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24 April 2020
File No. 132051-002

Harrison, Temblador, Hungerford & Johnson LLP
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Attention: Mr. Adam Guernsey, Esq.
aguernsey@hthjlaw.com

Subject: **Addendum to Geotechnical Evaluation Report**
Vulcan Materials Company Area Q Project
2400 West Highland Avenue
San Bernardino, California

Ladies and Gentlemen:

We are pleased to submit this Addendum to our geotechnical evaluation report dated 17 October 2019 responding to geotechnical peer review comments for Vulcan Materials Company's (Vulcan) proposed Area Q mining project (Project). The peer review was performed on our geotechnical evaluation report dated 17 October 2019, addressing site geology, potential hazards, and engineering recommendations pertaining to the proposed mine project. The purpose of this letter is to respond to comments presented in a Memorandum prepared by Lilburn Corporation (Lilburn) titled, "Review of Geotechnical and Geology Screening Reports for Vulcan Area Q Project" dated 5 March 2020 under file number LC 1380.

Presented below are the comments provided by Lilburn with our responses immediately following.

1. ***The location of the Glen Helen Fault shall be further investigated with respect to the potential for slope stability and potential slope failure, since the geotechnical report concludes the risk of surface faulting and secondary ground failure due to fault rupture to be high especially in the south end of Area Q (page 14). This investigation should include, but not be limited to, subsurface exploration (trenching, CPT), geophysical methods, and/or detailed mapping of adjacent slope exposures. Mitigation measures should be provided if considered appropriate, such as geologic inspections during mining.***

   Response: An observation of faulting in the Quarry's Area L and M south slopes was made during the 5 May 2018 visit. No major faulting was observed in the exposed beds and lenses other than a few small non-tectonic style cracks with insignificant signs of movement in the Area L slopes. The Area M south slope was bladed smooth and planted during a reclamation. Erosion of the slope exposed a few continuous layers of silt and clay with a few overlapping lenses. The Area M south slope was the closest to the inferred Glen Helen Fault trace which is mapped a few hundred feet to

the west (California Division of Mines & Geology, 1974) (Figure 1, Figure 4). A small section of alluvial tabular beds and lens deposits along the south slope above the aggregate conveyor belt in Area M and northwest of Area Q was exposed, so that portion was examined for faulting and none was observed. The potential for surface fault rupture hazard was evaluated initially by conducting geological research consisting of a detailed literature search, analyzing historical topographic maps, soil survey maps for soil types and analyzing available historical aerial photos. These studies are discussed in detail in the referenced Haley & Aldrich evaluation report dated October 2019.

Neither the inferred Glen Helen Fault nor any other major faulting was seen when performing an observation of the Area L and M southern slopes. The upper sediments exposed in the southern slopes were inferred to be Late Holocene in age, while the inferred Glen Helen Fault was considered to be a Fault that moved or had a seismic event during the Holocene. The return interval of, or whether the inferred Glen Helen Fault could have a future seismic event, is not known at this time, but the inferred Fault will be considered active. If a seismic event developed on the inferred Glen Helen Fault, movement on the Fault would be expected to have dextral movement. If seismic offset did occur on the inferred Glen Helen Fault, the displacement transfer to the surface should be minimal because the very young fanglomerate sediments filling the basin and deposited in the area of Area Q are less brittle than bedrock. Our literature review did not identify a maximum amount of energy that could be released during a seismic event associated with the inferred Glen Helen Fault trace. It was estimated by Wesnousky, 1986, that the Glen Helen/Lytle Creek Faults have a slip rate of 10 millimeters per year (mm/yr). The amount of dextral movement in the area of the quarry cannot be predicted at this time. As future information is collected, the amount of dextral movement on the inferred Glen Helen Fault during an earthquake event in the quarry could be assessed more accurately.

As published in the Haley & Aldrich report dated October 2019 and evaluated in this letter response, the sediments and stratigraphy consist of sand and gravels beds that are parallel and have no evident tectonic or depositional deformation. The Glen Helen Fault trace as inferred by Dibblee 2003 and 2004 (Figure 4), or any sympathetic and or antithetic faulting from offset associated with the inferred Glen Helen Fault trace as published on the AP map sheets, was not evident in the southern slopes of Area L or Area M.

Although the inferred fault trace mapped by Dibblee may not be present at ground surface, it could be found at depth, so it is possible that new quarry slopes could expose the Fault during mining at Area Q. Therefore, Haley & Aldrich recommends including the following mitigation as part of the Project: Approximately every 12 to 18 months during active mining, a California Certified Engineering Geologist (CEG) should observe exposed cut faces of the mining operation in Area Q for evidence of the Fault, and if warranted assess the potential for surface rupture and/or slope failure.

2. ***The geotechnical report should include a discussion and evaluation of stratigraphy and structure observed on adjacent existing slopes, including gravel layers, silty, and sandy lenses, and orientation of any observed bedding. Based on the results of this evaluation, geologic cross sections of anticipated structure should be included with the report. The report should include recommendations for mitigation of slope gradients, if considered necessary.***

Response: To better understand stratigraphy and potential for geologic structure two cross-sections were constructed with photographs taken during the site visit on 5 May 2018, which were projected from Areas L/M into Area Q. The cross-sections were schematic representations of the south slopes in Area L (Cross-Section L-L,' Appendix A) and Area M (Cross-Section M-M,' Appendix A. Figure 1 includes locations of the cross-sections. Figure 2 shows an excerpt of the USGS geologic map for the Area Q Area, and Figure 3 shows a chart correlating the stratigraphic units from the USGS map. The camera lens curvature and distortion of the panoramic photos were reduced but were not fully eliminated. To better illustrate the stratigraphy of the cross-sections, close-up photos of slope sections with different colored leader lines pointing out their locations on the cross-section were added. Detailed stratigraphic measurements were not made during the site visit nor was the logging of the borings from others accurate enough to get a precise measurement. However, given the nature and types of lithofacies observed and comparing to alluvial facies models (Miall, 1992), it is our opinion the cross-section projection is an appropriate methodology to interpret the depositional framework for comprising the Area Q stratigraphy.

The following sections will describe the general findings.

Cross-Section L-L'

Cross-Section L-L', consisting of a panoramic photo, illustrates the southern end of Area L. This slope had fresh exposures of the distinct sands, silt and gravel beds that were exposed during the mining process of the aggregate materials. This cross-section is adjacent to the north end of the proposed Area Q and illustrates that the Quarry material was consistent with the boring logs that were drilled in Area Q by others. The black dashed line, as drawn on the cross-section, followed two dominant and continuous grayish brown clayey silt beds. Throughout the slope, the uniform beds that ranged from gravelly sands to cobbly sand were parallel to near parallel Even though the area has undergone continuous loading from sediment deposition and tectonic uplift, these beds were continuous with no noticeable major deformation. Due to the mild to no pedogenic formation of soil in these beds, the estimated age of the beds was Holocene and most likely Late Holocene. If faulting does exist in this area, it is at depth below the slope toes and the bottom of the quarry.

Cross-Section M-M'

Cross-Section M-M', from a panoramic photo, illustrates the southern end of Area M. Though not adjacent to Area Q, this slope is the closest to the trace of the inferred Glen Helen Fault. During the site visit, it was noted that the slope was graded smooth, most of the coarse-grained gravels and cobbles were dislodged and the graded slope was planted with native vegetation. Though the exposures of key traceable beds were not fully exposed, portions were observed cropping out of

the slope due to mild erosion. The uppermost very young beds along the aggregate conveyor belt were continuous. Black dashed lines were drawn along some of the key beds to illustrate that the slope was not deformed where the beds were exposed. As with Cross-Section L-L', the exposed sand, silt, sand and cobble beds did not show faulting. If faulting were present in the area of this slope, the faults would be found below the conveyor belt and in areas where the beds are concealed by grading, below the slope toe, and/or below the bottom of the Quarry.

Based upon our interpretation, additional recommendations for mitigation of slope gradients are not considered necessary.

3. ***The geotechnical report (page 8) indicates that seismogenic faults in the area could create a local earthquake resulting in possible ground lurching on the Site's quarry perimeter where the surface seismic waves meet the quarry slopes. Mitigation measures should be provided to mitigate this potential.***

Response: Ground lurching is the horizontal movement of soil, sediments, or fills located on relatively steep embankments or scarps as a result of seismic activity, forming irregular ground surface cracks. The potential for lateral spreading or lurching is highest in areas underlain by soft, saturated materials, especially where bordered by steep banks or adjacent hard ground.

As presented in our report, known faults including the San Jacinto, San Andreas, and Cucamonga Faults are capable of inducing moderate to strong seismic events and geological seismic hazards, such as ground heave and lurching, ridge shattering, land sliding, and avalanches. These hazards could locally dislodge cobbles and boulders from slopes and could break the matrix bonds between sand grains causing local instabilities. Based on the currently planned excavation depth of the proposed pit and the depth to groundwater conditions, the potential for zones of saturated material is very low. The sands observed in the existing pits were generally clean of fines, with a cemented matrix holding the sand grains in place but were friable. Sands at the bottom of the existing pits effervesced after the application of 10 percent HCl, indicating that a fraction of carbonate was present in the sands. The carbonate cementation provides a hardening effect to the slopes. These factors indicate that the lithofacies are not conducive to significant ground lurching, so no significant impacts are expected, based on the proposed site use. As the potential for these hazards to manifest and associated risk of damage to the proposed site development are low, mitigation measures are not warranted.

4. ***The geotechnical report shall include an analysis of surficial slope stability for the proposed slopes. Based on the results of this analysis, mitigation measures should be recommended if factors of safety are less than normally accepted values.***

Response: The inter-site artificial terracing in Area L, created by mining within the quarry's bottom, was near vertical with a mild carbonate cementation (effervesced with 10% Hydrochloric Acid) forming a crust on the slope faces. This crust was up to a few inches in depth on dry slopes, and the crust prevented surficial crumbling of sand and fines. Where the slopes were moist, the carbonate cementation did not provide the stronger binding properties observed for the dry crust. Though the

clasts could be dislodged in both wet and dry conditions, more effort was required to dislodge large clasts when the crust was dry. The outer slopes had minor carbonate cementation. The inter-site artificial terraces (see Figure 1) created by mining showed erosion from flooding or artificial watering of the slopes. The slopes also showed a degree of grading that may have been performed to keep the slopes from losing their stability and to mitigate any slope material from becoming a fall hazard.

The observed erosion consisted of rills and channels with vertical to near vertical channel walls. Sands and fine gravels washed out, leaving loose deposits of large gravel, cobbles and a few boulders lagging within the erosional slots. The perimeter outer slopes did not show deep channeling, but some minor rilling was present. A pile of sand and gravel talus, which may have been a constructed berm, was noted at the toe of the slopes. A distinction as to whether the sand and gravel piles were talus or artificial berm was not able to be made during the field visit, but the sand and gravel piles did act as a barrier to deaccelerate and cushion dislodged coarse-grained quarry slope materials. The south slope in Area M was bladed smooth, planted, and laid back to about 60 degrees during the reclamation process. The reclaimed slopes were observed to be stable and holding up to erosion. Under static conditions, we anticipate that the same conditions and performance will be present in Area Q, given the similarity in lithofacies.

Since the slopes consisted of horizontal, multi-layered, very young coarse-grained fanglomerate alluvial deposits, shallow debris falls could develop during a local seismic event. Due to the predominance of coarse-grained lithologies, the slopes are expected to exhibit high percolation rates, so a debris flow on the slopes after heavy rains followed by a large seismic event would be rare. In those cases where meteoric water could temporarily and locally perch along top of clayey silt layers, there would be insufficient head to compel extensive saturation and therefore the water should not accumulate, but rather laterally disperse within the sands. Given these physical characteristics and the lack of observed evidence of direct slope failure in the adjoining quarry areas, Haley & Aldrich concludes that the potential for surficial slope stability failures during a seismic event is very low. Consequently, we consider the Project design slope configurations to be sufficiently stable under static conditions, and we do not consider the potential for failure to be significant. Mitigation is therefore not warranted.

5. ***The geotechnical report included a sample for lab testing from one location in the adjacent existing mine area. The geotechnical consultant should consider additional sample locations, preferably, on-site, or provide justification that one sample location is enough to represent slope conditions in Area Q.***

Response: Based on the borings and conclusions by Terramins, the material encountered in Area Q is fairly uniform including sands, silts, and gravels to depths of about 120 feet. This layer was encountered as being underlain by a coarse gravel bed from about 120 to 150 feet. Below a depth of about 150 feet, sands with high percentages of gravel should be anticipated. The site is composed of predominately granular soils to the proposed depth of mining.

The accessibility of the cut face of the adjacent Area L pit readily allowed for collection of samples for the large-scale direct shears. The samples collected along the face were judged to be representative of the materials observed in the cut face, based on the observed lithofacies types. Large-scale shears include testing on an effective area of 12 inches by 12 inches in plan dimension. The samples collected for this testing required a significant volume of material be collected. Based on the volume of material collected for the testing, the material was composited from a wide area. Testing additional large composite samples collected from the same area materials would have produced significantly similar results. The results of the testing were judged to be a reasonable reflection of the matrices exposed in the cut face and logged in the borings advanced by others in previous studies.

A layback of 2:1 for granular soils is considered appropriate without necessitating mitigation measures.

Based on the uniformity of the encountered granular subsurface conditions, the results of the tests performed on large volume samples, and the planned 2:1 layback, we determined that additional sampling and testing was not necessary.

6. ***The geotechnical consultant should re-evaluate the seismic stability of proposed slopes using the calculated seismic displacement method. This method is typically used to quantitatively evaluate the seismic performance of earth slopes in active seismic zones such as the project site. Depending on the results of this analysis, the geotechnical consultant should consider recommendations for mitigation.***

Response: As presented in our report, the slopes were evaluated using procedures outlined in Special Publication 117a (CGS, 2008), Guidelines for Evaluating and Mitigating Seismic Hazards in California. The screening procedures used for seismic slope stability begin with modeling a seismic coefficient (k) applied to a conventional limit equilibrium slope stability calculation. Following the techniques presented in the guideline, we followed the screening procedures outlined (Seed, 1979) including using a seismic coefficient, k_h, of 0.15 for a magnitude 8¼ earthquake. Using these parameters, we calculated Factor of Safety (FOS) of greater than the minimum requirement of 1.15 under a dynamic condition. Seed's approach uses Newmark displacements (Newmark, 1965) calculated with simple methods. The application of the approach is based on acceptable small deformations of 1 meter or less at the crest and is intended for dams and landfills. Based on this analysis with the acceptable deformation of up to 1 meter, the screen was passed and we concluded a seismic stability hazard is not likely at the site. This method is considered to be conservative (Stewart, 2003).

The procedures used include up to 1 meter of movement and would pose little to no risk to the proposed mining development. Additional screening analysis for hillside residential or commercial use (Stewart, 2003) to determine smaller acceptable displacements for these developments, is generally limited to either 5 or 15 centimeters. Based on the proposed site development as a quarry, this displacement criterion was deemed too restrictive for allowable movement and, therefore, the quarry is not an appropriate application of this additional screening. Specifically, it

was not warranted given the level of risk associated with slope displacement for a quarry development. As such, mitigation measures are not required.

7. ***The geotechnical report indicates that seismic shaking hazards could locally dislodge cobbles and boulders from slopes and could break the matrix bonds between sand grains causing local instabilities. Mitigation measures should be provided to address this issue.***

   Response: Materials contained in the slopes of Areas L (steep and near vertical) and M (laid back about 60 degrees and bladed smooth) were observed to stand up well to weathering, and were not showing any broad effects from erosion or mass wasting. Small piles of the slope materials were found along the toe of the south walls. This material was most likely talus in Area L but could be artificial berms in Area M. This material created a good cushion for falling rocks preventing the coarse cobbles and boulders from rolling out into the bottom of the quarries. Should there be areas along slopes where alluvial materials are loose, and/or there is evidence of dislodgement, it is recommended that the operator install a soil catchment berm at least 10 feet from the toe of the slope in those areas, as needed to prevent falling coarse materials from rolling out into the quarry bottom. The steeper the slope, the more the coarse material will fall down and imbed into the quarry bottom or lose energy and stop at the berm. If the slopes were cut at a higher angle, such as 1:1, the coarse materials that dislodge from the slope either from weathering or from a seismic event could start rolling and bouncing down the slope with increasing velocity toward the quarry bottom and could jump over the berm, impacting the mining equipment or human miners on the quarry bottom. However, as called for in the reclamation plan, the final slopes will be at an inclination of 2:1; which meets the prescriptive standard under Public Resources Code §3704.

8. ***The Conclusions section of the geotechnical report indicates if temporary or permanent structures are subsequently planned at the Site, the report recommends that a supplemental study be performed to address geotechnical impacts and provide recommendations for foundation and seismic design, especially if these structures are planned within a State-designated Earthquake Fault Zone. The geotechnical consultant shall provide a specific definition of temporary and permanent structures, relative to human occupancy and temporary types of structures (conveyors, crushers, etc.). If any proposed structures meet the geotechnical consultant's definitions, the supplemental study should be performed at this time.***

   Response: Fixed structures associated with the Project are limited to a conveyor line, which will extend from the base of the northern Area Q slope to top. This conveyor will transport the mined material up and over the cut slope to Area L for further conveyance. A structure is considered as unoccupied and falls under the California Building Code (CBC, 2019) as "U" category for use and occupancy. This category includes "Buildings and structures of an accessory character and miscellaneous structures not classified in any specific occupancy shall be constructed, equipped and maintained to conform to the requirements of this code commensurate with the fire and life hazard incidental to their occupancy." While Haley & Aldrich's report does recommend the evaluation of seismic effects with respect to structures, because the Project only involves a single conveyor line, which does not require occupancy to operate, and which will be constructed in according to applicable CBC standards, no additional study is needed.

We appreciate the opportunity to provide our services to you on this project. If you have any questions, please call.

Sincerely yours,
HALEY & ALDRICH, INC.

Katy Decker, P.G.
Project Manager

PROFESSIONAL GEOLOGIST
KATHRYN DECKER
No. 8805
Exp. 10/30/20
STATE OF CALIFORNIA

Catherine H. Ellis, P.E., G.E.
Senior Associate, Geotechnical Engineer

Attachments:
- Figures (4)
- Appendix A (2)
- References

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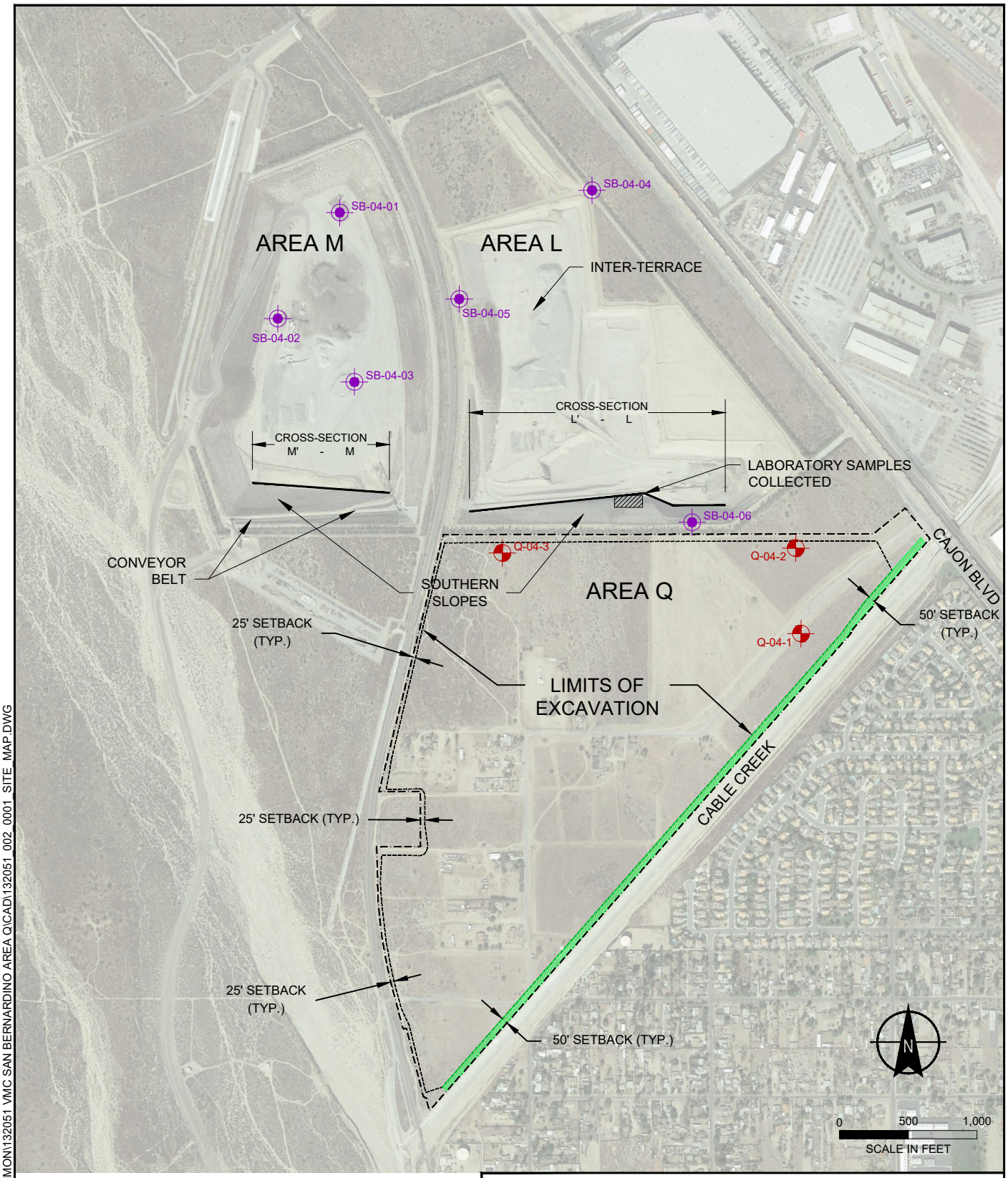
FIGURES



LEGEND

HOLLOW-STEM AUGER BORINGS (CLEATH & ASSOCIATES, 2004)

HOLLOW-STEM AUGER BORINGS (TERRAMINS, INC. 2004)

NOTES

1. BASEMAP SOURCE PROVIDED BY SESPE CONSULTING, INC., JUNE 2019

HALEY ALDRICH

VULCAN MATERIALS COMPANY
SAN BERNARDINO MINE - AREA Q EXPANSION
2400 W. HIGHLAND AVENUE
SAN BERNARDINO, CALIFORNIA

SITE MAP

SCALE: AS SHOWN
APRIL 2020

FIGURE 1

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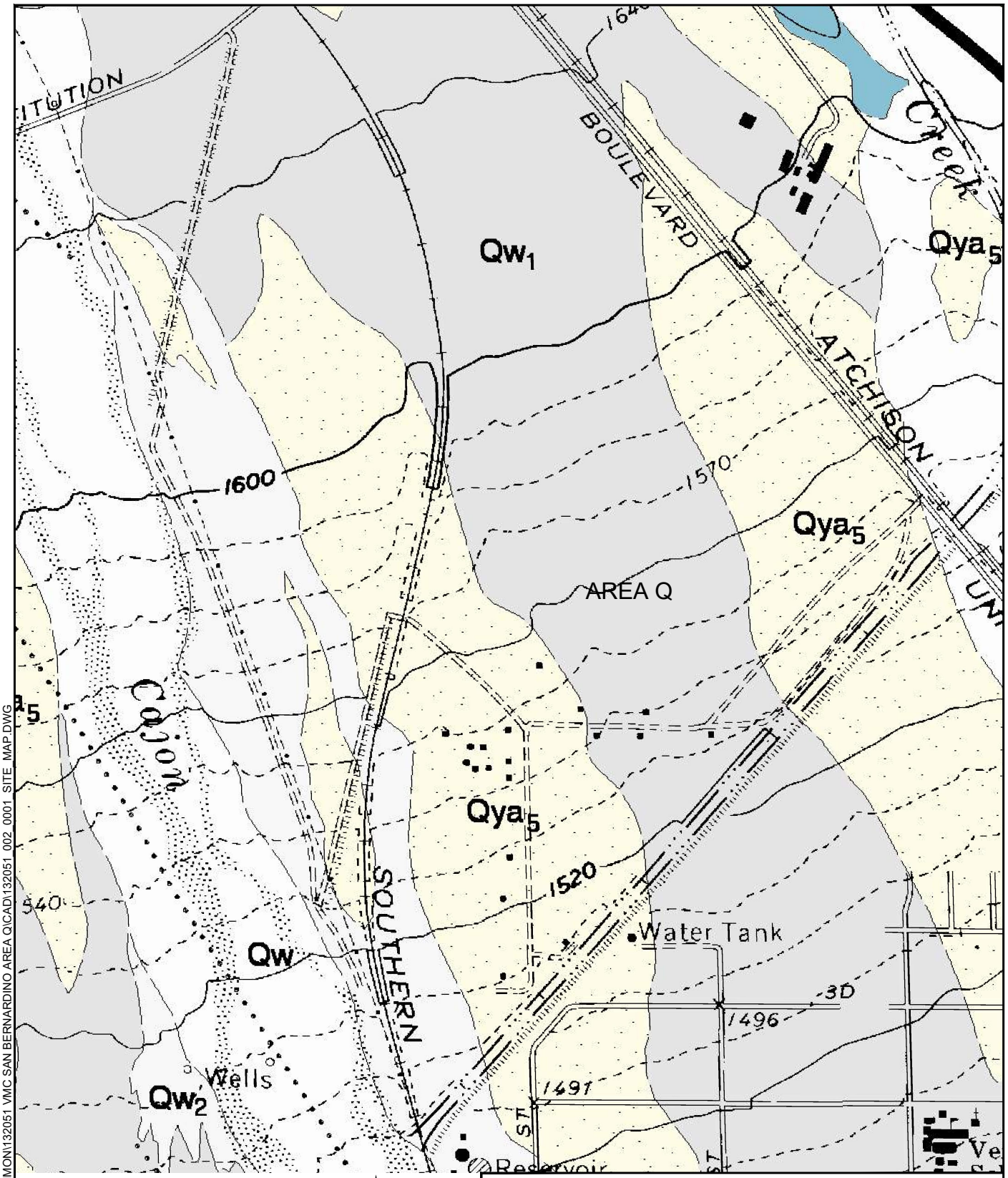

NOTES

SOURCE: MILLER, F.K., MATTI, J.C., CARSON, S.E., AND COSSETTE, P.M., 2001, GEOLOGIC MAP OF THE SAN BERNARDINO NORTH 7.5' QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA: U.S. GEOLOGICAL SURVEY, OPEN-FILE REPORT OF-2001-131

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APPROXIMATE SCALE IN FEET

HALEY ALDRICH

VULCAN MATERIALS COMPANY
SAN BERNARDINO MINE - AREA Q EXPANSION
2400 W. HIGHLAND AVENUE
SAN BERNARDINO, CALIFORNIA

GEOLOGY MAP OF AREA Q

SCALE: AS SHOWN
APRIL 2020

FIGURE 2

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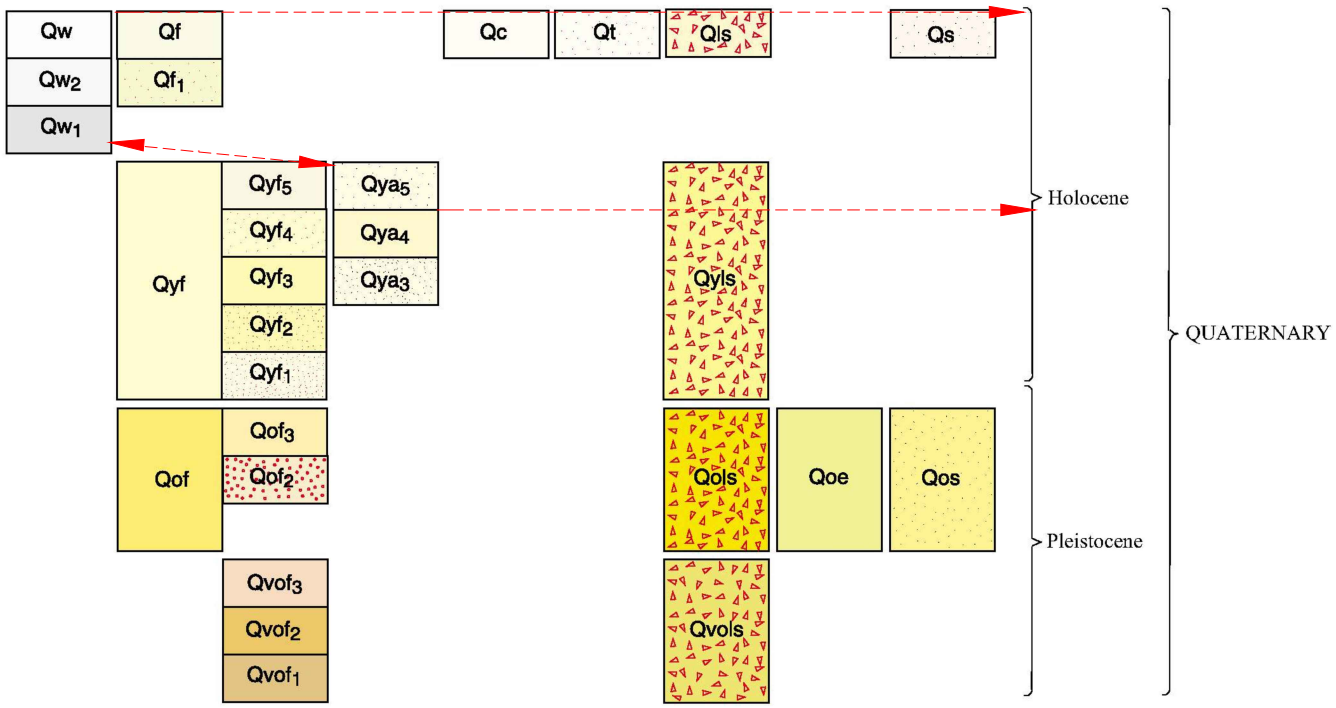
\\HALEYALDRICH\SHARE\WNC_COMMON\132051 VMC SAN BERNARDINO AREA Q\CAD\132051_002_0001_SITE_MAP.DWG

CORRELATION OF MAP UNITS



NOTES

SOURCE: MILLER, F.K., MATTI, J.C., CARSON, S.E., AND COSSETTE, P.M., 2001, GEOLOGIC MAP OF THE SAN BERNARDINO NORTH 7.5' QUADRANGLE, SAN BERNARDINO COUNTY, CALIFORNIA: U.S. GEOLOGICAL SURVEY, OPEN-FILE REPORT OF-2001-131

HALEY ALDRICH

VULCAN MATERIALS COMPANY
SAN BERNARDINO MINE - AREA Q EXPANSION
2400 W. HIGHLAND AVENUE
SAN BERNARDINO, CALIFORNIA

CORRELATION CHART OF THE QUATERNARY STRATIGRAPHIC UNITS

APRIL 2020

FIGURE 3

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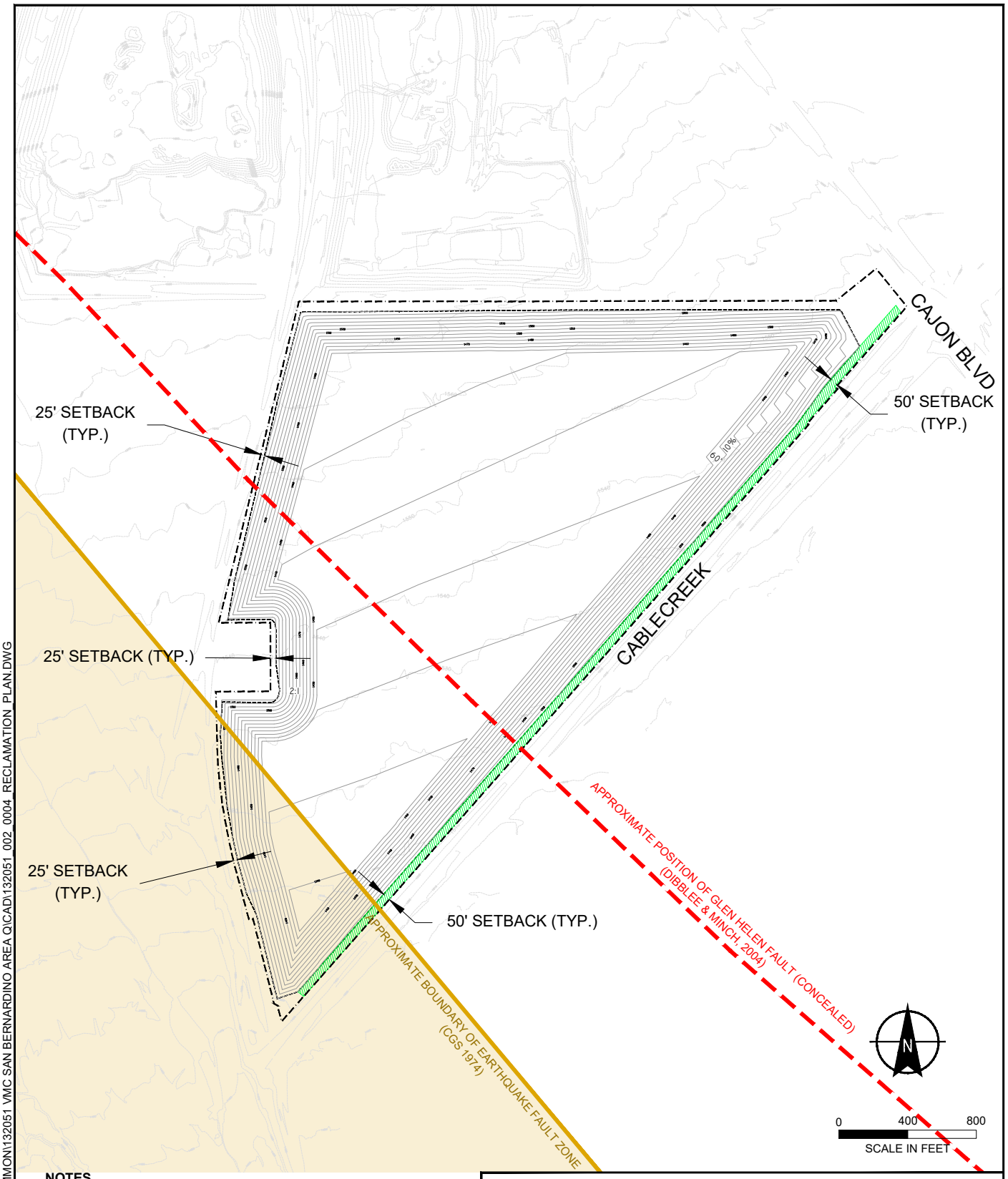
\\HALEYALDRICH\SHARE\WNC_COMMON\132051 VMC SAN BERNARDINO AREA Q\CAD\132051_002_0001_SITE_MAP.DWG



NOTES

1. BASEMAP SOURCE PROVIDED BY SESPE CONSULTING, INC., JUNE 2019
2. APPROXIMATE POSITION OF GLEN HELEN FAULT REPRODUCED FROM DIBBLEE, T.W., AND MINCH, J.A., 2004, DIBBLEE FOUNDATION MAP DF-127
3. APPROXIMATE BOUNDARY OF EARTHQUAKE FAULT ZONE FROM CGS (FORMERLY CDMG) 1974, "SPECIAL STUDIES ZONES, SAN BERNARDINO NORTH QUADRANGLE, OFFICIAL MAP."

HALEY ALDRICH

VULCAN MATERIALS COMPANY
SAN BERNARDINO MINE - AREA Q EXPANSION
2400 W. HIGHLAND AVENUE
SAN BERNARDINO, CALIFORNIA

RECLAMATION PLAN FOR AREA Q
WITH TOTAL DEPTH OF 120 FEET

SCALE: AS SHOWN
APRIL 2020

FIGURE 4

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\\HALEYALDRICH\SHARE\WNC_COMMON\132051 VMC SAN BERNARDINO AREA Q\CAD\132051_002_0004_RECLAMATION_PLAN.DWG

APPENDIX A

Cross-Sections

CROSS SECTION L-L' NOTES

Looking south at the southern slope in Area L.

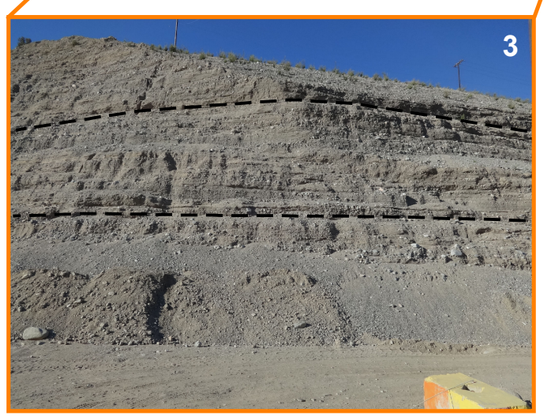
Note the black dashed lines, which represent continuous horizontal beds outcropping on the slope.

Photo 1 is a view from the artifcial Inter-Terrace complex, which are in the process of being cut down during the mining of aggregate.

Refer to Figure 1 for the location of Cross Section L-L', which is looking to the north so the cross-section seems to be reversed.

L

L'



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SAN BERNARDINO MINE - AREA Q EXPANASION
2400 W. HIGHLAND AVENUE
SAN BERNARDINO, CALIFORNIA

CROSS SECTION L-L'

APRIL 2020

FIGURE A-1

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M

M'

CROSS SECTION M-M' NOTES

Looking south at the southern slope in Area M.

Note the black dashed lines, which represent continuous horizontal beds outcropping on the slope.

Refer to Figure 1 for the location of Cross Section M-M', which is looking to the north so the cross section seems to be reversed.

Note the slopes are smooth and slope at a less angle than seen on Cross Section L-L'. There was less coarse-grained aggregate exposed below the conveyor belt with smoother planted slope surface. Erosion seemed to be less on the south slope in Area M than in Area L due to the reclamation.

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SAN BERNARDINO MINE - AREA Q EXPANASION
2400 W. HIGHLAND AVENUE
SAN BERNARDINO, CALIFORNIA

CROSS SECTION M-M'

APRIL 2020

FIGURE A-2

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