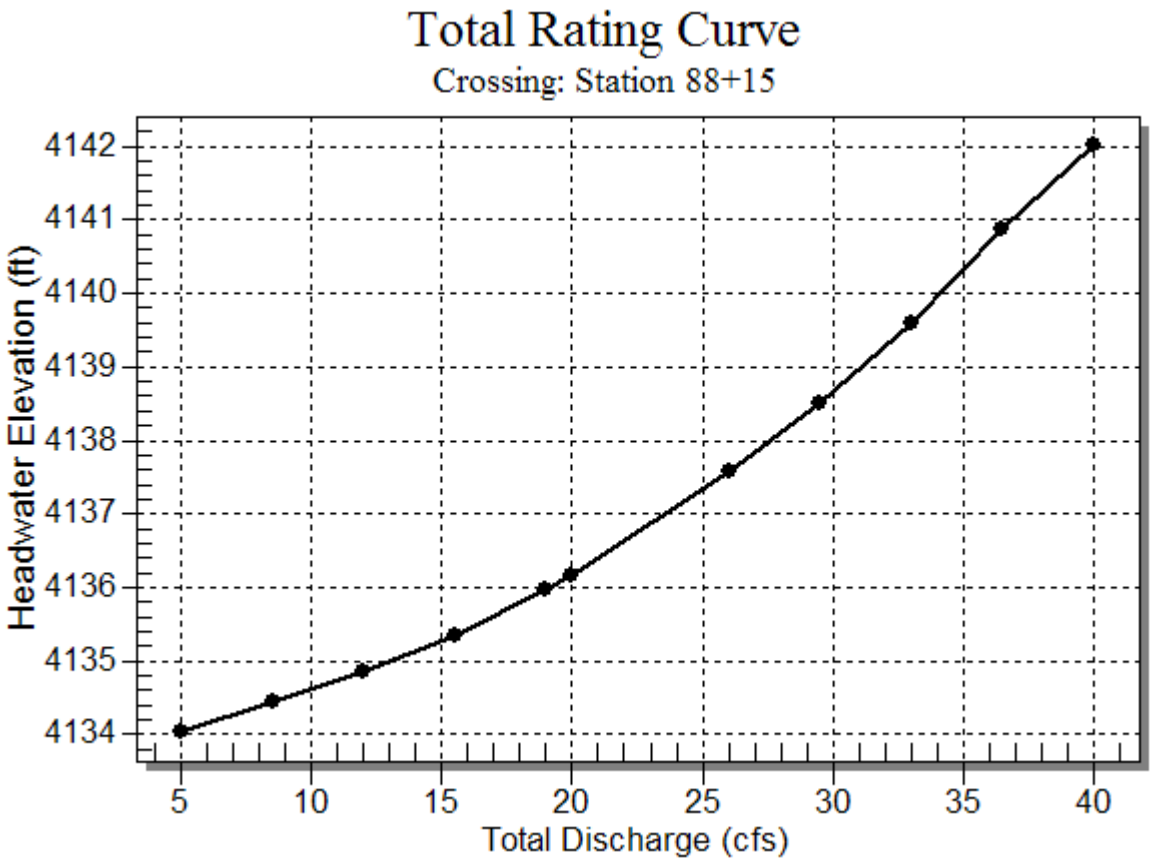


Table 23 - Culvert Summary Table: 24 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00	5.00	4134.04	1.141	0.0*	1-S2n	0.535	0.786	0.536	0.245	7.329	2.745
8.50	8.50	4134.44	1.545	0.0*	1-S2n	0.710	1.036	0.715	0.323	8.395	3.200
12.00	12.00	4134.85	1.947	0.0*	1-S2n	0.860	1.241	0.860	0.385	9.277	3.524
15.50	15.50	4135.34	2.442	0.0*	5-S2n	0.998	1.417	0.998	0.437	9.889	3.782
19.00	19.00	4135.97	3.067	0.0*	5-S2n	1.129	1.565	1.134	0.483	10.347	3.998
20.00	20.00	4136.17	3.270	0.0*	5-S2n	1.167	1.605	1.169	0.496	10.493	4.054
26.00	26.00	4137.58	4.680	0.0*	5-S2n	1.399	1.782	1.401	0.563	11.063	4.349
29.50	29.50	4138.52	5.615	0.0*	5-S2n	1.559	1.885	1.564	0.598	11.209	4.499
33.00	33.00	4139.61	6.706	0.0*	5-S2n	1.790	1.988	1.888	0.630	10.819	4.634
36.50	36.50	4140.88	7.981	7.750	6-FFc	2.000	2.000	2.000	0.661	11.618	4.759
40.00	38.60	4142.01	8.807	9.114	6-FFc	2.000	2.000	2.000	0.690	12.287	4.876

* theoretical depth is impractical. Depth reported is corrected.

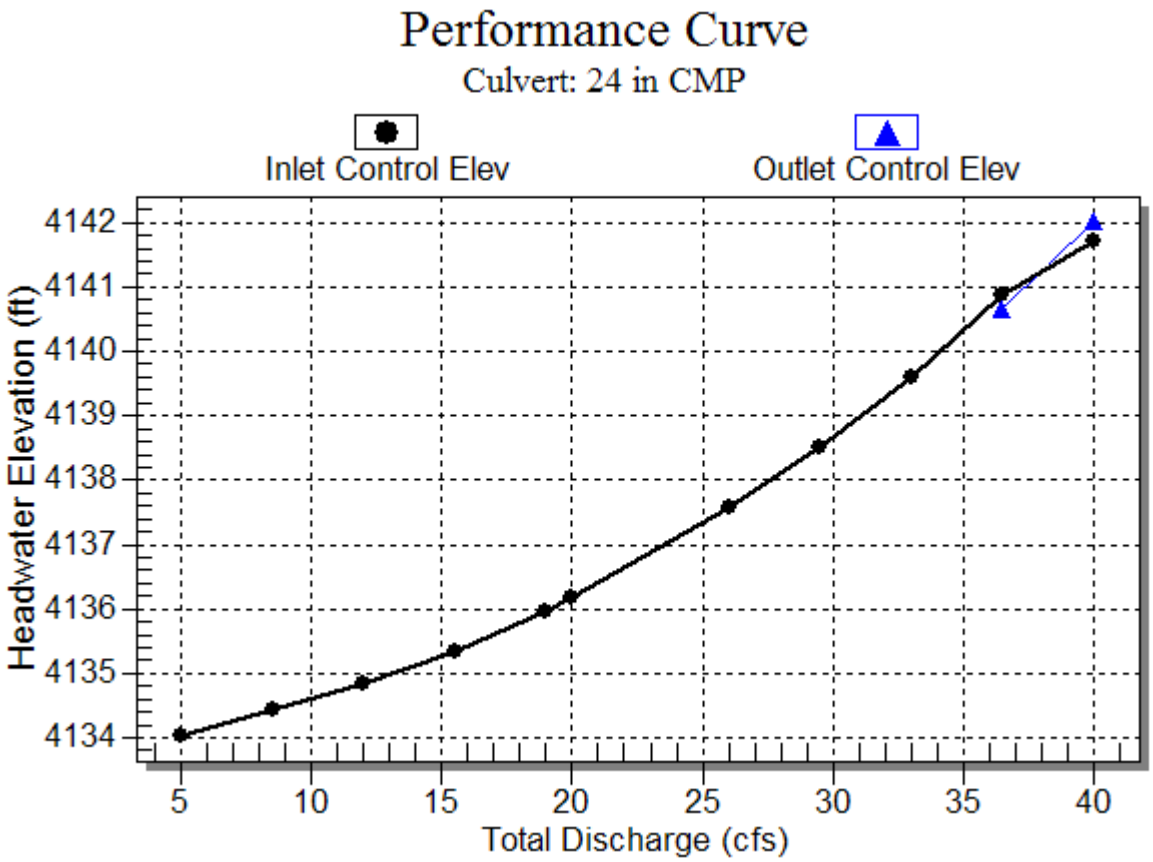
****

Inlet Elevation (invert): 4132.90 ft, Outlet Elevation (invert): 4127.13 ft

Culvert Length: 90.18 ft, Culvert Slope: 0.0641

****

Culvert Performance Curve Plot: 24 in CMP



Water Surface Profile Plot for Culvert: 24 in CMP

Site Data - 24 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4132.90 ft

Outlet Station: 90.00 ft

Outlet Elevation: 4127.13 ft

Number of Barrels: 1

Culvert Data Summary - 24 in CMP

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Mitered to Conform to Slope

Inlet Depression: NONE

Table 24 - Downstream Channel Rating Curve (Crossing: Station 88+15)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	4127.37	0.24	2.75	0.61	1.13
8.50	4127.45	0.32	3.20	0.81	1.17
12.00	4127.51	0.38	3.52	0.96	1.20
15.50	4127.57	0.44	3.78	1.09	1.22
19.00	4127.61	0.48	4.00	1.21	1.24
20.00	4127.63	0.50	4.05	1.24	1.24
26.00	4127.69	0.56	4.35	1.40	1.26
29.50	4127.73	0.60	4.50	1.49	1.27
33.00	4127.76	0.63	4.63	1.57	1.28
36.50	4127.79	0.66	4.76	1.65	1.29
40.00	4127.82	0.69	4.88	1.72	1.30

Tailwater Channel Data - Station 88+15

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4127.13 ft

Roadway Data for Crossing: Station 88+15

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4142.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Table 25 - Summary of Culvert Flows at Crossing: Station 90+00

Headwater Elevation (ft)	Total Discharge (cfs)	24 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4140.99	5.00	5.00	0.00	1
4141.39	8.50	8.50	0.00	1
4141.80	12.00	12.00	0.00	1
4142.29	15.50	15.50	0.00	1
4142.92	19.00	19.00	0.00	1
4143.12	20.00	20.00	0.00	1
4144.02	26.00	23.96	1.89	27
4144.04	29.50	24.03	5.24	4
4144.05	33.00	24.09	8.81	4
4144.06	36.50	24.14	12.17	3
4144.08	40.00	24.19	15.68	3
4144.00	23.88	23.88	0.00	Overtopping

Rating Curve Plot for Crossing: Station 90+00

Table 26 - Culvert Summary Table: 24 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
5.00	5.00	4140.99	1.141	0.0*	1-S2n	0.552	0.786	0.555	0.245	6.992	2.745
8.50	8.50	4141.39	1.545	0.0*	1-S2n	0.732	1.036	0.735	0.323	8.090	3.200
12.00	12.00	4141.80	1.947	0.0*	1-S2n	0.887	1.241	0.890	0.385	8.868	3.524
15.50	15.50	4142.29	2.442	0.0*	5-S2n	1.031	1.417	1.032	0.437	9.489	3.782
19.00	19.00	4142.92	3.067	0.0*	5-S2n	1.170	1.565	1.174	0.483	9.918	3.998
20.00	20.00	4143.12	3.270	0.0*	5-S2n	1.210	1.605	1.210	0.496	10.060	4.054
26.00	23.96	4144.02	4.168	0.0*	5-S2n	1.372	1.721	1.373	0.563	10.424	4.349
29.50	24.03	4144.04	4.185	0.0*	5-S2n	1.375	1.724	1.377	0.598	10.428	4.499
33.00	24.09	4144.05	4.200	0.0*	5-S2n	1.378	1.725	1.379	0.630	10.431	4.634
36.50	24.14	4144.06	4.213	0.0*	5-S2n	1.380	1.727	1.381	0.661	10.440	4.759
40.00	24.19	4144.08	4.224	0.0*	5-S2n	1.382	1.728	1.383	0.690	10.440	4.876

* theoretical depth is impractical. Depth reported is corrected.

****

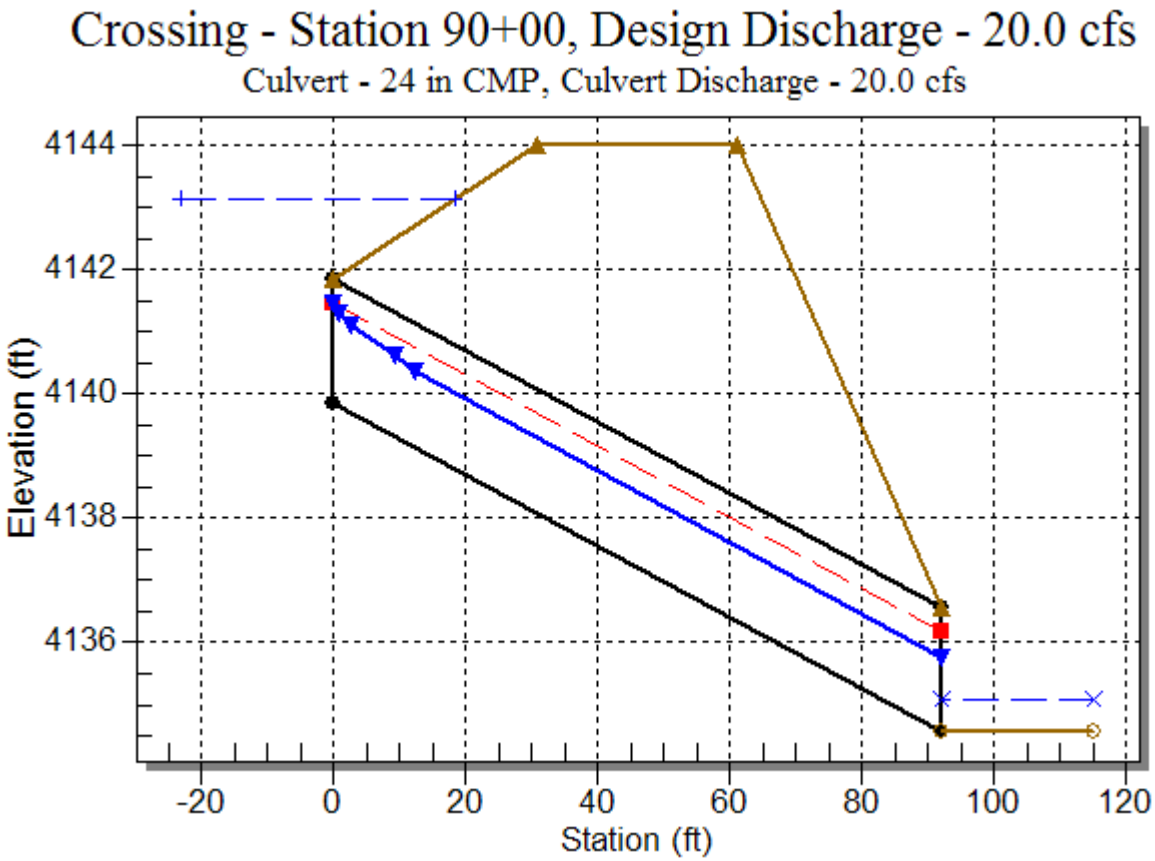
Inlet Elevation (invert): 4139.85 ft, Outlet Elevation (invert): 4134.57 ft

Culvert Length: 92.15 ft, Culvert Slope: 0.0574

****

Culvert Performance Curve Plot: 24 in CMP

Water Surface Profile Plot for Culvert: 24 in CMP



Site Data - 24 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4139.85 ft

Outlet Station: 92.00 ft

Outlet Elevation: 4134.57 ft

Number of Barrels: 1

Culvert Data Summary - 24 in CMP

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Mitered to Conform to Slope

Inlet Depression: NONE

Table 27 - Downstream Channel Rating Curve (Crossing: Station 90+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	4134.81	0.24	2.75	0.61	1.13
8.50	4134.89	0.32	3.20	0.81	1.17
12.00	4134.95	0.38	3.52	0.96	1.20
15.50	4135.01	0.44	3.78	1.09	1.22
19.00	4135.05	0.48	4.00	1.21	1.24
20.00	4135.07	0.50	4.05	1.24	1.24
26.00	4135.13	0.56	4.35	1.40	1.26
29.50	4135.17	0.60	4.50	1.49	1.27
33.00	4135.20	0.63	4.63	1.57	1.28
36.50	4135.23	0.66	4.76	1.65	1.29
40.00	4135.26	0.69	4.88	1.72	1.30

Tailwater Channel Data - Station 90+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4134.57 ft

Roadway Data for Crossing: Station 90+00

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4144.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Table 28 - Summary of Culvert Flows at Crossing: Station 144+70

Headwater Elevation (ft)	Total Discharge (cfs)	36 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4108.05	14.80	14.80	0.00	1
4108.32	19.03	19.03	0.00	1
4108.58	23.26	23.26	0.00	1
4108.83	27.49	27.49	0.00	1
4108.90	28.60	28.60	0.00	1
4109.39	35.95	35.95	0.00	1
4109.72	40.18	40.18	0.00	1
4110.08	44.41	44.41	0.00	1
4110.49	48.64	48.64	0.00	1
4110.93	52.87	52.87	0.00	1
4111.40	57.10	57.10	0.00	1
4118.10	99.90	99.90	0.00	Overtopping

Rating Curve Plot for Crossing: Station 144+70

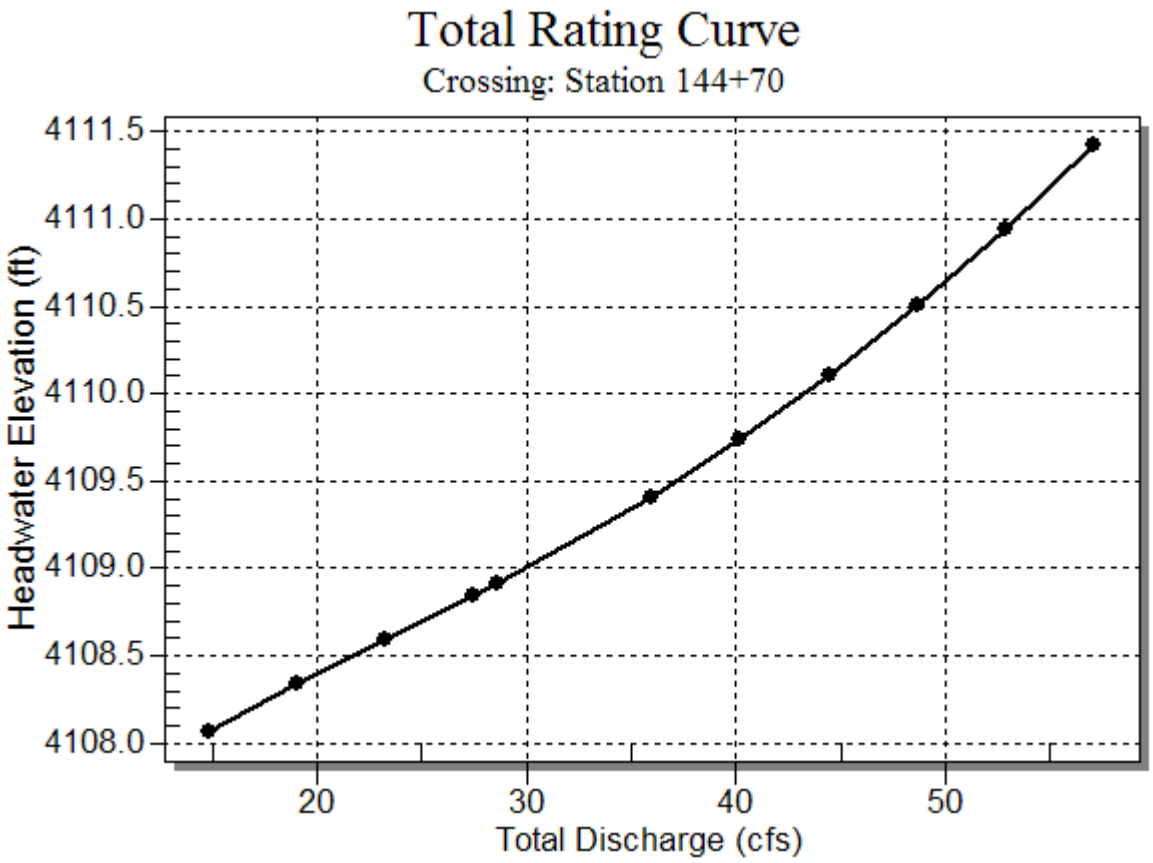


Table 29 - Culvert Summary Table: 36 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
14.80	14.80	4108.05	1.782	0.0*	1-S2n	0.668	1.224	0.673	0.427	12.385	3.735
19.03	19.03	4108.32	2.053	0.0*	1-S2n	0.756	1.391	0.761	0.484	13.358	4.000
23.26	23.26	4108.58	2.307	0.0*	1-S2n	0.845	1.549	0.848	0.533	14.100	4.222
27.49	27.49	4108.83	2.561	0.0*	1-S2n	0.926	1.689	0.928	0.578	14.808	4.414
28.60	28.60	4108.90	2.630	0.0*	1-S2n	0.943	1.726	0.945	0.589	15.055	4.462
35.95	35.95	4109.39	3.124	0.0*	5-S2n	1.062	1.943	1.063	0.656	15.990	4.740
40.18	40.18	4109.72	3.451	0.0*	5-S2n	1.130	2.061	1.135	0.691	16.370	4.880
44.41	44.41	4110.08	3.814	0.0*	5-S2n	1.198	2.165	1.198	0.724	16.859	5.010
48.64	48.64	4110.49	4.216	0.0*	5-S2n	1.257	2.262	1.261	0.755	17.239	5.131
52.87	52.87	4110.93	4.657	0.0*	5-S2n	1.316	2.359	1.318	0.785	17.676	5.244
57.10	57.10	4111.40	5.135	0.0*	5-S2n	1.375	2.439	1.378	0.813	18.009	5.351

* theoretical depth is impractical. Depth reported is corrected.

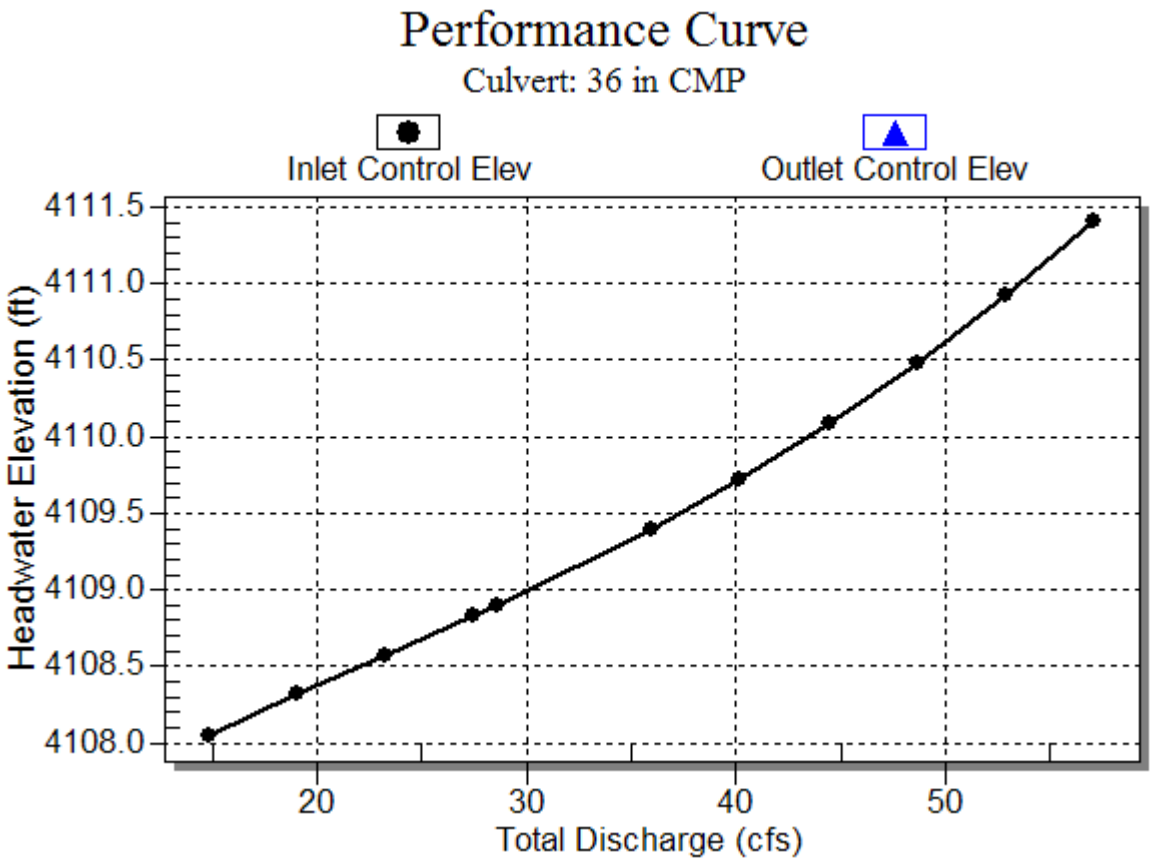
****

Inlet Elevation (invert): 4106.27 ft, Outlet Elevation (invert): 4088.54 ft

Culvert Length: 134.08 ft, Culvert Slope: 0.1334

****

Culvert Performance Curve Plot: 36 in CMP



Water Surface Profile Plot for Culvert: 36 in CMP

Site Data - 36 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4106.27 ft

Outlet Station: 132.90 ft

Outlet Elevation: 4088.54 ft

Number of Barrels: 1

Culvert Data Summary - 36 in CMP

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Mitered to Conform to Slope

Inlet Depression: NONE

Table 30 - Downstream Channel Rating Curve (Crossing: Station 144+70)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
14.80	4088.97	0.43	3.73	1.07	1.22
19.03	4089.02	0.48	4.00	1.21	1.24
23.26	4089.07	0.53	4.22	1.33	1.25
27.49	4089.12	0.58	4.41	1.44	1.27
28.60	4089.13	0.59	4.46	1.47	1.27
35.95	4089.20	0.66	4.74	1.64	1.29
40.18	4089.23	0.69	4.88	1.73	1.30
44.41	4089.26	0.72	5.01	1.81	1.31
48.64	4089.30	0.76	5.13	1.88	1.32
52.87	4089.32	0.78	5.24	1.96	1.32
57.10	4089.35	0.81	5.35	2.03	1.33

Tailwater Channel Data - Station 144+70

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4088.54 ft

Roadway Data for Crossing: Station 144+70

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4118.10 ft

Roadway Surface: Gravel

Roadway Top Width: 28.00 ft

Table 31 - Summary of Culvert Flows at Crossing: Station 150+40

Headwater Elevation (ft)	Total Discharge (cfs)	36 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4112.54	17.90	17.90	0.00	1
4112.88	23.50	23.50	0.00	1
4113.22	29.10	29.10	0.00	1
4113.59	34.70	34.70	0.00	1
4113.67	35.80	35.80	0.00	1
4114.51	45.90	45.90	0.00	1
4115.07	51.50	51.50	0.00	1
4115.69	57.10	57.10	0.00	1
4116.38	62.70	62.70	0.00	1
4117.12	68.30	68.30	0.00	1
4117.90	73.90	73.90	0.00	1
4128.00	124.10	124.10	0.00	Overtopping

Rating Curve Plot for Crossing: Station 150+40

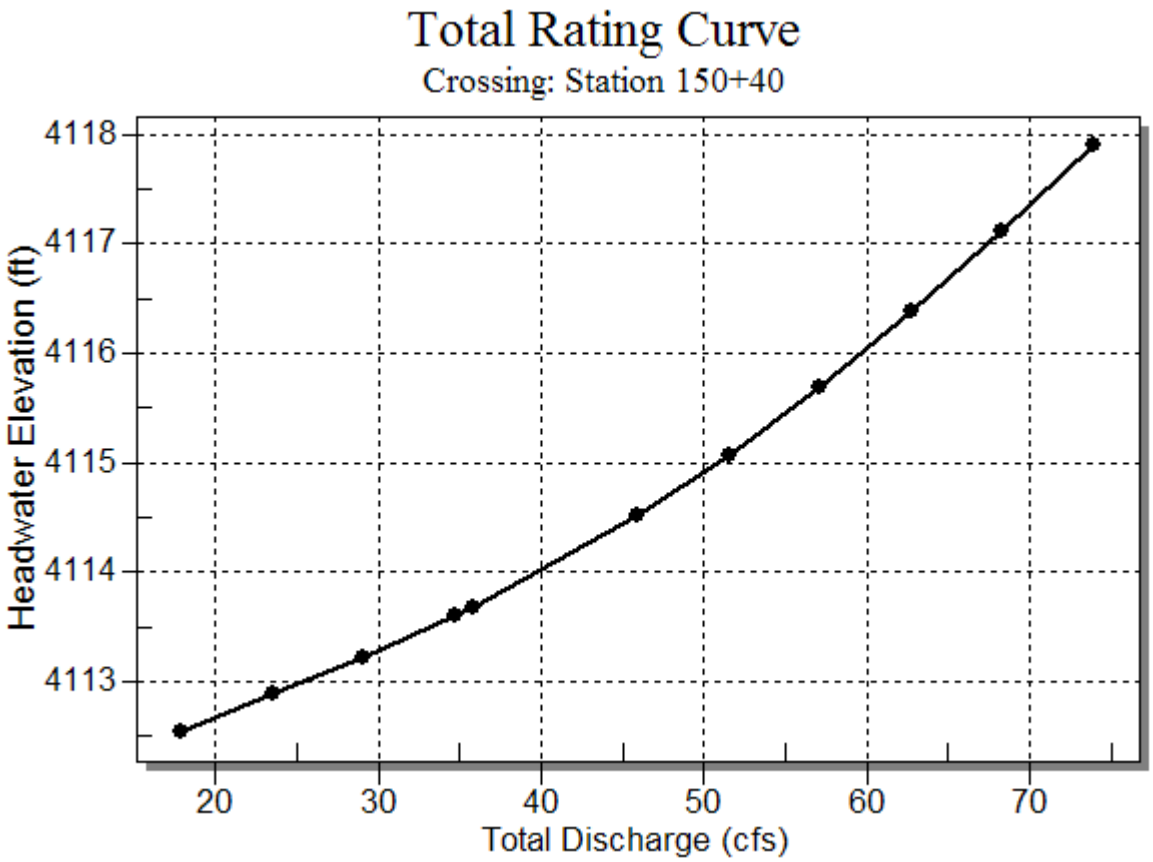


Table 32 - Culvert Summary Table: 36 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
17.90	17.90	4112.54	1.983	0.0*	1-S2n	0.791	1.347	0.801	0.469	11.728	3.933
23.50	23.50	4112.88	2.321	0.0*	1-S2n	0.920	1.557	0.926	0.536	12.692	4.234
29.10	29.10	4113.22	2.661	0.0*	1-S2n	1.024	1.742	1.032	0.594	13.462	4.482
34.70	34.70	4113.59	3.034	0.0*	5-S2n	1.128	1.908	1.137	0.645	14.107	4.696
35.80	35.80	4113.67	3.113	0.0*	5-S2n	1.149	1.939	1.158	0.655	14.212	4.735
45.90	45.90	4114.51	3.951	0.0*	5-S2n	1.318	2.199	1.319	0.735	15.326	5.054
51.50	51.50	4115.07	4.510	0.0*	5-S2n	1.408	2.327	1.417	0.775	15.663	5.208
57.10	57.10	4115.69	5.135	0.0*	5-S2n	1.498	2.439	1.499	0.813	16.171	5.351
62.70	62.70	4116.38	5.820	0.0*	5-S2n	1.584	2.529	1.588	0.848	16.517	5.482
68.30	68.30	4117.12	6.558	0.0*	5-S2n	1.669	2.619	1.678	0.882	16.806	5.604
73.90	73.90	4117.90	7.339	0.0*	5-S2n	1.755	2.709	1.758	0.914	17.178	5.720

* theoretical depth is impractical. Depth reported is corrected.

****

Inlet Elevation (invert): 4110.56 ft, Outlet Elevation (invert): 4093.34 ft

Culvert Length: 173.31 ft, Culvert Slope: 0.0999

****

Culvert Performance Curve Plot: 36 in CMP

Water Surface Profile Plot for Culvert: 36 in CMP

Site Data - 36 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4110.56 ft

Outlet Station: 172.45 ft

Outlet Elevation: 4093.34 ft

Number of Barrels: 1

Culvert Data Summary - 36 in CMP

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Mitered to Conform to Slope

Inlet Depression: NONE

Table 33 - Downstream Channel Rating Curve (Crossing: Station 150+40)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
17.90	4093.91	0.47	3.93	1.17	1.23
23.50	4093.98	0.54	4.23	1.34	1.26
29.10	4094.03	0.59	4.48	1.48	1.27
34.70	4094.09	0.65	4.70	1.61	1.29
35.80	4094.09	0.65	4.74	1.63	1.29
45.90	4094.18	0.74	5.05	1.84	1.31
51.50	4094.22	0.78	5.21	1.94	1.32
57.10	4094.25	0.81	5.35	2.03	1.33
62.70	4094.29	0.85	5.48	2.12	1.34
68.30	4094.32	0.88	5.60	2.20	1.35
73.90	4094.35	0.91	5.72	2.28	1.35

Tailwater Channel Data - Station 150+40

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4093.44 ft

Roadway Data for Crossing: Station 150+40

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4128.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Table 34 - Summary of Culvert Flows at Crossing: Station 154+20

Headwater Elevation (ft)	Total Discharge (cfs)	36 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4131.13	35.20	35.20	0.00	1
4132.25	48.42	48.42	0.00	1
4133.75	61.64	61.64	0.00	1
4135.54	74.86	74.86	0.00	1
4135.79	76.60	76.60	0.00	1
4136.09	101.30	78.68	22.26	9
4136.13	114.52	78.91	35.24	4
4136.16	127.74	79.11	48.45	4
4136.18	140.96	79.29	61.19	3
4136.21	154.18	79.45	74.36	3
4136.23	167.40	79.61	87.55	3
4136.00	78.04	78.04	0.00	Overtopping

Rating Curve Plot for Crossing: Station 154+20

Table 35 - Culvert Summary Table: 36 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
35.20	35.20	4131.13	3.070	0.0*	5-S2n	1.003	1.922	1.012	0.650	16.740	4.714
48.42	48.42	4132.25	4.194	0.0*	5-S2n	1.198	2.257	1.199	0.754	18.363	5.125
61.64	61.64	4133.75	5.686	0.0*	5-S2n	1.367	2.512	1.371	0.842	19.572	5.458
74.86	74.86	4135.54	7.477	0.0*	5-S2n	1.534	2.724	1.535	0.919	20.575	5.740
76.60	76.60	4135.79	7.729	0.0*	5-S2n	1.555	2.752	1.561	0.929	20.614	5.773
101.30	78.68	4136.09	8.034	0.0*	5-S2n	1.581	2.785	1.614	1.052	20.304	6.204
114.52	78.91	4136.13	8.068	0.0*	5-S2n	1.583	2.789	1.617	1.111	20.322	6.403
127.74	79.11	4136.16	8.097	0.0*	5-S2n	1.586	2.792	1.620	1.165	20.326	6.584
140.96	79.29	4136.18	8.123	0.0*	5-S2n	1.588	2.795	1.622	1.216	20.340	6.751
154.18	79.45	4136.21	8.148	0.0*	5-S2n	1.590	2.798	1.624	1.265	20.356	6.907
167.40	79.61	4136.23	8.172	0.0*	5-S2n	1.592	2.800	1.626	1.311	20.357	7.054

* theoretical depth is impractical. Depth reported is corrected.

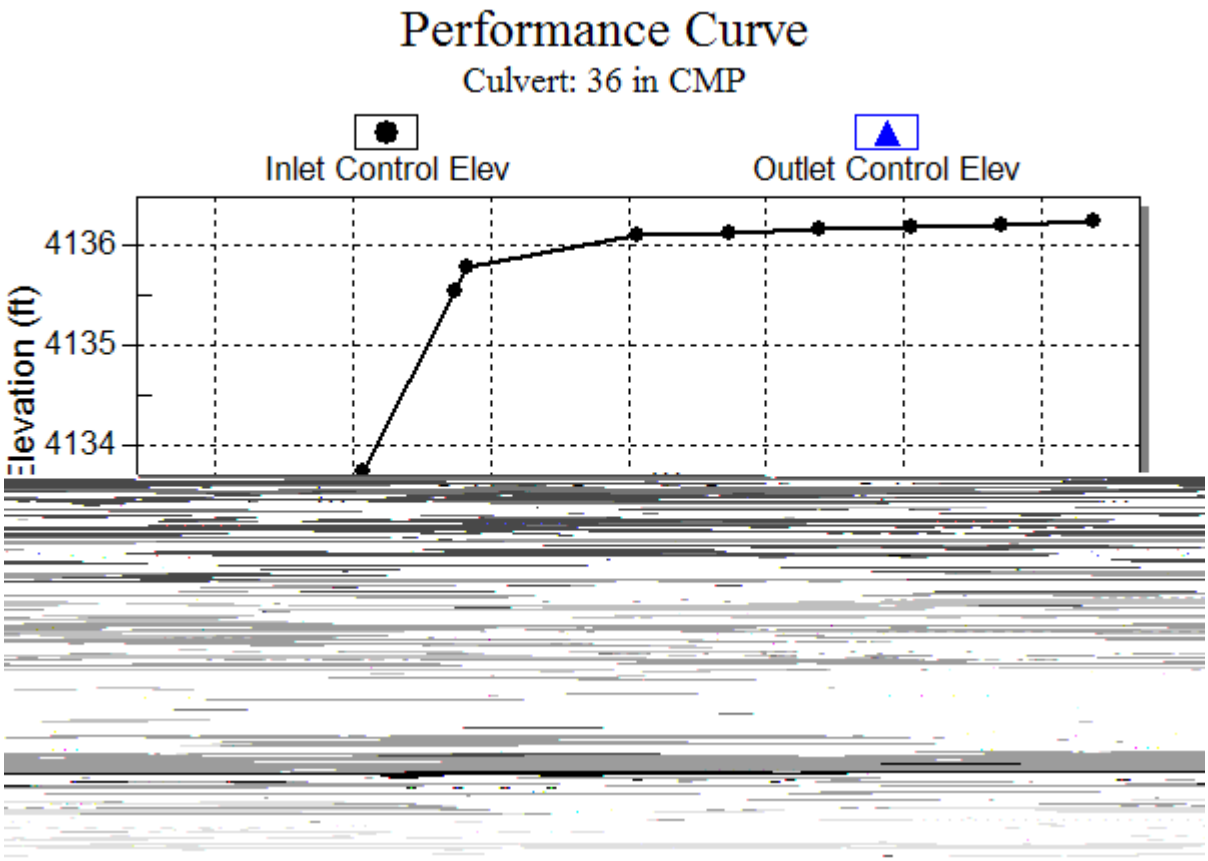
****

Inlet Elevation (invert): 4128.06 ft, Outlet Elevation (invert): 4116.34 ft

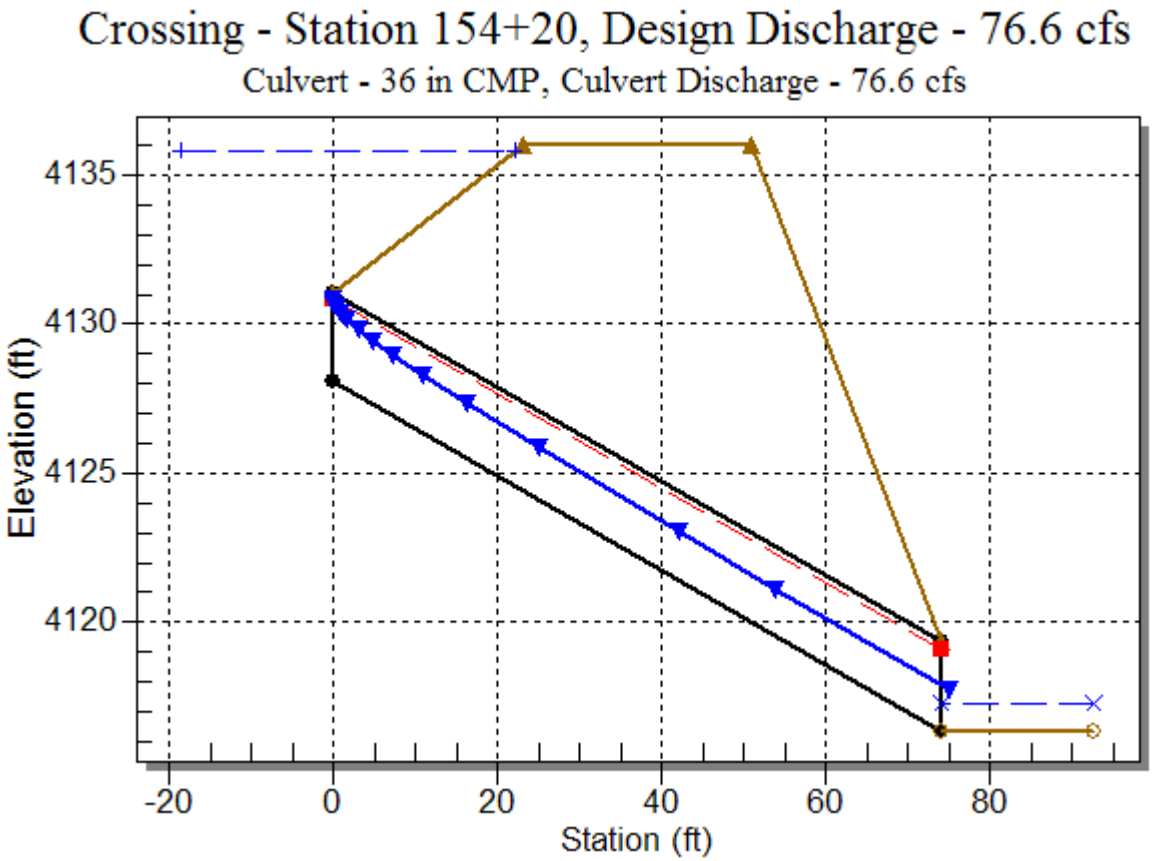
Culvert Length: 74.92 ft, Culvert Slope: 0.1584

****

Culvert Performance Curve Plot: 36 in CMP



Water Surface Profile Plot for Culvert: 36 in CMP



Site Data - 36 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4128.06 ft

Outlet Station: 74.00 ft

Outlet Elevation: 4116.34 ft

Number of Barrels: 1

Culvert Data Summary - 36 in CMP

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Mitered to Conform to Slope

Inlet Depression: NONE

Table 36 - Downstream Channel Rating Curve (Crossing: Station 154+20)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
35.20	4116.99	0.65	4.71	1.62	1.29
48.42	4117.09	0.75	5.12	1.88	1.32
61.64	4117.18	0.84	5.46	2.10	1.34
74.86	4117.26	0.92	5.74	2.29	1.35
76.60	4117.27	0.93	5.77	2.32	1.36
101.30	4117.39	1.05	6.20	2.63	1.38
114.52	4117.45	1.11	6.40	2.77	1.39
127.74	4117.51	1.17	6.58	2.91	1.40
140.96	4117.56	1.22	6.75	3.04	1.41
154.18	4117.60	1.26	6.91	3.16	1.42
167.40	4117.65	1.31	7.05	3.27	1.43

Tailwater Channel Data - Station 154+20

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4116.34 ft

Roadway Data for Crossing: Station 154+20

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4136.00 ft

Roadway Surface: Gravel

Roadway Top Width: 28.00 ft

Table 37 - Summary of Culvert Flows at Crossing: Station 170+50

Headwater Elevation (ft)	Total Discharge (cfs)	36 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4288.64	28.90	28.90	0.00	1
4289.42	39.93	39.93	0.00	1
4290.44	50.96	50.96	0.00	1
4291.72	61.99	61.99	0.00	1
4291.90	63.40	63.40	0.00	1
4294.83	84.05	84.05	0.00	1
4296.85	95.08	95.08	0.00	1
4298.03	106.11	100.93	4.72	17
4298.08	117.14	101.12	15.64	5
4298.11	128.17	101.27	26.52	4
4298.13	139.20	101.40	37.61	4
4298.00	100.76	100.76	0.00	Overtopping

Rating Curve Plot for Crossing: Station 170+50

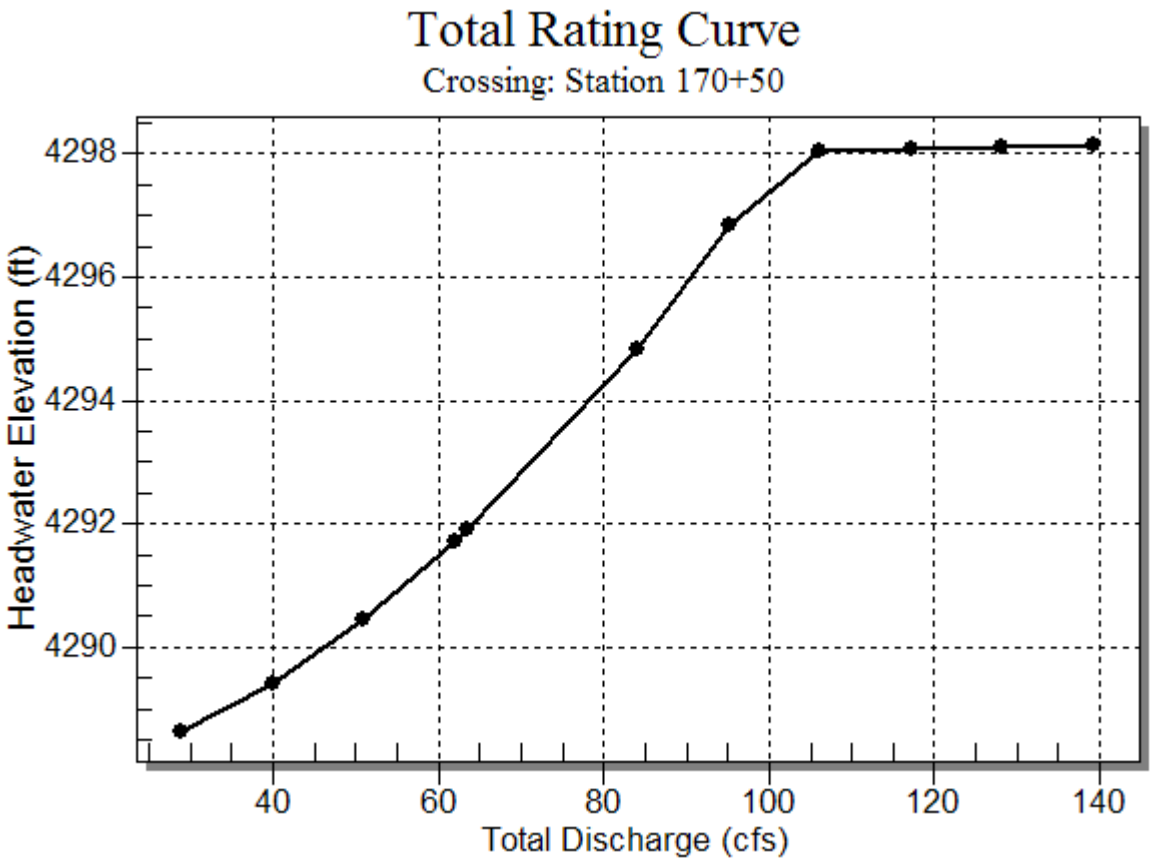


Table 38 - Culvert Summary Table: 36 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
28.90	28.90	4288.64	2.649	0.0*	1-S2n	0.966	1.736	0.975	0.592	14.471	4.474
39.93	39.93	4289.42	3.430	0.0*	5-S2n	1.150	2.054	1.153	0.689	15.935	4.873
50.96	50.96	4290.44	4.453	0.0*	5-S2n	1.316	2.315	1.324	0.772	16.932	5.194
61.99	61.99	4291.72	5.730	0.0*	5-S2n	1.475	2.517	1.476	0.844	17.895	5.466
63.40	63.40	4291.90	5.910	0.0*	5-S2n	1.496	2.540	1.499	0.853	17.952	5.498
84.05	84.05	4294.83	8.840	0.0*	5-S2n	1.779	2.872	1.781	0.968	19.232	5.914
95.08	95.08	4296.85	10.857	0.552	5-S2n	1.935	3.000	1.939	1.023	19.705	6.105
106.11	100.93	4298.03	12.043	2.326	5-S2n	2.019	3.000	2.023	1.074	19.925	6.279
117.14	101.12	4298.08	12.084	2.387	5-S2n	2.021	3.000	2.029	1.122	19.897	6.439
128.17	101.27	4298.11	12.115	2.434	5-S2n	2.024	3.000	2.029	1.167	19.927	6.589
139.20	101.40	4298.13	12.143	2.475	5-S2n	2.025	3.000	2.029	1.210	19.952	6.730

* theoretical depth is impractical. Depth reported is corrected.

****

Inlet Elevation (invert): 4285.99 ft, Outlet Elevation (invert): 4269.55 ft

Culvert Length: 133.81 ft, Culvert Slope: 0.1238

****

Culvert Performance Curve Plot: 36 in CMP

Water Surface Profile Plot for Culvert: 36 in CMP

Site Data - 36 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4285.99 ft

Outlet Station: 132.80 ft

Outlet Elevation: 4269.55 ft

Number of Barrels: 1

Culvert Data Summary - 36 in CMP

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Mitered to Conform to Slope

Inlet Depression: NONE

Table 39 - Downstream Channel Rating Curve (Crossing: Station 170+50)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
28.90	4270.14	0.59	4.47	1.48	1.27
39.93	4270.24	0.69	4.87	1.72	1.30
50.96	4270.32	0.77	5.19	1.93	1.32
61.99	4270.39	0.84	5.47	2.11	1.34
63.40	4270.40	0.85	5.50	2.13	1.34
84.05	4270.52	0.97	5.91	2.42	1.36
95.08	4270.57	1.02	6.10	2.55	1.38
106.11	4270.62	1.07	6.28	2.68	1.38
117.14	4270.67	1.12	6.44	2.80	1.39
128.17	4270.72	1.17	6.59	2.91	1.40
139.20	4270.76	1.21	6.73	3.02	1.41

Tailwater Channel Data - Station 170+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4269.55 ft

Roadway Data for Crossing: Station 170+50

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4298.00 ft

Roadway Surface: Gravel

Roadway Top Width: 28.00 ft

Table 40 - Summary of Culvert Flows at Crossing: Station 182+00

Headwater Elevation (ft)	Total Discharge (cfs)	84 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4323.41	128.00	128.00	0.00	1
4324.17	171.18	171.18	0.00	1
4324.89	214.36	214.36	0.00	1
4325.65	257.54	257.54	0.00	1
4325.75	262.80	262.80	0.00	1
4327.44	343.90	343.90	0.00	1
4328.52	387.08	387.08	0.00	1
4329.74	430.26	430.26	0.00	1
4331.09	473.44	473.44	0.00	1
4332.57	516.62	516.62	0.00	1
4334.15	559.80	559.80	0.00	1
4344.00	781.74	781.74	0.00	Overtopping

Rating Curve Plot for Crossing: Station 182+00

Table 41 - Culvert Summary Table: 84 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
128.00	128.00	4323.41	4.250	0.0*	1-S2n	1.477	2.910	1.500	1.166	21.036	6.587
171.18	171.18	4324.17	5.011	0.0*	1-S2n	1.694	3.390	1.710	1.323	23.273	7.094
214.36	214.36	4324.89	5.734	0.0*	1-S2n	1.910	3.809	1.919	1.458	24.877	7.512
257.54	257.54	4325.65	6.489	0.0*	1-S2n	2.121	4.208	2.127	1.576	26.082	7.869
262.80	262.80	4325.75	6.586	0.0*	1-S2n	2.141	4.249	2.148	1.590	26.273	7.910
343.90	343.90	4327.44	8.277	0.0*	5-S2n	2.454	4.885	2.475	1.781	28.165	8.467
387.08	387.08	4328.52	9.360	0.0*	5-S2n	2.620	5.165	2.625	1.871	29.298	8.724
430.26	430.26	4329.74	10.581	0.0*	5-S2n	2.786	5.443	2.792	1.956	30.042	8.960
473.44	473.44	4331.09	11.934	0.0*	5-S2n	2.932	5.684	2.934	2.035	30.923	9.179
516.62	516.62	4332.57	13.409	0.0*	5-S2n	3.076	5.879	3.108	2.110	31.285	9.382
559.80	559.80	4334.15	14.991	0.0*	5-S2n	3.220	6.073	3.223	2.181	32.323	9.575

* theoretical depth is impractical. Depth reported is corrected.

****

Inlet Elevation (invert): 4319.16 ft, Outlet Elevation (invert): 4278.92 ft

Culvert Length: 294.66 ft, Culvert Slope: 0.1379

****

Culvert Performance Curve Plot: 84 in CMP

Water Surface Profile Plot for Culvert: 84 in CMP

Site Data - 84 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4319.16 ft

Outlet Station: 291.90 ft

Outlet Elevation: 4278.92 ft

Number of Barrels: 1

Culvert Data Summary - 84 in CMP

Barrel Shape: Circular

Barrel Diameter: 7.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Inlet Type: Conventional

Inlet Edge Condition: Mitered to Conform to Slope

Inlet Depression: NONE

Table 42 - Downstream Channel Rating Curve (Crossing: Station 182+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
128.00	4280.09	1.17	6.59	2.91	1.40
171.18	4280.24	1.32	7.09	3.30	1.43
214.36	4280.38	1.46	7.51	3.64	1.45
257.54	4280.50	1.58	7.87	3.93	1.47
262.80	4280.51	1.59	7.91	3.97	1.47
343.90	4280.70	1.78	8.47	4.44	1.49
387.08	4280.79	1.87	8.72	4.67	1.50
430.26	4280.88	1.96	8.96	4.88	1.51
473.44	4280.95	2.03	9.18	5.08	1.52
516.62	4281.03	2.11	9.38	5.27	1.53
559.80	4281.10	2.18	9.57	5.44	1.54

Tailwater Channel Data - Station 182+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4278.92 ft

Roadway Data for Crossing: Station 182+00

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4344.00 ft

Roadway Surface: Gravel

Roadway Top Width: 28.00 ft

Appendix E – Roadway Hydraulic Calculations

```
  CIVILCADD/CIVILDESIGN  Engineering Software, (c) 2004   Version 7.0
------------------------------------------------------------------------
Lower Haul Road from Explosives Site to Culvert
Road Capacity Calculations
2 Year Flow

------------------------------------------------------------------------

Program License Serial Number 6026

------------------------------------------------------------------------
            *** Irregular Channel Analysis ***

      Upstream (headworks) Elevation =   4562.000(Ft.)
      Downstream (outlet) Elevation =   4482.000(Ft.)
      Runoff/Flow Distance =    584.000(Ft.)
      Maximum flow rate in channel(s) =      5.500(CFS)
------------------------------------------------------------------------

Depth of flow =   0.237(Ft.)
Average velocity =   3.776(Ft/s)
Total flow rate in 1/2 street =   5.500(CFS)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              4.00
      2              8.00              0.00
      3             43.00              0.70
      4             49.60              4.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =      5.500(CFS)
  '     '    flow top width =     12.308(Ft.)
  '     '    wetted perimeter =     12.366(Ft.)
  '     '    velocity=    3.776(Ft/s)
  '     '    area =      1.457(Sq.Ft)
  '     '    Froude number =     1.934

Upstream point elevation = 4562.000(Ft.)
Downstream point elevation = 4482.000(Ft.)
Flow length =   584.000(Ft.)
Depth of flow =   0.237(Ft.)
Average velocity =   3.776(Ft/s)
Total irregular channel flow =     5.500(CFS)
Irregular channel normal depth above invert elev. =   0.237(Ft.)
Average velocity of channel(s) =   3.776(Ft/s)
------------------------------------------------------------------

Sub-Channel No. 1 Critical depth =      0.309(Ft.)
  '     '       '     Critical flow top width =     16.047(Ft.)
  '     '       '     Critical flow velocity=    2.221(Ft/s)
  '     '       '     Critical flow area =      2.476(Sq.Ft)

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  CIVILCADD/CIVILDESIGN  Engineering Software, (c) 2004   Version 7.0

------------------------------------------------------------------------
Lower Haul Road from Explosives Site to Culvert
Road Capacity Calculations
10 Year Flow

------------------------------------------------------------------------

Program License Serial Number 6026

------------------------------------------------------------------------
            *** Irregular Channel Analysis ***

      Upstream (headworks) Elevation =   4562.000(Ft.)
      Downstream (outlet) Elevation =   4482.000(Ft.)
      Runoff/Flow Distance =    584.000(Ft.)
      Maximum flow rate in channel(s) =     21.900(CFS)
------------------------------------------------------------------------

Depth of flow =   0.397(Ft.)
Average velocity =   5.334(Ft/s)
Total flow rate in 1/2 street =  21.900(CFS)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              4.00
      2              8.00              0.00
      3             43.00              0.70
      4             49.60              4.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =     21.900(CFS)
  '     '    flow top width =     20.664(Ft.)
  '     '    wetted perimeter =     20.762(Ft.)
  '     '    velocity=    5.334(Ft/s)
  '     '    area =      4.106(Sq.Ft)
  '     '    Froude number =     2.109

Upstream point elevation = 4562.000(Ft.)
Downstream point elevation = 4482.000(Ft.)
Flow length =   584.000(Ft.)
Depth of flow =   0.397(Ft.)
Average velocity =   5.334(Ft/s)
Total irregular channel flow =    21.900(CFS)
Irregular channel normal depth above invert elev. =   0.397(Ft.)
Average velocity of channel(s) =   5.334(Ft/s)
------------------------------------------------------------------

Sub-Channel No. 1 Critical depth =      0.535(Ft.)
  '     '       '     Critical flow top width =     27.828(Ft.)
  '     '       '     Critical flow velocity=    2.941(Ft/s)
  '     '       '     Critical flow area =      7.446(Sq.Ft)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
  CIVILCADD/CIVILDESIGN  Engineering Software, (c) 2004   Version 7.0
------------------------------------------------------------------------
Lower Haul Road from Explosives Site to Culvert
Road Capacity Calculations
25 Year Flow

------------------------------------------------------------------------

Program License Serial Number 6026

------------------------------------------------------------------------
            *** Irregular Channel Analysis ***

      Upstream (headworks) Elevation =   4562.000(Ft.)
      Downstream (outlet) Elevation =   4482.000(Ft.)
      Runoff/Flow Distance =    584.000(Ft.)
      Maximum flow rate in channel(s) =     34.000(CFS)
------------------------------------------------------------------------

Depth of flow =   0.469(Ft.)
Average velocity =   5.954(Ft/s)
Total flow rate in 1/2 street =  34.000(CFS)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              4.00
      2              8.00              0.00
      3             43.00              0.70
      4             49.60              4.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =     34.000(CFS)
  '     '    flow top width =     24.370(Ft.)
  '     '    wetted perimeter =     24.485(Ft.)
  '     '    velocity=    5.954(Ft/s)
  '     '    area =      5.711(Sq.Ft)
  '     '    Froude number =     2.168

Upstream point elevation = 4562.000(Ft.)
Downstream point elevation = 4482.000(Ft.)
Flow length =   584.000(Ft.)
Depth of flow =   0.469(Ft.)
Average velocity =   5.954(Ft/s)
Total irregular channel flow =    34.000(CFS)
Irregular channel normal depth above invert elev. =   0.469(Ft.)
Average velocity of channel(s) =   5.954(Ft/s)
------------------------------------------------------------------

Sub-Channel No. 1 Critical depth =      0.641(Ft.)
  '     '       '     Critical flow top width =     33.313(Ft.)
  '     '       '     Critical flow velocity=    3.186(Ft/s)
  '     '       '     Critical flow area =     10.670(Sq.Ft)

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  CIVILCADD/CIVILDESIGN  Engineering Software, (c) 2004   Version 7.0
------------------------------------------------------------------------
Lower Haul Road from Explosives Site to Culvert
Road Capacity Calculations
100 Year Flow

------------------------------------------------------------------------

Program License Serial Number 6026

------------------------------------------------------------------------
            *** Irregular Channel Analysis ***

      Upstream (headworks) Elevation =   4562.000(Ft.)
      Downstream (outlet) Elevation =   4482.000(Ft.)
      Runoff/Flow Distance =    584.000(Ft.)
      Maximum flow rate in channel(s) =     63.200(CFS)
------------------------------------------------------------------------

Depth of flow =   0.591(Ft.)
Average velocity =   6.952(Ft/s)
Total flow rate in 1/2 street =  63.200(CFS)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              4.00
      2              8.00              0.00
      3             43.00              0.70
      4             49.60              4.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =     63.200(CFS)
  '     '    flow top width =     30.748(Ft.)
  '     '    wetted perimeter =     30.894(Ft.)
  '     '    velocity=    6.952(Ft/s)
  '     '    area =      9.091(Sq.Ft)
  '     '    Froude number =     2.253

Upstream point elevation = 4562.000(Ft.)
Downstream point elevation = 4482.000(Ft.)
Flow length =   584.000(Ft.)
Depth of flow =   0.591(Ft.)
Average velocity =   6.952(Ft/s)
Total irregular channel flow =    63.200(CFS)
Irregular channel normal depth above invert elev. =   0.591(Ft.)
Average velocity of channel(s) =   6.952(Ft/s)
------------------------------------------------------------------

Sub-Channel No. 1 Critical depth =      0.805(Ft.)
  '     '       '     Critical flow top width =     36.819(Ft.)
  '     '       '     Critical flow velocity=    3.814(Ft/s)
  '     '       '     Critical flow area =     16.573(Sq.Ft)

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```
  CIVILCADD/CIVILDESIGN  Engineering Software, (c) 2004   Version 7.0
------------------------------------------------------------------------
Upper Haul Road from Quarry to Explosives Site
Road Capacity Calculations
2 Year Flow

------------------------------------------------------------------------

Program License Serial Number 6026

------------------------------------------------------------------------
            *** Irregular Channel Analysis ***

      Upstream (headworks) Elevation =   5169.000(Ft.)
      Downstream (outlet) Elevation =   4978.000(Ft.)
      Runoff/Flow Distance =   1441.000(Ft.)
      Maximum flow rate in channel(s) =    244.300(CFS)
------------------------------------------------------------------------

Depth of flow =   0.961(Ft.)
Average velocity =  10.913(Ft/s)
Total flow rate in 1/2 street = 244.300(CFS)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              4.00
      2              8.00              0.00
      3             43.00              0.70
      4             49.60              4.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =    244.301(CFS)
  '     '    flow top width =     37.445(Ft.)
  '     '    wetted perimeter =     37.741(Ft.)
  '     '    velocity=   10.913(Ft/s)
  '     '    area =     22.387(Sq.Ft)
  '     '    Froude number =     2.487

Upstream point elevation = 5169.000(Ft.)
Downstream point elevation = 4978.000(Ft.)
Flow length =  1441.000(Ft.)
Depth of flow =   0.961(Ft.)
Average velocity =  10.913(Ft/s)
Total irregular channel flow =   244.300(CFS)
Irregular channel normal depth above invert elev. =   0.961(Ft.)
Average velocity of channel(s) =  10.913(Ft/s)
------------------------------------------------------------------

Sub-Channel No. 1 Critical depth =      1.469(Ft.)
  '     '       '     Critical flow top width =     39.475(Ft.)
  '     '       '     Critical flow velocity=    5.830(Ft/s)
  '     '       '     Critical flow area =     41.904(Sq.Ft)

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  CIVILCADD/CIVILDESIGN  Engineering Software, (c) 2004   Version 7.0
------------------------------------------------------------------------
Upper Haul Road from Quarry to Explosives Site
Road Capacity Calculations
10 Year Flow

------------------------------------------------------------------------

Program License Serial Number 6026

------------------------------------------------------------------------
            *** Irregular Channel Analysis ***

      Upstream (headworks) Elevation =   5169.000(Ft.)
      Downstream (outlet) Elevation =   4978.000(Ft.)
      Runoff/Flow Distance =   1441.000(Ft.)
      Maximum flow rate in channel(s) =    471.100(CFS)
------------------------------------------------------------------------

Depth of flow =   1.258(Ft.)
Average velocity =  13.996(Ft/s)
Total flow rate in 1/2 street = 471.100(CFS)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              4.00
      2              8.00              0.00
      3             43.00              0.70
      4             49.60              4.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =    471.100(CFS)
  '     '    flow top width =     38.630(Ft.)
  '     '    wetted perimeter =     39.066(Ft.)
  '     '    velocity=   13.996(Ft/s)
  '     '    area =     33.659(Sq.Ft)
  '     '    Froude number =     2.642

Upstream point elevation = 5169.000(Ft.)
Downstream point elevation = 4978.000(Ft.)
Flow length =  1441.000(Ft.)
Depth of flow =   1.258(Ft.)
Average velocity =  13.996(Ft/s)
Total irregular channel flow =   471.100(CFS)
Irregular channel normal depth above invert elev. =   1.258(Ft.)
Average velocity of channel(s) =  13.996(Ft/s)
------------------------------------------------------------------

Sub-Channel No. 1 Critical depth =      2.063(Ft.)
  '     '       '     Critical flow top width =     41.850(Ft.)
  '     '       '     Critical flow velocity=    7.133(Ft/s)
  '     '       '     Critical flow area =     66.048(Sq.Ft)

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  CIVILCADD/CIVILDESIGN  Engineering Software, (c) 2004   Version 7.0
------------------------------------------------------------------------
Upper Haul Road from Quarry to Explosives Site
Road Capacity Calculations
25 Year Flow

------------------------------------------------------------------------

Program License Serial Number 6026

------------------------------------------------------------------------
            *** Irregular Channel Analysis ***

      Upstream (headworks) Elevation =   5169.000(Ft.)
      Downstream (outlet) Elevation =   4978.000(Ft.)
      Runoff/Flow Distance =   1441.000(Ft.)
      Maximum flow rate in channel(s) =    636.900(CFS)
------------------------------------------------------------------------

Depth of flow =   1.437(Ft.)
Average velocity =  15.662(Ft/s)
Total flow rate in 1/2 street = 636.900(CFS)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              4.00
      2              8.00              0.00
      3             43.00              0.70
      4             49.60              4.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =    636.899(CFS)
  '     '    flow top width =     39.349(Ft.)
  '     '    wetted perimeter =     39.870(Ft.)
  '     '    velocity=   15.662(Ft/s)
  '     '    area =     40.665(Sq.Ft)
  '     '    Froude number =     2.715

Upstream point elevation = 5169.000(Ft.)
Downstream point elevation = 4978.000(Ft.)
Flow length =  1441.000(Ft.)
Depth of flow =   1.437(Ft.)
Average velocity =  15.662(Ft/s)
Total irregular channel flow =   636.900(CFS)
Irregular channel normal depth above invert elev. =   1.437(Ft.)
Average velocity of channel(s) =  15.662(Ft/s)
------------------------------------------------------------------

Sub-Channel No. 1 Critical depth =      2.438(Ft.)
  '     '       '     Critical flow top width =     43.350(Ft.)
  '     '       '     Critical flow velocity=    7.765(Ft/s)
  '     '       '     Critical flow area =     82.023(Sq.Ft)

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  CIVILCADD/CIVILDESIGN  Engineering Software, (c) 2004   Version 7.0
------------------------------------------------------------------------
Upper Haul Road from Quarry to Explosives Site
Road Capacity Calculations
100 Year Flow

------------------------------------------------------------------------

Program License Serial Number 6026

------------------------------------------------------------------------
            *** Irregular Channel Analysis ***

      Upstream (headworks) Elevation =   5169.000(Ft.)
      Downstream (outlet) Elevation =   4978.000(Ft.)
      Runoff/Flow Distance =   1441.000(Ft.)
      Maximum flow rate in channel(s) =    983.600(CFS)
------------------------------------------------------------------------

Depth of flow =   1.759(Ft.)
Average velocity =  18.374(Ft/s)
Total flow rate in 1/2 street = 983.600(CFS)
      ******* Irregular Channel Data ***********
------------------------------------------------------------------
Information entered for subchannel number 1 :
Point number      'X' coordinate     'Y' coordinate
      1              0.00              4.00
      2              8.00              0.00
      3             43.00              0.70
      4             49.60              4.00
Manning's 'N' friction factor =   0.035
------------------------------------------------------------------
Sub-Channel flow  =    983.600(CFS)
  '     '    flow top width =     40.636(Ft.)
  '     '    wetted perimeter =     41.309(Ft.)
  '     '    velocity=   18.374(Ft/s)
  '     '    area =     53.534(Sq.Ft)
  '     '    Froude number =     2.821

Upstream point elevation = 5169.000(Ft.)
Downstream point elevation = 4978.000(Ft.)
Flow length =  1441.000(Ft.)
Depth of flow =   1.759(Ft.)
Average velocity =  18.374(Ft/s)
Total irregular channel flow =   983.600(CFS)
Irregular channel normal depth above invert elev. =   1.759(Ft.)
Average velocity of channel(s) =  18.374(Ft/s)
------------------------------------------------------------------

Sub-Channel No. 1 Critical depth =      3.094(Ft.)
  '     '       '     Critical flow top width =     45.975(Ft.)
  '     '       '     Critical flow velocity=    8.835(Ft/s)
  '     '       '     Critical flow area =    111.333(Sq.Ft)

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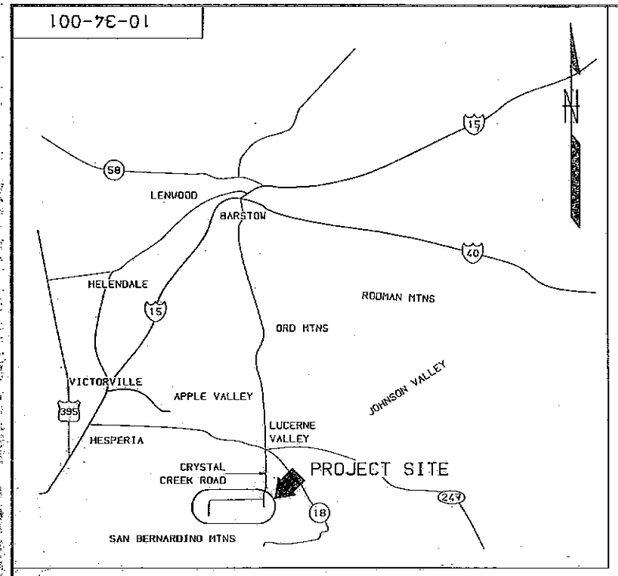
Appendix F –Haul & Access Road Improvement Plans by Morrison-Knudsen Engineers Prepared in 1987

10-34-001



VICINITY MAP
NOT TO SCALE

HAUL & ACCESS ROAD
for
PLUESS-STAUFER (CALIFORNIA), INC.
WHITE KNOB/WHITE RIDGE PROJECT

San Bernardino, County, California
T.3N., R.1W., SBM

GENERAL LEGEND

- SET 2" x 2" HUB & TACK AT PANEL POINT - UNLESS OTHERWISE NOTED
- SET 3'x 3' x 3' TRIANGULAR PANEL
- R/W ----- RIGHT OF WAY
- T1 TEST HOLE #1 APPROXIMATE LOCATION, AUGER HOLES & SHALLOW PITS DUG BY HAND
- ROAD SIGN
- (1) SIGN DESIGNATOR (SEE SIGN LEGEND)
- TOP OF CUT
- ℄ ROAD /W STATIONING AND GRAVEL EDGES
- TOE OF FILL
- SAFETY BERM
- CULVERT W/FLARED INLET
- CULVERT W/DROP INLET

GENERAL NOTES

1. THE BASE MAPPING WAS PROVIDED TO MKE BY BAUGHMAN & TURNER ENGINEERS & SURVEYORS FROM LAS VEGAS, NEVADA.
2. ALL USGS, COUNTY, PRIVATE & STATE BENCH MARKS, TOWNSHIPS & SECTION CORNERS SHALL NOT BE DISTURBED WITHOUT PRIOR WRITTEN APPROVAL FROM THE PARTY GOVERNING THE MONUMENTS.
3. A SOILS REPORT ENTITLED "GEOTECHNICAL INVESTIGATION FOR WHITE KNOB/ WHITE RIDGE HAUL ROAD" PREPARED BY MKE (MAY 4, 1987) IS A PART OF THIS CONTRACT.
4. DURING CLEARING AND GRUBBING OF THE ROAD R/W, REMOVAL AND RELOCATION OF JOSHUA TREES, MOJAVE YUCCAS AND CACTI PLANT SPECIES SHALL BE COMPLETED IN ACCORDANCE WITH THE SAN BERNARDINO COUNTY ENVIRONMENTAL ANALYSIS SECTION DURING ROAD CONSTRUCTION ACTIVITIES. (REF. SPEC. #34-0213)
5. HAUL ROAD DESIGN IS BASED ON THE FOLLOWING CRITERIA:
   - -BLM & BUREAU OF MINE STANDARDS
   - -85 TON HAUL TRUCKS
   - -ONE WAY TRAFFIC W/ NUMBERED TURNOUTS SPACED APPROX. 1000' APART
   - -DESIGN SPEED = 25 MPH WITH SLOVER SPEEDS AT DIPS (FORD CROSSINGS), STEEP DOWN GRADES, AND SHARP CURVES: ROAD CROWNED @ ℄ =3%
   - -SUPER ELEVATION WHERE POSSIBLE SHOULD START 2/3 OF THE RUNOUT LENGTH ON THE TANGENT W/ 1/3 OF THE LENGTH IN THE CURVE OR AS NOTED ON THE PLANS. SUPERELEVATIONS & RUNOUT LENGTHS SHALL BE 4% AND 100' UNLESS OTHERWISE NOTED IN THE CURVE DATA ON THE P&P SHEETS.
   - -POINT OF REVERSE CURVES SHALL BE 0.0% CROSS SLOPE
   - -CURVE WIDENING ON INSIDE OF CURVE = 400/R (ROUND OFF TO NEXT LARGEST EVEN FOOT). IF POSSIBLE START WIDENING AT START OF SUPERELEVATION.
   - -CATTLE GUARDS AND FENCING ARE NOT REQUIRED.
   - -LOCKED ACCESS GATE WITH WARNING SIGNS TO TRESPASSERS AT ENTRANCE TO BE SUPPLIED BY OWNER AND INSTALLED BY CONTRACTOR.
   - -TRAFFIC CONTROL SIGNS - REF. SPECIFICATION SECTION 34-0213.
   - -MAXIMUM 14% GRADE (PER OWNER'S DIRECTION)
   - -DIPS AT DRAINAGE CROSSING WHERE POSSIBLE, HYDROLOGY DESIGN BASED ON A 10 YEAR 24 HRS. STORM FREQUENCY USING THE TR-20 COMPUTER DESIGN.
6. THE CLEARING AND GRUBBING LIMITS SHALL BE A LINE 10' OUT SIDE THE TOE OF CUT/FILL LIMITS SHOWN ON THE PLANS. ALL CUT/FILL SLOPES IN UNCLASSIFIED MATERIAL AND DISTRUBED AREAS OUTSIDE THESE SLOPES SHALL BE SEEDED AND MULCHED PER THE SPECIFICATIONS. ROCK CUT/FILL SLOPES DO NOT REQUIRE TOPSOIL, SEEDING AND MULCHING. ALSO, THE CONTRACTOR SHALL PAY SPECIAL ATTENTION TO DUST AND EROSION CONTROL.
7. SAFETY BERM LOCATIONS ARE SHOWN AND/OR CALLED OUT WITH A NOTE ON THE PLAN & PROFILE DRAWINGS. PROVIDE 3' WIDE BREAKS IN BERMS AT 300' AND AT ALL LOW POINTS TO ALLOW FOR SURFACE DRAINAGE.
8. PROPER TRAFFIC CONTROL SIGNS SHALL BE SUPPLIED AND INSTALLED IN ACCORDANCE WITH THESE DRAWINGS, LOCAL, STATE AND FEDERAL LAWS BY OTHERS.
9. WILDLIFE GUZZLERS HAVE BEEN INSTALLED BY THE OWNER TO COMPLY WITH THE "ENVIRONMENTAL IMPACT REPORT".
10. PROPERTY BOUNDARY, PERMITS, AND EASEMENTS TO BE PROVIDED BY THE OWNER.
11. UNLESS OTHERWISE NOTED IN THE PROFILE THE CUT SLOPES SHALL BE 2:1. AREAS VARYING FROM THIS SLOPE ARE CALLED OUT ON THE PROFILE. FINAL CUT & FILLS MAY BE ADJUSTED IN THE FIELD BY THE SOILS ENGINEER.

SIGN LEGEND

(1)	R1-1	"STOP"
(2)	W3-1a	"STOP AHEAD"
(3)	W2-4	"T" INTERSECTION
(4)	W8-2	"DIP"
(5)	R2-1 (10mph)	"SPEED SIGN" @ 10 MILES PER HOUR
(6)	W2-1	"CROSS ROAD"
(7)	W1-4R	"REVERSE TURN"
(8)	W7-1 (7%) / W7-3	"DOWN GRADE" @ 7%
	W7-2	"TRUCKS USE LOWER GEAR"
	W7-3a	"NEXT 2 MILES"
(9)	W7-1a (7%) / W7-3	"UPGRADE" @ 7%
	W7-2	"TRUCKS USE LOWER GEAR"
	W7-3a	"NEXT 2 MILES"
(10)	W1-5	"WINDING ROAD SIGN"

SPECIFICATION LIST

SPEC. NO.	TITLE
34-0211A	CONSTRUCTION SURVEYING
34-0213	HAUL/ACCESS ROAD
34-0227	CORRUGATED STEEL CULVERT PIPE
34-0228	TOPSOIL STRIPPING & STOCKPILING
34-0229	SEEDING & MULCHING (BY OTHERS)
34-0230	TEMPORARY EROSION CONTROL
34-0243	RIPRAP

DRAWING LIST

DRAWING NO.	REF. NO.	TITLE
10-34-001	10C-1	LOCATION PLAN & TITLE SHEET
10-34-002	10C-2	HAUL/ACCESS ROAD PLAN & PROFILE #1 (0+00 TO 30+00)
10-34-003	10C-3	HAUL/ACCESS ROAD PLAN & PROFILE #2 (30+00 TO 60+00)
10-34-004	10C-4	HAUL/ACCESS ROAD PLAN & PROFILE #3 (60+00 TO 90+00)
10-34-005	10C-5	HAUL/ACCESS ROAD PLAN & PROFILE #4 (90+00 TO 117+00)
10-34-006	10C-6	HAUL/ACCESS ROAD PLAN & PROFILE #5 (117+00 TO 138+00)
10-34-007	10C-7	HAUL/ACCESS ROAD PLAN & PROFILE #6 (138+00 TO 166+00)
10-34-008	10C-8	HAUL/ACCESS ROAD PLAN & PROFILE #7 (166+00 TO 191+00)
10-34-009	10C-9	HAUL/ACCESS ROAD PLAN & PROFILE #8 (191+00 TO 216+50)
10-34-010	10C-10	HAUL/ACCESS ROAD PLAN & PROFILE #9 (216+50 TO 245+00)
10-34-011	10C-11	HAUL/ACCESS ROAD PLAN & PROFILE #10 (245+00 TO 272+50)
10-34-012	10C-12	HAUL/ACCESS ROAD TYPICAL SECTIONS & DETAILS
10-34-013	10C-13	HAUL/ACCESS ROAD DRAINAGE DETAILS NO. 1
10-34-014	10C-14	HAUL/ACCESS ROAD DRAINAGE DETAILS NO. 2

REFERENCE DWGS

DRAWING NO.	TITLE

REVISIONS

NO.	BY	DATE	CKD	DESCRIPTION
0	CF	5/10/88	[illegible]	ISSUE FOR CONSTRUCTION BUL.0-001
D	RA	1/10/87	SKM	ISSUE FOR OWNER APPROVAL TL# 003
C	KF	10/21/87	MLT	ISSUE FOR BID ADDENDUM NO. 1 TL# 007
B	EB	10/7/87	MLT	ISSUE FOR BID TL#006
A	RA	7/2/87	SKM	ISSUE FOR OWNER APPROVAL TL#003

APPROVALS

DEPT \ REV	A	B	C	D	0
ARCH					
CIV/STRL	MLT	MLT	MLT	MLT	[illegible]
MECH					
ELECT					
INSTM					
PIPING					
SAFETY					
SOILS					
DEPT MGR	JAB	JAB	JAB	JAB	[illegible]
PROJECT	JAB	JAB	JAB	JAB	[illegible]

SCALE	NONE	DATE
DRAWN BY	RARA	6/17/87
DESIGNED BY	MLT	6/17/87
CHECKED BY	SKM	6/30/87

CLIENT APPROVALS

REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.
A BECHTEL-KNUDSEN COMPANY

PLUESS-STAUFER (CALIFORNIA) INC.
WHITE KNOB/WHITE RIDGE PROJECT

DRAWING TITLE
LOCATION PLAN & TITLE SHEET

CONTRACT NO.	24 of 36
1928	
DRAWING NO.	
10-34-001	
REFERENCE NO.	REV
10C-1	0

10C-2

BASIS OF BEARINGS

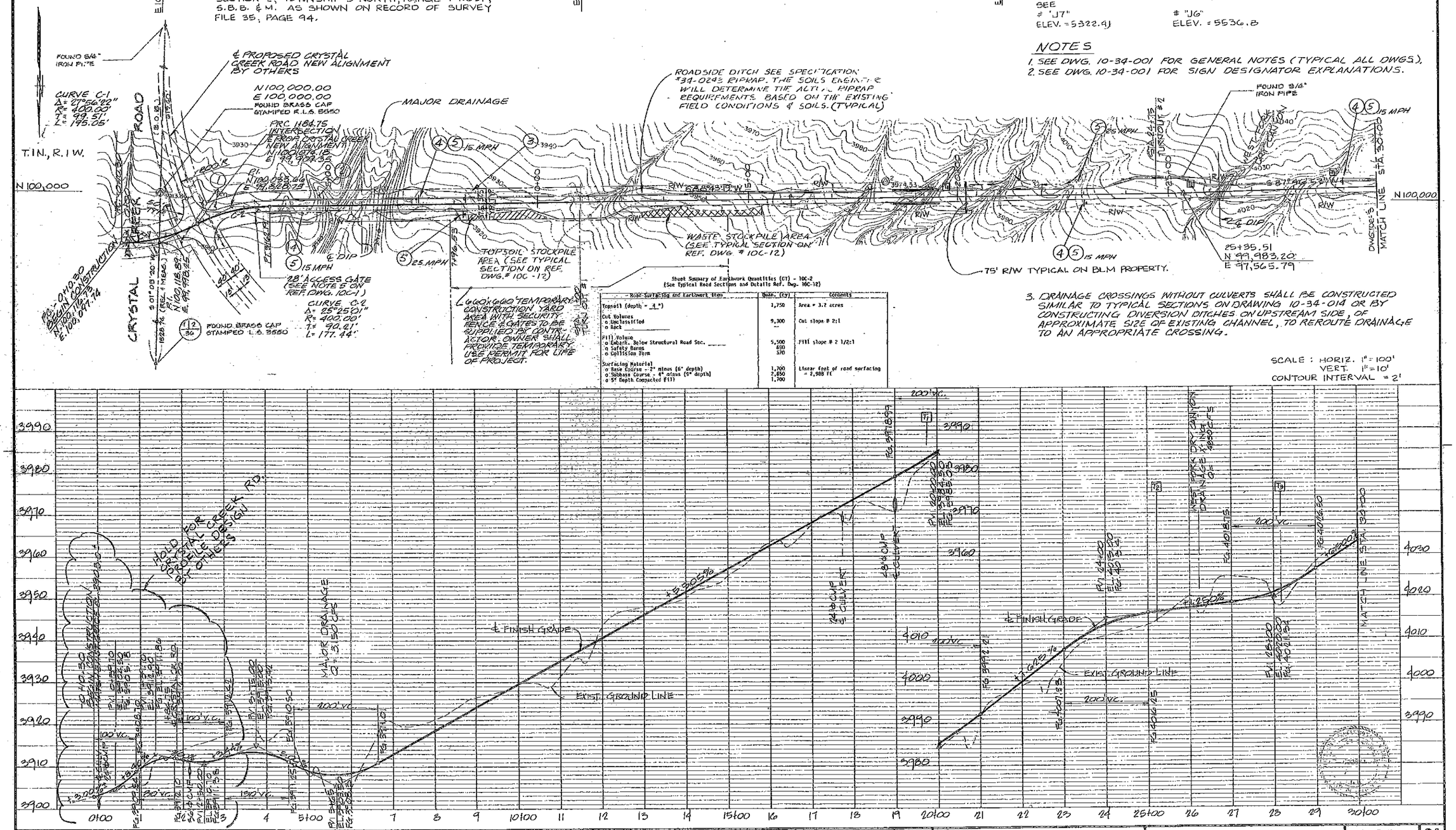
N 01°03'20" E - THE EASTERLY LINE OF FRACTIONAL SECTION 2, TOWNSHIP 3 NORTH, RANGE 1 WEST, S.B.B. & M. AS SHOWN ON RECORD OF SURVEY FILE 35, PAGE 94.

BENCH MARK

AERIAL PANEL POINTS SHOWN ON AERIAL SURVEY MAP BY AMERICAN AERIAL SURVEYS OF COVINA, CALIFORNIA. SEE
"J7" ELEV. = 5322.91
"J6" ELEV. = 5536.8

NOTES

1. SEE DWG. 10-34-001 FOR GENERAL NOTES (TYPICAL ALL DWGS).
2. SEE DWG. 10-34-001 FOR SIGN DESIGNATOR EXPLANATIONS.



Sheet Summary of Earthwork Quantities (CY) - 10C-2
(See Typical Road Sections and Details Ref. Dwg. 10C-12)

Road Surfacing and Earthwork Item	Quan. (CY)	Comments
Topsoil (depth = 1")	1,750	Area = 3.2 acres
Cut Volumes o Unclassified o Rock	9,300 —	Cut slope @ 2:1
Fill Volume o Embank. Below Structural Road Sec. ____ o Safety Berms o Collision Berm	5,500 690 570	Fill slope @ 2 1/2:1
Surfacing Material o Base Course - 2" minus (6" depth) o Subbase Course - 4" minus (9" depth) o 5" Depth Compacted Fill)	1,700 2,850 1,700	Linear feet of road surfacing = 2,988 ft

3. DRAINAGE CROSSINGS WITHOUT CULVERTS SHALL BE CONSTRUCTED SIMILAR TO TYPICAL SECTIONS ON DRAWING 10-34-014 OR BY CONSTRUCTING DIVERSION DITCHES ON UPSTREAM SIDE OF APPROXIMATE SIZE OF EXISTING CHANNEL, TO REROUTE DRAINAGE TO AN APPROPRIATE CROSSING.

SCALE : HORIZ. 1" = 100'
VERT. 1" = 10'
CONTOUR INTERVAL = 2'

REFERENCE DWGS	DRAWING NO.	TITLE
	10-34-001	LOCATION PLAN & TITLE SHEET
	10-34-003	HAUL/ACCESS ROAD PLAN & PROFILE #2
	10-34-012	HAUL/ACCESS ROAD TYP. SECT. & DETAILS
	10-34-013	HAUL/ACCESS ROAD DRAINAGE DETAILS #1
	10-34-014	HAUL/ACCESS ROAD DRAINAGE DETAILS #2
	10-34-015	EMERGENCY ESCAPE RAMP DETAILS

REVISIONS	NO.	BY	DATE	CKD	DESCRIPTION
	O	RJ	6/10/88	MLT	ISSUE FOR CONSTRUCTION BUL. D-001
	E	RA	11-10-87	SKM	ISSUE FOR OWNER APPROVAL TL# 009
	D	KF	10-22-87	MLT	ISSUE FOR BID ADDENDUM #1 TL# 007
	C	RA	10-7-87	MLT	ISSUE FOR BIDS TL# 006
	B	GM	9-16-87	SKM	ISSUE FOR OWNER APPROVAL TL# 005
	A	RA	7-2-87	SKM	ISSUE FOR OWNER APPROVAL TL# 003

APPROVALS	DEPT	REV	A	B	C	D	E	O
	ARCH		MLT	MLT	MLT	MLT	SKM	
	CIV/STRL							
	MECH							
	ELECT							
	INSTM							
	PIPING							
	SAFETY							
	DEPT MGR							
	PROJECT							

SCALE AS SHOWN	DATE
DRAWN BY KFF	5/87
DESIGNED BY MLT	6/87
CHECKED BY SKM	6/87
CLIENT APPROVALS	
REV / BY / DATE	

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON-KNUDSEN COMPANY

PLUESS-STAUFER (CALIFORNIA) INC.

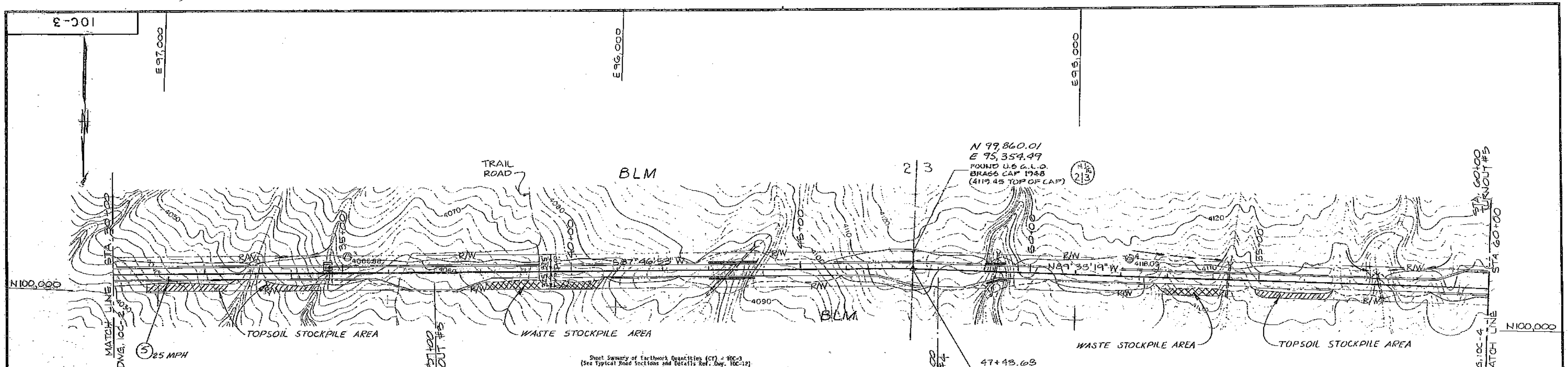
WHITE KNOB / WHITE RIDGE PROJECT

DRAWING TITLE
HAUL / ACCESS ROAD
PLAN & PROFILE #1

CONTRACT NO.	24 of 36
1928	
DRAWING NO.	10-34-002
REFERENCE NO.	REV
10C-2	O

BRUNING 44/32 65736

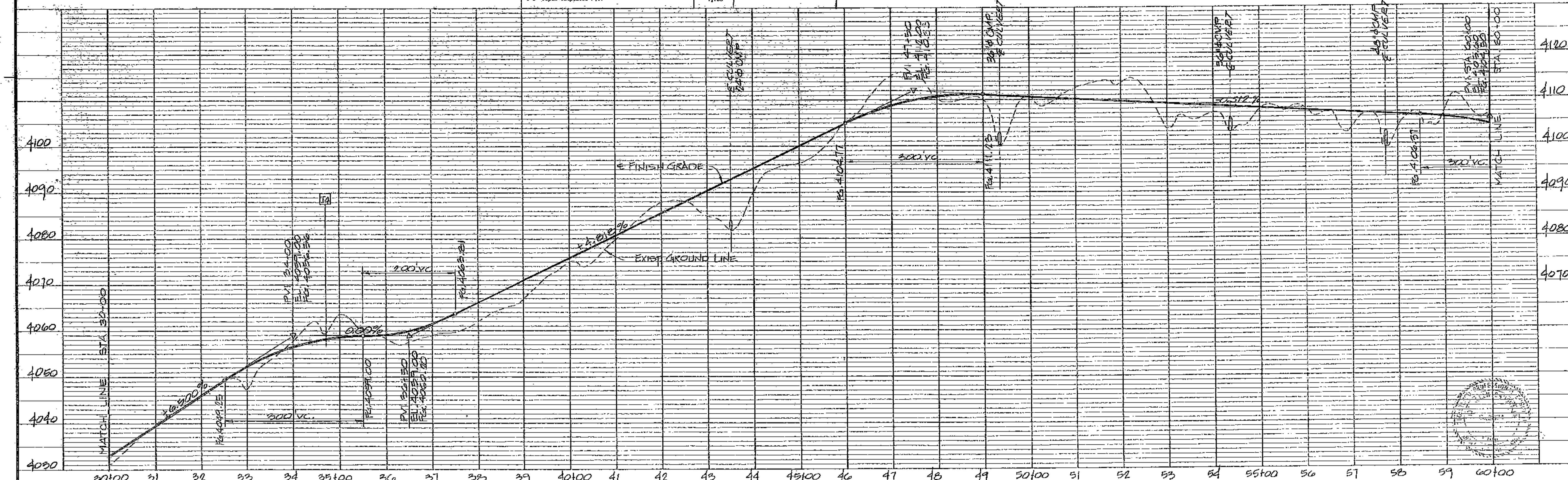
10C-3



Sheet Summary of Earthwork Quantities (CY) - 10C-3
(See Typical Road Sections and Details Ref. Dwg. 10C-12)

Road Surfacing and Earthwork Item	Quan. (cy)	Comments
Topsoil (depth = 4 ")	1,840	Area = 3.42 acres
Cut Volumes		
o Unclassified	9,650	Cut slope @ 2:1
o Rock	--	
Fill Volume		
o Embank. Below Structural Road Sec.	5,900	Fill slope @ 2 1/2:1
o Safety Berms	370	
Surfacing Material		
o Base Course - 2" minus (6" depth)	1,700	Linear feet of road surfacing = 3,000 ft
o Subbase Course - 4" minus (9" depth)	2,850	
o 5" Depth Compacted Fill	1,700	

SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'
CONTOUR INTERVAL = 2'



DRAWING NO.	TITLE
10-34-001	LOCATION PLAN & TITLE SHEET
10-34-002	HAUL/ACCESS ROAD P & P #1
10-34-004	HAUL/ACCESS ROAD P & P #3
10-34-012	HAUL/ACCESS ROAD TYP. SECT. & DETAILS
10-34-013	HAUL/ACCESS ROAD DRAINAGE DETAILS#1
10-34-014	HAUL/ACCESS ROAD DRAINAGE DETAILS#2

REFERENCE DWGS

NO.	BY	DATE	CKD	DESCRIPTION
O	RJ	5/10/88		ISSUE FOR CONSTRUCTION BUL. D-001
E	RA	11-10-87	SKM	ISSUE FOR OWNER APPROVAL TL#009
D	KF	10-22-87		ISSUE FOR BID ADDENDUM #1 TL#007
C	RA	10-7-87	MLT	ISSUE FOR BIDS TL#006
B	GM	9-16-87	SKM	ISSUE FOR OWNER APPROVAL TL#005
A	RA	7-2-87	SKM	ISSUE FOR OWNER APPROVAL TL#003

REVISIONS

DEPT \ REV	A	B	C	D	E	O
ARCH						
CIV/STRL		MLT	MLT	MLT	SKM	
MECH						
ELECT						
INSTM						
PIPING						
SAFETY						
DEPT MGR						
PROJECT						

APPROVALS

SCALE AS SHOWN	DATE
DRAWN BY KFF	5/87
DESIGNED BY MLT	6/87
CHECKED BY SKM	6/87

CLIENT APPROVALS

REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON-KNUDSEN COMPANY

PLUESS-STAUFER (CALIFORNIA) INC.

WHITE KNOB / WHITE RIDGE PROJECT

DRAWING TITLE
HAUL / ACCESS ROAD
PLAN & PROFILE # 2

CONTRACT NO. 1928

24 x 36

DRAWING NO. 10-34-003

REFERENCE NO. 10C-3

REV O

BRUNING 44-132 65738

10C-4

E94,000 E93,000 E92,000

N100,000

MATCH LINE DWG. 10C-3

STA. 60+00

WASTE STOCKPILE AREA

POUND ROCK MOUND
N 97,848.76
E 93,767.68

N 99°38' 16" W

R/W

DIVERSION DITCH

℄ HAUL/ ACCESS R.D.

STA. 70+50 TURNOUT #6

5 25 MPH

4 5 15 MPH

BLM

QUAIL SPRING DRAINAGE

CONST. ENTRANCE

TOPSOIL STOCKPILE AREAS

POUND 1"×2" STAKE & TACK

73+80.37
N 99,914.12
E 92,722.64

S 88° 43' 27" W

6

STA. 84+50 TURNOUT #7

WARNING - GAS LINE

24"ϕ CMP CULVERT

FOUND BRASS CAP

CONSTRUCT 16' WIDE ROAD APPROACH RT. & LT. 15% MAX. GRADE TO EXIST. GROUND

NO CONSTRUCTION EQUIPMENT IS ALLOWED TO CROSS THE PIPELINE UNTIL PROVISIONS STIPULATED BY THE GAS COMPANY ARE MET. SEE THE AGREEMENT BETWEEN THE GAS COMPANY AND BLM FILED W/ BLM 9/1/85.

MATCH LINE DWG. 10C-5 STA. 90+00

SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'
CONTOUR INTERVAL = 2'

Sheet Summary of Earthwork Quantities (CY) - 10C-4
(See Typical Road Sections and Details Ref. Dwg. 10C-12)

Road Surfacing and Earthwork Item	Quan. (cy)	Comments
Topsoil (depth = 4")	2,380	Area = 4.44 acres
Cut Volumes o Unclassified o Rock	13,550	Cut slope @ 2:1
Fill Volume o Embank. Below Structural Road Sec. ____ o Safety Bonus	10,400 310	Fill slope @ 2 1/2:1
Surfacing Material o Base Course = 2" minus (6" depth) o Subbase Course = 4" minus (9" depth) o 5" Depth Compacted Fill	1,200 2,850 1,900	Linear feet of road surfacing = 3,000 ft

4120 4110 4100 4090 4080

EXIST. GROUND LINE

FINISH GRADE

3.75% -2.74% 3.00% 4.00% 1.05%

300' VC 200' VC 100' VC

EXISTING GAS PIPELINE VALVE PROJECTS 12" ABOVE DELOY SPRING

WARNING

℄ GAS LINE

℄ ROAD, SEE PLAN FOR CULVERT

60+00 61 62 63 64 65+00 66 67 68 69 70+00 71 72 73 74 75+00 76 77 78 79 80+00 81 82 83 84 85+00 86 87 88 89 90+00

DRAWING NO.	TITLE
10-34-001	LOCATION PLAN & TITLE SHEET
10-34-003	HAUL/ACCESS ROAD P & P # 2
10-34-005	" " " P & P # 4
10-34-012	" " " TYP. SECT. & DETAILS
10-34-013	" " " DRAINAGE DETAILS #1
10-34-014	" " " " " #2

REFERENCE DWGS

REVISIONS NO.	BY	DATE	CKD.	DESCRIPTION
O	RJ	5/10/88	[illegible]	ISSUE FOR CONSTRUCTION BUL. D-001
E	RA	11-10-87	[illegible]	ISSUE FOR OWNER APPROVAL TL#009
D	KF	10-22-87	MLT	ISSUE FOR BID ADDENDUM #1 TL#007
C	RA	10-7-87	MLT	ISSUE FOR BID TL#006
B	GM	9-16-87	SKM	ISSUE FOR OWNER APPROVAL TL#005
A	RA	7-2-87	SKM	ISSUE FOR OWNER APPROVAL TL#003

APPROVALS DEPT \ REV	A	B	C	D	E	O
ARCH						
CIV/STRL	MLT	MLT	MLT	MLT	SKM	SKM
MECH						
ELECT						
INSTM.						
PIPING						
SAFETY						
DEPT MGR						
PROJECT						

SCALE AS SHOWN	DATE
DRAWN BY KFF	5/87
DESIGNED BY MLT	6/87
CHECKED BY SKM	6/87
CLIENT APPROVALS	
REV / BY / DATE	

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON-KNUDSEN COMPANY

PLUESS-STAUFER (CALIFORNIA) INC.

WHITE KNOB / WHITE RIDGE PROJECT

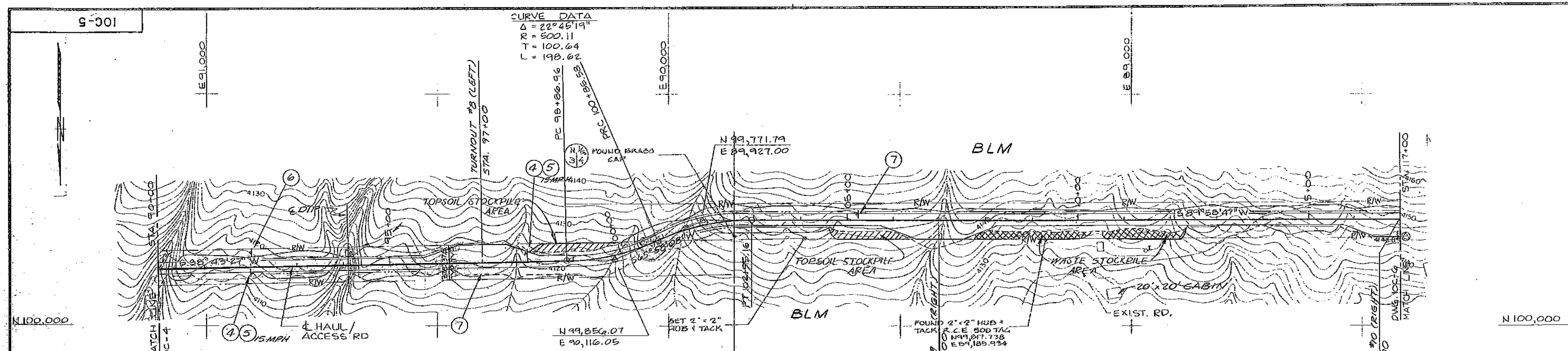
DRAWING TITLE
HAUL / ACCESS ROAD
PLAN & PROFILE # 3

CONTRACT NO. 1928 — 24 R 36

DRAWING NO. 10-34-004

REFERENCE NO. 10C-4 — REV O

BRUNING 44-32-8738



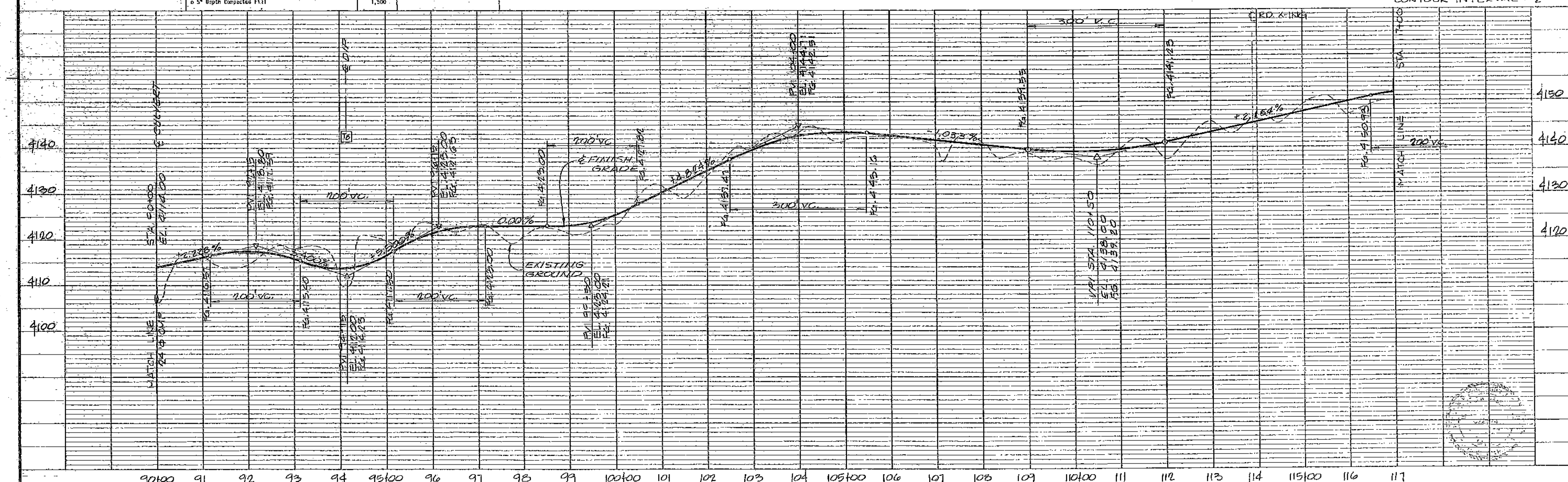
Sheet Summary of Earthwork Quantities (CY) - 10C-5
(See Typical Road Sections and Details Ref. Dwg. 10C-12)

Road Surfacing and Earthwork Item	Quan. (CY)	Comments
Topsoil (depth = 4 ")	1,740	Area = 3.25 acres
Cut Volumes		
o Unclassified	7,550	Cut slope @ 2:1
o Rock	—	
Fill Volume		
o Embank. Below Structural Road Sec.	4,300	Fill slope @ 2 1/2:1
o Safety Berms	700	
Surfacing Material		
o Base Course - 2" minus (6" depth)	1,500	Linear feet of road surfacing = 2,700 ft
o Subbase Course - 4" minus (9" depth)	2,500	
o 5" Depth Compacted Fill	1,500	

CURVE DATA
Δ = 24°00'39"
R = 500.11
T = 106.35
L = 209.58

TURNOUT #9 (RIGHT) STA. 107+00
TURNOUT #10 (RIGHT) STA. 117+00

SCALE: HORIZ. 1" = 100'
VERT. 1" = 10'
CONTOUR INTERVAL = 2'



Drawing No.	Title
10-34-001	LOCATION PLAN & TITLE SHEET
10-34-004	HAUL/ACCESS ROAD PLAN & PROFILE # 3
10-34-006	" " " PLAN & PROFILE # 5
10-34-012	" " " TYP. SECT'S & DETAILS
10-34-013	" " " DRAINAGE DETAILS #1
10-34-014	" " " " " #2

REFERENCE DWGS

No.	By	Date	CKD	Description
O	RJ	5/10/88		ISSUE FOR CONSTRUCTION BUL. D-001
E	RA	11-10-87	SKM	ISSUE FOR OWNER APPROVAL TL#009
D	KF	10-22-87	MLT	ISSUE FOR BID ADDENDUM #1 TL#007
C	RA	10-7-87	MLT	ISSUE FOR BID TL#006
B	GM	9-16-87	SKM	ISSUE FOR OWNER APPROVAL TL#005
A	RA	7-2-87	SKM	ISSUE FOR OWNER APPROVAL TL#003

REVISIONS

DEPT \ REV	A	B	C	D	E	O
ARCH						
CIV/STRL	MLT	MLT	MLT	MLT	SKM	
MECH						
ELECT						
INSTM						
PIPING						
SAFETY						
DEPT MGR						
PROJECT						

APPROVALS

SCALE AS SHOWN	DATE
DRAWN BY KFF	5/87
DESIGNED BY MLT	6/87
CHECKED BY SKM	6/87

CLIENT APPROVALS

REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON-KNUDSEN COMPANY

PLUESS-STAUFER (CALIFORNIA) INC.

WHITE KNOB / WHITE RIDGE PROJECT

DRAWING TITLE
HAUL / ACCESS ROAD
PLAN & PROFILE #4

CONTRACT NO. 1928
24 of 36
DRAWING NO. 10-34-005
REFERENCE NO. 10C-5
REV O

BRUNING 44-132 65738

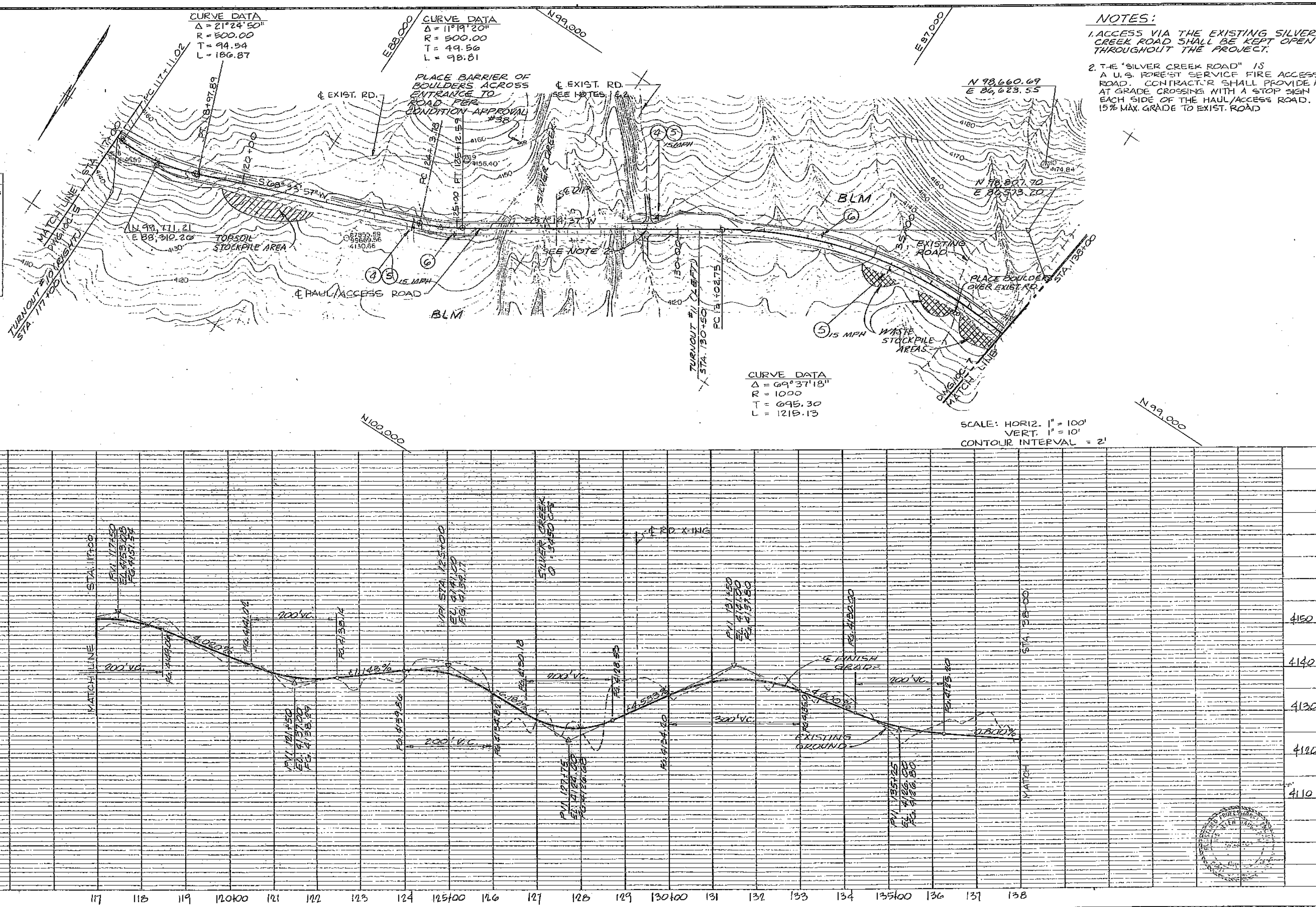
9-001

NOTES:

1. ACCESS VIA THE EXISTING SILVER CREEK ROAD SHALL BE KEPT OPEN THROUGHOUT THE PROJECT.
2. THE "SILVER CREEK ROAD" IS A U.S. FOREST SERVICE FIRE ACCESS ROAD. CONTRACTOR SHALL PROVIDE AN AT GRADE CROSSING WITH A STOP SIGN EACH SIDE OF THE HAUL/ACCESS ROAD. 15% MAX. GRADE TO EXIST. ROAD

Sheet Summary of Earthwork Quantities (CY) - 10C-6
(See Typical Road Sections and Details Ref. Dwg. 10C-12)

Road Surfacing and Earthwork Item	Quantities (cy)	Comments
Topsoil (depth = 4")	1,440	Area = 2.68 acres
Cut Volumes		
o Unclassified	8,075	Cut slope @ 2:1
o Rock	--	
Fill Volume		
o Embank. Below Structural Road Sec.	5,150	Fill slope @ 2 1/2:1
o Safety Berms	450	
Surfacing Material		
o Base Course - 2" minus (6" depth)	1,300	Linear feet of road surfacing = 2,100 ft
o Subbase Course - 4" minus (9" depth)	2,100	
o 5" Depth Compacted Fill	1,300	



DRAWING NO.	TITLE
10-34-001	LOCATION PLAN & TITLE SHEET
10-34-005	HAUL/ACCESS ROAD PLAN & PROFILE #4
10-34-007	" " " " " #6
10-34-012	" " " TYP. SECT'S & DETAILS
10-34-013	" " " DRAINAGE DETAILS #1
10-34-014	" " " " " #2

REVISIONS

NO.	BY	DATE	CKD	DESCRIPTION
O	RJ	5/10/88		ISSUE FOR CONSTRUCTION BUL. D-001
E	RA	11-10-87	SKM	ISSUE FOR OWNER APPROVAL TL#009
D	KF	10-22-87	MLT	ISSUE FOR BID ADDENDUM #1 TL#007
C	RA	10-7-87	MLT	ISSUE FOR BID T.L. #006
B	GM	9-16-87	SKM	ISSUE FOR OWNER APPROVAL TL#005
A	RA	7-2-87	SKM	ISSUE FOR OWNER APPROVAL TL#003

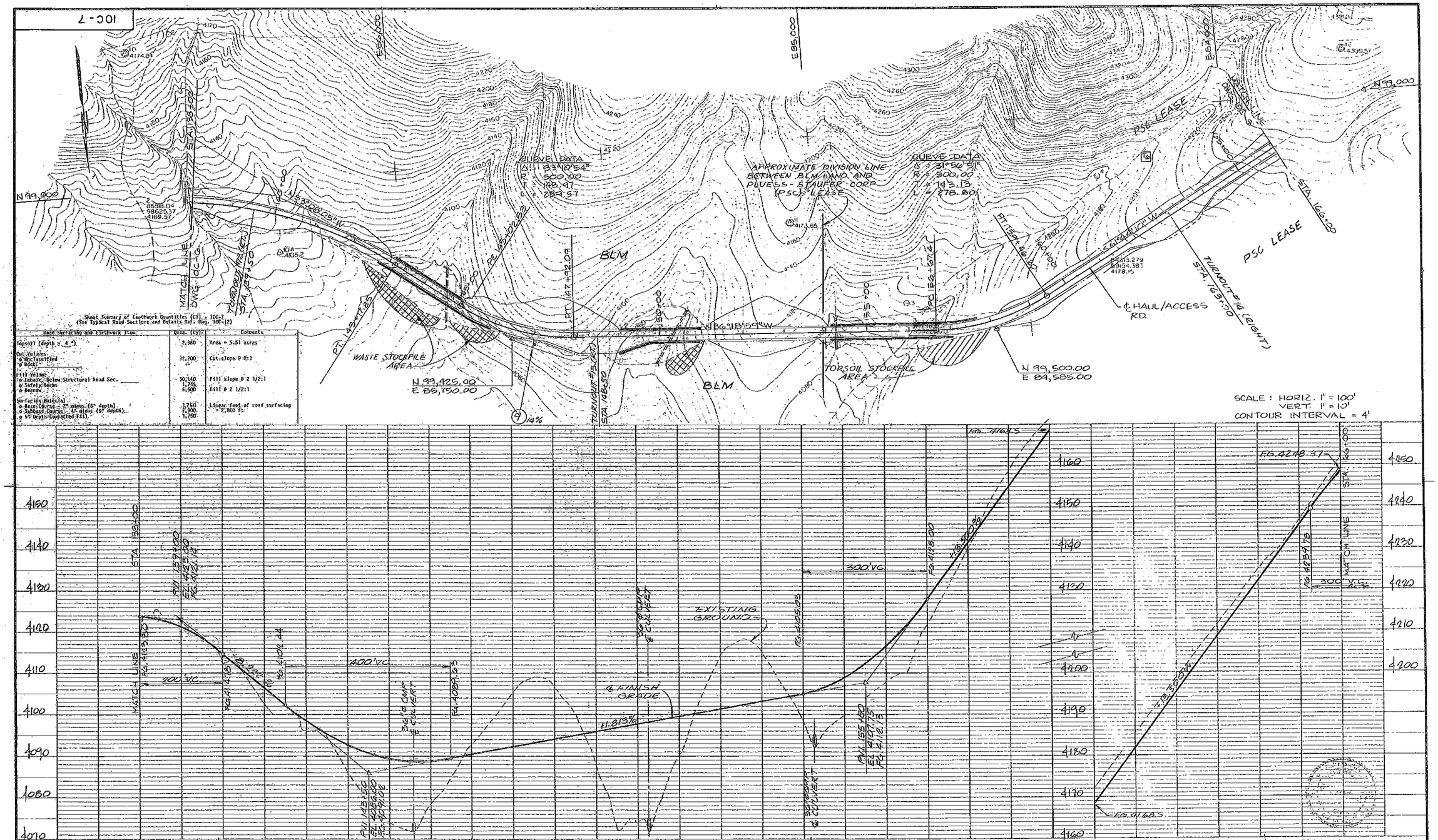
MORRISON-KNUDSEN ENGINEERS, INC.

PLUESS-STAUFER (CALIFORNIA) INC.

WHITE KNOB / WHITE RIDGE PROJECT

DRAWING TITLE: HAUL / ACCESS ROAD PLAN & PROFILE #5

10C-7



Sheet Summary of Earthwork Quantities (CY) - 10C-7
(See Typical Road Sections and Details Ref. Dwg. 10C-12)

Road Surfacing and Earthwork Items	Quan. (CY)	Comments
Topsoil (depth = 4")	2,360	Area = 5.51 acres
Cut Volume:		
o Unclassified	37,200	Cut slope 0 2:1
o Rock:		
Fill Volume:		
o Imbank. Below Structural Road Sec.	30,140	Fill slope 0 2 1/2:1
o Safety Berm	1,745	
o Borrow	8,900	Fill 0 2 1/2:1
Surfacing Material		
o Base Course - 2" minus (6" depth)	1,750	Linear feet of road surfacing
o Subbase Course - 4" minus (9" depth)	2,900	= 2,800 ft.
o 6" Depth Compacted Fill	1,750	

REFERENCE DWGS

DRAWING NO.	TITLE
10-34-001	LOCATION PLAN & TITLE SHEET
10-34-006	HAUL/ACCESS ROAD PLAN & PROFILE # 5
10-34-008	" " " " " # 7
10-34-012	TYP. SECT'S & DETAILS
10-34-013	DRAINAGE DETAILS #1
10-34-014	" " " " " #2

REVISIONS

NO.	BY	DATE	CKD	DESCRIPTION
O	KJ	5/10/88	[illegible]	ISSUE FOR CONSTRUCTION BUL. D-001
E	RA	11-10-87	SKM	ISSUE FOR OWNER APPROVAL TL#009
D	KF	10-22-87	MLT	ISSUE FOR BID ADDENDUM #1 TL#007
C	RA	10-7-87	MLT	ISSUE FOR BID TL#006
B	GM	9-16-87	SKM	ISSUE FOR OWNER APPROVAL TL#005
A	RA	7-2-87	SKM	ISSUE FOR OWNER APPROVAL TL#003

APPROVALS

DEPT \ REV	A	B	C	D	E	O
ARCH						
CIV/STRL	MLT	MLT	MLT	MLT	SKM	KJ
MECH						
ELECT						
INSTM						
PIPING						
SAFETY						
DEPT. MGR		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PROJECT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

SCALE AS SHOWN	DATE
DRAWN BY KFF	5/87
DESIGNED BY MLT	6/87
CHECKED BY SKM	6/87

CLIENT APPROVALS

REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON-KNUDSEN COMPANY

PLUESS-STAUFFER (CALIFORNIA) INC.
WHITE KNOB / WHITE RIDGE PROJECT
DRAWING TITLE
HAUL / ACCESS ROAD
PLAN & PROFILE # 6

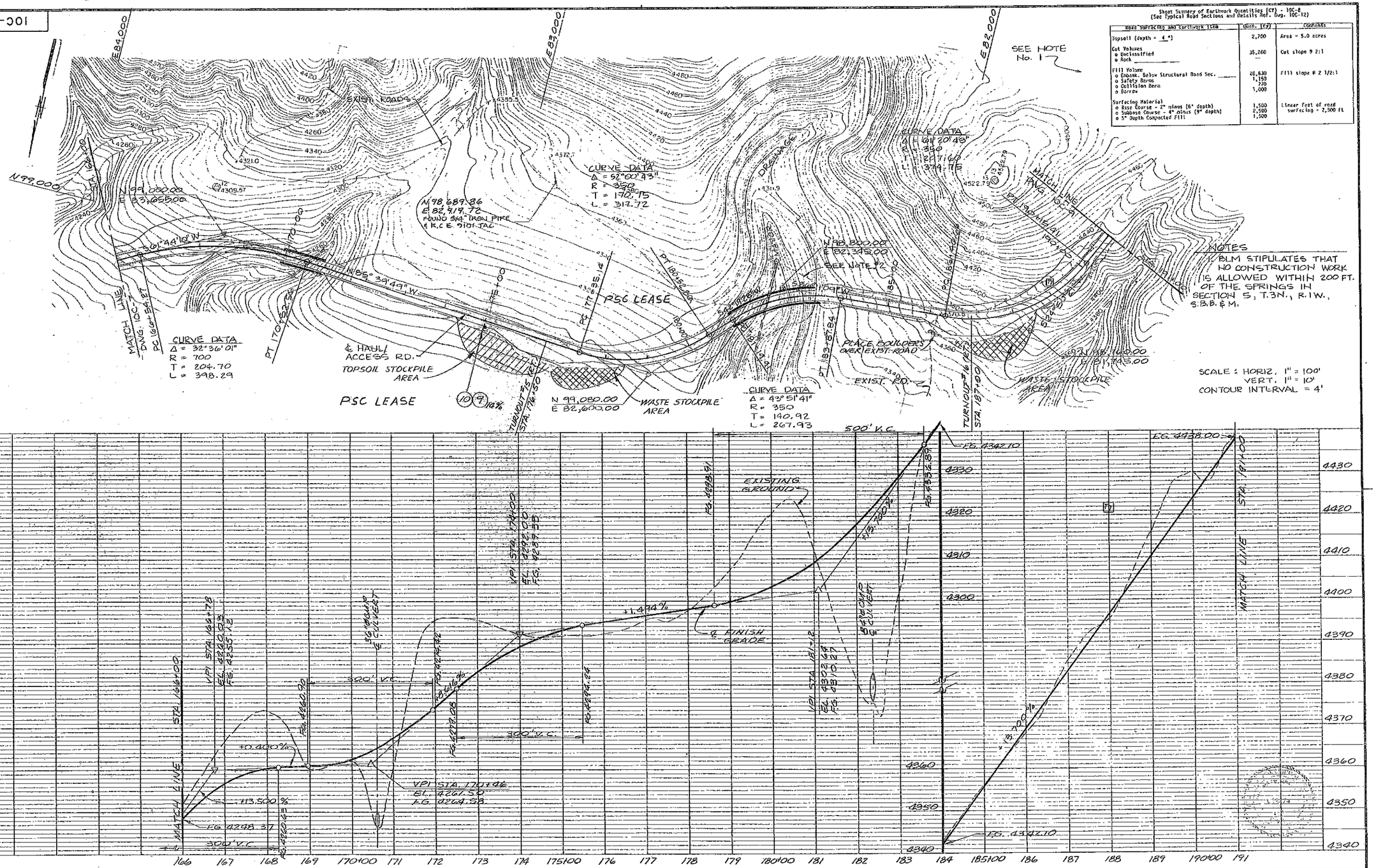
CONTRACT NO. 1928 — 24 of 36
DRAWING NO. 10-34-007
REFERENCE NO. 10C-7 — REV O

BRUNING 44-132 69795

8-001

Sheet Summary of Earthwork Quantities (CY) - 10C-8
(See Typical Road Sections and Details Ref. Dwg. 10C-12)

Road Surfacing and Earthwork Item	Quan. (CY)	Comments
Topsoil (depth = 4")	2,700	Area = 5.0 acres
Cut Volumes o Unclassified o Rock	35,260 —	Cut slope @ 2:1
Fill Volume o Embank. Below Structural Road Sec. ____ o Safety Berms o Collision Berm o Berms	28,630 1,150 700 1,000	Fill slope @ 2 1/2:1
Surfacing Material o Base Course - 2" minus (6" depth) o Subbase Course - 4" minus (9" depth) o 5" Depth Compacted Fill	1,500 2,500 1,500	Linear feet of road surfacing = 2,500 ft



DRAWING NO.	TITLE
10-34-001	LOCATION PLAN & TITLE SHEET
10-34-007	HAUL/ACCESS ROAD PLAN & PROFILE # 6
10-34-009	" " " " " # 8
10-34-012	" " " TYP. SECT. & DETAILS
10-34-013	" " " DRAINAGE DETAILS
10-34-014	" " " " " #2
10-34-015	EMERGENCY ESCAPE RAMP DETAILS

REVISIONS NO.	BY	DATE	CKD	DESCRIPTION
O	RJ	5/10/88	MLT	ISSUE FOR CONSTRUCTION BUL. D-001
E	RA	11-10-87	SKM	ISSUE FOR OWNER APPROVAL TL# 009
D	KF	10-22-87	MLT	ISSUE FOR BID ADDENDUM # 1 TL# 007
C	RA	10-7-87	MLT	ISSUE FOR BID T.L. #006
B	GM	9-16-87	SKM	ISSUE FOR OWNER APPROVAL TL# 005
A	RA	7-2-87	SKM	ISSUE FOR OWNER APPROVAL TL# 003

APPROVALS DEPT \ REV	A	B	C	D	E	O
ARCH						
CIV/STRL	MLT 7/87	MLT	MLT	MLT	SKM	SKM
MECH						
ELECT						
INSTM						
PIPING						
SAFETY						
DEPT MGR						
PROJECT						

SCALE AS SHOWN	DATE
DRAWN BY KFF	5/87
DESIGNED BY MLT	6/87
CHECKED BY SKM	6/87

CLIENT APPROVALS

REV	BY	DATE

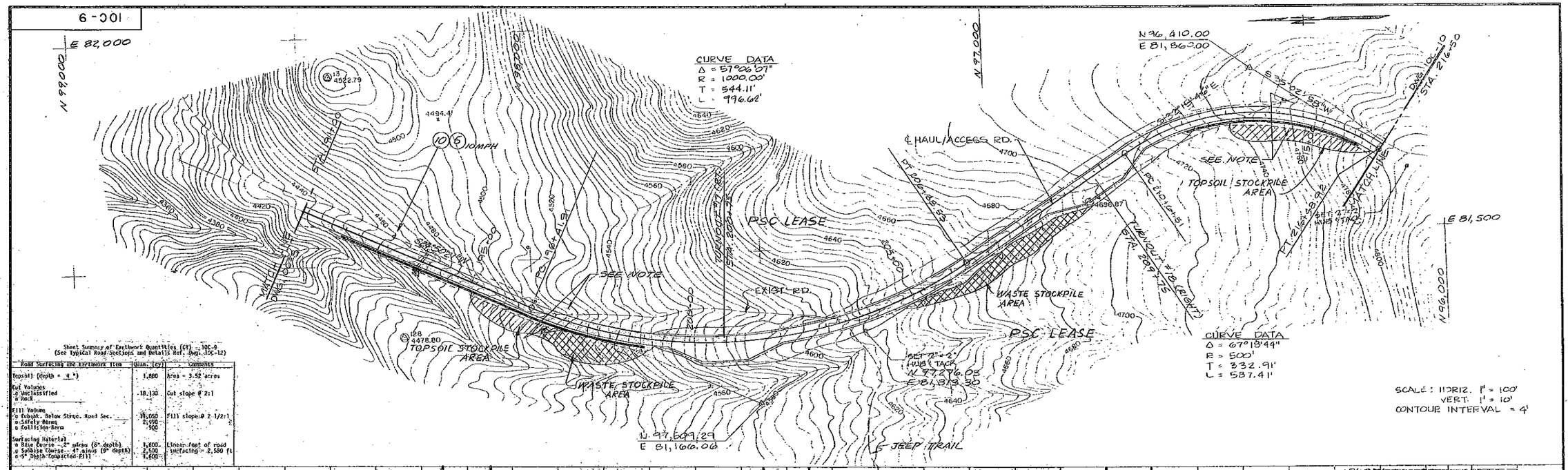
MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON-KNUDSEN COMPANY

PLUESS-STAUFER (CALIFORNIA) INC.
WHITE KNOB / WHITE RIDGE PROJECT
DRAWING TITLE
HAUL / ACCESS ROAD
PLAN & PROFILE # 7

CONTRACT NO. 1928 — 24 N 36
DRAWING NO. 10-34-008
REFERENCE NO. 10C-8 — REV O

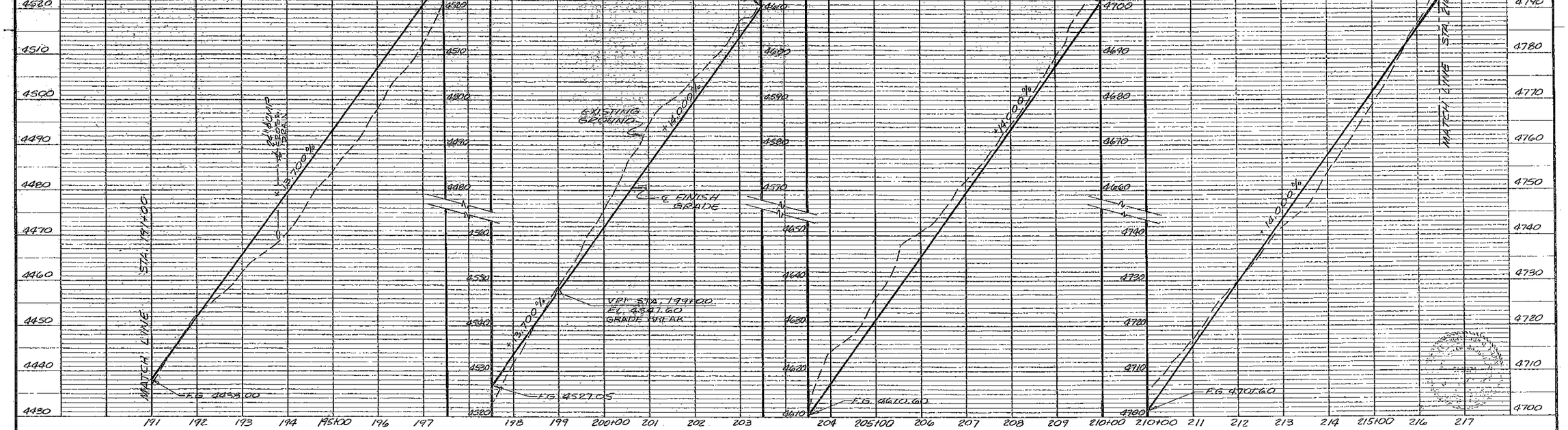
DRAWING 44-134-85738
REFERENCE DWGS

6-001



Sheet Summary of Earthwork Quantities (CY) - 10C-9
(See Typical Road Sections and Details Ref. Dwgs. 10C-12)

Road Surfacing and Earthwork Item	Quan. (CY)	Comments
Topsoil (Depth = 4")	1,880	Area = 3.52 acres
Cut Volumes a Unclassified a Rock	18,130	Cut slope @ 2:1
Fill Volume a Subgrd. Below Struc. Road Sec. a Safety Berms a Collision Berm	19,050 2,950 500	Fill slope @ 2 1/2:1
Surfacing Material a Base Course - 2" minus (8" depth) a Subbase Course - 4" minus (8" depth) a 8" Depth Compacted Fill	1,600 2,500 1,600	Linear feet of road surfacing = 2,550 ft



10-34-001	LOCATION PLAN & TITLE SHEET						
10-34-008	HAUL/ACCESS ROAD PLAN & PROFILE	# 7					
10-34-010	" " " " "	# 9					
10-34-012	" " "	TYP. SECT'S & DETAILS					
10-34-013	" " "	DRAINAGE DETAILS	#1				
10-34-014	" " " " "		#2				
10-34-015	EMERGENCY ESCAPE RAMP DETAILS						
DRAWING NO.	TITLE						

NO.	BY	DATE	CKD	DESCRIPTION
O	RJ	5/10/88	SKM	ISSUE FOR CONSTRUCTION BUL. D-001
E	RA	11-10-87	SKM	ISSUE FOR OWNER APPROVAL TL#009
D	KF	10-22-87	MLT	ISSUE FOR BID ADDENDUM #1 TL#007
C	RA	10-7-87	MLT	ISSUE FOR BID TL#006
B	GM	9-16-87	SKM	ISSUE FOR OWNER APPROVAL TL#005
A	RA	7-2-87	SKM	ISSUE FOR OWNER APPROVAL TL#003

DEPT \ REV	A	B	C	D	E	O
ARCH						
CIV/STRL	MLT	MLT	MLT	MLT	SKM	SKM
MECH						
ELECT						
INSTM						
PIPING						
SAFETY						
DEPT MGR						
PROJECT						

SCALE AS SHOWN	DATE
DRAWN BY KFF	6/87
DESIGNED BY MLT	6/87
CHECKED BY SKM	6/87
CLIENT APPROVALS	
REV / BY / DATE	

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON-KNUDSEN COMPANY

PLUESS-STAUFER (CALIFORNIA) INC.

WHITE KNOB / WHITE RIDGE PROJECT

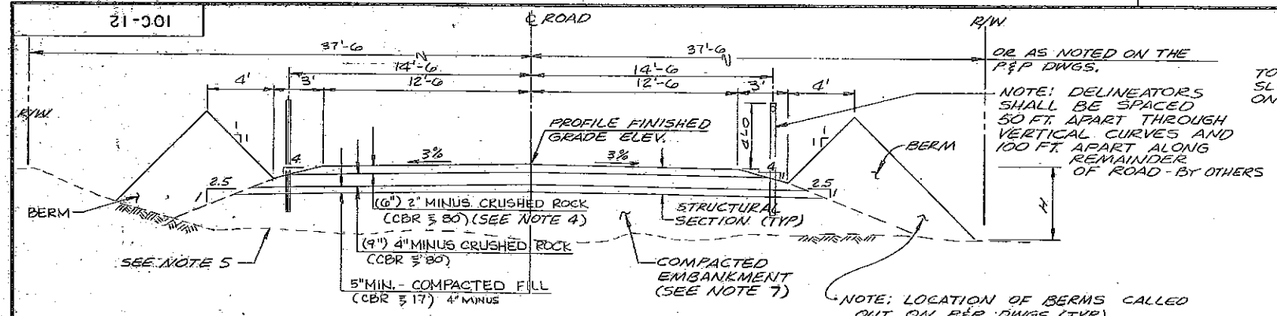
DRAWING TITLE
HAUL / ACCESS ROAD
PLAN & PROFILE # 8

CONTRACT NO. 1928 — 24 x 36

DRAWING NO. 10-34-009

REFERENCE NO. 10C-9 — REV O

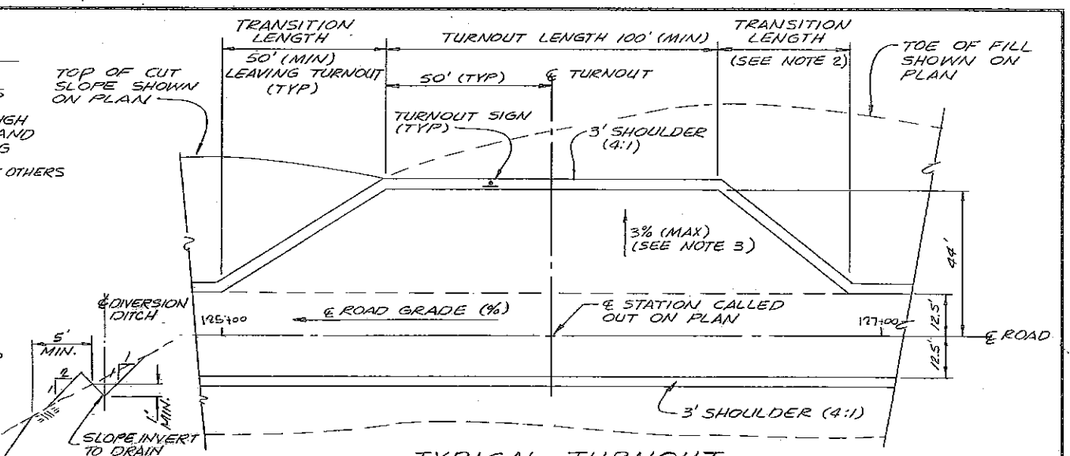
REFERENCE DWGS
BRUNING 44-132736



TYPICAL FILL SECTION

1/4" = 1'-0

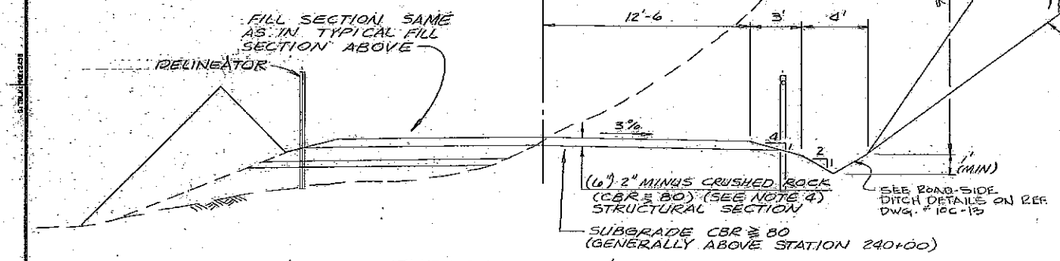
NOTE: LOCATION OF BERMS CALLED OUT ON P&P DWGS. (TYP) BERMS ARE REQUIRED ON FILLS WHERE H > 10' & ON DOWN HILL SIDE WHERE THE EXISTING GROUND CROSS-SLOPE IS CONSIDERED A SAFETY HAZARD



NOTE: DIVERSION DITCHES TO BE LOCATED WHERE SHOWN ON THE PLANS OR AS DETERMINED IN THE FIELD.

TYPICAL TURNOUT PLAN

NOT TO SCALE



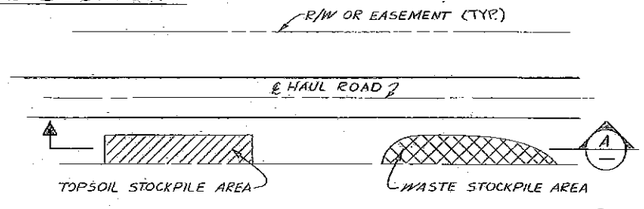
TYPICAL CUT/FILL SECTION

1/4" = 1'-0

SLOPE TABLE

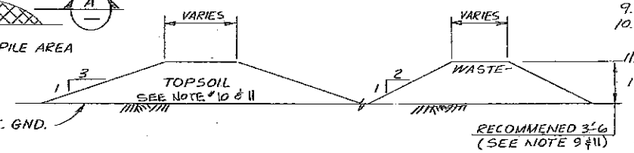
S	CUT SLOPE MATERIAL
1 (MIN)	ROCK CUTS IN FAULT ZONES OR HIGHLY FRACTURED ROCK
1.2	SIDE CUT SLOPE IN WELL CONSOLIDATED ALLUVIUM AND FAN GRAVELS
1.4	SIDE CUT SLOPE IN ROCK TALUS
2	SIDE CUT SLOPE IN LOOSE ALLUVIUM OR GRAVELS

NOTE: SEE THE SOILS REPORT NOTED ON DWG. 10C-1 FOR ADDITIONAL SOILS DATA.



PLAN

TYPICAL TOPSOIL/WASTE STOCKPILE



SECTION A

NTS

NOTES (CONTINUED)

12. THE QUANTITIES SHOWN ON THE P&P SHEET IS OUR BEST ESTIMATE BASED ON THE LIMITED SOILS DATA. THEREFORE, THESE QUANTITIES MAY VARY DURING THE ACTUAL CONSTRUCTION.

NOTES

1. SEE THE LOCATION OF TURNOUTS SHOWN ON THE PLAN VIEW OF THE P&P PROFILE SHEETS. THIS PLAN SHOWS THE TURNOUT ON THE LEFT SIDE OF THE ROAD (LOOKING UP STATION) THE TURNOUTS WILL BE CALLED OUT LEFT OR RIGHT AND WILL BE NUMBERED CONSECUTIVELY.
2. TRANSITION LENGTH TABLE:

℄ ROAD GRADE	TRANSITION ENTRANCE LENGTH
0% - 5%	50'
5% - 10%	100'
10% - 14%	200'

3. IF TURNOUT IS ON THE OUTSIDE OF A CURVE IN A SUPERELEVATION, THE 3% GRADE SHALL SLOPE THE OPPOSITE DIRECTION THAN AS SHOWN.
4. 3" OF QUARRY FINES MAY BE SUBSTITUTED FOR UPPER 1" OF CRUSHED ROCK.
5. ALL TOPSOIL IN THE ROAD SECTION AREA SHALL BE STRIPPED AND STOCKPILED (THICKNESS GENERALLY VARIES FROM 1" TO 6"; AVERAGE = 4").
6. ALL CRUSHED ROCK SHALL BE WELL GRADED.
7. THE OVERALL SIDE SLOPE (INCLINATION) OF THE NATURAL SOIL TO RECEIVE THE FILL (AFTER STRIPPING AND PREPARATION OF STEPPED BASE ON WHICH TO CONSTRUCT THE FILL) SHALL BE ≥ 20%.
8. CUT SLOPES IN COMPETENT ROCK SHOULD BE NO STEEPER THAN 0.7H:1.0V UNLESS OTHERWISE NOTED ON THE PROFILE AND APPROVED BY THE ENGINEER. HORIZONTAL BENCHES WITH A MINIMUM WIDTH OF 15' SHALL BE CONSTRUCTED AT MAXIMUM VERTICAL INTERVALS OF 90' MAXIMUM.
9. THE ENGINEER MAY VARY THE FILL SLOPES & WEIGHTS.
10. PERMANENT TOPSOIL STOCKPILES SHALL BE SEEDED & MULCHED BY OTHERS.
11. ALL TOPSOIL/WASTE AREAS TO BE GRADED TO DRAIN.
12. ROAD SURFACING SHALL BE BY OTHERS.

REGISTERED PROFESSIONAL ENGINEER — JOHN ALLEN KNUDSEN — C22870 — CIVIL — STATE OF CALIFORNIA

REFERENCE DWGS

DRAWING NO.	TITLE
10-34-002	HAUL/ACCESS ROAD PLAN & PROFILE
THRU -011	#1 THRU #10
10-34-013	HAUL/ACCESS ROAD DRAINAGE DET.
10-34-001	LOCATION PLAN & TITLE SHEET

REVISIONS

NO.	BY	DATE	CKD	DESCRIPTION
O	RJ	5/10/88	VK	ISSUE FOR CONSTRUCTION EWL. D-001
E	RA	11-10-87	SKM	ISSUE FOR OWNER APPROVAL TL#009
D	KF	10-22-87	MLT	ISSUE FOR BID ADDENDUM #1 TL#007
C	RA	10-7-87	MLT	ISSUE FOR BID TL#006
B	GM	9-16-87	SKM	ISSUE FOR OWNER APPROVAL TL#005
A	RA	7-2-87	SKM	ISSUE FOR OWNER APPROVAL TL#003

APPROVALS

DEPT / REV	A	B	C	D	E	O
ARCH						
CIV/STRL	MLT	MLT	MLT	MLT	SKM	EWL
MECH						
ELECT						
INSTM						
PIPING						
SAFETY						
SOILS						
DEPT MGR						
PROJECT						

SCALE	AS NOTED
DRAWN BY	KF / RA
DESIGNED BY	MLT
CHECKED BY	SKM
DATE	6-1-87 / 6-1-87 / 6-30-87

CLIENT APPROVALS

REV	BY	DATE

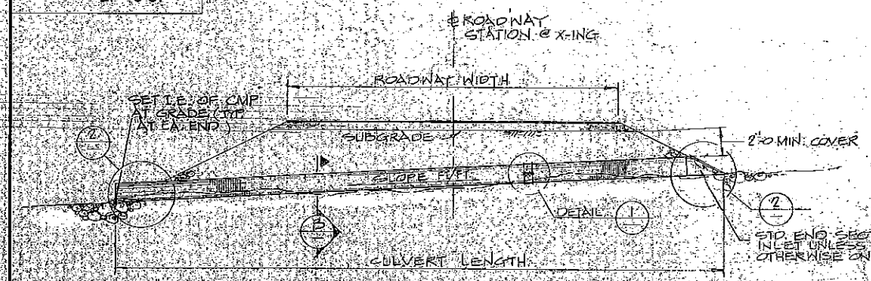
MORRISON-KNUDSEN ENGINEERS, INC. — A MORRISON-KNUDSEN COMPANY

PLUESS-STAUFER (CALIFORNIA) INC.

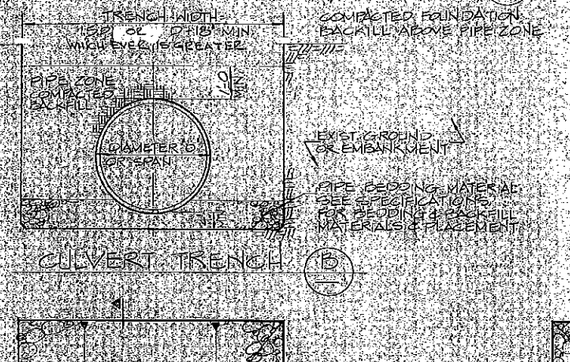
WHITE KNOB / WHITE RIDGE PROJECT

DRAWING TITLE: HAUL / ACCESS ROAD TYPICAL SECTIONS & DETAILS

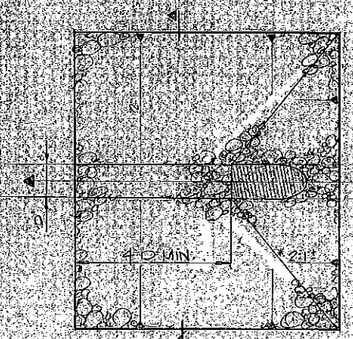
CONTRACT NO.	1928
	24 of 36
DRAWING NO.	10-34-012
REFERENCE NO.	10C-12
REV	O

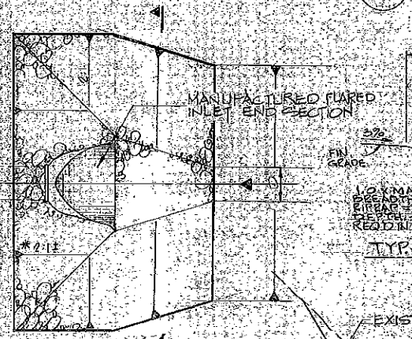


CULVERT SECTION (A)

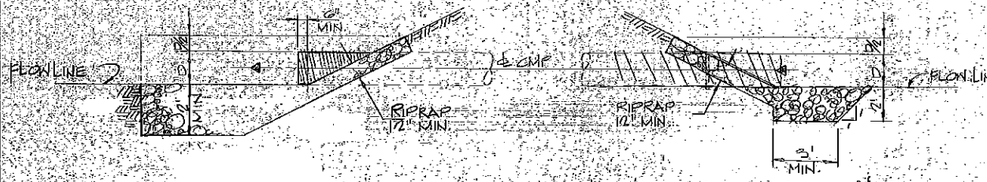


CULVERT TRENCH (B)



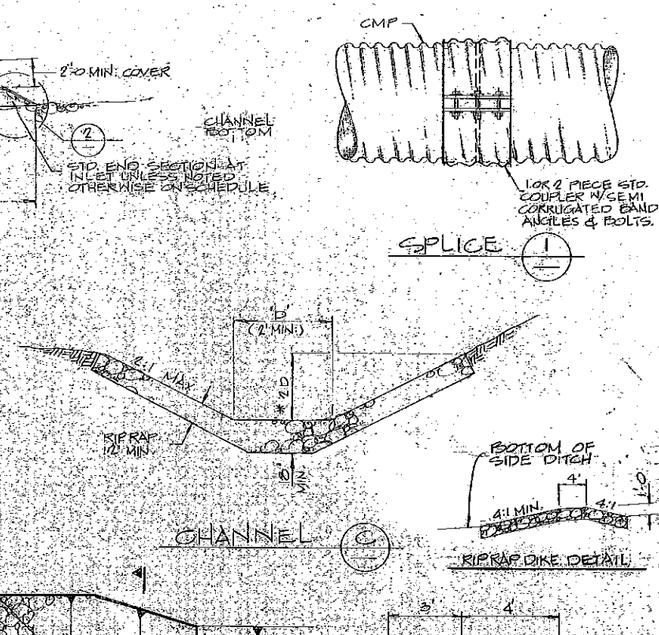


PLAN



SECTION ON ℄ CULVERT

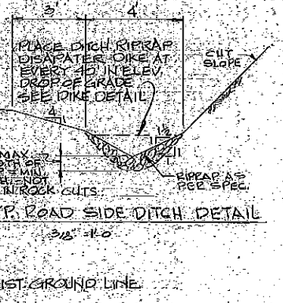
END TREATMENT (2)



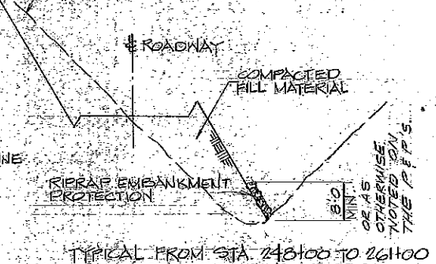
SPLICE (1)

CHANNEL (C)

RIPRAP DIKE DETAIL



TYP. ROAD SIDE DITCH DETAIL



TYPICAL FROM STA. 248+00 TO 261+00 OR AS REQUIRED BY FIELD CONDITIONS IN DRAINAGE AREAS

DETAIL (3) NTS.

DRAINAGE STRUCTURE TABLE

STA.	DRWG. REF.	CULVERT TYPE	SIZE (IN.)	LENGTH (FT.)	SLOPE (FT./FT.)	Q10 (a) (CFS)	GAGE	CORRUGATION	(1)(7) END SECTION	REMARKS
.0+00	10C-2	CMP	24"Φ	60'	0.071	40	14	2⅔ x ½"	FLARED INLET	
2+15	↓	↓	36"Φ	100'	0.071	50	14			
17+70			24"Φ	66'	0.083	20	16			
19+00			48"Φ	120'	0.091	90	12			
45+30	10C-3	CMP	24"Φ	150'	0.071	20	16			
49+35	↓	↓	36"Φ	96'	0.083	50	14			
54+35			36"Φ	70'	0.100	50	14			
57+75			48"Φ	70'	0.080	90	12			
62+30	10C-4	CMP	24"Φ	76'	0.080	20	16			
86+85	↓	↓	24"Φ	20'	0.080	—	16			18' LT. OF ℄
88+15			24"Φ	90'	0.118	20	16			
90+00	10C-5	CMP	24"Φ	92'	0.077	20	16			
141+55	10C-7	CMP	36"Φ	136'	0.133	50	14			
150+25	↓	↓	36"Φ	140'	0.111	50	14			
154+25			36"Φ	70'	0.125	50	14		FLARED INLET	
190+50	10C-8	CMP	36"Φ	100'	0.125	50	14		FLARED INLET	
192+20	↓	↓	84"Φ	190'	0.091	900	8		FLARED INLET	
193+80	10C-9	CMP	24"Φ	70'	0.100	20	16		FLARED INLET	
248+65	10C-10	CMP	24"Φ	70'	0.100	20	16		DROP INLET	SEE NOTE 6
259+55	10C-11	CMP	84"Φ	100'	0.250	700	8		FLARED INLET	

NOTES:
1. END SECTIONS SHALL BE MANUFACTURED GALVANIZED STEEL FLARED TYPE WITH END TOE PLATES AND CONNECTION FOR PIPE ENDS.
2. ALL CULVERTS SHALL BE PROVIDED WITH RIPRAP CHANNEL PROTECTION ON INLET AND OUTLET ENDS UNLESS NOTED OTHERWISE. SEE DETAILS THIS DRAWING.
3. SKEW ANGLES FOR CULVERTS SHALL MAINTAIN NATURAL EXISTING DRAINAGE CROSSINGS.
4. DITCHES THAT ARE IN ALLUVIAL DEPOSITS SHALL BE RIPRAPED. SEE SECTION C THIS DWG.
5. HYDROLOGIC DESIGN STORM BASIS = 10 YR - 24 HOUR STORM EVENT.
6. FOR DROP INLET DETAILS, SEE DRWG. 10C-14.
7. FOR ADDITIONAL NOTES, SEE DRWG. 10C-1.
8. FOR CORRUGATED METAL PIPE (CMP) CULVERTS, SEE SPEC. 34-0227.
9. FOR RIP RAP, SEE SPEC. 34-0243.
10. FIELD LOCATE INVERT ELEVATIONS TO MATCH EXISTING FLOW LINE.

REGISTERED PROFESSIONAL ENGINEER — JOE ALLEN BAUGHMAN — C22874 — CIVIL — STATE OF CALIFORNIA — 5-10-88

REVISIONS					DESCRIPTION
12	RJ	5/10/88	MH		ISSUE FOR CONSTRUCTION BUL. 0.001
11	RA		MH		ISSUE FOR OWNER APPROVAL TL#009
10	KE	10-22-87	MH		ISSUE FOR BID ADDENDUM #1 TL#007
9	RA	10-7-87	MH		ISSUE FOR BID TL#006
8	GM	9-16-87	MH		ISSUE FOR OWNER APPROVAL TL#005
7	KA	7-2-87	MH		ISSUE FOR OWNER APPROVAL TL#003
NO.	BY	DATE	CKD		DESCRIPTION

DRAWING NO. | TITLE

APPROVALS	REV	A	B	C	D	E	O
DEPT	ARCH						
CIV/STRL		MH	MH	MH	MH	SKM	SKM
MECH							
ELECT.							
INSTN							
PIPING							
SAFETY							
DEPT MGR							
PROJECT							

SCALE	NONE
DRAWN BY	RJHJ
DESIGNED BY	SKM
CHECKED BY	MLT
DATE	JUNE '87

CLIENT APPROVALS

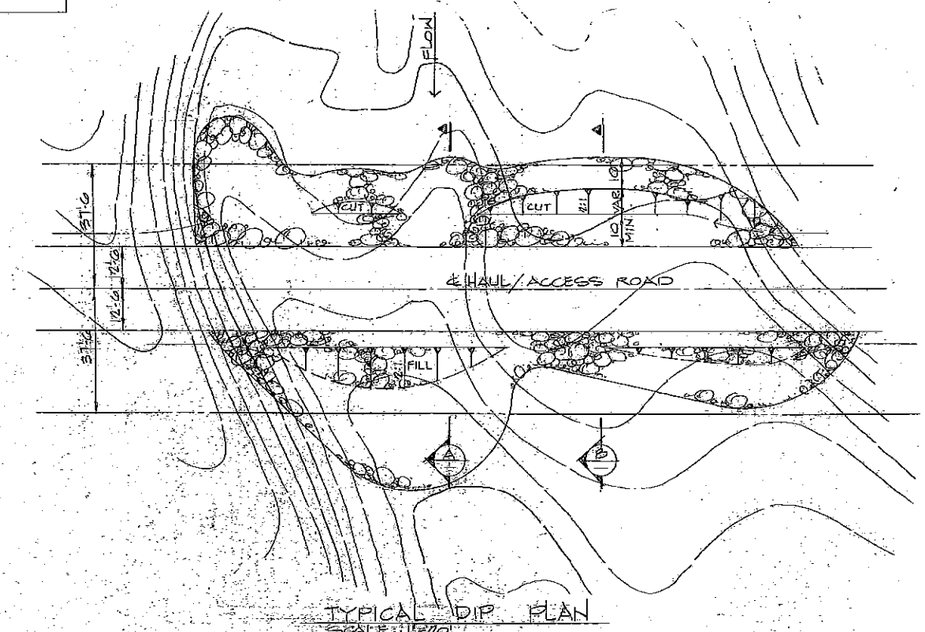
REV.	BY	DATE

MORRISON-KNUDSEN COMPANY, INC.

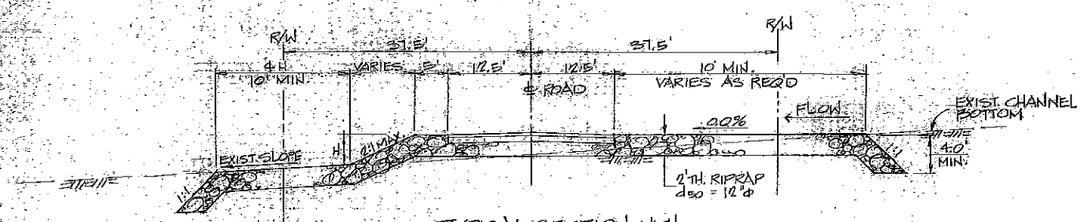
PLUESS-STAUFER (CALIFORNIA) INC.
WHITE KNOB / WHITE RIDGE PROJECT

DRAWING TITLE
HAUL / ACCESS ROAD
CULVERT DETAILS & SCHEDULE

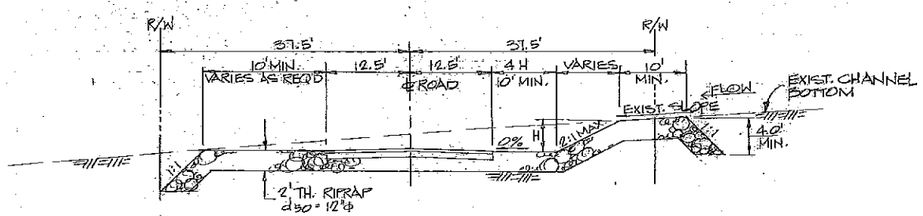
CONTRACT NO. 1928 | 24 JI 36
DRAWING NO. 10-34-013
REFERENCE NO. 10C-13 | REV O



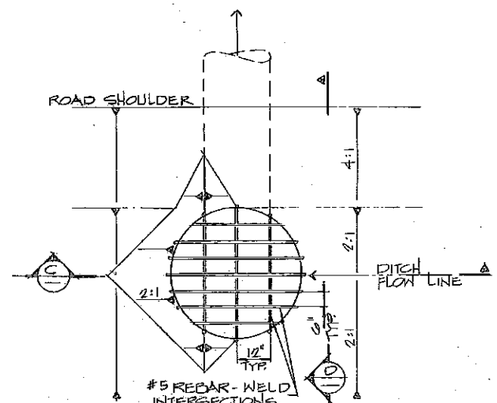
TYPICAL DIP PLAN
SCALE: 1"=20'



TYPICAL SECTION WITH
ROAD PROFILE ABOVE CHANNEL BOTTOM
SCALE: 1"=10'

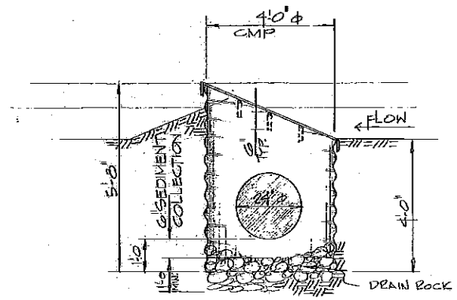


TYPICAL SECTION WITH
ROAD PROFILE BELOW CHANNEL BOTTOM
SCALE: 1"=10'

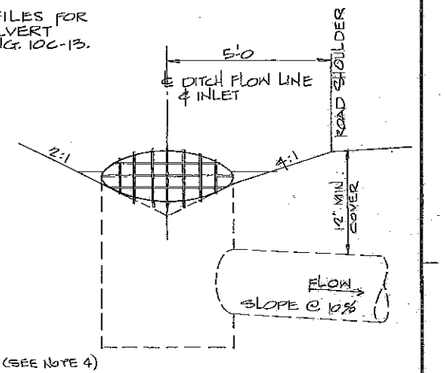


PLAN

SEE PLAN & PROFILES FOR LOCATIONS & CULVERT SCHEDULE ON DWG. 10C-13.



SECTION C



SECTION D

TYPICAL DROP INLET DETAIL
SCALE: 1/2"=1'-0

NOTES:
1. SEE RIPRAP SPECIFICATION 34-0243 FOR CLASSIFICATIONS AT DIPS.
2. DRAIN ROCK SHALL CONSIST OF HARD, DURABLE, PERMEABLE, CLEAN SAND AND RIVER ROCK FREE FROM ORGANIC MATERIAL, CLAY BALLS, OR OTHER DELETERIOUS SUBSTANCES. GRADATION SHALL BE AS FOLLOWS:

US SIEVE OR SCREEN SIZE	PERCENT PASSING
2"	100
No 4	0-15

REGISTERED PROFESSIONAL ENGINEER — JOHN ALLEN SHELTON — C23674 — STATE OF CALIFORNIA

REFERENCE DWGS.

DRAWING NO.	TITLE

REVISIONS

NO.	BY	DATE	CKD	DESCRIPTION
G	RJJ	5/10/88	MLT	ISSUE FOR CONSTRUCTION BUL. D-001
E	RA	11-10-87	MM	ISSUE FOR OWNER APPROVAL TL# 009
D	KF	10-22-87	MM	ISSUE FOR BID ADDENDUM #1 TL#- 007
C	RA	10-7-87	MLT	ISSUE FOR BID TL #006
B	GM	9-16-87	MM	ISSUE FOR OWNER APPROVAL TL# 005
A	RA	7-2-87	MM	ISSUE FOR OWNER APPROVAL TL# 003

APPROVALS

DEPT \ REV	A	B	C	D	E	G
ARCH						
CIV/STRL	MM	MM	MM	MM	SMK	SMK
MECH						
ELECT.						
INSTM						
PIPING						
SAFETY						
DEPT. MGR		9/11	9/6	9/8	9/5	10/11
PROJECT	9/0	9/11	9/6	9/8	9/5	10/11

SCALE AS NOTED	DATE
DRAWN BY RJJJ	JUNE '87
DESIGNED BY S.M.	JUNE '87
CHECKED BY MLT	JUNE '87

CLIENT APPROVALS

REV	BY	DATE

MORRISON-KNUDSEN ENGINEERS, INC.
A MORRISON-KNUDSEN COMPANY

PLUESS-STAUFER (CALIFORNIA) INC.
WHITE KNOB / WHITE RIDGE PROJECT
DRAWING TITLE
HAUL / ACCESS ROAD
DRAINAGE DETAILS

CONTRACT NO. 1928 — 24 H 36
DRAWING NO. 10-34-014
REFERENCE NO. 10C-14 — REV O

Appendix G – Culvert Riprap Calculations

Several relationships have been proposed for riprap sizing for culvert aprons and several of these are discussed in greater detail in Appendix D. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g. diameter), outlet Froude number, and tailwater. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

Whenever the flow is supercritical in the culvert, the culvert diameter is adjusted as follows:

$$D' = \frac{D + y_n}{2} \qquad (10.5)$$

where,

- D' = adjusted culvert rise, m (ft)
- y_n = normal (supercritical) depth in the culvert, m (ft)

Equation 10.4 assumes that the rock specific gravity is 2.65. If the actual specific gravity differs significantly from this value, the D_{50} should be adjusted inversely to specific gravity.

White Knob Haul Road
Riprap Apron Design
Method from HEC 14 by FHWA

Station 17+70

Q	20	cfs
D	2	Ft
TW	0.8	Ft
Froude	1.29	
Yn	1.38	Ft
D'	1.69	
D_{50}	0.67	

Use Class 3 Apron.
Apron Length = 5D = 10 Ft.

Station 19+00

Q	90	cfs
D	4	Ft
TW	1.6	Ft
Froude	1.94	
Yn	1.91	Ft
D'	2.955	
D_{50}	1.17	

Use Class 4 Apron.
Apron Length = 6D = 24 Ft.

Station 43+50

Q	20	cfs
D	2	Ft
TW	0.8	Ft
Froude	1.26	
Yn	1.41	Ft
D'	1.705	
D_{50}	0.66	

Use Class 3 Apron.
Apron Length = 5D = 10 Ft.

Station 49+35

Q	50	cfs
D	3	Ft
TW	1.2	Ft
Froude	1.79	
Yn	0.76	Ft
D'	1.88	
D_{50}	1.31	

Use Class 5 Apron.
Apron Length = 7D = 21 Ft.

Station 54+35

Q	50	cfs
D	3	Ft
TW	1.2	Ft
Froude	1.7	
Yn	1.43	Ft
D'	2.215	
D_{50}	1.05	

Use Class 4 Apron.
Apron Length = 6D = 18 Ft.

Station 57+75

Q	90	cfs
D	4	Ft
TW	1.6	Ft
Froude	1.08	
Yn	2.69	Ft
D'	3.345	
D_{50}	1.00	

Use Class 4 Apron.
Apron Length = 6D = 24 Ft.

White Knob Haul Road
Riprap Apron Design
Method from HEC 14 by FHWA

Station 62+30

Q	20	cfs
D	2	Ft
TW	0.8	Ft
Froude	1.39	
Yn	1.32	Ft
D'	1.66	
D_{50}	0.68	

Use Class 3 Apron.
Apron Length = 5D = 10 Ft.

Station 88+15

Q	20	cfs
D	2	Ft
TW	0.8	Ft
Froude	1.71	
Yn	1.17	Ft
D'	1.585	
D_{50}	0.73	

Use Class 3 Apron.
Apron Length = 5D = 10 Ft.

Station 90+00

Q	20	cfs
D	2	Ft
TW	0.8	Ft
Froude	1.61	
Yn	1.21	Ft
D'	1.605	
D_{50}	0.71	

Use Class 3 Apron.
Apron Length = 5D = 10 Ft.

Station 144+70

Q	37.9	cfs
D	3	Ft
TW	1.2	Ft
Froude	2.72	
Yn	1.1	Ft
D'	2.05	
D_{50}	0.80	

Use Class 3 Apron.
Apron Length = 5D = 15 Ft.

White Knob Haul Road
Riprap Apron Design
Method from HEC 14 by FHWA

Station 150+40

Q	48	cfs
D	3	Ft
TW	1.2	Ft
Froude	2.34	
Yn	1.36	Ft
D'	2.18	
D_{50}	1.02	

Use Class 4 Apron.
Apron Length = 6D = 18 Ft.

Station 154+20

Q	104.8	cfs
D	3	Ft
TW	1.2	Ft
Froude	2.82	
Yn	1.62	Ft
D'	2.31	
D_{50}	2.66	

Use Class 6 Apron.
Apron Length = 8D = 24 Ft.

Station 170+50

Q	86.9	cfs
D	3	Ft
TW	1.2	Ft
Froude	2.53	
Yn	1.82	Ft
D'	2.41	
D_{50}	1.96	

Use Class 6 Apron.
Apron Length = 8D = 24 Ft.

Station 182+00

Q	262.8	cfs
D	7	Ft
TW	2.8	Ft
Froude	3.16	
Yn	2.15	Ft
D'	4.575	
D_{50}	1.56	

Use Class 5 Apron.
Apron Length = 7D = 49 Ft.

Appendix H – Proposed Right Of Way Maps

PROPOSED RIGHT OF WAY

PROPOSED RIGHT OF WAY

SEE SHEET NO. 2

1033 OUTLET
4001.93 (TOP)
3997.83 (INV)

1035 OUTLET
3996.62 (TOP)
3994.62 (INV)

1032 INLET
4008.89 (TOP)
4004.79 (INV)

1034 INLET
3999.61 (TOP)
3997.61 (INV)

PI = 25+34.90

PC = 0+00.00

PT = 3+62.11

PRC = 1+84.67

E 6,877,500
E 6,878,000
E 6,878,500
E 6,879,000
E 6,879,500
E 6,880,000
N 1,963,500
N 1,962,500

HV-8
3958.37

INDEX MAP
NOT TO SCALE

SCALE: 1" = 100'

GRAPHIC SCALE
100 0 50 100 200 400
(IN FEET)
1 inch = 100 ft.

NO.	DATE	REVISIONS

DESIGNED BY:
DRAFTED BY:
CHECKED BY:
DATE:

PREPARED UNDER THE SUPERVISION OF:

NAME DATE

STANTEC CONSULTING INC.
19 TECHNOLOGY DRIVE
IRVINE, CA 92618
949.923.6000
stantec.com

WHITE KNOB HAUL ROAD
RIGHT OF WAY
FROM STA 0+00 TO STA 30+00

PROJECT NO.
2042484500

SHEET 1
OF 7

DRAWING: v:\projects\2042484500\dwg\prsd0002.dwg PLOTTED: 8/12/2011 3:04 PM BY: Carey, Paul

SEE SHEET NO. 2

SEE SHEET NO. 1

PROPOSED RIGHT OF WAY

PROPOSED RIGHT OF WAY

1023 OUTLET
4122.42 (TOP)
4120.32 (INV)

1025 OUTLET
4133.23 (TOP)
4129.03 (INV)

1027 OUTLET
4133.86 (TOP)
4131.86 (INV)

1029 OUTLET
4131.34 (TOP)
4128.34 (INV)

1031 OUTLET
4112.19 (TOP)
4110.19 (INV)

1022 INLET
4125.68 (TOP)
4123.68 (INV)

1024 INLET
4134.62 (TOP)
4130.52 (INV)

1026 INLET
4138.92 (TOP)
4135.57 (INV)

1028 INLET
4137.26 (TOP)
4134.16 (INV)

1030 INLET
4117.89 (TOP)
4115.79 (INV)

PI = 474+47.53

E 6,874,000
E 6,874,500
E 6,875,000
E 6,875,500
E 6,876,000
E 6,876,500
E 6,877,000

INDEX MAP
NOT TO SCALE

SCALE: 1" = 100'

GRAPHIC SCALE
100 0 50 100 200 400
(IN FEET)
1 inch = 100 ft.

NO.	DATE	REVISIONS

DESIGNED BY:
DRAFTED BY:
CHECKED BY:
DATE:

PREPARED UNDER THE SUPERVISION OF:

NAME DATE

Stantec
STANTEC CONSULTING INC.
19 TECHNOLOGY DRIVE
IRVINE, CA 92618
949.923.6000
stantec.com

WHITE KNOB HAUL ROAD
RIGHT OF WAY
FROM STA 30+00 TO STA 62+00

PROJECT NO. 2042484500

SHEET 2 OF 7

SEE SHEET NO. 4

SEE SHEET NO. 2

PROPOSED RIGHT OF WAY

PROPOSED RIGHT OF WAY

1021 OUTLET
4129.13 (TOP)
4127.13 (INV)

1019 OUTLET
4136.57 (TOP)
4134.57 (INV)

1018 INLET
4141.85 (TOP)
4139.85 (INV)

1020 INLET
4139.90 (TOP)
4137.90 (INV)

1023 OUT
4122.42
4120.32

P.I. 73+78.56

PLC 01-0027

PLC 01-0028

INDEX MAP
NOT TO SCALE

SCALE: 1" = 100'

GRAPHIC SCALE
100 0 50 100 200 400
(IN FEET)
1 inch = 100 ft.

NO.	DATE	REVISIONS	DESIGNED BY:		DRAFTED BY:		CHECKED BY:		DATE:	

PREPARED UNDER THE SUPERVISION OF:

NAME DATE

Stantec
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19 TECHNOLOGY DRIVE
IRVINE, CA 92618
949.923.6000
stantec.com

WHITE KNOB HAUL ROAD
RIGHT OF WAY
FROM STA 62+00 TO STA 94+00

PROJECT NO. 2042484500

SHEET 3 OF 7

DRAWING: v:\projects\2042484500\dwg\prsd0004.dwg PLOTTED: 8/12/2011 3:31 PM BY: Carey, Paul

PROPOSED RIGHT OF WAY

PROPOSED RIGHT OF WAY

SEE SHEET NO. 3

SEE SHEET NO. 5

PC = 117+08.13

PT = 102+92.61

PC = 98+84.55

PT = 100+83.10

PLC 01-D025

PLC 01-D026

N 1,963,000

E 6,868,000

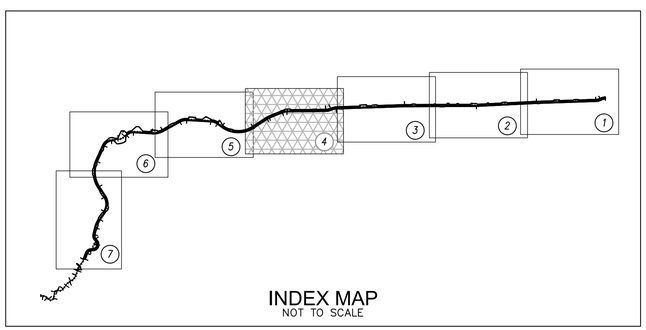
E 6,868,500

E 6,869,000

E 6,869,500

E 6,870,000

E 6,870,500



INDEX MAP
NOT TO SCALE

SCALE: 1" = 100'

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

NO.	DATE	REVISIONS

DESIGNED BY:
DRAFTED BY:
CHECKED BY:
DATE:

PREPARED UNDER THE SUPERVISION OF:

NAME DATE

Stantec

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19 TECHNOLOGY DRIVE
IRVINE, CA 92618
949.923.6000
stantec.com

WHITE KNOB HAUL ROAD
RIGHT OF WAY
FROM STA 94+00 TO STA 127+00

PROJECT NO. 2042484500

SHEET 4 OF 7

DRAWING: v:\projects\2042484500\dwg\grsd0005.dwg PLOTTED: 8/12/2011 3:33 PM BY: Carey, Paul

SEE SHEET NO. 6

SEE SHEET NO. 4

PROPOSED RIGHT OF WAY

1005 OUTLET
4119.44 (TOP)
4116.34 (INV)

1004 INLET
4131.16 (TOP)
4128.06 (INV)

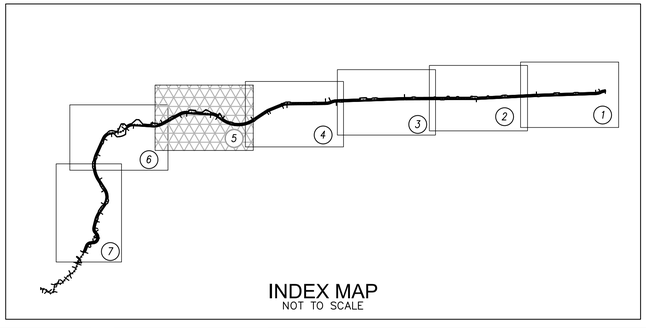
1006 INLET
4113.66 (TOP)
4110.56 (INV)

1007 OUTLET
4093.44 (TOP)
4090.34 (INV)

1008 INLET
4109.37 (TOP)
4106.27 (INV)

1009 OUTLET
4091.54 (TOP)
4088.54 (INV)

PROPOSED RIGHT OF WAY



INDEX MAP
NOT TO SCALE

SCALE: 1" = 100'

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

NO.	DATE	REVISIONS

DESIGNED BY:
DRAFTED BY:
CHECKED BY:
DATE:

PREPARED UNDER THE SUPERVISION OF:

NAME DATE

STANTEC CONSULTING INC.
19 TECHNOLOGY DRIVE
IRVINE, CA 92618
949.923.6000
stantec.com

WHITE KNOB HAUL ROAD
RIGHT OF WAY
FROM STA 127+00 TO STA 162+00

PROJECT NO. 2042484500

SHEET 5 OF 7

DRAWING: v:\projects\2042484500\dwg\prsd0006.dwg PLOTTED: 8/12/2011 3:34 PM BY: Carey, Paul

PROPOSED RIGHT OF WAY

PROPOSED RIGHT OF WAY

1001 OUTLET
4286.13 (TOP)
4278.92 (INV)

1000 INLET
4326.46 (TOP)
4319.16 (INV)

1002 INLET
4289.09 (TOP)
4285.98 (INV)

1003 OUTLET
4272.65 (TOP)
4269.55 (INV)

1010 OUTLET
4469.31 (INV)

1011 INLET
4474.25 (INV)

1012 OUTLET
4475.08 (INV)

1013 INLET
4476.44 (INV)

1014 OUTLET
4551.33 (INV)

1015 INLET
4555.08 (INV)

1016 OUTLET
4556.06 (INV)

1017 INLET
4557.10 (INV)

PC = 1864+36.19

PC = 1771+30.89

PT = 1833+43.43

PT = 1809+85.54

PC = 1815+56

PT = 1901+08.84

PT = 1748+48.43

PC = 1664+84.29

SEE SHEET NO. 5

SEE SHEET NO. 7

INDEX MAP
NOT TO SCALE

SCALE: 1" = 100'

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

NO.	DATE	REVISIONS

DESIGNED BY:
DRAFTED BY:
CHECKED BY:
DATE:

PREPARED UNDER THE SUPERVISION OF:

NAME DATE

Stantec

STANTEC CONSULTING INC.
19 TECHNOLOGY DRIVE
IRVINE, CA 92618
949.923.6000
stantec.com

WHITE KNOB HAUL ROAD
RIGHT OF WAY
FROM STA 162+00 TO STA 200+00

PROJECT NO. 2042484500

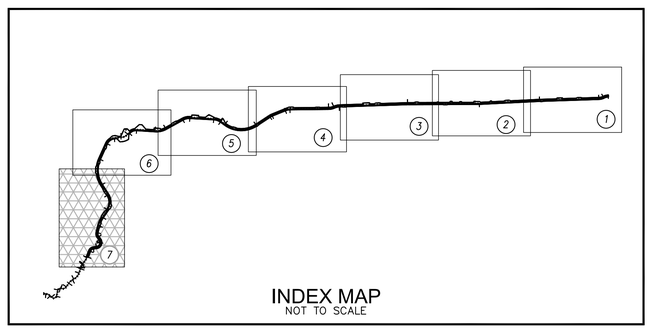
SHEET 6 OF 7

DRAWING: v:\projects\2042484500\dwg\prsd0007.dwg PLOTTED: 8/12/2011 3:36 PM BY: Carey, Paul

PROPOSED RIGHT OF WAY

PROPOSED RIGHT OF WAY

SEE SHEET NO. 6



INDEX MAP
NOT TO SCALE

SCALE: 1"= 100'

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

NO.	DATE	REVISIONS

DESIGNED BY:
DRAFTED BY:
CHECKED BY:
DATE:

PREPARED UNDER THE SUPERVISION OF:

NAME DATE

STANTEC CONSULTING INC.
19 TECHNOLOGY DRIVE
IRVINE, CA 92618
949.923.6000
stantec.com

WHITE KNOB HAUL ROAD
RIGHT OF WAY
FROM STA 200+00 TO STA 237+84

PROJECT NO.
2042484500

SHEET 7
OF 7

DRAWING: v:\projects\2042484500\dwg\prs6008.dwg PLOTTED: 8/12/2011 3:38 PM BY: Carey, Paul

Appendix I – 1988 Amendment of Right of Way Grant

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Barstow Resource Area
150 Coolwater Lane
Barstow, CA 92311
(619) 256-3591

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:
CA-16644
2800 (CA-068.22)

JUL 15 1988

DECISION

Pluess-Staufer (California) Inc. :
P.O. Box 825 : Right-of-Way CA-16644
Lucerne Valley, CA 92356

Amendment of Right-of-Way Grant Approved
Rental Rate Adjusted

On December 31, 1985, right-of-way CA-16644 was granted to Pluess-Staufer (California) Inc., for a 25 year term, for construction, use, and maintenance of the "White Knob" mine access/haul road across public lands near Lucerne Valley, California. The right-of-way was granted pursuant to Title V of the Act of October 21, 1976 (43 U.S.C. 1761) for a strip of land 75 feet wide and approximately 23,200 feet long within Sections 2 through 5, T.3N., R.1W., SBM, as shown on the right-of-way map filed October 18, 1985. The right-of-way contains 39.98 acres, more or less.

On October 22, 1987, Pluess-Staufer (California) Inc. filed an application to amend the right-of-way for a realignment of the roadway, and addition of a 660 foot by 660 foot construction/maintenance yard within Section 2, T.3N., R.1W., SBM. Revised right-of-way maps were filed on April 13, 1988 and June 3, 1988.

A favorable field report concerning the Pluess-Staufer (California) Inc. application has been approved. Accordingly, right-of-way amendment CA-16644 is approved pursuant to Title V of the Act of October 21, 1976, Supra, subject to the terms and conditions identified below. The Holder's revised right-of-way maps filed April 13, 1988 and June 3, 1988 supersede the original right-of-way map filed October 18, 1985. The amended right-of-way contains 66.88 acres, more or less, and is described in Exhibit C, attached to and made a part of the grant.

The rental provisions in Section B.9. of this grant are hereby amended to read as follows:

In consideration for these uses, the Holder shall pay to the Bureau of Land Management rental in the sum of eight-hundred twenty-five dollars ($825.00) for the period from December 31, 1985 through December 31, 1988. Thereafter, an annual rental payment, calculated in accordance with the linear right-of-way fee schedule in 43 CFR 2803.1-2, shall be paid in advance of each calendar year. Rental charges may be made or readjusted whenever necessary to place the charges on the basis of fair market value for the uses authorized under this grant. This right-of-way is not in force unless the Holder has paid the annual rental in advance. That portion of the right-of-way between Stations 154.00 and 245.00 (9,100 feet by variable width averaging 125 feet; 25.113 acres) is not subject to rental as long as a possessory interest in the surface is maintained by pre-P.L. 167 mining claim locator(s).

Stipulation 1 in Exhibit B of the grant is amended to read as follows:

The BLM Authorized Officer for the administration of this grant is the Area Manager, Barstow Resource Area, 150 Coolwater Lane, Barstow, CA 92311.

All other existing grant terms and conditions in the original grant remain in effect.

You have the right of appeal to the Board of Land Appeals, Office of the Secretary, in accordance with the regulations contained in 43 CFR Part 4 and the enclosed Form 1842-1. If an appeal is taken, your Notice of Appeal must be filed in this office so that the case file can be promptly transmitted to the Board. A copy of the Notice of Appeal and of any statement of reasons, written arguments, or briefs must be served on the Regional Solicitor, Pacific Southwest Region, U.S. Department of the Interior, 2800 Cottage Way, Room E-2753, Sacramento, California 95825 within 15 days of the filing of any such document. If the procedures set forth in the regulations are not followed, an appeal is subject to dismissal.

Alden Sievers
Area Manager

Enclosures: Form 1842-1
Exhibit C

CA-16644
2800 (CA-068.22)

EXHIBIT C

Amended R/W Description and Acreage

Access/Haul Road

Sta. 0.00-Sta. 117.00	11,700 ft x 75 ft wide	20.145 ac.
Sta. 117.00-Sta. 245.00	12,800 ft x variable width (average 125 feet)	36.731 ac.
Construction/Maintenance Yard	660 ft x 660 ft	10.000 ac.
Total Right-of-Way Area		66.876 ac.

Technical Memorandum

White Knob Quarry and Haul Road

Stantec

Prepared for:
OMYA, Incorporated

Prepared by:
Stantec Consulting Services Inc.

September 12, 2013

1.0 Introduction and Purpose

Omya Incorporated operates a calcium carbonate mining and processing operation in San Bernardino County, south of the town of Lucerne Valley. Omya's plant is on Crystal Creek Road approximately 4 miles south of State Highway 18. The White Knob Quarry, where calcium carbonate is mined, is southwest of the plant in the San Bernardino National Forest. The haul road to bring materials mined at the White Knob Quarry to the plant is 5.1 miles long, going westerly from the plant for approximately 3.5 miles then turning southerly to climb at a 14% grade up to the quarry site. Once in the quarry, the access road varies in grade from 12% to 18%.

The first 4.4 miles of the haul road crosses land managed by the US Department of Interior, Bureau of Land Management (BLM). Use and occupation of the haul road is authorized under a Federal Land Policy Management Act (FLPMA) right-of-way. On April 20, 2011 a Settlement Agreement was entered into by and between BLM and Omya regarding Omya's activities at the White Knob Quarry.

Stantec Consulting prepared a Drainage Report and Plan of Development in August 2011 to analyze the existing drainage conditions at the quarry and along the haul road and provide recommendations for facilities to control stormwater and sediment runoff and provide protection for the surrounding drainages. This report was intended to specifically comply with items 15 through 17 of part B of the agreement.

Subsequently, Omya is applying for permits to cover approximately the next 40 years of their operation at the White Knob Quarry. As part of this application effort, Omya has retained the services of PMC to prepare an Environmental Impact Report for the quarry and haul road. The intent of this Technical Memorandum is to support PMC in their preparation of that EIR. Specifically, there are three areas of further investigation to be explored in this Technical Memorandum:

1. The previous report utilized a 50-year, 24-hour storm event for design of the sedimentation basins, and a 10-year return storm for culvert and riprap design. SMARA CCR 3706(d) requires that erosion control measures be designed for not less than a 20-year, 1-hour intensity storm. The design of the sedimentation basins exceeds this requirement, but it could be argued that the design of the haul road culverts and outlet riprap aprons should be designed for a 20-year storm. This technical memo will investigate the adequacy of the existing culverts and proposed riprap aprons in light of the 20-year storm.

2. The Soils map in Figure 3 of Stantec's 2011 Drainage Report and Plan of Development will be compared to the 2008 report on Soil Resources by Webber and Webber Mining Consultants. This comparison will determine if there is any correlation or conflicts between the reports.

3. DCI prepared a report titled: Sedimentation and Erosion Monitoring, 2011–2012 Reporting Period dated July 2012. The reported sedimentation volumes from this report will be compared to Stantec's 2011 Drainage Report and Plan of Development predicted sedimentation values to see if there is any correlation or conflict.

2.0 20-Year Return Flow Calculations

2.1 BACKGROUND

As mentioned above, SMARA CCR 3706(d) requires that erosion control measures be designed for not less than a 20-year, 1-hour intensity storm. Specifically, section 3706(d) reads:

(d) Surface runoff and drainage from surface mining activities shall be controlled by berms, silt fences, sediment ponds, revegetation, hay bales, or other erosion control measures, to ensure that surrounding land and water resources are protected from erosion, gullying, sedimentation and contamination. Erosion control methods shall be designed to handle runoff from not less than the 20 year/l hour intensity storm event.

This designation, with a return frequency and a time designation, is generally useful for sizing volumetric measures, such as sedimentation basins. Culverts and riprap aprons are generally based on peak flows, with the intensity of the storm used for design based on the size and configuration of the tributary area. Generally speaking, for smaller tributary areas, the time of concentration is also smaller, with a corresponding higher intensity storm to be used for peak flow determination.

From the previous design report, the lowest intensity used for the 10-year flow design was 1.551 inches per hour for a 34 minute time of concentration. While NOAA does not report intensities for a 20-year 1-hour storm, this intensity would be somewhere between the reported 10-year 1-hour storm of 0.745 inches and the 25-year, 1-hour storm of 0.944. An estimate of approximately 0.9 inches per hour for a 20-year, 1-hour storm in this location would be appropriate. In other words, the design storm with a 10-year frequency for determining peak flows in the drainages looked at in the previous report has a higher intensity than the 20-year, 1-hour storm event required by SMARA. Therefore, we will investigate the 20-year return frequency peak flow to check the capacity of the existing culverts and adequacy of the previous riprap design.

The previous report investigated flow conditions at 14 corrugated metal pipe (CMP) culverts ranging in size from 24” to 84”. For the five culverts closest to the quarry, full hydrology calculations were prepared, determining flows for the 2-year, 10-year, 25-year, and 100-year return storms. The other nine culverts are in minor drainages on an alluvial fan, where drainage basins are difficult to determine, and are subject to change with each major storm event. The previous report mentioned that these culverts have been in place for 24 years, with no capacity problems identified. Because of that, the 10-year flows identified on the haul road improvement plans prepared in 1987 by Morrison Knudsen Engineers were accepted for design of the riprap outlet protection.

2.2 20-YEAR HYDROLOGY METHOD

Given that NOAA does not publish rainfall data for 20-year return frequency storms, and roughly 2/3 of the culvert locations were not designed based on traditional hydrology calculations, an alternative method of determining a 20-year peak flow at each location will be used. We will determine the 20-year flow at a

few representative locations where we had previous hydrology calculations, then determine a factor to be applied against the previous 10-year flow rates to arrive at 20-year design flows at all locations.

To determine predicted flow frequencies at a location with a stream gauge and adequate historical flow data, a log-Pearson type III distribution is typically utilized. For this distribution, the flows of record are ranked and given a plotting position based on the total years of record. These flows are then plotted on log-normal probability paper from which the desired return frequencies can be determined graphically.

To determine 20-year return flows, we can use a similar process, but with calculated flows rather than gauged flows. The 2-year, 10-year, 25-year, and 100-year flows for three representative locations were plotted on log-normal probability paper using the inverse of the return frequency for the storm probability (2-year storm has a probability of 50%; a 25-year storm has a probability of 4%, etc.). For this exercise, we chose the following three locations from the previous drainage report:

Node	Description	Tributary Area (Ac)	2-year Flow (cfs)	10-year Flow (cfs)	25-year Flow (cfs)	100-year Flow (cfs)
30	Culvert Crossing at Station 144+70	14.26	14.8	28.6	37.9	57.1
230	Culvert Crossing at Station 154+20	59.56	35.2	76.6	104.8	167.4
465	Culvert Crossing at Station 182+00	191.37	128.0	262.8	358.6	559.8

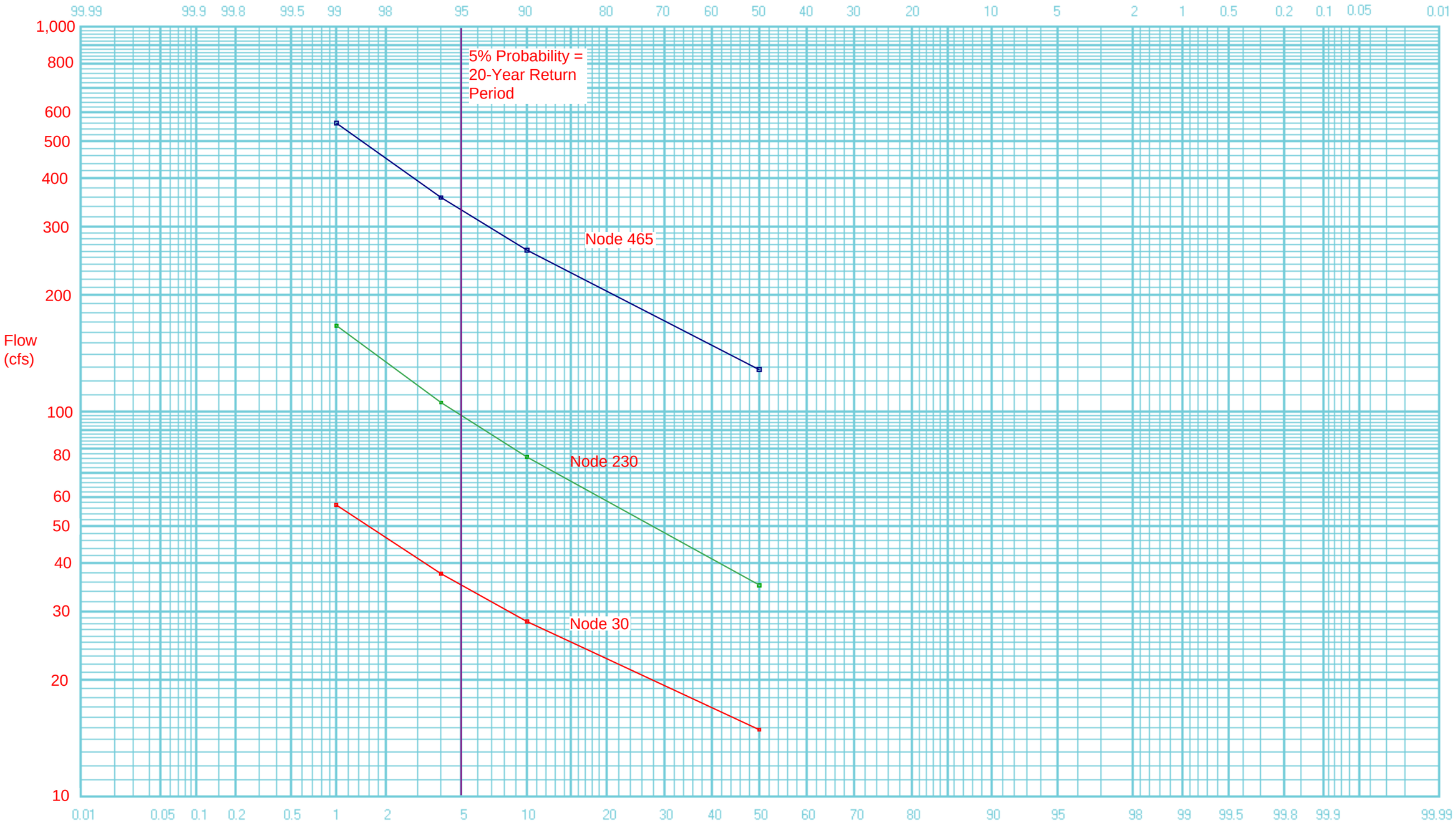


Chart 1 - Log Probability Plot of Calculated Flows

www.PrintablePaper.net

The graph of these values is shown on Chart 1. The results and determination of a design factor are summarized in the following table:

Node	Description	Calculated 10-year Flow (cfs)	Graphical 20-year Flow (cfs)	Q20/Q10
30	Culvert Crossing at Station 144+70	28.6	35.5	1.241
230	Culvert Crossing at Station 154+20	76.6	98	1.279
465	Culvert Crossing at Station 182+00	262.8	327	1.244

Based on this approach, the expected 20-year design flow will be determined by increasing the 10-year flow value by a factor of 24%. This results in the following flow information:

Station	Culvert Size	10 Yr Flow (cfs)	20 Yr Flow (cfs)
17+70	24 in CMP	20	25
19+00	48 in CMP	90	112
43+50	24 in CMP	20	25
49+35	36 in CMP	50	62
54+35	36 in CMP	50	62
57+75	48 in CMP	90	112
62+30	24 in CMP	20	25
88+15	24 in CMP	20	25
90+00	24 in CMP	20	25
144+70	36 in CMP	28.6	35
150+40	36 in CMP	35.8	44
154+20	36 in CMP	76.6	95
170+50	36 in CMP	63.4	79
182+00	84 in CMP	262.8	326

2.3 CULVERT FLOW CALCULATIONS

As with the previous report, culvert capacities were checked using the Federal Highway Administration's HY-8 computer program (version 7.2), this time using the 20-year design flows identified in Section 2.2 of this report. Full results of the calculations using the HY-8 program are included in Appendix A. Following is a summary of those results:

Station	Culvert Size	20 Yr Flow (cfs)	Headwater Depth (ft)	Outlet Velocity (fps)	Overtopping?	Culvert Capacity (cfs)
17+70	24 in CMP	25	4.40	8.74	Yes	24.7
19+00	48 in CMP	112	5.30	15.37	Yes	90.3
43+50	24 in CMP	25	4.48	8.53	No	28
49+35	36 in CMP	62	5.81	13.48	Yes	61.9
54+35	36 in CMP	62	3.33	11.48	Yes	35.9
57+75	48 in CMP	112	6.48	10.39	Yes	111.5
62+30	24 in CMP	25	4.33	9.33	Yes	24.3
88+15	24 in CMP	25	4.52	10.92	No	38.6
90+00	24 in CMP	25	4.16	10.4	Yes	23.6
144+70	36 in CMP	35	3.34	15.84	No	97.8
150+40	36 in CMP	44	3.99	15.16	No	122.1
154+20	36 in CMP	95	8.02	20.16	Yes	75.8
170+50	36 in CMP	79	8.34	18.98	No	98.8
182+00	84 in CMP	326	8.54	27.85	No	764

In the previous report, only the culvert at Station 54+35 overtopped the roadway at the 10-year flow. Investigating the 20-year flow, 8 of the 14 culverts would overtop the roadway. However for 5 of those 8 culverts, the overtopping capacity is very close to the 20-year flow. For the culverts at stations 19+00 and 54+35, the difficulty in predicting flows in an alluvial fan, along with the fact that the culverts have been in place for 26 years without problems lead us to conclude that the culverts are adequately sized. For the culvert at station 154+20, flow exceeding the capacity of the culvert will most likely enter the roadway prism and run along the roadway to the culvert at station 150+40, which has excess capacity. This condition has also been in place for at least 26 years without causing problems, so replacement of this culvert is not recommended.

2.4 CULVERT RIPRAP CALCULATIONS

Riprap sizing calculations were performed using the same methodology as described in the previous report. Calculations for the individual culvert locations are included in Appendix B, and are summarized below. The riprap class and required thickness are based on Caltrans Standard Specifications:

	Pipe Size	Apron Class	Apron Length	Required Riprap D_{50} Size (ft)	Required Riprap D_{50} Weight (lbs)	Specified Riprap Class	Riprap Thickness (ft)
Station 17+70	24" CMP	3	10	0.80	44.4	Light	2.5
Station 19+00	48" CMP	5	28	1.57	333.6	1/4 Ton	3.3
Station 43+50	24" CMP	3	10	0.82	48.4	Light	2.5
Station 49+35	36" CMP	5	21	1.24	166.2	Light	2.5
Station 54+35	36" CMP	5	21	1.41	243.3	1/4 Ton	3.3
Station 57+75	48" CMP	5	28	1.21	153.3	Light	2.5
Station 62+30	24" CMP	4	12	0.84	51.2	Light	2.5
Station 88+15	24" CMP	4	12	0.90	63.1	Light	2.5
Station 90+00	24" CMP	4	12	0.90	63.8	Light	2.5
Station 144+70	36" CMP	3	15	0.74	34.4	Light	2.5
Station 150+40	36" CMP	4	18	0.92	68.3	Light	2.5
Station 154+20	36" CMP	6	24	2.36	1142.5	1 Ton	5.4
Station 170+50	36" CMP	6	24	1.78	488.5	1/4 Ton	3.3
Station 182+00	84" CMP	6	56	2.01	702.9	1/2 Ton	4.3

Compared to the previous results, the specified riprap class increased at stations 19+00, 54+35, and 182+00. The apron length increased at stations 19+00, 54+35, 57+75, 62+30, 88+15, 90+00, and 182+00.

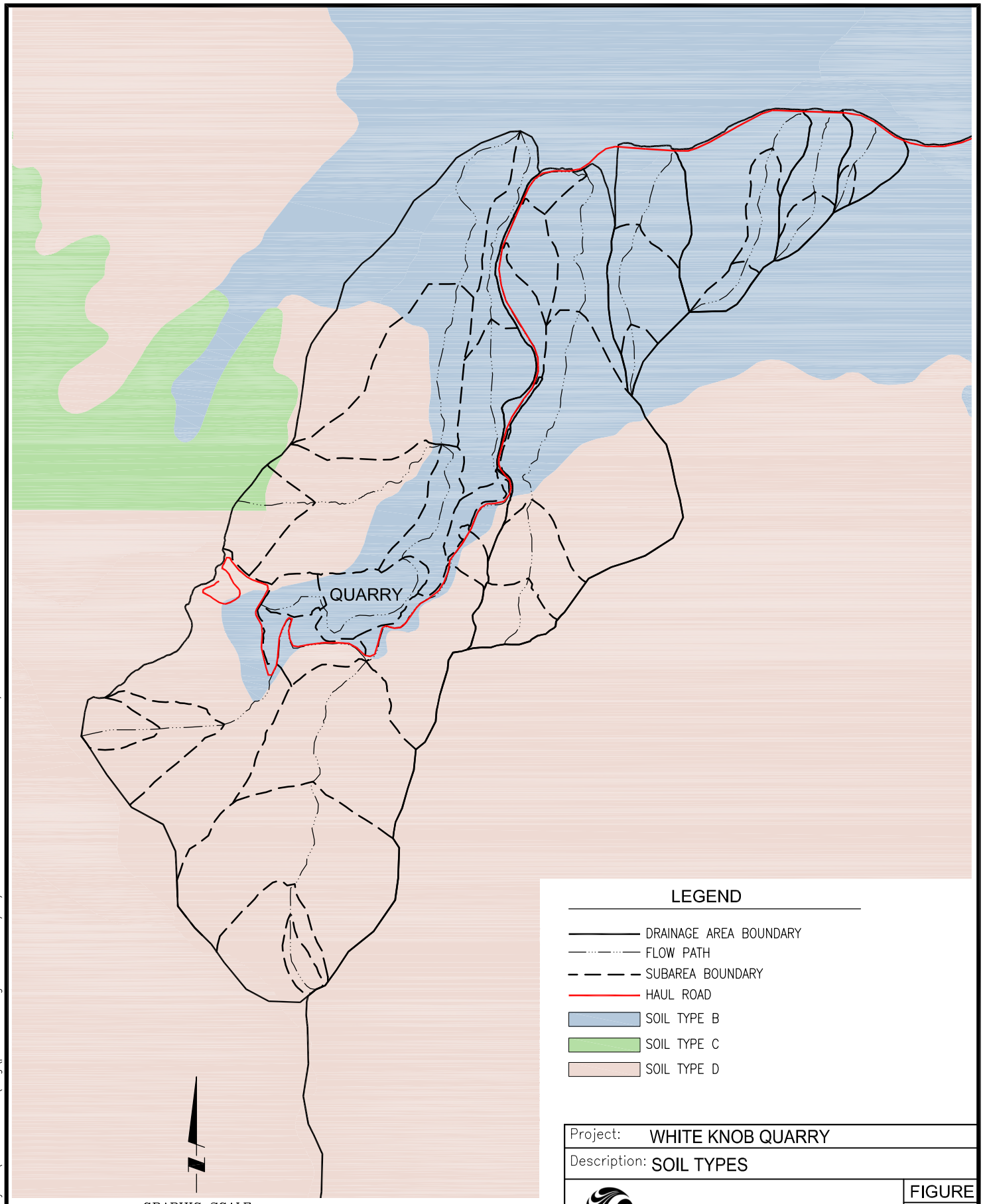
3.0 Soils Map Comparison

In reviewing the Webber and Webber Mining Consultants, Inc. report titled "Soil Resources at White Knob Quarry – OMYA California, Inc. – CA Mine ID #91-36-0067" dated October 2008, the source of their soils mapping data is the same as for our hydrologic soils map. The descriptions are different because the reports are looking at different soils qualities. The Stantec report investigated the hydrologic runoff characteristics of the soil, and the Webber and Webber report investigated the structural characteristics. Even though the reports were for different purposes, there is some correlation between the soil types.

Figure 3 from the previous Stantec report is reproduced on the next page, which shows the hydrologic soil types that were used in our hydrologic calculations. We have also included a printout from the USDA Natural Resources Conservation Service's Web Soil Survey website in Appendix C. The Area of Interest shown is similar to the extent of the map on Figure 3.

The Area of Interest covers two separate soil surveys as noted in the Webber and Webber report. The boundary between surveys is evident in the straight east-west line across the Area of Interest. In compiling information to perform the hydrologic calculations, we noted that there were unnatural boundaries between hydrologic sol types along the boundary between soil surveys. Most concerning to us was the appearance that map symbol 101 (Arrastre – Rock Outcrop) from the Soil Survey of San Bernardino County, California, Mojave River Area (CA671) and map symbol DxG (Wapi-Pacifico families, dry-rock outcrop) from the San Bernardino Forest Area (CA777) soil survey appear to be mapping similar soil types. However, map symbol 101 is shown as soil type B and map symbol DxG is shown as soil type D. We chose to map both symbols as soil type D for our calculations, which would yield higher runoff rates.

There is a similar anomaly between map symbol 121 (Crafton-Sheephead-Rock Outcrop) and map symbol DxF (Wapi-Pacifico families, dry-rock outcrop), which are mapped as soil types C and D, respectively. Since this is such a minor area of the studied tributary areas, and is likely to have minimal impact on the quantity of flow calculations, we chose to accept the mapped soil type designations.



Project: WHITE KNOB QUARRY

Description: SOIL TYPES

STANTEC CONSULTING INC.
19 TECHNOLOGY DRIVE
IRVINE, CA 92618
949.923.6000
stantec.com

Job No.: 2042484500 Date: 07-29-2011

FIGURE 3

DRAWING: v:\projects\2042484500\dwg\prex0003.dwg PLOTTED: 7/29/2011 8:58 AM BY: Uribe Gonzales, Martha

4.0 Sedimentation Comparison

The DCI report titled: Sedimentation and Erosion Monitoring, 2011–2012 Reporting Period investigated the erosion and sedimentation volumes for the water year 2011-2012 in what is termed the western drainage. The western drainage is westerly and northerly of the quarry, and is not included in the drainage study previously prepared by Stantec. However, since this is an adjacent drainage, sedimentation rates can be expected to be similar to the areas investigated by Stantec.

The previous Stantec report calculated expected sediment volumes for a 50-year, 24-hour storm event. According to the National Oceanic and Atmospheric Administration's Precipitation Frequency Data Server Atlas 14 (http://hdsc.nws.noaa.gov/hdsc/pfds/), the 50-year, 24-hour rainfall depth for the vicinity of the White Knob quarry is 5.84 inches. In contrast, the total rainfall for the 2011-2012 water year according to the DCI report was 3.98 inches. Because of this, we would expect the sediment generation rate to be much lower in the DCI report.

The Stantec report looked at sediment generation from two drainage tributary areas. The first was the area tributary to the existing basin near the explosives storage facility. This tributary has a total drainage area of 350.81 acres, and is expected to generate 7,729 cubic yards of debris and sediment from a 50-year, 24-hour storm event. The second area is the drainage tributary to the haul road from the explosives storage facility to turnout 64. This tributary has a total drainage area of 30.13 acres, and is expected to generate 1,147 cubic yards of debris and sediment from a 50-year, 24-hour storm event.

The DCI report calculates the surface changes (either erosion or sedimentation) for 19 reaches of the western drainage covering a distance along the drainage course of about 7,500 feet. The total drainage area is not reported, but appears to be in the order of magnitude of 600 acres. Of the 19 reaches, 2 were not measured due to site hazards and vegetation constraints. One additional reach had no measurable net change in the surface. A total of nine reaches experienced sedimentation, with a total volume of 32 cubic yards. The remaining seven reaches experienced erosion, with a total volume of 15 cubic yards.

As mentioned above, the sediment generation rate measured in the DCI report is much lower than that predicted in the Stantec report. This is to be expected, since the measured sediment generation was for a relatively dry year, and the predicted sediment generation rates are for a 50-year, 24-hour storm.

Appendix A – Culvert Hydraulic Calculations

HY-8 Culvert Analysis Report

Crossing Discharge Data Sta 17+70

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 25 cfs

Maximum Flow: 40 cfs

Table 1 - Summary of Culvert Flows at Crossing: Station 17+70

Headwater Elevation (ft)	Total Discharge (cfs)	24 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
3998.80	5.00	5.00	0.00	1
3999.20	8.50	8.50	0.00	1
3999.60	12.00	12.00	0.00	1
4000.10	15.50	15.50	0.00	1
4000.72	19.00	19.00	0.00	1
4001.48	22.50	22.50	0.00	1
4002.00	25.00	24.69	0.08	80
4002.03	29.50	24.81	4.48	5
4002.05	33.00	24.87	8.02	4
4002.06	36.50	24.92	11.36	3
4002.07	40.00	24.97	14.88	3
4002.00	24.68	24.68	0.00	Overtopping

Rating Curve Plot for Crossing: Station 17+70

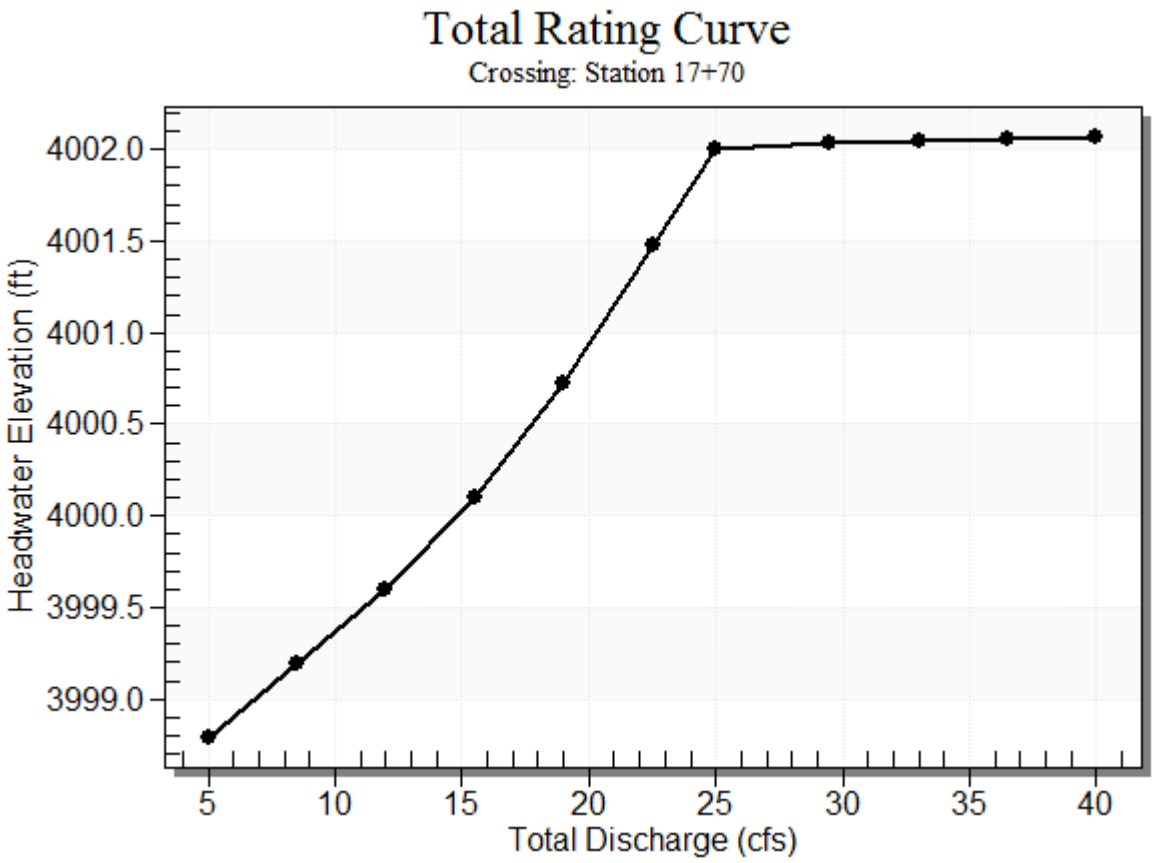


Table 2 - Culvert Summary Table: 24 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	5.00	5.00	3998.80	1.196	0.0*	1-S2n	0.611	0.783	0.611	0.245	6.132
	8.50	8.50	3999.20	1.599	0.0*	1-S2n	0.814	1.038	0.814	0.323	7.074
	12.00	12.00	3999.60	2.002	0.0*	5-S2n	0.991	1.239	0.991	0.385	7.725
	15.50	15.50	4000.10	2.497	0.287	5-S2n	1.161	1.415	1.161	0.437	8.205
	19.00	19.00	4000.72	3.122	1.587	5-S2n	1.333	1.566	1.333	0.483	8.556
	22.50	22.50	4001.48	3.876	2.769	5-S2n	1.525	1.690	1.525	0.525	8.769
	25.00	24.69	4002.00	4.402	3.596	5-S2n	1.679	1.753	1.679	0.552	8.743
	29.50	24.81	4002.03	4.433	3.644	5-S2n	1.692	1.757	1.692	0.598	8.773
	33.00	24.87	4002.05	4.448	3.669	5-S2n	1.699	1.758	1.699	0.630	8.768
	36.50	24.92	4002.06	4.460	3.687	5-S2n	1.704	1.759	1.704	0.661	8.763
	40.00	24.97	4002.07	4.472	3.707	5-S2n	1.709	1.761	1.709	0.690	8.759

* Full Flow Headwater elevation is below inlet invert.

****

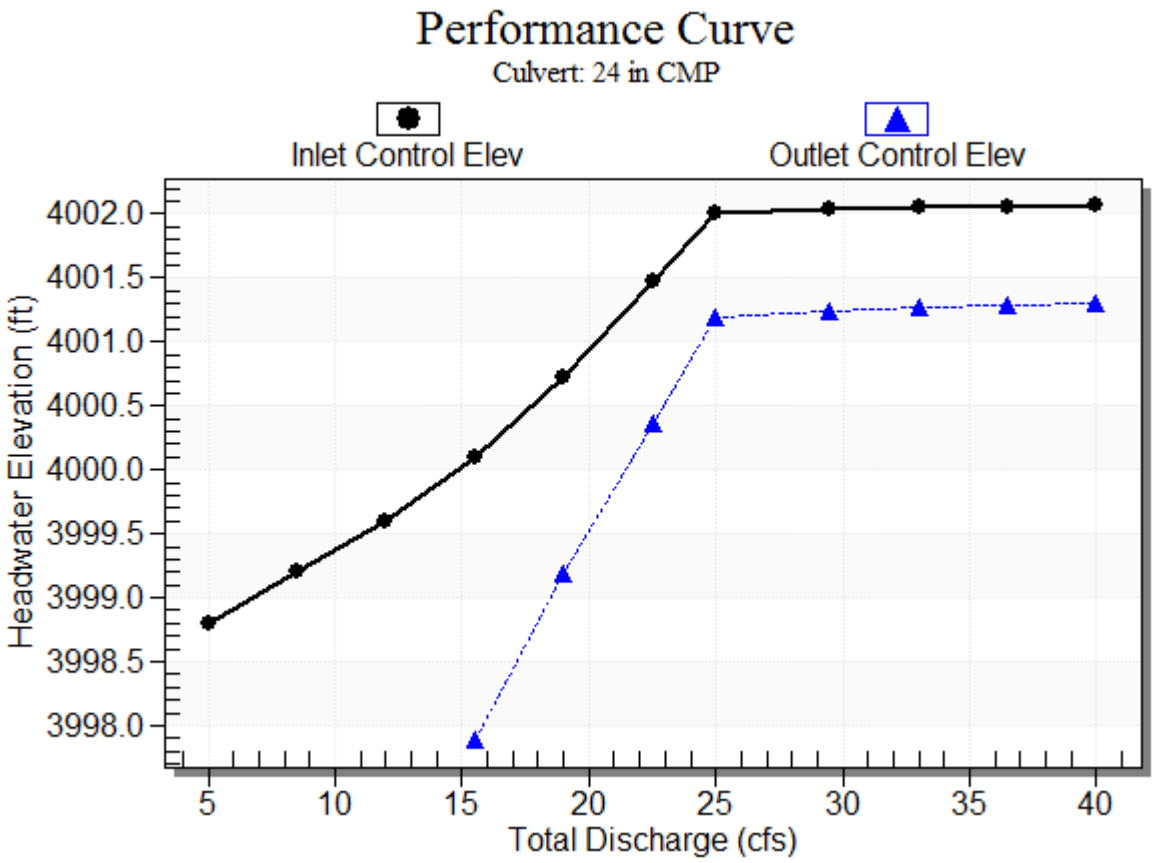
Straight Culvert

Inlet Elevation (invert): 3997.60 ft, Outlet Elevation (invert): 3994.62 ft

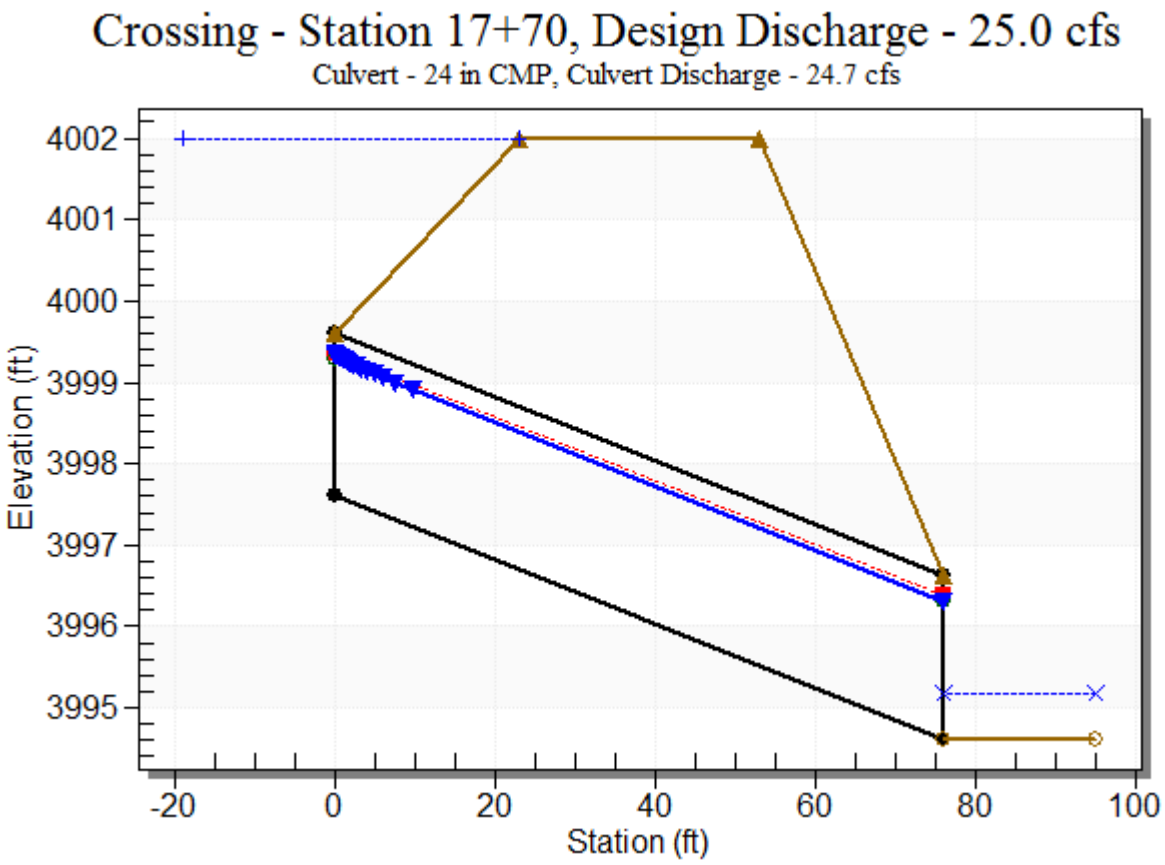
Culvert Length: 76.06 ft, Culvert Slope: 0.0392

****

Culvert Performance Curve Plot: 24 in CMP



Water Surface Profile Plot for Culvert: 24 in CMP



Site Data - 24 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 3997.60 ft

Outlet Station: 76.00 ft

Outlet Elevation: 3994.62 ft

Number of Barrels: 1

Culvert Data Summary - 24 in CMP

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: Station 17+70)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	3994.86	0.24	2.75	0.61	1.13
8.50	3994.94	0.32	3.20	0.81	1.17
12.00	3995.00	0.38	3.52	0.96	1.20
15.50	3995.06	0.44	3.78	1.09	1.22
19.00	3995.10	0.48	4.00	1.21	1.24
22.50	3995.14	0.52	4.18	1.31	1.25
25.00	3995.17	0.55	4.30	1.38	1.26
29.50	3995.22	0.60	4.50	1.49	1.27
33.00	3995.25	0.63	4.63	1.57	1.28
36.50	3995.28	0.66	4.76	1.65	1.29
40.00	3995.31	0.69	4.88	1.72	1.30

Tailwater Channel Data - Station 17+70

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 3994.62 ft

Roadway Data for Crossing: Station 17+70

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4002.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Crossing Discharge Data Sta 19+00

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 112 cfs

Maximum Flow: 150 cfs

Table 4 - Summary of Culvert Flows at Crossing: Station 19+00

Headwater Elevation (ft)	Total Discharge (cfs)	48 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4005.77	5.00	5.00	0.00	1
4006.81	19.50	19.50	0.00	1
4007.50	34.00	34.00	0.00	1
4008.07	48.50	48.50	0.00	1
4008.65	63.00	63.00	0.00	1
4009.31	77.50	77.50	0.00	1
4010.01	92.00	90.49	1.10	40
4010.07	106.50	91.50	14.72	6
4010.09	112.00	91.77	19.93	4
4010.14	135.50	92.72	42.43	4
4010.17	150.00	93.21	56.27	3
4010.00	90.27	90.27	0.00	Overtopping

Rating Curve Plot for Crossing: Station 19+00

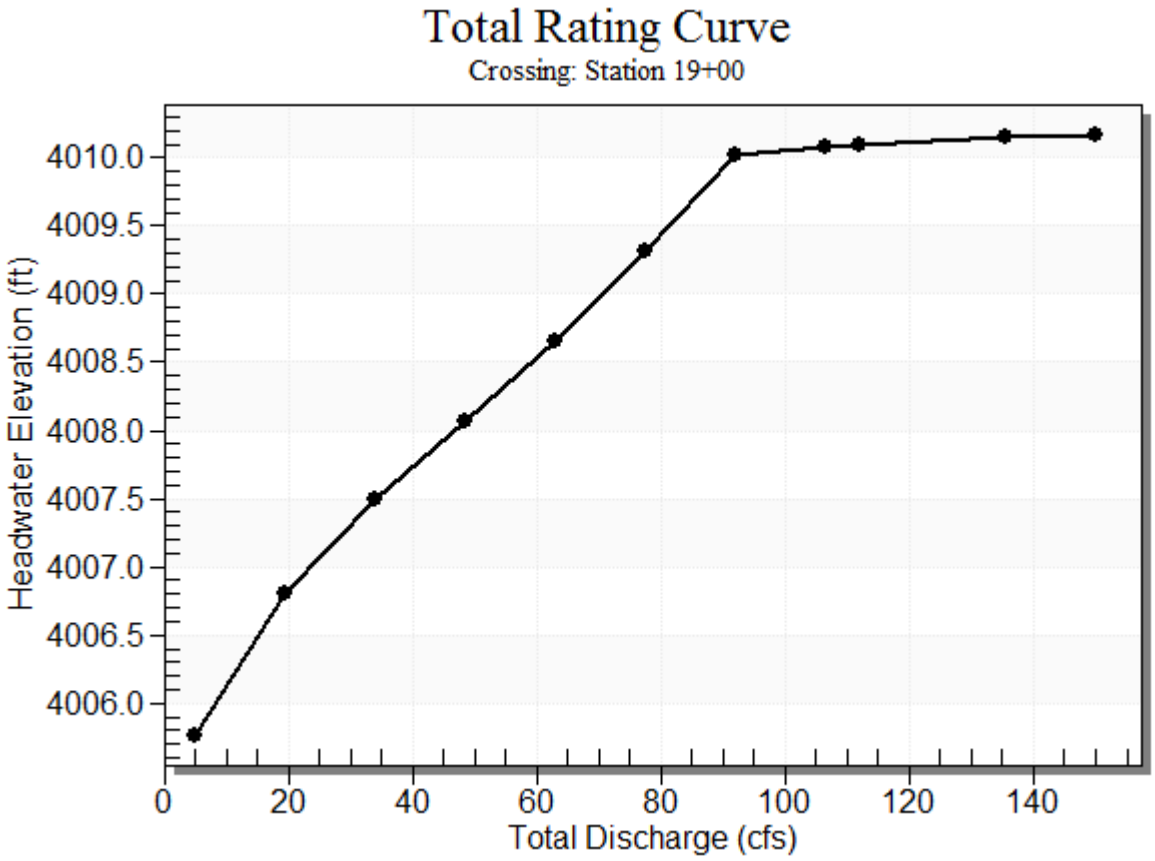


Table 5 - Culvert Summary Table: 48 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	5.00	5.00	4005.77	0.979	0.0*	1-S2n	0.419	0.643	0.439	0.245	6.459
	19.50	19.50	4006.81	2.019	0.0*	1-S2n	0.837	1.294	0.837	0.490	10.119
	34.00	34.00	4007.50	2.708	0.0*	1-S2n	1.123	1.732	1.123	0.639	11.784
	48.50	48.50	4008.07	3.282	0.0*	1-S2n	1.348	2.086	1.379	0.754	12.605
	63.00	63.00	4008.65	3.861	0.0*	1-S2n	1.554	2.391	1.583	0.850	13.599
	77.50	77.50	4009.31	4.523	0.0*	5-S2n	1.744	2.663	1.744	0.934	14.716
	92.00	90.49	4010.01	5.223	0.0*	5-S2n	1.907	2.881	1.907	1.008	15.311
	106.50	91.50	4010.07	5.282	0.0*	5-S2n	1.919	2.897	1.919	1.076	15.355
	112.00	91.77	4010.09	5.298	0.0*	5-S2n	1.922	2.901	1.922	1.100	15.367
	135.50	92.72	4010.14	5.354	0.0*	5-S2n	1.934	2.916	1.964	1.196	15.102
	150.00	93.21	4010.17	5.384	0.0*	5-S2n	1.939	2.923	1.970	1.250	15.121

* Full Flow Headwater elevation is below inlet invert.

****

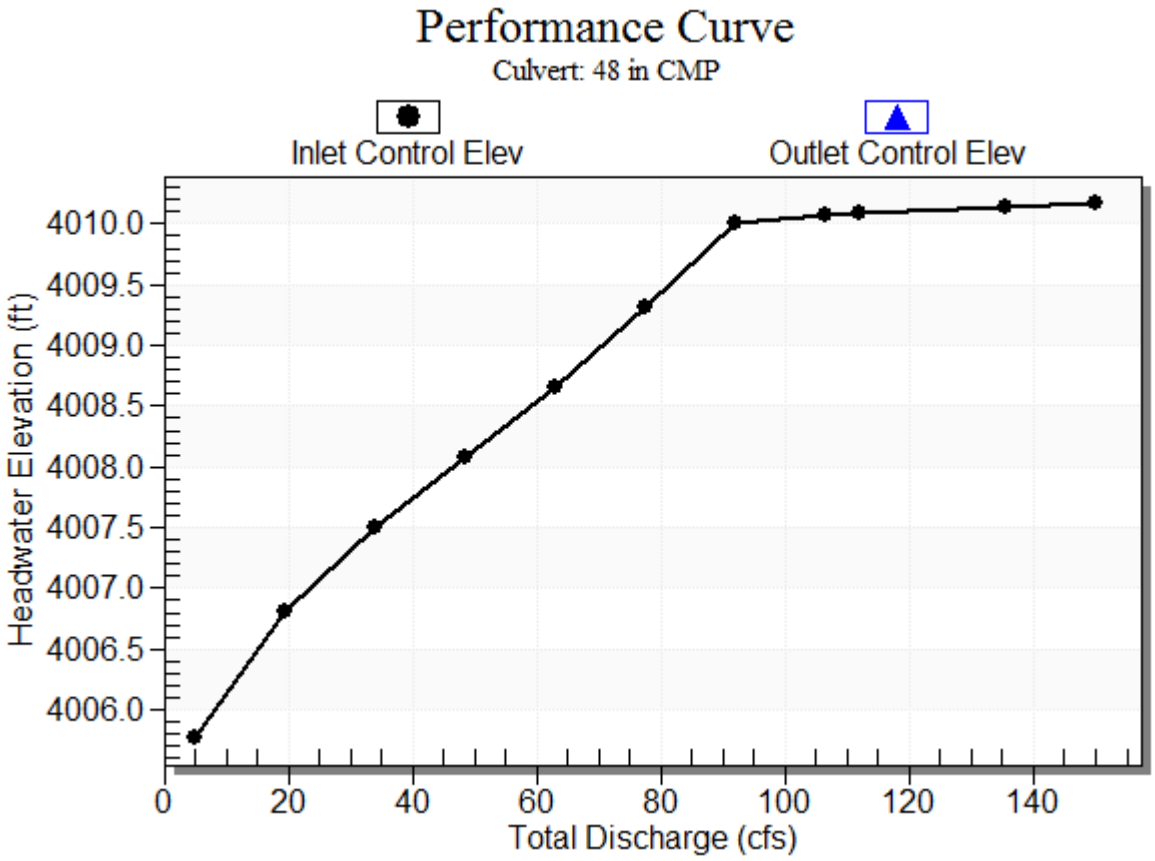
Straight Culvert

Inlet Elevation (invert): 4004.79 ft, Outlet Elevation (invert): 3997.83 ft

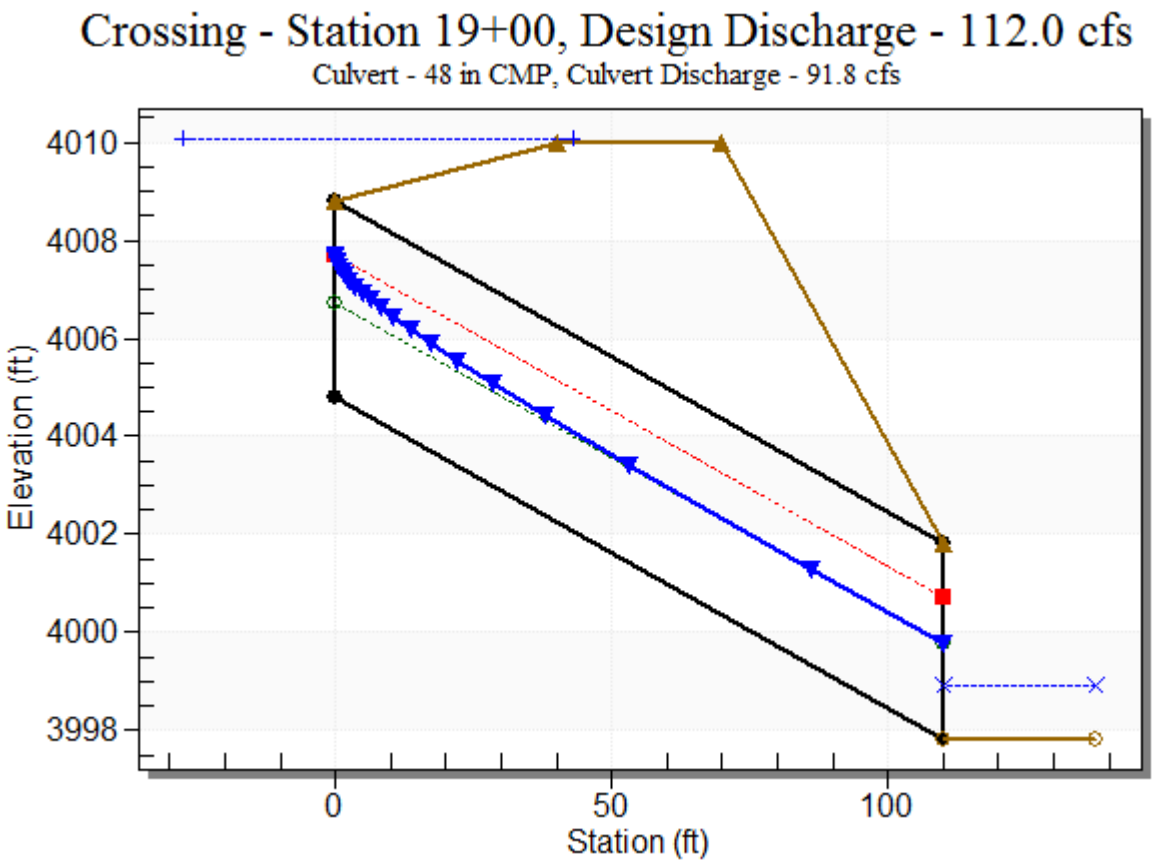
Culvert Length: 110.22 ft, Culvert Slope: 0.0633

****

Culvert Performance Curve Plot: 48 in CMP



Water Surface Profile Plot for Culvert: 48 in CMP



Site Data - 48 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4004.79 ft

Outlet Station: 110.00 ft

Outlet Elevation: 3997.83 ft

Number of Barrels: 1

Culvert Data Summary - 48 in CMP

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: NONE

Table 6 - Downstream Channel Rating Curve (Crossing: Station 19+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	3998.07	0.24	2.75	0.61	1.13
19.50	3998.32	0.49	4.03	1.22	1.24
34.00	3998.47	0.64	4.67	1.60	1.29
48.50	3998.58	0.75	5.13	1.88	1.32
63.00	3998.68	0.85	5.49	2.12	1.34
77.50	3998.76	0.93	5.79	2.33	1.36
92.00	3998.84	1.01	6.05	2.52	1.37
106.50	3998.91	1.08	6.28	2.68	1.39
112.00	3998.93	1.10	6.37	2.75	1.39
135.50	3999.03	1.20	6.68	2.98	1.41
150.00	3999.08	1.25	6.86	3.12	1.42

Tailwater Channel Data - Station 19+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 3997.83 ft

Roadway Data for Crossing: Station 19+00

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4010.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Crossing Discharge Data Sta 43+50

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 25 cfs

Maximum Flow: 40 cfs

Table 7 - Summary of Culvert Flows at Crossing: Station 43+50

Headwater Elevation (ft)	Total Discharge (cfs)	24 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4116.98	5.00	5.00	0.00	1
4117.39	8.50	8.50	0.00	1
4117.79	12.00	12.00	0.00	1
4118.28	15.50	15.50	0.00	1
4118.91	19.00	19.00	0.00	1
4119.66	22.50	22.50	0.00	1
4120.27	25.00	25.00	0.00	1
4122.01	29.50	28.05	1.27	47
4122.03	33.00	28.08	4.63	4
4122.05	36.50	28.09	8.29	4
4122.06	40.00	28.11	11.67	3
4122.00	28.03	28.03	0.00	Overtopping

Rating Curve Plot for Crossing: Station 43+50

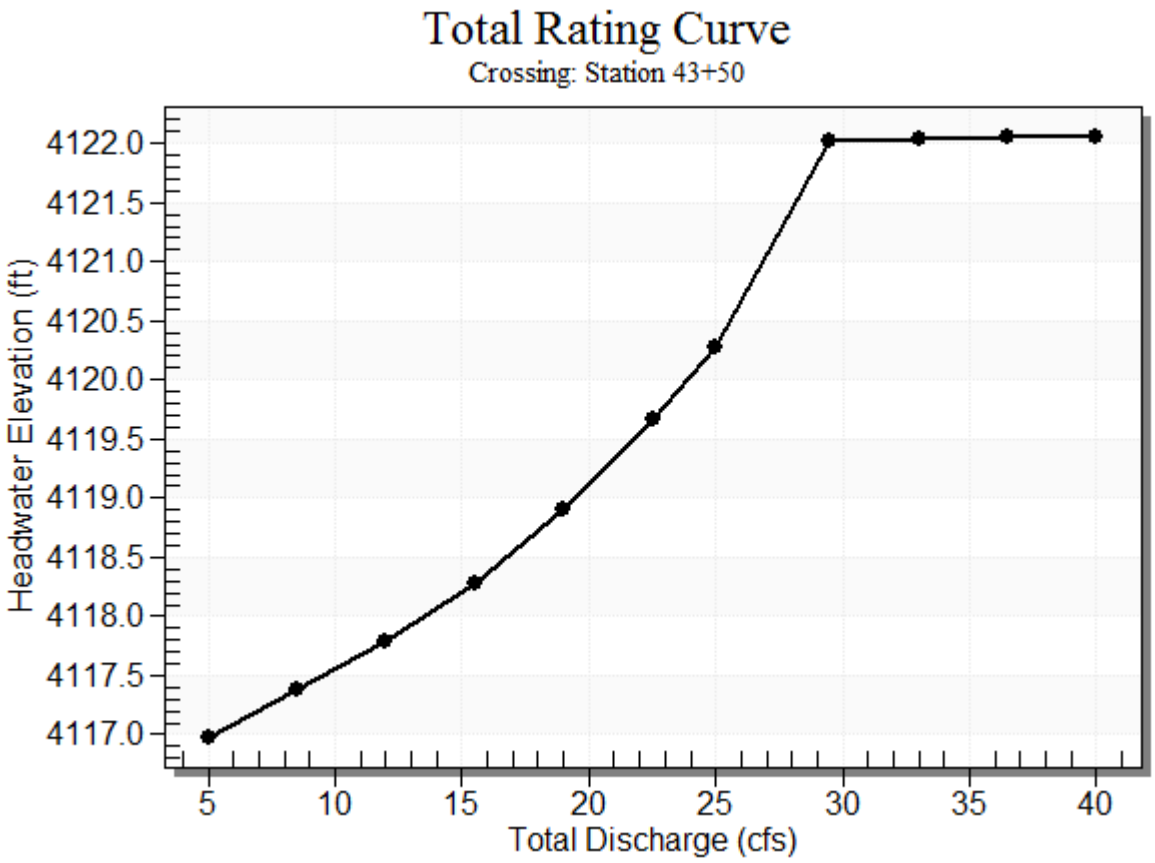


Table 8 - Culvert Summary Table: 24 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	5.00	5.00	4116.98	1.193	0.0*	1-S2n	0.618	0.783	0.618	0.245	6.026
	8.50	8.50	4117.39	1.597	0.0*	1-S2n	0.825	1.038	0.825	0.323	6.948
	12.00	12.00	4117.79	2.000	0.0*	1-S2n	1.006	1.239	1.006	0.385	7.584
	15.50	15.50	4118.28	2.495	0.0*	5-S2n	1.179	1.415	1.179	0.437	8.050
	19.00	19.00	4118.91	3.120	0.737	5-S2n	1.357	1.566	1.355	0.483	8.398
	22.50	22.50	4119.66	3.874	2.631	5-S2n	1.560	1.690	1.560	0.525	8.574
	25.00	25.00	4120.27	4.478	3.674	7-M2c	1.777	1.761	1.761	0.552	8.533
	29.50	28.05	4122.01	5.271	6.225	7-M2c	2.000	1.829	1.829	0.598	9.311
	33.00	28.08	4122.03	5.279	6.244	7-M2c	2.000	1.830	1.830	0.630	9.319
	36.50	28.09	4122.05	5.284	6.260	7-M2c	2.000	1.830	1.830	0.661	9.323
	40.00	28.11	4122.06	5.290	6.272	7-M2c	2.000	1.831	1.831	0.690	9.329

* Full Flow Headwater elevation is below inlet invert.

****

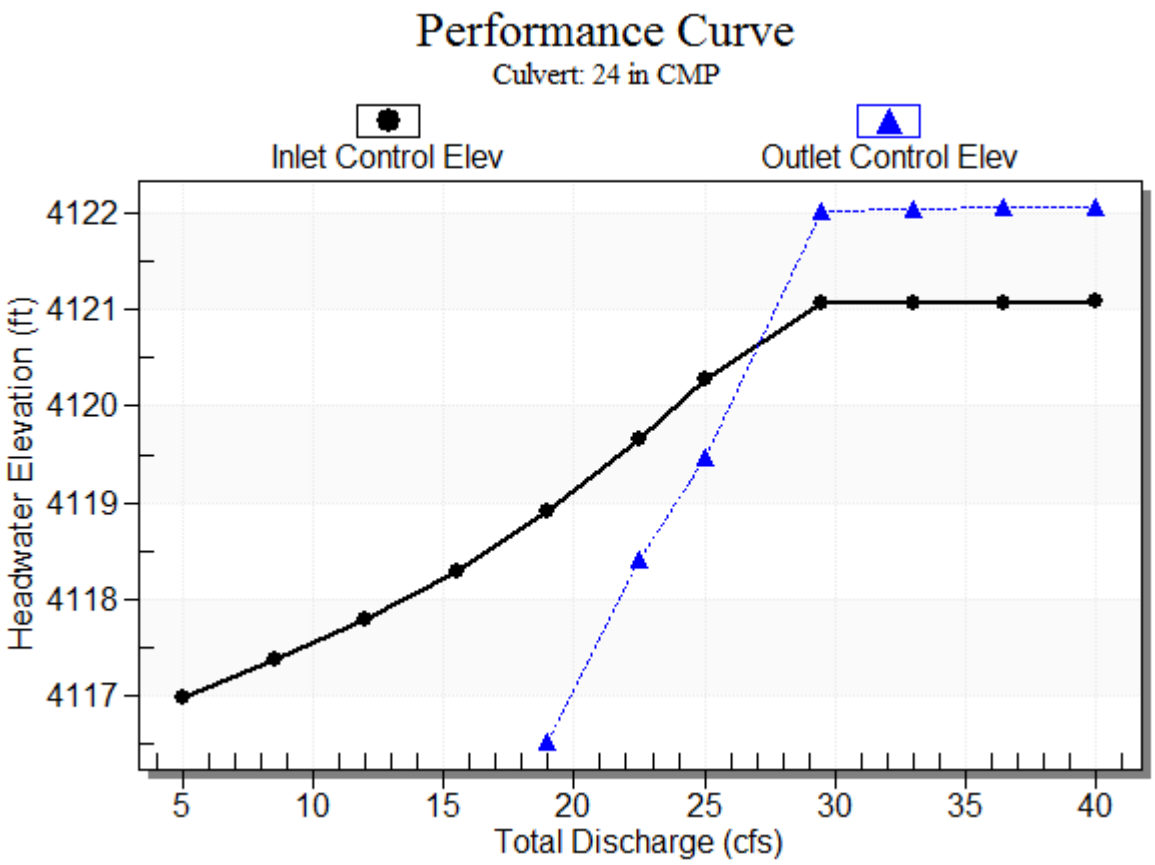
Straight Culvert

Inlet Elevation (invert): 4115.79 ft, Outlet Elevation (invert): 4110.19 ft

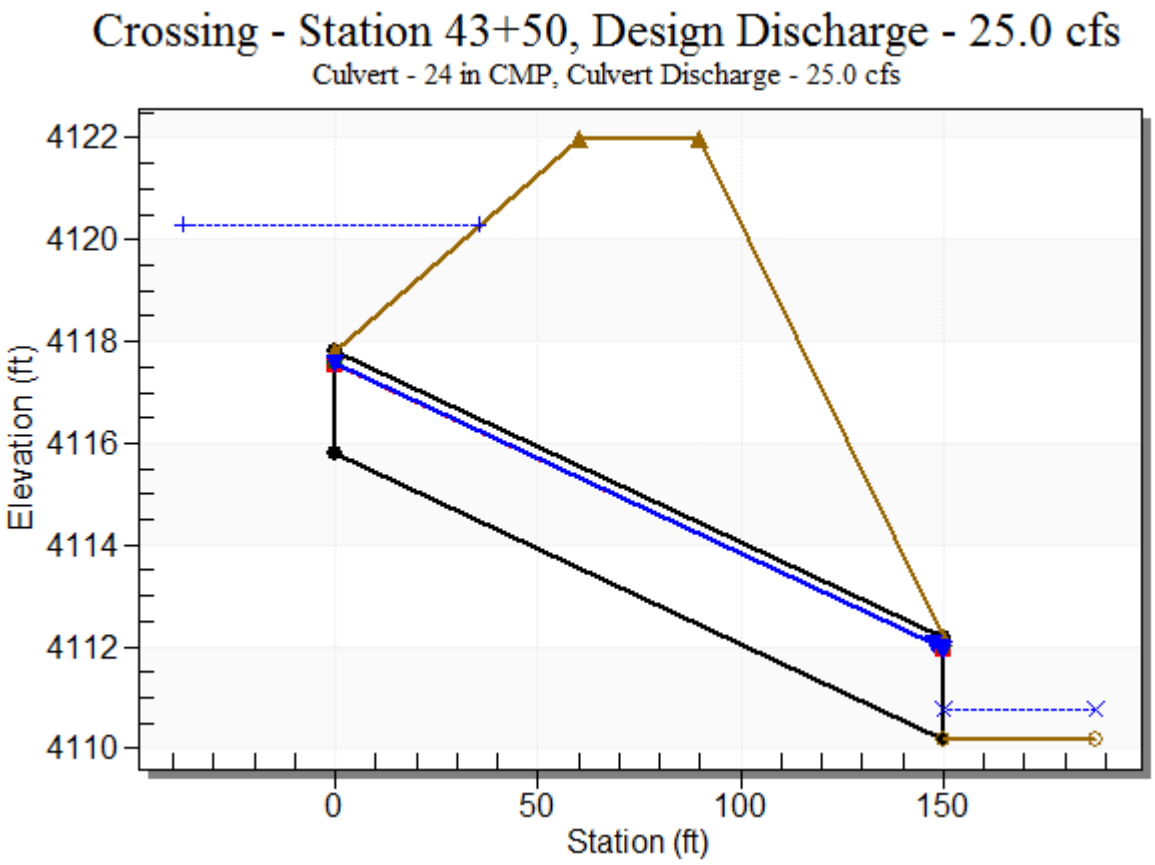
Culvert Length: 150.10 ft, Culvert Slope: 0.0373

****

Culvert Performance Curve Plot: 24 in CMP



Water Surface Profile Plot for Culvert: 24 in CMP



Site Data - 24 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4115.79 ft

Outlet Station: 150.00 ft

Outlet Elevation: 4110.19 ft

Number of Barrels: 1

Culvert Data Summary - 24 in CMP

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: NONE

Table 9 - Downstream Channel Rating Curve (Crossing: Station 43+50)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	4110.43	0.24	2.75	0.61	1.13
8.50	4110.51	0.32	3.20	0.81	1.17
12.00	4110.57	0.38	3.52	0.96	1.20
15.50	4110.63	0.44	3.78	1.09	1.22
19.00	4110.67	0.48	4.00	1.21	1.24
22.50	4110.71	0.52	4.18	1.31	1.25
25.00	4110.74	0.55	4.30	1.38	1.26
29.50	4110.79	0.60	4.50	1.49	1.27
33.00	4110.82	0.63	4.63	1.57	1.28
36.50	4110.85	0.66	4.76	1.65	1.29
40.00	4110.88	0.69	4.88	1.72	1.30

Tailwater Channel Data - Station 43+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4110.19 ft

Roadway Data for Crossing: Station 43+50

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4122.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Crossing Discharge Data Sta 49+35

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 62 cfs

Maximum Flow: 100 cfs

Table 10 - Summary of Culvert Flows at Crossing: Station 49+35

Headwater Elevation (ft)	Total Discharge (cfs)	36 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4135.23	5.00	5.00	0.00	1
4136.05	14.50	14.50	0.00	1
4136.64	24.00	24.00	0.00	1
4137.24	33.50	33.50	0.00	1
4137.98	43.00	43.00	0.00	1
4138.90	52.50	52.50	0.00	1
4139.97	62.00	61.64	0.00	40
4140.05	71.50	62.26	8.96	7
4140.08	81.00	62.50	18.14	4
4140.11	90.50	62.71	27.64	4
4140.13	100.00	62.89	36.76	3
4140.00	61.85	61.85	0.00	Overtopping

Rating Curve Plot for Crossing: Station 49+35

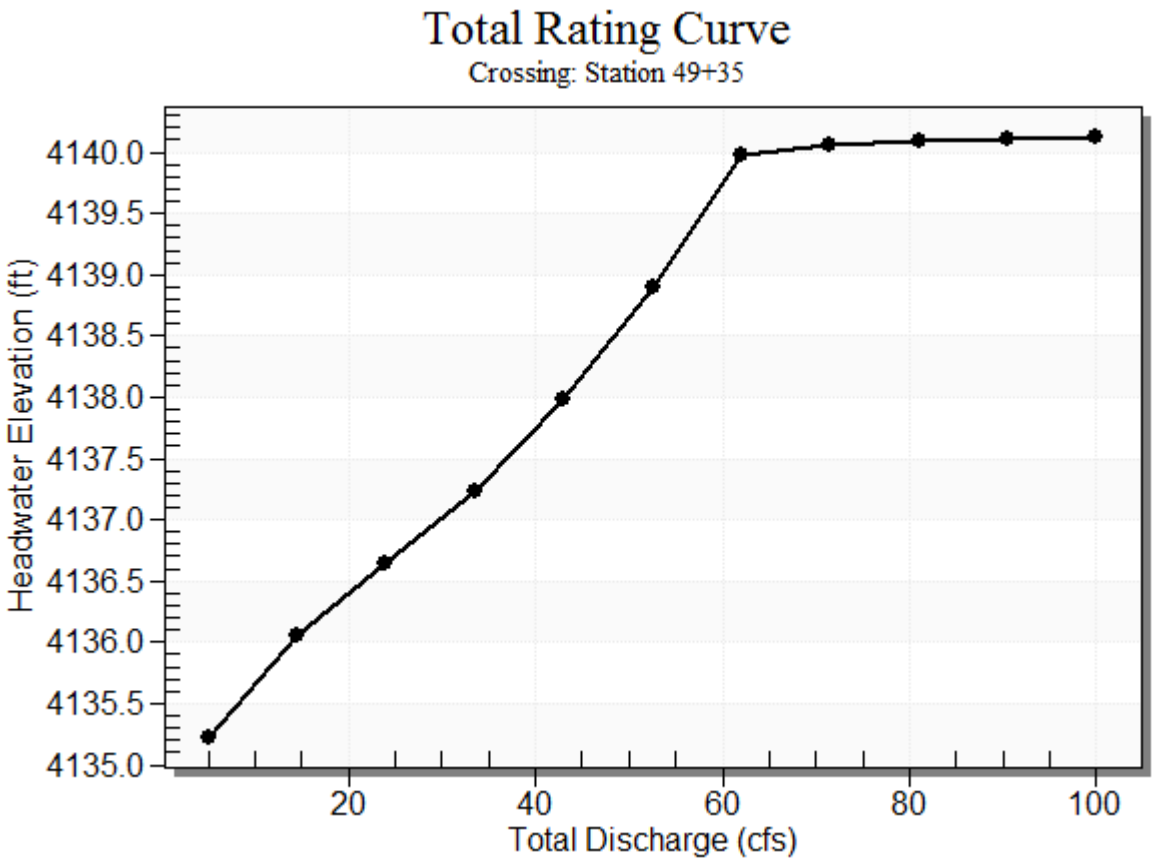


Table 11 - Culvert Summary Table: 36 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	5.00	5.00	4135.23	1.069	0.0*	1-S2n	0.466	0.697	0.466	0.245	6.992
	14.50	14.50	4136.05	1.889	0.0*	1-S2n	0.818	1.208	0.818	0.423	9.284
	24.00	24.00	4136.64	2.478	0.0*	1-S2n	1.061	1.577	1.061	0.541	10.722
	33.50	33.50	4137.24	3.078	0.0*	5-S2n	1.271	1.876	1.271	0.635	11.745
	43.00	43.00	4137.98	3.816	0.0*	5-S2n	1.467	2.134	1.467	0.713	12.515
	52.50	52.50	4138.90	4.744	0.332	5-S2n	1.656	2.353	1.662	0.782	13.063
	62.00	61.64	4139.97	5.813	1.735	5-S2n	1.835	2.529	1.851	0.844	13.477
	71.50	62.26	4140.05	5.892	1.838	5-S2n	1.848	2.539	1.865	0.900	13.488
	81.00	62.50	4140.08	5.923	1.878	5-S2n	1.852	2.543	1.871	0.952	13.492
	90.50	62.71	4140.11	5.949	1.913	5-S2n	1.856	2.547	1.875	1.001	13.496
	100.00	62.89	4140.13	5.971	1.942	5-S2n	1.860	2.550	1.879	1.046	13.499

* Full Flow Headwater elevation is below inlet invert.

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Straight Culvert

Inlet Elevation (invert): 4134.16 ft, Outlet Elevation (invert): 4128.34 ft

Culvert Length: 96.18 ft, Culvert Slope: 0.0606

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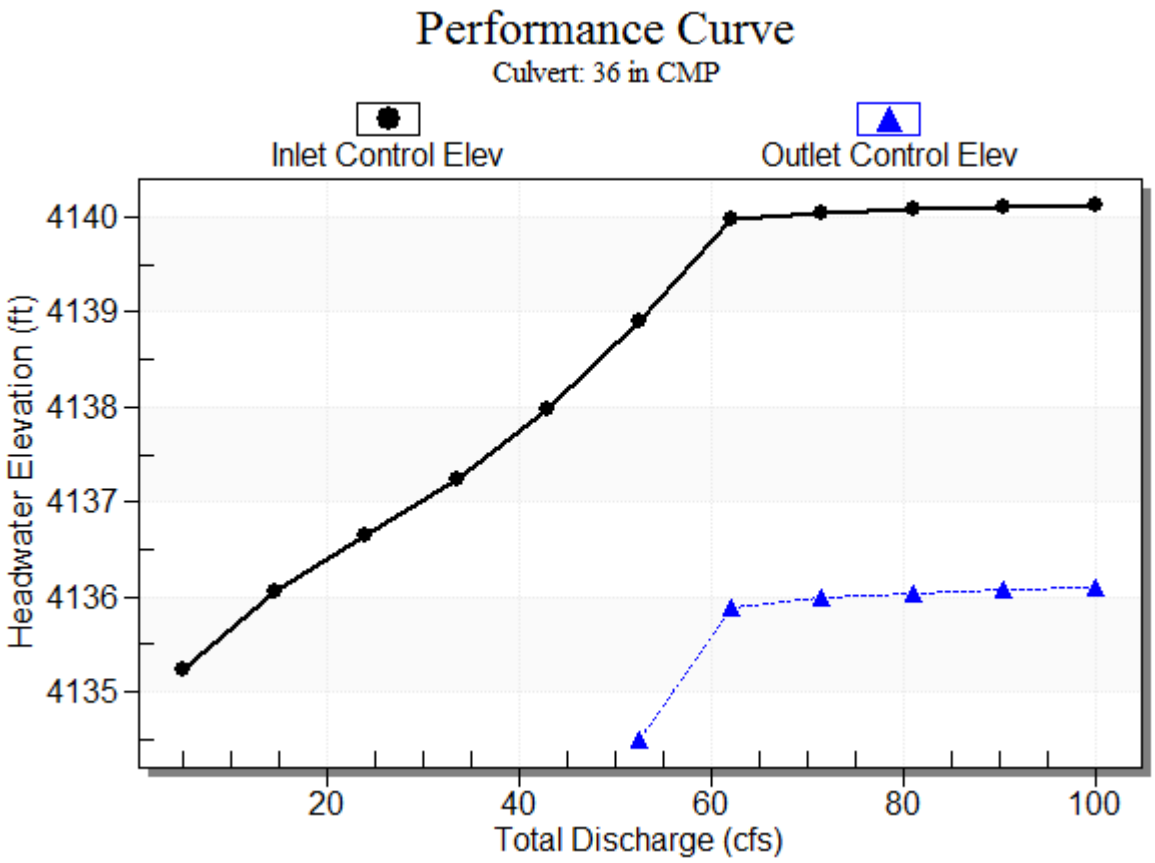
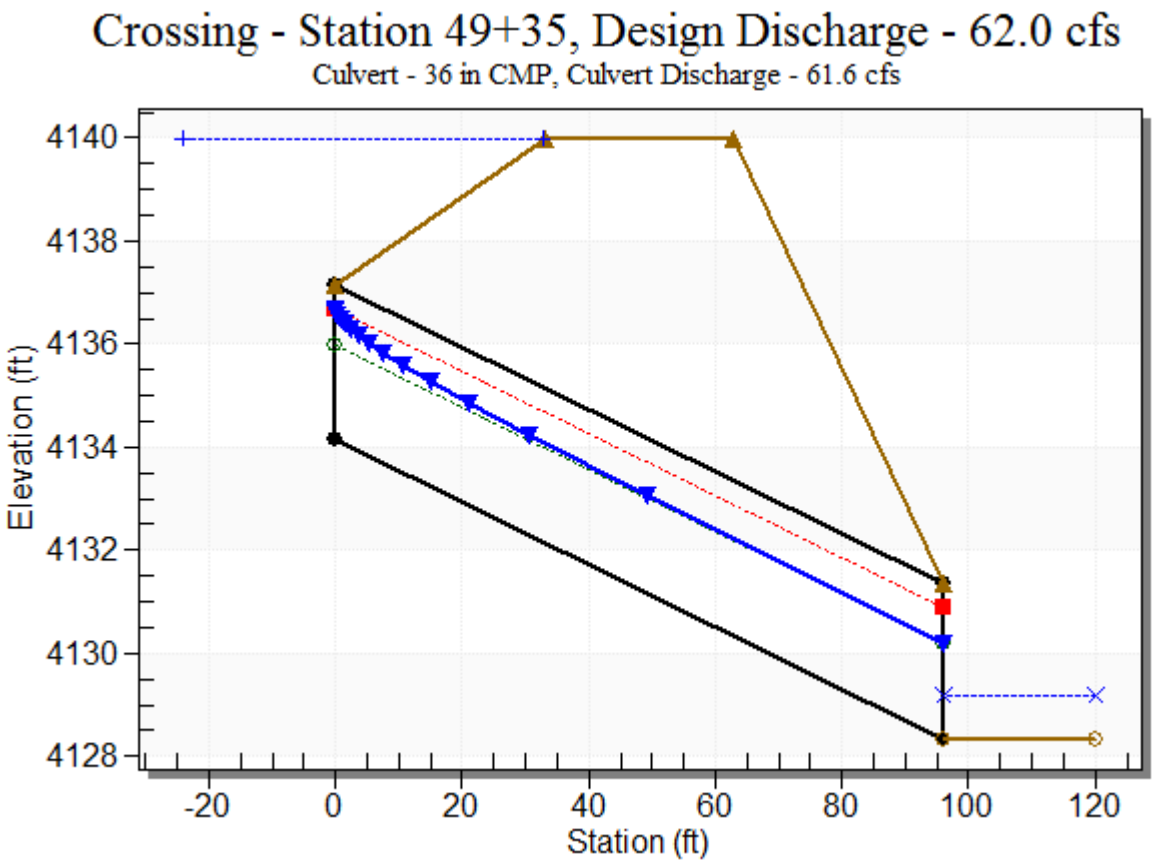
Culvert Performance Curve Plot: 36 in CMP



Water Surface Profile Plot for Culvert: 36 in CMP



Site Data - 36 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4134.16 ft

Outlet Station: 96.00 ft

Outlet Elevation: 4128.34 ft

Number of Barrels: 1

Culvert Data Summary - 36 in CMP

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: NONE

Table 12 - Downstream Channel Rating Curve (Crossing: Station 49+35)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	4128.58	0.24	2.75	0.61	1.13
14.50	4128.76	0.42	3.71	1.06	1.22
24.00	4128.88	0.54	4.26	1.35	1.26
33.50	4128.97	0.63	4.65	1.58	1.29
43.00	4129.05	0.71	4.97	1.78	1.31
52.50	4129.12	0.78	5.23	1.95	1.32
62.00	4129.18	0.84	5.47	2.11	1.34
71.50	4129.24	0.90	5.67	2.25	1.35
81.00	4129.29	0.95	5.86	2.38	1.36
90.50	4129.34	1.00	6.03	2.50	1.37
100.00	4129.39	1.05	6.18	2.61	1.38

Tailwater Channel Data - Station 49+35

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4128.34 ft

Roadway Data for Crossing: Station 49+35

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4140.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Crossing Discharge Data

Sta 54+35

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 62 cfs

Maximum Flow: 100 cfs

Table 13 - Summary of Culvert Flows at Crossing: Station 54+35

Headwater Elevation (ft)	Total Discharge (cfs)	36 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4136.63	5.00	5.00	0.00	1
4137.44	14.50	14.50	0.00	1
4138.03	24.00	24.00	0.00	1
4138.63	33.50	33.50	0.00	1
4138.84	43.00	36.43	6.22	12
4138.87	52.50	36.87	15.16	4
4138.90	62.00	37.23	24.57	4
4138.92	71.50	37.54	33.54	3
4138.95	81.00	37.82	42.90	3
4138.97	90.50	38.08	52.26	3
4138.98	100.00	38.32	61.60	3
4138.80	35.87	35.87	0.00	Overtopping

Rating Curve Plot for Crossing: Station 54+35

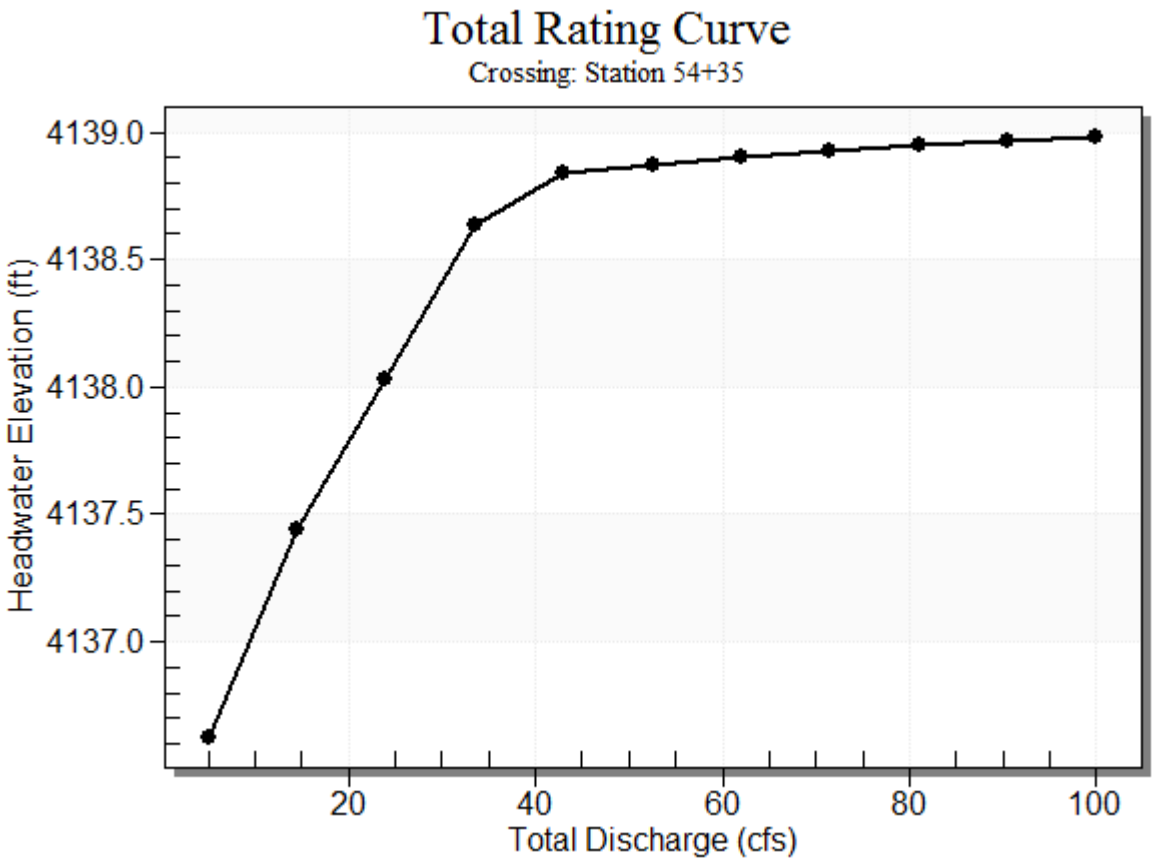


Table 14 - Culvert Summary Table: 36 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	5.00	5.00	4136.63	1.058	0.0*	1-S2n	0.485	0.697	0.485	0.245	6.626
	14.50	14.50	4137.44	1.873	0.0*	1-S2n	0.844	1.208	0.844	0.423	8.915
	24.00	24.00	4138.03	2.462	0.0*	1-S2n	1.101	1.577	1.101	0.541	10.205
	33.50	33.50	4138.63	3.062	0.0*	5-S2n	1.321	1.876	1.321	0.635	11.164
	43.00	36.43	4138.84	3.271	0.0*	5-S2n	1.387	1.958	1.387	0.713	11.404
	52.50	36.87	4138.87	3.303	0.0*	5-S2n	1.396	1.970	1.396	0.782	11.443
	62.00	37.23	4138.90	3.331	0.0*	5-S2n	1.404	1.980	1.404	0.844	11.475
	71.50	37.54	4138.92	3.354	0.0*	5-S2n	1.410	1.988	1.410	0.900	11.501
	81.00	37.82	4138.95	3.376	0.0*	5-S2n	1.416	1.996	1.445	0.952	11.223
	90.50	38.08	4138.97	3.396	0.0*	5-S2n	1.422	2.003	1.450	1.001	11.249
	100.00	38.32	4138.98	3.414	0.0*	5-S2n	1.427	2.009	1.455	1.046	11.274

* Full Flow Headwater elevation is below inlet invert.

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Straight Culvert

Inlet Elevation (invert): 4135.57 ft, Outlet Elevation (invert): 4131.86 ft

Culvert Length: 70.10 ft, Culvert Slope: 0.0530

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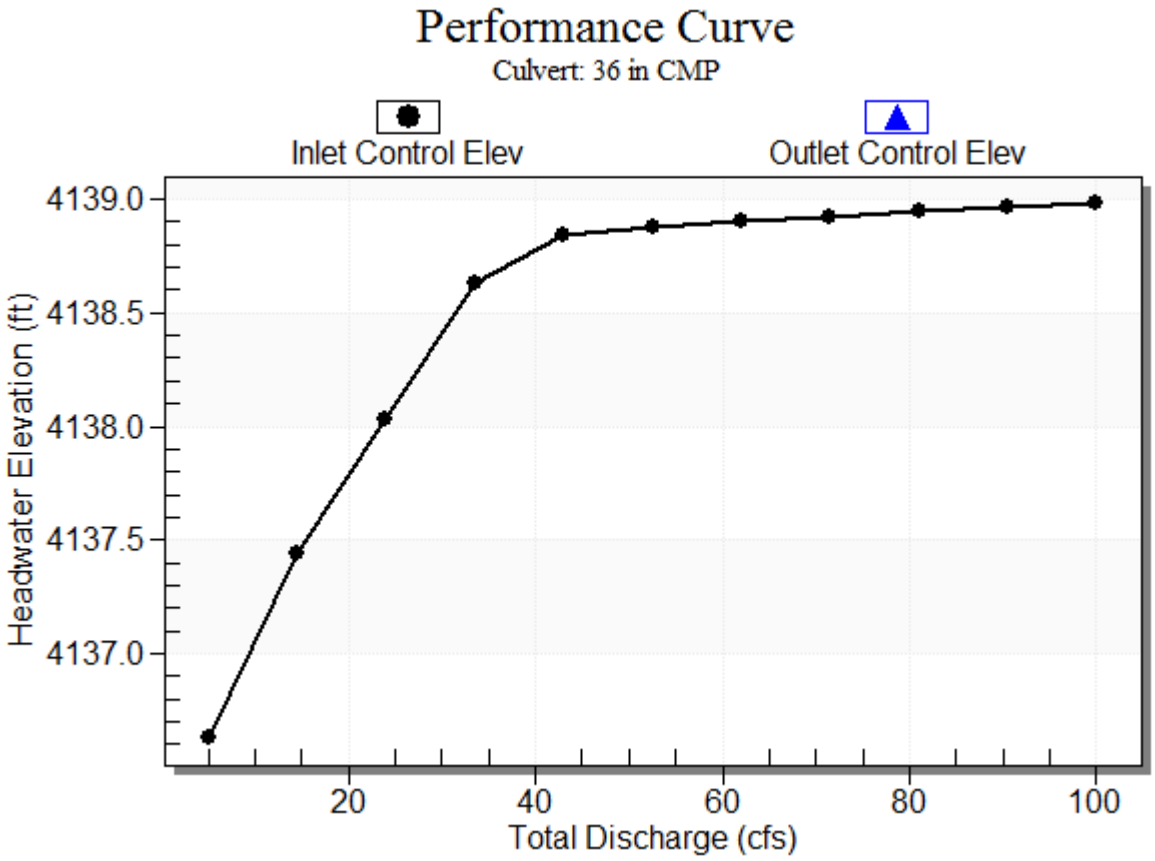
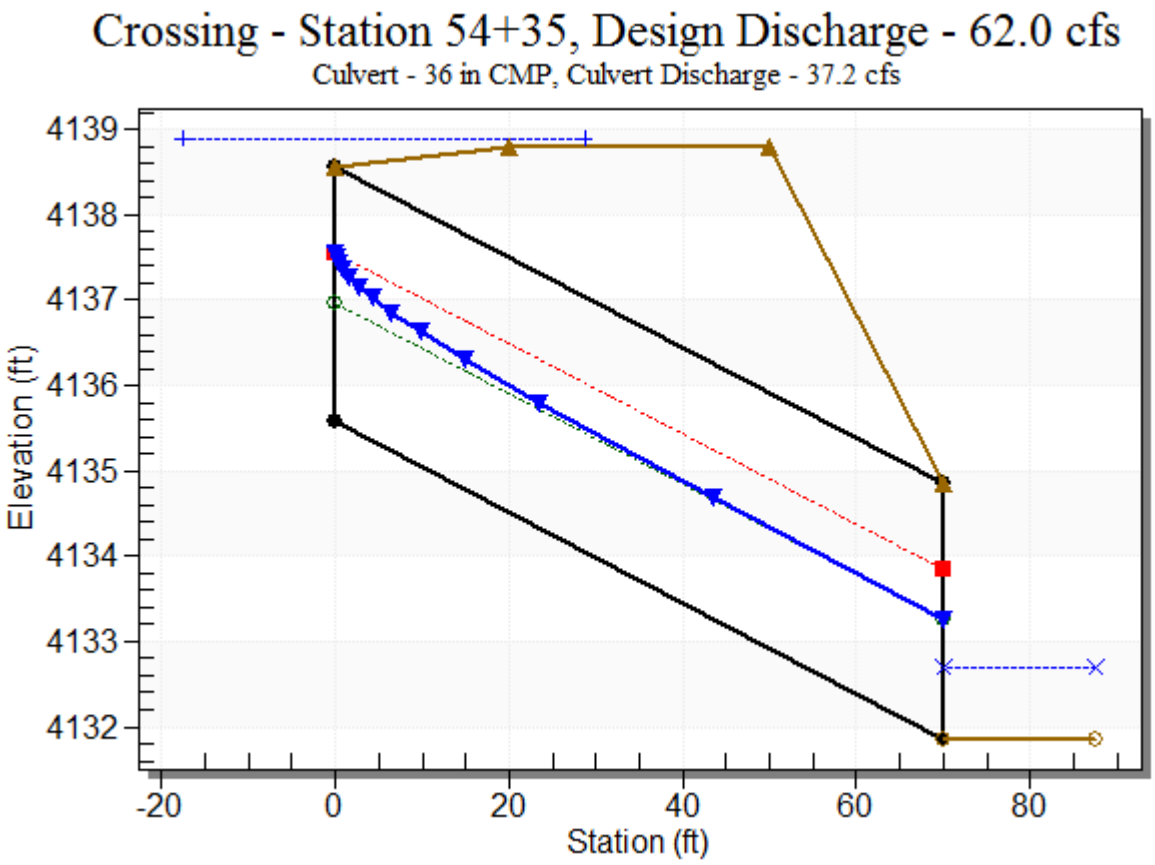
Culvert Performance Curve Plot: 36 in CMP



Water Surface Profile Plot for Culvert: 36 in CMP



Site Data - 36 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4135.57 ft

Outlet Station: 70.00 ft

Outlet Elevation: 4131.86 ft

Number of Barrels: 1

Culvert Data Summary - 36 in CMP

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: NONE

Table 15 - Downstream Channel Rating Curve (Crossing: Station 54+35)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	4132.10	0.24	2.75	0.61	1.13
14.50	4132.28	0.42	3.71	1.06	1.22
24.00	4132.40	0.54	4.26	1.35	1.26
33.50	4132.49	0.63	4.65	1.58	1.29
43.00	4132.57	0.71	4.97	1.78	1.31
52.50	4132.64	0.78	5.23	1.95	1.32
62.00	4132.70	0.84	5.47	2.11	1.34
71.50	4132.76	0.90	5.67	2.25	1.35
81.00	4132.81	0.95	5.86	2.38	1.36
90.50	4132.86	1.00	6.03	2.50	1.37
100.00	4132.91	1.05	6.18	2.61	1.38

Tailwater Channel Data - Station 54+35

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4131.86 ft

Roadway Data for Crossing: Station 54+35

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4138.80 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Crossing Discharge Data Sta 57+75

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 112 cfs

Maximum Flow: 150 cfs

Table 16 - Summary of Culvert Flows at Crossing: Station 57+75

Headwater Elevation (ft)	Total Discharge (cfs)	48 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4131.45	5.00	5.00	0.00	1
4132.42	19.50	19.50	0.00	1
4133.11	34.00	34.00	0.00	1
4133.68	48.50	48.50	0.00	1
4134.26	63.00	63.00	0.00	1
4134.93	77.50	77.50	0.00	1
4135.71	92.00	92.00	0.00	1
4136.65	106.50	106.50	0.00	1
4137.00	112.00	111.50	0.04	63
4137.10	135.50	112.79	22.47	6
4137.13	150.00	113.27	36.44	4
4137.00	111.48	111.48	0.00	Overtopping

Rating Curve Plot for Crossing: Station 57+75

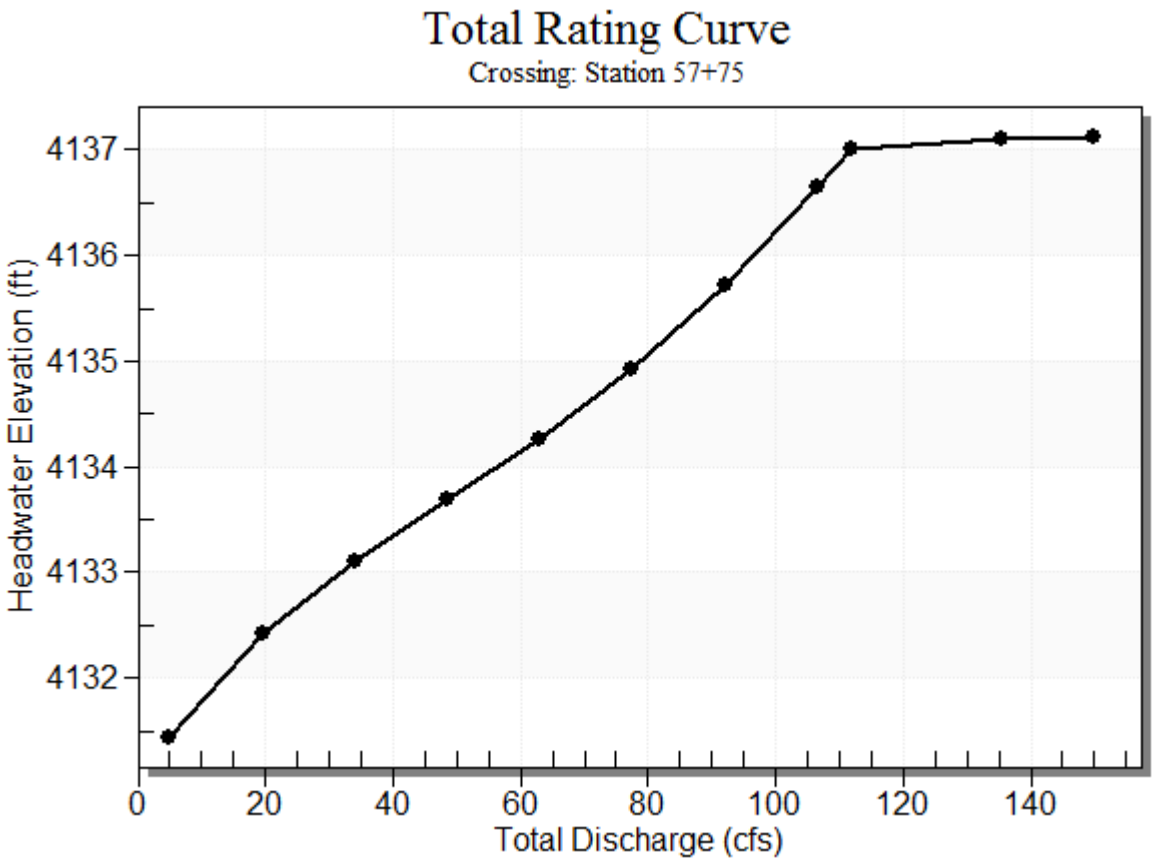


Table 17 - Culvert Summary Table: 48 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	5.00	5.00	4131.45	0.926	0.0*	1-S2n	0.541	0.643	0.541	0.245	4.750
	19.50	19.50	4132.42	1.905	0.0*	1-S2n	1.118	1.294	1.118	0.490	6.805
	34.00	34.00	4133.11	2.591	0.568	1-S2n	1.497	1.732	1.505	0.639	7.856
	48.50	48.50	4133.68	3.165	1.259	1-S2n	1.824	2.086	1.824	0.754	8.693
	63.00	63.00	4134.26	3.743	2.021	1-S2n	2.125	2.391	2.125	0.850	9.288
	77.50	77.50	4134.93	4.405	2.868	5-S2n	2.423	2.663	2.423	0.934	9.738
	92.00	92.00	4135.71	5.194	3.803	5-S2n	2.734	2.904	2.734	1.008	10.068
	106.50	106.50	4136.65	6.126	5.270	5-S2n	3.084	3.119	3.084	1.076	10.266
	112.00	111.50	4137.00	6.481	6.016	7-M2c	3.217	3.187	3.187	1.100	10.386
	135.50	112.79	4137.10	6.575	6.059	7-M2c	3.252	3.204	3.204	1.196	10.453
	150.00	113.27	4137.13	6.610	6.076	7-M2c	3.265	3.210	3.210	1.250	10.478

* Full Flow Headwater elevation is below inlet invert.

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Straight Culvert

Inlet Elevation (invert): 4130.52 ft, Outlet Elevation (invert): 4129.03 ft

Culvert Length: 70.02 ft, Culvert Slope: 0.0213

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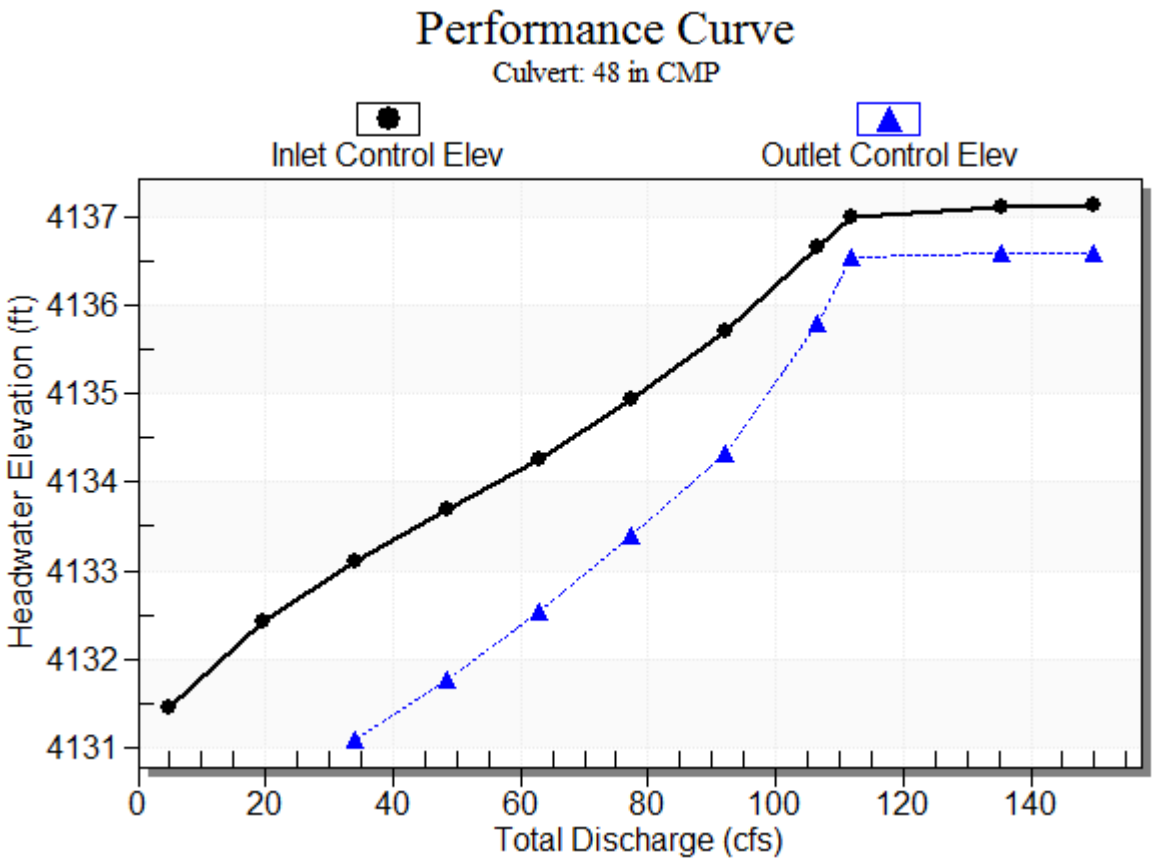
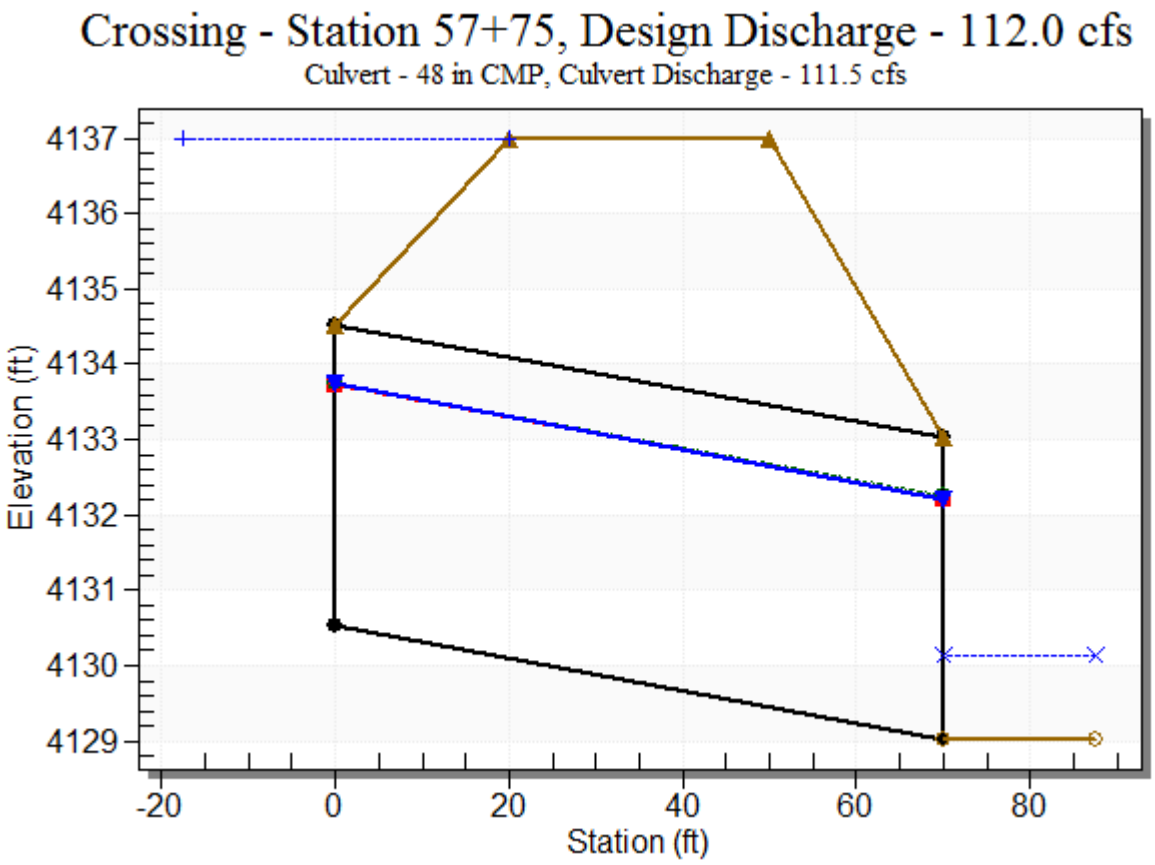
Culvert Performance Curve Plot: 48 in CMP



Water Surface Profile Plot for Culvert: 48 in CMP



Site Data - 48 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4130.52 ft

Outlet Station: 70.00 ft

Outlet Elevation: 4129.03 ft

Number of Barrels: 1

Culvert Data Summary - 48 in CMP

Barrel Shape: Circular

Barrel Diameter: 4.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: NONE

Table 18 - Downstream Channel Rating Curve (Crossing: Station 57+75)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	4129.27	0.24	2.75	0.61	1.13
19.50	4129.52	0.49	4.03	1.22	1.24
34.00	4129.67	0.64	4.67	1.60	1.29
48.50	4129.78	0.75	5.13	1.88	1.32
63.00	4129.88	0.85	5.49	2.12	1.34
77.50	4129.96	0.93	5.79	2.33	1.36
92.00	4130.04	1.01	6.05	2.52	1.37
106.50	4130.11	1.08	6.28	2.68	1.39
112.00	4130.13	1.10	6.37	2.75	1.39
135.50	4130.23	1.20	6.68	2.98	1.41
150.00	4130.28	1.25	6.86	3.12	1.42

Tailwater Channel Data - Station 57+75

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4129.03 ft

Roadway Data for Crossing: Station 57+75

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4137.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Crossing Discharge Data Sta 62+30

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 25 cfs

Maximum Flow: 40 cfs

Table 19 - Summary of Culvert Flows at Crossing: Station 62+30

Headwater Elevation (ft)	Total Discharge (cfs)	24 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4124.88	5.00	5.00	0.00	1
4125.29	8.50	8.50	0.00	1
4125.69	12.00	12.00	0.00	1
4126.18	15.50	15.50	0.00	1
4126.81	19.00	19.00	0.00	1
4127.56	22.50	22.50	0.00	1
4128.01	25.00	24.35	0.46	53
4128.03	29.50	24.47	4.88	5
4128.05	33.00	24.53	8.37	4
4128.06	36.50	24.58	11.72	3
4128.07	40.00	24.62	15.23	3
4128.00	24.33	24.33	0.00	Overtopping

Rating Curve Plot for Crossing: Station 62+30

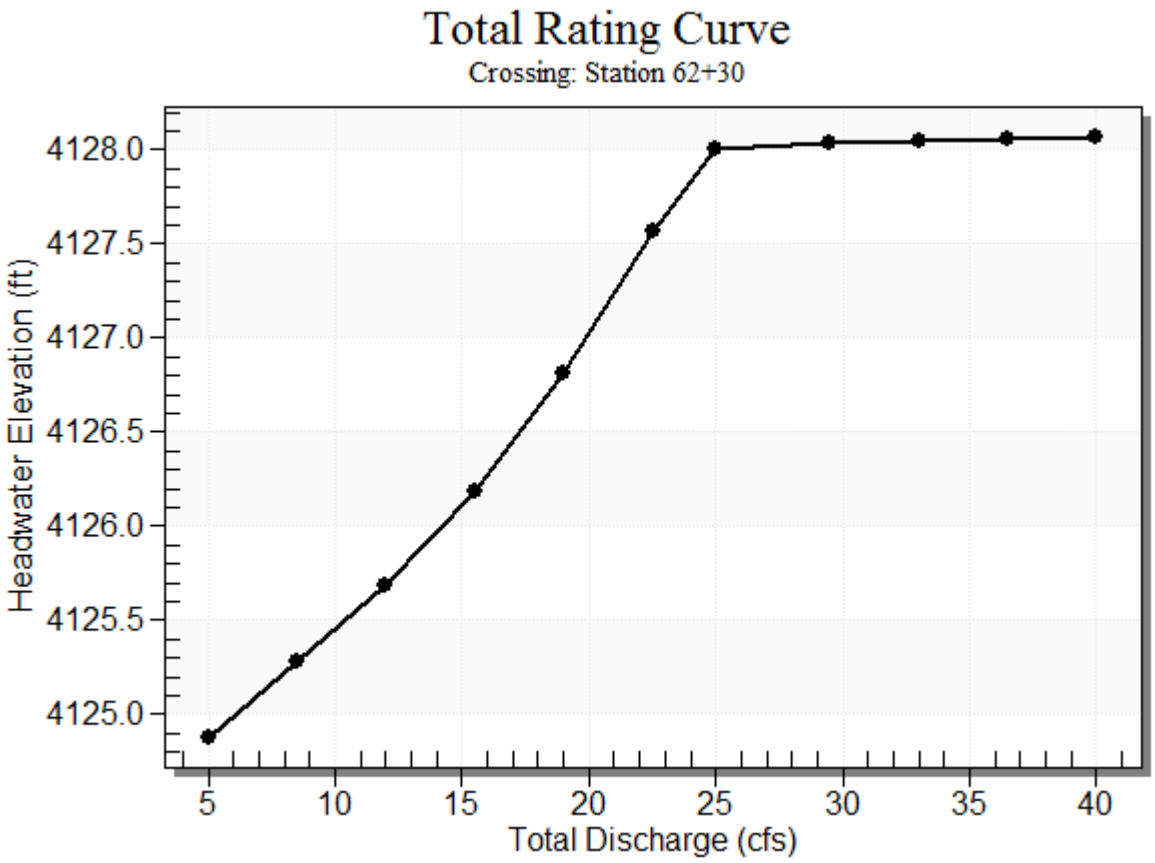


Table 20 - Culvert Summary Table: 24 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	5.00	5.00	4124.88	1.203	0.0*	1-S2n	0.593	0.783	0.593	0.245	6.470
	8.50	8.50	4125.29	1.606	0.0*	1-S2n	0.787	1.038	0.787	0.323	7.391
	12.00	12.00	4125.69	2.009	0.0*	5-S2n	0.957	1.239	0.957	0.385	8.087
	15.50	15.50	4126.18	2.504	0.0*	5-S2n	1.117	1.415	1.117	0.437	8.588
	19.00	19.00	4126.81	3.129	1.207	5-S2n	1.276	1.566	1.276	0.483	8.983
	22.50	22.50	4127.56	3.883	2.389	5-S2n	1.445	1.690	1.445	0.525	9.258
	25.00	24.35	4128.01	4.327	3.087	5-S2n	1.553	1.744	1.553	0.552	9.326
	29.50	24.47	4128.03	4.355	3.130	5-S2n	1.559	1.747	1.559	0.598	9.330
	33.00	24.53	4128.05	4.370	3.154	5-S2n	1.563	1.749	1.563	0.630	9.331
	36.50	24.58	4128.06	4.382	3.173	5-S2n	1.566	1.750	1.566	0.661	9.333
	40.00	24.62	4128.07	4.394	3.192	5-S2n	1.568	1.752	1.568	0.690	9.334

* Full Flow Headwater elevation is below inlet invert.

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Straight Culvert

Inlet Elevation (invert): 4123.68 ft, Outlet Elevation (invert): 4120.32 ft

Culvert Length: 76.07 ft, Culvert Slope: 0.0442

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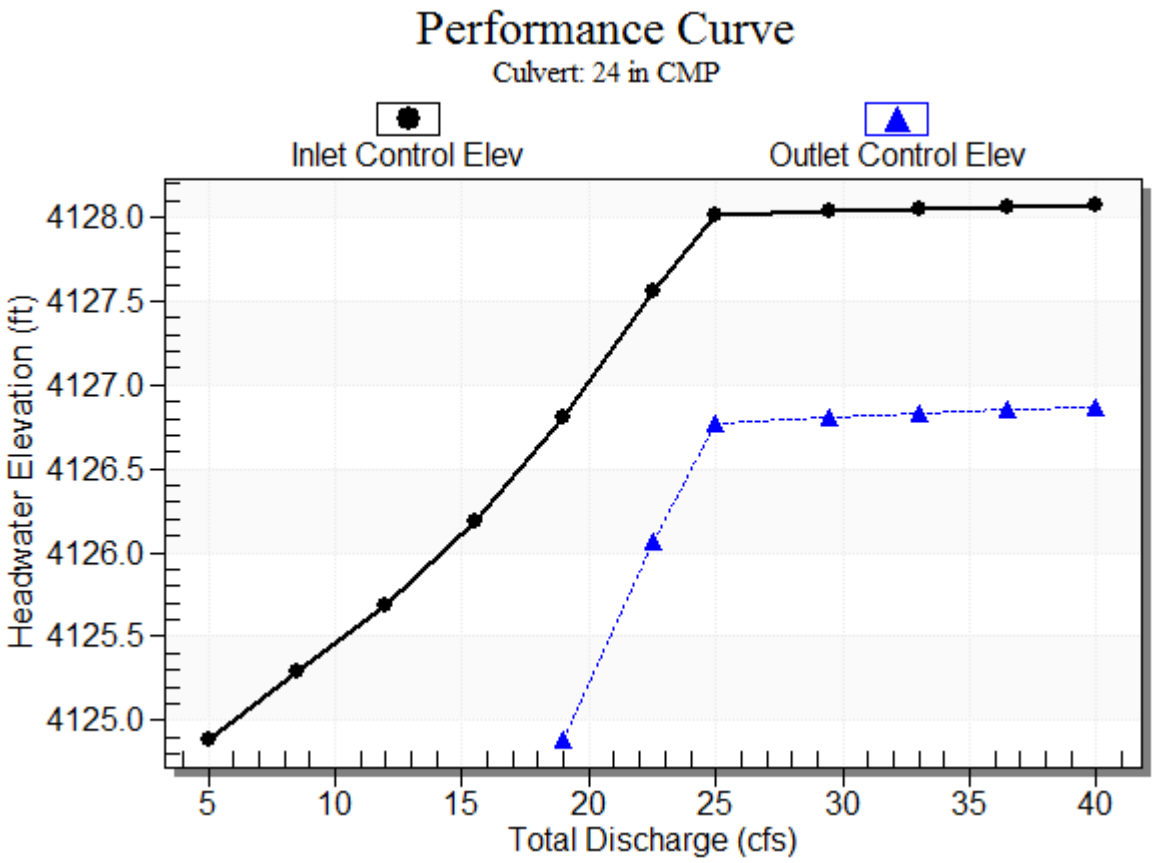
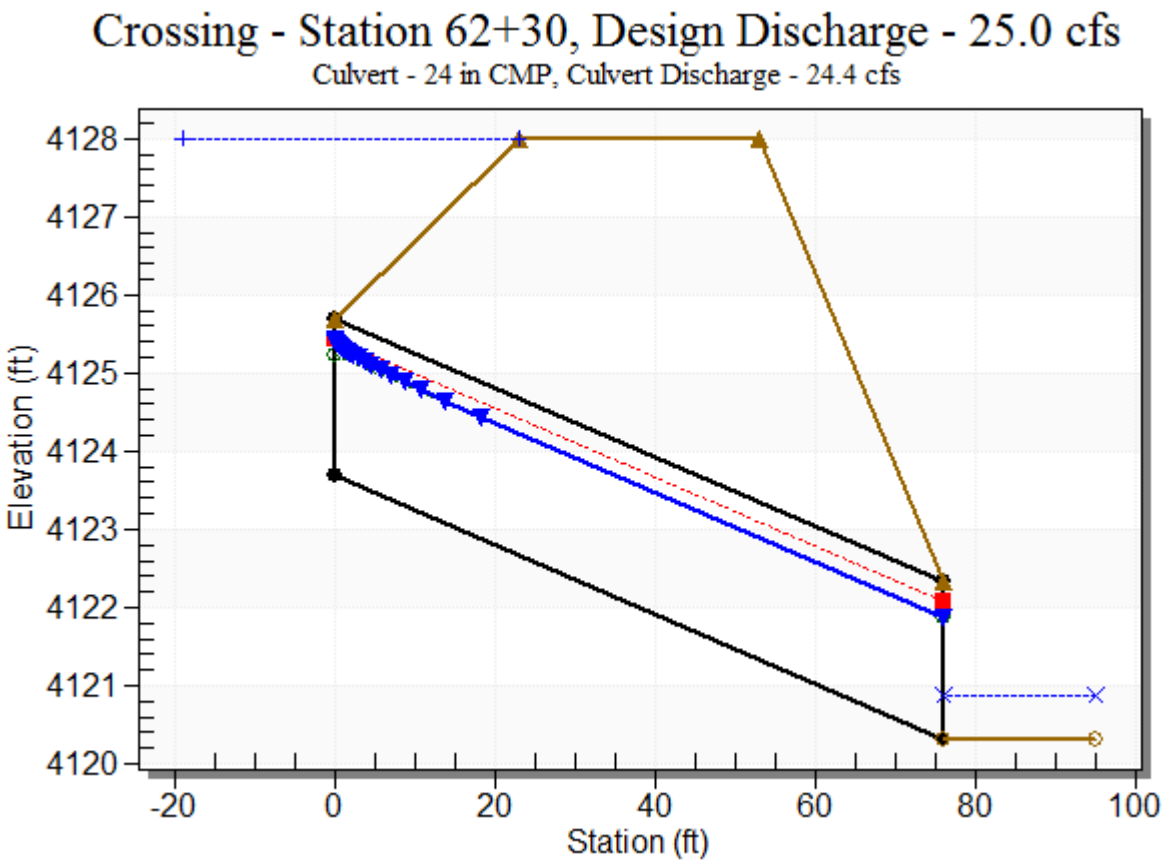
Culvert Performance Curve Plot: 24 in CMP



Water Surface Profile Plot for Culvert: 24 in CMP



Site Data - 24 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4123.68 ft

Outlet Station: 76.00 ft

Outlet Elevation: 4120.32 ft

Number of Barrels: 1

Culvert Data Summary - 24 in CMP

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: NONE

Table 21 - Downstream Channel Rating Curve (Crossing: Station 62+30)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	4120.56	0.24	2.75	0.61	1.13
8.50	4120.64	0.32	3.20	0.81	1.17
12.00	4120.70	0.38	3.52	0.96	1.20
15.50	4120.76	0.44	3.78	1.09	1.22
19.00	4120.80	0.48	4.00	1.21	1.24
22.50	4120.84	0.52	4.18	1.31	1.25
25.00	4120.87	0.55	4.30	1.38	1.26
29.50	4120.92	0.60	4.50	1.49	1.27
33.00	4120.95	0.63	4.63	1.57	1.28
36.50	4120.98	0.66	4.76	1.65	1.29
40.00	4121.01	0.69	4.88	1.72	1.30

Tailwater Channel Data - Station 62+30

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4120.32 ft

Roadway Data for Crossing: Station 62+30

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4128.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Crossing Discharge Data Sta 88+15

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 25 cfs

Maximum Flow: 40 cfs

Table 22 - Summary of Culvert Flows at Crossing: Station 88+15

Headwater Elevation (ft)	Total Discharge (cfs)	24 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4134.13	5.00	5.00	0.00	1
4134.53	8.50	8.50	0.00	1
4134.94	12.00	12.00	0.00	1
4135.43	15.50	15.50	0.00	1
4136.06	19.00	19.00	0.00	1
4136.81	22.50	22.50	0.00	1
4137.42	25.00	25.00	0.00	1
4138.60	29.50	29.50	0.00	1
4139.73	33.00	33.00	0.00	1
4141.03	36.50	36.50	0.00	1
4142.01	40.00	38.65	1.32	9
4142.00	38.63	38.63	0.00	Overtopping

Rating Curve Plot for Crossing: Station 88+15

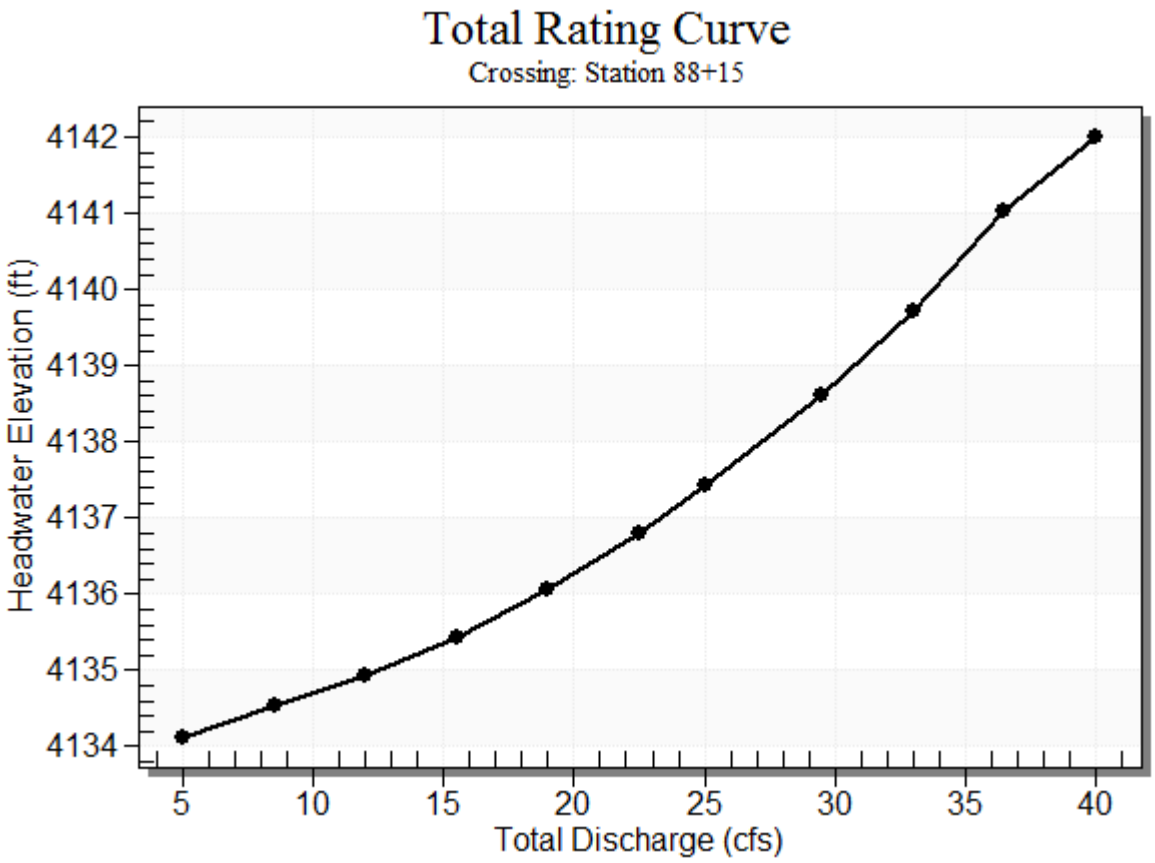


Table 23 - Culvert Summary Table: 24 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	5.00	5.00	4134.13	1.230	0.0*	1-S2n	0.542	0.783	0.542	0.245	7.267
	8.50	8.50	4134.53	1.634	0.0*	1-S2n	0.713	1.038	0.713	0.323	8.445
	12.00	12.00	4134.94	2.037	0.0*	5-S2n	0.860	1.239	0.860	0.385	9.278
	15.50	15.50	4135.43	2.532	0.0*	5-S2n	0.997	1.415	0.997	0.437	9.903
	19.00	19.00	4136.06	3.157	0.0*	5-S2n	1.130	1.566	1.122	0.483	10.469
	22.50	22.50	4136.81	3.911	0.452	5-S2n	1.261	1.690	1.286	0.525	10.540
	25.00	25.00	4137.42	4.516	1.515	5-S2n	1.361	1.761	1.369	0.552	10.922
	29.50	29.50	4138.60	5.705	3.681	5-S2n	1.561	1.853	1.561	0.598	11.236
	33.00	33.00	4139.73	6.826	5.595	5-S2n	1.797	1.897	1.797	0.630	11.109
	36.50	36.50	4141.03	8.127	0.000	7-M2c	2.000	1.744	1.744	0.661	12.558
	40.00	38.65	4142.01	8.991	9.114	7-M2c	2.000	1.940	1.940	0.690	12.412

* Full Flow Headwater elevation is below inlet invert.

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Straight Culvert

Inlet Elevation (invert): 4132.90 ft, Outlet Elevation (invert): 4127.13 ft

Culvert Length: 90.18 ft, Culvert Slope: 0.0641

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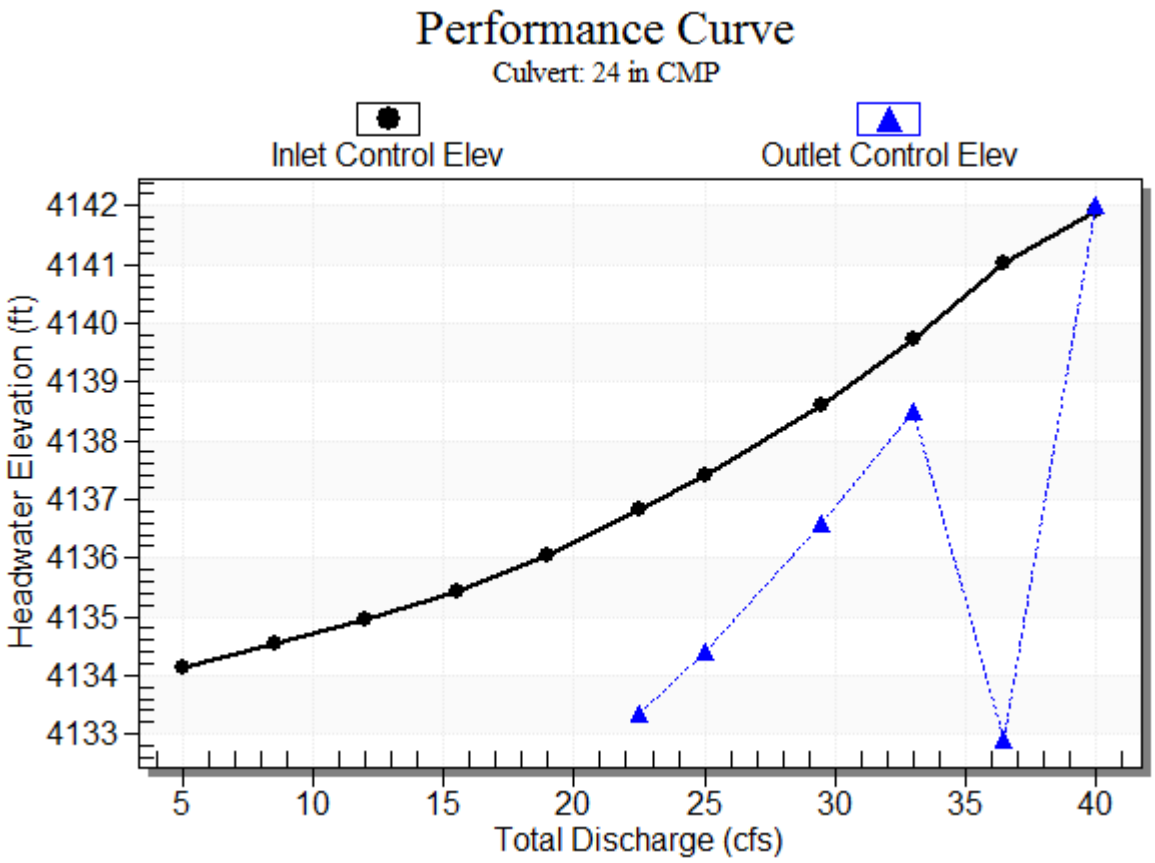
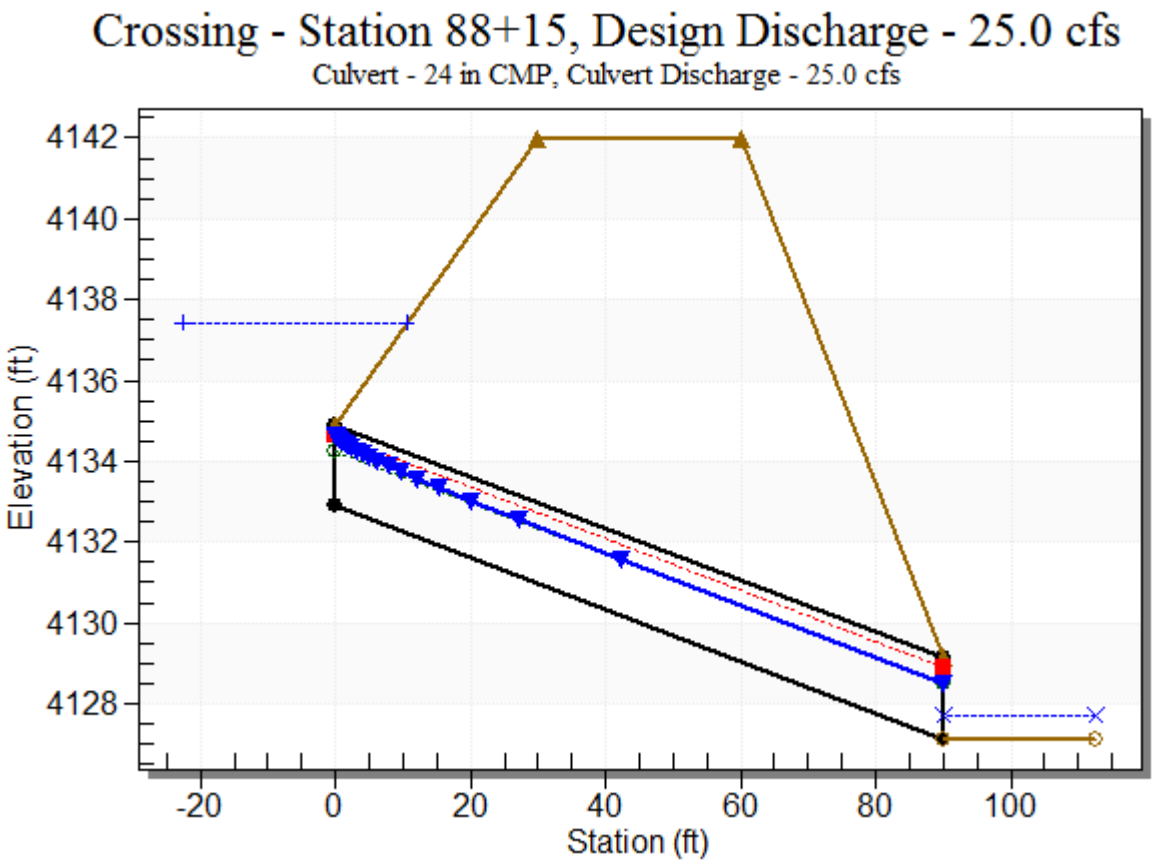
Culvert Performance Curve Plot: 24 in CMP



Water Surface Profile Plot for Culvert: 24 in CMP



Site Data - 24 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4132.90 ft

Outlet Station: 90.00 ft

Outlet Elevation: 4127.13 ft

Number of Barrels: 1

Culvert Data Summary - 24 in CMP

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: NONE

Table 24 - Downstream Channel Rating Curve (Crossing: Station 88+15)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	4127.37	0.24	2.75	0.61	1.13
8.50	4127.45	0.32	3.20	0.81	1.17
12.00	4127.51	0.38	3.52	0.96	1.20
15.50	4127.57	0.44	3.78	1.09	1.22
19.00	4127.61	0.48	4.00	1.21	1.24
22.50	4127.65	0.52	4.18	1.31	1.25
25.00	4127.68	0.55	4.30	1.38	1.26
29.50	4127.73	0.60	4.50	1.49	1.27
33.00	4127.76	0.63	4.63	1.57	1.28
36.50	4127.79	0.66	4.76	1.65	1.29
40.00	4127.82	0.69	4.88	1.72	1.30

Tailwater Channel Data - Station 88+15

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4127.13 ft

Roadway Data for Crossing: Station 88+15

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4142.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Crossing Discharge Data Sta 90+00

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 25 cfs

Maximum Flow: 40 cfs

Table 25 - Summary of Culvert Flows at Crossing: Station 90+00

Headwater Elevation (ft)	Total Discharge (cfs)	24 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4141.07	5.00	5.00	0.00	1
4141.47	8.50	8.50	0.00	1
4141.88	12.00	12.00	0.00	1
4142.37	15.50	15.50	0.00	1
4143.00	19.00	19.00	0.00	1
4143.75	22.50	22.50	0.00	1
4144.01	25.00	23.61	1.23	28
4144.04	29.50	23.71	5.69	5
4144.05	33.00	23.77	8.93	3
4144.06	36.50	23.82	12.46	3
4144.08	40.00	23.87	16.00	3
4144.00	23.55	23.55	0.00	Overtopping

Rating Curve Plot for Crossing: Station 90+00

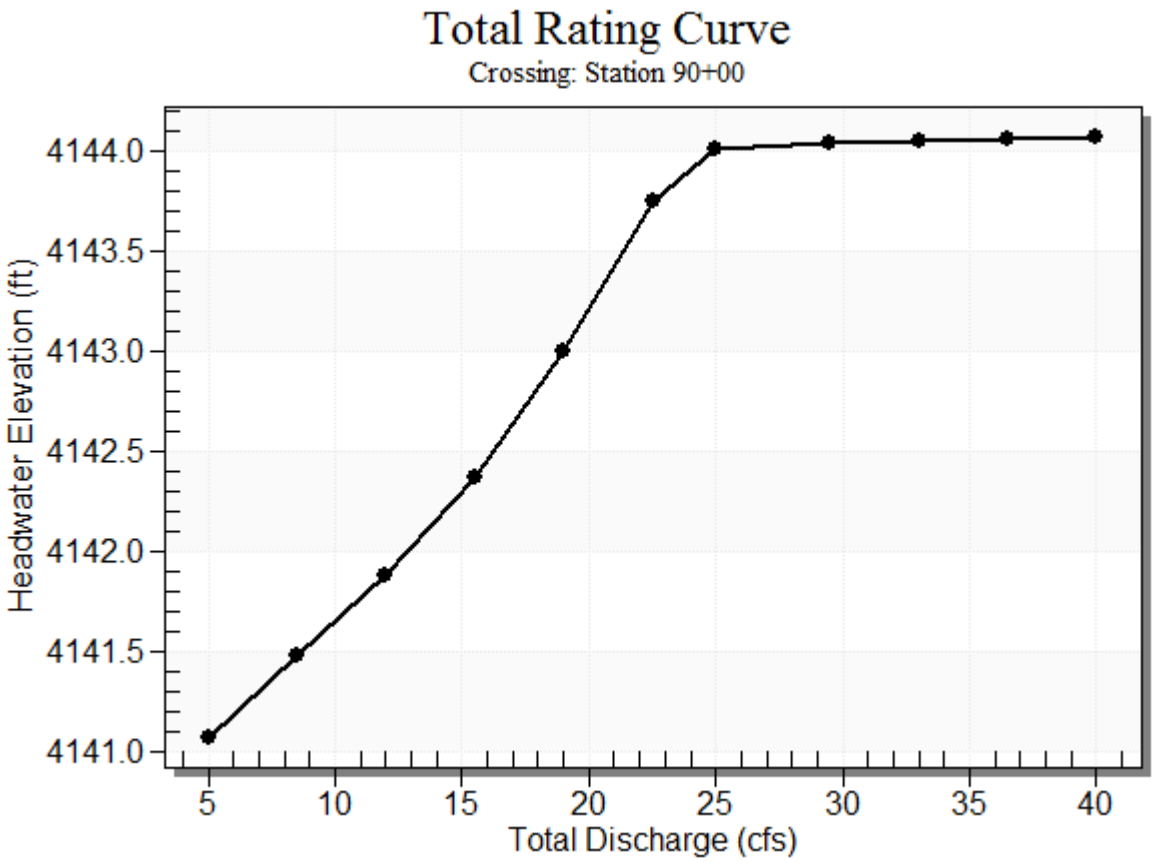


Table 26 - Culvert Summary Table: 24 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	5.00	5.00	4141.07	1.221	0.0*	1-S2n	0.557	0.783	0.557	0.245	7.016
	8.50	8.50	4141.47	1.625	0.0*	1-S2n	0.736	1.038	0.736	0.323	8.114
	12.00	12.00	4141.88	2.028	0.0*	5-S2n	0.888	1.239	0.888	0.385	8.897
	15.50	15.50	4142.37	2.523	0.0*	5-S2n	1.031	1.415	1.041	0.437	9.383
	19.00	19.00	4143.00	3.148	0.0*	5-S2n	1.170	1.566	1.170	0.483	9.956
	22.50	22.50	4143.75	3.902	1.008	5-S2n	1.312	1.690	1.314	0.525	10.275
	25.00	23.61	4144.01	4.164	1.474	5-S2n	1.359	1.723	1.359	0.552	10.400
	29.50	23.71	4144.04	4.188	1.518	5-S2n	1.363	1.726	1.370	0.598	10.349
	33.00	23.77	4144.05	4.202	1.541	5-S2n	1.366	1.728	1.373	0.630	10.354
	36.50	23.82	4144.06	4.214	1.564	5-S2n	1.368	1.729	1.375	0.661	10.358
	40.00	23.87	4144.08	4.226	1.585	5-S2n	1.370	1.731	1.370	0.690	10.420

* Full Flow Headwater elevation is below inlet invert.

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Straight Culvert

Inlet Elevation (invert): 4139.85 ft, Outlet Elevation (invert): 4134.57 ft

Culvert Length: 92.15 ft, Culvert Slope: 0.0574

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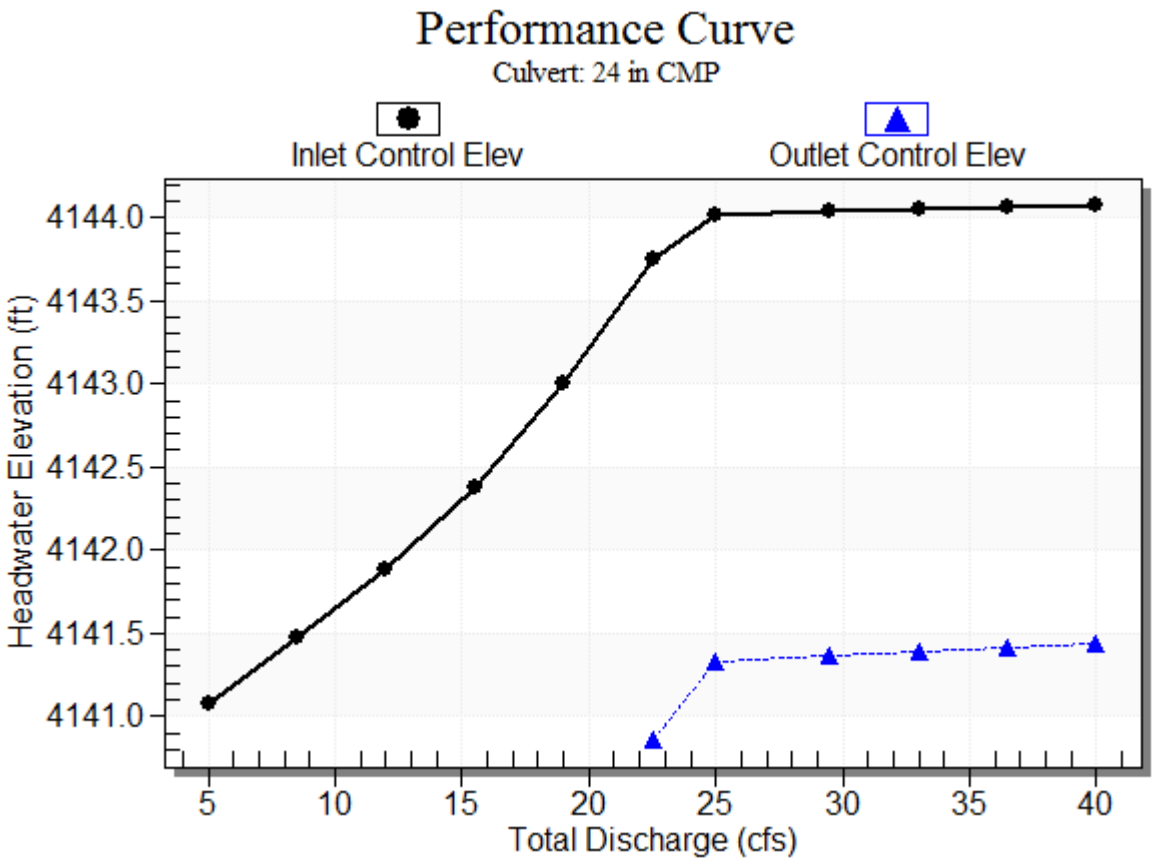
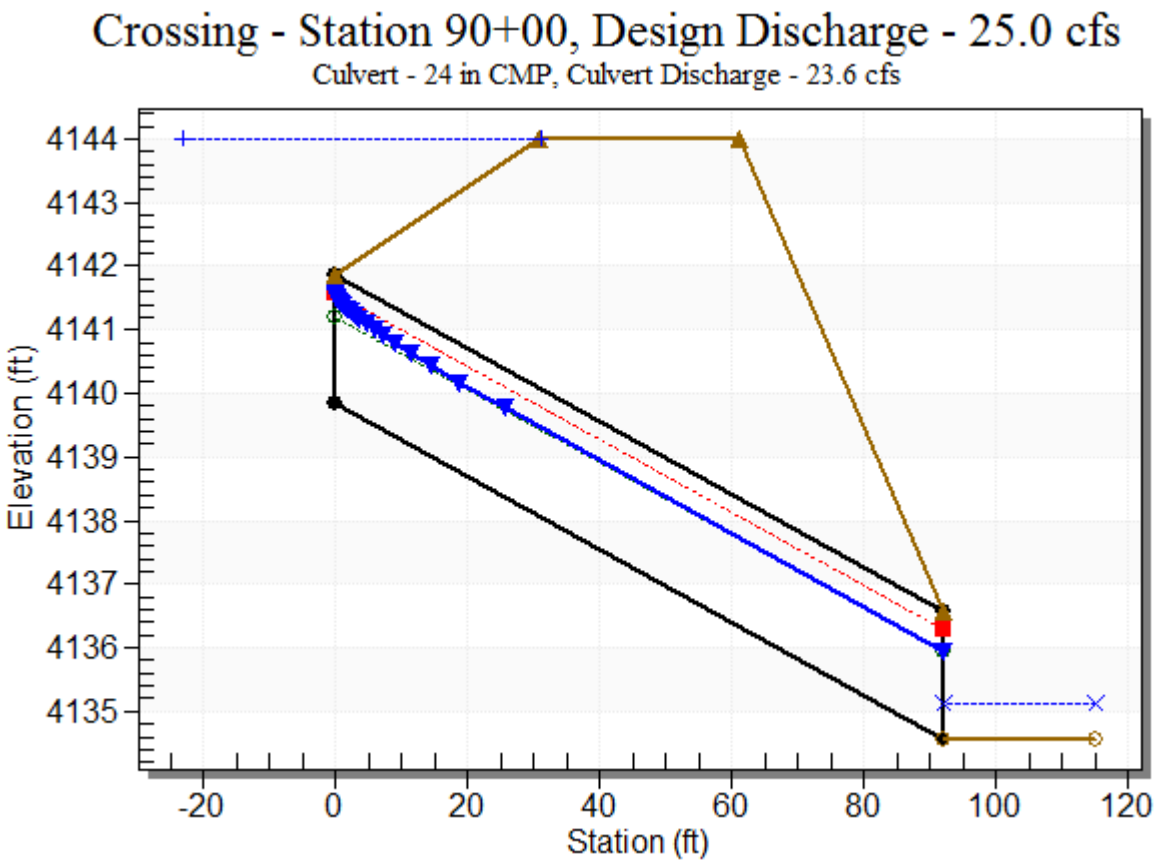
Culvert Performance Curve Plot: 24 in CMP



Water Surface Profile Plot for Culvert: 24 in CMP



Site Data - 24 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4139.85 ft

Outlet Station: 92.00 ft

Outlet Elevation: 4134.57 ft

Number of Barrels: 1

Culvert Data Summary - 24 in CMP

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: NONE

Table 27 - Downstream Channel Rating Curve (Crossing: Station 90+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	4134.81	0.24	2.75	0.61	1.13
8.50	4134.89	0.32	3.20	0.81	1.17
12.00	4134.95	0.38	3.52	0.96	1.20
15.50	4135.01	0.44	3.78	1.09	1.22
19.00	4135.05	0.48	4.00	1.21	1.24
22.50	4135.09	0.52	4.18	1.31	1.25
25.00	4135.12	0.55	4.30	1.38	1.26
29.50	4135.17	0.60	4.50	1.49	1.27
33.00	4135.20	0.63	4.63	1.57	1.28
36.50	4135.23	0.66	4.76	1.65	1.29
40.00	4135.26	0.69	4.88	1.72	1.30

Tailwater Channel Data - Station 90+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4134.57 ft

Roadway Data for Crossing: Station 90+00

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4144.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Crossing Discharge Data Sta 144+70

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 14.8 cfs

Design Flow: 35 cfs

Maximum Flow: 57.1 cfs

Table 28 - Summary of Culvert Flows at Crossing: Station 144+70

Headwater Elevation (ft)	Total Discharge (cfs)	36 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4108.33	14.80	14.80	0.00	1
4108.60	19.03	19.03	0.00	1
4108.86	23.26	23.26	0.00	1
4109.11	27.49	27.49	0.00	1
4109.38	31.72	31.72	0.00	1
4109.61	35.00	35.00	0.00	1
4110.00	40.18	40.18	0.00	1
4110.36	44.41	44.41	0.00	1
4110.77	48.64	48.64	0.00	1
4111.21	52.87	52.87	0.00	1
4111.68	57.10	57.10	0.00	1
4118.10	97.76	97.76	0.00	Overtopping

Rating Curve Plot for Crossing: Station 144+70

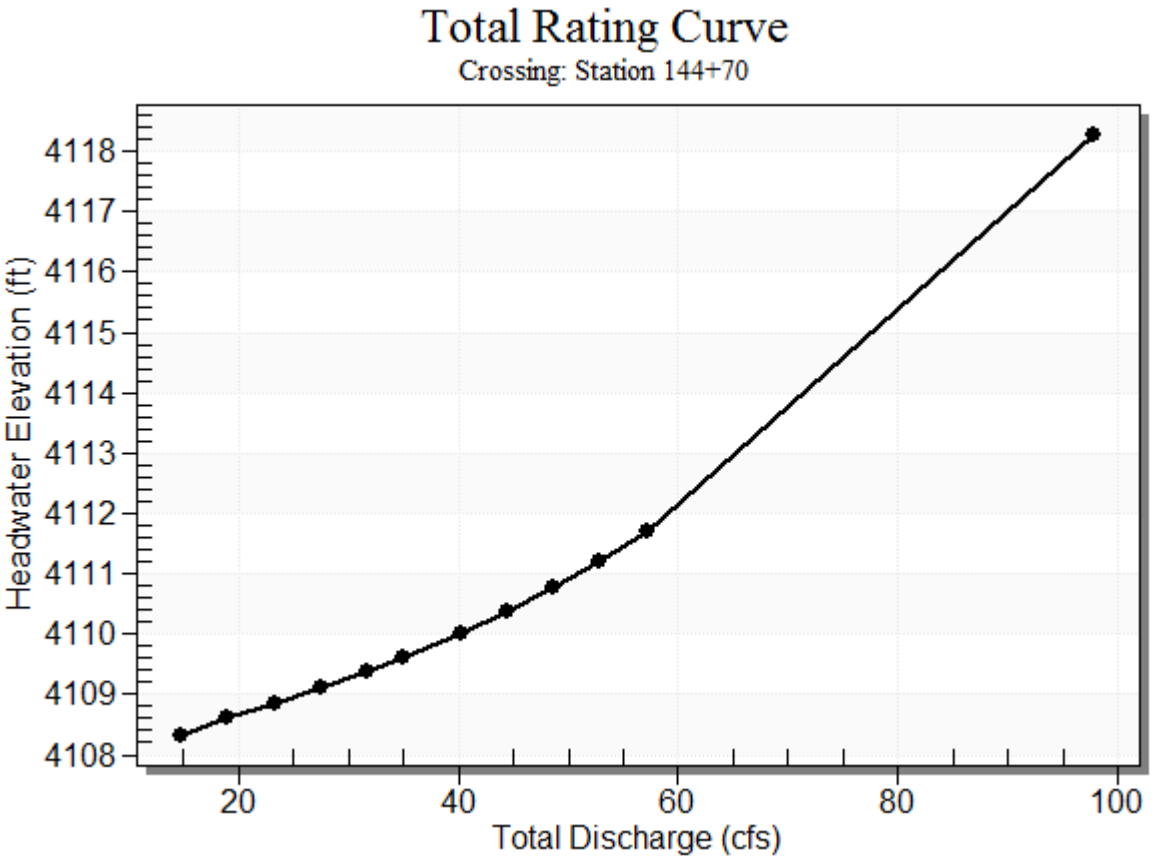


Table 29 - Culvert Summary Table: 36 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	14.80	14.80	4108.33	2.062	0.0*	1-S2n	0.665	1.222	0.665	0.427	12.559
	19.03	19.03	4108.60	2.333	0.0*	1-S2n	0.762	1.399	0.784	0.484	12.896
	23.26	23.26	4108.86	2.587	0.0*	1-S2n	0.848	1.552	0.848	0.533	14.205
	27.49	27.49	4109.11	2.842	0.0*	1-S2n	0.921	1.692	0.921	0.578	14.868
	31.72	31.72	4109.38	3.111	0.0*	5-S2n	0.994	1.824	0.994	0.619	15.458
	35.00	35.00	4109.61	3.336	0.0*	5-S2n	1.050	1.919	1.050	0.648	15.841
	40.18	40.18	4110.00	3.731	0.0*	5-S2n	1.132	2.062	1.132	0.691	16.485
	44.41	44.41	4110.36	4.094	0.0*	5-S2n	1.194	2.168	1.194	0.724	16.915
	48.64	48.64	4110.77	4.496	0.0*	5-S2n	1.255	2.268	1.255	0.755	17.328
	52.87	52.87	4111.21	4.937	0.0*	5-S2n	1.317	2.360	1.313	0.785	17.765
	57.10	57.10	4111.68	5.415	0.0*	5-S2n	1.378	2.446	1.378	0.813	18.031

* Full Flow Headwater elevation is below inlet invert.

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Straight Culvert

Inlet Elevation (invert): 4106.27 ft, Outlet Elevation (invert): 4088.54 ft

Culvert Length: 134.08 ft, Culvert Slope: 0.1334

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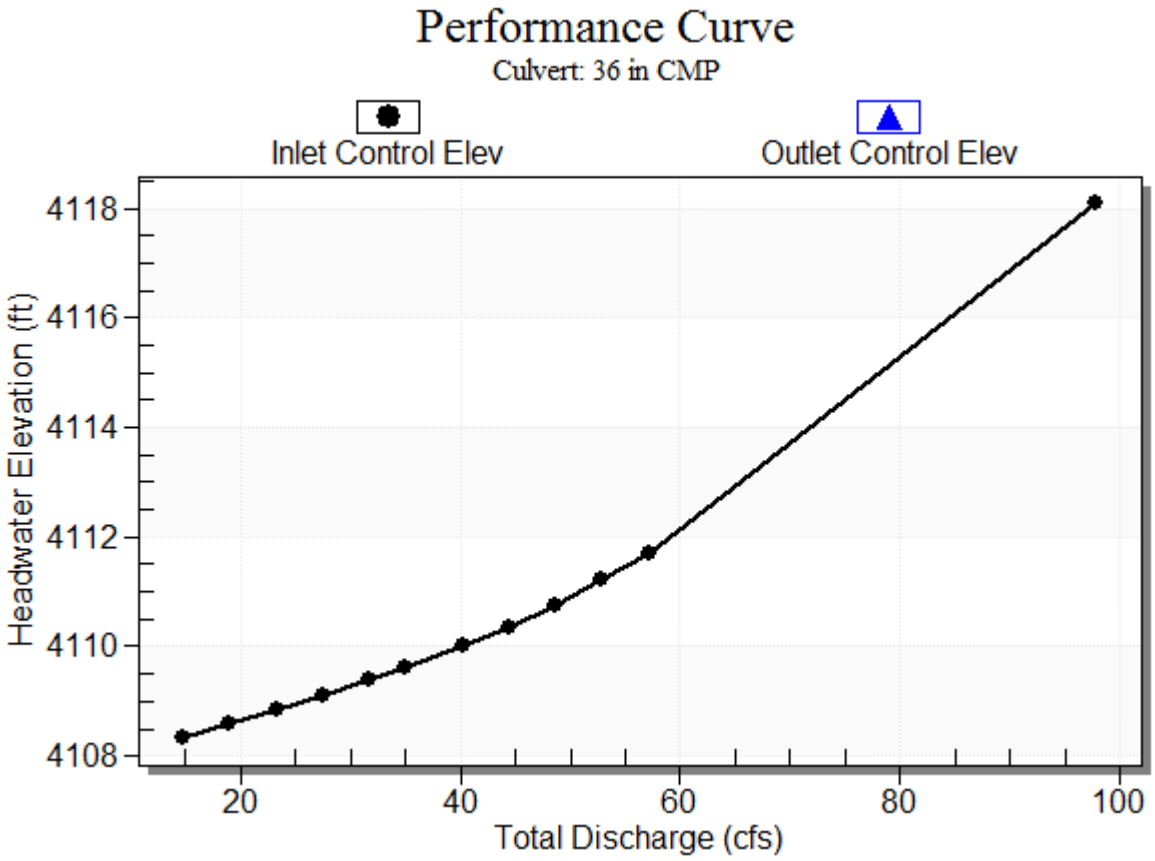
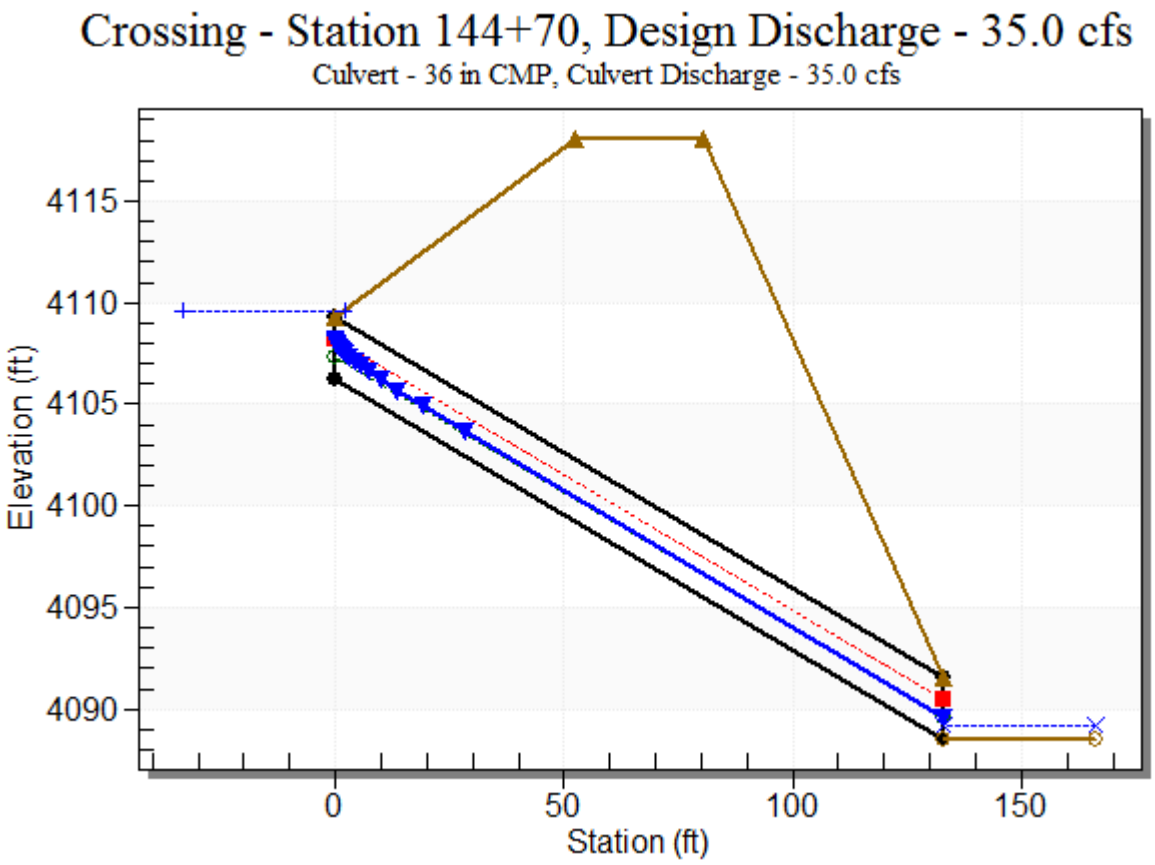
Culvert Performance Curve Plot: 36 in CMP



Water Surface Profile Plot for Culvert: 36 in CMP



Site Data - 36 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4106.27 ft

Outlet Station: 132.90 ft

Outlet Elevation: 4088.54 ft

Number of Barrels: 1

Culvert Data Summary - 36 in CMP

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: NONE

Table 30 - Downstream Channel Rating Curve (Crossing: Station 144+70)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
14.80	4088.97	0.43	3.73	1.07	1.22
19.03	4089.02	0.48	4.00	1.21	1.24
23.26	4089.07	0.53	4.22	1.33	1.25
27.49	4089.12	0.58	4.41	1.44	1.27
31.72	4089.16	0.62	4.59	1.54	1.28
35.00	4089.19	0.65	4.71	1.62	1.29
40.18	4089.23	0.69	4.88	1.73	1.30
44.41	4089.26	0.72	5.01	1.81	1.31
48.64	4089.30	0.76	5.13	1.88	1.32
52.87	4089.32	0.78	5.24	1.96	1.32
57.10	4089.35	0.81	5.35	2.03	1.33

Tailwater Channel Data - Station 144+70

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4088.54 ft

Roadway Data for Crossing: Station 144+70

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4118.10 ft

Roadway Surface: Gravel

Roadway Top Width: 28.00 ft

Crossing Discharge Data Sta 150+40

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 17.9 cfs

Design Flow: 44 cfs

Maximum Flow: 73.9 cfs

Table 31 - Summary of Culvert Flows at Crossing: Station 150+40

Headwater Elevation (ft)	Total Discharge (cfs)	36 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4112.75	17.90	17.90	0.00	1
4113.09	23.50	23.50	0.00	1
4113.43	29.10	29.10	0.00	1
4113.80	34.70	34.70	0.00	1
4114.23	40.30	40.30	0.00	1
4114.55	44.00	44.00	0.00	1
4115.28	51.50	51.50	0.00	1
4115.90	57.10	57.10	0.00	1
4116.59	62.70	62.70	0.00	1
4117.33	68.30	68.30	0.00	1
4118.11	73.90	73.90	0.00	1
4128.00	122.11	122.11	0.00	Overtopping

Rating Curve Plot for Crossing: Station 150+40

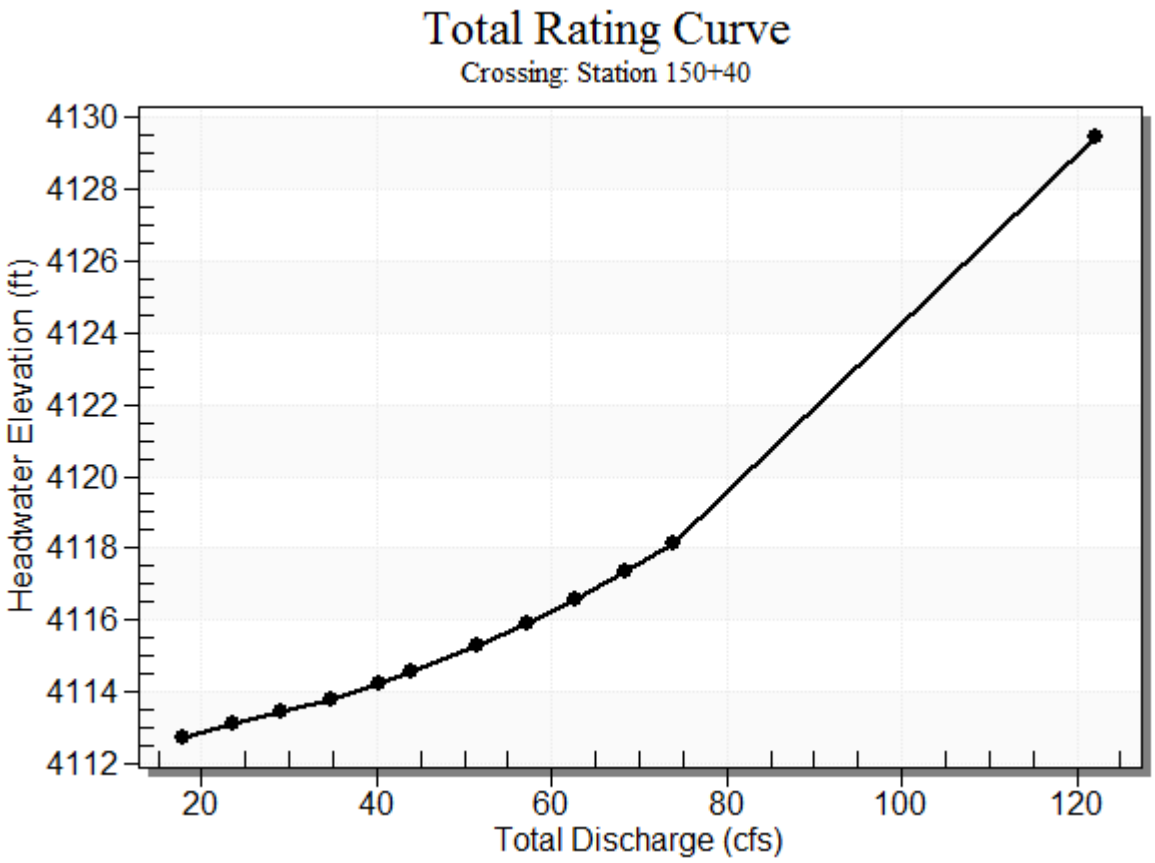


Table 32 - Culvert Summary Table: 36 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	17.90	17.90	4112.75	2.193	0.0*	1-S2n	0.800	1.354	0.800	0.469	11.814
	23.50	23.50	4113.09	2.531	0.0*	1-S2n	0.916	1.560	0.916	0.536	12.819
	29.10	29.10	4113.43	2.871	0.0*	1-S2n	1.027	1.742	1.027	0.594	13.573
	34.70	34.70	4113.80	3.244	0.0*	5-S2n	1.131	1.910	1.131	0.645	14.254
	40.30	40.30	4114.23	3.670	0.0*	5-S2n	1.225	2.065	1.218	0.692	14.946
	44.00	44.00	4114.55	3.987	0.0*	5-S2n	1.288	2.158	1.288	0.721	15.160
	51.50	51.50	4115.28	4.719	0.0*	5-S2n	1.410	2.331	1.410	0.775	15.785
	57.10	57.10	4115.90	5.344	0.0*	5-S2n	1.497	2.446	1.497	0.813	16.199
	62.70	62.70	4116.59	6.030	0.0*	5-S2n	1.584	2.547	1.584	0.848	16.567
	68.30	68.30	4117.33	6.768	0.0*	5-S2n	1.670	2.634	1.670	0.882	16.892
	73.90	73.90	4118.11	7.549	0.0*	5-S2n	1.756	2.706	1.756	0.914	17.209

* Full Flow Headwater elevation is below inlet invert.

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Straight Culvert

Inlet Elevation (invert): 4110.56 ft, Outlet Elevation (invert): 4093.34 ft

Culvert Length: 173.31 ft, Culvert Slope: 0.0999

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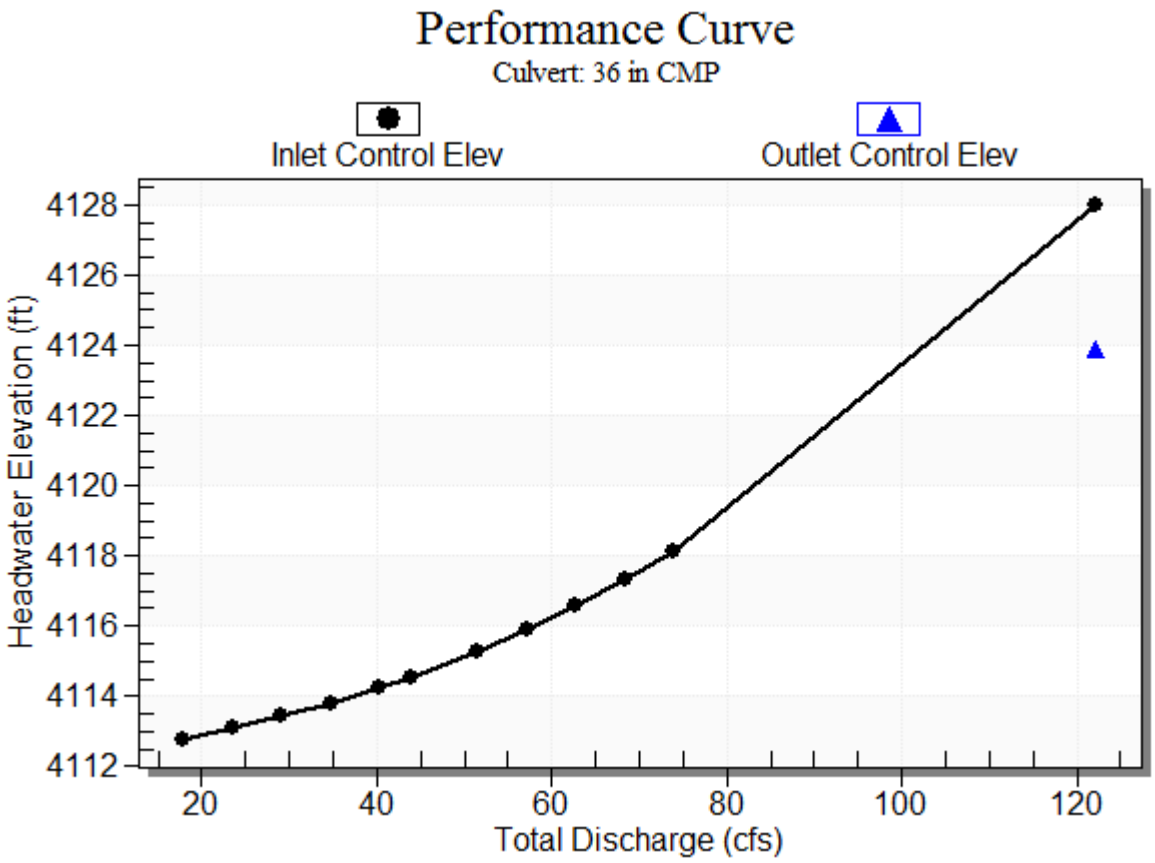
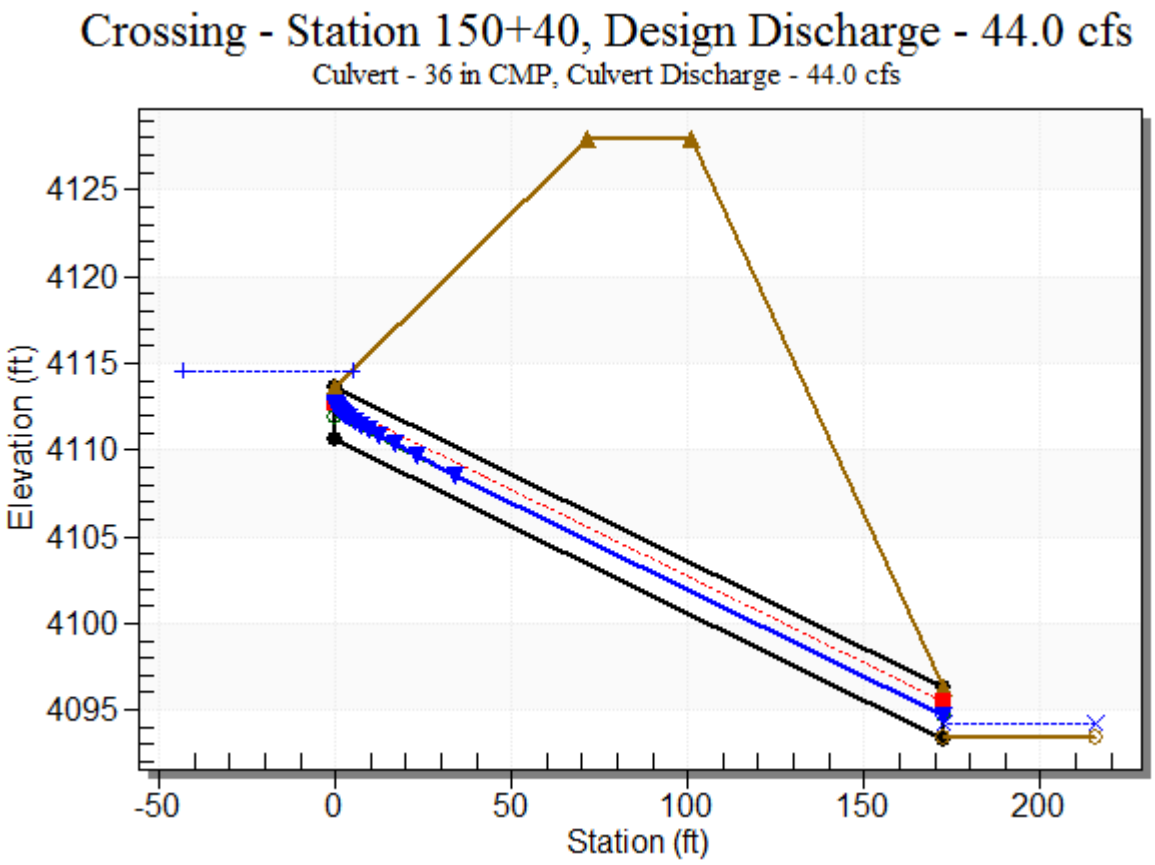
Culvert Performance Curve Plot: 36 in CMP



Water Surface Profile Plot for Culvert: 36 in CMP



Site Data - 36 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4110.56 ft

Outlet Station: 172.45 ft

Outlet Elevation: 4093.34 ft

Number of Barrels: 1

Culvert Data Summary - 36 in CMP

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: NONE

Table 33 - Downstream Channel Rating Curve (Crossing: Station 150+40)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
17.90	4093.91	0.47	3.93	1.17	1.23
23.50	4093.98	0.54	4.23	1.34	1.26
29.10	4094.03	0.59	4.48	1.48	1.27
34.70	4094.09	0.65	4.70	1.61	1.29
40.30	4094.13	0.69	4.89	1.73	1.30
44.00	4094.16	0.72	5.00	1.80	1.31
51.50	4094.22	0.78	5.21	1.94	1.32
57.10	4094.25	0.81	5.35	2.03	1.33
62.70	4094.29	0.85	5.48	2.12	1.34
68.30	4094.32	0.88	5.60	2.20	1.35
73.90	4094.35	0.91	5.72	2.28	1.35

Tailwater Channel Data - Station 150+40

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4093.44 ft

Roadway Data for Crossing: Station 150+40

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4128.00 ft

Roadway Surface: Gravel

Roadway Top Width: 30.00 ft

Crossing Discharge Data Sta 154+20

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 35.2 cfs

Design Flow: 95 cfs

Maximum Flow: 167.4 cfs

Table 34 - Summary of Culvert Flows at Crossing: Station 154+20

Headwater Elevation (ft)	Total Discharge (cfs)	36 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4131.46	35.20	35.20	0.00	1
4132.59	48.42	48.42	0.00	1
4134.08	61.64	61.64	0.00	1
4135.87	74.86	74.86	0.00	1
4136.06	88.08	76.19	11.62	11
4136.08	95.00	76.33	18.15	4
4136.13	114.52	76.68	37.32	4
4136.16	127.74	76.88	50.69	4
4136.19	140.96	77.06	63.46	3
4136.21	154.18	77.22	76.62	3
4136.24	167.40	77.38	89.80	3
4136.00	75.76	75.76	0.00	Overtopping

Rating Curve Plot for Crossing: Station 154+20

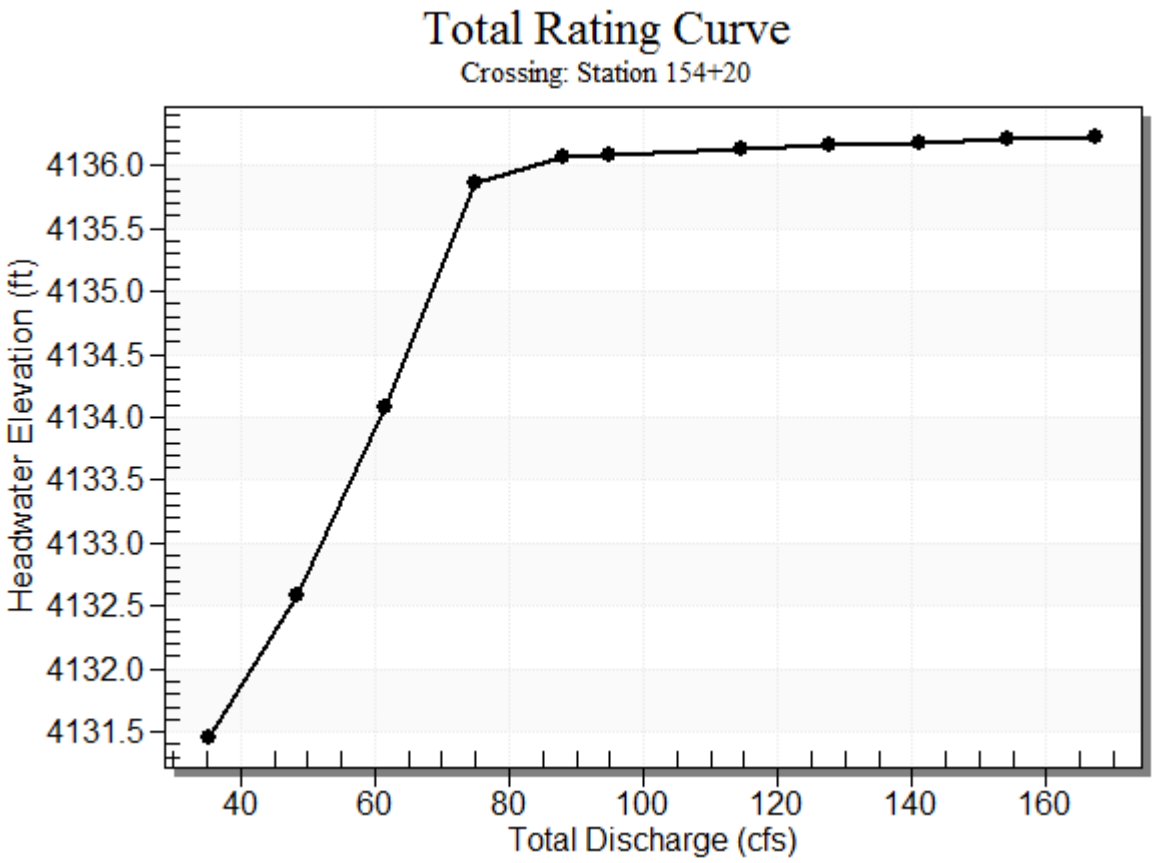


Table 35 - Culvert Summary Table: 36 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	35.20	35.20	4131.46	3.403	0.0*	5-S2n	1.004	1.924	1.004	0.650	16.922
	48.42	48.42	4132.59	4.526	0.0*	5-S2n	1.194	2.263	1.194	0.754	18.434
	61.64	61.64	4134.08	6.019	0.0*	5-S2n	1.370	2.529	1.396	0.842	19.143
	74.86	74.86	4135.87	7.809	0.0*	5-S2n	1.533	2.717	1.567	0.919	20.049
	88.08	76.19	4136.06	8.001	0.0*	5-S2n	1.549	2.733	1.582	0.989	20.151
	95.00	76.33	4136.08	8.022	0.0*	5-S2n	1.551	2.734	1.584	1.022	20.163
	114.52	76.68	4136.13	8.073	0.0*	5-S2n	1.555	2.738	1.588	1.111	20.194
	127.74	76.88	4136.16	8.102	0.0*	5-S2n	1.558	2.740	1.590	1.165	20.213
	140.96	77.06	4136.19	8.128	0.0*	5-S2n	1.560	2.742	1.592	1.216	20.229
	154.18	77.22	4136.21	8.152	0.0*	5-S2n	1.562	2.744	1.593	1.265	20.246
	167.40	77.38	4136.24	8.175	0.0*	5-S2n	1.564	2.745	1.595	1.311	20.260

* Full Flow Headwater elevation is below inlet invert.

****

Straight Culvert

Inlet Elevation (invert): 4128.06 ft, Outlet Elevation (invert): 4116.34 ft

Culvert Length: 74.92 ft, Culvert Slope: 0.1584

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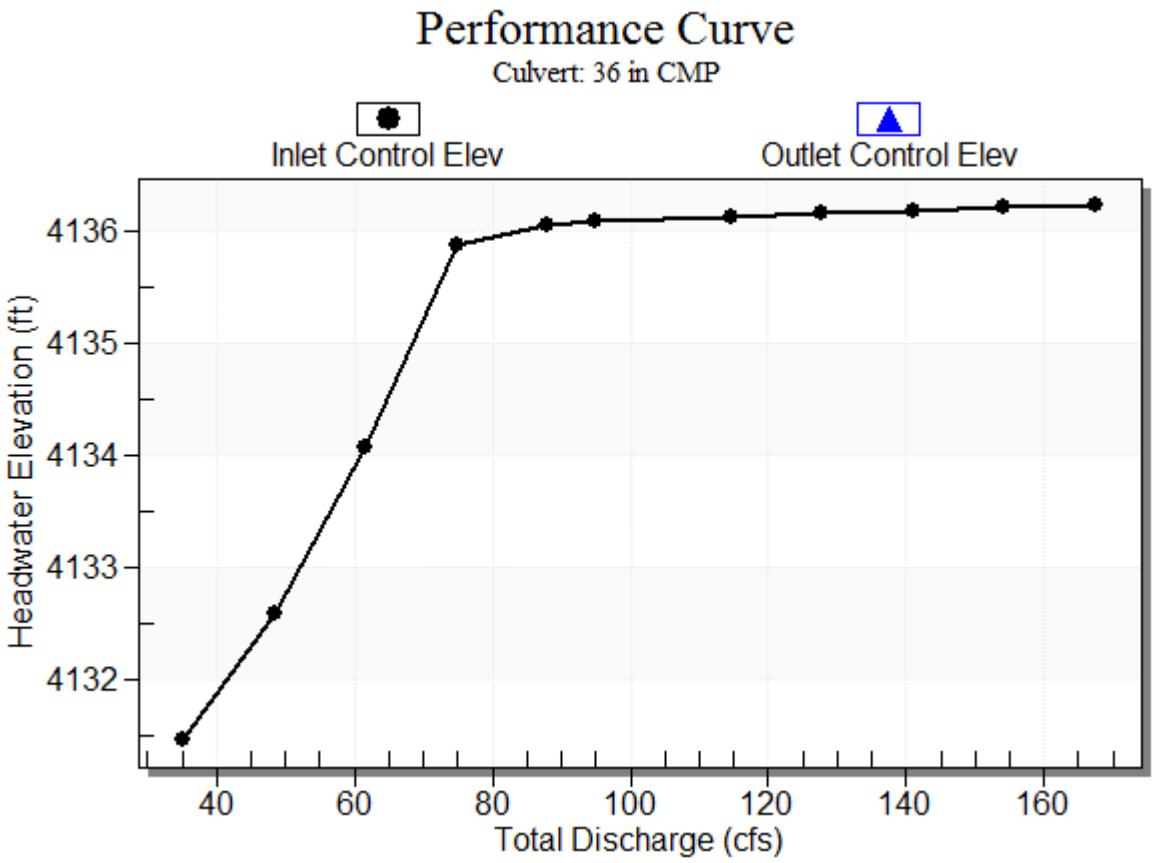
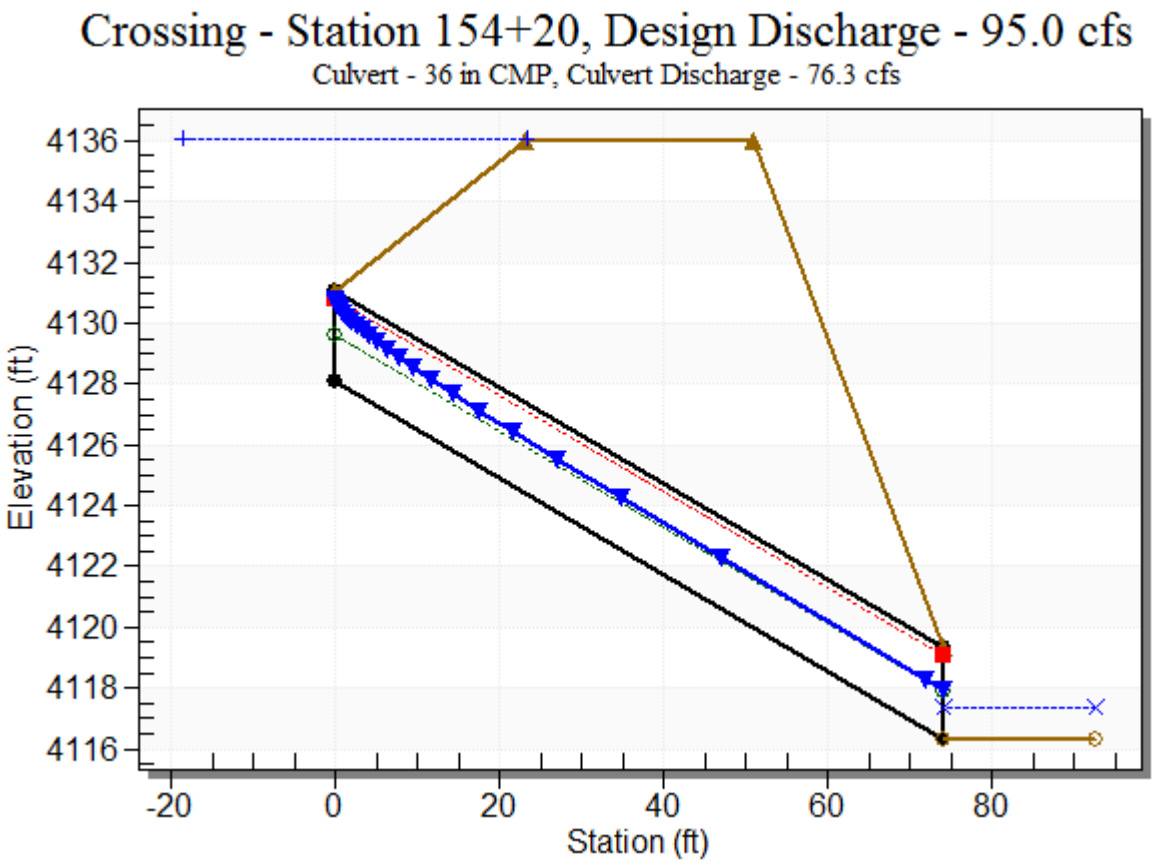
Culvert Performance Curve Plot: 36 in CMP



Water Surface Profile Plot for Culvert: 36 in CMP



Site Data - 36 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4128.06 ft

Outlet Station: 74.00 ft

Outlet Elevation: 4116.34 ft

Number of Barrels: 1

Culvert Data Summary - 36 in CMP

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: NONE

Table 36 - Downstream Channel Rating Curve (Crossing: Station 154+20)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
35.20	4116.99	0.65	4.71	1.62	1.29
48.42	4117.09	0.75	5.12	1.88	1.32
61.64	4117.18	0.84	5.46	2.10	1.34
74.86	4117.26	0.92	5.74	2.29	1.35
88.08	4117.33	0.99	5.99	2.47	1.37
95.00	4117.36	1.02	6.10	2.55	1.38
114.52	4117.45	1.11	6.40	2.77	1.39
127.74	4117.51	1.17	6.58	2.91	1.40
140.96	4117.56	1.22	6.75	3.04	1.41
154.18	4117.60	1.26	6.91	3.16	1.42
167.40	4117.65	1.31	7.05	3.27	1.43

Tailwater Channel Data - Station 154+20

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4116.34 ft

Roadway Data for Crossing: Station 154+20

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4136.00 ft

Roadway Surface: Gravel

Roadway Top Width: 28.00 ft

Crossing Discharge Data Sta 170+50

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 28.9 cfs

Design Flow: 79 cfs

Maximum Flow: 139.2 cfs

Table 37 - Summary of Culvert Flows at Crossing: Station 170+50

Headwater Elevation (ft)	Total Discharge (cfs)	36 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4288.90	28.90	28.90	0.00	1
4289.68	39.93	39.93	0.00	1
4290.70	50.96	50.96	0.00	1
4291.98	61.99	61.99	0.00	1
4293.46	73.02	73.02	0.00	1
4294.33	79.00	79.00	0.00	1
4297.23	95.08	95.08	0.00	1
4298.04	106.11	98.96	6.82	20
4298.08	117.14	99.14	17.71	5
4298.11	128.17	99.28	28.57	4
4298.14	139.20	99.41	39.63	4
4298.00	98.76	98.76	0.00	Overtopping

Rating Curve Plot for Crossing: Station 170+50

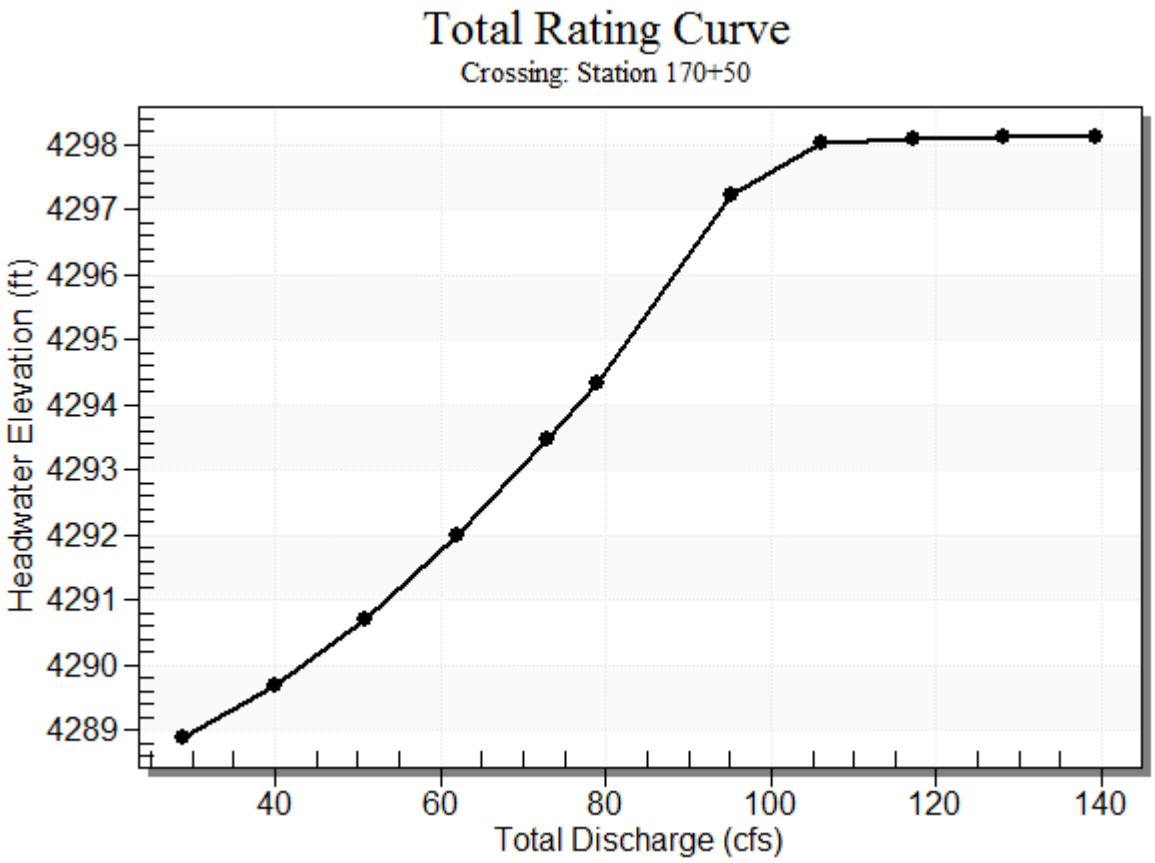


Table 38 - Culvert Summary Table: 36 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	28.90	28.90	4288.90	2.909	0.0*	1-S2n	0.964	1.736	0.964	0.592	14.674
	39.93	39.93	4289.68	3.690	0.0*	5-S2n	1.151	2.055	1.151	0.689	15.982
	50.96	50.96	4290.70	4.713	0.0*	5-S2n	1.318	2.319	1.318	0.772	17.043
	61.99	61.99	4291.98	5.990	0.0*	5-S2n	1.475	2.535	1.475	0.844	17.923
	73.02	73.02	4293.46	7.474	0.0*	5-S2n	1.628	2.696	1.628	0.909	18.635
	79.00	79.00	4294.33	8.341	0.0*	5-S2n	1.711	2.761	1.711	0.942	18.984
	95.08	95.08	4297.23	11.241	0.456	5-S2n	1.933	2.808	1.933	1.023	19.737
	106.11	98.96	4298.04	12.053	1.575	5-S2n	1.990	2.713	1.990	1.074	19.900
	117.14	99.14	4298.08	12.091	1.628	5-S2n	1.993	2.710	1.993	1.122	19.906
	128.17	99.28	4298.11	12.122	1.670	5-S2n	1.995	2.707	1.995	1.167	19.911
	139.20	99.41	4298.14	12.148	1.706	5-S2n	1.997	2.703	1.997	1.210	19.916

* Full Flow Headwater elevation is below inlet invert.

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Straight Culvert

Inlet Elevation (invert): 4285.99 ft, Outlet Elevation (invert): 4269.55 ft

Culvert Length: 133.81 ft, Culvert Slope: 0.1238

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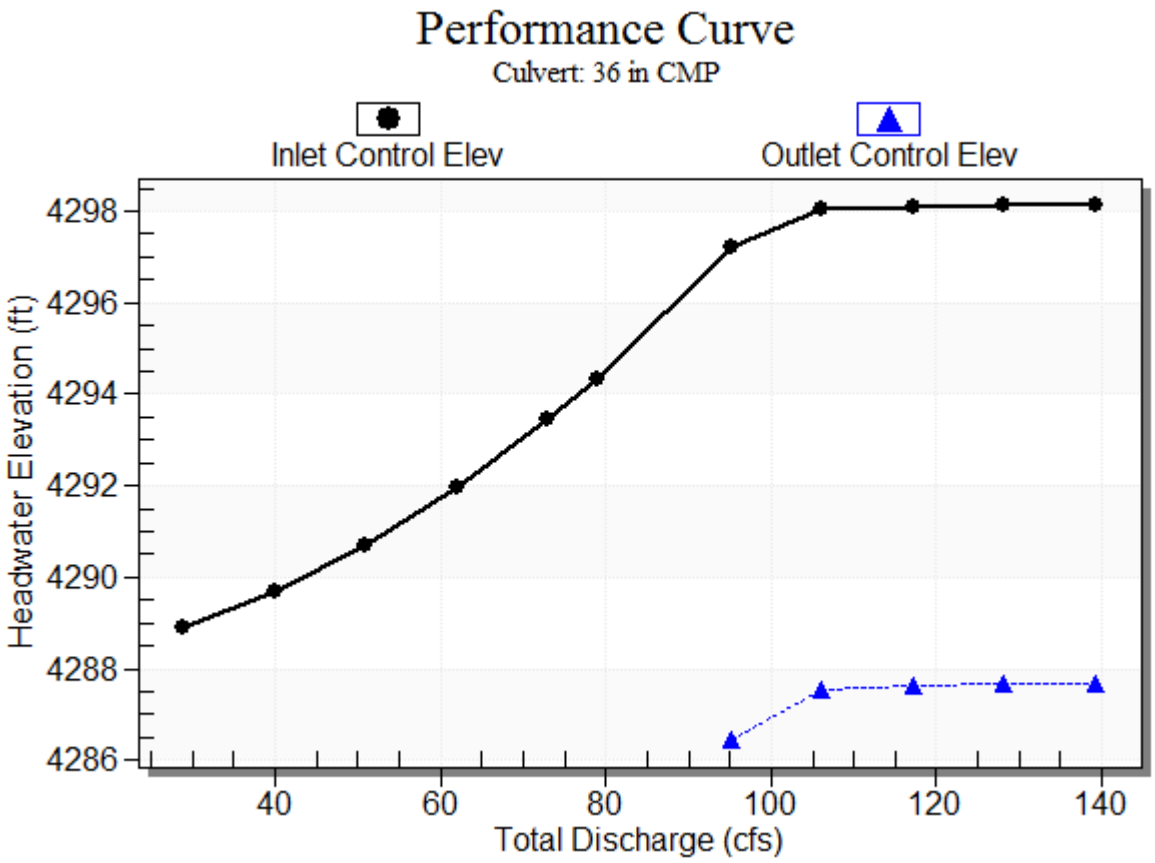
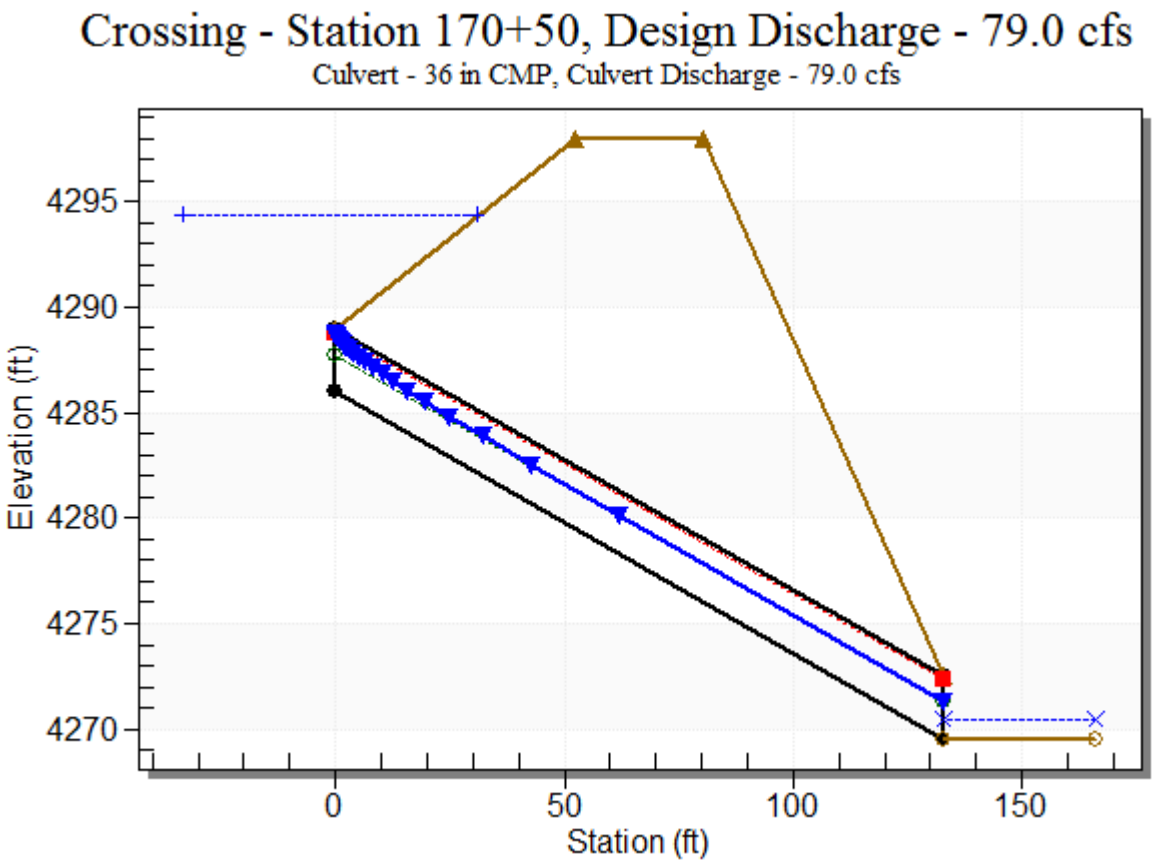
Culvert Performance Curve Plot: 36 in CMP



Water Surface Profile Plot for Culvert: 36 in CMP



Site Data - 36 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4285.99 ft

Outlet Station: 132.80 ft

Outlet Elevation: 4269.55 ft

Number of Barrels: 1

Culvert Data Summary - 36 in CMP

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: NONE

Table 39 - Downstream Channel Rating Curve (Crossing: Station 170+50)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
28.90	4270.14	0.59	4.47	1.48	1.27
39.93	4270.24	0.69	4.87	1.72	1.30
50.96	4270.32	0.77	5.19	1.93	1.32
61.99	4270.39	0.84	5.47	2.11	1.34
73.02	4270.46	0.91	5.70	2.27	1.35
79.00	4270.49	0.94	5.82	2.35	1.36
95.08	4270.57	1.02	6.10	2.55	1.38
106.11	4270.62	1.07	6.28	2.68	1.38
117.14	4270.67	1.12	6.44	2.80	1.39
128.17	4270.72	1.17	6.59	2.91	1.40
139.20	4270.76	1.21	6.73	3.02	1.41

Tailwater Channel Data - Station 170+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4269.55 ft

Roadway Data for Crossing: Station 170+50

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4298.00 ft

Roadway Surface: Gravel

Roadway Top Width: 28.00 ft

Crossing Discharge Data Sta 182+00

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 128 cfs

Design Flow: 326 cfs

Maximum Flow: 559.8 cfs

Table 40 - Summary of Culvert Flows at Crossing: Station 182+00

Headwater Elevation (ft)	Total Discharge (cfs)	84 in CMP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
4324.09	128.00	128.00	0.00	1
4324.85	171.18	171.18	0.00	1
4325.57	214.36	214.36	0.00	1
4326.32	257.54	257.54	0.00	1
4327.16	300.72	300.72	0.00	1
4327.70	326.00	326.00	0.00	1
4329.20	387.08	387.08	0.00	1
4330.42	430.26	430.26	0.00	1
4331.77	473.44	473.44	0.00	1
4333.24	516.62	516.62	0.00	1
4334.83	559.80	559.80	0.00	1
4344.00	764.40	764.40	0.00	Overtopping

Rating Curve Plot for Crossing: Station 182+00

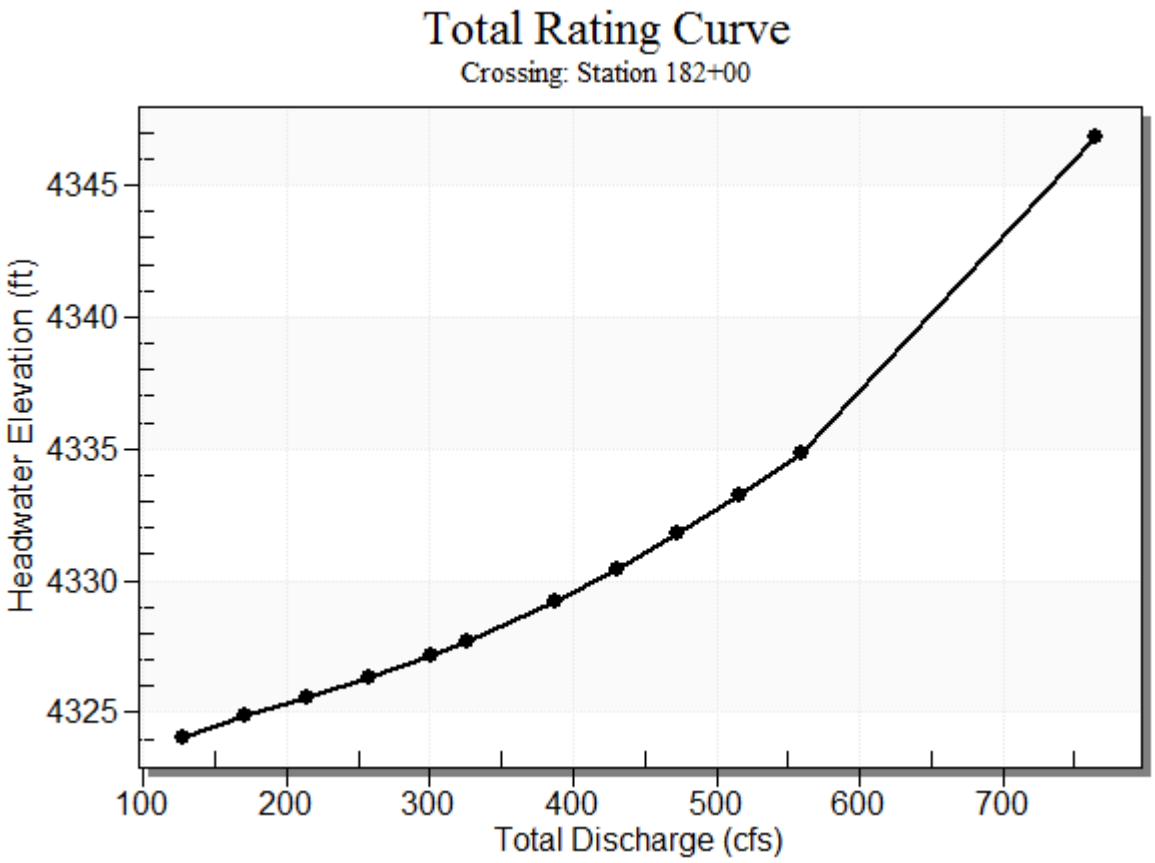


Table 41 - Culvert Summary Table: 84 in CMP

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
	128.00	128.00	4324.09	4.926	0.0*	1-S2n	1.465	2.917	1.465	1.166	21.689
	171.18	171.18	4324.85	5.686	0.0*	1-S2n	1.700	3.400	1.700	1.323	23.508
	214.36	214.36	4325.57	6.409	0.0*	1-S2n	1.930	3.820	1.933	1.458	24.809
	257.54	257.54	4326.32	7.164	0.0*	5-S2n	2.108	4.204	2.146	1.576	25.635
	300.72	300.72	4327.16	8.001	0.0*	5-S2n	2.286	4.558	2.286	1.683	27.453
	326.00	326.00	4327.70	8.543	0.0*	5-S2n	2.390	4.751	2.402	1.741	27.846
	387.08	387.08	4329.20	10.036	0.0*	5-S2n	2.627	5.183	2.642	1.871	29.086
	430.26	430.26	4330.42	11.256	0.0*	5-S2n	2.778	5.456	2.778	1.956	30.209
	473.44	473.44	4331.77	12.609	0.0*	5-S2n	2.929	5.702	2.929	2.035	30.985
	516.62	516.62	4333.24	14.084	0.0*	5-S2n	3.080	5.922	3.116	2.110	31.182
	559.80	559.80	4334.83	15.666	0.0*	5-S2n	3.227	6.112	3.260	2.181	31.866

* Full Flow Headwater elevation is below inlet invert.

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Straight Culvert

Inlet Elevation (invert): 4319.16 ft, Outlet Elevation (invert): 4278.92 ft

Culvert Length: 294.66 ft, Culvert Slope: 0.1379

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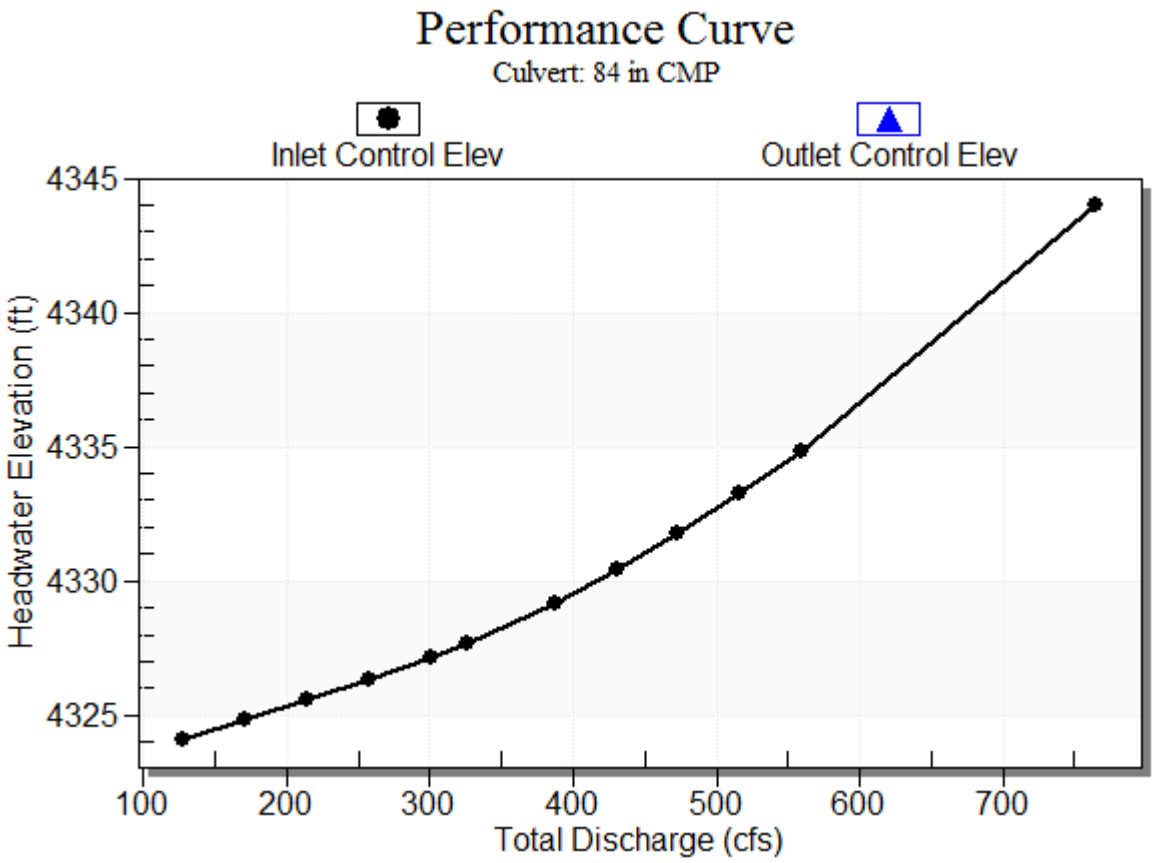
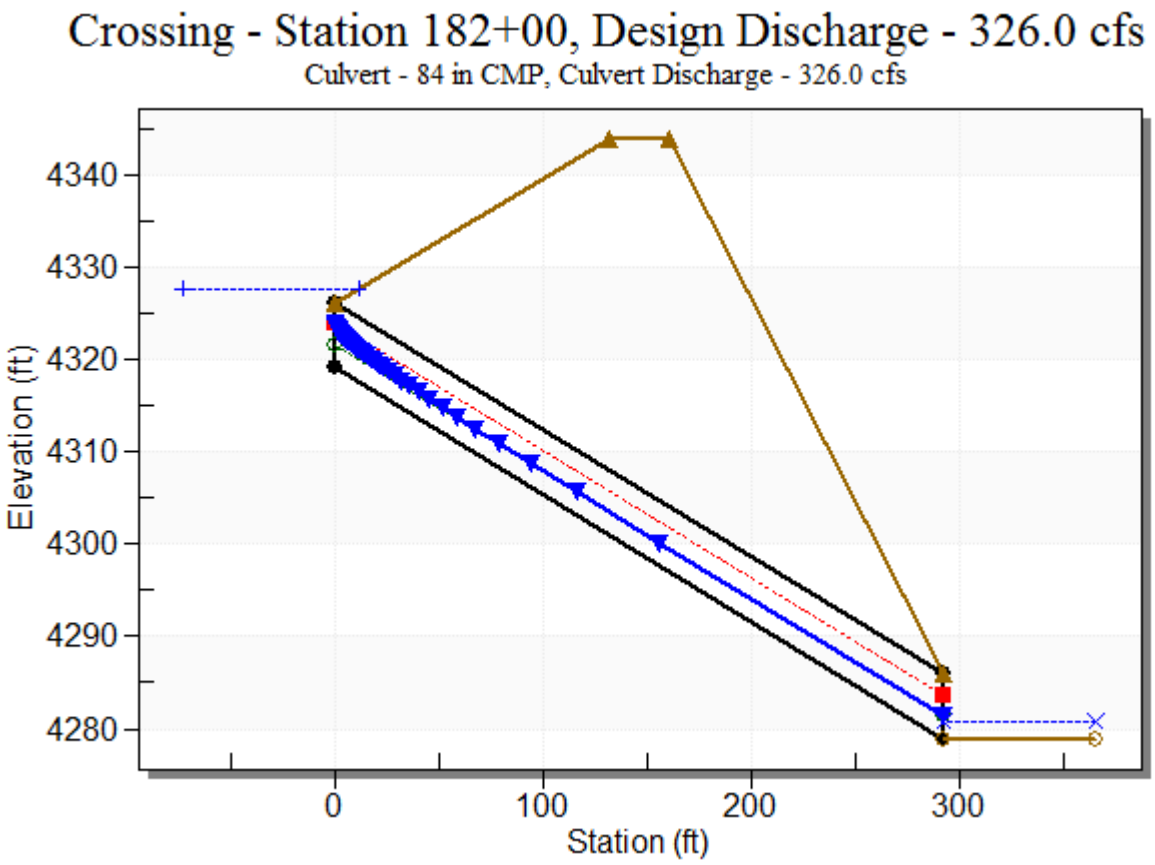
Culvert Performance Curve Plot: 84 in CMP



Water Surface Profile Plot for Culvert: 84 in CMP



Site Data - 84 in CMP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 4319.16 ft

Outlet Station: 291.90 ft

Outlet Elevation: 4278.92 ft

Number of Barrels: 1

Culvert Data Summary - 84 in CMP

Barrel Shape: Circular

Barrel Diameter: 7.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0240

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope

Inlet Depression: NONE

Table 42 - Downstream Channel Rating Curve (Crossing: Station 182+00)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
128.00	4280.09	1.17	6.59	2.91	1.40
171.18	4280.24	1.32	7.09	3.30	1.43
214.36	4280.38	1.46	7.51	3.64	1.45
257.54	4280.50	1.58	7.87	3.93	1.47
300.72	4280.60	1.68	8.18	4.20	1.48
326.00	4280.66	1.74	8.35	4.35	1.49
387.08	4280.79	1.87	8.72	4.67	1.50
430.26	4280.88	1.96	8.96	4.88	1.51
473.44	4280.95	2.03	9.18	5.08	1.52
516.62	4281.03	2.11	9.38	5.27	1.53
559.80	4281.10	2.18	9.57	5.44	1.54

Tailwater Channel Data - Station 182+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 10.00 (_:1)

Channel Slope: 0.0400

Channel Manning's n: 0.0350

Channel Invert Elevation: 4278.92 ft

Roadway Data for Crossing: Station 182+00

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 4344.00 ft

Roadway Surface: Gravel

Roadway Top Width: 28.00 ft

Appendix B – Culvert Riprap Calculations

Several relationships have been proposed for riprap sizing for culvert aprons and several of these are discussed in greater detail in Appendix D. The independent variables in these relationships include one or more of the following variables: outlet velocity, rock specific gravity, pipe dimension (e.g. diameter), outlet Froude number, and tailwater. The following equation (Fletcher and Grace, 1972) is recommended for circular culverts:

$$D_{50} = 0.2\,D\left(\frac{Q}{\sqrt{g}D^{2.5}}\right)^{4/3}\left(\frac{D}{TW}\right) \qquad (10.4)$$

where,

- D_{50} = riprap size, m (ft)
- Q = design discharge, m^3/s (ft^3/s)
- D = culvert diameter (circular), m (ft)
- TW = tailwater depth, m (ft)
- g = acceleration due to gravity, 9.81 m/s^2 (32.2 ft/s^2)

Tailwater depth for Equation 10.4 should be limited to between 0.4D and 1.0D. If tailwater is unknown, use 0.4D.

Whenever the flow is supercritical in the culvert, the culvert diameter is adjusted as follows:

$$D' = \frac{D + y_n}{2} \qquad (10.5)$$

where,

- D' = adjusted culvert rise, m (ft)
- y_n = normal (supercritical) depth in the culvert, m (ft)

Equation 10.4 assumes that the rock specific gravity is 2.65. If the actual specific gravity differs significantly from this value, the D_{50} should be adjusted inversely to specific gravity.

White Knob Haul Road
Riprap Apron Design
Method from HEC 14 by FHWA

Station 17+70

Q	25	cfs
D	2	Ft
TW	0.8	Ft
Froude	1.19	
Yn	1.68	Ft
D'	1.84	
D_{50}	0.80	

Use Class 3 Apron.
Apron Length = 5D = 10 Ft.

Station 19+00

Q	112	cfs
D	4	Ft
TW	1.6	Ft
Froude	1.95	
Yn	1.92	Ft
D'	2.96	
D_{50}	1.57	

Use Class 5 Apron.
Apron Length = 7D = 28 Ft.

Station 43+50

Q	25	cfs
D	2	Ft
TW	0.8	Ft
Froude	1.13	
Yn	1.6	Ft
D'	1.8	
D_{50}	0.82	

Use Class 3 Apron.
Apron Length = 5D = 10 Ft.

Station 49+35

Q	62	cfs
D	3	Ft
TW	1.2	Ft
Froude	1.75	
Yn	1.84	Ft
D'	2.42	
D_{50}	1.24	

Use Class 5 Apron.
Apron Length = 7D = 21 Ft.

Station 54+35

Q	62	cfs
D	3	Ft
TW	1.2	Ft
Froude	1.71	
Yn	1.4	Ft
D'	2.2	
D_{50}	1.41	

Use Class 5 Apron.
Apron Length = 7D = 21 Ft.

Station 57+75

Q	112	cfs
D	4	Ft
TW	1.6	Ft
Froude	1.03	
Yn	3.19	Ft
D'	3.595	
D_{50}	1.21	

Use Class 5 Apron.
Apron Length = 7D = 28 Ft.

White Knob Haul Road
Riprap Apron Design
Method from HEC 14 by FHWA

Station 62+30

Q	25	cfs
D	2	Ft
TW	0.8	Ft
Froude	1.32	
Yn	1.55	Ft
D'	1.775	
D_{50}	0.84	

Use Class 4 Apron.
Apron Length = 6D = 12 Ft.

Station 88+15

Q	25	cfs
D	2	Ft
TW	0.8	Ft
Froude	1.64	
Yn	1.37	Ft
D'	1.685	
D_{50}	0.90	

Use Class 4 Apron.
Apron Length = 6D = 12 Ft.

Station 90+00

Q	25	cfs
D	2	Ft
TW	0.8	Ft
Froude	1.57	
Yn	1.36	Ft
D'	1.68	
D_{50}	0.90	

Use Class 4 Apron.
Apron Length = 6D = 12 Ft.

Station 144+70

Q	35	cfs
D	3	Ft
TW	1.2	Ft
Froude	2.72	
Yn	1.05	Ft
D'	2.025	
D_{50}	0.74	

Use Class 3 Apron.
Apron Length = 5D = 15 Ft.

White Knob Haul Road
Riprap Apron Design
Method from HEC 14 by FHWA

Station 150+40

Q	44	cfs
D	3	Ft
TW	1.2	Ft
Froude	2.35	
Yn	1.29	Ft
D'	2.145	
D_{50}	0.92	

Use Class 4 Apron.
Apron Length = 6D = 18 Ft.

Station 154+20

Q	95	cfs
D	3	Ft
TW	1.2	Ft
Froude	2.82	
Yn	1.58	Ft
D'	2.29	
D_{50}	2.36	

Use Class 6 Apron.
Apron Length = 8D = 24 Ft.

Station 170+50

Q	79	cfs
D	3	Ft
TW	1.2	Ft
Froude	2.56	
Yn	1.71	Ft
D'	2.355	
D_{50}	1.78	

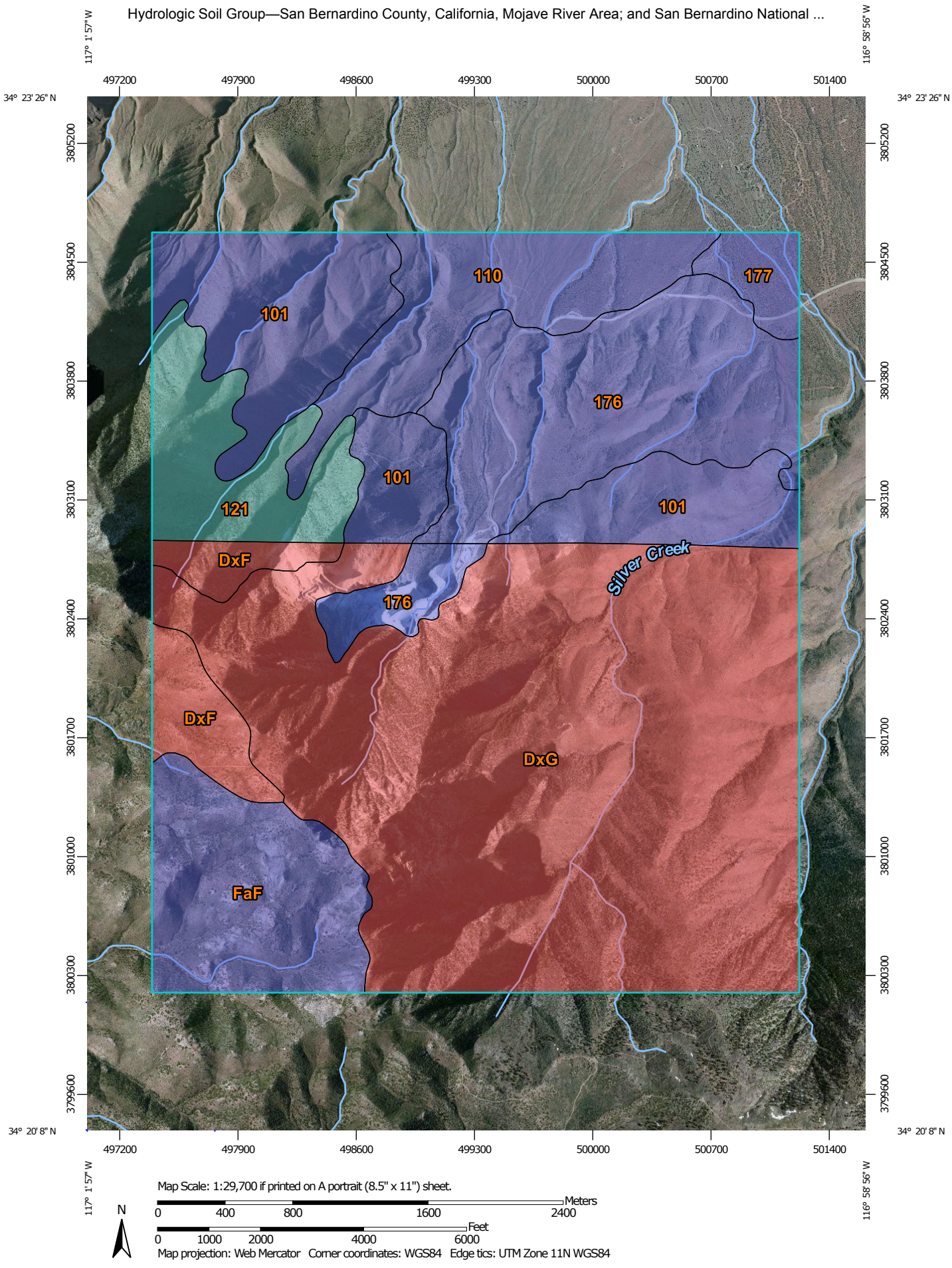
Use Class 6 Apron.
Apron Length = 8D = 24 Ft.

Station 182+00

Q	326	cfs
D	7	Ft
TW	2.8	Ft
Froude	3.17	
Yn	2.4	Ft
D'	4.7	
D_{50}	2.01	

Use Class 6 Apron.
Apron Length = 8D = 56 Ft.

Appendix C – NRCS Web Soil Survey


117° 1' 57" W
116° 58' 56" W
34° 23' 26" N
34° 20' 8" N
497200
497900
498600
499300
500000
500700
501400
3805200
3804500
3803800
3803100
3802400
3801700
3801000
3800300
3799600
110
177
101
176
101
121
101
DxF
Silver Creek
176
DxF
DxG
FaF
Map Scale: 1:29,700 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0
400
800
1600
2400
Feet
0
1000
2000
4000
6000
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Bernardino County, California, Mojave River Area
Survey Area Data: Version 5, Sep 26, 2008

Soil Survey Area: San Bernardino National Forest Area, California
Survey Area Data: Version 5, Sep 1, 2009

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 1, 2001—Jul 3, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Bernardino County, California, Mojave River Area (CA671)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
101	ARRASTRE-ROCK OUTCROP COMPLEX, 30 TO 50 PERCENT SLOPES*	B	580.9	13.7%
110	BRYMAN-CAJON ASSOCIATION, ROLLING*	B	313.1	7.4%
121	CRAFTON-SHEEPHEAD-ROCK OUTCROP ASSOCIATION, STEEP*	C	243.9	5.7%
176	YERMO GRAVELLY SANDY LOAM, 30 TO 50 PERCENT SLOPES	B	539.2	12.7%
177	YERMO-KIMBERLINA, COOL, ASSOCIATION, SLOPING*	B	64.0	1.5%
Subtotals for Soil Survey Area			**1,741.2**	**40.9%**
Totals for Area of Interest			**4,255.1**	**100.0%**

Hydrologic Soil Group— Summary by Map Unit — San Bernardino National Forest Area, California (CA777)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
176	Yermo gravelly sandy loam, 30 to 50 percent slopes	B	75.3	1.8%
DxF	Wapi-Pacifico families, dry-Rock outcrop complex, 30 to 50 percent slopes	D	155.3	3.7%
DxG	Wapi-Pacifico families, dry-Rock outcrop complex, 50 to 75 percent slopes	D	1,926.9	45.3%
FaF	Olete-Goulding families. association, 30 to 50 percent slopes	B	356.3	8.4%
Subtotals for Soil Survey Area			**2,513.9**	**59.1%**
Totals for Area of Interest			**4,255.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

APPENDIX H
PUBLIC SERVICES AND UTILITIES

Water Supply Assessment

Amended Plan of Operations and Mine Reclamation Plans for the Butterfield - Sentinel Quarries and the White Knob - White Ridge Quarries

Prepared for:

Omya California
7225 Crystal Creek Road
Lucerne Valley, CA 92356

Prepared by:

Lilburn Corporation
1905 Business Center Drive
San Bernardino, CA 92408

June 2013

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1.0 EXECUTIVE SUMMARY

Omya California's (Omya) has requested approval from the U.S. Department of Agriculture, Forest Service (USFS) and the County of San Bernardino (County) to expand the existing Butterfield – Sentinel quarries and White Knob - White Ridge quarries located south of Lucerne Valley in San Bernardino County. The Amended Plans are subject to the California Environmental Quality Act process (CEQA) and Environmental Impact Reports are being prepared. The County of San Bernardino, as CEQA Lead Agency, has requested a Water Supply Assessment (WSA) to be prepared to complete the CEQA process and to approve the Amended Plans.

The existing permitted Butterfield - Sentinel quarries are located within the San Bernardino National Forest and White Knob - White Ridge quarries are located on private property. The proposed Amended Plans would provide for mining at the various quarries to be extended up to the year 2055. The current production combined from all quarries would increase to a permitted maximum of 680,000 tons per year of ore to the Lucerne Valley processing plant. Mined material is crushed at the quarry sites and the ore is processed at the Lucerne Valley processing plant located north and east of the quarries. Reclamation will occur concurrently with mining.

Water is used at Omya's operations for dust control at the quarries, overburden placement areas, haul roads, crushers, and for establishment of vegetation in reclaimed areas. The water source is two wells owned and operated by Omya; one located at the processing plant site in Lucerne Valley, and one located in Crystal Creek Canyon near Turnout 5 on the Crystal Creek Haul Road. Small increases in water use for dust control will occur with the implementation of the proposed Amended Plans for the quarries. Omya's existing operation's and proposed projects' water demands would total an estimated 17.55 acre-feet per year or 92.3% of Omya's current Free Production Allowance (FPA) of 19 acre-feet.

The proposed operational changes will not have a significant impact on agricultural, potable or industrial users. Neither will there by an affect on the water supply for any lower-income housing projects. As described herein, Omya has a right to groundwater extracted from a basin that has been adjudicated and the proposed projects combined with other existing and planned operations will not result in water demand exceeding that water right.

2.0 INTRODUCTION

2.1 BACKGROUND

Omya California's (Omya) is proposing to amend its Plan of Operations and Mine Reclamation Plans for the Butterfield - Sentinel Quarries and the White Knob - White Ridge Quarries. The quarries are located south of Lucerne Valley in San Bernardino County, California (see Figure 1). Omya California (Omya), a division of Omya Inc., has requested approval from the U.S. Department of Agriculture, Forest Service (USFS) and the County of San Bernardino (County) to expand the existing Butterfield - Sentinel, and White Knob - White Ridge quarries.

The existing permitted Butterfield - Sentinel quarries are located within the San Bernardino National Forest and the White Knob - White Ridge quarries are located on private property (see Figure 2). Once permitted, available ore resources will provide an additional 40 years to the mine life of the Butterfield Quarry, 20 years to the Sentinel Quarry, and 24 years to the White Knob - White Ridge quarries. Mining at the various quarries would be extended through the year 2055. The quarries combined ore production rates will be a maximum of 680,000 tons per year. Mined material is crushed at the quarry sites and the ore is processed at the Lucerne Valley processing plant located north and east of the quarries. Reclamation (including revegetation) will occur concurrently with mining.

Since the Amended Plans are subject to the CEQA process, Environmental Impact Reports are being prepared. The County, the CEQA Lead Agency, has requested a Water Supply Assessment (WSA) be prepared to complete the CEQA process and to approve the Amended Plans. The Butterfield - Sentinel Quarries are also subject to review under the National Environmental Policy Act with the U.S. Forest Service acting as lead federal agency.

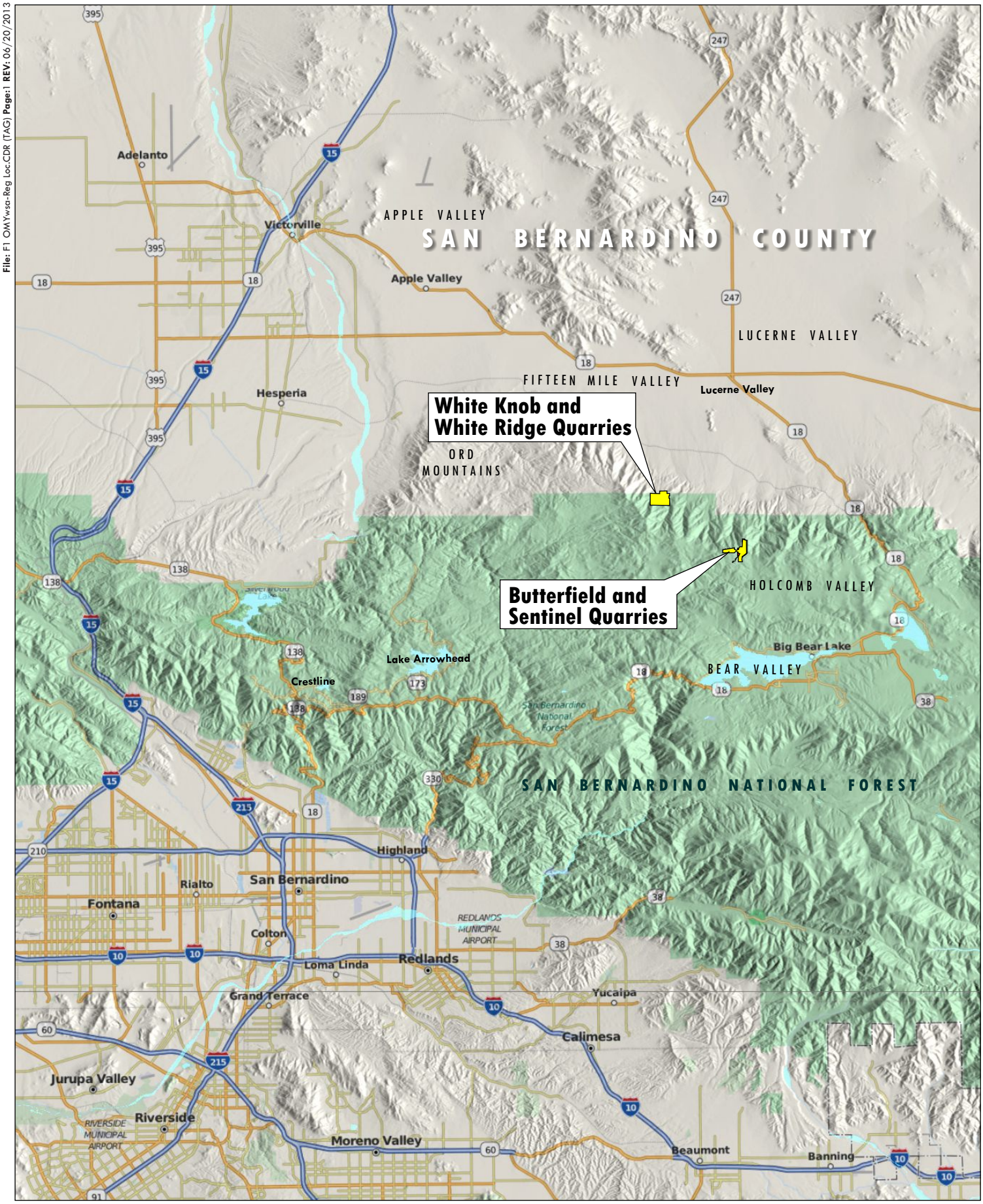
Quarry development and expansion will be phased. Disturbance proposed for the Amended Plans includes expansion of the existing quarries, associated overburden placement sites, additional internal access roads and ancillary facility areas, and minor adjustments to existing disturbance boundaries. Less than ½-acre-foot of the total annual water use is hauled by truck for establishing vegetation at reclaimed areas.

2.2 PURPOSE OF DOCUMENT

Upon request of a local government, a public water supplier (PWS) is required by law to provide documentation regarding the water supply for new projects. The WSA is included in the CEQA documentation and it becomes information used in the approval process. In the case of the proposed projects, there is no PWS that provides water service to the area of the Project Site.

At completion, the proposed projects will generate a maximum water demand for dust control and irrigation totaling an estimated 3.75 acre-feet per year (over existing water use). This is based on historic water use records compared to proposed quarry production. The supply source

File: F1 OMYwsa-Reg Loc.CDR (TAG) Page:1 REV: 06/20/2013



0 5.25
Mile

Source: World Topo Map, 2012

LILBURN CORPORATION

REGIONAL LOCATION

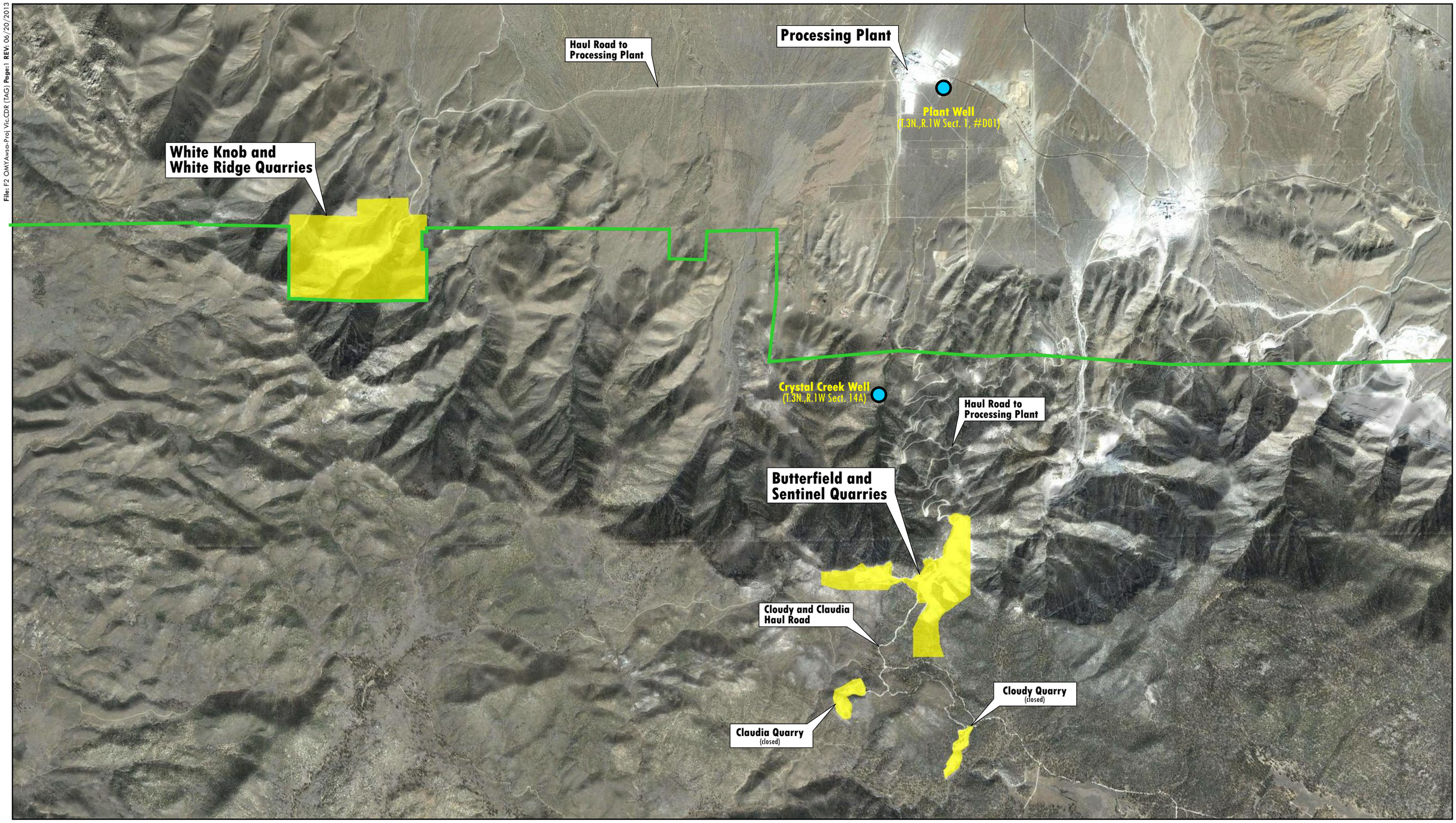
WHITE KNOB-WHITE RIDGE QUARRIES and BUTTERFIELD-SENTINEL QUARRIES

Water Supply Assessment

Omya California, San Bernardino National Forest, California

FIGURE 1

File: F2 OMYAwsa-Proj Vic.CDR (TAG) Page:1 REV: 06/20/2013



N

0 1,700
Feet

Sources: Lilburn Corp., 2013

LILBURN CORPORATION

LEGEND

- Well Location
- USFS Boundary

WELL and QUARRY LOCATIONS

WHITE KNOB-WHITE RIDGE QUARRIES and BUTTERFIELD-SENTINEL QUARRIES
Water Supply Assessment
Omya California, San Bernardino National Forest, California

FIGURE 2

would be the existing groundwater wells currently owned and used by Omya, located both on-site and off-site. The total demand at maximum production would be approximately 17.55 acre-feet per year.

The regional water management agency overlying the source of water supply is the Mojave Water Agency (MWA) and therefore the MWA 2010 Urban Water Management Plan and the 2004 Regional Water Management Plan was referenced in preparation of this WSA. The WSA discusses the historic and current water supplies of the Project Site and the proposed projects' impact on the Este Subarea's water supplies. Project water demands are evaluated in light of the single dry year event and a multiple dry year event to determine the adequacy of the water supply.

2.2.1 Applicability of a Water Supply Assessment

A WSA is required for a project consisting of a "proposed industrial, manufacturing or processing plant" occupying more than 40 acres of land (Water Code Section 10912; SB 610). In the May 2010 decision in *Center for Biological Diversity v. County of San Bernardino*, the Court of Appeal held that a biosolids composting facility is a "processing plant" and thus a "project" within the meaning of SB 610 if it meets the 40-acre threshold, even if only small structures will be constructed on-site. It is less likely that Omya's proposed quarry expansions would be considered a "project" under SB610, since the project does not involve any new processing equipment within the mine, or any new or modified equipment at the plant. Nonetheless, given the uncertainty created by the *Center for Biological Diversity* decision, this Water Supply Assessment has been prepared to support Omya's quarry applications.

2.3 PUBLIC WATER SYSTEM

2.3.1 Description

The projects are located south of the unincorporated community of Lucerne Valley and north of the City of Big Bear Lake, in the San Bernardino Mountains. Residents of Lucerne Valley receive their water via individual wells, mutual water companies, or small County water districts. The County of San Bernardino has a County Service Area (CSA 29) in Lucerne Valley that serves commercial customers only and does not overlie the Project Sites. On the north shore of Big Bear Lake, the community of Fawnskin is served by the Big Bear Department of Water and Power, and the remainder of the north shore lies within a CSA 53-C. The Big Bear Department of Water and Power could not provide a water supply to the Project Sites without expansion of the City of Big Bear Lake incorporated boundaries. CSA 53-C lies approximately 8 miles south of the project site, and furthermore does not presently have a water supply system developed. A PWS therefore is not applicable to the proposed projects.

3.0 WATER DEMANDS

During operations, the existing and proposed quarry operations will generate a water demand for dust control totaling an estimated 17.55 acre feet per year. This assumes water application is

required based on historic data maintained by Omya. The existing mine and processing plant operations utilize on- and off-site wells for dust control. The average annual production from the two wells, verified by the Watermaster during the 5-year period of 2007/08 to 2011/2012 was 13.8 acre-feet.

Omya intends to increase production of processed materials to a permitted maximum from all quarries of 680,000 tpy. An increase in water consumption of 3.75 acre-feet per year to be used for dust control is expected concurrent with the increase in production rates. Future operations are estimated to require an additional 1.5 acre-feet/year for the Butterfield - Sentinel quarries, and 2.25 acre-feet/year for the White Knob - White Ridge quarries, for a total increase in water production of 3.75 acre-feet/year, representing an increase of 27% at maximum production over the most recent 5-year average verified water production. The supply would continue to be the existing Omya wells which use groundwater pumped from the Este Subarea of the adjudicated Mojave Basin.

Lucerne Valley lies within the Este Subarea of the Mojave Basin (see Figure 3). The Final 2010 UWMP shows that the subarea had a population of 6,680 in 2005 and the population was projected to grow to 11,785 by the year 2035. Water production in the Este subarea has declined according to reports filed with the Mojave Basin Watermaster. Water production was 9,700 acre-feet in 1996, 7,100 acre-feet in 1998 and 2000 and 5,900 acre-feet in 2003. Projected water demand within the Este subarea was estimated to increase from 6,981 acre feet in 2005 to 7,369 acre feet in 2035 (*Final 2010 Urban Water Management Plan, Mojave Water Agency, June 9, 2010*).

The proposed projects' net increase in demand of 3.75 acre-feet/year would represent 0.25% of the minimum Este Subarea groundwater deficit of 1,500 acre-feet projected to occur during a single dry year event, and 0.12% of the maximum deficit of 3,050 acre-feet. The single dry year event is based on the Agriculture 2 Scenario which was adopted as part of the Mojave Water Agency 2004 Regional Water Management Plan as the basis for future planning. Under this scenario, there are assumed significant decreases in agricultural consumptive use based on voluntary transfers of FPA from agricultural to non-agricultural uses. Existing water uses in the Este Subarea are primarily Agricultural followed by Industrial.

3.1 PROJECT-SPECIFIC WATER CONSERVATION

No water conservation measures are proposed for the proposed projects because water use will be limited to dust control and a minor amount (less than ½-acre-foot/year) used for occasionally establishing revegetation areas. In the event water supplies become limited, Omya could maintain a limitation on its annual water use to be equivalent or less than 65% of its BPA (65% of 23 = 14.95 acre-feet). Under current projections, this limitation on water use would not require the implementation of conservation measures but would limit the operations when sufficient water was not available during dry hydrologic conditions to meet dust control and/or irrigation demands.

MOJAVE WATER AGENCY ADJUDICATED BOUNDARY

WHITE KNOB-WHITE RIDGE QUARRIES and BUTTERFIELD-SENTINEL QUARRIES
Water Supply Assessment
Omya California, San Bernardino National Forest, California

LILBURN CORPORATION

OMYA **FIGURE 3**

4.0 WATER SUPPLY ASSESSMENT

4.1 GENERAL

A requirement of the WSA is to identify and describe the water supply sources in the PWS that will serve the Project. Water Code Section 10910(d) requires a WSA to include an identification of any existing water supply entitlements, water rights, or water service contracts relevant to the identified water supply for the proposed project, and a description of the quantities of water received in prior years by the PWS.

4.2 IDENTIFICATION OF WATER SOURCES

4.2.1 Primary Water Sources

The proposed projects will use well water for dust control. A water supply has been developed on Omya properties (two wells) and a PWS does not serve the site. The source of water for dust control will be the existing Omya wells located both on- and off-site (refer to Figure 2). These wells pump groundwater from the Este Subarea of the Mojave Water Basin.

The Watermaster for the Mojave Basin, the Mojave Water Agency, in its Nineteenth Annual Report of the Mojave Basin Area for Water Year 2011-12, dated May 1, 2013, indicates that water levels in the Este Subarea have remained stable for the past several years, indicating a relative balance between recharge and discharge. Unused Free Production Allowance (FPA) for the Este Subarea, as reported by the Watermaster, was 14,430 acre-feet for Water Year 2009-10, 13,632 acre-feet for Water Year 2010-11, and 14,800 for Water Year 2011-12. Based on the Watermaster report, the Water Year 2012-13 FPA for the Este Subarea is recommended to be set at 80% of the Base Production Allowance of 19,277 acre feet, or 15,422 acre feet. Table 1 below summarizes the 2011-12 Watermaster Report data.

Table 1
Watermaster Data for Este Subarea Groundwater Production
(in acre-feet)

2011-12 Verified Production	Production Safe Yield	2011-12 Free Production Allowance	2012-13 Recommended Free Production Allowance
5,433	7,156	16,376	15,422

4.2.2 Additional Water Sources

Omya is currently using both of the wells it has developed. Groundwater would continue to be the sole source of supply as long as Omya's available allowance under the Stipulated Judgment *(discussed below)* will meet production demands. No recycled water exists in the area that could be made available to the Project Sites.

4.3 ANALYSIS OF WATER SUPPLY

4.3.1 Aquifer Adjudication

The Mojave Basin, including the Este Subarea where the proposed projects will be located, has been the subject of an adjudication to determine the water rights of the various producers. The adjudication process of the groundwater in Mojave Basin began in 1990 with cross complaints filed in 1991. In 1992 numerous parties agreed to conduct good faith negotiations and by 1993 over 75 percent of the parties involved were agreed to the Stipulated Judgment, thus binding the involved parties. In 1995 a trial of the non-stipulated parties was completed. The final judgment was entered in 1996 adopting the physical solution set forth in the Stipulated Judgment. The purpose of the Stipulated Judgment was to create incentives to conserve local water, guarantee that downstream producers will not be adversely affected by upstream producers, and assess producers to obtain funding for the purchase of imported water.

In addition, the Stipulated Judgment required that the Mojave Basin Area Watermaster generate an annual report summarizing the yearly Watermaster activities and water supply conditions for the Mojave Water Basin. The Mojave Water Basin includes the Alto Subarea, Baja Subarea, Centro Subarea, Este Subarea and the Oeste Subarea. The Project Site obtains groundwater from wells located in the Este Subarea.

4.3.2 Groundwater

To carry out the Mojave Basin Judgment (the Adjudication), the MWA assigned Base Annual Production (BAP) amounts to each producer using 10-acre feet per year or more, based on historical production (1986-1990). The total BAP from all producers was ramped down in each year from 1994 to 2005 in order to achieve the point where water imports and inflows versus consumption achieve safe yield of the basin. The MWA achieved its target rampdown in 2004/2005.

Each pumper also has been assigned a variable Free Production Allowance (FPA), which is a uniform percentage of BAP set for each area. A substantial make-up water assessment is charged for water pumped in excess of the assigned FPA. Water purveyors also have the option of leasing additional water rights from the open market.

Omya has a FPA that was allocated as part of the Basin Adjudication. Omya's original (1993) base production was set at 23 acre-feet per year. This has been ramped down annually to a FPA that is currently 19 acre-feet per year (82.6% of BAP).

Any groundwater that Omya pumps over and above the FPA is subject to replacement. Replacement can occur either by paying the Watermaster to purchase supplemental water from MWA or by acquiring/transferring unused production rights within that subarea from another party to the Judgment. Historically, Omya has had prior year carryover from unused FPA. In 2011/2012, Omya produced (verified production) 14 acre-feet of its 19 acre-foot FPA, with a prior year carryover of 19 acre-feet, and a total adjusted FPA of 38 acre-feet. Table 2 shows

FPA, verified production, carryover credits, and unused FPA for the period of water years 2002-03 through 2011-12.

Table 2
Omya Free Production Allowance & Production
Water Years 2002-03 through 2011-12

Water Year	FPA	Verified Production	Carryover Credits	Unused FPA
2002-03	19	15	19	19
2003-04	19	14	19	19
2004-05	19	14	19	19
2005-06	19	18	19	19
2006-07	19	19	19	19
2007-08	19	14	19	19
2008-09	19	14	19	19
2009-10	19	14	19	19
2010-11	19	13	19	19
2011-12	19	14	19	19

4.3.3 Historical Groundwater Data

According to the MWA 2010 UWMP, verified groundwater production in the Este Subarea decreased from 8,800 acre-feet in 1994 to 6,500 acre-feet in 2004. Since 1998, verified groundwater production in the Este Subarea has been less than 7,100 acre-feet.

The Mojave Basin Area Adjudication mandates that groundwater extraction from the basin not exceed the estimated annual supplies, and empowers the Watermaster to enforce pumping limits as mandated by the Court. MWA will continue to recharge the aquifer so that groundwater will remain a reliable source of water for the foreseeable future. Among other things, MWA has established a groundwater replenishment program for the Mojave Basin, including the Este Subarea, the purpose of which is to reduce annual and cumulative groundwater overdraft through artificial recharge to the groundwater basin.

The Omya production well located near the plant ("Plant Well") was drilled in 1987; depth to groundwater at the time of well installation was 867 feet below ground surface (bgs). The second well located in Crystal Canyon ("Crystal Creek Well") was drilled in 1990 and depth to groundwater was recorded as 85 feet bgs. Omya has not recently maintained depth to water records for either well.

4.3.4 State Water Project Water

MWA is one of the 29 State Water Project (SWP) contractors. The SWP includes 660 miles of aqueduct and conveyance facilities extending from Lake Oroville in the north to Lake Perris in the south. The SWP is contracted to deliver 4.1 million ac-ft/yr to the 29 contracting agencies. However, State and federal biological opinions to protect endangered fish, climate change, and levee vulnerability in the Delta have decreased projected deliveries to 60% of contracted amounts until the year 2028, increasing to 61% in 2029. SWP delivery reliability factors of between 60 and 61% were utilized in the MWA 2010 UWMP, yielding projected supplies as shown in Table 3 below.

Table 3
Mojave Water Agency
Summary of Current and Planned Water Supplies (Acre Feet/Yr)

Supply Type	2010	2015	2020	2025	2030	2035
Local	131,994	137,633	141,314	147,121	152,921	54,778
State Water Project	49,680	51,480	53,880	53,880	54,778	158,712
Total	181,674	189,113	195,194	201,001	207,699	213,490

Source: Final 2010 Urban Water Management Plan, Table 3-1:

MWA has recognized the need for additional imported water in order to eliminate groundwater overdraft, and has purchased additional water from the SWP when available. Additional SWP water is not expected to be available on a regular basis in the future and should not be relied upon as the only long-term source of overdraft reduction in the Mojave Water Basin. Purchase of additional SWP water involves the purchase of water on the spot market, as opposed to the purchase of entitlement to an ongoing supply of that water. It should be noted that the spot market comes into play when all of MWA's entitlements are being imported into the basin.

MWA reached agreement with the Metropolitan Water District (MWD) of Southern California in 2003 to store up to 75,000 (45,000 delivered to date) acre-feet for MWD in the Mojave basin. This storage is being provided in exchange for MWD's right to receive an equal amount of water in the future, through entitlement exchange, should there be a significant drought. In addition to spot market, on an on-going basis MWA is pursuing additional SWP entitlements when they become available. In dry years when SWP or Colorado River supplies are reduced, MWD will have the ability to call back some of the transferred water stored in the Mojave Basin, based on the limitations of the storage agreement between MWD and MWA.

4.3.5 Surface Water

The Mojave River is the primary source for replenishment of the Mojave Basin, with an average natural inflow of 65,500 acre-feet. The local surface inflows depend on climatic conditions and represent a small portion of the total supply. Recharge flows are often sub-surface and not available for surface water capture or treatment. Water from the State Water Project is the only other surface water that may be considered for treatment or direct use, and is limited by the

variability of the supply from the delta and the amount of water MWA has available after contractual deliveries are met. Surface water is not treated or used for domestic water purposes.

4.3.6 Recycled Water

No recycled water is available to the project sites or within the area of the water supply. The existing plant administrative offices are connected to a septic system. Portable toilets are used at the quarry sites.

4.4 Sufficiency Analysis (see Example)

The Mojave Water Agency 2004 Regional Water Management Plan projects the single-dry year conditions to be based on the 1977 southern California drought conditions. Such hydrologic conditions are used by the State Department of Water Resources as conditions under which State Water Project water deliveries would be limited to 4% of SWP contractors' entitlements. As shown in Table 5-16 of the MWA 2004 Regional Water Management Plan, the Este Subarea would experience deficits (in 5-year increments) as follows:

2005	(2,650) acre-feet
2010	(2,850) acre-feet
2015	(3,050) acre-feet
2020	(1,500) acre-feet
2025	(1,650) acre-feet
2030	(1,850) acre-feet

The BPA is a percentage of water production that occurred during the "base year" as established in the Judgment and is used by the Watermaster for purposes of annually establishing a FPA for each major groundwater producer. According to the Nineteenth Annual Report of the Mojave Basin Area Watermaster, the Este Subarea may be subject to future rampdown of the BPA to 65% immediately if water use conditions change.

The projected additional net demand of 3.75 acre-feet/year over Omya's 10-year average production, would represent 0.25% of the minimum basin subarea groundwater deficit of 1,500 acre-feet during a single dry year event, and 0.123% of the maximum deficit of 3,050 acre-feet. As stated in Section 3.1 above, in the event water supplies become limited, Omya could maintain a limitation on its water use to be equivalent or less than 65% of its' BPA (65% of 23 = 14.95 acre-feet). Under current projections, this limitation on water use would not require the implementation of conservation measures.

The water supplies and demands of the Mojave Water Agency's entire service area were projected in the Final 2010 Urban Water Management Plan in the event of a single-dry year event and a four-year multiple-dry year event occurring during the period 2010 through 2035. The analyses presented in the UWMP show that MWA has adequate supplies to meet demands

during average, single-dry, and multiple-dry years throughout the 20-year planning period (*Final 2010 Urban Water Management Plan, Mojave Water Agency, pages 6-7).*

5.0 IMPACTS ON OTHER PROJECTS

These Projects will not have a significant impact on agricultural, potable or industrial users. Neither will these Projects affect the water supply for any lower-income housing projects. As described herein, Omya has a right to groundwater extracted from a basin that has been adjudicated. The Watermaster responsible for carrying out the terms of the adjudication establishes the amount of groundwater available to Omya on an annual basis. Since water year 1993/94, Omya has not utilized its full entitlement to groundwater and the proposed projects do not exceed Omya's FPA thereby requiring the acquisition of replacement water that might impact other projects.

6.0 RIGHTS TO GROUNDWATER

Under the Stipulated Judgment and applicable law, producers in Lucerne Valley continue to have the right to pump groundwater from the Este Subarea. As previously noted, the aquifer from which water supply would be produced for the proposed projects has been adjudicated. The MWA acts as the Watermaster for the adjudicated basin. The amount of water that may be produced in any subarea in any year by a producer free of any replacement obligation is that producer's share of the FPA. The BPA has been ramped down (from the base year of 1993-94) for the first ten years following the adjudication, as a part of the physical solution established by the Judgment. The Watermaster for the Mojave Basin, the Mojave Water Agency, in its Seventeenth Annual Report of the Mojave Basin Area for Water Year 2009-10, dated May 1, 2011 recommends that each Producer's FPA be established at 80% of the base year for the ensuing water year.

Omya has a FPA that was allocated as part of the Basin Adjudication. For the 2010-11, the Watermaster recommends a FPA for the Este Subarea at 80% of BAP, subject to future rampdown to 65% immediately if water use conditions change.

The existing operation's and proposed projects' water demand would total an estimated 17.55 acre-feet/ year or 92.3% of Omya's current FPA of 19 acre-feet/year. In the event the reliability of water supplies becomes limited due to State-wide or local hydrologic conditions, Omya could maintain a limitation on its water use to 65% of its Base Production Allowance (65% of 23 = 14.95 acre-feet/year) if imposed by the Watermaster. The proposed projects' water demands could be met by Omya purchasing replenishment water.

7.0 VERIFICATION

This document verifies the water supply for the Project as required by California Government Code 66473.7 is available.

List of Supporting Documentation

Supporting documentation was used in preparing this assessment. These include the following:

- California Department of Water Resources Water Data Base: www.water.ca.gov/waterdatalibrary
- Final 2010 Urban Water Management Plan, Mojave Water Agency, June 9, 2011
- Mojave Water Agency 2004 Regional Water Management Plan, Mojave Water Agency, September 2004
- Watermaster Annual Report for Water Year 2002-03, Mojave Basin Area Watermaster, April 1, 2004
- Watermaster Annual Report for Water Year 2003-04, Mojave Basin Area Watermaster, April 1, 2005
- Watermaster Annual Report for Water Year 2004-05, Mojave Basin Area Watermaster, April 1, 2006
- Watermaster Annual Report for Water Year 2005-06, Mojave Basin Area Watermaster, April 1, 2007
- Watermaster Annual Report for Water Year 2006-07, Mojave Basin Area Watermaster, April 1, 2008
- Watermaster Annual Report for Water Year 2007-08, Mojave Basin Area Watermaster, May 1, 2009
- Watermaster Annual Report for Water Year 2008-09, Mojave Basin Area Watermaster, May 1, 2010
- Watermaster Annual Report for Water Year 2009-10, Mojave Basin Area Watermaster, May 1, 2011
- Watermaster Annual Report for Water Year 2010-11, Mojave Basin Area Watermaster, May 1, 2012
- Watermaster Annual Report for Water Year 2011-12, Mojave Basin Area Watermaster, May 1, 2013

White Knob Project
Operational
Fuel Usage

Project Action	CO2e (Metric tons)		Gallons of Fuel Annually	Gallons of Fuel Daily
Construction				
White Knob Baseline	**13183**	13,183,000.00	1,298,818	3,558
Proposed Project Increment	**1893**	1,893,000.00	186,502	511

Baseline + Project Total Fuels Consumed Annually	**1,485,320**
Baseline + Project Total Fuels Consumed Daily	**4,069**

Notes:
Fuel used by vehicle hauling trips and processing equipment assumed to be diesel.

Sources:
Carbon Dioxide Equivalent Emissions: See Section 3.6; Conversion Ratios: California Climate Action Registry 200

COUNTY OF SAN BERNARDINO

WHITE KNOB/WHITE RIDGE LIMESTONE QUARRIES EXPANSION

FINAL ENVIRONMENTAL IMPACT REPORT

SCH No. 2013061020

Prepared for:

COUNTY OF SAN BERNARDINO
385 N. ARROWHEAD AVENUE
SAN BERNARDINO, CA 92415

Prepared by:

6020 CORNERSTONE COURT WEST, SUITE 260
SAN DIEGO, CA 92121

MAY 2015

COUNTY OF SAN BERNARDINO

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MAY 2015

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VOLUME 2 - DRAFT ENVIRONMENTAL IMPACT REPORT

Submitted under separate cover

Executive Summary

ES.1 PURPOSE AND SCOPE OF THE FINAL EIR

San Bernardino County, serving as the lead agency under the California Environmental Quality Act (CEQA), has prepared an environmental impact report (EIR) to provide the public and responsible and trustee agencies with information about the potential environmental effects implementation of the White Knob/White Ridge Limestone Quarries Expansion project. This Final EIR summarizes the environmental effects of the proposed project and mitigation measures, responds to comments received on the Draft EIR, and identifies minor revisions to the Draft EIR.

ES.2 PROJECT CHARACTERISTICS

Omya Inc. proposed an Amended Mine and Reclamation Plan (Amended Plan or proposed project) for expansion of the existing White Knob/White Ridge Limestone Quarries, a limestone mining operation located in the San Bernardino Mountains in southwestern San Bernardino County. The Amended Plan would increase the operational years of the quarry by 24 years from the existing permit expiration date of 2031 to the year 2055.

The Amended Plan includes approximately 375.1 acres, consisting of approximately 335.1 acres of existing or planned surface mining operation–related disturbance and approximately 40 acres of existing Bureau of Land Management (BLM) haul road right-of-way. This 375.1-acre area comprises the "project site" for this EIR. The primary areas to be reclaimed are the existing White Knob Quarry and White Knob Annex Quarry, the approved White Ridge Quarry, the existing Overburden Site #1 and proposed Overburden Sites #2 and #3, and the ancillary disturbance areas, which include haul/access roads, sediment basins, storage pads, crusher location, west slope impact area, and boulder roll-down area.

The proposed project is designed to make the reclaimed lands suitable for future open space uses and wildlife habitat. It includes site-specific activities to satisfy the reclamation requirements of the Surface Mining and Reclamation Act of 1975, as amended, and its implementing regulations (collectively, SMARA) as well as the County's surface mining and land reclamation ordinance (San Bernardino County Code Section 88.03.000). A lead-agency-approved reclamation plan is required for all surface mining operations in the state that are subject to SMARA. The County has primary discretionary authority over the proposed project and serves as the lead agency responsible under CEQA and SMARA. If approved, the proposed project would not preclude future permitting of extraction and reclamation activities within or beyond the project site. Any such future proposal would require authorization from the County and compliance with CEQA.

ES.3 PROJECT ALTERNATIVES SUMMARY

CEQA Guidelines Section 15126.6(a) states that an EIR shall describe and analyze a range of reasonable alternatives to a project. These alternatives should feasibly attain most of the basic objectives of the project, while avoiding or substantially lessening one or more of the significant environmental impacts of the project. An EIR need not consider every conceivable alternative to a project, nor is it required to consider alternatives that are infeasible. The discussion of alternatives shall focus on those which are capable of avoiding or substantially lessening any significant effects of the project, even if they impede the attainment of the project objectives to some degree or would be more costly [CEQA Guidelines Section 15126.6(b)]. The Draft EIR considered the following alternatives:

- **Alternative1 – No Project** – This alternative would retain the approved 1986 White Knob-White Ridge Limestone Mine Site Approval and Reclamation Plan. The 1986 Plan has an

expiration date of December 31, 2031. The approved quarry site consists of 145 acres of mining facilities within 357.5 acres of patented fee land, portions of which are leased and owned by Omya. Additionally, as with the proposed project, Alternative 1 would include proposed changes to the existing haul road to the White Knob/White Ridge Quarries from the processing plant.

- **Alternative 2 – Elimination of OB-2** – Under Alternative 2, overburden site 2 (OB-2) would be eliminated from the project. This alternative would remove the impacts on the wetland features in this area. The overburden that would have been placed in this 13-acre site would be placed in OB-1 or OB-3, increasing the size and height of these areas. The elimination of OB-2 would also result in the reduction in size of the project area from 335.1 acres to 322.1 acres. The proposed project lists the total size of OB-1 as 31.9 acres and OB-3 as 3.0 acres. Assuming the overburden from the OB-2 site would be absorbed into OB-1 and OB-3 using the same proportional size, OB-1 is approximately 10.6 times the size of OB-3, OB-1 would increase to 43.7 acres and OB-3 to 4.3 acres in size. Additional changes to these overburden sites would also have to be incorporated into this alternative such as additional sedimentation basins or other drainage features and the re-contouring of OB-1 and OB-3 to accommodate the additional overburden, as well as the realignment of the on-site haul road to reach the White Ridge Quarry.

- **Alternative 3 – Backfill Central White Knob and Annex Quarries** – Alternative 3 would include the backfilling of the White Knob and Annex Quarries. This alternative would be similar to the proposed project except that upon reclamation the OB-1 overburden storage area and central portions of the White Knob and Annex Quarries would be much higher because material placed in the White Ridge Quarry would now be placed in the White Knob and Annex Quarries. This would require that the final backfill elevation of OB-1 and the White Knob and Annex Quarries be raised to accommodate the additional fill, depending on slope stability. Under the proposed project, design of overburden fill slopes in all three disposal areas was found to have adequate slope stability; however, Alternative 3 would remove the fill in OB-3, the upper portions of OB-2, and some portion of the toe of OB-1, thereby reducing the potential for the mining-related fill slopes to fail or otherwise become unstable, and reducing the area of disturbance in the central and eastern drainages. The amount of fill that can be placed in each quarry would be restricted by the stability of the final fill, i.e., the slope angle and height. Overburden that could not be placed in the White Knob and Annex Quarries would continue to be placed in OB-1.

ES.4 EFFECTS FOUND NOT TO BE SIGNIFICANT

CEQA Guidelines Section 15128 requires an EIR to briefly describe any possible significant effects that were determined not to be significant and were therefore not discussed in detail in the Draft EIR. The Final EIR has determined that the project would not result in significant impacts in the following environmental issue areas:

- Agricultural and Forestry Resources
- Hazards and Hazardous Materials
- Land Use and Planning
- Mineral Resources

- Noise
- Population and Housing
- Public Services
- Recreation
- Transportation and Traffic

ES.5 ISSUES TO BE RESOLVED AND AREAS OF CONTROVERSY

Chapter 1.0, Introduction, in the Draft EIR provided a description of issues were identified during the Notice of Preparation (NOP) comment period. These issues, discussed in comment letters received during the NOP review period, include potential impacts on biological resources, the potential impacts on Native American cultural resources, and the requirements of the California Department of Conservation – Office of Mine Reclamation (OMR) for the proposed Amedned Plan. These issues were evaluated in the Draft EIR, and mitigation measures were identified to reduce the impacts to less than significant levels.

One other significant environmental impact, not raised during the NOP process, was identified during preparation of the Draft EIR. A substantial adverse effect on a scenic vista and the existing visual character was determined to result in cumulatively considerable and significant and unavoidable impact, as no feasible mitigation is available to reduce this impact to a less than significant level.

ES.6 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Table ES-1 provides a summary of project impacts and mitigation measures identified in the Draft EIR. Changes to mitigation measures identified in the table below are as a result of comments made on the Draft EIR and are shown in revision marks (underline/~~strikeout~~).

CEQA Section 21100(b)(2)(A) requires an EIR to identify significant environmental effects that cannot be avoided if a project is implemented. The Draft EIR evaluated the following topics in detail: aesthetics, air quality, biological resources, cultural and paleontological resources, geology and soils, greenhouse gas emissions, hydrology and water quality, and water supply and storm drainage. Most of the impacts of the project either would be less than significant or would be mitigated to a less than significant level.

Two impacts were identified in the Draft EIR that would remain significant and unavoidable after mitigation. Implementation of the proposed project could have a substantial effect on a scenic vista (Project Impact 3.1.1). Implementation of the proposed project, in combination with other reasonably foreseeable mining projects in San Bernardino County, would contribute to the alteration of the visual character of the San Bernardino Mountains (Cumulative Impact 4.0.1).

TABLE ES-1
EXECUTIVE SUMMARY

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
Aesthetics			
Impact 3.1.1 Substantial Adverse Effect on a Scenic Vista and the Existing Visual Character	Significant and unavoidable	**MM 3.1.1** The Amended Plan includes design features and reclamation activities that would reduce visual impacts. These measures are incorporated into this DEIR in order to ensure compliance. These measures include the following: • Implement measures to minimize boulder roll-down visual impacts including: – Precision drilling and buffer blasting when the outside edge is approached. – Drilling lifters on the edge to undercut the remaining slope and let it fall into the pit (like directional falling of a tree). – Excavator to pull down and pull in toward the pit blasted rock away from the edge. – Use of alternatives to blasting along the outside such as rock breakers, surface miners, cutting heads, and excavators. – Loader to pull back material from the edge. – Loader to dig at an angle to the edge or parallel to the edge when possible. – Manually scaling boulders from the high walls where they may be above a haulage road. • Maintain the existing crusher site at the White Knob Quarry or use a portable plant within an active quarry to reduce its visibility from Lucerne Valley. • Deposit waste rock within the White Knob Quarry footprint, as described in the Amended Plan, to reduce the area of disturbance for overburden stockpiles and visual impact outside the quarry. • Design and phase mining of the White Ridge Quarry, which allows for concurrent reclamation and leaves an approximately	Significant and unavoidable

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		300-foot-high ridge of undisturbed hillside facing Lucerne Valley to minimize visual impacts. • Implement reclamation and revegetation on completed equipment-accessible quarry benches and on overburden stockpiles concurrent with mining where feasible. • Utilize color-staining product to darken the visible quarry and roll-down slopes where not subject to raveling to reduce visual impacts. • Deposit darker waste rock on overburden sites where available to reduce color contrast. • Design adequate erosion control features along the haul and access roads and quarry to control and limit erosion and sediment transport for a 20-year, one-hour duration storm event. • Where feasible, construct catchment berms at the foot of stockpiles to reduce rock roll-down and sediment flow. • Limit surface disturbances to areas identified in the Amended Plan. • Implement appropriate dust controls to reduce visible dust.	
Impact 4.0.1 Cumulative Impacts on Aesthetics and Visual Resources	Cumulatively considerable and significant and unavoidable	None available	Cumulatively considerable and significant and unavoidable
Air Quality			
Impact 3.2.1 Emissions of Air Pollutants Resulting in Violation of Air Quality Standards or Contributing to Existing Violations	Potentially sigificant	**MM 3.2.1** It shall be required in the final Amended Mine and Reclamation Plan that the following PM10 reduction measures be implemented as part of quarry operations and reclamation. • Limit maximum speed on unpaved roads to 25 miles per hour. • Water unpaved roads at least twice per day, more if needed to control dust emissions by at least 80 percent. Alternatively, a dust palliative, such as magnesium chloride, may be used to treat the unpaved roads. • Water all areas to be graded and areas where bulldozers operate at least twice per day, more if needed, to control dust emissions.	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
Impact 3.2.2 Conflict with MDAQMD Air Quality Management Plans	Less than significant	None required	Less than significant
Impact 3.2.3 Conflict with Federal Land Managers' Air Quality Related Values	Less than significant	None required	Less than significant
Impact 3.2.4 Exposure of Sensitive Receptors to Localized Criteria Pollutants	Potentially significant	Implement mitigation measure **MM 3.2.1.**	Less than significant
Impact 3.2.5 Exposure of Sensitive Receptors to Toxic Air Contaminant Pollutant Concentrations	Less than significant	None required	Less than significant
Impact 4.0.2 Cumulative Impacts on Air Quality	Less than cumulatively considerable	None required	Less than cumulatively considerable
Biological Resources			
Impact 3.3.1 through **Impact 3.3.10** Impacts on Candidate, Sensitive, or Special-Status Species	Potentially significant	**MM 3.3.1a** The mine operator shall retain a qualified biologist to conduct mandatory contractor/worker awareness training for project personnel. The awareness training will be provided to all personnel to brief them on the identified location of sensitive biological resources, including how to identify species (visual and auditory) most likely to be present, the need to avoid impacts on biological resources (e.g., plants, wildlife, and jurisdictional waters), and to brief them on the penalties for not complying with biological mitigation requirements. If new personnel are added to the project, the mine operator will ensure that they receive the mandatory training before starting work. **MM 3.3.1b** The mine operator shall designate a field contact representative (FCR) responsible for overseeing compliance with protections to special-status species. The FCR shall be on-site during all project activities that could potentially cause significant impacts on sensitive biological resources. The FCR shall have the authority to halt activities that are in violation of the committed measures and non-emergency project-related activities that may endanger special-status species. The FCR shall authorize re-initiation of project activities after the hazards are removed, the species is no longer at risk, or the individual(s) are moved out of harm's way by the qualified biologist.	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		MM 3.3.1c Project-related vehicles will stay on roads and observe a 25 mile per hour speed limit in all project areas, except on county roads and state and federal highways. **MM 3.3.1d** Project-related vehicles shall be checked before moving for wildlife, as wildlife may seek shade and shelter under parked vehicles and construction equipment. **MM 3.3.1e** All construction pipes, culverts, or similar structures that are stored on the project site for one or more nights shall be inspected thoroughly for the presence of wildlife before they are used or moved. If wildlife is present, they shall be allowed to move out of the area on their own or moved out of harm's way by a qualified biologist. **MM 3.3.1f** Encounters with a special-status wildlife species shall be reported to the FCR and qualified biologist. The qualified biologist shall maintain records of all encounters during the project, the species' condition, location found, and location released. **MM 3.3.1g** All food-related trash items such as food wrappers, cans, bottles, and food scraps shall be disposed of in secured, closed containers and removed regularly from the project site. **MM 3.3.1h** Fueling of vehicles and equipment shall be prohibited within 100 feet of riparian/riverine areas. **MM 3.3.1i** No rodenticides shall be used on the project site.	
Impact 3.3.2 Special-Status Plant Species	Potentially significant	**MM 3.3.2 ~~Rare Plant Surveys~~ Carbonate Habitat Management Strategy (CHMS) Consistency.** Prior to initiating project-related activities in undisturbed portions of the site, the mine operator shall complete land dedication or claim relinquishments to offset project impacts on listed threatened or endangered plants at a 3:1 ratio, consistent with the requirements of the CHMS, and provide documentation of the completed transaction to the County. The 3:1 ratio will apply to total number of conservation units (CUs) (calculated by San Bernardino County National Forest [SBNF] staff according to the provisions of the CHMS) and total occupied habitat, in acres or fractions of acres, for each listed species. This mitigation measure consists of four parts: (1) field surveys to determine conservation value of proposed disturbance areas; (2) comparable	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		field surveys to verify conservation value of mining claims to be relinquished; (3) administrative requirements to complete the land dedication or claim relinquishments (which may include mineral withdrawal); and (4) protection measures for special-status plants located adjacent to project disturbance areas that are not planned to be removed. (1) Project Area Field Surveys and Conservation Value Calculation. The mine operator shall retain a qualified biologist to perform focused surveys to determine the presence/ or absence of special-status plant species identified in Table 3.3-1 and within 100 feet of the proposed impact area. For listed threatened or endangered plants, the extent of occupied habitat shall be mapped and quantified. For any other special-status plants located in the project area, the biologist shall collect global positioning system (GPS) coordinates of occurrences and qualitative estimates of their abundance. These surveys shall be conducted in accordance with the CDFW (2009) *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities*. These guidelines require that rare plant surveys be "floristic in nature," conducted by field botanists familiar with the regional flora, and conducted at the proper time of year when rare or endangered species are both evident and identifiable. Field surveys shall be scheduled to coincide with known flowering periods and/or during appropriate developmental periods that are necessary to identify the plant species of concern. Field survey results and mapping data shall be provided to the County and the SBNF for inclusion in the CHMS GIS data and calculation of total CHMS conservation value of the proposed project area. (2) Mitigation Lands Field Surveys and Conservation Value Calculation. The mine operator shall identify one or more parcels of land or mining claims suitable for relinquishment and shall retain a qualified biologist to perform focused botanical surveys of those lands. Survey methods and data collection shall be as described above for project site field surveys. Field survey	

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		results and mapping data shall be provided to the San Bernardino National Forest for inclusion in the CHMS GIS data and calculation of total CHMS conservation value of the proposed project area. (3) Land Dedication or Claim Relinquishment. The mining operator shall specify lands or mining claims whose conservation values and habitat area occupied by listed species total no less than three times the total conservation value of the project area and roughly three times the occupied habitat for each affected listed species. The mining operator shall dedicate the lands or relinquish those claims according to the terms of the CHMS and the MOU. The operator shall provide written documentation of the land dedication or claim relinquishment to the County upon completion. (4) Protect Special-Status Plant Locations Adjacent to Project Site. Any special-status plant species that are identified within 100 feet of the proposed impact area, but not proposed to be disturbed by the project, shall be protected by barrier fencing to ensure that construction activities and material stockpiles do not impact any special-status plant species. These avoidance areas shall be identified on project plans. ~~If any state or federally listed, CNPS List 1, or CNPS List 2 plant species are found in or adjacent to (within 25 feet) the proposed impact area during the surveys, these plant species shall be avoided to the extent feasible and the following mitigation measures shall be implemented:~~ ~~(1) In some cases involving state-listed plants, it may be necessary to obtain an incidental take permit under Section 2081 of the Fish and Game Code (2081 permit). The mine operator shall consult with the CDFW to determine whether a 2081 permit is required and obtain all required authorizations prior to initiation of ground breaking activities.~~ ~~(2) Before the approval of grading plans or any ground breaking activity within the PSA, the mine operator shall submit a mitigation plan concurrently to the CDFW and the USFWS (if appropriate) for review and comment. The plan shall include~~	

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		~~mitigation measures for the population(s) to be directly affected. Possible mitigation for impacts to special-status plant species can include implementation of a program to transplant, salvage, cultivate, or re-establish the species at suitable sites (if feasible) or through the purchase of credits from an approved mitigation bank, if available. The actual level of mitigation may vary depending on the sensitivity of the species, its prevalence in the area, and the current state of knowledge about overall population trends and threats to its survival. The final mitigation strategy for directly impacted plant species shall be determined by the CDFW and the USFWS (if appropriate) through the mitigation plan approval process.~~ (3) ~~Any special-status plant species that are identified adjacent to the PSA, but not proposed to be disturbed by the project, shall be protected by barrier fencing to ensure that construction activities and material stockpiles do not impact any special-status plant species. These avoidance areas shall be identified on project plans.~~	
Impact 3.3.3 Desert Tortoise	Potentially significant	**MM 3.3.3a Desert Tortoise Surveys**. Prior to implementation of project-related activities, the mine operator shall retain a USFWS-authorized desert tortoise biologist to conduct pre-project surveys in accordance with the USFWS pre-project field survey protocol (2010). If no desert tortoises are identified during pre-project surveys, no further mitigation is required. If individuals or their sign are identified during pre-project surveys, mitigation measure **MM 3.3.3b** shall be implemented. **MM 3.3.3b Desert Tortoise Avoidance, Minimization, and Mitigation.** Should occupied desert tortoise habitat be identified during the pre-project surveys, a habitat ~~biological~~ mitigation and monitoring plan and raven control plan shall be developed in consultation with the USFWS and the CDFW. This plan shall describe all measures to be implemented prior to, during, and after construction, including, but not limited to, the following: (1) All tortoise burrows shall be avoided to the greatest extent feasible, and temporary exclusionary tortoise fencing (1x2-inch mesh hardware cloth) shall be installed at the limits of	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		disturbance prior to initiation of construction activities. Fence installation and ongoing oversight of the need for maintenance shall be monitored by a USFWS-authorized desert tortoise biologist. (2) Upon completion of fence installation, the authorized biologist shall conduct a clearance survey of the fenced area prior to declaring the construction area free of tortoises. (3) If it is necessary to excavate a desert tortoise from its burrow to move it out of harm's way, excavation shall be done with hand tools, either by or under the direct supervision of the authorized biologist. (4) Desert tortoises removed from burrows shall be placed in an unoccupied burrow of approximately the same size as the one from which they were removed. If an existing burrow is not available, the authorized biologist shall construct one. (5) Desert tortoises moved during inactive periods will be monitored for at least two days after relocation or the end of construction, whichever occurs first. (6) If desert tortoises need to be moved at a time of day when ambient temperatures could harm them (less than 40 degrees and over 90 degrees Fahrenheit), they shall be held overnight in a clean cardboard box and released the following day during more favorable temperatures. Cardboard boxes used to hold tortoises shall only be used once. (7) All handling of desert tortoises shall be performed consistent with the *Guidelines for Handling Desert Tortoises During Construction Projects* (Desert Tortoise Council 1994). (8) The mine operator shall mitigate for impacts on occupied desert tortoise habitat at a 1:1 minimum ratio through the purchase of credits from an approved desert tortoise mitigation bank. The amount of credits purchased and the location of the mitigation bank used ~~shall be established through consultation with and~~ are subject to approval by the USFWS and the CDFW. The mine operator shall provide the County with evidence that the permit and/or other requirements established by either agency have been satisfactorily met.	

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
Impact 3.3.4 Coast Horned Lizard	Potentially significant	**MM 3.3.4 Coast Horned Lizard Surveys.** Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine if suitable habitat for this species occurs within 250 feet of the proposed impact area. If suitable habitat exists, preconstruction surveys must be performed by a qualified biologist in a manner to maximize detection of coast horned lizards (i.e., during warm weather, walking slowly). If any lizards are discovered within the work areas, they shall be actively moved or passively encouraged to leave the work area.	Less than significant
Impact 3.3.5 Burrowing Owl	Potentially significant	**MM 3.3.5 Burrowing Owl Surveys.** If clearing and construction activities will occur during the nesting period for burrowing owls (February 1–August 31), the mine operator shall retain a qualified biologist to determine if suitable nesting habitat occurs within 500 feet of the proposed impact area. If suitable habitat exists, focused surveys must be performed by a qualified biologist in accordance with the CDFW's *Staff Report on Burrowing Owl Mitigation,* published March 7, 2012. Surveys shall be repeated if project activities are suspended or delayed for more than 15 days during nesting season. If no burrowing owls are detected, no further mitigation is required. If active burrowing owl nest sites are detected, the mine operator shall implement the avoidance, minimization, and mitigation methodologies outlined in the CDFW's *Staff Report on Burrowing Owl Mitigation* prior to initiating project-related activities that may impact burrowing owls.	Less than significant
Impact 3.3.6 Le Conte's Thrasher and other Migratory Birds	Potentially significant	**MM 3.3.6 Migratory Bird Surveys.** If clearing and/or construction activities will occur in undisturbed portions of the site, or blasting activities will occur in any portion of the project site, during the migratory bird nesting season (March 15–August 15), preconstruction surveys to identify active migratory bird nests shall be conducted by a qualified biologist within 14 days of ~~construction~~ initiation of project activities. Focused surveys must be performed by a qualified biologist for the purposes of determining the presence/absence of active nest sites within the proposed impact area and a 200-foot buffer (if feasible). Surveys shall be repeated if project activities are	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		delayed or postponed for more than 30 days. If active nest sites are identified within 200 feet of project activities, the mine operator shall impose a limited operating period (LOP) for all active nest sites prior to commencement of any project ~~construction~~ activities to avoid construction or project-related disturbances to migratory bird nesting activities. An LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, blasting, and construction) will not occur and will be imposed within 100 feet of any active nest sites until the nest is deemed inactive. Activities permitted within and the size (i.e., 100 feet) of LOPs may be adjusted through consultation with the CDFW and~~/or~~ the County. When an active nest is located within 200 feet of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to CDWF and the County until the nest(s) are deemed inactive.	
Impact 3.3.7 Golden Eagle and Other Raptors	Potentially significant	**MM 3.3.7a Raptor Conservation Strategy.** The applicant shall participate in and implement the Raptor Conservation Strategy. **MM 3.3.7b Raptor Surveys.** If clearing and/or construction activities would occur in undisturbed portions of the site, or blasting activities will occur in any portion of the project site, during the raptor nesting season (January 15–August 15), preconstruction surveys to identify active raptor nests shall be conducted by a qualified biologist within 14 days of construction initiation. Focused surveys must be performed by a qualified biologist for the purposes of determining presence/absence of active nest sites within the proposed impact area. If no active nests are found, no further mitigation is required. Surveys shall be repeated if project activities are delayed or postponed for more than 30 days. If active golden eagle or other raptor nest sites are identified within a half mile of project activities, the applicant shall impose a limited	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		operating period (LOP) for all active nest sites prior to commencement of any project activities to avoid construction- or project-related disturbances to nesting raptors. A LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, blasting, and construction) will not occur and shall be imposed within 500 feet of any active nest sites until the nest is deemed inactive. Activities permitted within LOPs and the size (i.e., 500 feet) of LOPs may be adjusted through consultation with the CDFW and the County. When an active nest is located within a half mile of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to the County until the nest(s) are deemed inactive.	
Impact 3.3.8 Mule Deer and Bighorn Sheep	Less than significant	None required	Less than significant
Impact 3.3.9 Special-Status Bats	Potentially significant	**MM 3.3.9 Bat Surveys.** Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine whether potential roosting sites for special-status bats may be affected. If potential roost sites are identified, a preconstruction survey by a qualified biologist shall be conducted ~~prior to the end of April~~ between March 1 and July 31 to determine the presence or absence of roosting bats. If the survey does not identify the presence of occupied roosts, no further mitigation is required. If ~~day roosts or maternity roosts~~ non-breeding roosts occupied by special-status bat species are documented within construction areas, the bats shall be safely flushed from the sites where roosting habitat is planned to be removed prior to May of each construction phase ~~(maternity roosts are generally occupied from May to August)~~ and prior to the onset of construction activities. The removal of the roosting sites shall occur during the time of day when the roost is	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		unoccupied. If a maternity colony is detected, a 100-foot construction-free buffer shall be established around the roost site and remain in place until it has been determined by a qualified biologist that the nursery is no longer active. Removal of maternity roosts shall be restricted to between March 1 and April 15 or August 15 and October 15 to avoid interfering with an active nursery. The loss of each roost will be compensated for by the construction and installation of two bat boxes suitable to the bat species and colony size excluded from the original roosting site. The bat boxes shall be installed in the vicinity prior to removal of the original non-breeding/maternity roost sites. A detailed program for bat flushing, roosting site removal, and installation of bat boxes shall be developed in consultation with a qualified biologist.	
Impact 3.3.10 Pallid San Diego Pocket Mouse	Potentially significant	**MM 3.3.10 Pallid San Diego Pocket Mouse Surveys.** Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine if suitable habitat for this species occurs within 250 feet of the proposed impact area. If suitable habitat exists, preconstruction surveys must be performed by a qualified biologist in a manner to maximize detection of pallid San Diego pocket mice. If any mice are discovered within the work areas, they shall be actively moved or passively encouraged to leave the work area.	Less than significant
Impact 3.3.11 Impacts on Riparian Habitat or Sensitive Natural Communities	Potentially significant	**MM 3.3.11a No Net Loss of Riparian Vegetation.** The mine operator shall ensure there is no net loss of riparian vegetation. Mitigation can include on-site restoration or purchase of mitigation credits at a USACE-approved mitigation bank, placing a conservation easement over a riparian area, or quit claiming mineral claims over a riparian area. Mitigation, as required in regulatory permits issued through the CDFW, the USACE, or the RWQCB, may be applied to satisfy this measure. Evidence of compliance with this mitigation measure shall be provided prior to construction and grading activities for the proposed project. **MM 3.3.11b Oak Woodlands.** The mine operator shall ensure there	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		is no net loss of oak woodland habitat. Mitigation can include any one or combination of the following: (1) Preservation of existing oak woodlands by recording a conservation easement(s) in favor of the County or an approved organization or agency. (2) Replacement or restoration of former oak woodlands. The County may require the planting and maintenance of replacement trees, including replacing dead or diseased trees. The replacement ratio and tree sizes shall be based on the recommendation of an Oak Reforestation Program prepared by a registered professional forester. The requirement to maintain trees in compliance with this paragraph shall terminate seven years after the trees are planted. (3) Contribution of in-lieu mitigation fees to the Oak Woodlands Conservation Fund, established under Fish and Game Code Section 1363 for the purpose of purchasing oak woodlands conservation easements. A project applicant who contributes funds in compliance with this subsection shall not receive or use a grant from the Oak Woodlands Conservation Fund as part of the mitigation for the project. The in-lieu fee for replacement trees shall be calculated based on their equivalent value as established by the International Society of Arboriculture's current edition of the *Guide for Plant Appraisal*. (4) Performing other mitigation measures as may be required by the County (e.g., inch-for-inch off-site replacement planting, transfer of development rights, enrollment of project with offset provider for carbon credits in greenhouse gas emission registry, carbon reduction, and carbon trading system).	
Impact 3.3.12 Impacts on Federally Protected Wetlands	No impact	None required	No impact
Impact 3.3.13 Impacts on Wildlife Movement	Less than significant	None required	Less than significant
Impact 3.3.14 Conflict with Local Policies and Ordinances	No impact	None required	No impact

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
Impact 3.3.15 Conflict with Conservation Plans	Less than significant	None required	Less than significant
Impact 4.0.3 Cumulative Impacts on Biological Resources	Cumulatively considerable	Implement mitigation measures **MM 3.3.1a** through **MM 3.3.1i, MM 3.3.2, MM 3.3.3a** and **MM 3.3.3b, MM 3.3.4, MM 3.3.5, MM 3.3.6, MM 3.3.9,** and **MM 3.3.10**.	Less than cumulatively considerable
Cultural and Paleontological Resources			
Impact 3.4.1 Substantial Adverse Impact on an Archaeological or Historical Resource	Potentially significant	**MM 3.4.1** It shall be required in the final Amended Mine and Reclamation Plan, that if, during the course of construction, mining, or reclamation activities previously unknown cultural resources (i.e., prehistoric or historic sites) are discovered, work shall be halted immediately within 50 feet of the discovery, the San Bernardino County Land Use Services Department shall be notified, and a professional archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards in prehistoric or historical archaeology shall be retained to determine the significance of the discovery. Determination of impacts, significance, and mitigation that protects the discovered resource shall be made by a qualified archaeologist in consultation with recognized local Native American groups, if appropriate. The San Bernardino County Museum shall also be contacted for review of the archaeological find(s). In addition, prior to the commencement of project excavations, all construction and mining personnel shall be informed of the potential to inadvertently uncover cultural resources and the procedures to follow subsequent to an inadvertent discovery of cultural resources.	Less than significant
Impact 3.4.2 Disturb Human Remains	Less than significant	None required	Less than sigificant
Impact 3.4.3 Destroy a Unique Paleontological Resource or Geologic Feature	Potentially significant	**MM 3.4.3** If non-metamorphosed fossiliferous limestones are encountered during mining activities, they shall be removed and retained for examination by a qualified paleontologist. If any fossil-bearing materials are encountered, a program to protect and preserve such resources that might be exposed or unearthed shall be developed in cooperation with the project applicant and San Bernardino County. The program shall be developed in accordance with the proposed guidelines of the Society of Vertebrate	Less than sigificant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		Paleontology and shall include, but not be limited to, the following: • All non-metamorphosed fossiliferous limestones that are encountered during mining shall be stockpiled for examination by a qualified paleontologist. The monitor shall be prepared to quickly salvage any fossils that might be present. The monitor should also remove samples of sediments that are likely to contain the remains of small fossil vertebrates and invertebrates. • Collected samples of sediments shall be processed to recover small invertebrate and vertebrate fossils. Recovered specimens shall be prepared so that they can be identified and permanently preserved. • Any specimens shall be identified, curated, and placed into a repository with permanent retrievable storage. • A report of findings, including an itemized inventory of recovered specimens, shall be prepared on completion of the steps outlined above. The report shall include a discussion of the significance of all recovered specimens. The report and inventory, when submitted to San Bernardino County, will signify completion of the program to mitigate impacts on paleontological resources.	
Impact 4.0.4 Cumulative Impacts on Cultural Resources	Less than cumulatively considerable	None required	Less than cumulatively considerable
Geology and Soils			
Impact 3.5.1 Exposure of People or Structures to Potential Substantial Adverse Seismic Effects	Less than significant	None required	Less than significant
Impact 3.5.2 Slope Stability	Less than significant	None required	Less than significant
Impact 3.5.3 Rock and Soil Talus Erosion	Potentially significant	**MM 3.5.3** Omya shall prepare and submit periodic monitoring of the Western Drainage and Ruby Springs area to the County of San Bernardino. If the results of periodic monitoring of the Western Drainage and Ruby Springs area finds that sediments from the White Knob Quarry operation have caused a measurable impact on Ruby	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		Springs, Omya shall prepare and submit for approval additional mitigation measures that may include (1) revision of the 2008 Sedimentation and Erosion Monitoring Technical Work Plan, and/or (2) remediation of the Western Drainage and/or Ruby Springs area. Any remediation efforts in the Western Drainage and/or Ruby Springs area will occur prior to proceeding with work on the ground. Omya shall obtain all necessary permits and pay all required fees and financial assurances, including, but not limited to, County of San Bernardino permits, BLM permits, California Department of Fish and Wildlife permits, and US Fish and Wildlife Service permits. Reporting of monitoring results shall be done at least once every two years and following any significant rain event that is equal to or exceeds the 10-year return period rainfall for the project site. Reports of monitoring activities, data, and findings shall be provided to the County of San Bernardino at least once every two years prior to the annual SMARA inspection. The first report shall be submitted within the year following the approval of the Amended Reclamation Plan. The monitoring shall be done in accordance with the 2008 Sedimentation and Erosion Monitoring Technical Work Plan (dated May 31, 2008) and any subsequent approved amendments.	
Impact 3.5.4 Erosion and Soil Loss	Less than significant	None required	Less than significant
Impact 4.0.5 Cumulative Impacts on Geology and Soils	Less than cumulatively considerable	None required	Less than cumulatively considerable
Greenhouse Gas Emissions			
Impact 3.6.1 Impact on the Environment	Less than cumulatively considerable	None required	Less than significant
Impact 3.6.2 and **Impact 4.0.6** Conflict with an Applicable Plan, Policy, or Regulation Adopted for the Purpose of Reducing the Emissions of Greenhouse Gases	Less than cumulatively considerable	None required	Less than cumulatively considerable

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
Hydrology and Water Quality			
Impact 3.7.1 Substantially Alter Drainage Pattern	Potentially significant	**MM 3.7.1** The following mitigation measures shall be implemented in addition to requirements contained in the project's SWPPP and SPCC. All measures shall be subject to County of San Bernardino approval prior to implementation. a. Implement the recommendations for modifications of the project's haul road drainage and sediment control structures given in the September 12, 2013, Stantec technical memorandum and August 2011 Stantec report, White Knob Haul Road Drainage Study and Plan Development, to implement Sections 15, 16, and 17 of the April 20, 2011, Settlement Agreement between Omya and the Bureau of Land Management in sections: – 2.3 Culvert Flow Calculations (EIR Appendix G, Stantec 2013, p.6); – 2.4 Culvert Riprap Calculations (EIR Appendix G, Stantec 2013, p. 7); – 3.1.2, Roadway Grading and Ditch Recommendations (EIR Appendix G, Stantec 2011, p. 3.3); – 3.2.2, Sediment Catchment Basins Recommendations(EIR Appendix G, Stantec 2011, p. 3.6); and – 4.0, Right-of-Way Recommendations (EIR Appendix G, Stantec 2011, p. 4.1). Inclusion of these improvements would ensure that no flow increases to downstream flows during flood events. b. All quarry areas, overburden fills, and haul roads shall be maintained to minimize erosion and sedimentation. c. Sedimentation basins shall be inspected regularly, at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. Sediment shall be removed and basin function restored as needed. d. Any sediment removed from basins shall be deposited on the overburden areas or into the White Knob Quarry sedimentation	Less than significant

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
		pond. Sediment placed on the overburden areas shall utilize temporary stormwater BMPs to prevent further sediment discharge and shall be revegetated in accordance with the 2013 Amended Reclamation Plan. e. Basin spillways shall remain in good working condition and repaired as necessary. f. Areas in haul roads that experience erosion shall be backfilled and rocked to minimize future erosion. g. Overburden fill slopes and benches shall be inspected regularly, at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. If erosion or sedimentation is observed, temporary BMPs shall be utilized on overburden slopes and benches as soon as possible to minimize future erosion. h. Areas of erosion or sediment deposition in overburden areas shall be permanently remediated as soon as possible, preferably before the next precipitation event. Remediated overburden slopes and benches shall be revegetated and/or armored in accordance with the 2013 Amended Reclamation Plan. i. Haul road culverts and Arizona crossings shall be inspected regularly at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. Culverts and crossing shall be repaired and maintained to allow for proper passage of floodwaters. j. If any of the haul road culverts are damaged or washed out, they shall be replaced with a culvert that provides a minimal capacity to pass a 20-year storm event without overtopping or excess erosion. k. The seven procedures that were implemented to minimize boulder roll-down shall continue for the life of the project. These procedures are identified in mitigation measure **MM 3.1.1**. Procedures shall be modified and/or additional measure put in place, as necessary, to achieve minimal boulder roll-down.	

Impact	Level of Significance Without Mitigation	Mitigation Measure	Resulting Level of Significance
Impact 4.0.7 Cumulative Impacts on Hydrology and Water Quality	Less than cumulatively considerable	None required	Less than cumulatively considerable
Utilities and Service Systems			
Impact 3.8.1.1 Construction of New Stormwater Drainage Infrastructure	Less than significant	None required	Less than significant
Impact 3.8.2.1 Adequate Water Supply	Less than significant	None required	Less than significant
Impact 4.0.8 Cumulative Impacts on Public Services and Utilities	Less than cumulatively considerable	None required	Less than cumulatively considerable

1.0 Introduction

This Final Environmental Impact Report (Final EIR) was prepared in accordance with the California Environmental Quality Act (CEQA) and the State CEQA Guidelines (Section 15132). The County of San Bernardino (County) is the lead agency for the environmental review of the proposed White Knob/White Ridge Limestone Quarries Expansion project. The County has the principal responsibility for approving the project. This Final EIR summarizes the environmental effects of the proposed project and mitigation measures, responds to comments received on the Draft EIR, and identifies minor revisions to the Draft EIR.

1.1 BACKGROUND AND PURPOSE OF THE EIR

OVERVIEW OF CEQA REQUIREMENTS FOR PREPARATION OF AN EIR

The County, serving as the lead agency, has prepared this EIR to provide the public and responsible and trustee agencies with information about the potential environmental effects of the proposed project. As set forth in the provisions of CEQA and implementing regulations, public agencies are charged with the duty to consider the environmental impacts of proposed development and to minimize these impacts where feasible while carrying out an obligation to balance a variety of public objectives, including economic, environmental, and social factors.

State CEQA Guidelines Section 15121(a) states that an EIR is an informational document for decision-makers and the general public that analyzes the significant environmental effects of a project, identifies possible ways to minimize significant effects, and describes reasonable alternatives to the project that could reduce or avoid its adverse environmental impacts. Public agencies with discretionary authority are required to consider the information in the EIR, along with any other relevant information, in making decisions on the project.

CEQA requires the preparation of an environmental impact report prior to approving any project, which may have a significant effect on the environment. For the purposes of CEQA, the term "project" refers to the whole of an action which has the potential for resulting in a direct physical change or a reasonably foreseeable indirect physical change in the environment (CEQA Guidelines Section 15378[a]). With respect to the proposed project, the County has determined that the proposed White Knob/White Ridge Limestone Quarries Expansion is a "project" within the definition of CEQA.

BACKGROUND OF ENVIRONMENTAL REVIEW PROCESS OF THE PROJECT

The following is an overview of the environmental review process for the proposed White Knob/White Ridge Limestone Quarries Expansion project that has led to the preparation of this Final EIR.

Background

The San Bernardino County Planning Commission approved the existing White Knob/White Ridge Limestone Mine Site Approval and Reclamation Plan in 1986 (RP# 86M-04) with an expiration date of December 31, 2031. RP# 86M-04 permits mining operations on 145 acres of the mine operator's 357.5 total acres of land holdings.

Omya Inc. has proposed an Amended Mine and Reclamation Plan for expansion of the existing White Knob/White Ridge Limestone Quarries. The Amended Plan would increase the operational years of the quarries by 24 years from the existing permit expiration date of 2031 to the year 2055. The Amended Plan also includes an increase in mine area of approximately 190.1 acres

over the existing approved quarry area of 145 acres. This increase results in a total quarry area of approximately 335.1 acres of existing or planned surface mining operation-related disturbance.

Approval of the Amended Plan by the San Bernardino Planning Commission is a discretionary project, as defined by CEQA Section 15357, and therefore requires environmental review.

Notice of Preparation

An Initial Study was prepared and circulated during the Notice of Preparation (NOP) review period. Analysis presented in the Initial Study determined that project would have potentially significant impacts on the physical environment and therefore, completion of an Environmental Impact Report was necessary.

The NOP was submitted for public review on June 10, 2013. As of the close of the public review period (July 12, 2013), four comment letters were received by the County of San Bernardino, the lead agency for the proposed project. The major topics of the received letters that are relevant to the Draft EIR were potential impact to biological resources and potential impact to Native American cultural resources. The Notice of Preparation and the comments received are included in Appendix A of the Draft EIR.

Draft EIR

The Draft EIR (Draft EIR) was released for public and agency review on October 30, 2014, and ended on December 15, 2014. The Draft EIR contained a description of the project, description of the environmental setting, identification of project impacts, and mitigation measures for impacts found to be significant, as well as an analysis of project alternatives. The Draft EIR was provided to interested public agencies and the public and was made available for review at the County offices and on the County's website. Over 135 copies of the Draft EIR were mailed to interested parties and public agencies at the beginning of the 45-day review period.

Final EIR

The County received six comment letters from interest groups, government agencies, and the public regarding the Draft EIR. This document responds to the written comments received as required by CEQA. This document also contains minor edits to the Draft EIR, which are included in Section 3.0, Revisions to the Draft EIR. This document constitutes the Final EIR.

Certification of the Final EIR/Project Consideration

The County will review and consider the Final EIR. If the County finds that the Final EIR is "adequate and complete," the County may certify the Final EIR. The rule of adequacy generally holds that the EIR can be certified if (1) it shows a good faith effort at full disclosure of environmental information, and (2) it provides sufficient analysis to allow decisions to be made regarding the project in contemplation of its environmental consequences.

Upon review and consideration of the Final EIR, the County may take action to adopt, revise, or reject the proposed project. A decision to approve the proposed project will be accompanied by written findings in accordance with State CEQA Guidelines Section 15091 and Section 15093. Public Resources Code Section 21081.6 also requires lead agencies to adopt a mitigation monitoring and reporting program to describe measures that have been adopted or made a condition of project approval in order to mitigate or avoid significant effects on the environment.

1.2 INTENDED USES OF THE EIR

The EIR is intended to evaluate the environmental impacts of the proposed project. This EIR, in accordance with CEQA Guidelines Section 15126, should be used as the primary environmental document to evaluate all planning and permitting actions associated with the proposed project. Please refer to Section 2.0, Project Description, in the Draft EIR for a detailed discussion of the proposed project.

COUNTY OF SAN BERNARDINO

The EIR is intended to be used by the County as a tool in evaluating the proposed project's environmental impacts and can be further used to modify, approve, or deny approval of the proposed project based on the analysis provided in the EIR. A description of any requested entitlements and subsequent approvals associated with approval and implementation of the proposed project are described in Section 2.0, Project Description, in the Draft EIR.

KNOWN TRUSTEE AND RESPONSIBLE AGENCIES

For the purpose of CEQA, the term "trustee agency" means a state agency having jurisdiction by law over natural resources affected by a project which are held in trust for the people of the State of California. Specifically, the following trustee agencies may have an interest in the proposed White Knob/White Ridge Limestone Quarries Expansion project:

- California Department of Fish and Wildlife
- California Department of Forestry and Fire Protection (Cal Fire)

In CEQA, the term "responsible agency" includes all public agencies other than the lead agency that may have discretionary actions associated with the implementation of the proposed White Knob/White Ridge Limestone Quarries Expansion project. The following agencies have been identified as responsible agencies for the proposed project:

- California Department of Conservation, Office of Mine Reclamation
- California Department of Fish and Wildlife
- U.S. Bureau of Land Management
- Mojave Desert Air Quality Management District
- Colorado River Basin Regional Water Quality Control Board
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service

1.3 ORGANIZATION AND SCOPE OF THE FINAL EIR

This document is organized in the following manner:

SECTION ES – EXECUTIVE SUMMARY

Section ES includes an updated Executive Summary that provides a brief project description and presents a summary table of probable environmental effects of the project.

SECTION 1.0 – INTRODUCTION

Section 1.0 provides an overview of the EIR process to date and what the Final EIR is required to contain.

SECTION 2.0 – COMMENTS AND RESPONSES TO COMMENTS ON THE DRAFT EIR

Section 2.0 provides a list of commenters, copies of written comments (coded for reference), and the responses to those written comments made on the Draft EIR.

SECTION 3.0 – REVISIONS TO THE DRAFT EIR

Section 3.0 provides a list of minor edits made to the Draft EIR as a result of comments received and other staff-initiated changes.

2.0 Comments and Responses to Comments on the Draft EIR

2.1 LIST OF COMMENTERS

The following individuals and representatives of organizations and agencies submitted written comments on the Draft EIR.

Letter	Agency, Organization or Individual	Date
A	Alan J. De Salvio, Mojave Desert Air Quality Management District	November 10, 2014
B	Franklin A. Dancy, Morongo Band of Mission Indians	November 18, 2014
C	Leslie S. MacNair, California Department of Fish and Wildlife	December 15, 2014
D	Beth Hendrickson, Department of Conservation, Office of Mine Reclamation	December 15, 2014
E	Scott Morgan, Governor's Office of Planning and Research	December 17, 2014
1	Ileene Anderson, Center for Biological Diversity	December 15, 2014

2.2 COMMENTS AND RESPONSES

REQUIREMENTS FOR RESPONDING TO COMMENTS ON A DRAFT EIR

State CEQA Guidelines Section 15088 requires that lead agencies evaluate all comments on environmental issues received on the Draft EIR and prepare a written response. The written response must address the significant environmental issue raised and must be detailed, especially when specific comments or suggestions (e.g., additional mitigation measures) are not accepted. In addition, there must be a good faith and reasoned analysis in the written response. However, lead agencies need only respond to significant environmental issues associated with the project and do not need to provide all the information requested by commenters, as long as a good faith effort at full disclosure is made in the EIR (State CEQA Guidelines 15204).

State CEQA Guidelines Section 15204 recommends that commenters provide detailed comments that focus on the sufficiency of the Draft EIR in identifying and analyzing the possible impacts on the environment and ways in which the significant effects of the project might be avoided or mitigated. State CEQA Guidelines Section 15204 also notes that commenters should provide an explanation and evidence supporting their comments. Pursuant to State CEQA Guidelines Section 15064, an effect shall not be considered significant in the absence of substantial evidence supporting such a conclusion.

State CEQA Guidelines Section 15088 also recommends that where a response to comments results in revisions to the Draft EIR, that those revisions be incorporated as a revision to the Draft EIR or as a separate section of the Final EIR. This Final EIR includes a section (Section 3.0) identifying changes made to the Draft EIR.

RESPONSES TO COMMENT LETTERS

Written comments on the Draft EIR are reproduced on the following pages, along with responses to those comments. To assist in referencing comments and responses, the following coding system is used:

- Agency and service provider comment letters are coded by letters and each issue raised in the comment letter is assigned a number (e.g., Comment Letter A, comment 1 is referred to as A-1).

- Individual and interest group comment letters are coded by numbers and each issue raised in the comment letter is assigned a number (e.g., Comment Letter 1, comment 1 is referred to as 1-1).

Where changes to the Draft EIR text result from responding to comments, those changes are included in the response and demarcated with revision marks (<u>underline</u> for new text, ~~strikeout~~ for deleted text).

Letter A

Mojave Desert Air Quality Management District
14306 Park Avenue, Victorville, CA 92392-2310
760.245.1661 • fax 760.245.2699
Visit our web site: http://www.mdaqmd.ca.gov
Eldon Heaston, Executive Director

FISCAL ADMIN
NOV 17 PM 2:54

November 10, 2014

RECEIVED
NOV 18 2014
San Bernardino County
Planning Division

Carrie Hyke, District Planner
Land Use Services Department, Planning Division
385 North Arrowhead Avenue
San Bernardino, CA 92415-0187

RE: White Knob/White Ridge Limestone Quarry Expansion Project

Dear Ms. Hyke:

The Mojave Desert Air Quality Management District (District) has reviewed the Draft Environmental Impact Report (DEIR) for the White Knob/White Ridge Limestone Quarry Expansion Project. This action proposes the expansion of the existing White Knob/White Ridge Limestone Quarries, a limestone mining operation. The proposed project would increase operational years of the quarries by 24 years from the existing permit expiration date of 2031 to the year 2055. The Amended Plan includes an increase in mine area of approximately 190.1 acres over the existing approved quarry area of 145 acres. This increase results in a total quarry area of approximately 335.1 acres of existing or planned surface mining operation-related disturbance. The Amended Plan would not result in the increase of mining equipment used at the quarry or the increase of daily quarried material. Approximately 40 acres of the existing 83.5-acre Bureau of Land Management (BLM) haul road right-of-way on federal public land must be reclaimed and is added to the proposed project reclamation total. The primary areas to be reclaimed are the existing White Knob Quarry and White Knob Annex Quarry, the approved White Ridge Quarry, the existing Overburden Site #1 and proposed Overburden Sites #2 and #3, and the ancillary disturbance areas, which include haul/access roads, sediment basins, storage pads, crusher location, west slope impact area, and boulder roll-down area. **A-1**

Based on the information provided in the DEIR, the District agrees with the proposed mitigation measure MM3.2.1 to reduce PM_{10} emissions. **A-2**

Thank you for the opportunity to review this planning document. If you have any questions regarding this letter, please contact me at (760) 245-1661, extension 6726, or Tracy Walters at extension 6122.

Sincerely,

Alan J. De Salvio
Supervising Air Quality Engineer

AJD/tw Omya White Knob White Ridge DEIR

City of Adelanto | Town of Apple Valley | City of Barstow | City of Blythe | City of Hesperia | City of Needles | County of Riverside | County of San Bernardino | City of Twentynine Palms | City of Victorville | Town of Yucca Valley

LETTER A ALAN J. DE SALVIO – MOJAVE DESERT AIR QUALITY MANAGEMENT DISTRICT

Response A-1: The commenter provides a description of the project. No remarks were made regarding the adequacy of the Draft EIR. This comment is noted.

Response A-2: The commenter states that the district agrees with proposed mitigation measure MM 3.2.1 to reduce PM_{10} emissions. This comment is noted.

Letter B

RECEIVED
NOV 2 0 2014
San Bernardino County
Planning Division

MORONGO BAND OF MISSION INDIANS

A SOVEREIGN NATION

November 18, 2014

Carrie Hyke, District Planner
County of San Bernardino
Land Use Services Department
385 N. Arrowhead Avenue, First Floor
San Bernardino, CA 92414

SUBJECT: Notice of Availability for the Draft Environmental Impact Report for OMYA Inc. White Knob/White Ridge Limestone Quarry Expansion Project (State Clearinghouse Number 2013061020)

Dear Ms. Hyke:

Thank you for contacting the Morongo Band of Mission Indians regarding the above referenced project. The Tribe greatly appreciates the opportunity to review the project and, respectfully, offer the following comments.

The project is outside of the Tribe's current reservation boundaries but within an area that may be considered a traditional use area or one in which the Tribe has cultural ties (e.g. Cahuilla/Serrano territory). Because the project involves a proposal for the expansion of the Omya Inc. White Knob/White Ridge Limestone Quarry, the Morongo Band of Mission Indians asks that you impose specific conditions regarding cultural and/or archaeological resources and buried cultural materials on any development plans or entitlement applications as follows: B-1

- If human remains are encountered during grading and other construction excavation, work in the immediate vicinity shall cease and the County Coroner shall be contacted pursuant to State Health and Safety Code §7050.5. B-2

- In the event that Native American cultural resources are discovered during project development/construction, all work in the immediate vicinity of the find shall cease and a qualified archaeologist meeting Secretary of Interior standards shall be hired to assess the find. Work on the overall project may continue during this assessment period.

  If significant Native American cultural resources are discovered, for which a Treatment Plan must be prepared, the developer or his archaeologist shall contact the Morongo Band of Mission Indians

12700 PUMARRA ROAD BANNING, CA 92220 951-849-4697 FAX: 951-849-4425

Letter B Continued

("Tribe")[1]. If requested by the Tribe, the developer or the project archaeologist shall, in good faith, consult on the discovery and its disposition (e.g. avoidance, preservation, return of artifacts to tribe, etc. B-2 Cont.

If I may be of further assistance with regard to this matter, please do not hesitate to contact me at your convenience.

Very truly yours,

MORONGO BAND OF MISSION INDIANS

Franklin A. Dancy,
Director of Planning

[1] The Morongo Band of Mission Indians realizes that there may be additional tribes claiming cultural affiliation to the area; however, Morongo can only speak for itself. The Tribe has no objection if the archaeologist wishes to consult with other tribes and if the city wishes to revise the condition to recognize other tribes.

LETTER B FRANKLIN A. DANCY – MORONGO BAND OF MISSION INDIANS

Response B-1: The commenter states that the project is outside of the Tribe's current reservation boundaries but within an area that may be considered a traditional use area or one in which the Tribe has cultural ties. No remarks were made regarding the adequacy of the Draft EIR. This comment is noted.

Response B-2: Impact 3.4.2 in the Draft EIR discusses the requirements if human remains are discovered during project development. This discussion explains that should human remains be discovered during any phase of the proposed project, the measures contained in Public Resources Code Section 5097.98 and Health and Safety Code Section 7050.5 would be followed, as required by state law. These measures include halting all work within a 200-foot radius of the discovery and notifying the County Coroner. If the remains are determined to be Native American, the coroner would notify the Native American Heritage Commission and the procedures outlined in CEQA Section 15064.5(d) and (e) would be followed. Compliance with these existing regulations would ensure that any human remains encountered during project implementation would be handled appropriately, and no significant impacts would occur.

For those cultural resources that are discovered during project development, mitigation measure MM 3.4.1 requires, in part:

> …if, during the course of construction, mining, or reclamation activities previously unknown cultural resources (i.e., prehistoric or historic sites) are discovered, work shall be halted immediately within 50 feet of the discovery, the San Bernardino County Land Use Services Department shall be notified, and a professional archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards in prehistoric or historical archaeology shall be retained to determine the significance of the discovery. Determination of impacts, significance, and mitigation that protects the discovered resource shall be made by a qualified archaeologist in consultation with recognized local Native American groups, if appropriate.

This mitigation measure is required to be a part of the final Amended Mine and Reclamation Plan and therefore is considered part of the development plan and entitlement process.

The process outlined in mitigation measure MM 3.4.1 is consistent with the conditions requested in the comment. It requires consultation with local Native American groups regarding the discovery cultural resources and implementation of state law requirements regarding the discovery of human remains. No further mitigation is considered necessary.

Letter C

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Inland Deserts Region
3602 Inland Empire Blvd Suite C-220
Ontario, CA 91764
www.wildlife.ca.gov

EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director

December 15, 2014

Carrie Hyke, District Planner
San Bernardino County
385 N. Arrowhead Avenue, 1st Floor
San Bernardino, CA 92415-0184

Subject: White Knob-White Ridge Limestone Quarries Expansion Project
Draft Environmental Impact Report
State Clearinghouse No. 2013061020

Dear Mr. Hyke,

The Department of Fish and Wildlife (Department) appreciates the opportunity to comment on the Draft Environmental Impact Report (EIR) for White Knob-White Ridge Limestone Quarries Project (Project) prepared by San Bernardino County (Lead Agency) State Clearinghouse No. 2013061020. The Department is responding to the Draft EIR as a Trustee Agency for fish and wildlife resources (California Fish and Game Code Sections 711.7 and 1802, and the California Environmental Quality Act (CEQA) Guidelines Section 15386), and as a Responsible Agency regarding any discretionary actions (CEQA Guidelines Section 15381), such as the issuance of a Lake or Streambed Alteration Agreement (California Fish and Game Code Sections 1600 et seq.) and/or a California Endangered Species Act (CESA) Permit for Incidental Take of Endangered, Threatened, and/or Candidate species (California Fish and Game Code Sections 2080 and 2080.1).

Project Location

The Project is located in the San Bernardino Mountains southwest of Lucerne Valley in southwestern San Bernardino County. The Project is located approximately 6 miles southwest of the community of Lucerne Valley and 8 miles northwest of Big Bear Lake just north of the San Bernardino National Forest (Sections 5, 6, 7, and 8 of Township 3 North, Range 1 West).

Project Description

C-1

The proposed Project will expand the existing White Knob-White Ridge Limestone Quarries from an existing 145 acres to 335.1 acres, an increase of a 190.1 acres. The Project will also increase the operational years of the quarry by 24 years from the existing Mine and Reclamation Plan permit with an expiration date of 2031 to the year 2055. Another 40 acres of Bureau of Land Management (BLM) haul road Right-Of-Way (ROW) on federal public land will be reclaimed as part of this Project as well. The total amount of disturbed acreage analyzed in this draft EIR is 375.1.

Conserving California's Wildlife Since 1870

Letter C Continued

White Knob-White Ridge Limestone Quarries Expansion
Draft Environmental Impact Report
State Clearinghouse No. 2013061020
Page 2 of 6

Project Specific Comments and Recommendations

Following review of the Biological Resources section of the Draft EIR, the Department offers the comments and recommendations listed below to assist the Lead Agency (i.e., San Bernardino County) in adequately identifying and/or mitigating the project's significant, or potentially significant, impacts on biological resources. The Department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of those species (i.e., biological resources). The Department is a Trustee Agency with responsibility under CEQA for commenting on projects that could affect biological resources. As a Trustee Agency, the Department is responsible for providing, as available, biological expertise to review and comment upon environmental documents and impacts arising from project activities (CEQA Guidelines, § 15386; Fish and Game Code, § 1802). The comments and recommendations listed below are based on the requirement for the environmental document to include the following information: C-2

- A description of feasible mitigation measures to avoid potentially significant impacts, and/or mitigate significant impacts, of the proposed project on the environment (CEQA Guidelines, §§ 15021, 15063, 15071, 15126.2, 15126.4 & 15370).

State Threatened, Endangered, and Candidate Species

The Department has discretionary authority over activities that could result in the "take" of any species listed as candidate, threatened, or endangered, pursuant to the California Endangered Species Act (CESA; Fish and Game Code, § 2050 et seq.). The Department considers adverse impacts to CESA-listed species, for the purposes of CEQA, to be significant without mitigation. Take of any CESA-listed species is prohibited except as authorized by state law (Fish and Game Code, §§ 2080 & 2085). Consequently, if a project, including project construction or any project-related activity during the life of the project, results in take of CESA-listed species, the Department recommends that the project proponent seek appropriate authorization prior to project implementation. This includes submitting an incidental take permit (ITP) to the Department (Fish and Game Code, §§ 2080.1 & 2081). C-3

Please note that the Department must comply with CEQA prior to issuance of an ITP for a project. As such, the Department may consider the lead agency's CEQA documentation for the project. To minimize additional requirements by the Department and/or under CEQA, the CEQA avoidance, minimization, mitigation, monitoring and reporting measures for issuance of the ITP.

Letter C Continued

Desert Tortoise

MM 3.3.3b. Desert Tortoise Avoidance, Minimization, and Mitigation.

The Draft EIR identifies the potential for Project-related impacts to desert tortoise (*Gopherus agassizii*). Protocol level survey results are valid for one year during the calendar year they were conducted. If the surveys indicate the onsite presence of desert tortoise a California Endanger Species Act (CESA) Incidental Take Permit (ITP) may be warranted along with consultation with the United States Fish and Wildlife Service.

The Department recommends that the applicant apply for a CESA ITP for incidental take of desert tortoise prior to commencing Project activities. An ITP will provide for greater flexibility during project construction, and minimize Project delays. C-4

MM 3.3.3b Measures 1-8. The Department agrees a biological mitigation and monitoring plan should be developed, however, the Habitat Mitigation and Monitoring Plan will discussed during the ITP process at which time the Department will have its recommendations.

Fully Protect Species

Bighorn sheep (*Ovis Canadensis*) is a state fully protected species. Bighorn sheep is known to occur near the project site and will be impacted by loss of habitat and water resources. The Department has jurisdiction over fully protected species of birds, mammals, amphibians, reptiles, and fish pursuant to Fish and Game Code sections 3511, 4700, 5050, and 5515. Take of any fully protected species is prohibited and the Department cannot authorize their take for development. The Department recommends that the Draft EIR evaluate and address Project related impacts to fully protected species including bighorn sheep and include appropriate species specific avoidance measures. C-5

Nesting Birds

Please note that it is the Lead Agency's responsibility to comply with all applicable laws related to nesting birds and birds of prey. Migratory non-game native bird species are protected by international treaty under the federal Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 U.S.C. 703 et seq.). In addition, sections 3503, 3503.5, and 3513 of the Fish and Game Code (FGC) stipulate the following: Section 3503 states that it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by FGC or any regulation made pursuant thereto; Section 3503.5 states that it is unlawful to take, possess, or destroy any birds in the orders FALCONIFORMES or STRIGIFORMES (birds-of-prey) to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by FGC or any regulation adopted pursuant thereto; and Section 3513 states that it is unlawful to take or possess C-6

Letter C Continued

any migratory nongame bird except as provided by the rules and regulations adopted by the Secretary of the Interior under provisions of the MBTA.

The Department recommends that the Lead Agency consult with a qualified ornithologist for advice in developing specific avoidance and minimization measures to ensure that impacts to nesting birds do not occur and that the Project complies with all applicable laws related to nesting birds and birds of prey, including Burrowing Owl. The Department recommends that Project-specific avoidance and minimization measures include, but not limited to: Project phasing and timing, monitoring of project-related noise (where applicable), sound walls, and buffers (where appropriate). C-6 cont.

Other Species

Mule deer (*Odocoileus hemionus*) are known to occur throughout the project area and will be impacted by loss of habitat and water sources, bobcat (*Lynx rufus*), mountain lion (*Puma concolor*) (a Department biologist found lion scat during previous site visits, and presence of mountain lion in the area should be added to the Draft EIR) gray fox (*Urocyon cinereoargenteus*), ringtail (*Bassariscus astutus*), and likely other species exist in the area, none of which are acknowledged as affected by loss of water source and habitat. Mitigation for these species is essential, but is not described properly in the Draft EIR. C-7

Lake or Streambed Alteration Program

For any activity that will divert or obstruct the natural flow, or change the bed, channel, or bank (which may include associated riparian resources) of a river or stream or use material from a streambed, the project applicant (or "entity") must provide written notification to the Department pursuant to Section 1602 of the Fish and Game Code. Based on this notification and other information, the Department then determines whether a Lake and Streambed Alteration (LSA) Agreement is required. The Department's issuance of an LSA Agreement is a "project" subject to CEQA (see Pub. Resources Code 21065). To facilitate issuance of an LSA Agreement, if necessary, the environmental document should fully identify the potential impacts to the lake, stream or riparian resources and provide adequate avoidance, mitigation, and monitoring and reporting commitments. Early consultation with the Department is recommended, since modification of the proposed project may be required to avoid or reduce impacts to fish and wildlife resources. To obtain a Lake or Streambed Alteration notification package, please go to http://www.dfg.ca.gov/habcon/1600/forms.html. C-8

The Department's website has information regarding dryland streams in "A review of Stream Processes and Forms in Dryland Watersheds," available at this location: http://www.dfg.ca.Qov/habcon/1600/1600resources.html.

Letter C Continued

Additional information can also be found in "Methods to Describe and Delineate Episodic Stream Processes on Arid Landscapes for Permitting Utility-Scale Solar Power Plants, With the MESA Field Guide - Final Project Report" available here: http://www.energy.ca.gov/2014publications/CEC-500-2014-013/index.html.

The drainage affected is roughly centered east-west, and draining from the south (upper) edge of the project to the haul road to the north (denoted by letter "C" in figure 3.3.-2 Jurisdictional Delineation) contains 1) perennial water with signs of use by wildlife, 2) 0.5-1 hector of mature oak, a valuable food source and habitat for terrestrial and avian wildlife. Neither of these features are acknowledged in the Draft EIR. Appropriate permits and measures should be completely addressed in the Draft EIR.

C-8 cont.

The Department appreciates the opportunity to provide comments on the Draft EIR for White Knob-White Ridge Limestone Quarries Expansion (State Clearinghouse No. 2013061020). Please contact Heather Weiche with questions regarding this letter and further coordination on project permitting needs at (909) 980-8607 or heather.weiche@wildlife.ca.gov.

Sincerely,

for Leslie S. MacNair
Inland Deserts Region
Acting Regional Manager

cc: State Clearinghouse
CORR

LETTER C LESLIE S. MACNAIR, CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

Response C-1: The commenter provides an accurate summary of the project location and description. This comment is noted.

Response C-2: The commenter describes the California Department of Fish and Wildlife's (CDFW's) responsibility under CEQA to comment on projects that could affect biological resources. This comment is noted.

Response C-3: As stated on page 3.3-52 in the Draft EIR, project-related impacts on species on the California Endangered Species Act (CESA) endangered or threatened list would be considered significant. The Draft EIR also notes that State-listed species are fully protected under the mandates of the CESA, and "take" of protected species incidental to otherwise lawful management activities may be authorized under Fish and Game Code Section 206.591. Authorization from the CDFW would be in the form of an incidental take permit (Fish and Game Code Sections 2080 and 2081). The applicant would be required to comply with these requirements. The County will forward the comments to the applicant regarding the need for consultation with the CDFW and the potential need for obtain an incidental take permit prior to initiation of project activities.

Response C-4: The Draft EIR evaluated impacts on desert tortoise (*Gopherus agassizii*) in Impact 3.3.3 in Section 3.3, Biological Resources, in the Draft EIR. Five biological assessments of the Project Study Area (PSA) have been conducted to date, including two focused surveys for desert tortoise. No individuals or their sign (e.g., scat, burrows, carcasses) were observed on or adjacent to the PSA during the previously conducted focused surveys. In addition, habitat suitability modeling conducted by the US Geologic Survey (USGS) (Nussear et al. 2009) classified the habitat within the PSA as having a low potential to support desert tortoise. Habitat suitability slightly increases along the haul road from the PSA to the processing plant. A new figure (Figure 3.3-7) has been added to the Draft EIR (see Section 3.0, Revisions to the Draft EIR) showing desert tortoise habitat suitability areas and maxent model scores indicating areas of low to high suitability. The project site is in an area with low suitability.

The County and the applicant understand that protocol-level surveys for desert tortoise are valid for one year. If surveys identify the presence of desert tortoise, a CESA incidental take permit may be warranted along with consultation with the U.S. Fish and Wildlife Service (USFWS) due to the potential for impacts on the species as a result of project-related activities.

To ensure that survey results are valid prior to implementation of project-related activities, in undisturbed portions of the site, the Draft EIR identified mitigation measure MM 3.3.3a, which requires protocol-level surveys. If desert tortoises are identified, mitigation measure MM 3.3.3b (avoidance, minimization, and mitigation), as amended herein (see Response 1-6), would be implemented.

The comment expresses agreement with mitigation measure MM 3.3.3b Measures 1 through 8, and clarifies that the Habitat Mitigation and Monitoring Plan will be discussed during the incidental take permit process.

It should be noted that these mitigation measures do not obviate the need to comply with Sections 2080 and 2081 of the Fish and Game Code regarding incidental take permits (see Response C-3). The County will forward the comments to the applicant regarding consultation with the CDFW and the potential need for obtain an incidental take permit prior to initiation of project activities.

Response C-5: The Draft EIR evaluated impacts on bighorn sheep. Information on bighorn sheep was provided in the Existing Setting subsection of Section 3.3, Biological Resources, on pages 3.3-3 (habitat), 3.3-12 (wildlife movement corridors), and 3.3-41 and 3.3-44 (special-status species). Impacts on bighorn sheep were evaluated in Impact 3.3.8 on pages 3.3-67 and -68.

As noted in the Draft EIR, the majority of the PSA has already been disturbed due to previous and ongoing mining activities, and the level of activity (e.g., traffic, equipment use) is not anticipated to increase. Reclamation would include typical slopes within the PSA and would be characterized by 45- to 50-foot vertical bench faces, at an angle averaging approximately 70 degrees, which is consistent with escape terrain requirements for bighorn sheep. Upland habitats would also be restored during reclamation activities. Furthermore, as stated on page 3.3-68, personal communication with Jeff Villepique, PhD, Acting Senior Environmental Scientist with the CDFW, indicated that the proposed project "falls outside the known home range of bighorn" and that "rare exploratory/breeding movements may occur, but it's not core habitat." These data result in the determination that impacts on bighorn sheep will be less than significant as a result of project-related activities, and no mitigation is required.

Response C-6: The Draft EIR evaluated impacts on nesting birds and birds of prey. The level of activity (e.g., traffic, equipment use, noise) is not anticipated to increase within the PSA as a result of project-related activities, and the majority of the PSA has already been disturbed by approved previous and ongoing mining operations. However, in order to ensure that the expansion of mining operations within the PSA does not result in significant impacts on migratory birds and raptors, several mitigation measures were included in the Draft EIR. These mitigation measures, which are described below, require surveys,

Impact 3.3.5 evaluated impacts on burrowing owl. Implementation of mitigation measure MM 3.3.5 would provide disturbance setback buffers and appropriate mitigation with regard to burrowing owl, in accordance with the CDFW's *Staff Report on Burrowing Owl Mitigation* (2012).

Impact 3.3.6 evaluated impacts on LeConte's thrasher and migratory birds. Mitigation measure MM 3.3.6 requires disturbance setback buffers for active nests of migratory birds and other special-status native birds, as

deemed appropriate by a qualified biologist through consultation with the CDFW and/or the County. Mitigation measure MM 3.3.6 has been revised as follows to address the commenter's concerns regarding impacts from project-related noise.

MM 3.3.6 **Migratory Bird Surveys.** If clearing and/or construction activities will occur in undisturbed portions of the site, or if blasting activities will occur in any portion of the project site, during the migratory bird nesting season (March 15–August 15), preconstruction surveys to identify active migratory bird nests shall be conducted by a qualified biologist within 14 days of ~~construction~~ initiation of project activities. Focused surveys must be performed by a qualified biologist for the purposes of determining the presence/absence of active nest sites within the proposed impact area and a 200-foot buffer (if feasible). Surveys shall be repeated if project activities are delayed or postponed for more than 30 days.

If active nest sites are identified within 200 feet of project activities, the mine operator shall impose a limited operating period (LOP) for all active nest sites prior to commencement of any project ~~construction~~ activities to avoid construction- or project-related disturbances to migratory bird nesting activities. An LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, blasting, and construction) will not occur and will be imposed within 100 feet of any active nest sites until the nest is deemed inactive. Activities permitted within and the size (i.e., 100 feet) of LOPs may be adjusted through consultation with the CDFW and~~/or~~ the County.

When an active nest is located within 200 feet of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to CDFW and the County until the nest(s) are deemed inactive.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Impact 3.3.7 evaluated impacts on golden eagle and other raptors, and the Draft EIR identified mitigation measure MM 3.3.7 to reduce impacts to less than significant. Mitigation measure MM 3.3.7 has been revised as follows to provide additional actions beyond the general design features

and protection measures in the Raptor Conservation Survey to ensure impacts would be less than significant.

MM 3.3.7a **Raptor Conservation Surveys.** The applicant shall participate in and implement the Raptor Conservation Strategy.

MM 3.3.7b **Raptor Surveys.** If clearing and/or construction activities would occur in undisturbed portions of the site, or if blasting activities will occur in any portion of the project site, during the raptor nesting season (January 15–August 15), preconstruction surveys to identify active raptor nests shall be conducted by a qualified biologist within 14 days of construction initiation. Focused surveys must be performed by a qualified biologist for the purposes of determining the presence/absence of active nest sites within the proposed impact area. If no active nests are found, no further mitigation is required. Surveys shall be repeated if project activities are delayed or postponed for more than 30 days.

If active golden eagle or other raptor nest sites are identified within a half mile of project activities, the applicant shall impose a limited operating period (LOP) for all active nest sites prior to commencement of any project activities to avoid construction- or project-related disturbances to nesting raptors. An LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, blasting, and construction) will not occur and shall be imposed within 500 feet of any active nest sites until the nest is deemed inactive. Activities permitted within LOPs and the size (i.e., 500 feet) of LOPs may be adjusted through consultation with the CDFW and the County.

When an active nest is located within a half mile of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to CDFW and the County until the nest(s) are deemed inactive.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Impact 3.3.1 provided an overall analysis of impact on special-status species, and mitigation measures MM 3.3.1a through MM 3.3.1i identified various actions to be taken during day-to-day routine operations to ensure worker awareness about species, procedures to check for species and notification if species are found, keeping work areas free of items that could attract species or harm them, and removing species, if they are discovered.

These mitigation measures, as revised above, address the issues raised by the commenter. Implementation of mitigation measures 3.3.1a through MM 3.3.1i, MM 3.3.5, MM 3.3.6, and MM 3.3.7 will ensure that project-related impacts on burrowing owls, migratory birds, golden eagles, and raptors will be less than significant.

Response C-7: The Draft EIR evaluated impacts on mule deer in Impact 3.3.8. Mule deer are associated with major river corridors in the Central Valley, in scattered desert mountain areas, and with early to intermediate successional stages of most forest, woodland, and brush habitats. A mosaic of diverse successional stages that provides woody cover, meadow, shrubby openings, and free water is preferred (Zeiner et al. 1988–1990). Mule deer are listed as a big game animal by the CDFW and therefore would not meet the criteria for rare or endangered under CEQA (14 CCR Section 15380).

Bobcats are associated with intermediate successional stages of low and mid-elevation conifer, oak, riparian, and pinyon-juniper forests, as well as all stages of chaparral. Suitable habitats consist of large areas of broken, rough, rocky terrain supporting brushy deciduous and confer forests or chaparral. No information on water needs was found, but availability of water may limit bobcat distribution (Zeiner et al. 1988–1990). Bobcats are listed as nongame animals; however, the CDFW issues hunting tags for this species, suggesting that population levels and threats to the species would not meet CEQA criteria for rare or endangered.

Gray foxes occur in shrublands, valley foothill riparian, montane riparian, and brush stages of deciduous and conifer forests, as well as in woodland habitats. This species requires a permanent water source near den sites (Zeiner et al. 1988–1990). Similar to bobcats, gray foxes are allowed to be taken by hunting activities with no bag limits, suggesting that this species would not meet CEQA criteria for rare or endangered.

Prime habitat for mountain lions occurs over more than half of California and is associated with the presence of deer; therefore, the foothill and mountain regions provide the most suitable habitat, while the valleys and deserts are considered unsuitable (CDFW 2014). Mountain lions are not listed as endangered, threatened, species of special concern, or fully protected by either the CDFW or the USFWS. In addition, the CDFW states that the mountain lion population is "relatively high" in California and that "their numbers appear to be stable (CDFW 2014). This data suggests that this species does not meet the CEQA definition of rare or endangered.

The ringtail cat was not returned in any database queries or previous agency correspondence; however, it is listed as fully protected by the CDFW and will be addressed herein. This species is associated with riparian, forest, and shrub habitats at low to middle elevations. In addition, this species is typically not found more than 0.6 mile (1 km) from a permanent water source (Zeiner et al. 1988–1990).

The proposed project would result in impacts on habitats that may be used by these species. **Table 2.0-1** provides a summary of the habitat coverages within 10 miles of the PSA, along with the total acreages that would be affected by the proposed project, and the percentage of habitat affected by the proposed project within a 10-mile radius of the PSA.

TABLE 2.0-1
SUMMARY OF AFFECTED HABITAT

Vegetation Type	Acreage Within 10 Miles of PSA	Acreage Impacted Within PSA	Percentage of Habitat Impacted
Alkali Desert Scrub	8,003.0		
Annual Grassland	2,954.6		
Barren	4,485.7	104.8	0.023
Bitterbrush	1,324.8		
Coastal Scrub	131.6		
Deciduous Orchard/Vineyard	169.0		
Desert Riparian	344.8	0.2	0.001
Desert Scrub	69,432.3	63.3	0.001
Desert Scrub/Desert Wash	1,837.1		
Desert Succulent Shrub	601.4		
Desert Succulent Shrub/Desert Wash	220.4		
Desert Wash (Intermittent Riverine Wash)	159.7	1.4	0.008
Eastside Pine	10,470.0		
Fresh Emergent Wetland	0.4		
Irrigated Row and Field Crops	2,045.0		
Jeffrey Pine	2,135.1		
Joshua Tree	5,979.2		
Juniper	7,045.9		
Lacustrine	2,936.8		
Mixed Chaparral	6,592.5	5.6	0.001
Montane Chaparral	20,540.6	35.9	0.002
Montane Hardwood	5,375.3		
Montane Hardwood-Conifer	5,868.4		
Montane Riparian (Pinyon-Oak)	99.9	4.5	0.045
Pasture	11.9		
Pinyon-Juniper	10,716.0	87.6	0.008
Sagebrush	35,109.8		
Sierran Mixed Conifer	5,680.4		
Urban	11,649.4		
Valley Foothill Riparian	338.0		
Wet Meadow	221.2		
Totals	**222,480.2**	**303.3**	**0.001**

As demonstrated in **Table 2.0-1**, the amount of habitat affected by the proposed project is minor in relation to the regional landscape. Therefore, an adequate amount of habitat, including water sources, is available in the vicinity of the PSA to support these wildlife species if they are present in the area. The proposed project will result in impacts on 0.003 acre of desert riparian wetland seep habitat that may provide a permanent water source for these species; however, two desert riparian seeps (0.197 acre) within the PSA will not be impacted by project-related activities and could be utilized as alternative water sources within 0.6 mile (1 km) of the PSA.

Based on the available data on habitat utilization and population size for mule deer, bobcat, mountain lion, gray fox, and ringtail cat, project-related activities would have a less than significant impact on these species and other species common to the area, and no mitigation for these wildlife species is required.

Moreover, the majority of the PSA has already been disturbed by previous and ongoing mining operations, and the level of activity is not anticipated to increase as a result of the proposed project. Additionally, reclamation activities would result in the restoration of upland habitats within the PSA. Impacts on all riparian and riverine habitats would be offset through implementation of mitigation measure MM 3.3.11. Implementation of mitigation measures MM 3.3.1a through MM 3.3.1i would aid in avoidance and minimization of potential impacts to mule deer, bobcat, mountain lion, gray fox, and ringtail cat, and no additional mitigation would be necessary.

Response C-8: The Draft EIR identified the requirements and permits associated with the Lake or Streambed Alteration Program under Fish and Game Code Section 1660 through 1607 on page 3.3-52.

Impact 3.3.11 in Draft EIR evaluated impacts on sensitive habitats, including drainages and riparian habitat. The jurisdictional delineation report provided by Tetra Tech (2013) identified 6,469 linear feet (1.355 acre) of CDFW jurisdictional drainages within the limits of planned disturbance (Figure 3.3-2). The entire length of drainage C (1,354 feet) is included in the total linear footage calculation of 6,469 feet. In addition, Tetra Tech (2013) identified 0.003 acre (131 square feet) of desert riparian habitat associated with drainage C (Figure 3.3-2), which was also evaluated in Impact 3.3.11 in the Draft EIR. The Section 1600 requirements were also noted in Impact 3.3.11 on page 3.3-70.

In order to offset these impacts, mitigation measure MM 3.3.11 was identified to ensure no net loss of riparian/riverine habitat. The proposed mitigation measures do not obviate the need to comply with Section 1602 of the Fish and Game Code; therefore, consultation with the CDFW regarding impacts on features subject to its jurisdiction will be required prior to initiation of project activities.

The oak woodlands (pinyon-oak) were not originally identified on the vegetation mapping provided in the Draft EIR; therefore, Figure 3.3-1a has

been revised to depict the extent of this community. Based on the preliminary mapping, approximately 4.5 acres (1.8 hectares) of pinyon oak are associated with drainage C. In order to reduce impacts on oak woodland habitat to a less than significant level, mitigation measure MM 3.3.11 has been revised as follows:

MM 3.3.11a **No Net Loss of Riparian Vegetation**. The mine operator shall ensure there is no net loss of riparian vegetation. Mitigation can include on-site restoration or purchase of mitigation credits at a USACE-approved mitigation bank, placing a conservation easement over a riparian area, or quit claiming mineral claims over a riparian area. Mitigation, as required in regulatory permits issued through the CDFW, the USACE, or the RWQCB, may be applied to satisfy this measure.

Evidence of compliance with this mitigation measure shall be provided prior to construction and grading activities for the proposed project.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

MM 3.3.11b **Oak Woodlands.** The mine operator shall ensure there is no net loss of oak woodland habitat. Mitigation can include any one or a combination of the following:

(1) Preservation of existing oak woodlands by recording a conservation easement(s) in favor of the County or an approved organization or agency.

(2) Replacement or restoration of former oak woodlands. The County may require the planting and maintenance of replacement trees, including replacing dead or diseased trees. The replacement ratio and tree sizes shall be based on the recommendation of an Oak Reforestation Program prepared by a registered professional forester. The requirement to maintain trees in compliance with this paragraph shall terminate seven years after the trees are planted.

(3) Contribution of in-lieu mitigation fees to the Oak Woodlands Conservation Fund, established under Fish and Game Code Section 1363 for the purpose of purchasing oak woodlands conservation easements. A project applicant who contributes funds in compliance with this subsection shall not receive or use a grant from the Oak Woodlands Conservation Fund as part of the mitigation for the project. The in-lieu fee for

replacement trees shall be calculated based on their equivalent value as established by the International Society of Arboriculture's current edition of the *Guide for Plant Appraisal*.

(4) Performing other mitigation measures as may be required by the County (e.g., inch-for-inch off-site replacement planting, transfer of development rights, enrollment of project with offset provider for carbon credits in greenhouse gas emission registry, carbon reduction, and carbon trading system).

Timing/Implementation: *Prior to impacting oak woodland habitat*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Letter D

NATURAL RESOURCES AGENCY

EDMUND G. BROWN JR., GOVERNOR

DEPARTMENT OF CONSERVATION
OFFICE OF MINE RECLAMATION
801 K STREET • MS 09-06 • SACRAMENTO, CALIFORNIA 95814
PHONE 916 / 323-9198 • FAX 916 / 445-6066 • TDD 916 / 324-2555 • WEB SITE conservation.ca.gov

December 15, 2014

VIA EMAIL: Carrie.Hyke@sdd.sbcounty.gov
ORIGINAL SENT BY MAIL

Ms. Carrie Hyke
San Bernardino County Land Use Services Department
385 N. Arrowhead Avenue, First Floor
San Bernardino, CA 92415-0182

Dear Ms. Hyke:

WHITE KNOB WHITE/RIDGE LIMESTONE QUARRY EXPANSION PROJECT
DRAFT ENVIRONMENTAL IMPACT REPORT
CALIFORNIA ID # 91-36-0067, SCH# 2013061020

The Department of Conservation's Office of Mine Reclamation (OMR) has reviewed the Draft Environmental Impact Report (DEIR) for the White Knob/White Ridge Limestone Quarry dated October 2014. The applicant, OMYA Inc., is proposing to expand the existing mining operation by 190.1 acres onto a total 375.1-acre project site and extend the existing permit expiration date by 24 years with an additional 10 years for reclamation. The maximum amount of all material excavated annually also will increase to up to 1,950,000 tons.

The project site is along the north slope of the San Bernardino Mountains approximately six miles southwest of Lucerne Valley. The site will be reclaimed to open space and wildlife habitat.

OMR staff conducted a site visit on December 2, 2014 to inspect site conditions and discuss reclamation issues. OMR reviewed the amended reclamation plan for the project and wrote a comment letter dated August 6, 2013. The amended reclamation plan should be revised to incorporate the comments presented in that letter as well as the findings and mitigation measures resulting from the CEQA review. The revised amended reclamation plan should be submitted for review to OMR prior to final approval. **D-1**

3.3 Environmental Impact Analysis – Biological Resources
Impacts to and mitigation measures for a range special status species and habitats are identified in the DEIR. Any mitigation measures that have an effect on the way mining and reclamation are carried out need to be incorporated into the revised version of the **D-2**

The Department of Conservation's mission is to balance today's needs with tomorrow's challenges and foster intelligent, sustainable, and efficient use of California's energy, land, and mineral resources.

Letter D Continued

amended reclamation plan. In particular, if there are requirements to plant carbonate endemic species, riparian vegetation, or other special status plants, these requirements, along with quantitative performance standards, should be included in the revegetation portion of the reclamation plan. During review of the Notice of Preparation (NOP), CDFW recommended that the revegetation plan within the SMARA reclamation plan should be updated and OMR concurs with this opinion. D-2 Cont.

3.5 Environmental Impact Analysis – Geology and Soils

The January 14, 2013 CHJ Consultants (CHJ) study entitled, "*Slope Stability Investigation, Proposed Amended Plan of Operations, White Knob Quarry Mining and Reclamation Plan, Lucerne Valley, California*" addresses the design and stability of final slopes. However, stability analyses on fill slopes do not consider the influence of water on slope stability in spite of the fact that Overburden Storage Site #2 (OB #2) will be constructed within a drainage with substantial drainage catchment above. This drainage likely will concentrate water into OB #2 and may affect the stability of the fill slopes. The CHJ study should be revised to account for the presence of water in the fill materials. D-3

The August 24, 2013 CHJ study entitled, "*Update to Slope Stability Investigation, Proposed Amended Plan of Operations, White Knob Quarry Mining and Reclamation Plan, Lucerne Valley, California*" characterizes the stability and condition of the Northwest Slope, which contains unstable mining waste. The report concludes that continued mining of the White Knob quarry above the Northwest Slope and mining of the White Knob Annex is feasible, provided suitable conditions can be established to limit addition of material or access to the existing and proposed slopes. The report recommends signage warning of rock fall hazard be placed around the quarry and slope to preclude casual entry into the area. In addition, the report recommends monitoring of the slope and that the construction of debris basins downstream from the slope appear feasible. No mitigation measure is proposed for Impact 3.5.2., Slope Stability, and the approach in the DEIR to reclaim the unstable Northwest Slope is to allow the slope to self-stabilize while monitoring the downstream effects on the Northwest Drainage and Ruby Springs. The DEIR should include a mitigation measure to periodically monitor the Northwest Slope during mining to make sure that the approach of self-stabilization is working. Additionally, the mitigation measure should include a provision to complete a stability study and recommend measures to repair the slope if the slope is not stabilizing or is deteriorating. The reclamation plan should be revised to include the mitigation measure. D-4

Mitigation Measure 3.5.3 proposed for Impact 3.5.3, Rock and Soil Talus Erosion, is to periodically monitor the effects of sediment from the erosion of the Northwest Slope on the Northwest Drainage and Ruby Springs, and if necessary, implement sediment control measures along the drainage and/or at the springs. The mitigation measure and requirements of any associated permit, such as a Streambed Alteration Agreement, that affect reclamation of the drainage should be incorporated in the reclamation plan. D-5

Letter D Continued

If you have any questions on these comments or require any assistance with other mine reclamation issues, please contact Beth at (916) 445-6175.

Sincerely,

Beth Hendrickson, Manager
Environmental Services Unit

John R. Wesling
Senior Engineering Geologist
Engineering Geology Unit

REGISTERED GEOLOGIST
JOHN R. WESLING
No. 1719
CERTIFIED
ENGINEERING
GEOLOGIST
Exp. 5/31/2015
STATE OF CALIFORNIA

cc: Alexandra Borack, OGER

LETTER D BETH HENDRICKSON, DEPARTMENT OF CONSERVATION, OFFICE OF MINE RECLAMATION

Response D-1: This comment is not specifically directed to the adequacy of the Draft EIR analysis, but addresses the Amended Reclamation Plan. OMR indicated that staff provided comments on the Amended Mine and Reclamation Plan on August 6, 2013. The County will require a revised Amended Mine and Reclamation Plan that will incorporate all mitigation measures identified in the Draft EIR. The revised amended reclamation plan will be submitted to OMR 30 days prior to final approval.

Response D-2: The Amended Mine and Reclamation Plan and conditions of approval will incorporate all mitigation measures identified in the Draft EIR. It is not currently anticipated that mitigation measures MM 3.3.1 through MM 3.3.11, which were identified in the Draft EIR to reduce impacts on biological resources, would affect mining or reclamation. The County is responsible for ensuring compliance with the mitigation measures, which it does through periodic and annual compliance reviews. If during its review the County subsequently determines there is an element of implementing a biological resources mitigation measure that may, for example, require changes in revegetation, the County will work with the mine operator to determine how the Amended Mine and Reclamation Plan should be revised. If changes are necessary, the County will require a revised Amended Mine and Reclamation Plan.

Response D-3: Slope stability at overburden storage site OB-2 was addressed in an August 23, 2013, letter responding to OMR's comments on the above-referenced January 14, 2013, report (included in Appendix A in this Final EIR). CHJ Consultants discussed slope stability calculations for OB-2, including saturation along the bedrock/fill contact CHJ stated (Appendix A #2, p. 2). These calculations indicate suitable factors for safety for static and seismic conditions. Further, a rock subdrain layer was recommended by PMC for OB-1 (#4, p. 2). In response, CHJ Consultants described potential rock subdrain layers that may be implemented for OB-1 and OB-3. OB-2 would be buttressed by OB-1 and become part of the same fill mass; therefore, a drainage blanket for OB-2 was not required. Based on this report, the Amended Mine and Reclamation Plan will be updated to include rock drains for OB-1 and OB-3.

Response D-4: Although the comment indicates the date of a report that evaluated the Northwest Slope as August 24, 2013, the study was performed in 2012 and the transmittal letter for the report (August 21, 2013) indicates the report date as November 21, 2012. There is no *Update to Slope Stability Investigation, Proposed Amended Reclamation Plan of Operations, White Knob Quarry Mining and Reclamation Plan, Lucerne Valley, California* dated August 24, 2013. This study, along with the January 14, 2013, report referenced in Comment D-3 (*Slope Stability Investigation, Proposed Amended Reclamation Plan of Operations, White Knob Quarry Mining and Reclamation Plan, Lucerne Valley, California*, prepared by CHJ Consultants) were incorporated in the analysis in Draft EIR Section 3.5, Geology and Soils, and the reports were included in Appendix F in the

Draft EIR. This response assumes the comment is in reference to the November 2012 report, which addressed the Northwest Slope.

As noted on page 16 of this study, the Northwest Slope is considered stable and no mitigation is required. However, it is acknowledged that there is potential for continued rock fall and debris slides on the Northwest Slope from continued mining and reclamation activities. Based on the CHJ Consultants' analysis, the Amended Mine and Reclamation Plan includes measures to minimize this impact. These measures are identified on Draft EIR pages 2.0-45 and -48 and consist of the following:

1) Precision drilling and buffer blasting when the outside edge is approached.

2) Drilling lifters on the edge to undercut the remaining slope and let it fall into the pit (like directional falling of a tree).

3) Excavator to pull down and pull in toward the pit blasted rock away from the edge.

4) Use of alternatives to blasting along the outside such as rock breakers, surface miners, cutting heads, and excavators.

5) Loader to pull back material from the edge.

6) Loader to dig at an angle to the edge or parallel to the edge when possible.

7) Manually scaling boulders from the highwalls where they may be above a haulage road.

There is no existing or proposed public access to the Northwest Slope that would expose people to potential hazards from rock fall. In addition, this slope and its stability will be annually inspected in compliance with County Code and SMARA.

Response D-5: This comment summarizes the actions in mitigation measure MM 3.5.3 and does not address the adequacy of the Draft EIR analysis. Mitigation measure 3.5.3 and any associated permits, such as the Streambed Alteration Agreement, would be incorporated into the Amended Mine and Reclamation Plan. See Response D-2.

Letter E

STATE OF CALIFORNIA
GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH
STATE CLEARINGHOUSE AND PLANNING UNIT

EDMUND G. BROWN JR.
GOVERNOR

KEN ALEX
DIRECTOR

December 17, 2014

RECEIVED
Dec 22, 2014

Carrie Hyke
San Bernardino County
385 N. Arrowhead Avenue, 1st Floor
San Bernardino, CA 92415-0184

Subject: White Knob-White Ridge Limestone Quarries Expansion
SCH#: 2013061020

Dear Carrie Hyke:

The State Clearinghouse submitted the above named Draft EIR to selected state agencies for review. On the enclosed Document Details Report please note that the Clearinghouse has listed the state agencies that reviewed your document. The review period closed on December 15, 2014, and the comments from the responding agency (ies) is (are) enclosed. If this comment package is not in order, please notify the State Clearinghouse immediately. Please refer to the project's ten-digit State Clearinghouse number in future correspondence so that we may respond promptly.

Please note that Section 21104(c) of the California Public Resources Code states that:

> "A responsible or other public agency shall only make substantive comments regarding those activities involved in a project which are within an area of expertise of the agency or which are required to be carried out or approved by the agency. Those comments shall be supported by specific documentation."

E-1

These comments are forwarded for use in preparing your final environmental document. Should you need more information or clarification of the enclosed comments, we recommend that you contact the commenting agency directly.

This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. Please contact the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process.

E-2

Sincerely,

Scott Morgan
Director, State Clearinghouse

Enclosures
cc: Resources Agency

1400 10th Street P.O. Box 3044 Sacramento, California 95812-3044
(916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

Document Details Report
State Clearinghouse Data Base

Letter E
Continued

SCH#	**2013061020**
Project Title	White Knob-White Ridge Limestone Quarries Expansion
Lead Agency	San Bernardino County
Type	**EIR** Draft EIR
Description	The Amended Plan would expand operations at the White Knob/White Ridge Limestone Quarries. The Amended Plan includes expansion of the three existing quarries and the existing overburden (OB) site, the creation of two new OB sites, and the expansion of the ancillary disturbance limits, which include haul and access roads, sediment basins and other erosion control features, storage pads, crusher location, west slope impacts, and incidental impacts from boulder roll-down. In addition, the proposed project would increase operational years of the quarries by 24 years from the existing permit expiration date of 2031 to the year 2055. The total existing permitted operational area is 145 acres. The Amended Plan would add 190.1 acres, for a total permitted operational area of approximately 375.1 acres. The amendment does not propose any new quarries.

Lead Agency Contact

Name	Carrie Hyke		
Agency	San Bernardino County		
Phone	909 387 5530	***Fax***	
email			
Address	385 N. Arrowhead Avenue, 1st Floor		
City	San Bernardino	***State*** CA	***Zip*** 92415-0184

Project Location

County	San Bernardino				
City					
Region					
Lat / Long	34° 21' 50.2" N / 117° 0' 52" W				
Cross Streets	Crystal Creek Road and Gateway Road				
Parcel No.	446-011-04/05/06, 446-021-11/35				
Township	3N	***Range*** 1W	***Section*** 5-8	***Base***	SBB&M

Proximity to:

Highways	Hwy 18
Airports	
Railways	
Waterways	
Schools	
Land Use	Surface Mining / Resource Conservation / Resource Conservation
Project Issues	Air Quality; Biological Resources; Drainage/Absorption; Geologic/Seismic; Soil Erosion/Compaction/Grading; Vegetation; Water Quality; Water Supply; Wetland/Riparian; Cumulative Effects; Aesthetic/Visual
Reviewing Agencies	Resources Agency; Department of Conservation; Department of Fish and Wildlife, Region 6; Department of Parks and Recreation; Department of Water Resources; Office of Emergency Services, California; Resources, Recycling and Recovery; California Highway Patrol; Caltrans, District 8; Air Resources Board, Major Industrial Projects; Regional Water Quality Control Board, Region 7; Department of Toxic Substances Control; Native American Heritage Commission; State Lands Commission

Date Received 10/30/2014 ***Start of Review*** 10/30/2014 ***End of Review*** 12/15/2014

Letter E Enclosure

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Inland Deserts Region
3602 Inland Empire Blvd Suite C-220
Ontario, CA 91764
www.wildlife.ca.gov

EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director

RECEIVED
DEC 15 2014
STATE CLEARING HOUSE

Clear
12/15/14
E

December 15, 2014

Carrie Hyke, District Planner
San Bernardino County
385 N. Arrowhead Avenue, 1st Floor
San Bernardino, CA 92415-0184

Subject: White Knob-White Ridge Limestone Quarries Expansion Project
Draft Environmental Impact Report
State Clearinghouse No. 2013061020

Dear Mr. Hyke,

The Department of Fish and Wildlife (Department) appreciates the opportunity to comment on the Draft Environmental Impact Report (EIR) for White Knob-White Ridge Limestone Quarries Project (Project) prepared by San Bernardino County (Lead Agency) State Clearinghouse No. 2013061020. The Department is responding to the Draft EIR as a Trustee Agency for fish and wildlife resources (California Fish and Game Code Sections 711.7 and 1802, and the California Environmental Quality Act (CEQA) Guidelines Section 15386), and as a Responsible Agency regarding any discretionary actions (CEQA Guidelines Section 15381), such as the issuance of a Lake or Streambed Alteration Agreement (California Fish and Game Code Sections 1600 et seq.) and/or a California Endangered Species Act (CESA) Permit for Incidental Take of Endangered, Threatened, and/or Candidate species (California Fish and Game Code Sections 2080 and 2080.1).

Project Location

The Project is located in the San Bernardino Mountains southwest of Lucerne Valley in southwestern San Bernardino County. The Project is located approximately 6 miles southwest of the community of Lucerne Valley and 8 miles northwest of Big Bear Lake just north of the San Bernardino National Forest (Sections 5, 6, 7, and 8 of Township 3 North, Range 1 West).

Project Description

The proposed Project will expand the existing White Knob-White Ridge Limestone Quarries from an existing 145 acres to 335.1 acres, an increase of a 190.1 acres. The Project will also increase the operational years of the quarry by 24 years from the existing Mine and Reclamation Plan permit with an expiration date of 2031 to the year 2055. Another 40 acres of Bureau of Land Management (BLM) haul road Right-Of-Way (ROW) on federal public land will be reclaimed as part of this Project as well. The total amount of disturbed acreage analyzed in this draft EIR is 375.1.

Conserving California's Wildlife Since 1870

Letter E Enclosure

Project Specific Comments and Recommendations

Following review of the Biological Resources section of the Draft EIR, the Department offers the comments and recommendations listed below to assist the Lead Agency (i.e., San Bernardino County) in adequately identifying and/or mitigating the project's significant, or potentially significant, impacts on biological resources. The Department has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and the habitat necessary for biologically sustainable populations of those species (i.e., biological resources). The Department is a Trustee Agency with responsibility under CEQA for commenting on projects that could affect biological resources. As a Trustee Agency, the Department is responsible for providing, as available, biological expertise to review and comment upon environmental documents and impacts arising from project activities (CEQA Guidelines, § 15386; Fish and Game Code, § 1802). The comments and recommendations listed below are based on the requirement for the environmental document to include the following information:

- A description of feasible mitigation measures to avoid potentially significant impacts, and/or mitigate significant impacts, of the proposed project on the environment (CEQA Guidelines, §§ 15021, 15063, 15071, 15126.2, 15126.4 & 15370).

State Threatened, Endangered, and Candidate Species

The Department has discretionary authority over activities that could result in the "take" of any species listed as candidate, threatened, or endangered, pursuant to the California Endangered Species Act (CESA; Fish and Game Code, § 2050 et seq.). The Department considers adverse impacts to CESA-listed species, for the purposes of CEQA, to be significant without mitigation. Take of any CESA-listed species is prohibited except as authorized by state law (Fish and Game Code, §§ 2080 & 2085). Consequently, if a project, including project construction or any project-related activity during the life of the project, results in take of CESA-listed species, the Department recommends that the project proponent seek appropriate authorization prior to project implementation. This includes submitting an incidental take permit (ITP) to the Department (Fish and Game Code, §§ 2080.1 & 2081).

Please note that the Department must comply with CEQA prior to issuance of an ITP for a project. As such, the Department may consider the lead agency's CEQA documentation for the project. To minimize additional requirements by the Department and/or under CEQA, the CEQA avoidance, minimization, mitigation, monitoring and reporting measures for issuance of the ITP.

Letter E Enclosure

Desert Tortoise

MM 3.3.3b. Desert Tortoise Avoidance, Minimization, and Mitigation.

The Draft EIR identifies the potential for Project-related impacts to desert tortoise (*Gopherus agassizii*). Protocol level survey results are valid for one year during the calendar year they were conducted. If the surveys indicate the onsite presence of desert tortoise a California Endanger Species Act (CESA) Incidental Take Permit (ITP) may be warranted along with consultation with the United States Fish and Wildlife Service.

The Department recommends that the applicant apply for a CESA ITP for incidental take of desert tortoise prior to commencing Project activities. An ITP will provide for greater flexibility during project construction, and minimize Project delays.

MM 3.3.3b Measures 1-8. The Department agrees a biological mitigation and monitoring plan should be developed, however, the Habitat Mitigation and Monitoring Plan will discussed during the ITP process at which time the Department will have its recommendations.

Fully Protect Species

Bighorn sheep (*Ovis Canadensis*) is a state fully protected species. Bighorn sheep is known to occur near the project site and will be impacted by loss of habitat and water resources. The Department has jurisdiction over fully protected species of birds, mammals, amphibians, reptiles, and fish pursuant to Fish and Game Code sections 3511, 4700, 5050, and 5515. Take of any fully protected species is prohibited and the Department cannot authorize their take for development. The Department recommends that the Draft EIR evaluate and address Project related impacts to fully protected species including bighorn sheep and include appropriate species specific avoidance measures.

Nesting Birds

Please note that it is the Lead Agency's responsibility to comply with all applicable laws related to nesting birds and birds of prey. Migratory non-game native bird species are protected by international treaty under the federal Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 U.S.C. 703 et seq.). In addition, sections 3503, 3503.5, and 3513 of the Fish and Game Code (FGC) stipulate the following: Section 3503 states that it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by FGC or any regulation made pursuant thereto; Section 3503.5 states that it is unlawful to take, possess, or destroy any birds in the orders FALCONIFORMES or STRIGIFORMES (birds-of-prey) to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by FGC or any regulation adopted pursuant thereto; and Section 3513 states that it is unlawful to take or possess

Letter E Enclosure

any migratory nongame bird except as provided by the rules and regulations adopted by the Secretary of the Interior under provisions of the MBTA.

The Department recommends that the Lead Agency consult with a qualified ornithologist for advice in developing specific avoidance and minimization measures to ensure that impacts to nesting birds do not occur and that the Project complies with all applicable laws related to nesting birds and birds of prey, including Burrowing Owl. The Department recommends that Project-specific avoidance and minimization measures include, but not limited to: Project phasing and timing, monitoring of project-related noise (where applicable), sound walls, and buffers (where appropriate).

Other Species

Mule deer (*Odocoileus hemionus*) are known to occur throughout the project area and will be impacted by loss of habitat and water sources, bobcat (*Lynx rufus*), mountain lion (*Puma concolor*) (a Department biologist found lion scat during previous site visits, and presence of mountain lion in the area should be added to the Draft EIR) gray fox (*Urocyon cinereoargenteus*), ringtail (*Bassariscus astutus*), and likely other species exist in the area, none of which are acknowledged as affected by loss of water source and habitat. Mitigation for these species is essential, but is not described properly in the Draft EIR.

Lake or Streambed Alteration Program

For any activity that will divert or obstruct the natural flow, or change the bed, channel, or bank (which may include associated riparian resources) of a river or stream or use material from a streambed, the project applicant (or "entity") must provide written notification to the Department pursuant to Section 1602 of the Fish and Game Code. Based on this notification and other information, the Department then determines whether a Lake and Streambed Alteration (LSA) Agreement is required. The Department's issuance of an LSA Agreement is a "project" subject to CEQA (see Pub. Resources Code 21065). To facilitate issuance of an LSA Agreement, if necessary, the environmental document should fully identify the potential impacts to the lake, stream or riparian resources and provide adequate avoidance, mitigation, and monitoring and reporting commitments. Early consultation with the Department is recommended, since modification of the proposed project may be required to avoid or reduce impacts to fish and wildlife resources. To obtain a Lake or Streambed Alteration notification package, please go to http://www.dfg.ca.gov/habcon/1600/forms.html.

The Department's website has information regarding dryland streams in "A review of Stream Processes and Forms in Dryland Watersheds," available at this location: http://www.dfg.ca.gov/habcon/1600/1600resources.html.

Letter E Enclosure

Additional information can also be found in "Methods to Describe and Delineate Episodic Stream Processes on Arid Landscapes for Permitting Utility-Scale Solar Power Plants, With the MESA Field Guide - Final Project Report" available here: http://www.energy.ca.gov/2014publications/CEC-500-2014-013/index.html.

The drainage affected is roughly centered east-west, and draining from the south (upper) edge of the project to the haul road to the north (denoted by letter "C" in figure 3.3.-2 Jurisdictional Delineation) contains 1) perennial water with signs of use by wildlife, 2) 0.5-1 hector of mature oak, a valuable food source and habitat for terrestrial and avian wildlife. Neither of these features are acknowledged in the Draft EIR. Appropriate permits and measures should be completely addressed in the Draft EIR.

The Department appreciates the opportunity to provide comments on the Draft EIR for White Knob-White Ridge Limestone Quarries Expansion (State Clearinghouse No. 2013061020). Please contact Heather Weiche with questions regarding this letter and further coordination on project permitting needs at (909) 980-8607 or heather.weiche@wildlife.ca.gov.

Sincerely,

for Leslie S. MacNair
Inland Deserts Region
Acting Regional Manager

cc: State Clearinghouse
CORR

LETTER E SCOTT MORGAN, GOVERNOR'S OFFICE OF PLANNING AND RESEARCH

Response E-1: The commenter states that the State Clearinghouse submitted the Draft EIR to selected state agencies for review. The State Clearinghouse received one letter, from the California Department of Fish and Wildlife (CDFW). This letter is included as Letter C, and responses to CDFW comments are provided in Responses C-1 through C-8.

Response E-2: The commenter states that the letter acknowledges that the County has complied with the State Clearinghouse review requirements for draft environmental documents. This comment is noted.

Letter 1

CENTER for BIOLOGICAL DIVERSITY

Because life is good.

protecting and restoring natural ecosystems and imperiled species through science, education, policy, and environmental law

December 15, 2014

Carrie Hyke, District Planner,
Land Use Services Department,
Planning Division,
385 North Arrowhead Avenue,
San Bernardino, CA 92415-0187
Carrie.Hyke@sdd.sbcounty.gov

RE: Comments on the Draft Environmental Impact Report for OMYA Inc. White Knob/White Ridge Limestone Quarry Expansion Project (State Clearinghouse Number 2013061020)

SUBMITTED DECEMBER 15, 2014 BY EMAIL TO Carrie.Hyke@sdd.sbcounty.gov AND BY MAIL

Dear Ms. Hyke,

Please accept the following comments on the Draft Environmental Impact Report for OMYA Inc. White Knob/White Ridge Limestone Quarry Expansion Project (State Clearinghouse Number 2013061020) on behalf of the Center for Biological Diversity (the "Center").

The Center for Biological Diversity is a nonprofit, public interest environmental organization dedicated to the protection of endangered species and wild places through science, policy, and environmental law. The Center represents the interest of its 50,822 members and over 800,000 online activists throughout the country and 31,862 members and 111,877 California online activists.

The Center is concerned about the impact this project will have on the area's biodiverse lands and numerous species status species including plant species protected under the Endangered Species Act - Cushenbury buckwheat (*Eriogonum ovalifolium* var. *vineum*), Cushenbury oxytheca (*Acanthoscyphus parishii* var. *goodmaniana*), and Parish's daisy (*Erigeron parishii*) - and a wide variety of protected wildlife species. **1-1**

The DEIR fails to comply with the California Environmental Quality Act ("CEQA") in that it does not adequately propose mitigation of substantial impacts and has not provided adequate information or analysis for a variety of protected wildlife species. The DEIR also fails to sufficiently address impacts to water resources and air quality, and does not provide a sufficient cumulative impacts analysis. The DEIR need to be redrafted to address these issue and recirculated for public comment. **1-2**

Letter 1 Continued

The DEIR Has Not Proposed Legally Sufficient Mitigation for Significant Impacts to Endangered Plant Species

The DEIR does not comply with CEQA in regards to substantial impacts to rare and protected species of plants. CEQA requires that mitigation measures adopted by a public agency must be "fully enforceable through permit conditions, agreements, or other measures." (Cal Pub. Resources Code, § 21081.6, subd. (b)); Federation of Hillside & Canyon Associations v. City of Los Angeles (2000) 83 Cal.App.4th 1252, 1261. California Code of Regulation, Title 14, § 15126.4 further directs that "[a]n EIR shall describe feasible measures which could minimize significant adverse impacts." Here, while acknowledging substantial impacts to numerous plant species, the DEIR proposes mitigation that is not shown to be fully enforceable or feasible. The DEIR needs to be redrafted to fully address impacts to protected plant species. As this will be a significant change to the draft, the new draft must be recirculated for public comment.

The DEIR documents the presence of the threatened Parish's daisy (*Erigeron parishii*) (DEIR at 3.3-36), the endangered Cushenbury buckwheat (*Eriogonum ovalifolium* var. *vineum*) (DEIR at 3.3-37) and Cushenbury oxytheca (*Acanthoscyphus parishii* var. *goodmaniana*) (DEIR at 3.3-15) on the proposed project site. The County acknowledges that "In addition, previous focused surveys have identified Cushenbury buckwheat, Cushenbury oxytheca, and Parish's daisy within the PSA" but claims that "Implementation of the CHMS will ensure that impacts on these species are mitigated to a less than significant level." (DEIR at p. 3.3-59.)

The DEIR does not specify how impacts to these federally protected species will be mitigated. The County has mischaracterized the CHMS – it is a guidance document that offers a number of strategies by which impacts to the identified Cushenbury buckwheat, Cushenbury oxytheca, and Parish's daisy *may* be mitigated. It is not a means by which incorporation by reference operates to automatically mitigate substantial impacts. The County's attempt to so invoke the CHMS is in violation of CEQA. **1-3**

The DEIR does provide an accurate description of the facility of the CHMS:

> The CHMS is a collaborative strategy to facilitate the preservation and recovery of carbonate plant species, while providing a method for mining projects to obtain Endangered Species Act compliance. The CHMS proposes multiple methods of permanent habitat conservation, including federal land use designations, federal purchases of private property, land exchanges, relinquishment of unpatented mining claims, and/or execution of a conservation easement or surface use restrictions coupled with a mineral withdrawal.

(DEIR at p 3.3-72.)

But, the DEIR does not specify how the CHMS will be implemented in this case to mitigate for the loss of the endangered plants. For example, will this be accomplished by Omya conservation banking or land exchanges or successful revegetation efforts, etc? If a CHMS strategy will be utilized as mitigation, the DEIR needs to specify exactly how the mitigation will be

Letter 1 Continued

accomplished. Without such detail, the proposed mitigation is neither legally enforceable nor feasible. **1-3 cont.**

Furthermore, it is unclear if the County has fulfilled its duties under the MOU. The MOU requires the County to do the following:

> Adopt standardized conditions of approval for addressing impacts to Carbonate Plants by proposed mining and reclamation projects in a manner that is consistent with the CHMS. Such conditions of approval shall apply under SMARA, the County land use ordinances, and CEQA, subject to the approval of the Board of Supervisors on a project-by-project basis. **1-4**

(DEIR at Appendix D.)

The DEIR does not state what these standardized conditions of approval are (or if they even exist) and does not state whether or not the Board of Supervisors has so approved this project. Again, without such information, the DEIR has failed, in violation of CEQA, to provide legally enforceable mitigation for a significant impact.

The DEIR also acknowledges that suitable habitat for 33 listed plants, in addition to those that might be addressed by a CHMS mitigation strategy, occur with the PSA. (DEIR 3.3-59.) The DEIR fails to establish a baseline condition for these 33 protected species and failed to propose any concrete mitigation measures for the significant impacts that will occur for species in the PSA.

The DEIR entirely defers analysis of impacts on these species until preconstruction surveys have been conducted. For the species that will be found, the DEIR proposes:

> Possible mitigation for impacts on special-status plant species can include implementation of a program to transplant, salvage, cultivate, or re-establish the species at suitable sites (***if feasible***) or through the purchase of credits from an approved mitigation bank, ***if available***. (emphasis added)

(DEIR at p. 3.3-60.) **1-5**

First, the plant surveys need to be conducted and the results analyses in the DEIR – the County cannot simply defer CEQA analysis to a future date. Second, as the above statement itself acknowledges, these "possible" mitigation measures may not be feasible and, as such, are not CEQA compliant mitigation measures. Per CEQA, the plant surveys need to be conducted, significant impacts identified, and complaint mitigation measures need to be proposed ***in*** the DEIR.

Avoidance of the rare plants located within the proposed expansion area is preferable because of the general lack of success in transplanting rare plants[1]. If transplantation is to be a part of the mitigation strategy, a detailed plan must be included *as part of the EIR* on the methodology for determination of appropriate conservation areas where plants may be transplanted, when/how plant are to be transplanted and identification of success criteria for transplantation. Monitoring of the transplanted plants needs to occur for a time period that is realistic to evaluate long-term success of the transplantation effort.

1 Fiedler 1991

Letter 1 Continued

The DEIR Does not Fully Address Protected Animal Species

Desert Tortoise

While the Omya expansion area appears to be in desert tortoise habitat, the Center is concerned about indirect, down slope impacts to this species which continues to decline throughout its range despite being under federal and state Endangered Species Acts protection for decades as threatened[2]. A revised and recirculated DEIR must look at ways to avoid impacts to the desert tortoise, for example, by identifying culvert locations along the access road that will keep animals out of harms' way and maintain the integrity of the hydrological processes of the down slope bajada. The DEIR must also look at ways to minimize any impacts that it finds are unavoidable, for example, limiting access roads to the project. Acquisition of lands that will be managed in perpetuity for conservation must be included as part of the strategy to mitigate impacts to all sensitive species, and mitigation lands should be high-quality habitat and, at minimum 5:1 mitigation should be provided of all acres of desert tortoise habitat impacted. 1-6

An aggressive raven prevention plan also needs to be developed as part of the EIR, and be made available for public review as part of the EIR and followed during project development and implementation.

Bats

The DEIR recognizes that numerous bat species could be present within the proposed expansion area, yet bat surveys were not done, eliminating the capacity to actually evaluate impacts to these sensitive mammals in the DEIR. The DEIR inappropriately defers surveys to pre-construction where bat encounters could impact the animals, cause delay work or require significant project realignment.

The DEIR has not established a sufficient baseline and has not sufficiently analyzed regulation of or impacts to the Townsend's big-eared bat (*Corynorhinus townsendii*). The DEIR fails to acknowledge that the Townsend's big-eared bat is protected under the California Endangered Species Act as a candidate species. The California Fish and Game Commission recognizes the perilous status of the Townsend's big-eared bat populations and bestowed that protection to the animal in June 2013[3]. The bats are severely threatened by a combination of habitat destruction and disturbance of roost sites[4]. 1-7

A revised and recirculated DEIR must include surveys for bats in the expansion areas, and if bats are encountered, a bat protection plan needs to be developed to avoid and minimize impacts to these declining species that provide so many benefits to humans through their voracious feeding on insects.

2 http://www.fws.gov/nevada/desert_tortoise/dt_reports.html
3 http://www.kcet.org/news/redefine/revisit/commentary/the-hidden-desert/help-on-the-way-for-big-eared-bats.html
4 http://www.iucnredlist.org/details/17598/0

Letter 1 Continued

Other Rare Species

The diversity of rare species found in the vicinity of the proposed project site is impressive (DEIR at Table 3.3-1 at pg. 3.3-21 through 3.3-32) and suggests that the site has great ecological value. Yet the DEIR downplays the uniqueness of the area and fails to clearly address avoidance, minimization and mitigation of the very significant impacts to all of the rare species that utilize the site for part or all of their lifecycle.

For example, the proposed expansion area is likely a foraging areas for a suite of rare species including but not limited to the desert bighorn sheep and golden eagles. Golden eagles have been documented to successfully nest in the adjacent mountains. Unfortunately, golden eagles in the western United States are declining. Other industrial development in the deserts of California and elsewhere are impacting foraging habitat for this iconic species. The EIR relies on the *North Slope Conservation Strategy* (DEIR at Appendix D), but this is only an unapproved draft. Indeed, as with so many of the rare species, surveys for eagles and other sensitive raptors were not done as part of the environmental documentation (DEIR at 3.3-42). Surveys to determine the eagle territories are requisite in order to evaluate the impact of the expansion on eagle survival. It must also incorporate all guidance on golden eagles, evaluate impacts to them as requirements by the U.S. Fish and Wildlife Service[5], and evaluate the need for a 'take" permit under the Bald and Golden Eagle Act. 1-8

Of the nine special status wildlife species with potential to occur on the proposed project site, no species specific surveys were done for six of them and it is unclear if surveys were done for the other three. As with the 33 special status plants described above, these surveys need to be conducted and the results analyzed ***in the DEIR***.

Even if avoidance to sensitive species is done, habitat impacts will require acquisition of lands that will be managed in perpetuity for conservation. Identification of those lands and the disposition of them including a management plan must be included as part of the revised and recirculated DEIR.

The DEIR fails to Address Impacts to Water Resources, Air Quality, or Cumulative Impacts

The project appears to impact on-site drainages. The revised and recirculated EIR must clarify the impacts to the jurisdictional Waters of U.S. and the Water of the State of California, and avoid, minimize and mitigate any impacts. 1-9

Activities associated with mining often create dust and PM10 emissions that are harmful to human and wildlife health. The Mojave Air Quality Management region is already out of compliance for ozone and PM10 and 2.5 levels set by the Clean Air Act. The revised and recirculated DEIR needs to propose additional strategies to decrease these harmful pollutants other than watering roads and graded areas or using dust palliative, such as paving the roads to decrease emissions. The effects of watering roads or using palliatives is not analyzed for its potential impacts on adjacent wildlands and wildlife. 1-10

5 http://www.fws.gov/migratorybirds/baldeagle.htm

Letter 1 Continued

Numerous industrial projects are being built and proposed in the project vicinity, along with a significant military base expansion to the northeast of the proposed Omya mine expansion. The update to the BLM's West Mojave plan and the Desert Renewable Energy Conservation Plan both also cover the proposed expansion area. A thorough analysis of the cumulative impacts from all of these projects on the resources, as required by CEQA, needs to be included. **1-11**

Thank you for your consideration of these comments. Please add us to the distribution list for all documents or notices associated with this project.

Sincerely,

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LETTER 1 ILEENE ANDERSON, CENTER FOR BIOLOGICAL DIVERSITY

Response 1-1: The County agrees with the commenter that the area is a land of biodiversity. This is illustrated in the Draft EIR through the comprehensive description of habitats and the number of special-status species that may be present in the area in subsection 3.3.1, Existing Setting, in Section 3.3, Biological Resources, pp. 3.3-1 through -48. Project impacts on special-status plant species referenced by the commenter (Cushenbury buckwheat [*Eriogonum ovalifolium* var. *vineum*], Cushenbury oxytheca [*Acanthoscyphus parishii* var. *goodmaniana*], and Parish's daisy [*Erigeron parishii]*) were evaluated in the Draft EIR in Impact 3.3.2 in Section 3.3, Biological Resources. Project impacts on protected wildlife species were evaluated in Impacts 3.3.3 through 3.3.10. Additional information regarding impacts, avoidance, minimization, and mitigation are provided in the responses to this letter and a letter submitted by the CDFW (Letter C).

Response 1-2: This is a general comment and does not specifically state how the Draft EIR fails to meet the impact analysis requirements for the impact areas identified in the comment (wildlife species, water resources, air quality, and cumulative analysis). Responses 1-6 through 1-11 address the topics identified in this comment.

In response to this comment letter and others, portions of the Draft EIR have been revised (see Section 3.0, Revisions to the Draft EIR) to incorporate minor additions and clarifications. The addition of this information clarifies or amplifies or makes insignificant modifications to the Draft EIR, but it is not "significant new information" and has not resulted in a new or more severe significant impact than previously disclosed (CEQA Guidelines Section 15088.5). As such, it is not necessary to recirculate a revised Draft EIR, as suggested by the commenter.

Response 1-3: The Draft EIR evaluated impacts on Parish's daisy, Cushenbury buckwheat, and Cushenbury buckwheat. Information about these species was presented on Draft EIR pages 3.3-15, 3.3-16, and 3.3-36 and in Table 3.3-1, and project impacts were evaluated in Impact 3.3.2. The Draft EIR included mitigation (mitigation measure MM 3.3.2) to reduce the potentially significant impacts on these species to a less than significant level. The following provides additional information about these species and the process for mitigating impacts, including how the Carbonate Habitat Management Strategy (CHMS) would be implemented.

Previous focused botanical surveys covering part, but not all, of the PSA identified three listed species—Cushenbury buckwheat, Cushenbury oxytheca, and Parish's daisy (e.g., carbonate-endemic species)—within the PSA. No designated critical habitat for listed species is found within the PSA. A preliminary geographic information system (GIS) analysis by San Bernardino National Forest (SBNF) staff estimates that a total of 4.26 acres occupied by one or more listed carbonate-endemic species and 137.10 acres of suitable habitat for listed carbonate-endemic species would be affected by the proposed project (Scott Eliason, SBNF, personal communication). These estimates are based on preliminary survey data and project area boundaries, and may not reflect all potential project

impacts on the listed species. The actual project impacts may be somewhat greater, but the existing data provides a suitable estimate for the purpose of the impact assessment.

Cushenbury buckwheat, Cushenbury oxytheca, and Parish's daisy (the three listed plant species on-site) and one other listed plant (Cushenbury milk-vetch) are endemic to carbonate soils, including soils developed from limestone and dolomite parent materials, in the northern San Bernardino Mountains. Mining impacts on these plants and their habitat are mitigated through the CHMS (Olson 2003), which was developed collaboratively by the mining industry, claimholders, land management and planning agencies (US Forest Service, Bureau of Land Management, San Bernardino County), and state and federal resource agencies (USFWS, CDFW). In 2003, Omya entered into a Memorandum of Understanding (MOU) with the agencies and other private parties, whereby all parties agreed to implement the terms of the CHMS in regard to future mining proposals. Under the CHMS, mining impacts on listed threatened or endangered carbonate-endemic plants are offset by the permanent set-aside of comparable habitat through land dedication or mining claim relinquishment at a 3:1 ratio. The CHMS specifies a process to evaluate "conservation value" of habitat proposed for mining. Conservation value is calculated in "conservation units" (CUs), based on the number of acres of suitable or occupied habitat and other factors such as proximity to disturbed areas or conservation lands.

SBNF staff used the estimated acreages and habitat suitability (above) to calculate total conservation value of the proposed quarry expansion project as approximately 114 CUs. To mitigate impacts on listed plants and for consistency with the CHMS, Omya would set aside land or mining claims with conservation value totaling approximately 342 CUs. This number is based on the acreage and conservation value estimates, and would be refined through additional field surveys prior to beginning ground-disturbing activities for the proposed project. Mitigation measure MM 3.3.2 describes a process to implement the CHMS, including (1) field surveys to determine final conservation value of proposed disturbance areas; (2) comparable field surveys to verify conservation value on mitigation sites (land to be dedicated or mining claims to be relinquished); and (3) administrative requirements to complete the conservation set-aside transactions. In addition to the 3:1 ratio for CUs, the mitigation lands would be required to conserve occupied habitat for each listed species at roughly a 3:1 ratio to the habitat acreage affected by the project. This component of the mitigation measure will ensure that impacts on each listed plant species are mitigated in kind by protecting each species proportionally. The two requirements are complementary rather than additive; both requirements may be satisfied on the same conservation acreage by selecting lands with comparable abundance of the listed species.

In response to this comment, mitigation measure MM 3.3.2 has been revised. By implementing mitigation measure MM 3.3.2, as revised below, the project's impacts on listed plant species would be mitigated to less than significant by permanently setting aside and protecting listed plants

and their habitat. This mitigation measure is feasible and is fully enforceable by the County.

MM 3.3.2 ~~**Rare Plant Surveys**~~ **Carbonate Habitat Management Strategy (CHMS) Consistency.** Prior to initiating project-related activities in undisturbed portions of the site, the mine operator shall ~~retain a qualified biologist to perform focused surveys to determine the presence/absence of special-status plant species with potential to occur in and adjacent to (within 25 feet, where appropriate) the proposed impact area. Species intended to be addressed by this mitigation measure include all species not covered by the CHMS and for which a "may affect" determination was made in Table 3.3-1.~~complete land dedication or claim relinquishments to offset project impacts on listed threatened or endangered plants at a 3:1 ratio, consistent with the requirements of the CHMS, and provide documentation of the completed transaction to the County. The 3:1 ratio will apply to the total number of conservation units (CUs) (calculated by San Bernardino National Forest [SBNF] staff according to the provisions of the CHMS) and total occupied habitat, in acres or fractions of acres, for each listed species. This mitigation measure consists of four parts: (1) field surveys to determine conservation value of proposed disturbance areas; (2) comparable field surveys to verify conservation value of mining claims to be relinquished; (3) administrative requirements to complete the land dedication or claim relinquishments (which may include mineral withdrawal); and (4) protection measures for special-status plants located adjacent to project disturbance areas that are not proposed to be removed.

(1) Project Area Field Surveys and Conservation Value Calculation. The mine operator shall retain a qualified biologist to perform focused surveys to determine the presence~~/~~ or absence of special-status plant species identified in Table 3.3-1 and within 100 feet of the proposed impact area. For listed threatened or endangered plants, the extent of occupied habitat shall be mapped and quantified. For any other special-status plants located in the project area, the biologist shall collect global positioning system (GPS) coordinates of occurrences and qualitative estimates of their abundance.

These surveys shall be conducted in accordance with the CDFW (2009) *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities*. These guidelines require that rare plant surveys be "floristic in nature," conducted by field botanists familiar with the regional flora, and

conducted at the proper time of year when rare or endangered species are both evident and identifiable. Field surveys shall be scheduled to coincide with known flowering periods and/or during appropriate developmental periods that are necessary to identify the plant species of concern.

Field survey results and mapping data shall be provided to the County and the SBNF for inclusion in the CHMS GIS data and calculation of total CHMS conservation value of the proposed project area.

(2) Mitigation Lands Field Surveys and Conservation Value Calculation. The mine operator shall identify one or more parcels of land or mining claims suitable for relinquishment and shall retain a qualified biologist to perform focused botanical surveys of those lands. Survey methods and data collection shall be as described above for project site field surveys. Field survey results and mapping data shall be provided to the San Bernardino National Forest for inclusion in the CHMS GIS data and calculation of total CHMS conservation value of the proposed project area.

(3) Land Dedication or Claim Relinquishment. The mining operator shall specify lands or mining claims whose conservation values and habitat area occupied by listed species total no less than three times the total conservation value of the project area and roughly three times the occupied habitat for each affected listed species. The mining operator shall dedicate the lands or relinquish those claims according to the terms of the CHMS and the MOU. The operator shall provide written documentation of the land dedication or claim relinquishment to the County upon completion.

(4) Protect Special-Status Plant Locations Adjacent to Project Site. Any special-status plant species that are identified within 100 feet of the proposed impact area, but not proposed to be disturbed by the project, shall be protected by barrier fencing to ensure construction activities and material stockpiles do not impact any special-status plant species. These avoidance areas shall be identified on project plans.

~~These surveys shall be conducted in accordance with the CDFW Guidelines for Assessing Effects of Proposed Developments on Rare Plants and Plant Communities (Nelson 1994). These guidelines require that rare plant surveys be conducted at the proper time of year when rare or endangered species are both evident and identifiable. Field surveys shall be scheduled to coincide~~

~~with known flowering periods and/or during appropriate developmental periods that are necessary to identify the plant species of concern.~~

~~If any state- or federally listed, CNPS List 1, or CNPS List 2 plant species are found in or adjacent to (within 25 feet) the proposed impact area during the surveys, these plant species shall be avoided to the extent feasible and the following mitigation measures shall be implemented:~~

~~(1) In some cases involving state-listed plants, it may be necessary to obtain an incidental take permit under Section 2081 of the Fish and Game Code (2081 permit). The mine operator shall consult with the CDFW to determine whether a 2081 permit is required and obtain all required authorizations prior to initiation of ground-breaking activities.~~

~~(2) Before the approval of grading plans or any ground-breaking activity within the PSA, the mine operator shall submit a mitigation plan concurrently to the CDFW and the USFWS (if appropriate) for review and comment. The plan shall include mitigation measures for the population(s) to be directly affected. Possible mitigation for impacts to special-status plant species can include implementation of a program to transplant, salvage, cultivate, or re-establish the species at suitable sites (if feasible) or through the purchase of credits from an approved mitigation bank, if available. The actual level of mitigation may vary depending on the sensitivity of the species, its prevalence in the area, and the current state of knowledge about overall population trends and threats to its survival. The final mitigation strategy for directly impacted plant species shall be determined by the CDFW and the USFWS (if appropriate) through the mitigation plan approval process.~~

~~(3) Any special-status plant species that are identified adjacent to the PSA, but not proposed to be disturbed by the project, shall be protected by barrier fencing to ensure that construction activities and material stockpiles do not impact any special-status plant species. These avoidance areas shall be identified on project plans.~~

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Response 1-4: This comment is not directed to the adequacy of the analysis in the Draft EIR and does not provide any information or evidence contradicting the conclusions of the Draft EIR. However, the following description of the Memorandum of Understanding (MOU) for the CHMS and standard conditions of approval is provided to inform the decision-making process. This information does not affect the significance conclusions in the Draft EIR.

The purpose of the CHMS MOU is to provide a framework for cooperation between the Bureau of Land Management (BLM), the U.S. Forest Service (USFS), the San Bernardino National Forest, the County of San Bernardino, the California Native Plant Society, and various private parties to implement the CHMS. The MOU is included in the Draft EIR in Appendix D.

The following are examples of standard conditions of approval established by the County for mining and reclamation projects that have been authorized to date.

- To minimize the loss of genetic material present in the "carbonate species" on-site, efforts shall be made to salvage this plant material for nursery stock or a seed source for nursery stock to maintain existing genetic diversity.

- The applicant shall submit a research program and a plant nursery design to the Advance Planning Division within six months of project approval. The applicant shall establish a plant nursery and revegetation research program within one year of project approval. The plant nursery shall provide stock for outplanting in revegetation of the site. The research program shall be designed to provide reliable propagation of all plants to be used in revegetation including the carbonate endemics. Nursery services may be contracted for subject to demonstrated experience working with native plant species.

- As directed by the Advance Planning Division, the applicant shall update baseline vegetation data, including cover, density and diversity measures, prior to clearing and grubbing for quarry or waste dump expansion. These surveys shall be conducted during the peak flowering period of the carbonate endemic plants, typically mid-April to mid-June, and submit the report to the Advance Planning Division.

- The project proponent may choose to participate in the Carbonate Habitat Management Strategies (CHMS) developed by the USFS, BLM, County, and USFWS.

Response 1-5: The Draft EIR described baseline conditions for 37 special-status plant species and habitat suitability within the PSA and evaluated impacts in Impact 3.3.2. Five biological assessments of the PSA have been conducted to date, including three focused surveys for rare plants. These reconnaissance-level and focused surveys are sufficient for evaluating impacts and developing mitigation measures.

Information from the following reports, which documented surveys and assessments, was used to prepare the Draft EIR:

- Scott White Biological Consulting (SWBC). 2007. *Proposed Omya (California) White Knob Quarry: General Biological Resources Assessment and Focused Rare Plant Survey.*

- Lilburn Corporation. 2012. *Focus Plant Survey for the Direct Land Sale Area Adjacent to the OMYA White Knob Quarry.*

- Lilburn Corporation. 2012. *Plants Report for the OMYA White Knob Quarry Haul Road Improvement Project.*

- Lilburn Corporation. 2012. *Biological Resources Assessment for the Omya White Knob Quarry Haul Road Improvement Project.*

- Lilburn Corporation. 2013. *Biological Resources Assessment for the Direct Land Sale Omya White Knob Quarry.*

The data in the above-referenced reports was combined with occurrence data from the following sources to identify special-status plant species with the potential to be adversely affected by the proposed project:

- The CDFW's California Natural Diversity Database

- The California Native Plant Society's Inventory of Rare, Threatened, and Endangered Plants of California

- The USFWS's Information Planning and Conservation System

All of this data was synthesized and presented in the Draft EIR. A summary of habitats within the PSA was provided on pages 3.3-2 through -10. Table 3.3-1 in the Draft EIR provided a summary of all special-status species identified in the database results, along with a description of the habitat requirements for each species and conclusions regarding the potential for each species to be impacted by project components (Draft EIR pages 3.3-21 through -33). Furthermore, a discussion of all special-status plants with the potential to be affected by the proposed project was provided on pages 3.3-15 through -43. All of the information presented on the above-referenced pages in the Draft EIR adequately establishes a baseline condition for the 33 special-status plant species identified as having the potential to occur within the PSA.

The Draft EIR also analyzed impacts on special-status plant species in Impact 3.3.2 on page 3.3-59; however, additional analysis is provided here for clarification. Project implementation could directly affect occurrences of special-status plants that may occur in the PSA (Draft EIR Table 3.3-1). Impacts on any of these species may be considered "substantial" according to the "Standards of Significance 1" on Draft EIR page 3.3-56. Without mitigation, this impact is considered potentially significant. However, all of these additional special-status species are found on limestone soils more widely throughout the northern San Bernardino

Mountains. Due to the comprehensive region-wide nature of the CHMS, adequate conservation measures for these species will be implemented through the CHMS. Omya's participation in the CHMS for this project as described in mitigation measure MM 3.3.2, as amended above, will mitigate its contribution to habitat loss for these plants below a level of significance.

In addition to loss of plants and their habitat for mining, the proposed project could indirectly affect special-status plants, including listed species, located adjacent to the limits of planned disturbance. Potential effects include dust, runoff, or inadvertent soil disturbance. Mitigation measure MM 3.3.2, as amended above, includes a condition to protect special-status plant occurrences adjacent to the PSA. By implementing this measure, likely adverse effects to these plants, if any, would be minimized and impacts would be less than significant.

Transplanting has been removed as an option in mitigation measure MM 3.3.2, as amended above.

The Draft EIR does not defer analysis or mitigation. As indicated above, evaluation of the studies prepared to date concluded that there could be impacts on rare plants, and those impacts could be significant. Mitigation measure MM 3.3.2, as amended above, requires (1) field surveys to determine conservation value of proposed disturbance areas; (2) comparable field surveys to verify conservation value of mining claims to be relinquished; (3) administrative requirements to complete the land dedication or claim relinquishments (which may include mineral withdrawal); and (4) protection measures for special-status plants located adjacent to project disturbance areas. This is a feasible and County-enforceable mitigation measure that complies with the standards set forth in CEQA Guidelines Section 15126.4.

Response 1-6: The Draft EIR evaluated impacts on desert tortoise in Impact 3.3.3. Each dry wash depicted on Figure 3.3-1b in the Draft EIR has a culvert associated with its crossing of the haul (access) road to maintain in-stream hydrology. No culverts are proposed for removal; therefore, no impacts on down slope bajada processes will occur as a result of project-related activities, and no further or alternative mitigation is required to address downslope processes.

There is only one haul (access) road from the processing plant to the mine. No additional haul roads to the plant are proposed.

Per the criteria set forth in the *Compensation for the Desert Tortoise* (Desert Tortoise Oversight Management Group 1991), the PSA would meet the criteria for Category III (least valuable) lands, which are given a compensation rate of one regardless of all other factors. Only lands within Desert Wildlife Management Areas and/or critical habitat units, or other areas with very high habitat values (Category I lands), are subject to 5:1 compensation ratios. The classification of the PSA as Category III lands is further supported by habitat suitability modeling conducted by the USGS (Nussear et al. 2009), which classifies the habitat suitability within the PSA

as low, with habitat values increasing slightly along the haul road from the PSA to the processing plant (see Figure 3.3-7 in Section 3.0 of this Final EIR). Mitigation measure MM 3.3.3b has been revised (see below) to incorporate compensation ratios for impacts on desert tortoise habitat, should this species be identified during the pre-project surveys required under mitigation measure MM 3.3.3a.

The proposed project is not anticipated to attract more ravens to the area. No new structures that typically attract ravens are proposed, such as buildings, fences, or transmission lines. In addition, mitigation measure MM 3.3.1g will be implemented to ensure that all food-related trash is removed from the project site regularly, which will minimize attraction of ravens to the project site. However, mitigation measure MM 3.3.3b has been revised to include development of a raven control plan, if occupied desert tortoise habitat is found during pre-project surveys (mitigation measure MM 3.3.3a), which will be developed in consultation with the USFWS and the CDFW. Implementation of mitigation measures MM 3.3.3a and MM 3.3.3b (as amended) will reduce impacts to desert tortoise to a less than significant level; therefore, no further or alternative mitigation is proposed.

Mitigation measure MM 3.3.3b has been revised as follows to ensure project-related impacts on desert tortoise are less than significant.

MM 3.3.3b Desert Tortoise Avoidance, Minimization, and Mitigation. Should occupied desert tortoise habitat be identified during the pre-project surveys, a habitat ~~biological~~ mitigation and monitoring plan and raven control plan shall be developed in consultation with the USFWS and the CDFW. This plan shall describe all measures to be implemented prior to, during, and after construction, including, but not limited to, the following:

(1) All tortoise burrows shall be avoided to the greatest extent feasible, and temporary exclusionary tortoise fencing (1x2-inch mesh hardware cloth) shall be installed at the limits of disturbance prior to initiation of construction activities. Fence installation and ongoing oversight of the need for maintenance shall be monitored by a USFWS-authorized desert tortoise biologist.

(2) Upon completion of fence installation, the authorized biologist shall conduct a clearance survey of the fenced area prior to declaring the construction area free of tortoises.

(3) If it is necessary to excavate a desert tortoise from its burrow to move it out of harm's way, excavation shall be done with hand tools, either by or under the direct supervision of the authorized biologist.

(4) Desert tortoises removed from burrows shall be placed in an unoccupied burrow of approximately the same size as

the one from which they were removed. If an existing burrow is not available, the authorized biologist shall construct one.

(5) Desert tortoises moved during inactive periods will be monitored for at least two days after relocation or the end of construction, whichever occurs first.

(6) If desert tortoises need to be moved at a time of day when ambient temperatures could harm them (less than 40 degrees and over 90 degrees Fahrenheit), they shall be held overnight in a clean cardboard box and released the following day during more favorable temperatures. Cardboard boxes used to hold tortoises shall only be used once.

(7) All handling of desert tortoises shall be performed consistent with the *Guidelines for Handling Desert Tortoises During Construction Projects* (Desert Tortoise Council 1994).

(8) The mine operator shall mitigate for impacts on occupied desert tortoise habitat at a 1:1 minimum ratio through the purchase of credits from an approved desert tortoise mitigation bank. The amount of credits purchased and the location of the mitigation bank used ~~shall be established through consultation with and~~ are subject to approval by the USFWS and the CDFW. The mine operator shall provide the County with evidence that the permit and/or other requirements established by either agency have been satisfactorily met.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

The information and recommendations provided by the commenter concerning desert tortoise do not alter the conclusions of the Draft EIR. Revisions to mitigation measure MM 3.3.3b clarify the mitigation actions, but are not "significant new information," and no new or more severe desert tortoise impacts have been identified that would require recirculating the Draft EIR (see Response 1-2 regarding recirculation).

Response 1-7: The Draft EIR described baseline conditions for special-status bat species within the PSA and evaluated impacts in Impact 3.3.9. Three biological assessments of the PSA have been conducted to date evaluating impacts on special-status bats. These reconnaissance-level surveys are sufficient for evaluating impacts and developing mitigation measures.

Information from the following reports, which documented surveys and assessments, was used to prepare the Draft EIR:

- Scott White Biological Consulting (SWBC). 2007. *Proposed Omya (California) White Knob Quarry: General Biological Resources Assessment and Focused Rare Plant Survey.*

- Lilburn Corporation. 2012. *Biological Resources Assessment for the Omya White Knob Quarry Haul Road Improvement Project*

- Lilburn Corporation. 2013. *Biological Resources Assessment for the Direct Land Sale Omya White Knob Quarry.*

The data from the above-referenced reports was combined with occurrence data from the following sources to identify special-status bat species with the potential to be adversely affected by the proposed project:

- The CDFW's California Natural Diversity Database

- The California Native Plant Society's Inventory of Rare, Threatened, and Endangered Plants of California

- The USFWS's Information Planning and Conservation System

All of this data was synthesized and presented in the Draft EIR. A summary of habitats within the PSA was provided on Draft EIR pages 3.3-2 through -10. Table 3.3-1 provided a summary of all special-status species identified in the database results, along with a description of the habitat requirements for each species and conclusions regarding the potential for each species to be impacted by project components (Draft EIR pages 3.3-21 through -33). Furthermore, a discussion of the Townsend's big-eared bat and western mastiff bat was provided on pages 3.3-43 and -44. All of the information presented on the above-referenced pages of the Draft EIR adequately establishes a baseline condition for the special-status bat species identified as having the potential to occur within the PSA. The Draft EIR also analyzed impacts on special-status bat species in Impact 3.3.9 on page 3.3-68; however, additional analysis is provided herein for clarification.

Acoustic monitoring and mist net surveys were conducted by Brown & Rainey in September 2014. This survey identified eleven bat species, of which one, the Townsend's big-eared bat, is listed as a species of special concern (SSC) by the CDFW and is also a candidate for listing as a threatened species under the CESA. The following species of bats were identified on or in the immediate vicinity of the PSA during the 2014 survey period.

- California myotis

- Small-footed myotis

- Long-legged myotis

- Mexican free-tailed bat

- Canyon bat
- Hoary bat
- Long-eared myotis
- Western mastiff bat (SSC)
- Townsend's big-eared bat (CT/SSC)
- Fringed myotis
- Spotted bat (SSC)

Brown & Rainey (2014) also identified the following species as not detected but having the potential to occur on or in the vicinity of the PSA.

- Big brown bat
- Red bat (SSC)
- Pallid bat (SSC)
- Pocketed free-tailed bat (SSC)
- Silver-haired bat
- Yuma myotis

The documented occurrences of several special-status bat species result in the potential for project implementation to directly or indirectly affect special-status bats on or in the vicinity of the PSA. The three species of bats that were found to be more closely associated with tree-covered areas for foraging (Townsend's big-eared bats, long-eared myotis, and fringed myotis) could be impacted by removal of riparian, rocky canyon habitat. Direct mortality of bats (especially canyon bats, spotted bats, and western mastiff bats) that may roost in quarry walls or those that roost in trees (most myotis, hoary bats, and big brown bats) could occur during site preparation and construction activities. There are no water-like surfaces (e.g., open sumps of process waters potentially containing injurious chemicals) associated with the proposed project operations that would attract and/or harm these species.

Radiotelemetry studies of a number of bat species suggest that bats can have home ranges greater than 12 miles (20 km) (H. T. Harvey & Associates 2004). An extensive amount of suitable roosting and foraging habitat exists in the vicinity of the PSA that could support bats; therefore, mitigation for loss of habitat is not proposed. However, in order offset potential direct and indirect impacts on roosting bats, mitigation measure MM 3.3.9 will be amended as follows.

MM 3.3.9 Bat Surveys. Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine whether potential roosting sites for special-status bats may be affected. If potential roost sites are identified, a preconstruction survey by a qualified biologist shall be conducted ~~prior to the end of April~~ between March 1 and July 31 to determine the presence or absence of roosting bats. If the survey does not identify the presence of occupied roosts, no further mitigation is required.

If ~~day roosts or maternity roosts~~ non-breeding roosts occupied by special-status bat species are documented within construction areas, the bats shall be safely flushed from the sites where roosting habitat is planned to be removed prior to May of each construction phase ~~(maternity roosts are generally occupied from May to August)~~ and prior to the onset of construction activities. The removal of the roosting sites shall occur during the time of day when the roost is unoccupied.

If a maternity colony is detected, a 100-foot construction-free buffer shall be established around the roost site and remain in place until it has been determined by a qualified biologist that the nursery is no longer active. Removal of maternity roosts shall be restricted to between March 1 and April 15 or August 15 and October 15 to avoid interfering with an active nursery.

The loss of each roost will be compensated for by the construction and installation of two bat boxes suitable to the bat species and colony size excluded from the original roosting site. The bat boxes shall be installed in the vicinity prior to removal of the original non-breeding/maternity roost sites. A detailed program for bat flushing, roosting site removal, and installation of bat boxes shall be developed in consultation with a qualified biologist.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Implementation of mitigation measure MM 3.3.9, as amended above, will reduce impacts on special-status bat species to a less than significant level.

The Draft EIR does not defer analysis or mitigation. As indicated above, evaluation of the studies prepared to date concluded there could be impacts on special-status bat species, and those impacts could be significant. Mitigation measure MM 3.3.9, as amended above, outlines the process for surveying for bats during the appropriate time relative to mining or reclamation operations and for protecting roosting bats and maternity colonies that may be present during active operations.

The information and recommendations provided by the commenter concerning special-status bat species do not alter the conclusions of the Draft EIR. Revisions to mitigation measure MM 3.3.9 clarify the mitigation actions but are not "significant new information," as no new or more severe special-status bats impacts have been identified that would require recirculating the Draft EIR (see Response 1-2 regarding recirculation).

Response 1-8: While a significant number of special-status species are known to occur in the vicinity of the PSA, the majority of the PSA has already been disturbed by previous and ongoing mining operations; therefore, the ecological value provided by the site is marginal at best. Furthermore, the proposed expansion activities are anticipated to have a less than significant impact of habitats regionally (see **Table 2.0-1** provided under Response C-7).

The Draft EIR analyzed impacts on 37 special-status plant species (see Response 1-3) and eight special-status wildlife species, as well as mule deer and bighorn sheep, and provided mitigation as appropriate to offset any potentially significant impacts on these species. Potential impacts on four additional species—mountain lion, gray fox, bobcat, and ringtail cat—are provided under Response C-7; please refer to that response for additional analyses for impacts to these species. As a result, the Draft EIR together with the responses provided in this Final EIR adequately address impacts on rare species and provide fully enforceable and feasible avoidance, minimization, and mitigation.

Impacts on desert bighorn sheep are adequately addressed in the Draft EIR on pages 3.3-46, 3.3-70, and 3.3-71. Additional analysis for this species is also provided in Response C-5.

The Draft EIR acknowledged the potential for golden eagles to be impacted by project-related activities and analyzed impacts on this species. Additionally, reconnaissance-level surveys are sufficient for evaluating impacts and developing mitigation measures. Mitigation measure MM 3.3.7b provided under Response C-6 will ensure that project-related activities do not result in adverse impacts on nesting golden eagles or other raptor species. The requirement for surveys under MM 3.3.7b will result in the identification of active nest sites and the avoidance of these sites; therefore, take of golden eagles is not anticipated and a permit would not be required. Implementation of mitigation measure MM 3.3.7b does not eliminate the need to comply with the Bald and Golden Eagle Protection Act in the event take is anticipated.

As stated previously, multiple reconnaissance-level biological surveys have been conducted in the PSA to date. The data obtained from these surveys is sufficient to analyze impacts on special-status species and to develop mitigation measures.

Habitat acquisition is not proposed as a compensatory mitigation measure.

The information, general observations, and recommendations provided by the commenter concerning other rare species noted in this comment do not alter the conclusions of the Draft EIR. See Response 1-2 regarding recirculation.

Response 1-9: Impacts on waters of the State were evaluated in the Draft EIR in Impact 3.3.11 (pages 3.3-73 and -74). Mitigation measure MM 3.3.11 provides a no-net-loss mitigation strategy for the on-site drainages/wetlands. As discussed on pages 3.3-11 and 3.3-74 in the Draft EIR, the drainages located within the PSA are in a closed watershed and are therefore not considered waters of the United States.

Waters of the United States or of the State of California are described starting on page 3.3-11 in the Draft EIR. As discussed on this page, a jurisdictional delineation was performed by Tetra Tech (2013) within the proposed White Knob quarry boundary. Based on the data presented in this report, approximately 7,200 linear feet of ephemeral dry wash and 0.2 acre of desert riparian habitats occur within the PSA. The amount and location of jurisdictional features that have the potential to be affected by the proposed haul road improvements have not been formally delineated to date; however, data obtained from the CDFW indicates that at least 10 ephemeral dry washes intersect the haul road. Under Section 401 of the Clean Water Act (CWA) and the Porter-Cologne Water Quality Act, the Colorado River Regional Water Quality Control Board (RWQCB) asserts jurisdiction over jurisdictional wetlands and those non-isolated waters associated with traditional navigable waters. Because the on-site drainages do not connect to the Mojave River, they are not subject to regulatory authority by the Colorado River RWQCB under Clean Water Act Section 401. The desert riparian wetland associated with Drainage C meets the three-point federal criteria as a wetland and therefore may be subject to regulatory authority by the Colorado River RWQCB under the Porter-Cologne Act.

Page 3.3-53 in the Draft EIR describes the Colorado River RWQCB's responsibility for enforcing water quality criteria and protecting water resources in the project area. In addition, the RWQCB is responsible for controlling discharges to surface waters of the state by issuing waste discharge requirements (WDR) or commonly by issuing conditional waivers to WDRs. The RWQCB requires that a project proponent obtain a CWA Section 401 water quality certification for CWA Section 404 permits issued by the U.S. Army Corps of Engineers (USACE). A request for water quality certification (including WDRs) by the RWQCB and an application for a General Permit for Storm Water Discharges Associated with Construction Activities are prepared and submitted following completion of the CEQA environmental document and submittal of the wetland delineation to the USACE.

Impact 3.2.11 discusses impacts on riparian habitat. Implementation of project activities may result in adverse impacts on riparian and aquatic communities should they be present in areas proposed for disturbance. Based on the data provided in the jurisdictional delineation report provided by Tetra Tech (2013), 0.003 acre of wetland and 6,469 linear feet

(1.355 acre) of jurisdictional drainage occur within the limits of planned disturbance and therefore have the potential to be impacted by project-related activities. In addition, 10 ephemeral dry washes were identified on the CDFW California Streams data layer as intersecting the haul road; however, this number may increase once a formal field delineation is completed. In any event, the repairs and remediation to control runoff and sedimentation along the haul road required in the BLM/CDFW 2011 Settlement Agreement have the potential to impact riparian habitat. The Draft EIR provides mitigation measure MM 3.3.11, which requires no net loss of riparian vegetation.

Finally, Impact 3.3.12 discusses the potential impacts on federally protected wetlands. The biological analysis determined that the approved jurisdictional determination (AJD) for the Marathon Solar Project concluded that the on-site drainages are isolated and are not subject to USACE regulation under Clean Water Act Section 404. The Marathon Solar Project AJD indicates that Rabbit Lake and Lucerne Lake are part of the same depositional environment and are both located in the Lucerne Valley Groundwater Basin Este Subarea. Based on the approved jurisdictional determination issued for the solar project that shares the same watershed as the PSA drainages, it is likely that jurisdictional drainages within the PSA are isolated and not subject to USACE jurisdiction. As a result, the project is anticipated to have no impact on federally protected wetlands.

Based on the information provided in the Draft EIR and discussed above, impacts on the waters of the United States and of the State are adequately discussed in the Draft EIR. No further revision to the EIR regarding impacts on the waters of the United States and of the State are necessary. See Response 1-2 regarding recirculation.

Response 1-10

The Draft EIR evaluated air quality emissions impacts in Impact 3.2.1, and Impact 3.2.3 addressed consistency with the Federal Land Managers' Air Quality Related Values. These impacts considered ozone, PM_{10}, and $PM_{2.5}$ emissions.

Ozone (O_3), or smog, is one of a number of substances called photochemical oxidants that are formed when reactive organic gases (ROG) and nitrogen oxides (NO_X) react with sunlight. Particulate matter (PM) is a mixture of pollutants in liquid and solid forms. Primary particulates are emitted directly by emission sources, whereas secondary particulates are formed through atmospheric reaction of gases. As stated in Impact 3.2.1 in the Draft EIR, the only air emission threshold that was surpassed by the proposed project was PM_{10}. As such, mitigation measures were provided in the Draft EIR to reduce this impact to a less than significant level as required. Project ROG, NOx, nor $PM_{2.5}$ emissions do not exceed the significance thresholds. Mitigation of air emissions that do not surpass the significance thresholds is not required. Therefore, no strategies to reduce ozone or $PM_{2.5}$ emissions are required for the proposed project.

Watering the unpaved road and graded areas and the use of dust palliatives is a commonly used practice to reduce PM_{10} emissions and is

considered acceptable by the Mojave Desert Air Quality Management District, as stated in their comment letter (Response A-2). Further, the project currently waters the road and uses palliatives to control the dust coming from the project site, and has done so for many years. Water quality control features are already incorporated into the project drainage system.

The County has considered the commenter's suggestion to pave the haul road. The road currently exists, so there would be no construction-related air emissions; however, this would not be the case with paving the road. Paving roads would add additional emissions during construction, require more intensive reclamation (pavement would have to be removed) which would also increase the amount of air emissions, and would be in constant need of repair given the size of trucks and equipment used at the quarry.

While the Draft EIR does consider existing conditions for the purpose of determining whether impacts would be significant, the Draft EIR is not required to evaluate the environmental impacts of existing dust control measures for purposes of determining whether mitigation is needed. Further, it should be noted that the Draft EIR evaluated potential impacts of changes in drainage patterns resulting from project implementation (including possible runoff from dust control activities such as watering or use of dust palliatives) in Impact 3.7.1 in Section 3.7, Hydrology and Water Quality. Mitigation measures were identified to ensure mining and reclamation would not result in substantial erosion, siltation, or other water quality impacts. This would reduce the likelihood for project impacts on adjacent wildlands and wildlife. Impact 3.3.11 in Section 3.3, Biological Resources, evaluated project impacts (expansion and operation including dust control) on riparian and aquatic communities, and identified mitigation to reduce impacts to less than significant levels.

Response 1-11: CEQA Guidelines Section 15130 requires that EIRs include an analysis of the cumulative impacts of a project when the project's effect is considered cumulatively considerable. Each technical section in the Draft EIR considers whether the project's effect on anticipated cumulative setting conditions is cumulatively considerable (i.e., a significant effect). "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects (CEQA Guidelines Section 15065(a)(3)).

Section 4.0 in the Draft EIR includes a description of the cumulative setting's geographic extent based on the characteristics of the environmental issue under consideration as set forth in Section 15130(b) of the CEQA Guidelines. The geographic scope of area and time horizon considered for each cumulative impact evaluated in the EIR is dictated by the specific type and nature of the impact being considered. In addition, Section 15130(b) identifies the following elements as necessary for an adequate cumulative impact analysis:

1) Either:

(A) A list of past, present, and probable future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the agency; or,

(B) A summary of projections contained in an adopted general plan or related planning document, or in a prior environmental document which has been adopted or certified, which described or evaluated regional or area-wide conditions contributing to the cumulative impact. Any such planning document shall be referenced and made available to the public at a location specified by the lead agency.

Both of these elements were used in the Draft EIR. The general cumulative setting conditions are based on:

- General Plans. These are the existing land use plans that provide general growth patterns in the region, consisting of unincorporated San Bernardino County and the cities of San Bernardino, Victorville, Apple Valley, Hesperia, Big Bear Lake, Lake Arrowhead, Crestline, and Running Springs.

- Large-Scale Surface Mining Projects. This includes current large-scale proposed and approved surface mining projects in San Bernardino County Supervisorial District 1, which encompasses the project site. The Draft EIR includes a list of 30 projects similar to the proposed project in the area in Table 3.0-1.

The commenter does not identify which specific industrial projects or military expansion projects should be included as a part of the cumulative analysis. The BLM's Desert Renewable Energy Conservation Plan (draft available September 2014) has not yet been adopted. The project site is not located within the BLM's West Mojave Plan, as this plan only applies to public lands. At this time, the Carbonate Habitat Management Strategy (CHMS) is the only adopted conservation plan to which the proposed project would be subject. This plan was described in Draft EIR Section 3.3, Biological Resources.

As previously stated, the Draft EIR included a list of 30 projects similar to the proposed project in the area as well as area general plans. As such, the projects are considered adequate for the Draft EIR's cumulative analysis. No revision to the EIR is necessary regarding this comment.

REFERENCES

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3.0 REVISIONS TO THE DRAFT EIR

3.1 INTRODUCTION

This section identifies revisions to the Draft EIR. These modifications are minor and are the result of response to comments received during the Draft EIR public review period as well as staff-initiated changes.

Revisions herein do not result in new significant environmental impacts and do not constitute significant new information, nor do they alter the conclusions of the environmental analysis. Changes are provided in revision marks (underline for new text and ~~strikeout~~ for deleted text).

3.2 CHANGES AND EDITS TO THE DRAFT EIR

EXECUTIVE SUMMARY

Table ES-1 is revised as follows:

Impact 3.3.2 Special-Status Plant Species	Potentially significant	**MM 3.3.2 ~~Rare Plant Surveys~~ Carbonate Habitat Management Strategy (CHMS) Consistency.** Prior to initiating project-related activities in undisturbed portions of the site, the mine operator shall ~~retain a qualified biologist to perform focused surveys to determine the presence/absence of special-status plant species with potential to occur in and adjacent to (within 25 feet, where appropriate) the proposed impact area. Species intended to be addressed by this mitigation measure include all species not covered by the CHMS and for which a "may affect" determination was made in Table 3.3-1.~~complete land dedication or claim relinquishments to offset project impacts on listed threatened or endangered plants at a 3:1 ratio, consistent with the requirements of the CHMS, and provide documentation of the completed transaction to the County. The 3:1 ratio will apply to total number of conservation units (CUs) (calculated by San Bernardino County National Forest [SBNF] staff according to the provisions of the CHMS) and total occupied habitat, in acres or fractions of acres, for each listed species. This mitigation measure consists of four parts: (1) field surveys to determine conservation value of proposed disturbance areas; (2) comparable field surveys to verify conservation value of mining claims to be relinquished; (3) administrative requirements to complete the land dedication or claim relinquishments (which may include mineral withdrawal); and (4) protection measures for special-status plants located adjacent to project disturbance areas that are not planned to be removed. (1) Project Area Field Surveys and Conservation Value Calculation. The mine operator shall retain a qualified biologist to perform focused surveys to determine the	Less than significant

		presence/ or absence of special-status plant species identified in Table 3.3-1 and within 100 feet of the proposed impact area. For listed threatened or endangered plants, the extent of occupied habitat shall be mapped and quantified. For any other special-status plants located in the project area, the biologist shall collect global positioning system (GPS) coordinates of occurrences and qualitative estimates of their abundance. These surveys shall be conducted in accordance with the CDFW (2009) *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities*. These guidelines require that rare plant surveys be "floristic in nature," conducted by field botanists familiar with the regional flora, and conducted at the proper time of year when rare or endangered species are both evident and identifiable. Field surveys shall be scheduled to coincide with known flowering periods and/or during appropriate developmental periods that are necessary to identify the plant species of concern. Field survey results and mapping data shall be provided to the County and the SBNF for inclusion in the CHMS GIS data and calculation of total CHMS conservation value of the proposed project area. (2) Mitigation Lands Field Surveys and Conservation Value Calculation. The mine operator shall identify one or more parcels of land or mining claims suitable for relinquishment and shall retain a qualified biologist to perform focused botanical surveys of those lands. Survey methods and data collection shall be as described above for project site field surveys. Field survey results and mapping data shall be provided to the San Bernardino National Forest for inclusion in the CHMS GIS data and calculation of total CHMS conservation value of the proposed project area. (3) Land Dedication or Claim Relinquishment. The mining operator shall specify lands or mining claims whose conservation values and habitat area occupied by listed species total no less than three times the total conservation value of the project area and roughly three times the occupied habitat for each affected listed species. The mining operator shall dedicate the lands or relinquish those claims according to the terms of the CHMS and the MOU. The	

		operator shall provide written documentation of the land dedication or claim relinquishment to the County upon completion. (4) Protect Special-Status Plant Locations Adjacent to Project Site. Any special-status plant species that are identified within 100 feet of the proposed impact area, but not proposed to be disturbed by the project, shall be protected by barrier fencing to ensure that construction activities and material stockpiles do not impact any special-status plant species. These avoidance areas shall be identified on project plans. ~~These surveys shall be conducted in accordance with the CDFW Guidelines for Assessing Effects of Proposed Developments on Rare Plants and Plant Communities (Nelson 1994). These guidelines require that rare plant surveys be conducted at the proper time of year when rare or endangered species are both evident and identifiable. Field surveys shall be scheduled to coincide with known flowering periods and/or during appropriate developmental periods that are necessary to identify the plant species of concern.~~ ~~If any state or federally listed, CNPS List 1, or CNPS List 2 plant species are found in or adjacent to (within 25 feet) the proposed impact area during the surveys, these plant species shall be avoided to the extent feasible and the following mitigation measures shall be implemented:~~ ~~(1) In some cases involving state listed plants, it may be necessary to obtain an incidental take permit under Section 2081 of the Fish and Game Code (2081 permit). The mine operator shall consult with the CDFW to determine whether a 2081 permit is required and obtain all required authorizations prior to initiation of ground-breaking activities.~~ ~~(2) Before the approval of grading plans or any ground breaking activity within the PSA, the mine operator shall submit a mitigation plan concurrently to the CDFW and the USFWS (if appropriate) for review and comment. The plan shall include mitigation measures for the population(s) to be directly affected. Possible mitigation for impacts to special status plant species can include implementation of a program to transplant, salvage, cultivate, or re-establish the species at suitable sites (if feasible) or through the purchase of credits from an approved mitigation bank, if available. The actual level of mitigation may vary depending on~~	

		~~the sensitivity of the species, its prevalence in the area, and the current state of knowledge about overall population trends and threats to its survival. The final mitigation strategy for directly impacted plant species shall be determined by the CDFW and the USFWS (if appropriate) through the mitigation plan approval process.~~ (3) ~~Any special-status plant species that are identified adjacent to the PSA, but not proposed to be disturbed by the project, shall be protected by barrier fencing to ensure that construction activities and material stockpiles do not impact any special-status plant species. These avoidance areas shall be identified on project plans.~~	
Impact 3.3.3 Desert Tortoise	Potentially signifcant	**MM 3.3.3b Desert Tortoise Avoidance, Minimization, and Mitigation.** Should occupied desert tortoise habitat be identified during the pre-project surveys, a habitat ~~biological~~ mitigation and monitoring plan and raven control plan shall be developed in consultation with the USFWS and the CDFW. This plan shall describe all measures to be implemented prior to, during, and after construction, including, but not limited to, the following: (1) All tortoise burrows shall be avoided to the greatest extent feasible, and temporary exclusionary tortoise fencing (1x2-inch mesh hardware cloth) shall be installed at the limits of disturbance prior to initiation of construction activities. Fence installation and ongoing oversight of the need for maintenance shall be monitored by a USFWS-authorized desert tortoise biologist. (2) Upon completion of fence installation, the authorized biologist shall conduct a clearance survey of the fenced area prior to declaring the construction area free of tortoises. (3) If it is necessary to excavate a desert tortoise from its burrow to move it out of harm's way, excavation shall be done with hand tools, either by or under the direct supervision of the authorized biologist. (4) Desert tortoises removed from burrows shall be placed in an unoccupied burrow of approximately the same size as the one from which they were removed. If an existing burrow is not available, the authorized biologist shall construct one. (5) Desert tortoises moved during inactive periods will be monitored for at least two days after relocation or the end of	Less than significant

		construction, whichever occurs first. (6) If desert tortoises need to be moved at a time of day when ambient temperatures could harm them (less than 40 degrees and over 90 degrees Fahrenheit), they shall be held overnight in a clean cardboard box and released the following day during more favorable temperatures. Cardboard boxes used to hold tortoises shall only be used once. (7) All handling of desert tortoises shall be performed consistent with the *Guidelines for Handling Desert Tortoises During Construction Projects* (Desert Tortoise Council 1994). (8) The mine operator shall mitigate for impacts on occupied desert tortoise habitat at a 1:1 ratio through the purchase of credits from an approved desert tortoise mitigation bank. The amount of credits purchased and the location of the mitigation bank used ~~shall be established through consultation with and~~ are subject to approval by the USFWS and the CDFW. The mine operator shall provide the County with evidence that the permit and/or other requirements established by either agency have been satisfactorily met.	
Impact 3.3.6 Le Conte's Thrasher and other Migratory Birds	Potentially significant	**MM 3.3.6 Migratory Bird Surveys.** If clearing and/or construction activities will occur in undisturbed portions of the site, or blasting activities will occur in any portion of the project site, during the migratory bird nesting season (March 15–August 15), preconstruction surveys to identify active migratory bird nests shall be conducted by a qualified biologist within 14 days of ~~construction~~ initiation of project activities. Focused surveys must be performed by a qualified biologist for the purposes of determining the presence/absence of active nest sites within the proposed impact area and a 200-foot buffer (if feasible). Surveys shall be repeated if project activities are delayed or postponed for more than 30 days. If active nest sites are identified within 200 feet of project activities, the mine operator shall impose a limited operating period (LOP) for all active nest sites prior to commencement of any project ~~construction~~ activities to avoid construction or project-related disturbances to migratory bird nesting activities. An LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, blasting, and construction) will not occur and will be imposed within 100 feet of any active nest sites until the nest is deemed inactive. Activities permitted within and the size	Less than significant

		(i.e., 100 feet) of LOPs may be adjusted through consultation with the CDFW and~~/or~~ the County. When an active nest is located within 200 feet of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to the CDWF and County until the nest(s) are deemed inactive.	
Impact 3.3.7 Golden Eagle and Other Raptors	Potentially significant	**MM 3.3.7a Raptor Conservation Strategy.** The applicant shall participate in and implement the Raptor Conservation Strategy. **MM 3.3.7b Raptor Surveys.** If clearing and/or construction activities would occur in undisturbed portions of the site, or blasting activities will occur in any portion of the project site, during the raptor nesting season (January 15–August 15), preconstruction surveys to identify active raptor nests shall be conducted by a qualified biologist within 14 days of construction initiation. Focused surveys must be performed by a qualified biologist for the purposes of determining presence/absence of active nest sites within the proposed impact area. If no active nests are found, no further mitigation is required. Surveys shall be repeated if project activities are delayed or postponed for more than 30 days. If active golden eagle or other raptor nest sites are identified within a half mile of project activities, the applicant shall impose a limited operating period (LOP) for all active nest sites prior to commencement of any project activities to avoid construction- or project-related disturbances to nesting raptors. An LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, blasting, and construction) will not occur and shall be imposed within 500 feet of any active nest sites until the nest is deemed inactive. Activities permitted within LOPs and the size (i.e., 500 feet) of LOPs may be adjusted through consultation with the CDFW and the County. When an active nest is located within a half mile of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast	Less than significant

		mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to CDFW and the County until the nest(s) are deemed inactive.	
Impact 3.3.9 Special-Status Bats	Potentially significant	**MM 3.3.9 Bat Surveys.** Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine whether potential roosting sites for special-status bats may be affected. If potential roost sites are identified, a preconstruction survey by a qualified biologist shall be conducted ~~prior to the end of April~~ between March 1 and July 31 to determine the presence or absence of roosting bats. If the survey does not identify the presence of occupied roosts, no further mitigation is required. If ~~day roosts or maternity roosts~~ non-breeding roosts occupied by special-status bat species are documented within construction areas, the bats shall be safely flushed from the sites where roosting habitat is planned to be removed prior to May of each construction phase ~~(maternity roosts are generally occupied from May to August)~~ and prior to the onset of construction activities. The removal of the roosting sites shall occur during the time of day when the roost is unoccupied. If a maternity colony is detected, a 100-foot construction-free buffer shall be established around the roost site and remain in place until it has been determined by a qualified biologist that the nursery is no longer active. Removal of maternity roosts shall be restricted to between March 1 and April 15 or August 15 and October 15 to avoid interfering with an active nursery. The loss of each roost will be compensated for by the construction and installation of two bat boxes suitable to the bat species and colony size excluded from the original roosting site. The bat boxes shall be installed in the vicinity prior to removal of the original non-breeding/maternity roost sites. A detailed program for bat flushing, roosting site removal, and installation of bat boxes shall be developed in consultation with a qualified biologist.	Less than significant
Impact 3.3.11 Impacts on Riparian Habitat or Sensitive Natural Communities	Potentially significant	**MM 3.3.11a No Net Loss of Riparian Vegetation.** The mine operator shall ensure there is no net loss of riparian vegetation. Mitigation can include on-site restoration or purchase of mitigation credits at a USACE-approved mitigation bank, placing a conservation easement over a riparian area, or quit claiming mineral claims over a riparian area. Mitigation, as required in regulatory	Less than significant

		permits issued through the CDFW, the USACE, or the RWQCB, may be applied to satisfy this measure. Evidence of compliance with this mitigation measure shall be provided prior to construction and grading activities for the proposed project. **MM 3.3.11b Oak Woodlands.** The mine operator shall ensure there is no net loss of oak woodland habitat. Mitigation can include any one or combination of the following: (1) Preservation of existing oak woodlands by recording a conservation easement(s) in favor of the County or an approved organization or agency. (2) Replacement or restoration of former oak woodlands. The County may require the planting and maintenance of replacement trees, including replacing dead or diseased trees. The replacement ratio and tree sizes shall be based on the recommendation of an Oak Reforestation Program prepared by a registered professional forester. The requirement to maintain trees in compliance with this paragraph shall terminate seven years after the trees are planted. (3) Contribution of in-lieu mitigation fees to the Oak Woodlands Conservation Fund, established under Fish and Game Code Section 1363 for the purpose of purchasing oak woodlands conservation easements. A project applicant who contributes funds in compliance with this subsection shall not receive or use a grant from the Oak Woodlands Conservation Fund as part of the mitigation for the project. The in-lieu fee for replacement trees shall be calculated based on their equivalent value as established by the International Society of Arboriculture's current edition of the *Guide for Plant Appraisal*. (4) Performing other mitigation measures as may be required by the County (e.g., inch-for-inch off-site replacement planting, transfer of development rights, enrollment of project with offset provider for carbon credits in greenhouse gas emission registry, carbon reduction, and carbon trading system).	

SECTION 2.0 PROJECT DESCRIPTION

Page 2.0-16 is revised as follows:

Figures 2.0-4a, 2.0-4b and **2.0-4c** illustrate a change in the Amended Mine Plan map. These changes increase the bench width and somewhat the locations of the benches. The also increased the height of the cut slopes. However, these changes do not affect the environmental analysis.

(See Figures 2.0-4a, 2.0-4b, and 2.0-4c located on pages 3.0-19 through -23 of this FEIR for the figure additions.)

SECTION 3.4 BIOLOGICAL RESOURCES

Page 3.3-59 is revised as follows:

MM 3.3.2 ~~**Rare Plant Surveys**~~ **Carbonate Habitat Management Strategy (CHMS) Consistency.** Prior to initiating project-related activities in undisturbed portions of the site, the mine operator shall ~~retain a qualified biologist to perform focused surveys to determine the presence/absence of special status plant species with potential to occur in and adjacent to (within 25 feet, where appropriate) the proposed impact area. Species intended to be addressed by this mitigation measure include all species not covered by the CHMS and for which a "may affect" determination was made in Table 3.3-1.~~complete land dedication or claim relinquishments to offset project impacts on listed threatened or endangered plants at a 3:1 ratio, consistent with the requirements of the CHMS, and provide documentation of the completed transaction to the County. The 3:1 ratio will apply to the total number of conservation units (CUs) (calculated by San Bernardino National Forest [SBNF] staff according to the provisions of the CHMS) and total occupied habitat, in acres or fractions of acres, for each listed species. This mitigation measure consists of four parts: (1) field surveys to determine conservation value of proposed disturbance areas; (2) comparable field surveys to verify conservation value of mining claims to be relinquished; (3) administrative requirements to complete the land dedication or claim relinquishments (which may include mineral withdrawal); and (4) protection measures for special-status plants located adjacent to project disturbance areas that are not planned to be removed.

(1) Project Area Field Surveys and Conservation Value Calculation. The mine operator shall retain a qualified biologist to perform focused surveys to determine the presence~~/~~ or absence of special-status plant species identified in Table 3.3-1 and within 100 feet of the proposed impact area. For listed threatened or endangered plants, the extent of occupied habitat shall be mapped and quantified. For any other special-status plants located in the project area, the biologist shall collect global positioning system (GPS) coordinates of occurrences and qualitative estimates of their abundance.

These surveys shall be conducted in accordance with the CDFW (2009) *Protocols for Surveying and Evaluating Impacts to Special Status Native*

Plant Populations and Natural Communities. These guidelines require that rare plant surveys be "floristic in nature," conducted by field botanists familiar with the regional flora, and conducted at the proper time of year when rare or endangered species are both evident and identifiable. Field surveys shall be scheduled to coincide with known flowering periods and/or during appropriate developmental periods that are necessary to identify the plant species of concern.

Field survey results and mapping data shall be provided to the County and the SBNF for inclusion in the CHMS GIS data and calculation of total CHMS conservation value of the proposed project area.

(2) Mitigation Lands Field Surveys and Conservation Value Calculation. The mine operator shall identify one or more parcels of land or mining claims suitable for relinquishment and shall retain a qualified biologist to perform focused botanical surveys of those lands. Survey methods and data collection shall be as described above for project site field surveys. Field survey results and mapping data shall be provided to the San Bernardino National Forest for inclusion in the CHMS GIS data and calculation of total CHMS conservation value of the proposed project area.

(3) Land Dedication or Claim Relinquishment. The mining operator shall specify lands or mining claims whose conservation values and habitat area occupied by listed species total no less than three times the total conservation value of the project area and roughly three times the occupied habitat for each affected listed species. The mining operator shall dedicate the lands or relinquish those claims according to the terms of the CHMS and the MOU. The operator shall provide written documentation of the land dedication or claim relinquishment to the County upon completion.

(4) Protect Special-Status Plant Locations Adjacent to Project Site. Any special-status plant species that are identified within 100 feet of the proposed impact area, but not proposed to be disturbed by the project, shall be protected by barrier fencing to ensure that construction activities and material stockpiles do not impact any special-status plant species. These avoidance areas shall be identified on project plans.

~~These surveys shall be conducted in accordance with the CDFW Guidelines for Assessing Effects of Proposed Developments on Rare Plants and Plant Communities (Nelson 1994). These guidelines require that rare plant surveys be conducted at the proper time of year when rare or endangered species are both evident and identifiable. Field surveys shall be scheduled to coincide with known flowering periods and/or during appropriate developmental periods that are necessary to identify the plant species of concern.~~

~~If any state- or federally listed, CNPS List 1, or CNPS List 2 plant species are found in or adjacent to (within 25 feet) the proposed impact area during the surveys, these plant species shall be avoided to the extent feasible and the following mitigation measures shall be implemented:~~

~~(1) In some cases involving state-listed plants, it may be necessary to obtain an incidental take permit under Section 2081 of the Fish and Game Code (2081 permit). The mine operator shall consult with the CDFW to determine whether a 2081 permit is required and obtain all required authorizations prior to initiation of ground-breaking activities.~~

~~(2) Before the approval of grading plans or any ground-breaking activity within the PSA, the mine operator shall submit a mitigation plan concurrently to the CDFW and the USFWS (if appropriate) for review and comment. The plan shall include mitigation measures for the population(s) to be directly affected. Possible mitigation for impacts to special-status plant species can include implementation of a program to transplant, salvage, cultivate, or re-establish the species at suitable sites (if feasible) or through the purchase of credits from an approved mitigation bank, if available. The actual level of mitigation may vary depending on the sensitivity of the species, its prevalence in the area, and the current state of knowledge about overall population trends and threats to its survival. The final mitigation strategy for directly impacted plant species shall be determined by the CDFW and the USFWS (if appropriate) through the mitigation plan approval process.~~

~~(3) Any special-status plant species that are identified adjacent to the PSA, but not proposed to be disturbed by the project, shall be protected by barrier fencing to ensure that construction activities and material stockpiles do not impact any special-status plant species. These avoidance areas shall be identified on project plans.~~

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Page 3.3-60 is revised as follows:

Previous surveys did not detect desert tortoises or tortoise sign (burrows, scat, carcasses, etc.) on or adjacent to the PSA. In addition, the closest documented occurrence in the region is approximately 7 miles north of the PSA. Figure 3.3-7 shows desert tortoise habitat suitability areas and maxent model scores indicating areas of low to high suitability. The project site is in an area with low suitability. Nonetheless, suitable habitat exists for this species within the PSA; therefore, this species could potentially inhabit the site, which would result in adverse impacts on desert tortoises should they be present in areas proposed for disturbance. The impact is considered potentially significant.

MM 3.3.3b **Desert Tortoise Avoidance, Minimization, and Mitigation.** Should occupied desert tortoise habitat be identified during the pre-project surveys, a habitat ~~biological~~ mitigation and monitoring plan and raven control plan shall be developed in consultation with the USFWS and the CDFW. This plan shall describe all measures to be implemented prior to, during, and after construction, including, but not limited to, the following:

(1) All tortoise burrows shall be avoided to the greatest extent feasible, and temporary exclusionary tortoise fencing (1x2-inch mesh hardware cloth) shall be installed at the limits of disturbance prior to initiation of construction activities. Fence installation and ongoing oversight of the need for maintenance shall be monitored by a USFWS-authorized desert tortoise biologist.

(2) Upon completion of fence installation, the authorized biologist shall conduct a clearance survey of the fenced area prior to declaring the construction area free of tortoises.

(3) If it is necessary to excavate a desert tortoise from its burrow to move it out of harm's way, excavation shall be done with hand tools, either by or under the direct supervision of the authorized biologist.

(4) Desert tortoises removed from burrows shall be placed in an unoccupied burrow of approximately the same size as the one from which they were removed. If an existing burrow is not available, the authorized biologist shall construct one.

(5) Desert tortoises moved during inactive periods will be monitored for at least two days after relocation or the end of construction, whichever occurs first.

(6) If desert tortoises need to be moved at a time of day when ambient temperatures could harm them (less than 40 degrees and over 90 degrees Fahrenheit), they shall be held overnight in a clean cardboard box and released the following day during more favorable temperatures. Cardboard boxes used to hold tortoises shall only be used once.

(7) All handling of desert tortoises shall be performed consistent with the *Guidelines for Handling Desert Tortoises During Construction Projects* (Desert Tortoise Council 1994).

(8) The mine operator shall mitigate for impacts on occupied desert tortoise habitat at a 1:1 minimum ratio through the purchase of credits from an approved desert tortoise mitigation bank. The amount of credits purchased and the location of the mitigation bank used ~~shall be established through consultation with and~~ are subject to approval by the USFWS and the CDFW. The mine operator shall provide the County with evidence that the permit and/or other requirements established by either agency have been satisfactorily met.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

A new figure (Figure 3.3-7, Desert Tortoise Habitat Suitability) has been added to the Draft EIR following page 3.3-60. Figure 3.3-7 is provided at the end of this section.

Page 3.3-64 is revised as follows:

MM 3.3.6 **Migratory Bird Surveys.** If clearing and/or construction activities will occur in undisturbed portions of the site, or blasting activities will occur in any portion of the project site, during the migratory bird nesting season (March 15–August 15), preconstruction surveys to identify active migratory bird nests shall be conducted by a qualified biologist within 14 days of ~~construction~~ initiation of project activities. Focused surveys must be performed by a qualified biologist for the purposes of determining the presence/absence of active nest sites within the proposed impact area and a 200-foot buffer (if feasible). Surveys shall be repeated if project activities are delayed or postponed for more than 30 days.

If active nest sites are identified within 200 feet of project activities, the mine operator shall impose a limited operating period (LOP) for all active nest sites prior to commencement of any project ~~construction~~ activities to avoid construction or project-related disturbances to migratory bird nesting activities. An LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, blasting, and construction) will not occur and will be imposed within 100 feet of any active nest sites until the nest is deemed inactive. Activities permitted within and the size (i.e., 100 feet) of LOPs may be adjusted through consultation with the CDFW and~~/or~~ the County.

When an active nest is located within 200 feet of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to CDFW and the County until the nest(s) are deemed inactive.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Page 3.3-66 is revised as follows:

MM 3.3.7a **Raptor Conservation Strategy.** The applicant shall participate in and implement the Raptor Conservation Strategy.

MM 3.3.7b **Raptor Surveys.** If clearing and/or construction activities would occur in undisturbed portions of the site, or blasting activities will occur in any portion of the project site, during the raptor nesting season (January 15–August 15), preconstruction surveys to identify active raptor nests shall be conducted by a qualified biologist within 14 days of construction initiation. Focused surveys must be performed by a qualified biologist for the purposes of determining the presence/absence of active nest sites within the proposed impact area. If no active nests are found, no further mitigation is required. Surveys shall be

repeated if project activities are delayed or postponed for more than 30 days.

If active golden eagle or other raptor nest sites are identified within a half mile of project activities, the applicant shall impose a limited operating period (LOP) for all active nest sites prior to commencement of any project activities to avoid construction- or project-related disturbances to nesting raptors. An LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, blasting, and construction) will not occur and shall be imposed within 500 feet of any active nest sites until the nest is deemed inactive. Activities permitted within LOPs and the size (i.e., 500 feet) of LOPs may be adjusted through consultation with the CDFW and the County.

When an active nest is located within a half mile of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to CDWF and the County until the nest(s) are deemed inactive.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Page 3.3-68 is revised as follows:

MM 3.3.9 **Bat Surveys.** Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine whether potential roosting sites for special-status bats may be affected. If potential roost sites are identified, a preconstruction survey by a qualified biologist shall be conducted ~~prior to the end of April~~ between March 1 and July 31 to determine the presence or absence of roosting bats. If the survey does not identify the presence of occupied roosts, no further mitigation is required.

If ~~day roosts or maternity roosts~~ non-breeding roosts occupied by special-status bat species are documented within construction areas, the bats shall be safely flushed from the sites where roosting habitat is planned to be removed prior to May of each construction phase ~~(maternity roosts are generally occupied from May to August)~~ and prior to the onset of construction activities. The removal of the roosting sites shall occur during the time of day when the roost is unoccupied.

If a maternity colony is detected, a 100-foot construction-free buffer shall be established around the roost site and remain in place until it has been determined by a qualified biologist that the nursery is no longer active.

Removal of maternity roosts shall be restricted to between March 1 and April 15 or August 15 and October 15 to avoid interfering with an active nursery.

The loss of each roost will be compensated for by the construction and installation of two bat boxes suitable to the bat species and colony size excluded from the original roosting site. The bat boxes shall be installed in the vicinity prior to removal of the original non-breeding/maternity roost sites. A detailed program for bat flushing, roosting site removal, and installation of bat boxes shall be developed in consultation with a qualified biologist.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

Page 3.3-70 is revised as follows:

MM 3.3.11a **No Net Loss of Riparian Vegetation.** The mine operator shall ensure there is no net loss of riparian vegetation. Mitigation can include on-site restoration or purchase of mitigation credits at a USACE-approved mitigation bank, placing a conservation easement over a riparian area, or quit claiming mineral claims over a riparian area. Mitigation, as required in regulatory permits issued through the CDFW, the USACE, or the RWQCB, may be applied to satisfy this measure.

Evidence of compliance with this mitigation measure shall be provided prior to construction and grading activities for the proposed project.

Timing/Implementation: *Ongoing during quarry and reclamation activities*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

MM 3.3.11b **Oak Woodlands.** The mine operator shall ensure there is no net loss of oak woodland habitat. Mitigation can include any one or combination of the following:

(1) Preservation of existing oak woodlands by recording a conservation easement(s) in favor of the County or an approved organization or agency.

(2) Replacement or restoration of former oak woodlands. The County may require the planting and maintenance of replacement trees, including replacing dead or diseased trees. The replacement ratio and tree sizes shall be based on the recommendation of an Oak Reforestation Program prepared by a registered professional forester. The requirement to maintain trees in compliance with this paragraph shall terminate seven years after the trees are planted.

(3) Contribution of in-lieu mitigation fees to the Oak Woodlands Conservation Fund, established under Fish and Game Code Section 1363 for the purpose of purchasing oak woodlands conservation easements. A project applicant who contributes funds in compliance with this subsection shall not receive or use a grant from the Oak Woodlands Conservation Fund as part of the mitigation for the project. The in-lieu fee for replacement trees shall be calculated based on their equivalent value as established by the International Society of Arboriculture's current edition of the *Guide for Plant Appraisal*.

(4) Performing other mitigation measures as may be required by the County (e.g., inch-for-inch off-site replacement planting, transfer of development rights, enrollment of project with offset provider for carbon credits in greenhouse gas emission registry, carbon reduction, and carbon trading system).

Timing/Implementation: *Prior to impacting oak woodland habitat*

Enforcement/Monitoring: *San Bernardino County Land Use Services Department*

6.0 REFERENCES

Page 6.0-3 under Section 3.3, Biological Resources, is revised as follows:

Lilburn Corporation. 2012a. *Biological Resources Assessment for the Omya White Knob Quarry Haul Road Improvement Project.* San Bernardino, CA.

———. 2012b. *Focus Plant Survey for the Direct Land Sale Area Adjacent to the OMYA White Knob Quarry.* San Bernardino, CA.

———. 2012c. *Plants Report for the OMYA White Knob Quarry Haul Road Improvement Project*. San Bernardino, CA.

T:_GIS\San_Bernardino_County\MXD\WHite_Knob\Desert Tortoise Habitat.mxd (1/14/2015)

Legend

- Project Study Area
- Existing Haul Road

Maxent Model Score

- High : 1
- Low : 0

Source: DRECP (2014); Tetra Tech (2014); ESRI.

N

0 0.5 1

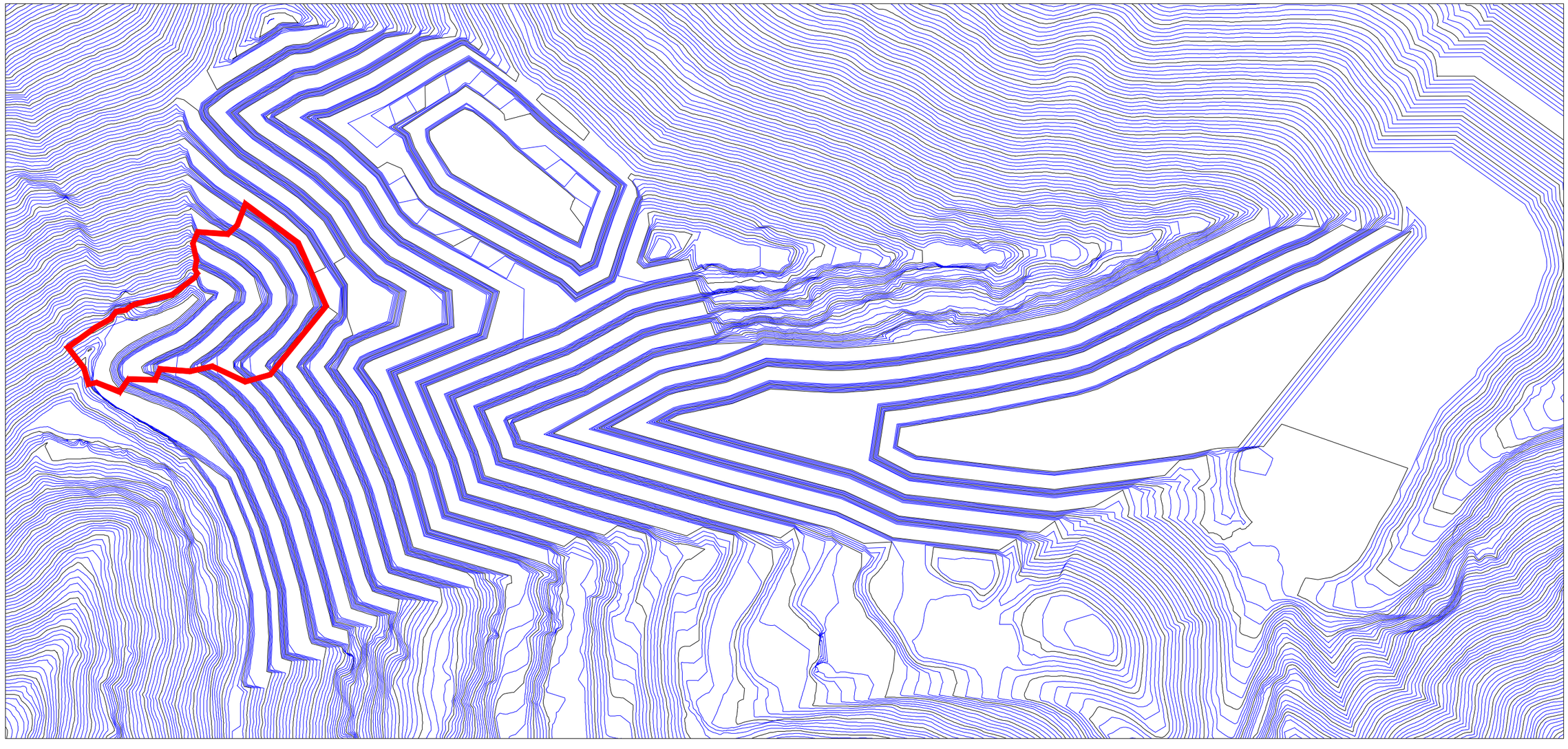
Miles

Figure 3.3-7
Desert Tortoise Habitat Suitability

PMC

T:_CS\Work\San Bernardino, County of\White Knob EIR\Figures

Mine Plan showing topography proposed in 2013 red outline indicates area where changes are needed.



Source: Omya

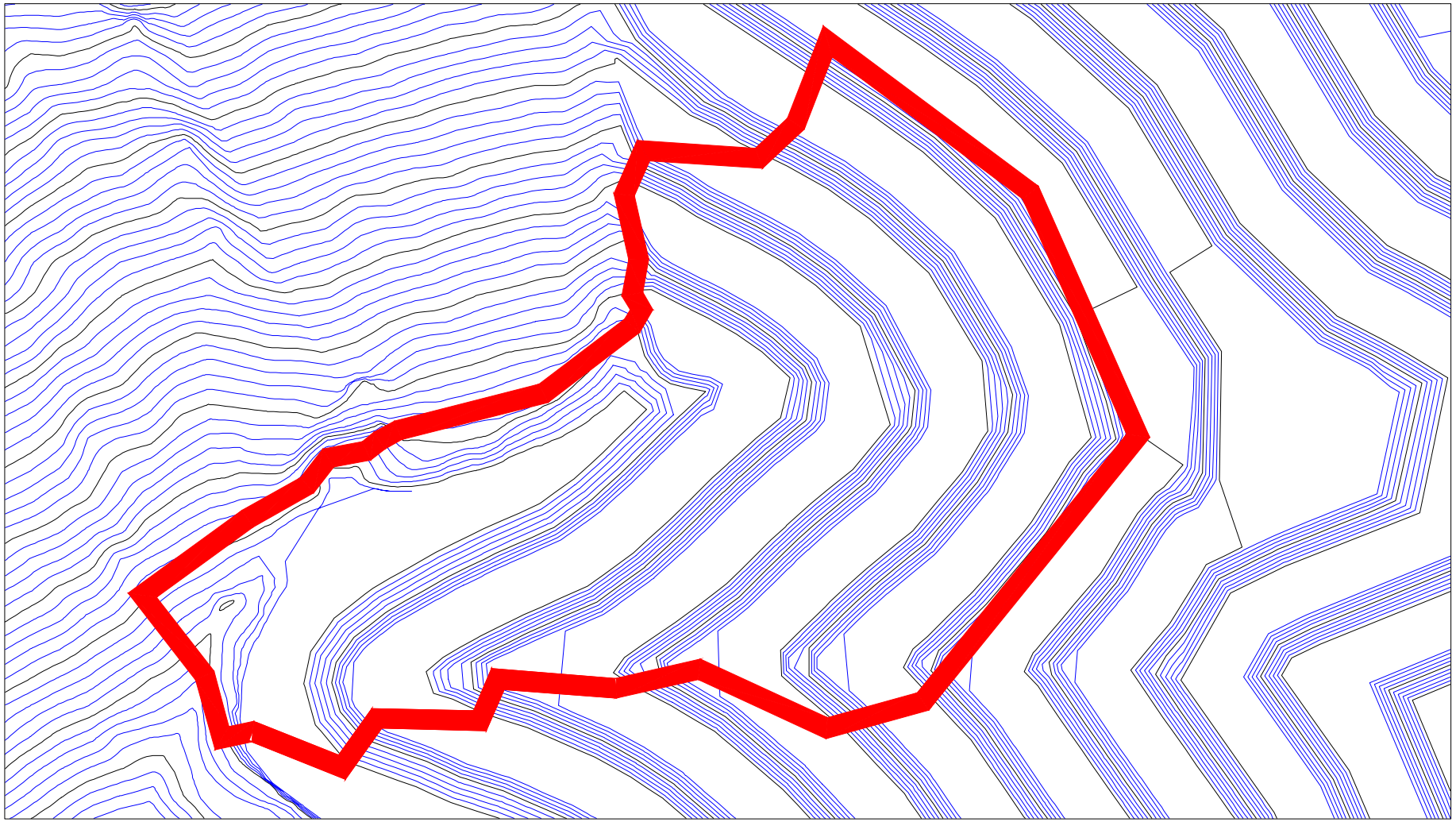
Not to scale

Figure 2.0-4a
Site Change Location

PMC®

T:\ CS \Work\ San Bernardino, County of \White Knob EIR \Figures

Mine Plan showing topography proposed in 2013 red outline indicates area where changes are needed.



Source: Omya

Not to scale

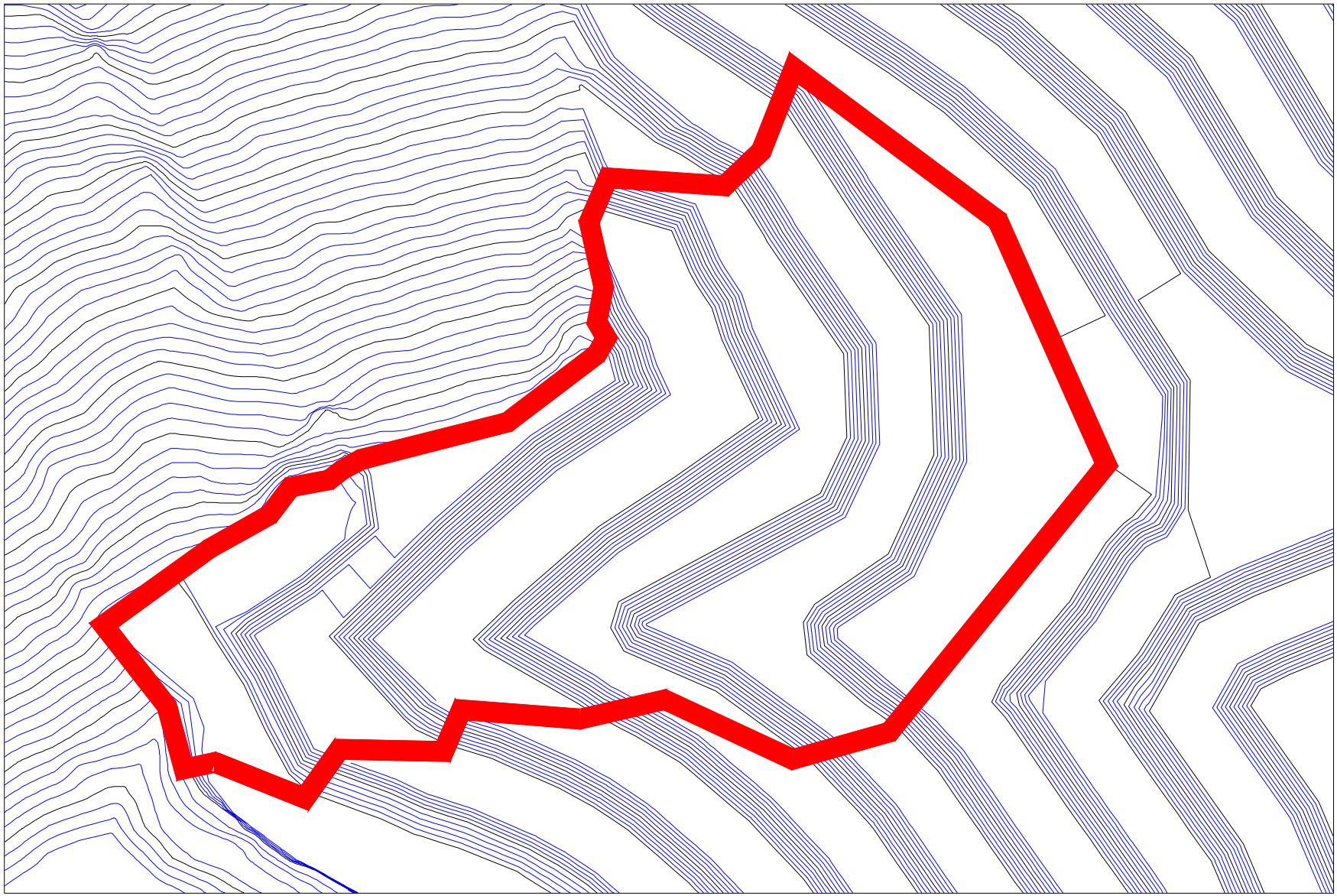
Figure 2.0-4b

2013 Original Site Area Configuration

PMC®

T:\ CS \Work\ San Bernardino, County of \White Knob EIR \Figures

Mine Plan showing topography proposed in 2013 outside red line and changes proposed July 2014 inside the red line.



Source: Omya

Figure 2.0-4c

Not to scale

2014 Site Area Change

PMC®

APPENDIX A

CHJ Consultants
1355 E. Cooley Drive, Suite C, Colton, CA 92324 ◆ Phone (909) 824-7311 ◆ Fax (909) 503-1136
15345 Anacapa Road, Suite D, Victorville, CA 92392 ◆ Phone (760) 243-0506 ◆ Fax (760) 243-1225
77-564A Country Club Drive, Suite 122, Palm Desert, CA 92211 ◆ Phone (760) 772-8234 ◆ Fax (909) 503-1136

August 23, 2013

Omya California
A Division of Omya, Incorporated
7225 Crystal Creek Road
Lucerne Valley, California 92356
Attention: Mr. James Rogers

Job No. 13502-8

Subject: Response to Comments
Slope Stability Investigation, Proposed Amended Plan of Operations
White Knob Quarry Mining and Reclamation Plan
Lucerne Valley, California
CHJ Consultants, Dated January 14, 2012

Dear Mr. Rogers:

In accordance with your request, we have prepared this response to comments by PMC, Incorporated and the State of California Office of Mine Reclamation (OMR) regarding our slope stability investigation report for White Knob/White Ridge quarries in Lucerne Valley, California. The slope stability report was prepared to address proposed amendments to reclamation plan slopes and quarry configurations. We appreciate the opportunity to receive comments and suggestions from reviewers.

This letter addresses the review comments provided in electronic mail attachments. The comments by PMC and OMR are presented in italics below, followed by our response.

Comments by PMC

The slope stability analysis was done for deep-seated landsliding and quarry slope rockwall planar and wedge failures. The mine plan calls for creation of three overburden storage areas (OB-1, OB-2, and OB-3) that will have final slopes with grades ranging from 1.5H:1V to 2H:1V. A fourth overburden storage area is at the bottom of the White Knob Quarry pit.

1 The report doesn't discuss the condition of the northwestern slope that in the past received overcast material or an analysis of that slope's long-term stability. It is recommended that additional discussion and analysis of the slope stability in this area be included. In addition, recommendations for minimizing future rockfalls and slope slips should be provided, as necessary.

The condition of the northwest slope, slope stability and rockfall calculations, and recommendations for minimizing rockfall and providing for long-term stability of the northwest slope area are discussed under separate cover in a report by CHJ dated November 21, 2012.

2 Stability analysis for the overburden fills assumed a maximum slope of 2H:1V. However, OB-2 shows slopes at 1.5H:1V. Additional stability analysis for this fill slope is needed.

Slope stability calculations along Section D-D' constructed through the OB-2 area and including saturation along the bedrock/fill contact are attached. The results are presented in Figures A-1.1 through A-1.3 and indicate suitable factors of safety for static and seismic conditions. The slope model is presented on A-1.4.

3 As noted in the comments on the Stantec August 2011 drainage report, the overburden fill slopes need additional details regarding the locations and design of runoff conveyance structures on the overburden fill slopes and along benches. The geotechnical engineer should evaluate these structures to ensure they don't cause any slope instability.

We can review the design of surface drainage improvements and provide an evaluation with regard to slope stability at such time as plans are available.

4 It is recommended that the project geotechnical engineer consider placing a rock subdrain for several hundred feet upslope from the toe of the overburden fills to prevent buildup of seepage pressures from infiltrating water. This may be particularly important for OB-1 because the mine quarry will be backfilled and at final reclamation is intended to function as a sedimentation and infiltration basin. Infiltration in this basin may flow as groundwater out through the OB-1 fill. Design drawings and construction details for any recommended rock subdrains should be provided.

A rock subdrain layer may be placed along the (topographic low) axis of valley areas to receive overburden stockpile material prior to backfill with overburden. In the case of OB-1, the rock layer may extend from the toe of the existing overburden stockpile to the area of the anticipated final toe of the OB-1 stockpile. For OB-3, the drain may extend 250 feet upgradient from the toe. OB-2 will be

buttressed by OB-1 and become part of the same fill mass; therefore, a drainage blanket is not required for OB-2. The following guidelines are provided for placement, rock size and drain dimensions.

- Install along the natural drainage system (path).
- Extend from the toe up gradient as recommended.
- Rock blanket to consist of non-degradable limestone or other durable rock that will not slake in water and will be free of clay.
- Not more than 20 percent of the rock may be less than 4 inches in size and no single rock may be larger than 20 percent of the width of the drain. The minimum size of the main underdrain may be:

Total Amount of Fill Material	**Minimum Size of Drain, in Feet**	
	Width	Height
Less than 1,000,000 yards	10	2
More than 1,000,000 yards	16	4

5 Kinematic analysis
Enclosure B-4.0 – This analysis is only for planar failures. The figure also appears to show two wedge failure intersections within the critical zone. One intersection comes from a joint and a foliation and the other for two joints. A discussion is needed on why these intersections were not included in the analysis.

Figures B-1.1 and B-1.2 provide an alternate depiction of the discontinuity data for the White Ridge quarry as a wedge sliding analysis with a greater statistical emphasis. The plot indicates a significant potential for wedge geometry in south-facing cuts. Current mining practice includes scaling of loose blocks during excavation of final bench faces and inclusion of catch benches in the mining plan. These mitigation measures have resulted in stable wall configurations in the existing White Knob

quarry and are anticipated to mitigate potential instabilities in the future White Ridge quarry. In addition, observation of slope conditions by mining personnel, including Omya geologists, and annual inspection by geologic consultants is included in current operations to identify and mitigate instabilities during mining.

Enclosure B-5.0 – This analysis is for one wedge failure. The figure appears to show a second wedge failure caused by the intersections of a foliation and a fault within the critical zone. A discussion is needed on why this intersection wasn't included in the analysis.

Figures B-2.1 and B-2.2 provide an alternate depiction of the discontinuity data for the White Ridge quarry as a wedge sliding analysis with a greater statistical emphasis. Based on the percentage of "critical" features versus the total intersections, the potential for wedge failure in west-facing slopes is low. Current mining practice includes scaling of loose blocks during excavation of final bench faces and inclusion of catch benches in the mining plan. These mitigation measures have resulted in stable wall configurations in the existing White Knob quarry and are anticipated to mitigate potential instabilities in the future White Ridge quarry. In addition, observation of slope conditions by mining personnel and annual inspection by geologic consultants are included in current operations to identify and mitigate instabilities during mining.

Enclosure B-9.0 – The plane 2 dip value and dip direction values used in the wedge failure analysis do not appear to be listed in the tables in Enclosure B-1.1 or B-1.2. The failure plane may be an average of several that appear to intersect where plane 2 is shown on the figure. Additional discussion is needed as to why this dip and directional information is provided for the wedge analysis of plane 2.

The data point referenced in the above comment is Discontinuity No. 18 on Table B-1.1; dip = 60, dip direction = 175, representing a small joint. Figures B-3.1 and B-3.2 provide an alternate depiction of the discontinuity data with No. 18 labeled. According to this depiction, the potential for wedge geometries in southwest-facing slopes of the White Knob quarry is moderate. Empirical data (observation of the existing quarry walls) does not indicate that wedge failure is an issue for the quarry. This observation supports the conclusion that ongoing mining practices produce suitably stable quarry walls with sufficient bench width and spacing to result in a stable reclamation

condition. It should be noted that a majority of discontinuities plotted in Figures B-3.1 and B-3.2 are discontinuous joints so that the volume of any individual feature is small.

The coefficient of friction and cohesive strength used in the kinematic analysis were 50 degrees and 800 pounds per square foot, respectively. The report does not discuss how these values were determined. Additional discussion is needed on how these rock slope material strength values were determined.

A cohesion value of 800 psi and a friction angle of 50 degrees were estimated for use in the wedge and plane analyses based on a moderate to high degree of cementation along joint surfaces and the moderately rough to rough surface conditions exhibited in the site bedrock. The presence of jointed and very steep to vertical rock faces in excavations and natural outcrops provides empirical support for selection of these values.

The existing CHJ geotechnical report, dated January 14, 2013, doesn't discuss the Alquist-Priolo Earthquake Fault Study Zones that run across the northern portion of the project. The County's Geohazards Maps also show two large landslide areas near the mine site. These landslides look like they are northwest of the project but the County maps are difficult to locate precisely.

The entire mine site is located within the Bulter Peak 7.5-minute quadrangle, which does not include any Alquist-Priolo Earthquake Fault Zones (AP). Therefore, no portion of the mine boundary is located in an AP zone. For this reason, page 10 of the CHJ report (January 14, 2013) states that "ground rupture due active faulting in the quarry is not anticipated within the quarry area." The closest AP zone to the mining boundary is approximately one-half mile to the north. The seismic hazard from nearby fault zones is addressed by use of a seismic coefficient of 0.2 for the stability analyses. Landslides depicted on San Bernardino County geologic hazard overlay map nos. FH08 C and FH16C are located outside of the mining boundary. Mapped landslides are not located within the mining project boundary.

Comments by OMR

The January 14, 2013 CHJ Consultants (CHJ) study entitled, "Slope Stability Investigation, Proposed Amended Plan of Operations, White Knob Quarry Mining and Reclamation Plan, Lucerne Valley, California" addresses the design and stability of final cut slopes. The study concludes that final cut slopes will have suitable factors of safety against failure of the overall slope (referred to as "global"

stability) for both static and pseudostatic results. Additionally, kinematic analyses completed indicate that block, wedge and topple failures may be possible for certain quarry wall orientations. The following Items should be addressed and the report revised, as appropriate, prior to approval:

The study by CHJ includes no engineering geologic cross sections of the final slopes. Engineering geologic cross sections of final slopes should be included in the study, and those sections should form the basis for stability models.

The major geologic contacts are depicted in the slope stability sections presented in Appendix C of the January 14, 2013 report. The rock (slope-forming) material was modeled using the criteria of Hoek-Brown that consider the unconfined compressive strength, geologic strength index, intact rock constant and disturbance factor of the rock mass. Individual joints and shear zones, as observed in existing quarry and natural exposures, do not exhibit significant continuity at the cross-section scale. Use of the Hoek-Brown criteria addresses the engineering geologic condition of the rock mass. Future excavations may reveal structures or trends that differ from those currently observable. This potential is addressed by period mine inspections and annual reporting.

Stability analyses on fill slopes do not consider the presence of groundwater. However, Overburden Storage Site #2 (OB #2) will be constructed within a drainage with substantial drainage area above. This drainage likely will concentrate water on OB #2 and likely affect the stability of the fill slopes. The CHJ study should be revised to account for the presence of water in the fill materials.

Stereonet analyses indicate that planar, wedge, and topple failures are kinematically possible, and the analyses by CHJ only note factors of safety of less than 1.0 for some planar joints. CHJ indicates that the joints with geometries suitably oriented for planar failures have a limited extent and concludes that the potential for large planar failures is low. However, there appears to be a potential for smaller, bench-scale failures. Slope inspection measures to identify potentially unstable areas should be included in the reclamation plan, and mitigation measures for stabilizing these areas should be proposed and evaluated in the CEQA analyses.

Slope inspection by the mine operator and annual geologic inspections by consultants for compliance to the reclamation plan are part of the ongoing quarry operation plan. Current mining practice includes scaling of loose blocks during excavation of final bench faces and inclusion of catch benches in the mining plan. These mitigation measures have resulted in stable wall configurations in the existing White Knob quarry and are anticipated to mitigate potential instabilities in the future White Ridge quarry. In addition, observation of slope conditions by mining personnel and annual

inspection by geologic consultants are included in current operations to identify and mitigate instabilities during mining.

CLOSURE

We trust this information is sufficient for your needs at this time. If you should have questions, please contact this firm at your convenience.

REGISTERED GEOLOGIST
JOHN S. McKEOWN
NO. 2396
CERTIFIED ENGINEERING GEOLOGIST
Exp. 06-30-15
STATE OF CALIFORNIA

Respectfully submitted,
CHJ CONSULTANTS

John S. McKeown, E.G. 2396
Project Geologist

Jay J. Martin, E.G. 1529
Vice President

PROFESSIONAL GEOLOGIST
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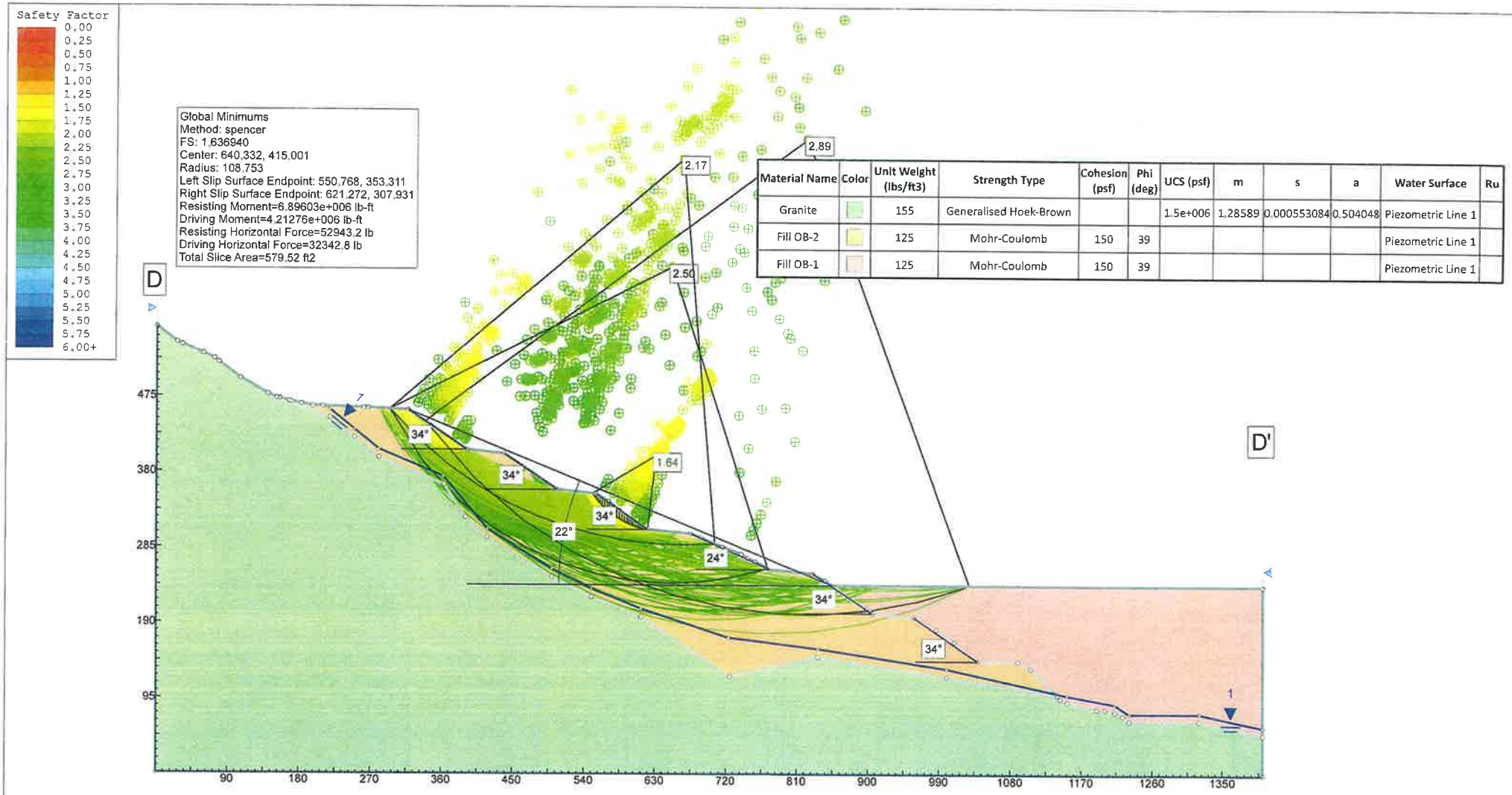
JMc/JJM/lb

Enclosures:
"A-1.1" - "A-1.4" - Slope Stability Calculations - Section D-D'
"A-1.5" - Location of Section D-D'
"B-1.1" - "B-3.2" - Kinematic Diagrams

Distribution: Omya California (2)
James Rogers (electronic)
K. Shapiro (electronic)

REFERENCES

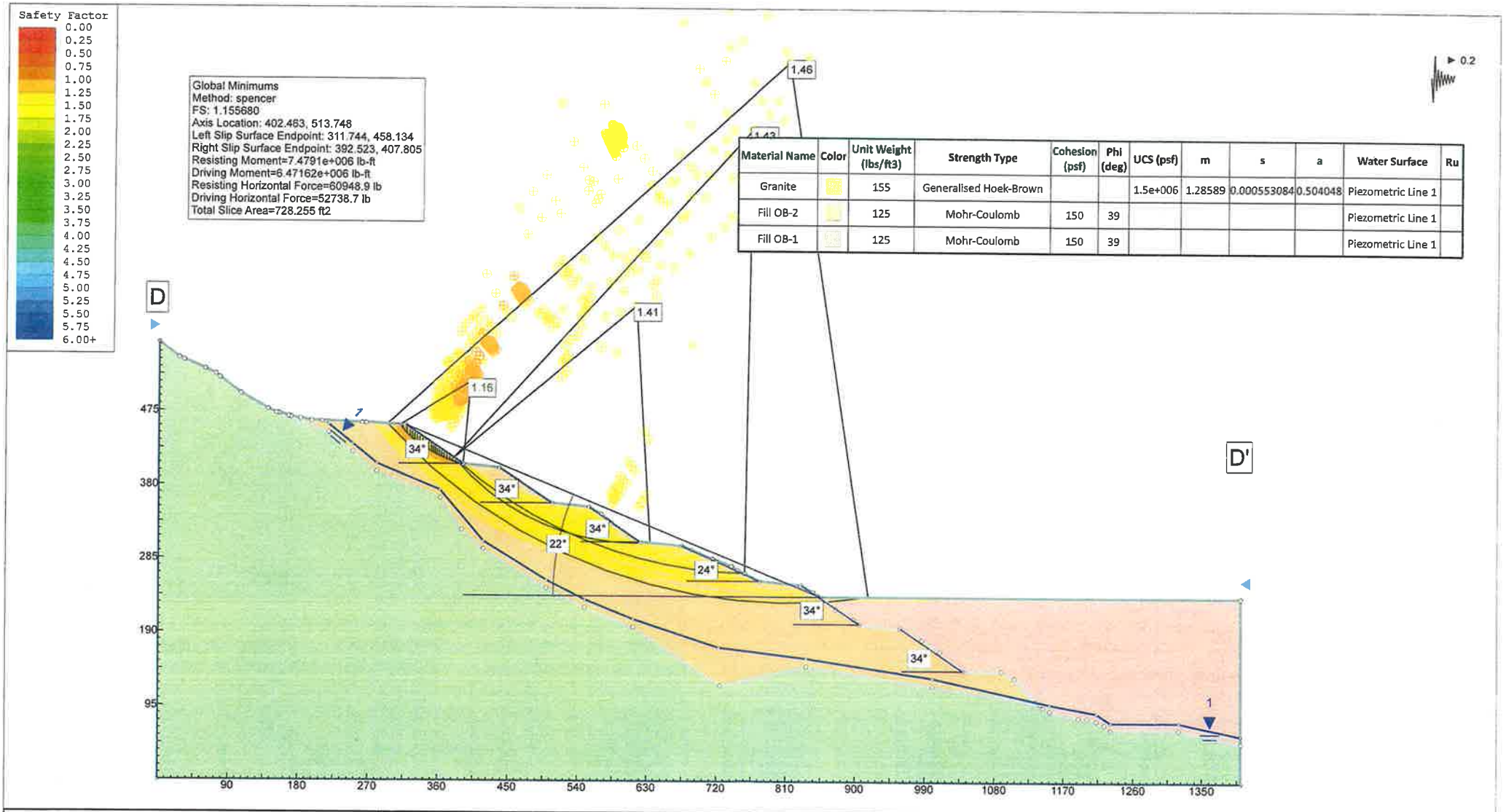
CHJ Consultants, January 14, 2012, Slope Stability Investigation, Proposed Amended Plan of Operations, White Knob Quarry Mining and Reclamation Plan, Lucerne Valley, California, Prepared for Omya California, a Division of Omya Incorporated, CHJ Job Number 12715-8.



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	UCS (psf)	m	s	a	Water Surface	Ru
Granite		155	Generalised Hoek-Brown			1.5e+006	1.28589	0.000553084	0.504048	Piezometric Line 1	
Fill OB-2		125	Mohr-Coulomb	150	39					Piezometric Line 1	
Fill OB-1		125	Mohr-Coulomb	150	39					Piezometric Line 1	

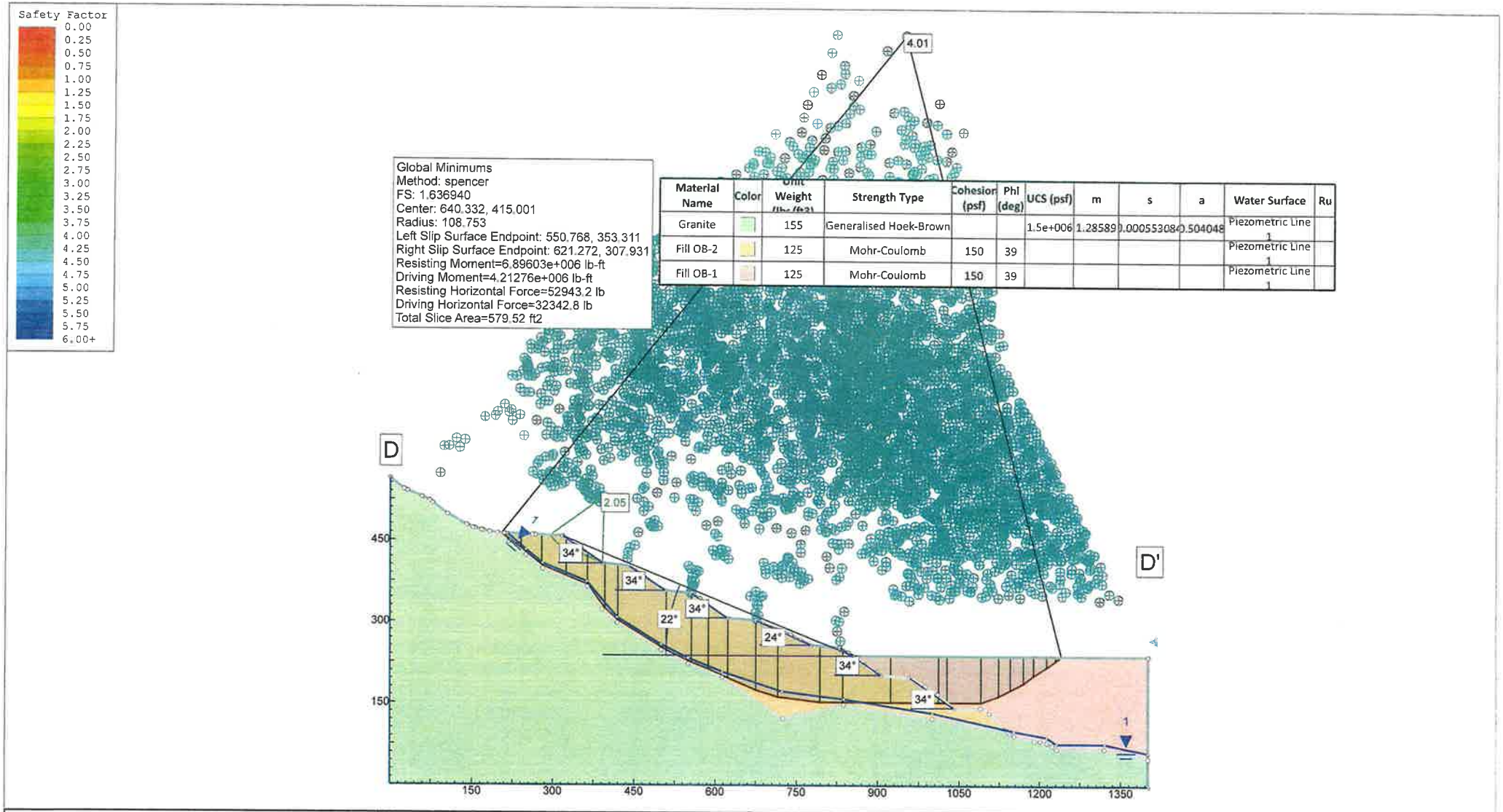
SLIDEINTERPRET 6.024

Project	White Knob Quarry OB-2		
Analysis Description	Section D-D'		
Drawn By: CHJ	Author: JMc	Scale: 1:1400	
File Name: Slide1.slim	Date: 8/15/2013	Enclosure: A-1.1	



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	UCS (psf)	m	s	a	Water Surface	Ru
Granite		155	Generalised Hoek-Brown			1.5e+006	1.28589	0.000553084	0.504048	Piezometric Line 1	
Fill OB-2		125	Mohr-Coulomb	150	39					Piezometric Line 1	
Fill OB-1		125	Mohr-Coulomb	150	39					Piezometric Line 1	

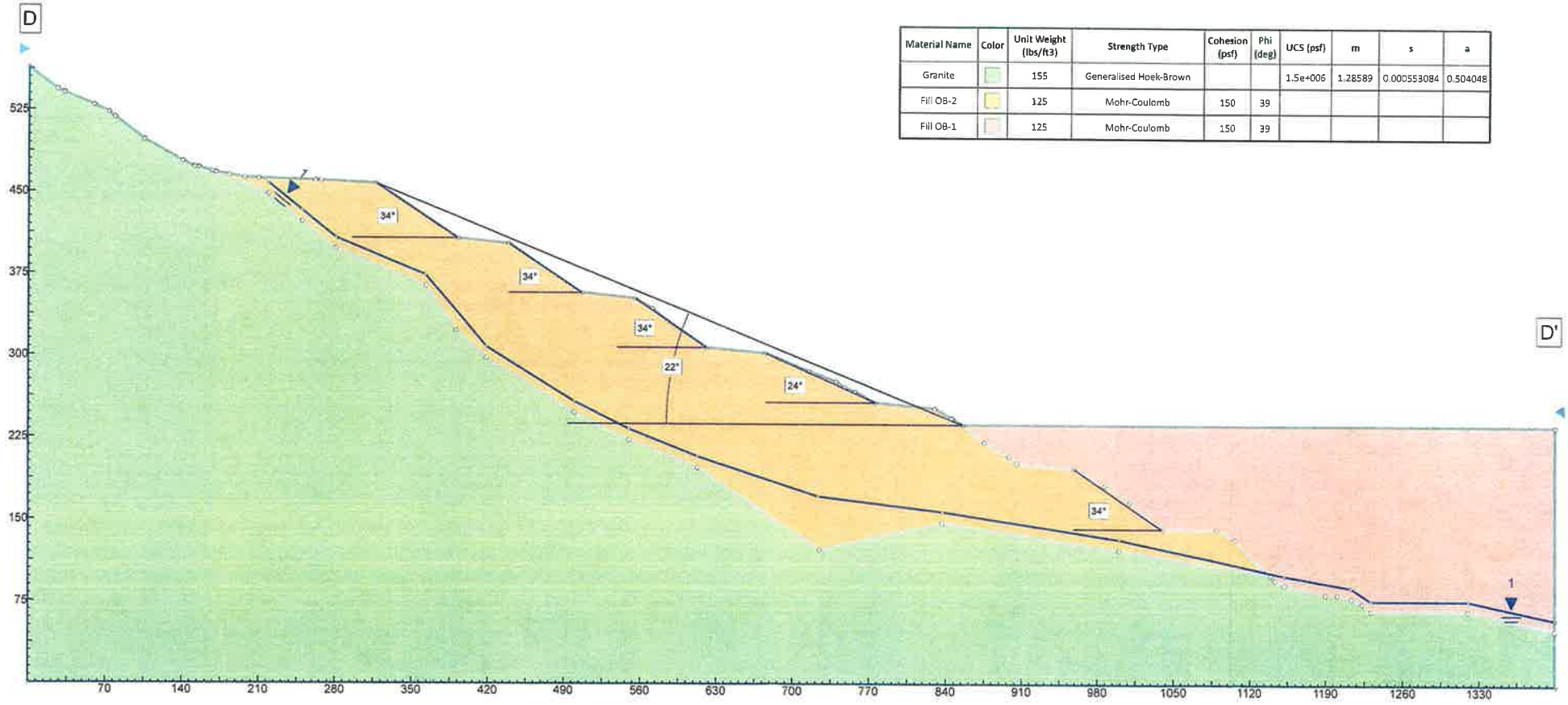
Project	White Knob Quarry OB-2				
Analysis Description	Section D-D'				
Drawn By	CHJ	Author	JMc	Scale	1:1400
File Name	Slide1 seis.slim	Date	8/15/2013	Enclosure	A-1.2



Project	White Knob Quarry OB-2		
Analysis Description	Section D-D' Fill/Rock Contact Evaluation		
Drawn By	CHJ	Author	JMc
File Name	Sect D OB-2_limits.slim	Date	8/15/2013
Scale	1:2000	Enclosure	A-1.3

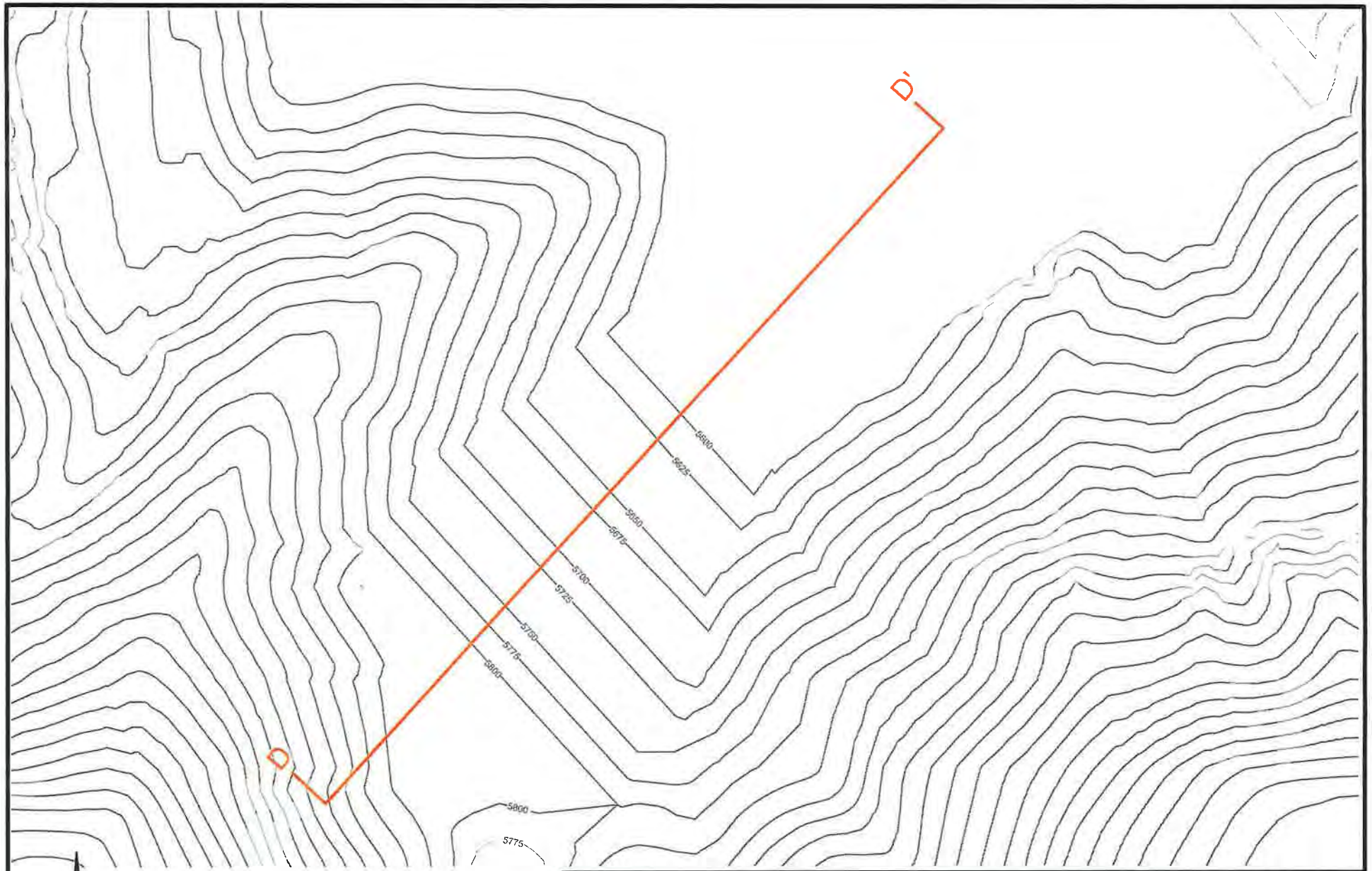
SLIDEINTERPRET 6.024

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	UCS (psf)	m	s	a
Granite		155	Generalised Hoek-Brown			1.5e+006	1.28589	0.000553084	0.504048
Fill OB-2		125	Mohr-Coulomb	150	39				
Fill OB-1		125	Mohr-Coulomb	150	39				



Project	White Knob/White Ridge			
Analysis Description	Section D-D' - OB-2			
Drawn By	CHJ	Author	JMc	Scale 1:1100
File Name	Slide1.slim	Date	8/16/2013	Enclosure A-1.4

SLIDE 6.024



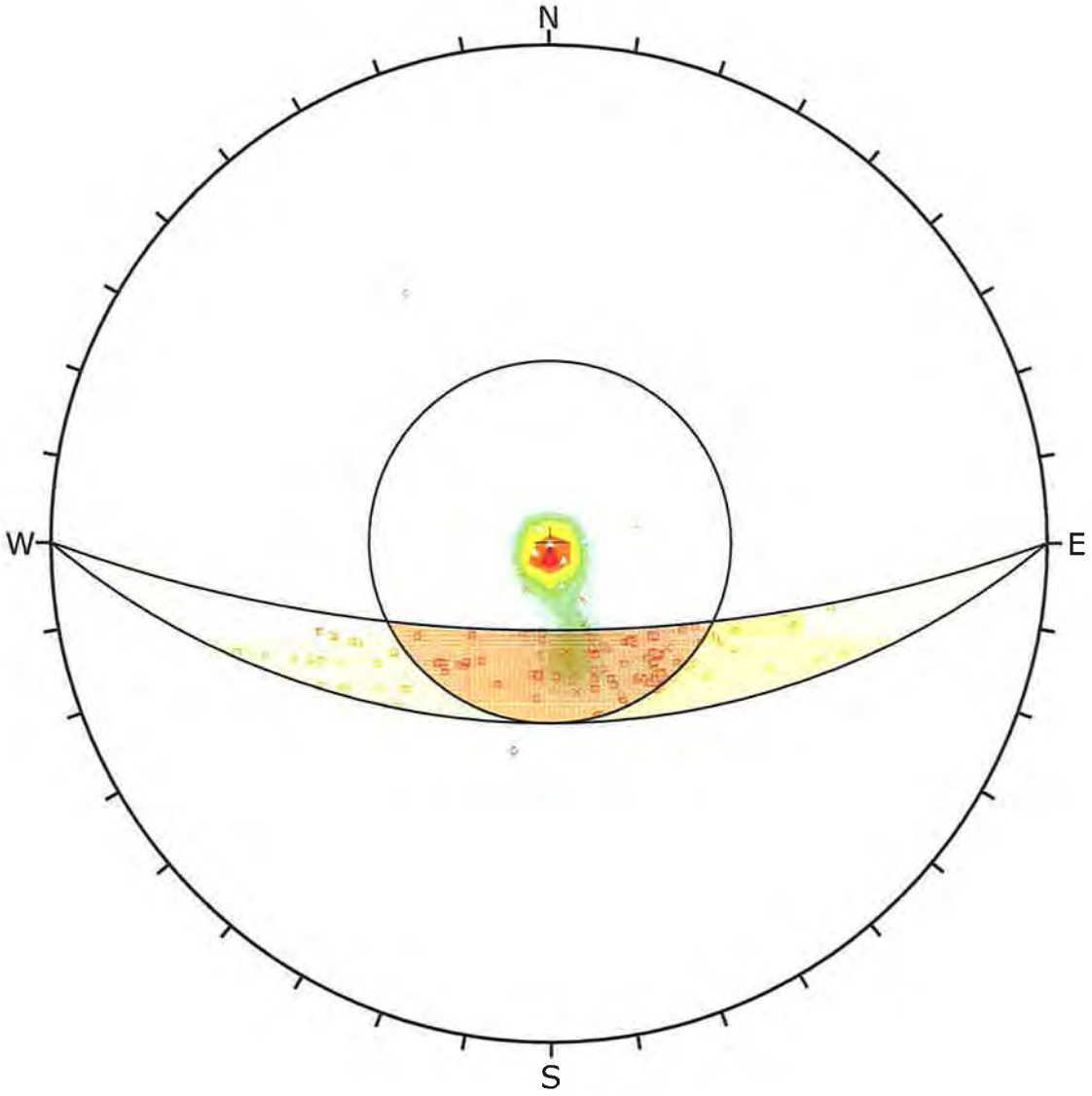
-N-

SCALE: 1" = 200'

LOCATION OF SECTION D-D'

FOR: OMYA CALIFORNIA	SLOPE STABILITY INVESTIGATION PROPOSED AMENDED PLAN OF OPERATIONS WHITE KNOB QUARRY MINING AND RECLAMATION PLAN LUCERNE VALLEY, CALIFORNIA	ENCLOSURE "A-1.5"
DATE: AUGUST 2013		JOB NUMBER 13502-8

CHJ Consultants



Symbol	TYPE	Quantity
◇	dike	2
	foliation	10
	joint	17
	shear	4
Symbol	**Feature**	
	Critical Intersection	

Color	Density Concentrations
	0.00 - 2.80
	2.80 - 5.60
	5.60 - 8.40
	8.40 - 11.20
	11.20 - 14.00
	14.00 - 16.80
	16.80 - 19.60
	19.60 - 22.40
	22.40 - 25.20
	25.20 - 28.00

Maximum Density	27.36%
Contour Data	Dip Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

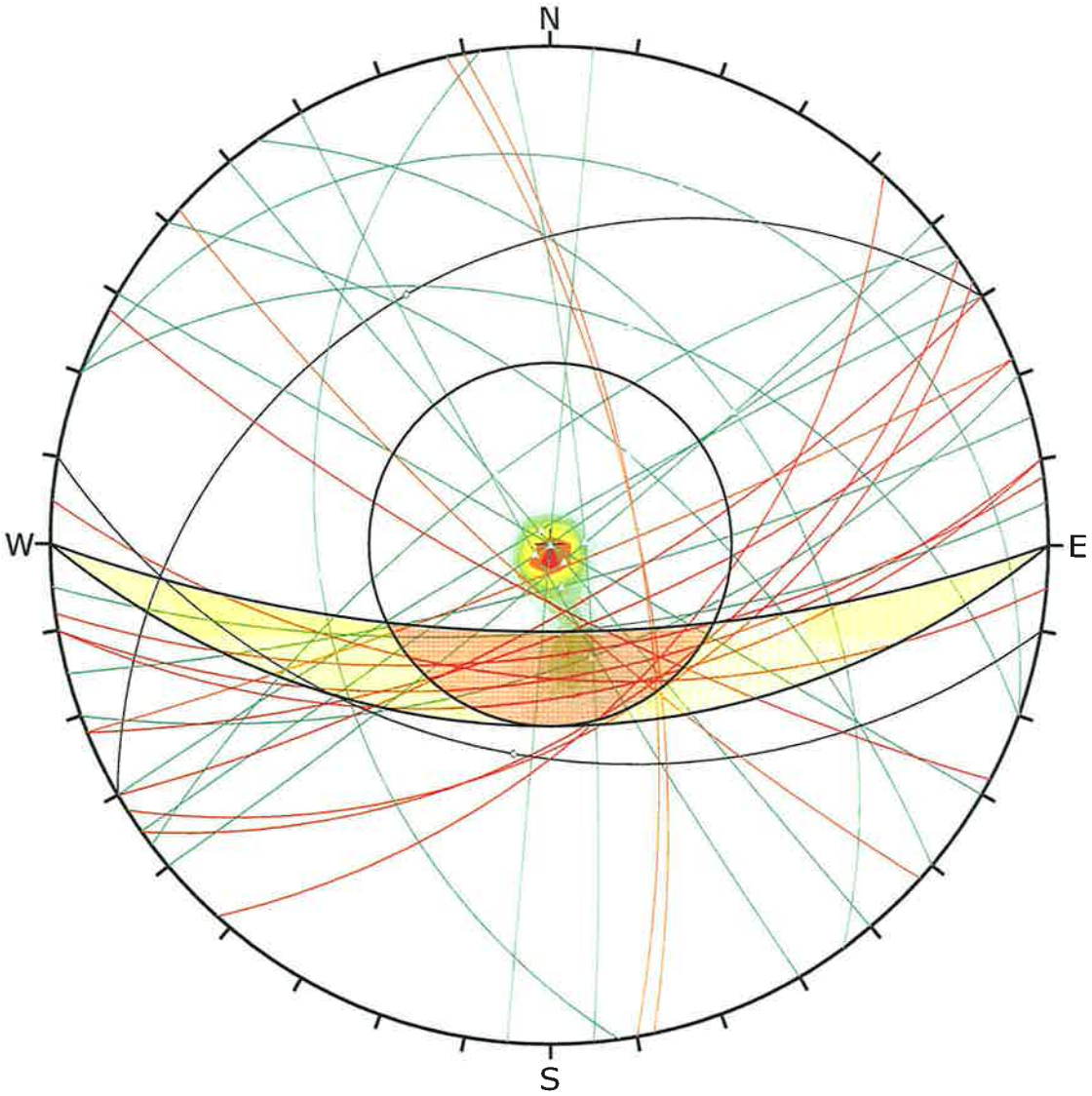
Kinematic Analysis	Wedge Sliding
Slope Dip	70
Slope Dip Direction	180
Friction Angle	50°

	Critical	Total	%
Wedge Sliding	130	528	24.62%

Plot Mode	Dip Vectors
Vector Count	33 (33 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	528
Hemisphere	Lower
Projection	Equal Angle

DIPS 6.008

Project	White Ridge Quarry		
Analysis Description	Azimuth 180/Slope Angle 70/Dip Vector Plot/Wedge Sliding Evaluation		
Drawn By	CHJ	*Author*	JMc
File Name	White Ridge Set.dips6	*Date*	8/15/2013
		Enclosure	B-1.1



Symbol	TYPE	Quantity
◇	dike	2
	foliation	10
	joint	17
	shear	4

Color	Density Concentrations
	0.00 - 2.80
	2.80 - 5.60
	5.60 - 8.40
	8.40 - 11.20
	11.20 - 14.00
	14.00 - 16.80
	16.80 - 19.60
	19.60 - 22.40
	22.40 - 25.20
	25.20 - 28.00

Maximum Density	27.36%
Contour Data	Dip Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

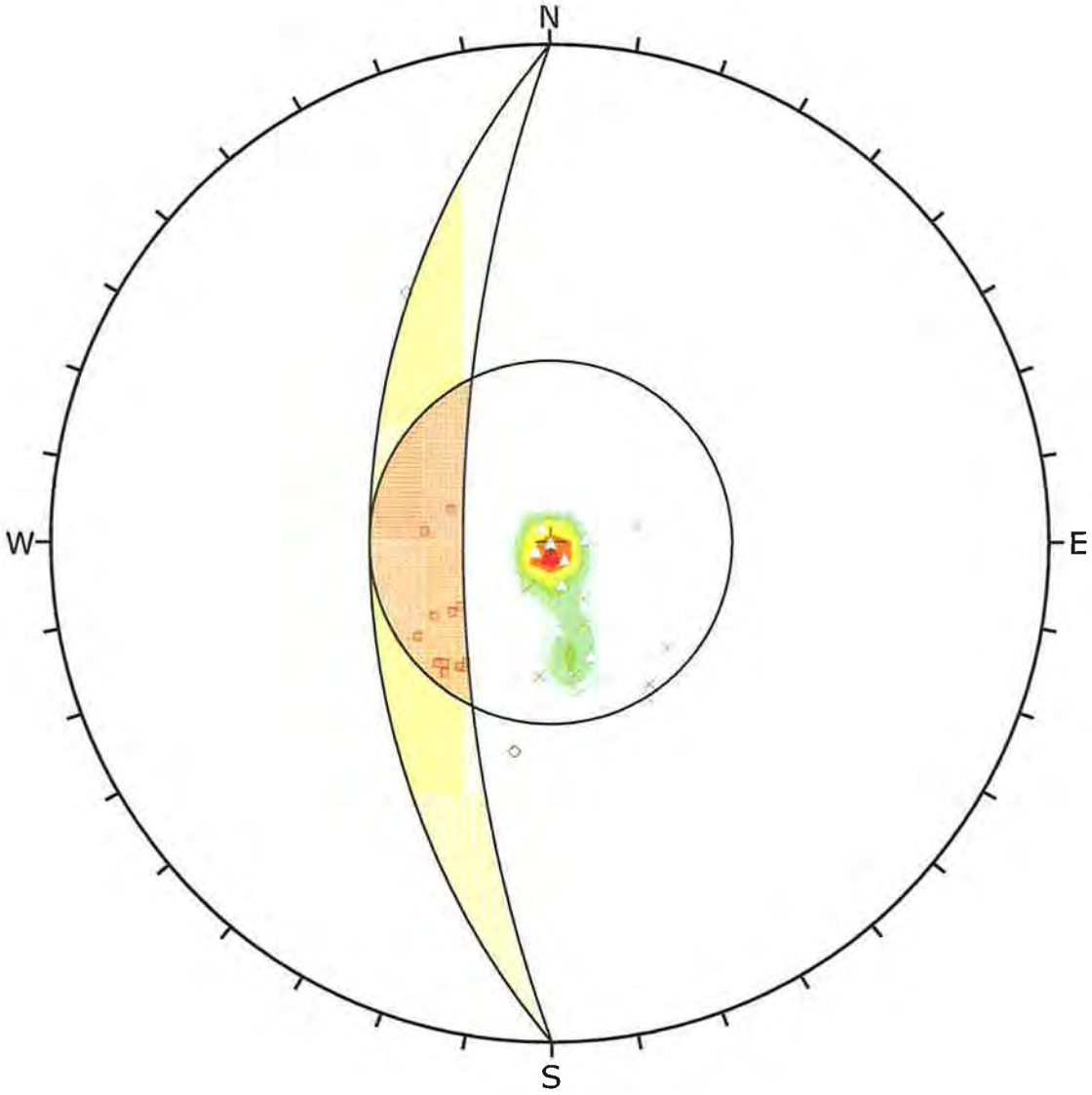
Kinematic Analysis	Wedge Sliding
Slope Dip	70
Slope Dip Direction	180
Friction Angle	50°

	Critical	Total	%
Wedge Sliding	130	528	24.62%

Plot Mode	Dip Vectors
Vector Count	33 (33 Entries)
Hemisphere	Lower
Projection	Equal Angle

DIPS 6.008

Project	White Ridge Quarry		
Analysis Description	Azimuth 180/Slope Angle 70/Dip Vector Plot/Wedge Sliding Evaluation		
Drawn By	CHJ	*Author*	JMc
File Name	White Ridge Set.dips6	*Date*	8/15/2013
Enclosure	B-1.2		



Symbol	TYPE	Quantity
◇	dike	2
	foliation	10
	joint	17
	shear	4

Symbol	Feature
	Critical Intersection

Color	Density Concentrations
	0.00 - 2.80
	2.80 - 5.60
	5.60 - 8.40
	8.40 - 11.20
	11.20 - 14.00
	14.00 - 16.80
	16.80 - 19.60
	19.60 - 22.40
	22.40 - 25.20
	25.20 - 28.00

Maximum Density	27.36%
Contour Data	Dip Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

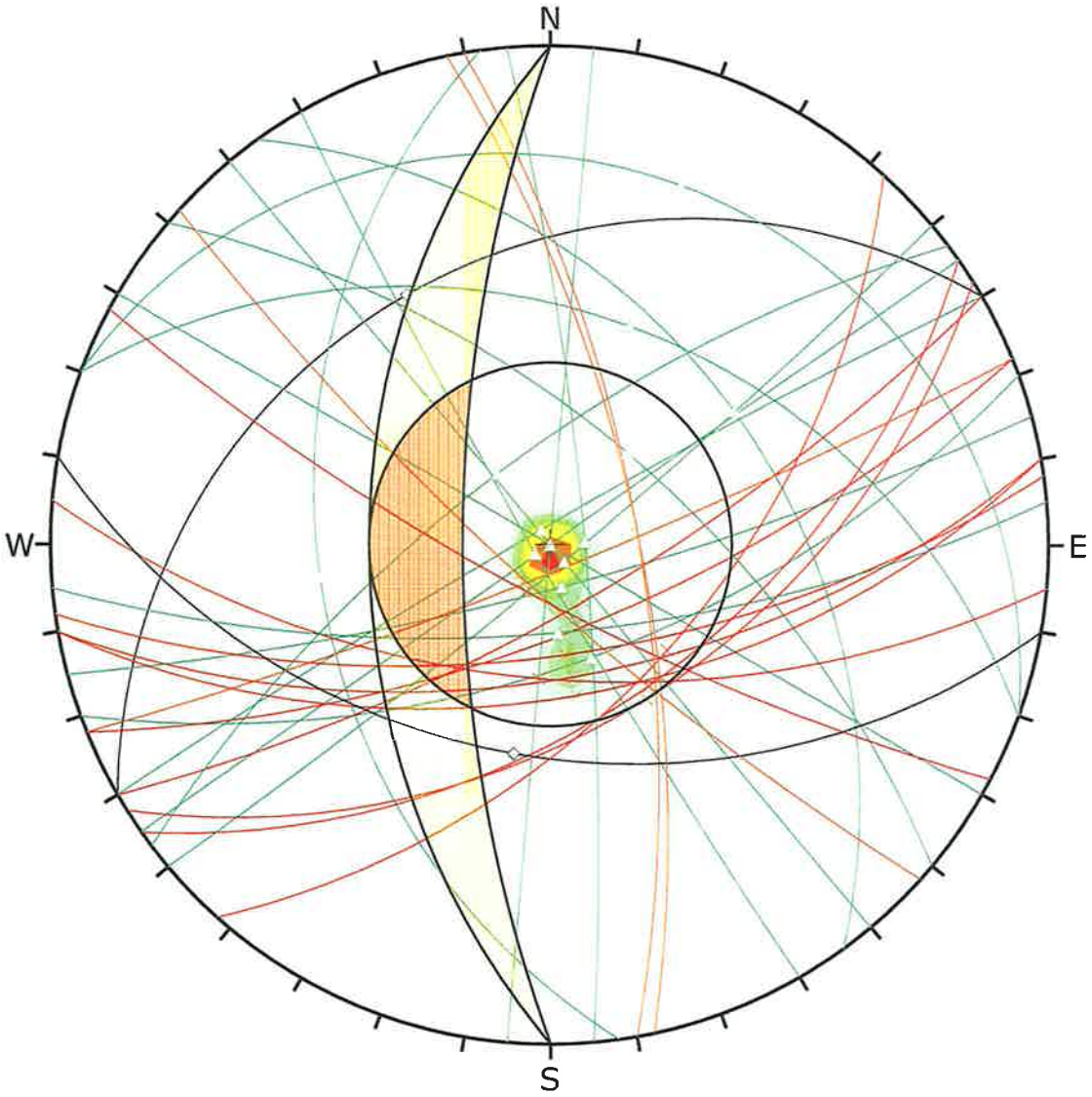
Kinematic Analysis	Wedge Sliding
Slope Dip	70
Slope Dip Direction	270
Friction Angle	50°

	Critical	Total	%
Wedge Sliding	13	528	2.46%

Plot Mode	Dip Vectors
Vector Count	33 (33 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	528
Hemisphere	Lower
Projection	Equal Angle

DIPS 6.008

Project	White Ridge Quarry		
Analysis Description	Azimuth 270/Slope Angle 70/Dip Vector Plot/Wedge Sliding Evaluation		
Drawn By	CHJ	*Author*	JMc
File Name	White Ridge Set.dips6	*Date*	8/15/2013
Enclosure	B-2.1		



Symbol	TYPE	Quantity
◇	dike	2
	foliation	10
	joint	17
	shear	4

Color	Density Concentrations
	0.00 - 2.80
	2.80 - 5.60
	5.60 - 8.40
	8.40 - 11.20
	11.20 - 14.00
	14.00 - 16.80
	16.80 - 19.60
	19.60 - 22.40
	22.40 - 25.20
	25.20 - 28.00

Maximum Density	27.36%
Contour Data	Dip Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

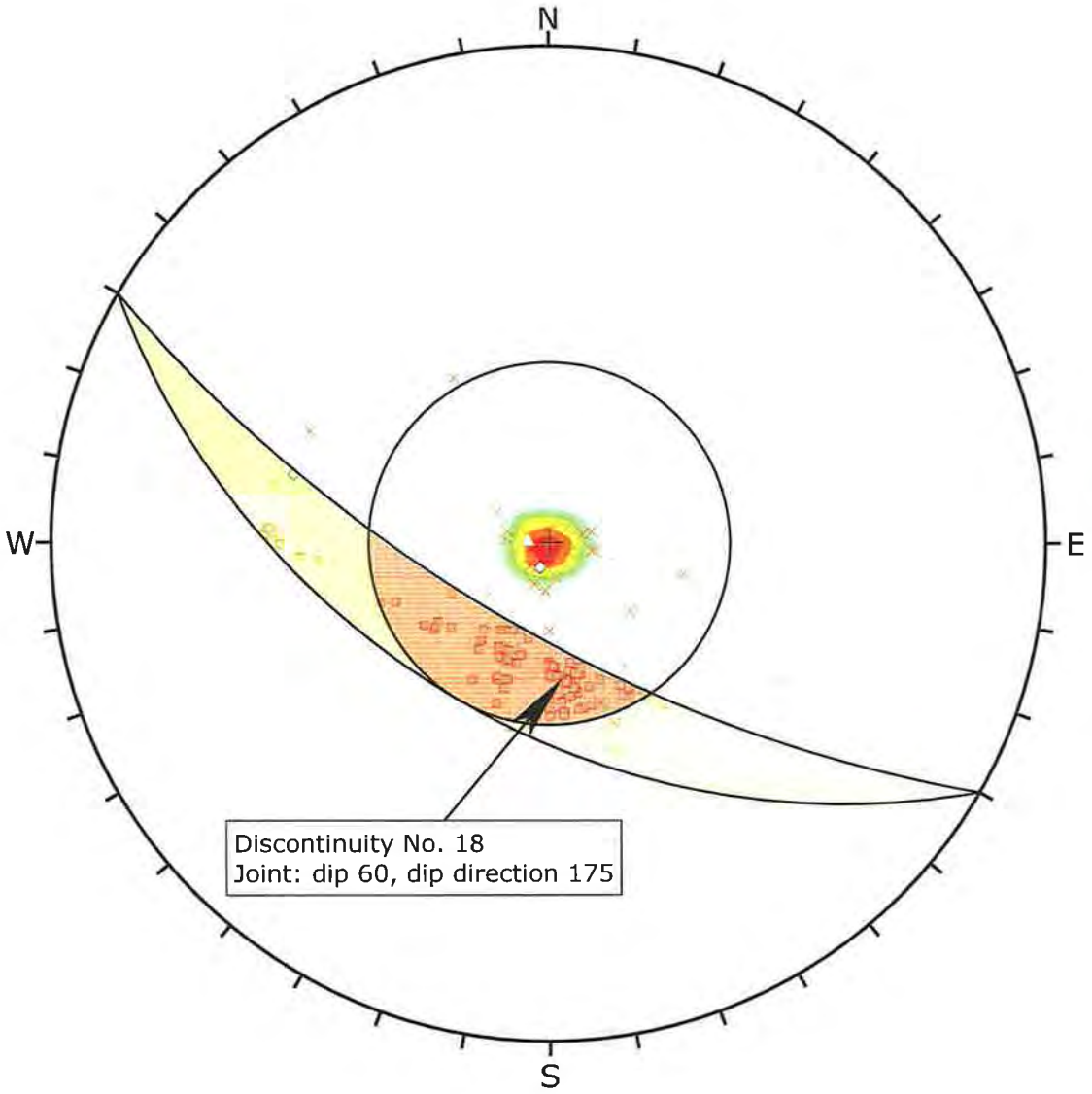
Kinematic Analysis	Wedge Sliding
Slope Dip	70
Slope Dip Direction	270
Friction Angle	50°

	Critical	Total	%
Wedge Sliding	13	528	2.46%

Plot Mode	Dip Vectors
Vector Count	33 (33 Entries)
Hemisphere	Lower
Projection	Equal Angle

DIPS 6.008

Project	White Ridge Quarry		
Analysis Description	Azimuth 270/Slope Angle 70/Dip Vector Plot/Wedge Sliding Evaluation		
Drawn By	CHJ	*Author*	JMc
File Name	White Ridge Set.dips6	*Date*	8/15/2013
		Enclosure	B-2.2



Symbol	TYPE	Quantity
◇	dike	2
	joint	41
	shear	2

Symbol	Feature
	Critical Intersection

Color	Density Concentrations
	0.00 - 4.20
	4.20 - 8.40
	8.40 - 12.60
	12.60 - 16.80
	16.80 - 21.00
	21.00 - 25.20
	25.20 - 29.40
	29.40 - 33.60
	33.60 - 37.80
	37.80 - 42.00

Maximum Density	41.43%
Contour Data	Dip Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

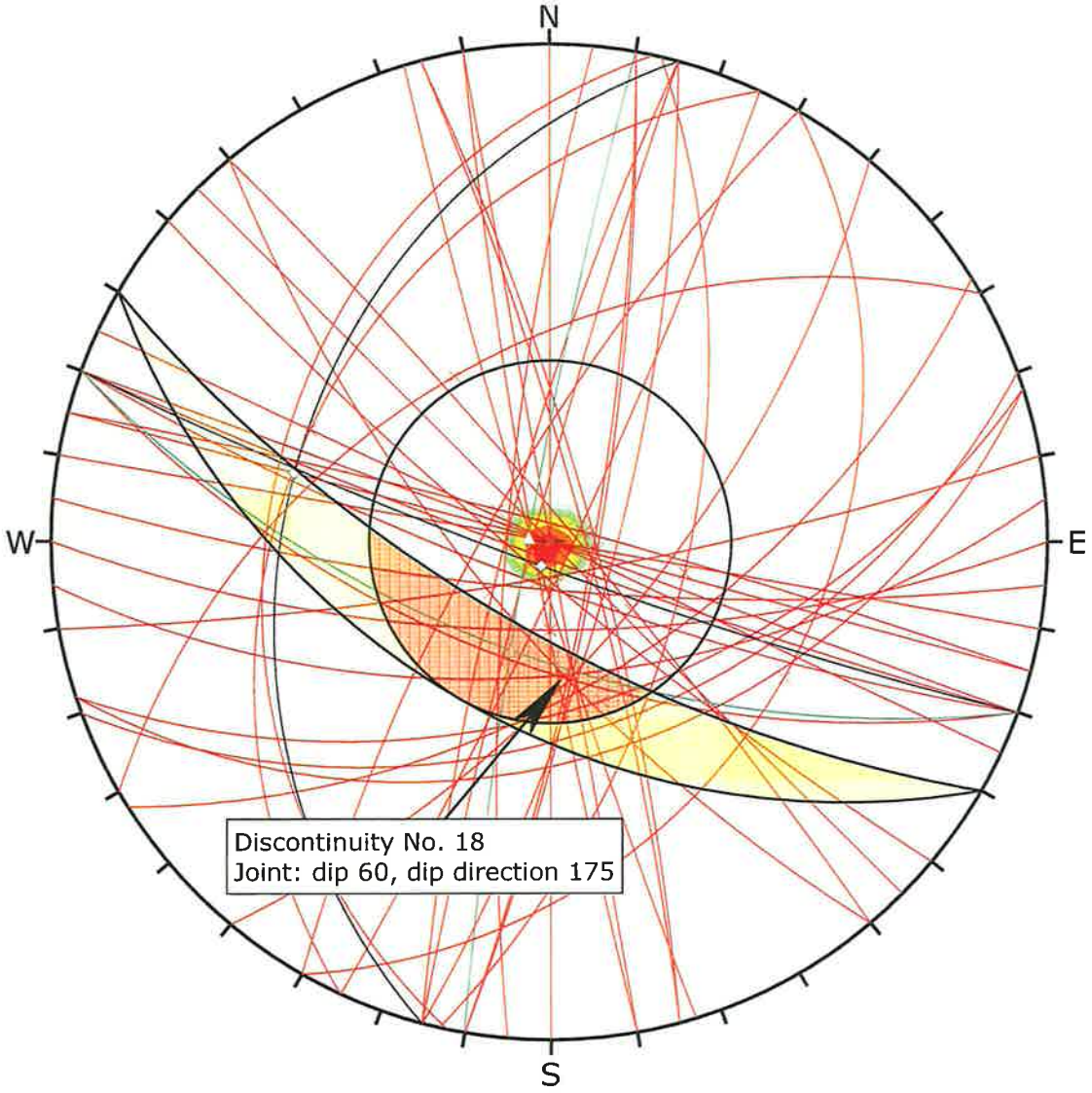
Kinematic Analysis	Wedge Sliding
Slope Dip	70
Slope Dip Direction	210
Friction Angle	50°

	Critical	Total	%
Wedge Sliding	128	989	12.94%

Plot Mode	Dip Vectors
Vector Count	45 (45 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	989
Hemisphere	Lower
Projection	Equal Angle

DIPS 6.008

Project	White Knob Quarry		
Analysis Description	Azimuth 210/Slope Angle 70/Dip Vector Plot		
Drawn By	CHJ	*Author*	JMc
File Name	White Knob Set.dips6	*Date*	8/15/2013
		Enclosure	B-3.1



Symbol	TYPE	Quantity
◇	dike	2
	joint	41
	shear	2

Color	Density Concentrations
	0.00 - 4.20
	4.20 - 8.40
	8.40 - 12.60
	12.60 - 16.80
	16.80 - 21.00
	21.00 - 25.20
	25.20 - 29.40
	29.40 - 33.60
	33.60 - 37.80
	37.80 - 42.00

Maximum Density	41.43%
Contour Data	Dip Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Wedge Sliding
Slope Dip	70
Slope Dip Direction	210
Friction Angle	50°

	Critical	Total	%
Wedge Sliding	128	989	12.94%

Plot Mode	Dip Vectors
Vector Count	45 (45 Entries)
Hemisphere	Lower
Projection	Equal Angle

DIPS 6.008

Project	White Knob Quarry		
Analysis Description	Azimuth 210/Slope Angle 70/Dip Vector Plot		
Drawn By	CHJ	*Author*	JMc
File Name	White Knob Set.dips6	*Date*	8/15/2013
		Enclosure	B-3.2

EXHIBIT E

Mitigation Monitoring and Reporting Program

1. INTRODUCTION

This document is the Mitigation Monitoring and Reporting Program (MMRP) for the White Knob/White Ridge Quarry Expansion project. An MMRP is required for the proposed project because the EIR has identified significant adverse impacts, and measures have been identified to mitigate those impacts. This MMRP has been prepared pursuant to Section 21081.6 of the California Public Resources Code, which requires public agencies to "adopt a reporting and monitoring program for the changes made to the project or conditions of project approval, adopted in order to mitigate or avoid significant effects on the environment."

2. MITIGATION MONITORING AND REPORTING PROGRAM

As the lead agency, the County of San Bernardino will be responsible for monitoring compliance with all mitigation measures. Different County departments are responsible for various aspects of the project. The MMRP identifies the department with the responsibility for ensuring the measure is completed; however, it is expected that one or more departments will coordinate efforts to ensure compliance.

The MMRP is presented in tabular form on the following pages. The components of the MMRP are described briefly below.

- **Mitigation Measure:** The mitigation measures are taken from the Environmental Impact Report (EIR), in the same order they appear in the EIR.
- **Timing:** Identifies at which stage of the project the mitigation must be completed.
- **Monitoring Responsibility:** Identifies the department within the County with responsibility for mitigation monitoring.
- **Verification (Date and Initials):** Provides a contact who reviewed the mitigation measure and the date the measure was determined complete.

MITIGATION MONITORING AND REPORTING PROGRAM

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
3.1 Aesthetics Resources			
MM 3.1.1 The Amended Plan includes design features and reclamation activities that would reduce visual impacts. These measures are incorporated into this DEIR in order to ensure compliance. These measures include the following: • Implement measures to minimize boulder roll-down visual impacts including: - Precision drilling and buffer blasting when the outside edge is approached. - Drilling lifters on the edge to undercut the remaining slope and let it fall into the pit (like directional falling of a tree). - Excavator to pull down and pull in toward the pit blasted rock away from the edge. - Use of alternatives to blasting along the outside such as rock breakers, surface miners, cutting heads, and excavators. - Loader to pull back material from the edge. - Loader to dig at an angle to the edge or parallel to the edge when possible. - Manually scaling boulders from the high walls where they may be above a haulage road. • Maintain the existing crusher site at the White Knob Quarry or use a portable plant within an active quarry to reduce its visibility from Lucerne Valley. • Deposit waste rock within the White Knob Quarry footprint, as described in the Amended Plan, to reduce the area of disturbance for overburden stockpiles and visual impact outside the quarry. • Design and phase mining of the White Ridge Quarry, which allows for concurrent reclamation and leaves an approximately 300-foot-high	Implemented during mining and reclamation activities	County of San Bernardino Land Services Department	

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
ridge of undisturbed hillside facing Lucerne Valley to minimize visual impacts. • Implement reclamation and revegetation on completed equipment-accessible quarry benches and on overburden stockpiles concurrent with mining where feasible. • Utilize color-staining product to darken the visible quarry and roll-down slopes where not subject to raveling to reduce visual impacts. • Deposit darker waste rock on overburden sites where available to reduce color contrast. • Design adequate erosion control features along the haul and access roads and quarry to control and limit erosion and sediment transport for a 20-year, one-hour duration storm event. • Where feasible, construct catchment berms at the foot of stockpiles to reduce rock roll-down and sediment flow. • Limit surface disturbances to areas identified in the Amended Plan. • Implement appropriate dust controls to reduce visible dust.			
3.2 Air Quality			
MM 3.2.1 It shall be required in the final Amended Mine and Reclamation Plan that the following PM10 reduction measures be implemented as part of quarry operations and reclamation. • Limit maximum speed on unpaved roads to 25 miles per hour. • Water unpaved roads at least twice per day, more if needed to control dust emissions by at least 80 percent. Alternatively, a dust palliative, such as magnesium chloride, may be used to treat the unpaved roads. • Water all areas to be graded and areas where bulldozers operate at least twice per day, more if needed, to control dust emissions.	Required to be placed in the final version of the Amended Plan and implemented during mining and reclamation activities	County of San Bernardino Land Services Department	
3.3 Biological Resources			
MM 3.3.1a The mine operator shall retain a qualified biologist to conduct mandatory contractor/worker awareness training for project personnel. The awareness training will be provided to all personnel to brief them on the identified location of sensitive biological resources, including how to	Prior to and ongoing during quarry operation	San Bernardino County Planning Department	

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
identify species (visual and auditory) most likely to be present, the need to avoid impacts on biological resources (e.g., plants, wildlife, and jurisdictional waters), and to brief them on the penalties for not complying with biological mitigation requirements. If new personnel are added to the project, the mine operator will ensure that they receive the mandatory training before starting work. **MM 3.3.1b** The mine operator shall designate a field contact representative (FCR) responsible for overseeing compliance with protections to special-status species. The FCR shall be on-site during all project activities that could potentially cause significant impacts on sensitive biological resources. The FCR shall have the authority to halt activities that are in violation of the committed measures and non-emergency project-related activities that may endanger special-status species. The FCR shall authorize re-initiation of project activities after the hazards are removed, the species is no longer at risk, or the individual(s) are moved out of harm's way by the qualified biologist. **MM 3.3.1c** Project-related vehicles will stay on roads and observe a 25 mile per hour speed limit in all project areas, except on county roads and state and federal highways. **MM 3.3.1d** Project-related vehicles shall be checked before moving for wildlife, as wildlife may seek shade and shelter under parked vehicles and construction equipment. **MM 3.3.1e** All construction pipes, culverts, or similar structures that are stored on the project site for one or more nights shall be inspected thoroughly for the presence of wildlife before they are used or moved. If wildlife is present, they shall be allowed to move out of the area on their own or moved out of harm's way by a qualified biologist. **MM 3.3.1f** Encounters with a special-status wildlife species shall be reported to the FCR and qualified biologist. The qualified biologist shall maintain records of all encounters during the project, the species' condition, location found, and location released. **MM 3.3.1g** All food-related trash items such as food wrappers, cans, bottles, and food scraps shall be disposed of in secured, closed containers and removed regularly from the project site.			

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
MM 3.3.1h Fueling of vehicles and equipment shall be prohibited within 100 feet of riparian/riverine areas. **MM 3.3.1i** No rodenticides shall be used on the project site.			

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
MM 3.3.2 Carbonate Habitat Management Strategy (CHMS) Consistency. Prior to initiating project-related activities in undisturbed portions of the site, the mine operator shall complete land dedication or claim relinquishments to offset project impacts on listed threatened or endangered plants at a 3:1 ratio, consistent with the requirements of the CHMS, and provide documentation of the completed transaction to the County. The 3:1 ratio will apply to total number of conservation units (CUs) (calculated by San Bernardino County National Forest [SBNF] staff according to the provisions of the CHMS) and total occupied habitat, in acres or fractions of acres, for each listed species. This mitigation measure consists of four parts: (1) field surveys to determine conservation value of proposed disturbance areas; (2) comparable field surveys to verify conservation value of mining claims to be relinquished; (3) administrative requirements to complete the land dedication or claim relinquishments (which may include mineral withdrawal); and (4) protection measures for special-status plants located adjacent to project disturbance areas that are not planned to be removed. (1) Project Area Field Surveys and Conservation Value Calculation. The mine operator shall retain a qualified biologist to perform focused surveys to determine the presence~~/~~ or absence of special-status plant species identified in Table 3.3-1 and within 100 feet of the proposed impact area. For listed threatened or endangered plants, the extent of occupied habitat shall be mapped and quantified. For any other special-status plants located in the project area, the biologist shall collect global positioning system (GPS) coordinates of occurrences and qualitative estimates of their abundance. These surveys shall be conducted in accordance with the CDFW (2009) *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities*. These guidelines require that rare plant surveys be "floristic in nature," conducted by field botanists familiar with the regional flora, and conducted at the proper time of year when rare or endangered species are both evident and identifiable. Field surveys shall be scheduled to coincide with known flowering periods and/or during appropriate developmental periods	Ongoing during quarry and reclamation activities	San Bernardino County Land Use Services Department	

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
that are necessary to identify the plant species of concern. Field survey results and mapping data shall be provided to the County and the SBNF for inclusion in the CHMS GIS data and calculation of total CHMS conservation value of the proposed project area. (2) Mitigation Lands Field Surveys and Conservation Value Calculation. The mine operator shall identify one or more parcels of land or mining claims suitable for relinquishment and shall retain a qualified biologist to perform focused botanical surveys of those lands. Survey methods and data collection shall be as described above for project site field surveys. Field survey results and mapping data shall be provided to the San Bernardino National Forest for inclusion in the CHMS GIS data and calculation of total CHMS conservation value of the proposed project area. (3) Land Dedication or Claim Relinquishment. The mining operator shall specify lands or mining claims whose conservation values and habitat area occupied by listed species total no less than three times the total conservation value of the project area and roughly three times the occupied habitat for each affected listed species. The mining operator shall dedicate the lands or relinquish those claims according to the terms of the CHMS and the MOU. The operator shall provide written documentation of the land dedication or claim relinquishment to the County upon completion. (4) Protect Special-Status Plant Locations Adjacent to Project Site. Any special-status plant species that are identified within 100 feet of the proposed impact area, but not proposed to be disturbed by the project, shall be protected by barrier fencing to ensure that construction activities and material stockpiles do not impact any special-status plant species. These avoidance areas shall be identified on project plans.			
MM 3.3.3a Desert Tortoise Surveys. Prior to implementation of project-related activities, the mine operator shall retain a USFWS-authorized desert tortoise biologist to conduct pre-project surveys in accordance with the USFWS pre-project field survey protocol (2010). If no desert tortoises are identified during pre-project surveys, no further mitigation is required. If	Ongoing during quarry and reclamation activities	San Bernardino County Land Use Services Department	

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
individuals or their sign are identified during pre-project surveys, mitigation measure **MM 3.3.3b** shall be implemented. **MM 3.3.3b Desert Tortoise Avoidance, Minimization, and Mitigation.** Should occupied desert tortoise habitat be identified during the pre-project surveys, a habitat mitigation and monitoring plan and raven control plan shall be developed in consultation with the USFWS and the CDFW. This plan shall describe all measures to be implemented prior to, during, and after construction, including, but not limited to, the following: (1) All tortoise burrows shall be avoided to the greatest extent feasible, and temporary exclusionary tortoise fencing (1x2-inch mesh hardware cloth) shall be installed at the limits of disturbance prior to initiation of construction activities. Fence installation and ongoing oversight of the need for maintenance shall be monitored by a USFWS-authorized desert tortoise biologist. (2) Upon completion of fence installation, the authorized biologist shall conduct a clearance survey of the fenced area prior to declaring the construction area free of tortoises. (3) If it is necessary to excavate a desert tortoise from its burrow to move it out of harm's way, excavation shall be done with hand tools, either by or under the direct supervision of the authorized biologist. (4) Desert tortoises removed from burrows shall be placed in an unoccupied burrow of approximately the same size as the one from which they were removed. If an existing burrow is not available, the authorized biologist shall construct one. (5) Desert tortoises moved during inactive periods will be monitored for at least two days after relocation or the end of construction, whichever occurs first. (6) If desert tortoises need to be moved at a time of day when ambient temperatures could harm them (less than 40 degrees and over 90 degrees Fahrenheit), they shall be held overnight in a clean cardboard box and released the following day during more favorable temperatures. Cardboard boxes used to hold tortoises shall only be used once.			

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
(7) All handling of desert tortoises shall be performed consistent with the *Guidelines for Handling Desert Tortoises During Construction Projects* (Desert Tortoise Council 1994). (8) The mine operator shall mitigate for impacts on occupied desert tortoise habitat at a 1:1 minimum ratio through the purchase of credits from an approved desert tortoise mitigation bank. The amount of credits purchased and the location of the mitigation bank used are subject to approval by the USFWS and the CDFW. The mine operator shall provide the County with evidence that the permit and/or other requirements established by either agency have been satisfactorily met.			
MM 3.3.4 Coast Horned Lizard Surveys. Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine if suitable habitat for this species occurs within 250 feet of the proposed impact area. If suitable habitat exists, preconstruction surveys must be performed by a qualified biologist in a manner to maximize detection of coast horned lizards (i.e., during warm weather, walking slowly). If any lizards are discovered within the work areas, they shall be actively moved or passively encouraged to leave the work area.	Ongoing during quarry and reclamation activities	San Bernardino County Land Use Services Department	
MM 3.3.5 Burrowing Owl Surveys. If clearing and construction activities will occur during the nesting period for burrowing owls (February 1–August 31), the mine operator shall retain a qualified biologist to determine if suitable nesting habitat occurs within 500 feet of the proposed impact area. If suitable habitat exists, focused surveys must be performed by a qualified biologist in accordance with the CDFW's *Staff Report on Burrowing Owl Mitigation,* published March 7, 2012. Surveys shall be repeated if project activities are suspended or delayed for more than 15 days during nesting season. If no burrowing owls are detected, no further mitigation is required. If active burrowing owl nest sites are detected, the mine operator shall implement the avoidance, minimization, and mitigation methodologies outlined in the CDFW's *Staff Report on Burrowing Owl Mitigation* prior to initiating project-related activities that may impact burrowing owls.	Ongoing during quarry and reclamation activities	San Bernardino County Land Use Services Department	

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
MM 3.3.6 Migratory Bird Surveys. If clearing and/or construction activities will occur in undisturbed portions of the site, or blasting activities will occur in any portion of the project site, during the migratory bird nesting season (March 15–August 15), preconstruction surveys to identify active migratory bird nests shall be conducted by a qualified biologist within 14 days of initiation of project activities. Focused surveys must be performed by a qualified biologist for the purposes of determining the presence/absence of active nest sites within the proposed impact area and a 200-foot buffer (if feasible). Surveys shall be repeated if project activities are delayed or postponed for more than 30 days. If active nest sites are identified within 200 feet of project activities, the mine operator shall impose a limited operating period (LOP) for all active nest sites prior to commencement of any project ~~construction~~ activities to avoid construction or project-related disturbances to migratory bird nesting activities. An LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, blasting, and construction) will not occur and will be imposed within 100 feet of any active nest sites until the nest is deemed inactive. Activities permitted within and the size (i.e., 100 feet) of LOPs may be adjusted through consultation with the CDFW and~~/or~~ the County. When an active nest is located within 200 feet of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to CDWF and the County until the nest(s) are deemed inactive.	Ongoing during quarry and reclamation activities	San Bernardino County Land Use Services Department	
MM 3.3.7a Raptor Conservation Strategy. The applicant shall participate in and implement the Raptor Conservation Strategy. **MM 3.3.7b Raptor Surveys.** If clearing and/or construction activities would occur in undisturbed portions of the site, or blasting activities will occur in any portion of the project site, during the raptor nesting season	Ongoing during quarry and reclamation activities	San Bernardino County Land Use Services Department	

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
(January 15–August 15), preconstruction surveys to identify active raptor nests shall be conducted by a qualified biologist within 14 days of construction initiation. Focused surveys must be performed by a qualified biologist for the purposes of determining presence/absence of active nest sites within the proposed impact area. If no active nests are found, no further mitigation is required. Surveys shall be repeated if project activities are delayed or postponed for more than 30 days. If active golden eagle or other raptor nest sites are identified within a half mile of project activities, the applicant shall impose a limited operating period (LOP) for all active nest sites prior to commencement of any project activities to avoid construction- or project-related disturbances to nesting raptors. A LOP constitutes a period during which project-related activities (i.e., vegetation removal, earth moving, blasting, and construction) will not occur and shall be imposed within 500 feet of any active nest sites until the nest is deemed inactive. Activities permitted within LOPs and the size (i.e., 500 feet) of LOPs may be adjusted through consultation with the CDFW and the County. When an active nest is located within a half mile of project activities, monitoring shall be conducted weekly by a qualified biologist until the nest is deemed inactive. If nest monitoring detects changes in behavior of nesting birds associated with blasting activities, use of noise attenuation devices or techniques (e.g., blast mats, different blasting compounds) shall be used during the breeding season. When active nests are present, a monthly nest monitoring report shall be prepared by the qualified biologist and submitted to the County until the nest(s) are deemed inactive.			
MM 3.3.9 Bat Surveys. Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine whether potential roosting sites for special-status bats may be affected. If potential roost sites are identified, a preconstruction survey by a qualified biologist shall be conducted between March 1 and July 31 to determine the presence or absence of roosting bats. If the survey does not identify the presence of occupied roosts, no further mitigation is required. If non-breeding roosts occupied by special-status bat species are	Ongoing during quarry and reclamation activities	San Bernardino County Land Use Services Department	

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
documented within construction areas, the bats shall be safely flushed from the sites where roosting habitat is planned to be removed prior to May of each construction phase and prior to the onset of construction activities. The removal of the roosting sites shall occur during the time of day when the roost is unoccupied. If a maternity colony is detected, a 100-foot construction-free buffer shall be established around the roost site and remain in place until it has been determined by a qualified biologist that the nursery is no longer active. Removal of maternity roosts shall be restricted to between March 1 and April 15 or August 15 and October 15 to avoid interfering with an active nursery. The loss of each roost will be compensated for by the construction and installation of two bat boxes suitable to the bat species and colony size excluded from the original roosting site. The bat boxes shall be installed in the vicinity prior to removal of the original non-breeding/maternity roost sites. A detailed program for bat flushing, roosting site removal, and installation of bat boxes shall be developed in consultation with a qualified biologist.			
MM 3.3.10 Pallid San Diego Pocket Mouse Surveys. Prior to implementation of project-related activities in undisturbed portions of the site, the mine operator shall retain a qualified biologist to determine if suitable habitat for this species occurs within 250 feet of the proposed impact area. If suitable habitat exists, preconstruction surveys must be performed by a qualified biologist in a manner to maximize detection of pallid San Diego pocket mice. If any mice are discovered within the work areas, they shall be actively moved or passively encouraged to leave the work area.	Ongoing during quarry and reclamation activities	San Bernardino County Land Use Services Department	
MM 3.3.11a No Net Loss of Riparian Vegetation. The mine operator shall ensure there is no net loss of riparian vegetation. Mitigation can include on-site restoration or purchase of mitigation credits at a USACE-approved mitigation bank, placing a conservation easement over a riparian area, or quit claiming mineral claims over a riparian area. Mitigation, as required in regulatory permits issued through the CDFW, the USACE, or the RWQCB, may be applied to satisfy this measure.	Ongoing during quarry and reclamation activities for riparian vegetation Prior to impacting oak woodland habitat for oak woodlands	San Bernardino County Land Use Services Department	

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
Evidence of compliance with this mitigation measure shall be provided prior to construction and grading activities for the proposed project. **MM 3.3.11b Oak Woodlands.** The mine operator shall ensure there is no net loss of oak woodland habitat. Mitigation can include any one or combination of the following: (1) Preservation of existing oak woodlands by recording a conservation easement(s) in favor of the County or an approved organization or agency. (2) Replacement or restoration of former oak woodlands. The County may require the planting and maintenance of replacement trees, including replacing dead or diseased trees. The replacement ratio and tree sizes shall be based on the recommendation of an Oak Reforestation Program prepared by a registered professional forester. The requirement to maintain trees in compliance with this paragraph shall terminate seven years after the trees are planted. (3) Contribution of in-lieu mitigation fees to the Oak Woodlands Conservation Fund, established under Fish and Game Code Section 1363 for the purpose of purchasing oak woodlands conservation easements. A project applicant who contributes funds in compliance with this subsection shall not receive or use a grant from the Oak Woodlands Conservation Fund as part of the mitigation for the project. The in-lieu fee for replacement trees shall be calculated based on their equivalent value as established by the International Society of Arboriculture's current edition of the *Guide for Plant Appraisal*. (4) Performing other mitigation measures as may be required by the County (e.g., inch-for-inch off-site replacement planting, transfer of development rights, enrollment of project with offset provider for carbon credits in greenhouse gas emission registry, carbon reduction, and carbon trading system).			
3.4 Cultural Resources			
MM 3.4.1 It shall be required in the final Amended Mine and Reclamation Plan, that if, during the course of construction, mining, or reclamation activities previously unknown cultural resources (i.e., prehistoric or historic	Required to be placed in the final version of the Amended Plan and	County of San Bernardino Planning Department	

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
sites) are discovered, work shall be halted immediately within 50 feet of the discovery, the San Bernardino County Land Use Services Department shall be notified, and a professional archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards in prehistoric or historical archaeology shall be retained to determine the significance of the discovery. Determination of impacts, significance, and mitigation that protects the discovered resource shall be made by a qualified archaeologist in consultation with recognized local Native American groups, if appropriate. The San Bernardino County Museum shall also be contacted for review of the archaeological find(s). In addition, prior to the commencement of project excavations, all construction and mining personnel shall be informed of the potential to inadvertently uncover cultural resources and the procedures to follow subsequent to an inadvertent discovery of cultural resources.	implemented during mining and reclamation activities		
MM 3.4.3 If non-metamorphosed fossiliferous limestones are encountered during mining activities, they shall be removed and retained for examination by a qualified paleontologist. If any fossil-bearing materials are encountered, a program to protect and preserve such resources that might be exposed or unearthed shall be developed in cooperation with the project applicant and San Bernardino County. The program shall be developed in accordance with the proposed guidelines of the Society of Vertebrate Paleontology and shall include, but not be limited to, the following: • All non-metamorphosed fossiliferous limestones that are encountered during mining shall be stockpiled for examination by a qualified paleontologist. The monitor shall be prepared to quickly salvage any fossils that might be present. The monitor should also remove samples of sediments that are likely to contain the remains of small fossil vertebrates and invertebrates. • Collected samples of sediments shall be processed to recover small invertebrate and vertebrate fossils. Recovered specimens shall be prepared so that they can be identified and permanently preserved. • Any specimens shall be identified, curated, and placed into a repository with permanent retrievable storage.	Required to be placed in the final version of the Amended Plan and implemented during mining and reclamation activities	County of San Bernardino Planning Department	

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
• A report of findings, including an itemized inventory of recovered specimens, shall be prepared on completion of the steps outlined above. The report shall include a discussion of the significance of all recovered specimens. The report and inventory, when submitted to San Bernardino County, will signify completion of the program to mitigate impacts on paleontological resources.			
3.5 Geology and Soils			
MM 3.5.3 Omya shall prepare and submit periodic monitoring of the Western Drainage and Ruby Springs area to the County of San Bernardino. If the results of periodic monitoring of the Western Drainage and Ruby Springs area finds that sediments from the White Knob Quarry operation have caused a measurable impact on Ruby Springs, Omya shall prepare and submit for approval additional mitigation measures that may include (1) revision of the 2008 Sedimentation and Erosion Monitoring Technical Work Plan, and/or (2) remediation of the Western Drainage and/or Ruby Springs area. Any remediation efforts in the Western Drainage and/or Ruby Springs area will occur prior to proceeding with work on the ground. Omya shall obtain all necessary permits and pay all required fees and financial assurances, including, but not limited to, County of San Bernardino permits, BLM permits, California Department of Fish and Wildlife permits, and US Fish and Wildlife Service permits. Reporting of monitoring results shall be done at least once every two years and following any significant rain event that is equal to or exceeds the 10-year return period rainfall for the project site. Reports of monitoring activities, data, and findings shall be provided to the County of San Bernardino at least once every two years prior to the annual SMARA inspection. The first report shall be submitted within the year following the approval of the Amended Reclamation Plan. The monitoring shall be done in accordance with the 2008 Sedimentation and Erosion Monitoring Technical Work Plan (dated May 31, 2008) and any subsequent approved amendments.	Ongoing as part of quarry operations	County of San Bernardino Planning Department	
3.7 Hydrology and Water Quality – None required.			
MM 3.7.1 The following mitigation measures shall be implemented in	Required to be placed in	County of San Bernardino	

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
addition to requirements contained in the project's SWPPP and SPCC. All measures shall be subject to County of San Bernardino approval prior to implementation. a. Implement the recommendations for modifications of the project's haul road drainage and sediment control structures given in the September 12, 2013, Stantec technical memorandum and August 2011 Stantec report, White Knob Haul Road Drainage Study and Plan Development, to implement Sections 15, 16, and 17 of the April 20, 2011, Settlement Agreement between Omya and the Bureau of Land Management in sections: - 2.3 Culvert Flow Calculations (EIR Appendix G, Stantec 2013, p.6); - 2.4 Culvert Riprap Calculations (EIR Appendix G, Stantec 2013, p. 7); - 3.1.2, Roadway Grading and Ditch Recommendations (EIR Appendix G, Stantec 2011, p. 3.3); - 3.2.2, Sediment Catchment Basins Recommendations(EIR Appendix G, Stantec 2011, p. 3.6); and - 4.0, Right-of-Way Recommendations (EIR Appendix G, Stantec 2011, p. 4.1). Inclusion of these improvements would ensure that no flow increases to downstream flows during flood events. b. All quarry areas, overburden fills, and haul roads shall be maintained to minimize erosion and sedimentation. c. Sedimentation basins shall be inspected regularly, at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. Sediment shall be removed and basin function restored as needed. d. Any sediment removed from basins shall be deposited on the overburden areas or into the White Knob Quarry sedimentation pond. Sediment placed on the overburden areas shall utilize temporary stormwater BMPs to prevent further sediment discharge and shall be revegetated in accordance with the 2013 Amended Reclamation Plan.	the final version of the Amended Plan and implemented during mining and reclamation activities	Planning Department	

Mitigation Measure	Timing	Monitoring Responsibility	Verification (Date and Initials)
e. Basin spillways shall remain in good working condition and repaired as necessary. f. Areas in haul roads that experience erosion shall be backfilled and rocked to minimize future erosion. g. Overburden fill slopes and benches shall be inspected regularly, at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. If erosion or sedimentation is observed, temporary BMPs shall be utilized on overburden slopes and benches as soon as possible to minimize future erosion. h. Areas of erosion or sediment deposition in overburden areas shall be permanently remediated as soon as possible, preferably before the next precipitation event. Remediated overburden slopes and benches shall be revegetated and/or armored in accordance with the 2013 Amended Reclamation Plan. i. Haul road culverts and Arizona crossings shall be inspected regularly at least once every 30 days during the rainy season, October to April, and following any significant precipitation event, equal to or greater than ½ inch of direct rainfall. Culverts and crossing shall be repaired and maintained to allow for proper passage of floodwaters. j. If any of the haul road culverts are damaged or washed out, they shall be replaced with a culvert that provides a minimal capacity to pass a 20-year storm event without overtopping or excess erosion. k. The seven procedures that were implemented to minimize boulder roll-down shall continue for the life of the project. These procedures are identified in mitigation measure **MM 3.1.1**. Procedures shall be modified and/or additional measure put in place, as necessary, to achieve minimal boulder roll-down.			