REPORT OF LIMITED GEOTECHNICAL STUDY AND INFILTROMETER TESTING PROPOSED MANUFACTURING / WAREHOUSING FACILITY NORTHEAST CORNER OF COLTON AVENUE AND OPAL AVENUE IN THE MENTONE AREA OF SAN BERNARDINO COUNTY, CALIFORNIA

PROJECT NO.: 1100-A17
REPORT NO.: 1

JUNE 5, 2017

SUBMITTED TO:

800 OPAL LLC c/o
THATCHER ENGINEERING & ASSOCIATES, INC.
1461 FORD STREET
REDLANDS, CA 92373

PREPARED BY:

HILLTOP GEOTECHNICAL, INC.
786 SOUTH GIFFORD AVENUE
SAN BERNARDINO, CA 92408

HILLTOP GEOTECHNICAL
INCORPORATED

786 S. GIFFORD AVENUE • SAN BERNARDINO • CALIFORNIA 92408
hilltopg@hgeotech.com • FAX 909-890-9055 • **909-890-9079**

June 6, 2017

800 Opal LLC c/o
Thatcher Engineering & Associates, Inc.
1461 Ford Street, Suite 105
Redlands, CA 92373

Project No.: 1100-A17
Report No.: 1

Attention: Ms. Kayla Jordan

Subject: **Report of Limited Geotechnical Study and Infiltrometer Testing, Proposed Manufacturing / Warehousing Facility, Northeast Corner of Colton Avenue and Opal Avenue in the Mentone Area of San Bernardino County, California.**

References:

1. **Hilltop Geotechnical, Inc.**, February 20, 2014, *Report of Preliminary Geotechnical / Geologic Study, Proposed 132 Lot Subdivision, Tentative Tract 18952, Northeast Corner of Colton Avenue and Opal Avenue in the Mentone Area of San Bernardino County, California*, Project No.: 950-A14, Report No. 1.

2. **Thatcher Engineering & Associates, Inc.**, April 6, 2017, Minor Use Permit Site Plan for proposed Manufacturing / Warehousing Facility, Job No.: 154801, Reference Number: 154801CUP.

3. Technical References - See Appendix 'B.'

Gentlemen:

According to your request, we have completed a limited geotechnical study and infiltrometer testing for the design and construction of the proposed manufacturing

The findings of this study indicate that the project site is suitable for the proposed development provided the recommendations presented in the attached report are complied with and incorporated into the design and construction of the project.

Copies of this report should be forwarded to the other consultants for the project (i.e., Civil Engineer, Architect, Structural Engineer, etc.) as needed to implement the recommendations presented. The required number of the original, wet ink signed reports should be saved for submittal, along with the CD containing a pdf copy of this report, and the other required documentation to the appropriate agency having jurisdiction over the project for review and permitting purposes.

If you have any questions after reviewing the findings and recommendations contained in the attached report, please do not hesitate to contact this office. This opportunity to be of professional service is sincerely appreciated.

Respectfully Submitted,
HILLTOP GEOTECHNICAL, INC.

Mark Hulett, CEG No. 1623
President

Sundaramoorthy Srirajan, GE No. 2871
Senior Engineer
Date Signed: 6-5-17

Ashley Hulett, GIT No. 574
Staff Geologist

MH/SS/AH/dh

Distribution: (4) Addressee
Via U.S. Hand Delivery
(1) Addressee
pdf Copy Via E-Mail (kaylaj@thatcherengineering.com)

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

REPORT OF LIMITED GEOTECHNICAL STUDY AND INFILTROMETER TESTING PROPOSED MANUFACTURING / WAREHOUSING FACILITY NORTHEAST CORNER OF COLTON AVENUE AND OPAL AVENUE IN THE MENTONE AREA OF SAN BERNARDINO COUNTY, CALIFORNIA

PROJECT NO.: 1100-A17
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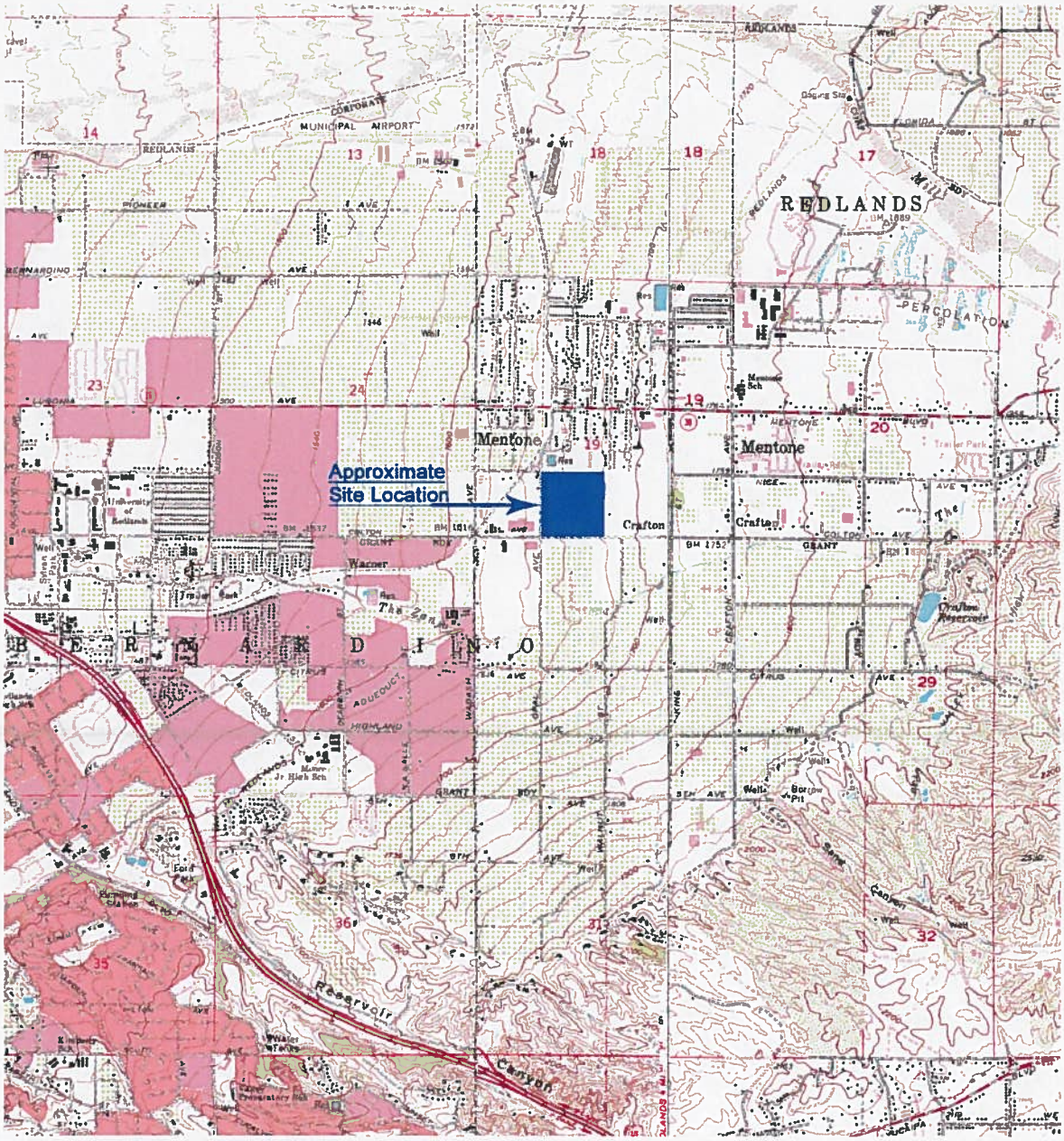
JUNE 5, 2017

INTRODUCTION

AUTHORIZATION

This report presents results of the limited geotechnical / geologic study conducted on the subject site for the proposed manufacturing / warehousing facility to be located north of Colton Avenue between Opel Avenue to the west and Beryl Avenue to the east in the Mentone area of San Bernardino County, California. The general location of the subject site is indicated on the 'Site Location Map,' Figure No. 1.

Authorization to perform this study was in the form of a signed proposal from **Hilltop Geotechnical, Inc. (HGI)** (Geotechnical / Geologic Consultant) to **800 Opal LLC** (Client), dated April 7, 2017, Proposal Number: P17057 and signed by Mr. Charles Walden on April 25, 2017.



0 3500 7000

Approximate Scale in Feet

N

Reference: **United States Department of the Interior, Geologic Survey**, 1967, Photorevised 1988, *Redlands Quadrangle, California,* 7.5 Minute Topographic Series, Scale: 1:24,000.
United States Department of the Interior, Geologic Survey, 1967, Photorevised 1988, *Yucaipa Quadrangle, California,* 7.5 Minute Topographic Series, Scale: 1:24,000.

HILLTOP GEOTECHNICAL INCORPORATED

SITE LOCATION MAP	
By: AH	Date: 5/2017
Project No.: 1100-A17.1	Figure No.: 1

PURPOSE AND SCOPE OF STUDY

The scope of work performed for this study was designed to determine and evaluate the surface and subsurface conditions in the vicinity of the proposed improvements on the subject site with respect to geotechnical characteristics that may effect the development of the site, and to provide geotechnical recommendations and criteria for use in the design and construction of the proposed site improvements. The scope of work included the following:

- Review of locally and easily available published and unpublished soil, geologic, and seismologic reports and data for the area (see References in Appendix 'B'), including geotechnical and geologic reports prepared by HGI (Reference No. 1 noted on the cover sheet of this report), etc. to ascertain earth material, geologic, and hydrologic conditions of the area.

- Telephone conversations with the client and/or representatives of the client.

- Engineering analysis of field and laboratory data to provide a basis for geotechnical conclusions and recommendations regarding retention basins and pavement design parameters.

- Preparation of this report to present the geotechnical conclusions and recommendations for the proposed site development.

This report presents our conclusions and/or recommendations regarding:

- Preliminary pavement section recommendations.

- Infiltrometer rates for the design of the proposed on-site retention basins.

The scope of work performed for this report did not include any testing of earth materials or groundwater for environmental purposes, an environmental assessment of the property, or opinions relating to the possibility of surface or subsurface contamination by hazardous or toxic substances.

This study was prepared for the exclusive use of **800 Opal LLC** and their consultants for specific application to the development of the proposed project in accordance with generally accepted standards of the geotechnical and geologic professions and generally accepted geotechnical engineering principles and practices at the time this report was prepared. Other warranties, implied or expressed, are not made. Although reasonable effort has been made to obtain information regarding geotechnical / geologic and subsurface conditions of the site, limitations exist with respect to knowledge of unknown regional or localized off-site conditions which may have an impact at the site. The conclusions and recommendations presented in this report are valid as of the date of this report. However, changes in conditions of a property can occur with passage of time, whether they are due to natural processes or to works of man on this and/or adjacent properties.

If conditions are observed or information becomes available during the design and construction process which are not reflected in this report, **HGI**, as Geotechnical / Geologic Consultant of record for the project, should be notified so that supplemental evaluations can be performed and conclusions and recommendations presented in this report can be verified or modified in writing, as necessary. Changes in applicable or appropriate standards of care in the geologic / geotechnical professions occur, whether they result from legislation or the broadening of knowledge and experience. Accordingly, the conclusions and recommendations presented in this report may be invalidated, wholly or in part, by changes outside the influence of the project Geotechnical / Geologic Consultant which occur in the future.

PREVIOUS SITE STUDIES

Prior to this report, a previous preliminary Geotechnical / Geologic Study was performed on the subject site. The results of those studies were presented in the Reference No.1 noted on the first page of the cover letter for this report.

PROJECT DESCRIPTION / PROPOSED DEVELOPMENT

As part of our study, we have discussed the project with Mrs. Kayla Jordan and Kristin Tissot of Thatcher Engineering, the Civil Engineer for the project. We have also been provided with the Reference No. 2 'Site Plan,' for the project noted on the first page of the cover letter for this report. In addition, we have reviewed the Reference No. 1 report which was previously prepared for the subject site.

The above project description and assumptions were used as the basis for the field exploration, laboratory testing program, the engineering analysis, and the conclusions and recommendations presented in this report. **HGI** should be notified if structures, foundation loads, grading, and/or details other than those represented herein are proposed for final development of the site so a review can be performed, a supplemental evaluation made, and revised recommendations submitted, if required.

SITE DESCRIPTION

The subject property comprises approximately 42.37 acres, is rectangular in shape, and approximately 1,230 feet by 1,245 feet in plan dimension as shown on the Reference No. 2 'Site Plan' noted on the first page of the cover letter for this report. The subject property is located in the northeast quadrant of the intersection of Opal Avenue and Colton Avenue in the Mentone area of San Bernardino County, California. The subject property is located in the southwest portion of Section 19,

T1S, R2W of the San Bernardino Principle Meridian at Latitude: 34.0647° North, Longitude: 117.1320° West.

The subject property is bounded by Colton Avenue to the south, Opal Avenue to the west, and Nice Avenue to the north. A wall and housing community bounds the proposed site to the east, as shown on the 'Exploratory Excavation Location Plan,' Plate No. 1, presented in Appendix 'A.'

Walden Structures Construction occupies the west portion of the site. Grading reports and/or compaction reports were not made available at the time of this study, nor were/or they available at the County of San Bernardino Building and Safety Department. The west portion of the site contains office buildings, equipment buildings, trailers, storage areas, rock roadways, several parking lots, and concrete curbs. Surrounding Walden Structures Construction facility were various fenced areas and open areas that allow access to the eastern portion of the site.

Total on-site relief in was approximately 40 feet. The minimum and maximum elevations within the immediate area of the proposed development was approximately 1647 and 1687 Mean Sea Level (MSL), respectively.

At the time of the field study, buildings or other type structures were present on the site. Utilities consisting of electric, telephone, gas, sewer, water, as well as other unknown underground and overhead lines, were observed to be present on and adjacent to the site in the existing street right-of-way. Some of the utilities were noted on the referenced plans and are adjacent to the site. Due to the ages of the structures and the locations on the site, it is anticipated that cisterns, leach lines, and septic tanks also may still be present on the site. In the location of

infiltration test P-1, a leach line was exposed at a depth of approximately three feet.

Several end dumped piles of construction debris, miscellaneous debris and refuse, soil, etc. were observed at various locations throughout the subject property, mainly on the undeveloped portion of the site. Vegetation across the east portion of the site was light and consisted of seasonal native grasses, weeds, forbs, and brush. The west portion of the site was developed and consisted of one area of grass and a few open areas with light brush, curbs, gutters and pavement.

FIELD EXPLORATION AND LABORATORY TESTING

Field study and laboratory testing that were performed on January 20, 2014 and January 23, 2014 for the previous 'Geotechnical Study' (Reference No. 1).

A more detailed explanation of the field study and laboratory tests are presented in Appendix 'A' of this report.

FINDINGS

LOCAL SUBSURFACE CONDITIONS

Presented as follows are brief descriptions of the earth materials encountered in the exploratory excavations performed for the Reference No. 1 'Geotechnical Study,' noted on the second page of the cover letter for this report. More detailed descriptions of encountered earth materials are presented on the 'Subsurface Exploration Log,' Nos. 3 through 9, presented in Appendix 'A' of this report. The earth material strata, as shown on the logs, represent conditions at the actual

exploratory excavation locations. Other variations may occur beyond and/or between the excavations. Lines of demarcation between earth materials on the logs represented the approximate boundary between the material types; however, the transition may be gradual.

The earth materials encountered on the subject site during the field exploration were identified as man-made fill (af) and young axial valley deposits (alluvium) (Qya_3).

Man made fill was encountered at the location of trench T-2, T-3, T-5, and T-6. The fill extended to a depth of approximately 1.5 to 4.5 feet at the locations of the exploratory excavations. The fill generally consisted of silty fine to coarse sand with a trace to some gravel, a little cobbles, and a trace boulders. The fill encountered was orange-brown, light brown, and brown in color and dry at the surface to moist with depth. Additionally, numerous end-dumped piles of soil, concrete, and other hard construction materials were also observed in various areas on the site. The fill is considered to be undocumented and unsuitable for support of structural fill and/or a building structure. Where easily visible, the approximate location of the fill materials is shown on the Exploratory Excavation Location Plan, Plate No. 1, presented in Appendix 'A.'

Alluvium was encountered below the fill materials and at the surface at the locations of trench T-1, T-4, and T-7. The alluvium generally consisted of silty fine to coarse sands with varying amounts of gravel, cobbles, and boulders (SM), gravelly, fine to coarse sands with traces of silt, gravels, and cobbles (SP), fine to coarse, sandy gravel with a little to some cobbles and a trace to a little boulders (GP), gravel with some cobbles and a trace boulders (GP), cobbles with a little gravel, a little fine to coarse sand, and a trace boulders (GP), and gravel with a

trace silt and a trace fine to coarse sand (GP). The alluvium was light brown, brown, dark brown, orange-brown, gray-brown, and gray in color and dry near the surface to moist with depth. Locally, the alluvium extended to depths in excess of 12 feet below the existing ground surfaces at the excavation locations on the subject site. A distinct coarsening of the materials with was noted with depth. The excavations were terminated in the alluvial deposit.

Groundwater

Groundwater was not encountered in the exploratory excavations, performed for Reference No. 1 'Preliminary Geotechncial Report' to the maximum depth explored of approximately 12 feet below existing ground surface.

Surface Water

Surface water was not observed on the subject site at the time the field study was performed for this report.

Site Variations

Based on results of our subsurface exploration and experience, variations in the continuity and nature of surface and subsurface conditions should be anticipated. Due to uncertainty involved in the nature and depositional characteristics of earth materials at the site, care should be exercised in extrapolating or interpolating subsurface conditions between and beyond the exploratory excavation locations.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

The conclusions and recommendations presented in this report are, in part, based on information provided to this firm, the results of the field and laboratory data on

the subject property from reference No. 1 "Preliminary Geotechnical Study', experience gained from work conducted by this firm on projects within the general vicinity of the subject site, the project description and assumptions presented in the 'Project Description / Proposed Development' section of this report, engineering analyses, and professional judgement. Based on a review of the field and laboratory data and the engineering analysis, the proposed development is feasible from a geotechnical / geologic standpoint. The subject property can be developed without adverse impact onto or from adjoining properties providing the recommendations contained within this report are adhered to during project design and construction.

Per the Reference No. 1 report, the average in-situ moisture contents and in-situ dry densities of the upper 5.0 to 7.0 feet of the near-surface alluvial materials on the subject site suggests that the soils have an average relative compaction of approximately 85 percent. Additionally, up to 4.5 feet of material present in some areas on the subject site was an undocumented fill material. The artificial fills on the site are also considered loose and compressible. The man-made fills are not considered suitable for the support of hardscape, and/or pavement.

Some remedial grading consisting of removals and replacement will have to be performed within loose, compressible, artificial fill and loose, near-surface alluvium in the area of proposed structural fills, structures, exterior hardscapes, and/or pavement.

The actual conditions of the near-surface supporting material across the site may vary. The nature and extent of variations of the surface and subsurface conditions between the exploratory excavations may not become evident until construction. If variations of the material become evident during construction of the proposed

development, **HGI** should be notified so that the project Geotechnical / Geologic Consultant can reevaluate the characteristics of the material and the conclusions and recommendations of this report, and, if needed, make revisions to the conclusions and recommendations presented herein.

Recommendations for site grading, foundations, slab support, pavement design, etc., are presented in the subsequent paragraphs.

SITE PREPARATION RECOMMENDATIONS

General

Since mass grading is not anticipated for the development of the project, the grading recommendations presented in this report are intended for the rework of unsuitable, near-surface, undocumented fill and alluvial earth materials to create satisfactory support for exterior hardscape (i.e., sidewalks, etc.) and pavement.

The grading should be performed in accordance with the recommendations presented in this report. We recommend that **HGI**, as the Geotechnical Engineer / Geologist of Record, be retained by the owner of the proposed project to observe the excavation and grading operations, foundation preparation, and test the compacted fill and utility trench backfill. If **HGI** were not selected to perform the required observation and testing of earthwork construction, **HGI** would cease to be the Geotechnical Consultant of Record for the project. A pregrading conference should be held at the site with representatives of the owner, the grading contractor, the County of San Bernardino, the Civil Engineer, and a representative of **HGI** in attendance. Special grading procedures and/or concerns can be addressed at that time.

Earthwork observation services allow the testing of only a small percentage of the fill placed at the site. Contractual arrangements with the grading contractor by the project owner should contain the provision that he is responsible for excavating, placing, and compacting fill in accordance with the recommendations presented in this report and the approved project grading plans and specifications. Observation by the project Geotechnical / Geologic Consultant and/or his representatives during grading should not relieve the grading contractor of his responsibility to perform the work in accordance with the recommendations presented in this report and the approved project plans and specifications.

The following recommendations may need to be modified and/or supplemented during grading as field conditions require.

Final Grading Plan Review

The project Civil Engineer should review this report, incorporate critical information on to the grading plan and/or reference this geotechnical / geologic study, by Company Name, Project No., Report No., and report date, on the grading plan. Final grading plans should be reviewed by **HGI** when they become available to address the suitability of our grading recommendations with respect to the proposed improvements.

Clearing and Grubbing

Debris, grasses, weeds, brush, trees, and other deleterious materials should be removed from the exterior hardscape and pavement areas and areas to receive structural fill before grading is performed. Any organic material and miscellaneous / demolition debris should be legally disposed of off site. Any topsoil or highly organic soils encountered should be stripped and stockpiled for use on finished grades in landscape areas or exported from the site. Disking or mixing of organic

material into the earth materials proposed to be used as structural fill should not be permitted.

Man-made objects encountered (i.e., septic tanks, leach lines, irrigation systems, underground utilities, old foundations, construction debris, etc.) should be overexcavated, exported from the site, and legally disposed of off site. Cesspools or seepage pits, if encountered (none were encountered during this study), should be abandoned and capped according to directions and supervision of San Bernardino County Department of Health, the State of California, and/or the appropriate governmental agency procedures which has jurisdiction over them before fill and/or pavement is placed over the area. If no procedures are required by the Health Department or if the following recommendations are more stringent, the cesspool or seepage pit should be pumped free of any liquid and filled with a low strength sand cement slurry to an elevation 5.0 feet below the final site grade in the area. The upper 5.0 feet of the cesspool or seepage pit should be excavated and the area backfilled with a properly compacted fill material. The location of the cesspool or seepage pit should be surveyed and plotted on the final 'As-Graded' plan prepared by the project Civil Engineer.

Wells, if encountered, should be abandoned and capped according to directions and supervision of San Bernardino County Department of Health, the State of California, and/or the appropriate governmental agency procedures which has jurisdiction over the well before fill and/or pavement is placed over the area.

Excavation Characteristics

Excavation and trenching within the subject property to the depths anticipated for the proposed development is anticipated to be relatively easy in the near-surface undocumented fills and alluvial materials on the subject site and should be

accomplished with conventional earth-moving equipment. It is anticipated that a significant amount of oversized rock material (i.e., 12 inches in greatest dimension) will be generated during the removal and replacement process within the existing fill materials and the near-surface alluvial materials which will require special handling during the development of the site.

Suitability of On-Site Materials as Fill

In general, the on-site earth materials present below any topsoil and/or highly organic materials are considered satisfactory for reuse as fill. Fill materials should be free of significant amounts of organic materials and/or debris and should not contain rocks or clumps greater than 12 inches in maximum dimension. It is noted that the average in-situ moisture content of the near-surface fill and alluvial earth materials on the subject site at the time this field study was performed for reference No. 1 report was below the average optimum moisture content for the on-site materials and that moisture will have to be added to the on-site earth materials if the earth materials are to be used as compacted fill material in the near future. Some over-size material is anticipated to be encountered within the near-surface soils on the subject site which will require special handling.

The existing HMA concrete and PCC concrete that are located on the site can be crushed down to a particle size of 3.0 inches or less in maximum dimension and incorporated into the fills required to achieve the finish grades for the subject development.

Removal and Recompaction

Unsuitable, loose, or disturbed near-surface undocumented fill and/or alluvial earth material in proposed areas which will support structural fills, exterior hardscape (i.e., sidewalks, curb / gutters, etc.), and pavement should be prepared

in accordance with the following recommendations for grading in such areas. If over-excavation and total removal of undocumented fill materials is elected not to be performed in hardscape, curb / gutter, and pavement areas, penetration of irrigation water with time may cause some settlement and distress to the improvements in those areas. The cost of the additional grading verses the risk of distress and cost of repairs to the pavement structure needs to be evaluated by the project owner.

- The near-surface undocumented fill and the loose, near-surface alluvial materials on the site are recommended to be overexcavated and recompacted. Based upon our exploratory excavations borings and laboratory test results frpm Reference No. 1 report, we anticipate that the overexcavation will extend to a depth of approximately 3 to 4 feet below existing ground surface in the areas which will receive structural fill. A relative compaction of 85 percent or greater should be obtained in the exposed earth material at the overexcavation depth prior to performing any scarification, moisture conditioning, and recompaction. If 85 percent relative compaction is not present, the overexcavation should be deepened until a minimum of 85 percent relative compaction is present. It is noted that fill placed to support sidewalks, driveways, and pavement are considered to be structural fill.

- In the proposed exterior hardscape (i.e., sidewalks, patio slabs, etc.), and pavement areas where structural fill will not be placed or cuts are proposed, the existing near-surface earth materials need only be processed to a depth of 6.0 to12 inches below existing site grades or proposed subgrade elevation, whichever is deeper unless old, undocumented fill materials are encountered at exposed grades. If undocumented fills are encountered, they will need to be overexcavated and properly compacted fill replaced to achieve proposed grades.

- Additional overexcavation will need to be performed in areas where the exposed subgrade can not be properly processed and recompacted per the following recommendations presented in this section of this report.

- The limits of processing or over-excavation for exterior hardscape, curb / gutter, and pavement areas should extend to a distance of 2.0 feet beyond the edge of the exterior hardscape, curb / gutter, or pavement, or to the

depth of the over-excavation beneath the finish subgrade elevation, whichever is greater.

- Where the exploratory backhoe trenches are located within the limits of the proposed overexcavations for the proposed structural fills, structures, decorative walls, trash enclosure walls, retaining walls, exterior hardscape, and/or pavement areas, the trenches should be overexcavated to the width and depth of the trench.

- It is noted that localized areas, once exposed, may warrant additional overexcavation for the removal of existing undocumented fills, loose, near-surface earth material, porous, moisture sensitive alluvial earth materials, and subsurface obstructions and/or debris which may not have been located during the field study. Actual depths of removals and the competency of the exposed overexcavation bottoms should be determined by the project Geotechnical / Geologic Consultant and/or his representative during grading operations at the time they are exposed and before scarification and recompaction or the placement of fill.

- The exposed overexcavation bottom surfaces should be scarified to a depth of 6.0 to 12 inches, brought to optimum moisture content to 3.0 percent above optimum moisture content, and compacted to 90 percent or greater relative compaction before placement of fill. Maximum dry density and optimum moisture content for compacted materials should be determined according to current ASTM D1557 procedures. The scarification and recompaction of the exposed overexcavation bottoms in alluvial materials may be deleted upon approval by the project Geotechnical / Geologic Consultant, and/or his representative when in-place density test results in the undisturbed alluvial materials indicate a relative compaction of 90 percent or greater.

Import Material

Import fill should be no more expansive than the on-site soils as determined by current ASTM D4829 procedures and have strength parameters (i.e., R-Value) equivalent to or greater than the on-site earth materials. Import fill material should be approved by the project Geotechnical Consultant prior to it being brought on-site.

Fill Placement Requirements

Fill material, whether on-site material or import, should be approved by the project Geotechnical / Geologic Consultant and/or his representative before placement. Fill material should be free from vegetation, organic material, debris, and oversize material (i.e., 12 inches in maximum dimension). Approved fill material should be placed in horizontal lifts not exceeding 6.0 to 12 inches in compacted thickness or in thicknesses the grading contractor can demonstrate that he can achieve adequate compaction and watered or aerated to obtain optimum moisture content to 3.0 percent above optimum moisture content. Each lift should be spread evenly and should be thoroughly mixed to ensure uniformity of earth material moisture. Fill soils should be compacted to 90 percent or greater relative compaction. Maximum dry density and optimum moisture content for compacted materials should be determined in accordance with current ASTM D1557 procedures.

Compaction Equipment

It is anticipated that the compaction equipment to be used for the project will include a combination of rubber-tired, track-mounted, sheepsfoot, and/or vibratory rollers to achieve compaction. Compaction by rubber-tired or track-mounted equipment, by itself, may not be sufficient. Adequate water trucks, water pulls, and/or other appropriate equipment should be available to provide sufficient moisture and dust control. The actual selection of equipment and compaction procedures are the responsibility of the contractor performing the work and should be such that uniform compaction of the fill is achieved.

Shrinkage, Bulking, and Subsidence

There will be a material loss due to the clearing and grubbing operations. The following values are exclusive of losses due to clearing, grubbing, or the removal

of other subsurface features and may vary due to differing conditions within the project boundaries and the limitations of this study.

Volumetric shrinkage of the near-surface earth materials (i.e., undocumented fill and near-surface alluvium) on the subject site that are excavated and replaced as controlled, compacted fill should be anticipated. It is estimated that the average shrinkage of the near-surface earth materials within the upper 5.0 to 7.0 feet of the site which will be removed and replaced will be approximately 6.0 to 12 percent, based on fill volumes when compacted to 90 to 95 percent of maximum dry density for the earth material type based on current ASTM D1557 procedures. For example, a 6.0 percent shrinkage factor would mean that it would take 1.06 cubic yards of excavated material to make 1.0 cubic yard of compacted fill at 90 percent relative compaction. A higher relative compaction would mean a larger shrinkage value. Oversize rock removal and export will also result in additional shrinkage.

A subsidence factor (loss of elevation due to compaction of existing undocumented fill and/or the near-surface alluvial earth materials in-place) of 0.06 to 0.11 foot per foot of compacted earth material should be used in areas where the existing earth materials are compacted in-place to 90 to 95 percent relative compaction and to a depth of 12 inches.

Subsidence of the site due to settlement from the placement of less than 10 feet of fill (not including the depth of overexcavation and replacement) during the planned grading operation or rebound of the underlying alluvium due to unloading during the planned grading operation is expected to be minimal.

Although the above values are only approximate, they represent the recommended estimate of some of the respective factors to be used to calculate lost volume that will occur during grading.

Abandonment of Existing Underground Lines

Abandonment of existing underground irrigation, utility, or pipelines, if present within the zone of construction, should be performed by either excavating the lines and filling in the excavations with documented, properly compacted fill or by filling the lines with a low strength sand / aggregate / cement slurry mixture. Filled lines should not be permitted closer than 3.0 feet below the bottom of proposed footings and/or concrete slabs on-grade. The lines should be cut off at a distance of 5.0 feet or greater from the area of construction. The ends of the lines should be plugged with 5.0 feet or more of concrete exhibiting minimal shrinkage characteristics to prevent water or fluid migration into or from the lines. Capping of the lines may also be needed if the lines are subject to line pressures. The slurry should consist of a fluid, workable mixture of sand, aggregate, cement, and water. Plugs should be placed at the ends of the line prior to filling with the slurry mixture. Cement should be Portland cement conforming to current ASTM C150 specifications. Water used for the slurry mixture should be free of oil, salts, and other impurities which would have an adverse effect on the quality of the slurry. Aggregate, if used in the slurry, mixture should meet the following gradation or a suitable equivalent:

SIEVE SIZE	PERCENT PASSING
1.5"	100
1.0"	80-100
3/4"	60-100
3/8"	50-100

SIEVE SIZE	PERCENT PASSING
No. 4	40-80
No. 100	10-40

The sand, aggregate, cement, and water should be proportioned either by weight or by volume. Each cubic yard of slurry should not contain less than 188 pounds (2.0 sacks) of cement. Water content should be sufficient to produce a fluid, workable mix that will flow and can be pumped without segregation of the aggregate while being placed. The slurry should be placed within 1.0 hour of mixing. The contractor should take precautions so that voids within the line to be abandoned are completely filled with slurry.

Local ordinances relative to abandonment of underground irrigation, utility, or pipelines, if more restrictive, supersede the above recommendations.

Protection of Work

During the grading process and prior to the completion of construction of permanent drainage controls, it is the responsibility of the grading contractor to provide good drainage and prevent ponding of water and damage to the in progress or finished work on the site and/or to adjoining properties.

Observation and Testing

During grading, observation and testing should be conducted by the project Geotechnical / Geologic Consultant and/or his representatives to verify that the grading is being performed according to the recommendations presented in this report. The project Geotechnical / Geologic Consultant and/or his representative should observe and test the overexcavation bottoms and the placement of fill and

should take tests to verify the moisture content, density, uniformity and degree of compaction obtained. The contractor should notify the project Geotechnical / Geologic Consultant when cleanout and/or overexcavation bottoms are ready for observation and prior to scarification and recompaction. Typically, one (1) in-place density test should be performed for every 2.0 vertical feet of fill material, or one (1) test for every 500 cubic yards of fill, which ever requires the greater number of tests. In-place density and moisture content tests should be performed during the placement of the fill materials during the grading operations in general accordance with the following current ASTM test procedures:

> Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) - ASTM D6938.
>
> Test Method for Density and Unit Weight of Soil in Place by Sand Cone Method - ASTM D1556.
>
> Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock - ASTM D2216.
>
> Method for Determination of Water (Moisture) Content of Soil by Direct Heating Method - ASTM D4959.
>
> Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method - ASTM D4643.

Where testing demonstrates insufficient density, additional compaction effort, with the adjustment of the moisture content when needed, should be applied until retesting shows that satisfactory relative compaction has been obtained. The results of observations and testing services should be presented in a formal 'Grading Report' following completion of the grading operations. Grading operations undertaken at the site without the project Geotechnical / Geologic Consultant and/or his representative present may result in exclusions of the

affected areas from the grading report for the project. The presence of the project Geotechnical / Geologic Consultant and/or his representative will be for the purpose of providing observations and field testing and will not include supervision or directing of the actual work of the contractor or the contractor's employees or agents. Neither the presence and/or the non-presence of the project Geotechnical / Geologic Consultant and/or his field representative nor the field observations and testing will excuse the contractor for defects discovered in the contractor's work. If **HGI** does not perform the observation and testing of the earthwork for the project and is replaced as Geotechnical / Geologic Consultant of record for the project, the work on the project should be stopped until the replacement Geotechnical / Geologic Consultant has reviewed the previous reports and work performed for the project, agreed in writing to accept the recommendations and prior work performed by **HGI** for the subject project, or has performed their own studies and submitted their revised recommendations. If **HGI** were not selected to perform the required observation and testing of earthwork construction, **HGI** would cease to be the Geotechnical Consultant of Record for the project.

PRELIMINARY PAVEMENT RECOMMENDATIONS

The following are preliminary recommendations for the structural pavement sections for the proposed streets, parking areas, and driveway areas for the subject development on the subject project site. The Hot Mix Asphalt (HMA) concrete pavement sections have been determined in general accordance with current **California Department of Transportation (CALTRANS)** design procedures using the CalFP Ver. 1.1 'Hot Mix Asphalt Empirical Design' computer program developed by the **CALTRANS, Office of Pavement Design** and are based on assumed Traffic Indexes for a 20 year design life and an assumed R-Value of at least 40 based on past experience in the vicinity of the site and visual textural

classification of the on-site earth material and/or import materials which are anticipated to be at subgrade elevation.

Portland Cement Concrete (PCC) pavement sections are based on an equivalent structural number as the recommended HMA pavement sections and a compressive strength of 2,500 psi or greater at 28 days for the concrete.

The preliminary recommendations for the pavement sections should consist of the following:

RECOMMENDED PAVEMENT SECTIONS			
Site Area	**Traffic Index***	**Subgrade R-Value****	**Pavement Section**
Streets, Driveway and Parking Areas for Autos and Light Weight Vehicles Only.	≤5.5	≥40	4.0" Hot Mix Asphaltic (HMA) Concrete over 4.0" Aggregate Base (AB) or 5.6" PCC @ 2,500 psi over properly prepared subgrade.
Streets, Driveway and Parking Areas for Delivery Trucks	≤6.0	≤40	4.0" HMA over 5.0" AB or 6.0" PCC @ 2,500 psi over properly prepared subgrade.

RECOMMENDED PAVEMENT SECTIONS			
Site Area	**Traffic Index***	**Subgrade R-Value****	**Pavement Section**
Streets, Driveway and Parking Areas for Heavy Trucks	≤7.0	≥40	4.0" HMA over 7.0" AB or 6.8" PCC @ 2,500 psi over properly prepared subgrade.
* Traffic Index was assumed for the project.			
** R-Values were assumed for the project.			

The San Bernardino County minimum guidelines may override the above pavement recommendations without prior County review and approval.

The pavement section for individual lot driveways should be according to current San Bernardino County, California standards.

HMA concrete pavement materials should be as specified in Section 39, 'Hot Mix Asphalt,' in the current CALTRANS Standard Specifications with the July 27, 2012 Revisions, or an equivalent substitute. Aggregate base should conform to Class 2 Material, 1-1/2" Maximum or 3/4" Maximum, as specified in Section 26-1.02A, 'General,' in the current, 2010 CALTRANS Standard Specifications with the July 27, 2012 Revisions, or an equivalent substitute.

Portland Cement Concrete sections are based on a compressive strength of 2,500 psi or greater at 28 days for the concrete. Higher strength design for the concrete can permit thinner pavement sections. Lower strength design for the concrete will require thicker pavement sections. Joints (longitudinal, transverse, construction,

and expansion), jointing arrangement, joint type, pavement and/or joint reinforcing, as well as drainage, crowning, finishing and curing of PCC pavement should be in accordance with current Portland Cement Association (PCA) recommendations.

The subgrade earth material, including utility trench backfill, should be compacted to 90 percent or greater relative compaction to a depth of 1.0 foot or greater below the finish pavement subgrade elevation. The aggregate base material should be compacted to 95 percent or greater relative compaction. If asphaltic concrete and/or PCC pavement is placed directly on subgrade, the upper 6.0 inches of the subgrade should be compacted to 95 percent or greater relative compaction. Maximum dry density and optimum moisture content for subgrade and aggregate base materials should be determined according to current ASTM D1557 procedures. The HMA concrete pavement should be densified to 95 percent or greater of the density obtained by current California Test 304 and 308 procedures (Hveem compacted laboratory samples).

If pavement subgrade earth materials are prepared at the time of grading of the building site and the areas are not paved immediately, additional observations and testing will have to be performed before placing aggregate base material, asphaltic concrete, or PCC pavement to locate areas that may have been damaged by construction traffic, construction activities, and/or seasonal wetting and drying. In the proposed pavement areas, earth material samples should be obtained at the time the subgrade is graded for Resistance (R-Value) testing according to current California Test 301 procedures to verify the pavement design recommendations.

Because the full design thickness of the HMA concrete is frequently not placed prior to construction traffic being allowed to use the streets in a development or the

parking lots, rutting and pavement failures can occur prior to project completion. To reduce this occurrence, it is recommended that either the full-design pavement section be placed prior to use by the construction traffic, or a higher Traffic Index (TI) be specified where construction traffic will use the pavement.

Surface water infiltration beneath pavements could significantly reduce the pavement design life. To limit the need for additional long-term maintenance of the pavement or pre-mature failure, it would be beneficial to protect at-grade pavements from landscape water infiltration by means of a concrete cutoff wall, deepened curbs, or equivalent. Pavement cut-off barriers should be considered where pavement areas are located downslope of any landscape areas that are to be irrigated. The cut-off barrier should extend to a depth of at least 4.0 inches below the pavement section aggregate base material.

Gradation is not the only quality guidelines for aggregate base material. The longevity and performance of pavements utilizing aggregate base material for support is dependent upon the quality of the material which composes the aggregate base. CALTRANS specifications do not specifically exclude the use of material other than a natural, crushed rock and rock dust for Class 2 Aggregate Base material as the Standard Specifications for Public Works Construction (2012 Edition of the 'Greenbook' with the 2013 Supplement), Section 200-2.2, does for Crushed Aggregate Base material. Often times, reclaimed Portland Cement concrete, Hot Mix Asphalt concrete, lean concrete base, and cement treated base are crushed, combined with broken stone, crushed gravel, natural rough surfaced gravel, and sand per the current Section 26-1.02A, 'General,' of the current 2010 CALTRANS 'Standard Specifications,' and graded to produce a Class 2 Aggregate Base material per CALTRANS gradation specifications. Bricks, concrete masonry units, tile, glass, ceramics, porcelain, wood, plastic, metal, etc. **are not** an

acceptable reclaimed material for use in a Class 2 Aggregate Base material per the current 2010 CALTRANS 'Standard Specifications.' The aggregate base material should be tested prior to delivery to the subject project site for the following quality requirements per the current, appropriate CALTRANS test procedures:

TEST	TEST METHOD NO.	QUALITY REQUIREMENT	
		OPERATING RANGE	CONTRACT COMPLIANCE
Resistance (R-Value)	Calif. Test 301	--	78 Minimum
Sand Equivalent	Calif. Test 217	25 Minimum	22 Minimum
Durability Index	Calif. Test 229	--	35 Minimum

If a reclaimed material or a pit run aggregate is proposed for use on the project as a 'Greenbook' Crushed Miscellaneous Base (CMB), the materials should be tested for the following quality requirements prior to delivery to the subject project, per the current 'Greenbook,' 2012 Edition with the 2013 Supplement, Section 200-2.4.3, and appropriate procedures as well as the required gradation and other requirements:

TEST	TEST METHOD NO.	QUALITY REQUIREMENT
Resistance (R-Value)	Calif. Test 301	78 Minimum[1]
Sand Equivalent	Calif. Test 217	35 Minimum
Percent Wear[2] 100 Revolutions 500 Revolutions	ASTM C131	 15 Maximum 52 Maximum

TEST	TEST METHOD NO.	QUALITY REQUIREMENT
1. R-Value requirement may be waived if Sand Equivalent is 40 or more. 2. The percentage wear requirements may be waived if the material has a minimum Durability Index of 40 in accordance with CALTRANS Test Method 229.		

A 'Greenbook' CMB may contain broken or crushed asphalt concrete or Portland Cement concrete and may contain crushed aggregate base or other rock materials. The CMB may contain no more than 3.0 percent brick retained on the # 4 sieve by dry weight of the total sample.

Samples of the proposed aggregate base using reclaimed material should be sampled from the manufacturer's stockpiles and tested prior to delivery to the project. The samples should be obtained at a time as near the delivery to the project as possible but would allow enough time to complete the testing and report the results before delivery to the site. Samples should again be obtained and tested for quality compliance from the materials delivered to the project. In addition, per the current 2010 CALTRANS 'Standard Specifications,' an aggregate grading and Sand Equivalent test shall not represent more than 500 cubic yards or one (1) days production if less than 500 cubic yards.

Concrete gutters should be provided at flow lines in paved areas. Pavements should be sloped to permit rapid and unimpaired flow of runoff water. In addition, paved areas should be protected from moisture migration and ponding from adjacent water sources. Saturation of aggregate base and/or subgrade materials could result in pavement failure and/or premature maintenance. The gutter

material and construction methods should conform to the current standards of the San Bernardino County, California.

RECHARGE BASIN RECOMMENDATIONS

LOCATION OF INFILTROMETER TESTING

This report presents the results of our infiltrometer testing conducted on the subject site at three (3) locations within the proposed retention basin areas provided by **Thatcher Engineering and Associates, Inc.** The three tests were conducted along the west portion of the site paralleling Opal Avenue. Infiltrometer testing was conducted at the locations and depths specified on the attached Plate No. 15, Infiltration Test Location Plan. Infiltration test P-1 was conducted at a depth of 3.5 feet, Infiltration test P-2 was conducted at a depth of 4.4 feet and Infiltration test P-3 was conducted at a depth of 1.4 feet beneath existing site grades. In the bottom of Trench P-1, a perforated pipe and encompassing gravel was encountered at a depth of 3.0 feet. The area was presumed to be a leach field. Infiltration testing P-1 and P-2 were conducted in planter areas in the front of the existing building. Infiltration test P-3, was performed in a paved area. A backhoe was used to excavate each test pit to the appropriate depths. The approximate infiltrometer test locations are shown on the 'Infiltration Test Location Plan', Plate No. 1.

SOIL CHARACTERISTICS OF THE SUBJECT SITE

- The soil characteristics for the subject site are defined as favorable.
- There was no visible evidence of shallow groundwater or impervious bedrock materials.

- Groundwater was not encountered in the exploratory excavations, performed for Reference No. 1 'Preliminary Geotechncial Report" to the maximum depth explored of approximately 12 feet below existing ground surface. Depth to groundwater data for the site area was available through the **California Department of Water Resources** internet web site. The depth to groundwater in State Well No. 01S02W30C001S, located approximately 300 feet west, (just south of Colton Avenue), of the subject site was approximately 120 feet on December 4, 1990. The surface elevation of this well is 1651 feet, generally lower (topographically) than that of the site

- Tests performed agreed with visual evidence.

- The natural slope of the ground surface above the proposed water infiltration areas are less than a 2.0 percent gradient.

- Soil conditions for the on-site, water infiltration systems were acceptable in the tested areas.

Soil Profile

- Percolation Hole No. 1: Infiltrometer test (P-1) was located in southwestern portion of the site and tested at the base of artificial fills. The fill encountered was a silty fine to coarse grained sand with various amounts of gravels, a trace of cobbles and 2-3 boulders (SM). At a depth of 3.0 feet, a perforated pipe encompassed by gravels was encountered. The tested depth was 0.5 feet lower than the pipe. Native alluvial soils were found under the fill and consisted of light brown, moist, silty, fine to coarse grained sand, with various amounts of gravels and a trace of cobbles. The excavation bottom was slightly compacted. The test hole was classified in general accordance with the Unified Soil Classification System as an SM.

- Percolation Hole No. 2: Infiltrometer test (P-2) was conducted in the middle west portion of the site at a depth of 4.4 feet beneath existing site grade. The materials encountered were native alluvial soils and generally finer grained in nature. The native alluvium was classified as a brown, moist, silty, fine to coarse sand (SM). The test hole was classified in general accordance with the Unified Soil Classification System to be an SM.

- Percolation Hole No. 3: Infiltrometer test (P-3) was conducted in the northwestern portion of the site at approximately 1.4 feet beneath existing site grade. A backhoe was used to excavate the test pit beneath 1.5 inches of asphalt to 1.4 feet. Materials encountered were classified as a silty, fine to coarse sand, with a trace of gravel (SM). The test hole was classified in general accordance with the Unified Soil Classification System to be an SM.

- No large plants or roots were encountered in the infiltrometer test areas.

- There were no wet or saturated soils encountered in the infiltrometer test areas.

- No groundwater was encountered within our infiltrometer test areas.

INFILTROMETER TEST PROCEDURES

Testing was performed in general accordance with ASTM D 3385 procedures. This method consists of driving two (2) open cylinders, one inside the other, into the ground, partially filling the rings with water, maintaining the water at a constant level, and measuring the volume of water required to maintain the constant level. The steel rings used for this project had nominal inside diameters of 11.75 inches and 23.75 inches. The volume of water added to the inner ring to maintain a

constant liquid level was the measure of the volume of liquid that infiltrates into the soil and is shown on Plate Nos. 16 through 18. The volume infiltrated during timed intervals was converted to an incremental infiltration velocity expressed in centimeters per hour, and the results were plotted on a graph versus elapsed time, as shown on Plate Nos. 19 through 21 attached to the rear of this report.

Test locations were chosen along the west portion of the site. A backhoe was used to excavate a small area of similar diameter of the rings at each of the infiltration test locations to a depth of approximately 3.5, 4.4, and 1.4 feet below existing grade. The outer and inner infiltrometer rings were then pressed into place to a depth of approximately 6.0 inches. Upon excavation, hand tools were used to prepare a smooth, flat test site free of loose, disturbed, and smeared soils.

Clear municipal water, was poured into the rings while using protective cardboard sheeting to prevent splashing and disturbance of the soil boundary. The pre-selected water test depth was approximately 6.0 inches (15.24cm). Initially, water levels were maintained within 5.0 millimeters of this depth during the test by periodic additions from 1000 milliliter graduated cylinder. However, the rates were fast and additions by use of 5 gallon water bottles were used for measurements. The apparatus was covered with cardboard sheeting to minimize evaporative losses from the sun. No significant wind occurred on the days of testing.

A tally of water added to the inner ring and annular space was made at periodic time intervals ranging from 15 to 60 minutes.

INFILTROMETER TEST RESULTS

The infiltration rates were moderate to fast and constant between the test pits. The Infiltration rates obtained are discussed below in Tables 1 and 2:

Table 1: Average Infiltration Rates

Ring (Inner / Outer)	Infiltration Rate (cm/hr)	Infiltration Rate (in/hr)
P-1, Inner	11.50	4.53
P-1, Outer	9.70	3.82
P-2, Inner	18.17	7.16
P-2, Outer	19.52	7.69
P-3, Inner	7.00	2.76
P-3, Outer	8.00	3.15

Table 2: Steady State Infiltration Rates

Ring (Inner / Outer)	Infiltration Rate (cm/hr)	Infiltration Rate (in/hr)
P-1, Inner	7.22	2.84
P-1, Outer	6.87	2.71
P-2, Inner	12.65	4.98
P-2, Outer	13.92	5.48
P-3, Inner	6.43	2.53
P-3, Outer	6.28	2.48

DISCUSSION

This area of Mentone is underlain by alluvial deposits that primarily consist of moderately consolidated silts, sand and gravel deposits. The rates presented above are generally consistent with the soil classifications in each area tested. Fast infiltrometer rates were obtained in percolation test P-2. Percolation tests P-1 and P-3 were similar in soils classification and tested infiltration rates.

Infiltration test P-2 was conducted in sands with a slight amount of silt. The sands were loose in nature and moist, contributing to faster infiltration results. Infiltration tests P-1 and P-3 were conducted in areas classified as a moderately compacted silty, fine to coarse grained sand with varying amounts of gravels and cobbles.

Field infiltration tests are subject to many factors that affect the infiltration rate, including soil texture, the condition of the soil surface, soil-moisture tension or the degree of saturation, the temperature of the water and soil, the percentage of entrapped air in the soil, and the head of the applied water.

INFILTRATION BASIN RECOMMENDATIONS

Infiltration testing in the proposed infiltration areas indicated percolation rates that appear to be consistent with respect to there respective on-site soil classification. The Project Civil Engineer should evaluate this information for final infiltration design.

Caution should be used in determining a percolation rate for any proposed infiltration basin or structure. Eventual siltation, water-borne silt from irrigation and precipitation runoff, and the accumulation of organic material in surface soils due to landscape grass and plant growth, can drastically reduce percolation rates

over time. We recommend that suitable methods to prevent siltation be considered in the project design.

LIMITATIONS

REVIEW, OBSERVATION, AND TESTING

The recommendations presented in this report are contingent upon review of final plans and specifications for the project by **HGI**. The project Geotechnical / Geologic Consultant should review and verify in writing the compliance of the final grading plan and the final foundation plans with the recommendations presented in this report.

It is recommended that **HGI** be retained to provide continuous Geotechnical / Geologic Consulting services during the earthwork operations (i.e., rough grading, utility trench backfill, subgrade preparation for slabs on-grade and pavement areas, finish grading, etc.) and foundation installation process. This is to observe compliance with the design concepts, specifications and recommendations and to allow for design changes in the event that subsurface conditions differ from those anticipated prior to start of construction. If **HGI** is replaced as Geotechnical / Geologic Consultant of record for the project, the work on the project should be stopped until the replacement Geotechnical / Geologic Consultant has reviewed the previous reports and work performed for the project, agreed in writing to accept the recommendations and prior work performed by **HGI** for the subject project, or has submitted their revised recommendations.

UNIFORMITY OF CONDITIONS

The recommendations and opinions expressed in this report reflect our understanding of the project requirements based on an evaluation of subsurface

earth material conditions encountered at the subsurface exploration locations and the assumption that earth material conditions do not deviate appreciably from those encountered. It should be recognized that the performance of the foundations may be influenced by undisclosed or unforeseen variations in earth material conditions that may occur in intermediate and unexplored areas. Any unusual conditions not covered in this report that may be encountered during site development should be brought to the attention of the **HGI** so that we may make modifications, if necessary.

CHANGE IN SCOPE

HGI should be advised of any changes in the project scope of proposed site grading so that it may be determined if recommendations contained herein are valid. This should be verified in writing or modified by a written addendum.

TIME LIMITATIONS

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they be due to natural processes or the work of man on this or adjacent properties. In addition, changes in the State-of-the-Art and/or government codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a period of two (2) years without a review by **HGI** verifying the validity of the conclusions and recommendations.

PROFESSIONAL STANDARD

In the performance of our professional services, we comply with the standard of care and skill ordinarily exercised under similar circumstances by members of the geologic / geotechnical professions currently practicing under similar conditions

and in the same locality. The client recognizes that subsurface conditions may vary from those encountered at the locations where our surveys and exploratory excavations were made, and that our data, interpretations, and recommendations are based solely on information obtained by us. We will be responsible for those data, interpretations, and recommendations, but should not be responsible for interpretations by others of the information presented and/or developed. Our services consist of professional consultation and observation only, and other warranties, expressed or implied, are not made or intended in connection with work performed by HGI or by the proposal for consulting or other services or by the furnishing of oral or written reports or findings.

CLIENT'S RESPONSIBILITY

It is the responsibility of the client and/or the client's representatives to ensure that information and recommendations contained herein are brought to the attention of the Engineers and Architect for the project and incorporated into project plans and specifications. It is further their responsibility to take measures so that the contractor and his subcontractors carry out such recommendations during construction.

APPENDIX A

FIELD EXPLORATION

The field study performed for this report included a visual reconnaissance of existing surface conditions of the subject site and surrounding area. Site observations were conducted on January 20, 2014 by a representative of HGI. The aerial distribution of the earth materials observed is shown on the 'Exploratory Excavation Location Plan,' Plate No. 1, presented in the map pocket in this Appendix.

A study of the property's subsurface condition was performed to evaluate underlying earth strata and the presence of groundwater. Seven (7) exploratory backhoe excavations were performed on the subject site on January 20, 2014. Locations of the exploratory excavations were determined in the field by sighting from the adjacent existing streets, adjacent structures, and topographic features as shown on the Reference No. 1 'Tract Map,' noted on the first page of the cover letter for this report. Approximate locations of the exploratory excavations are denoted on the 'Exploratory Excavation Location Plan' presented in the map pocket in this Appendix. Approximate elevations at the locations of the exploratory excavations were determined by interpolation to the closest 1.0 foot from a 1.0 foot contour interval topographic plot of the site (Reference No. 1 noted on the first page of the cover letter for this report). Locations and elevations of the exploratory excavations should be considered accurate only to the degree implied by the method used in determining them.

The exploratory trenches were excavated by using a rubber tired, tractor-mounted backhoe. The depths explored in the trenches was approximately 9.5 to 12 feet below the existing land surface at the excavation locations. Bulk and relatively undisturbed chunk samples were obtained from cuttings developed during the

backhoe excavation process and represent the earth materials within the depth indicated. In-place dry density and moisture content tests were also performed at various depths in the backhoe exploratory excavations. The tests were performed in general accordance with current Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) - ASTM D6938 test method. The dry density and moisture content test results are presented on the 'Summary of Field In-Place Density Test Results,' Plate No. 3 through 9, presented in this Appendix.

Groundwater observations were made during, and at the completion of the excavation process and are noted on the 'Subsurface Exploration Log' presented in this Appendix, if encountered.

The exploratory excavations were logged by a representative of **HGI** for fill material, natural earth material, and subsurface conditions encountered. Earth materials encountered in the exploratory excavations were visually described in the field in general accordance with the current Unified Soils Classification System (USCS), ASTM D2488, visual-manual procedures, as illustrated on the attached, simplified 'Subsurface Exploration Legend,' Plate No. 2, presented in this Appendix. The visual textural description, color of the earth material at natural moisture content, apparent moisture condition of the earth materials, and apparent relative density or consistency of the earth materials, etc., were recorded on the field logs. The field log for each excavation contains factual information and interpretation of earth material conditions between samples. The 'Subsurface Exploration Log' presented in this Appendix represent our interpretation of the field log contents and results of laboratory observations and tests performed on samples obtained in the field from the exploratory excavations.

Four (4) infiltrometer tests were also performed on the subject site as part of this study. The infiltrometer tests were performed in the proposed retention basin / storm water storage areas.

The exploratory backhoe excavations were backfilled with excavated earth materials and with reasonable effort to restore the areas to their initial condition before leaving the site but were not compacted to a relative compaction of 90 percent or greater. Recompaction of the exploratory backhoe excavation backfill, if located within proposed structural fill, building, hardscape, and/or pavement areas, should be addressed during site grading operations. In an area as small and deep as a backhoe excavation, consolidation and subsidence of backfill earth material may result in time, causing a depression of the excavation areas. The client is advised to observe exploratory excavation areas periodically and, when needed, backfill noted depressions.

LABORATORY TESTING PROGRAM

Laboratory tests were performed on selected, bulk samples obtained from exploratory excavations during the field study. Tests were performed in general accordance with generally accepted American Society for Testing and Materials (ASTM), State of California - Department of Transportation (CALTRANS), Environmental Protection Agency (EPA) or other suitable test methods or procedures. The remaining samples obtained during the field study will be discarded 30 days after the date of this report. This office should be notified immediately if retention of samples will be needed beyond 30 days. A brief description of the tests performed is presented below:

CLASSIFICATION

The field classification of earth material materials encountered in the exploratory excavations was verified in the laboratory in general accordance with the current Unified Soils Classification System, ASTM D2488, 'Standard Practice for Determination and Identification of Soils (Visual-Manual Procedures).' The final classification is shown on the 'Subsurface Exploration Log,' Plate Nos. 3 through 9, presented in this Appendix.

EXPANSION TEST

A laboratory expansion test was performed on a selected sample of near-surface earth material in general accordance with the current ASTM D4829 procedures. In this testing procedure, a remolded sample is compacted in two (2) layers in a 4-inch inside diameter mold to a total compacted thickness of approximately 1.0 inch by using a 5.5-pound weight dropping 12 inches and with 15 blows per layer. The sample should be compacted at a saturation between 48 and 52 percent. After remolding, the sample is confined under a pressure of 144 pounds per square foot

(psf) and allowed to soak for 24 hours. The resulting volume change due to the increase in moisture content within the sample is recorded and the Expansion Index (EI) calculated. The test results are summarized in the 'Summary of Laboratory Test Results,' Plate No. 10, presented in this Appendix.

SOLUBLE SULFATE TEST

The concentration of soluble sulfate was determined on selected samples of near-surface earth materials in general accordance with current EPA 300.0 procedures. The test results are summarized in the 'Summary of Laboratory Test Results,' Plate No. 10, presented in this Appendix.

SIEVE ANALYSIS

The percent by weight finer than a No. 200 sieve (silt and clay content) was determined for selected samples of earth materials in general accordance with current ASTM D1140 procedures. The test is performed by taking a known weight of an oven dry sample of earth material, washing it over a No. 200 sieve, and oven drying the earth material retained on the No. 200 sieve. The dry weight of earth material retained on the No. 200 sieve is measured and the resulting percentage retained is calculated based on the original total dry earth material sample weight. The percent passing the No. 200 sieve is determined by subtracting the percent retained from 100. The test results are summarized in the 'Summary of Laboratory Test Results,' Plate No. 11, presented in this Appendix.

MAXIMUM DRY DENSITY / OPTIMUM MOISTURE CONTENT RELATIONSHIP TEST

Maximum dry density / optimum moisture content relationship determinations were performed on samples of near-surface earth materials in general accordance with current ASTM D1557 procedures using a 4-inch and 6-inch diameter molds

for Methods 'B' and 'C,' respectively. Samples were prepared at various moisture contents and compacted in five (5) layers using a 10-pound weight dropping 18 inches and with 25 and 56 blows per layer for Methods 'B' and 'C,' respectively. A plot of the compacted dry density versus the moisture content of the specimens was constructed and the maximum dry density and optimum moisture content determined from the plot. The test results are summarized in the 'Maximum Dry Density / Optimum Moisture Content Relationship Test Results,' Plate Nos. 12 and 13, presented in this Appendix.

DIRECT SHEAR TEST

A direct shear test was performed on a selected remolded sample of near-surface earth material obtained from the borings in general accordance with current ASTM D3080 procedures. The shear machine is of the constant strain type. The shear machine is designed to receive a 1-inch high, 2.416-inch diameter ring sample. Three (3) specimens from the selected bulk sample of earth material were remolded at approximately 90 percent relative compaction and at optimum moisture content based on the maximum dry density and optimum moisture content of the earth material as determined by current ASTM D1557 procedures. Specimens from the remolded samples were sheared at various pressures normal to the face of the specimens. The specimens were tested in a submerged condition. The peak and ultimate shear stresses were plotted verses the normal confining stresses to determine the shear strength (cohesion and angle of internal friction). The test results are summarized in the 'Direct Shear Test Results,' Plate No. 14, presented in this Appendix.

REPORT OF PRELIMINARY GEOTECHNICAL / GEOLOGIC STUDY PROPOSED 132 LOT SUBDIVISION TENTATIVE TRACT MAP 18952 NORTHEAST CORNER OF COLTON AVENUE AND OPAL AVENUE IN THE MENTONE AREA OF SAN BERNARDINO COUNTY, CALIFORNIA

PROJECT NO.: 950-A14
REPORT NO.: 1

FEBRUARY 20, 2014

SUBMITTED TO:

WALDEN STRUCTURES c/o
THATCHER ENGINEERING & ASSOCIATES, INC.
1461 FORD STREET, SUITE 105
REDLANDS, CA 92373

PREPARED BY:

HILLTOP GEOTECHNICAL, INC.
786 SOUTH GIFFORD AVENUE
SAN BERNARDINO, CA 92408

IN THE COUNTY OF SAN BERNARDINO

TENTATIVE TRACT MAP NO. 18952

LEGAL DESCRIPTION

PARCEL A:

ALL THAT PORTION OF THE SOUTHEAST 1/4 OF THE SOUTHWEST 1/4 OF SECTION 19, TOWNSHIP 1 SOUTH, RANGE 2 WEST, SAN BERNARDINO MERIDIAN, DESCRIBED AS FOLLOWS:

BEING A STRIP OF LAND OF UNIFORM WIDTH OF 39 FEET ON AND ALONG THE SOUTH BOUNDARY LINE OF THE SOUTHEAST ONE QUARTER OF THE SOUTHWEST ONE QUARTER OF SECTION 19, TOWNSHIP 1 SOUTH, RANGE 2 WEST, SAN BERNARDINO MERIDIAN.

EXCEPTING AND RESERVING UNTO UNION PACIFIC RAILROAD COMPANY, A DELAWARE CORPORATION, ITS SUCCESSORS AND ASSIGNS, FOREVER, ALL MINERALS AND ALL MINERAL RIGHTS OF EVERY KIND AND CHARACTER NOW KNOWN TO EXIST OR HEREAFTER DISCOVERED UNDERLYING THE PROPERTY, INCLUDING, WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, OIL AND GAS AND RIGHTS THERETO, TOGETHER WITH THE SOLE, EXCLUSIVE AND PERPETUAL RIGHT TO EXPLORE FOR, REMOVE AND DISPOSE OF SAID MINERALS BY ANY MEANS OR METHODS SUITABLE TO GRANTOR, ITS SUCCESSORS AND ASSIGNS, BUT WITHOUT ENTERING UPON OR USING THE SURFACE OF THE PROPERTY, AND IN SUCH MANNER AS NOT TO DAMAGE THE SURFACE OF THE PROPERTY, OR TO INTERFERE WITH THE USE THEREOF BY GRANTEE, ITS SUCCESSORS OR ASSIGNS, AS RESERVED ON QUITCLAIM DEED RECORDED APRIL 07, 2006, AS INSTRUMENT NO. 2006-0239408, OF OFFICIAL RECORDS.

PARCEL B:

THE SOUTHEAST ONE QUARTER OF THE SOUTHWEST ONE-QUARTER OF SECTION 19, TOWNSHIP 1 SOUTH, RANGE 2 WEST, SAN BERNARDINO MERIDIAN, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ACCORDING TO THE OFFICIAL PLAT THEREOF.

EXCEPTING THE SOUTHERLY 39 FEET THEREOF, AS CONVEYED TO THE SOUTHERN PACIFIC RAILROAD BY DEED RECORDED OCTOBER 09, 1891, IN BOOK 139, PAGE 225 OF DEEDS.

ALSO SAVING AND EXCEPTING THE FOLLOWING DESCRIBED PROPERTY:

BEGINNING AT A POINT ON THE WEST LINE OF AFORESAID SOUTHEAST ONE QUARTER OF THE SOUTHWEST ONE-QUARTER OF SECTION 19, DISTANT THEREON 130 FEET SOUTH OF THE NORTHWEST CORNER THEREOF, THENCE EAST PARALLEL TO THE NORTH LINE OF SAID SOUTHEAST ONE-QUARTER OF THE SOUTHWEST ONE-QUARTER A DISTANCE OF 160 FEET, THENCE SOUTH PARALLEL TO THE WEST LINE OF SAID SOUTHEAST ONE-QUARTER OF THE SOUTHWEST ONE-QUARTER A DISTANCE OF 64 FEET, THENCE WEST PARALLEL TO THE NORTH LINE OF SAID SOUTHEAST ONE QUARTER OF THE SOUTHWEST ONE-QUARTER A DISTANCE OF 160 FEET TO THE WEST LINE OF SAID SOUTHEAST ONE-QUARTER OF THE SOUTHWEST ONE-QUARTER OF SECTION 19; THENCE NORTH ALONG SAID WEST LINE A DISTANCE OF 64 FEET TO THE POINT OF BEGINNING.

EASEMENTS

1 AN EASEMENT FOR CARRIAGE OF WATER TO DIG AND LAY WATER WAYS, ALSO THE RIGHT TO BUILD CONSTRUCT AND MAINTAIN UPON SAID DAMS AND RESERVOIRS AND INCIDENTAL PURPOSES IN FAVOR OF THE MENTONE IRRIGATION COMPANY RECORDED DECEMBER 01, 1887, IN BOOK 69 OF DEEDS, PAGE 144.

SAID EASEMENT IS NOT PLOTTABLE.

2 AN EASEMENT FOR HIGHWAY, ROADWAY AND INCIDENTAL PURPOSES IN FAVOR OF COUNTY OF SAN BERNARDINO, A BODY CORPORATE AND POLITIC OF THE STATE OF CALIFORNIA RECORDED JUNE 21, 2007 AS INSTRUMENT NO. 2007-0369493 OF OFFICIAL RECORDS.

SAID EASEMENT IN CONTAINED WITHIN THE COLTON AVENUE RIGHT OF WAY.

(3) AN EASEMENT FOR POLE LINES AND INCIDENTAL PURPOSES IN FAVOR OF SOUTHERN CALIFORNIA EDISON COMPANY RECORDED DECEMBER 30, 1953 IN BOOK 3302, PAGE 397 OF OFFICIAL RECORDS.

4 AN EASEMENT FOR STREET AND INCIDENTAL PURPOSES IN FAVOR OF LESTER C. ALBERTSON, ET UX. RECORDED JULY 02, 1956 IN BOOK 3976, PAGE 359 OF OFFICIAL RECORDS.

SAID EASEMENT IS CONTAINED WITHIN APN 0298-063-03.

5 AN EASEMENT FOR THE DEDICATION FOR HIGHWAY AND ROAD AND INCIDENTAL PURPOSES IN FAVOR OF THE COUNTY OF SAN BERNARDINO, A BODY CORPORATE AND POLITIC OF THE STATE OF CALIFORNIA RECORDED OCTOBER 28, 1977 IN BOOK 9294, PAGE 1750 OF OFFICIAL RECORDS.

SAID EASEMENT IS CONTAINED WITHIN THE NICE AVENUE RIGHT OF WAY.

(6) AN EASEMENT FOR THE DEDICATION FOR HIGHWAY AND ROAD AND INCIDENTAL PURPOSES IN FAVOR OF THE COUNTY OF SAN BERNARDINO, A BODY CORPORATE AND POLITIC OF THE STATE OF CALIFORNIA RECORDED OCTOBER 28, 1977 IN BOOK 9294, PAGE 1752 OF OFFICIAL RECORDS.

SAID EASEMENT IS CONTAINED WITHIN THE OPAL AVENUE RIGHT OF WAY.

(7) AN EASEMENT FOR CONSTRUCT, USE, MAINTAIN, OPERATE, ALTER, AND TO REPAIR, REPLACE, RECONSTRUCT, INSPECT AND REMOVE AT ANY TIME AND FROM TIME TO TIME AND INCIDENTAL PURPOSES IN FAVOR OF SOUTHERN CALIFORNIA EDISON, A CORPORATION, RECORDED OCTOBER 31, 1977 IN BOOK 9295, PAGE 1491 OF OFFICIAL RECORDS.

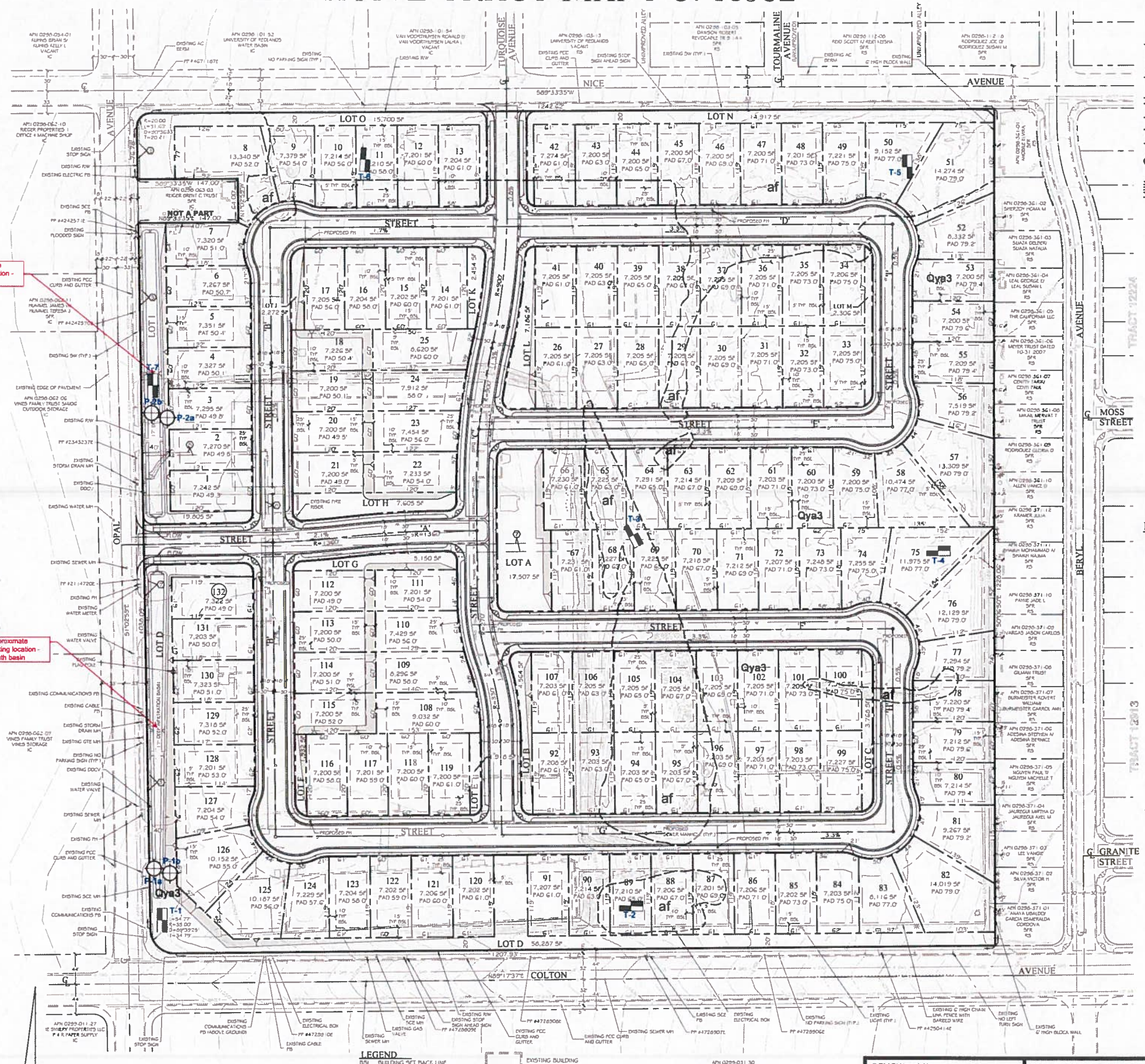
(8) AN EASEMENT FOR PUBLIC UTILITIES AND INCIDENTAL PURPOSES IN FAVOR OF SOUTHERN CALIFORNIA EDISON COMPANY, A CORPORATION, ITS SUCCESSORS AND ASSIGNS, RECORDED FEBRUARY 13, 1986 AS INSTRUMENT NO. 86-040551 OF OFFICIAL RECORDS.

9 AN EASEMENT FOR HIGHWAY AND ROAD AND INCIDENTAL PURPOSES IN FAVOR OF THE COUNTY OF SAN BERNARDINO, A BODY CORPORATE AND POLITIC OF THE STATE OF CALIFORNIA RECORDED JUNE 21, 2007 AS INSTRUMENT NO. 2007-0369494 OF OFFICIAL RECORDS.

SAID EASEMENT IS CONTAINED WITHIN THE OPAL AVENUE RIGHT OF WAY.

10 AN EASEMENT FOR HIGHWAY AND ROAD AND INCIDENTAL PURPOSES IN FAVOR OF THE COUNTY OF SAN BERNARDINO, A BODY CORPORATE AND POLITIC OF THE STATE OF CALIFORNIA RECORDED JUNE 21, 2007 AS INSTRUMENT NO. 2007-0382735 OF OFFICIAL RECORDS.

SAID EASEMENT IS CONTAINED WITHIN THE OPAL AVENUE AND NICE AVENUE RIGHT OF WAY.



Hilltop Geotechnical Inc. Legend

- Approximate Geologic Contact
- Approximate Double Ring Infiltrometer Test Location P-2b
- Approximate Trench Location T-7

OFFICIAL USE ONLY

Exploratory Excavation Location Plan

By	Date
AH	2/14
Project No 950-A14.1	Plate No. 1

HILLTOP GEOTECHNICAL

PROJECT NOTES:

1. ASSESSOR'S PARCEL NUMBER: 0298-063-07
2. GROSS AREA: 42.37 AC
3. EXISTING NET AREA: 35.17 AC
4. 6,159 LF OF NEW STREETS ARE PROPOSED
5. EXISTING NUMBER OF LOTS: 1
6. PROPOSED NUMBER OF LOTS: 132 SINGLE FAMILY LOTS + 15 LETTERED LOTS
7. PROPOSED DENSITY: 4.69 DU'S/NET ACRE
8. EXISTING ZONING DESIGNATION: COMMUNITY INDUSTRIAL (IC)
9. PROPOSED COUNTY ZONING AND GENERAL PLAN DESIGNATION: SINGLE RESIDENTIAL (RS)
10. PROPOSED GENERAL PLAN DESIGNATION FOR CITY OF REDLANDS: LOW MEDIUM DENSITY (0 TO 8 DU'S/GROSS AC)
11. EXISTING GENERAL PLAN DESIGNATION FOR CITY OF REDLANDS: LIGHT INDUSTRIAL
12. NO CONTIGUOUS OWNERSHIP
13. GRADING & DRAINAGE SHOWN ON THIS PLAN IS CONCEPTUAL ONLY.
14. EXISTING USE: WALDEN STRUCTURES INDUSTRIAL USE
15. PROPOSED USE: SINGLE FAMILY RESIDENTIAL LOTS
16. SITE IS NOT SUBJECT TO FLOOD WATERS, OVERFLOW OR INUNDATION
17. NO REGULATED TREES OR PLANTS KNOWN TO EXIST ON SITE.
18. NO ABOVE GROUND STRUCTURES WITHIN 15' OF PROJECT PROPERTY LINE, UNLESS OTHERWISE SHOWN
19. PROJECT SITE IS LOCATED WITHIN ZONE 'X' (AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOOD PER FIRM NO. 6717 OF 8400, DATED AUGUST 28, 2008.)
20. A RAIN GARDEN ON EACH SINGLE FAMILY LOT WILL PROVIDE WATER QUALITY TREATMENT OF STORMWATER FOR EACH LOT. RUNOFF FROM STREETS, SIDEWALKS AND OPEN SPACE WILL BE DIRECTED TO ONE OF TWO INFILTRATION BASINS (MAXIMUM 17' DEEP) LOCATED IN LOTS D & I FOR WATER QUALITY TREATMENT OF STORMWATER.
21. PRELIMINARY GRADING QUANTITIES:
    RAW CUT: 84,000 CY
    RAW FILL: 62,000 CY
    SITE BALANCE
22. ALL SLOPES 2:1 UNLESS OTHERWISE DESIGNATED. SLOPES 2' HIGH OR LESS ARE NOT SHOWN.
23. THIS PROJECT IS DESIGNED FOR DEVELOPER BUILD OUT.
24. ALL EXISTING FEATURES ONSITE WILL BE REMOVED. SEE PRE DEVELOPMENT TRIBUTARY AREA MAP FOR LOCATION AND IDENTIFICATION OF EXISTING FEATURES.

UTILITIES

ELECTRIC:
SOUTHERN CALIFORNIA EDISON COMPANY 257 TENNESSEE STREET REDLANDS, CA 92373 (909) 307-6731

GAS:
SOUTHERN CALIFORNIA GAS COMPANY 1981 WEST LUGONIA AVENUE REDLANDS, CA 92373 (909) 335-7750

CABLE:
TIME WARNER CABLE 1971 W REDLANDS BLVD. REDLANDS, CA 92374 (800) 892-2253

TELEPHONE:
VERIZON 9 SOUTH 4TH STREET REDLANDS, CA 92373 (909) 748-6676

WATER & SEWER:
CITY OF REDLANDS 35 CAJON STREET REDLANDS, CA 92373 (909) 798-7698

TYPICAL X-SECTION INTERIOR STREET
NTS

VICINITY MAP

SCALE: 1"=60'
0 60 120 180

SOURCE OF SURVEY:
TOPOGRAPHIC SURVEY BY:
ONPOINT LAND SURVEYING, INC.
DATED 6/2013
412 WILBAR CIRCLE
REDLANDS, CA 92374

LEGEND

BSL	BUILDING SET BACK LINE
DDCV	DOUBLE DETECTOR CHECK VALVE
FH	FIRE HYDRANT
MH	MANHOLE
PP	ELECTRIC POWER POLE
PL	PROPERTY LINE
PB	PULL BOX
PCC	PORTLAND CEMENT CONCRETE
P.L.	PROPERTY LINE
SFR	SINGLE FAMILY RESIDENCE
STL	STREET LIGHT
SW	SIDEWALK

ZONING LEGEND

IC COMMUNITY INDUSTRIAL (COUNTY)
RS SINGLE RESIDENTIAL (COUNTY)
IN INSTITUTIONAL (COUNTY)

BENCHMARK

CITY OF REDLANDS BENCHMARK R-43:
BRASS DISK IN THE TOP OF CURB @ NE COR. BERYL AVE. & COLTON AVE. EAST END OF RETURN
ELEVATION = 1,683.679

BASIS OF BEARING

CENTERLINE OF OPAL AVENUE PER RS 55/26 BEING N01°02'59"W

PREPARED FOR:

WALDEN STRUCTURES
ATTN: CHARLES WALDEN & JOEL MINER
801 OPAL AVENUE
MENTONE, CA 92359
PHONE: (909) 389-9102

APN 0298-063-07

TENTATIVE TRACT MAP NO. 18952

APPLICANT-REPRESENTATIVE:
WALDEN STRUCTURES
ATTN: CHARLES WALDEN & JOEL MINER
801 OPAL AVENUE, MENTONE, CA 92359

PROPERTY OWNER:
800 OPAL LLC
GD WALDEN STRUCTURES
ATTN: CHARLES WALDEN & JOEL MINER
801 OPAL AVENUE MENTONE, CA 92359

MAP PREPARER:
THATCHER ENGINEERING AND ASSOCIATES, INC
1461 FORD STREET SUITE 101, REDLANDS, CA 92373

DATE PREPARED: 1/13/2014

thatcher engineering & associates, inc.
1461 ford street suite 105, redlands, ca 92373
• land planning
• civil engineering
• landscape architecture
phone 909 748 7777
fax 909 748 7778

MELVIN W. THATCHER, III R.C.E. 39964 Exp. Dec. 31, 2015

Job Number:	Date Prepared:	Drawn By:	Reference Number:
154601	1/15/14	PP	154601TTM2014.1.2

SUBSURFACE EXPLORATION LEGEND

UNIFIED SOIL CLASSIFICATION SYSTEM Visual-Manual Procedure (ASTM D2488-09a)					CONSISTENCY / RELATIVE DENSITY
MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES	CRITERIA
Coarse-Grained Soils* More than 50 % Retained on No. 200 Sieve	Gravels 50 % or more of Coarse Fraction Retained on No. 4 Sieve	Clean Gravels	GW	Well Graded Gravels and Gravel-Sand Mixtures, Little or no Fines	Reference: 'Foundation Engineering'. Peck, Hansen, Thornburn. 2nd Edition.
			GP	Poorly Graded Gravels and Gravel-Sand Mixtures. Little or no Fines	Standard Penetration Test Granular Soils
		Gravels with Fines	GM	Silty Gravels, Gravel-Sand-Silt Mixtures**	Penetration Resistance, N, (Blows / Foot) / Relative Density
			GC	Clayey Gravel, Gravel-Sand-Clay Mixtures**	0 - 4 Very Loose
	Sands More than 50 % of Coarse Fraction Passes No. 4 Sieve	Clean Sands	SW	Well Graded Sands and Gravely Sands, Little or no Fines	5 - 10 Loose
			SP	Poorly Graded Sands and Gravelly Sands, Little or no Fines	11 - 30 Medium Dense
		Sands with Fines	SM	Silty Sands, Sand-Silt Mixtures**	31 - 50 Dense
			SC	Clayey Sands, Sand-Clay Mixtures**	> 50 Very Dense
Fine Grained Soils* 50 % or more Passes No. 200 Sieve	Silts and Clays Liquid Limits 50 % or less		ML	Inorganic Silts, Sandy Silts. Rock Flour	Standard Penetration Test Cohesive Soils
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays	Penetration Resistance, N, (Blows / Foot) / Consistency / Unconfined Compressive Strength, (Tons / Sq. Ft.)
			OL	Organic Silts and Organic silty Clays of Low Plasticity	< 2 Very Soft < 0.25
	Silts and Clays Liquid Limits Greater than 50 %		MH	Inorganic Silts, Micaceous or Diatomaceous silts, Plastic Silts	2 - 4 Soft 0.25 - 0.5
			CH	Inorganic Clays of High Plasticity, Fat Clays	5 - 8 Firm (Medium Stiff) 0.5 - 1.0
			OH	Organic Clays of Medium to High Plasticity	9 - 15 Stiff 1.0 - 2.0
					16 - 30 Very Stiff 2.0 - 4.0
Highly Organic Soils			PT	Peat, Muck, or Other Highly Organic Soils	> 31 Hard > 4.0

* Based on material passing the 3-inch sieve.

** More than 12% passing the No. 200 sieve; 5% to 12% passing No. 200 sieve requires use of duel symbols (i.e., SP-SM., GP-GM, SP-SC, GP-GC, etc.); Border line classifications are designated as CH/Cl, GM/SM, SP/SW, etc.

U.S. Standard Sieve Size 12" 3" 3/4" #4 #10 #40 #200

Unified Soil Classification Designation	Boulders	Cobbles	Gravel		Sand			Silt and Clay
			Coarse	Fine	Coarse	Medium	Fine	

Moisture Condition

Dry	Absence of moisture, dusty, dry to the touch.
Moist	Damp but no visible moisture.
Wet	Visible free water, usually below the water table.

Material Quantity

Trace (Few)	< 5 %
Slight	5 - 10%
Little	15 - 25%
Some	30 - 45 %

Other Symbols

C - Core Sample
S - SPT Sample
B - Bulk Sample
CK - Chunk Sample
R - Ring Sample
N - Nuclear Gauge Test
∇ - Water Table

HILLTOP GEOTECHNICAL INCORPORATED

(Revised 7-10-2013)

HILLTOP GEOTECHNICAL INCORPORATED

SUBSURFACE EXPLORATION LOG
TRENCH NO. T-1

Project Name: Proposed 132 Lot Subdivision, Tentative Tr. 18952, Mentone, CA.
Project No.: 950-A14.1 Date: 1/20/2014 Logged By: AH
Equipment Used: Rubber tired, tractor-mounted backhoe Elevation: ± 1649

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
1	B/N		SM	120.1	5.8	Qya_3		YOUNG AXIAL VALLEY DEPOSIT: Silty, fine to coarse sand, a little gravel, a little cobbles; Light brown to orange-brown; Moist.
2								
3	N			99.4	5.7			
4			SP					Gravelly, fine to coarse sand, trace boulders, trace silt; Brown; Moist.
5	B		GP					Fine to coarse, sandy gravel, some cobbles, trace boulders; Light gray-brown; Moist.
6								
7								
8								
9								
10								
11								
12								Bottom of trench at 11.5 feet. No groundwater encountered. Trench backfilled with excavated material.
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

B - Bulk Sample N - Nuclear Gauge Test CK - Chunk Sample

Plate No. 3

HILLTOP GEOTECHNICAL
INCORPORATED

SUBSURFACE EXPLORATION LOG
TRENCH NO. T-2

Project Name: Proposed 132 Lot Subdivision, Tentative Tr. 18952, Mentone, CA.
Project No.: 950-A14.1 Date: 1/20/2014 Logged By: AH
Equipment Used: Rubber tired, tractor-mounted backhoe Elevation: ± 1668

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
1			SM			af		ARTIFICIAL FILL: Silty, fine to coarse sand, some gravel, a little cobbles, trace boulders, trace roots, trace asphalt particles and plastic pieces; Light brown; Moist.
2	N			114.6	3.3			
3	B							4 to 5 Large Boulders.
4	N		SM	110.0	6.9	Qya_3		YOUNG AXIAL VALLEY DESPOSIT: Silty, fine to coarse sand, a little gravel, a little cobbles; Light brown to orange-brown; Moist.
5								
6								
7			GP					Fine to coarse, sandy gravel, a little cobbles, trace boulders; Light gray-brown; Moist.
8								
9								
10								
11	B							
12								Bottom of trench at 11.5 feet. No groundwater encountered. Trench backfilled with excavated material.
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

B - Bulk Sample N - Nuclear Gauge Test CK - Chunk Sample

Plate No. 4

HILLTOP GEOTECHNICAL INCORPORATED

SUBSURFACE EXPLORATION LOG
TRENCH NO. T-3

Project Name: Proposed 132 Lot Subdivision, Tentative Tr. 18952, Mentone, CA.
Project No.: 950-A14.1 Date: 1/20/2014 Logged By: AH
Equipment Used: Rubber tired, tractor-mounted backhoe Elevation: ± 1668

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
1	N		SM	128.8	2.9	af		ARTIFICIAL FILL: Silty, fine to coarse sand, a little gravel, a little cobbles; Light brown; Moist.
2								Asphalt pieces found at 2'
3	B N			126.1	4.5			
4								
5			SP			Qya_3		YOUNG AXIAL VALLEY DESPOSIT: Fine to coarse sand, a little gravel; Gray; Moist.
6			SM					Silty, fine to coarse sand, some gravel, trace cobble, trace boulders; Dark orange-brown; Moist.
7			GP					Fine to coarse, sandy gravel, some cobbles, a little boulders; Light gray-brown; Moist.
8								
9								
10								
11								
12								Bottom of trench at 11.5 feet. No groundwater encountered. Trench backfilled with excavated material.
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

B - Bulk Sample N - Nuclear Gauge Test CK - Chunk Sample

Plate No. 5

HILLTOP GEOTECHNICAL
INCORPORATED

SUBSURFACE EXPLORATION LOG
TRENCH NO. T-4

Project Name: Proposed 132 Lot Subdivision, Tentative Tr. 18952, Mentone, CA.
Project No.: 950-A14.1 Date: 1/20/2014 Logged By: AH
Equipment Used: Rubber tired, tractor-mounted backhoe Elevation: ± 1677

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
1			SM			Qya_3		YOUNG AXIAL VALLEY DEPOSIT: Silty, fine to coarse sand, a little gravel, a little cobbles, trace boulders; Light brown to orange-brown; Moist
2	N			104.6	2.7			
3			GP					5 Large boulders.
4	B/N		GP	116.4	4.2			Gravel, some fine to coarse sand, some cobbles, trace boulders; Gray-brown; Moist.
5								
6								
7								
8								
9								
10								Bottom of trench at 9.5 feet. No groundwater encountered. Trench backfilled with excavated material.
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

B - Bulk Sample N - Nuclear Gauge Test CK - Chunk Sample

Plate No. 6

HILLTOP GEOTECHNICAL INCORPORATED

SUBSURFACE EXPLORATION LOG
TRENCH NO. T-5

Project Name: Proposed 132 Lot Subdivision, Tentative Tr. 18952, Mentone, CA.

Project No.: 950-A14.1 Date: 1/20/2014 Logged By: AH

Equipment Used: Rubber tired, tractor-mounted backhoe Elevation: ± 1678

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
1	N		SM	109.9	3.3	af		ARTIFICIAL FILL: Silty, fine to coarse sand, trace gravel, trace cobbles; Orange-brown; Moist.
2	B		SM			Qya_3		YOUNG AXIAL VALLEY DEPOSIT: Silty, fine to coarse sand, trace gravel, trace cobbles; Orange-brown; Moist.
3	N			112.0	4.6			
4								
5			GP					Cobbles, a little gravel, a little fine to coarse sand, trace boulders; Gray; Moist.
6								
7			GP					Gravel, trace silt, trace fine to coarse sand; Gray; Moist.
8			GP					Cobbles, a little gravel, a little fine to coarse sand, trace boulders; Gray; Moist.
9								
10			GP					Gravel, trace silt, trace fine to coarse sand; Gray; Moist.
			GP					Cobbles, a little gravel, a little fine to coarse sand, trace boulders; Gray; Moist.
11								Bottom of trench at 10.5 feet. No groundwater encountered. Trench backfilled with excavated material.
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

B - Bulk Sample N - Nuclear Gauge Test CK - Chunk Sample

Plate No. 7

HILLTOP GEOTECHNICAL
INCORPORATED

SUBSURFACE EXPLORATION LOG
TRENCH NO. T-6

Project Name: Proposed 132 Lot Subdivision, Tentative Tr. 18952, Mentone, CA.
Project No.: 950-A14.1 Date: 1/20/2014 Logged By: AH
Equipment Used: Rubber tired, tractor-mounted backhoe Elevation: ± 1659

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
1	B		SM			af		ARTIFICIAL FILL: Silty, fine to coarse sand, a little gravel, trace cobbles, trace boulders, trace asphalt and plastics; Brown; Moist.
2			SM			Qya_3		YOUNG AXIAL VALLEY DEPOSIT: Silty, fine to coarse sand, a little gravel, trace cobbles, trace boulders; Orange-brown; Moist;.
3	N			108.8	4.8			
4								
5	B/N			102.5	5.8			
6			GP					Boulders, some cobbles, a little gravel, a little fine to coarse sand; Orange-brown to Gray-brown.
7			GP					Gravel, trace silt, trace fine to coarse sand; Gray; Moist.
8			GP					Boulders, some cobbles, a little gravel, a little fine to coarse sand; Orange-brown to Gray-brown.
9								
10								
11								
12								Bottom of trench at 12.0 feet. No groundwater encountered. Trench backfilled with excavated material.
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

B - Bulk Sample N - Nuclear Gauge Test CK - Chunk Sample

Plate No. 8

HILLTOP GEOTECHNICAL INCORPORATED

SUBSURFACE EXPLORATION LOG
TRENCH NO. T-7

Project Name: Proposed 132 Lot Subdivision, Tentative Tr. 18952, Mentone, CA.
Project No.: 950-A14.1 Date: 1/20/2014 Logged By: AH
Equipment Used: Rubber tired, tractor-mounted backhoe Elevation: ± 1651

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
1	N		SM	112.2	14.4	Qya_3		YOUNG AXIAL VALLEY DEPOSIT: Silty, fine to coarse sand, a little gravel, trace cobbles, trace boulders; Dark brown; Very moist.
2	B							
3	N			113.6	9.5			
4			SP					Fine to coarse sand, a little gravel, trace silt, trace cobbles; Dark brown; Moist.
5			GP					Cobbley, gravel, a little fine to coarse sand, trace silt, trace boulders; Dark brown; Moist.
6								
7								
8								
9								Bottom of trench at 9.0 feet due to sidewalll caving. No groundwater encountered. Trench backfilled with excavated material.
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								

B - Bulk Sample N - Nuclear Gauge Test CK - Chunk Sample

Plate No. 9

SUMMARY OF LABORATORY TEST RESULTS

EXPANSION INDEX TEST RESULTS (ASTM D4829 Test Method)						
SAMPLE NO.	MOISTURE CONTENT PRIOR TO TEST (to 0.1%)	DRY DENSITY PRIOR TO TEST (to 0.1 pcf)	SATURATION PRIOR TO TEST (to 0.1% between 48% & 52%)*	MOISTURE CONTENT AFTER TEST (to 0.1%)	EXPANSION INDEX	EXPANSION POTENTIAL **
T-5, 1.5'-2.0'	8.1	116.2	48.6	13.6	0	Non-Expansive

* Assumes a 2.70 Specific Gravity for the earth material.
** As defined in Section 1803.5.3, 'Expansive Soil,' in the 2013 California Building Code (CBC) (i.e., Non-Expansive: EI ≤20; Expansive: EI >20).

SOLUBLE SULFATE TEST RESULTS (EPA 300.0 Test Procedure)*			
SAMPLE NO.	SOLUBLE SULFATE CONTENT (%)	SULFATE EXPOSURE**	
		CLASS	SEVERITY
T-2, 2.5'-3.0'	0.0019	S0	Not Applicable
T-5, 1.5'-2.0'	<0.0005	S0	Not Applicable

* Test performed by **A & R Laboratories**.
** Per Table 4.2.1, 'Exposure Categories and Classes,' in **American Concrete Institute (ACI)** 318-11, Chapter 4, *Durability Requirements*, Section 4.2.1.

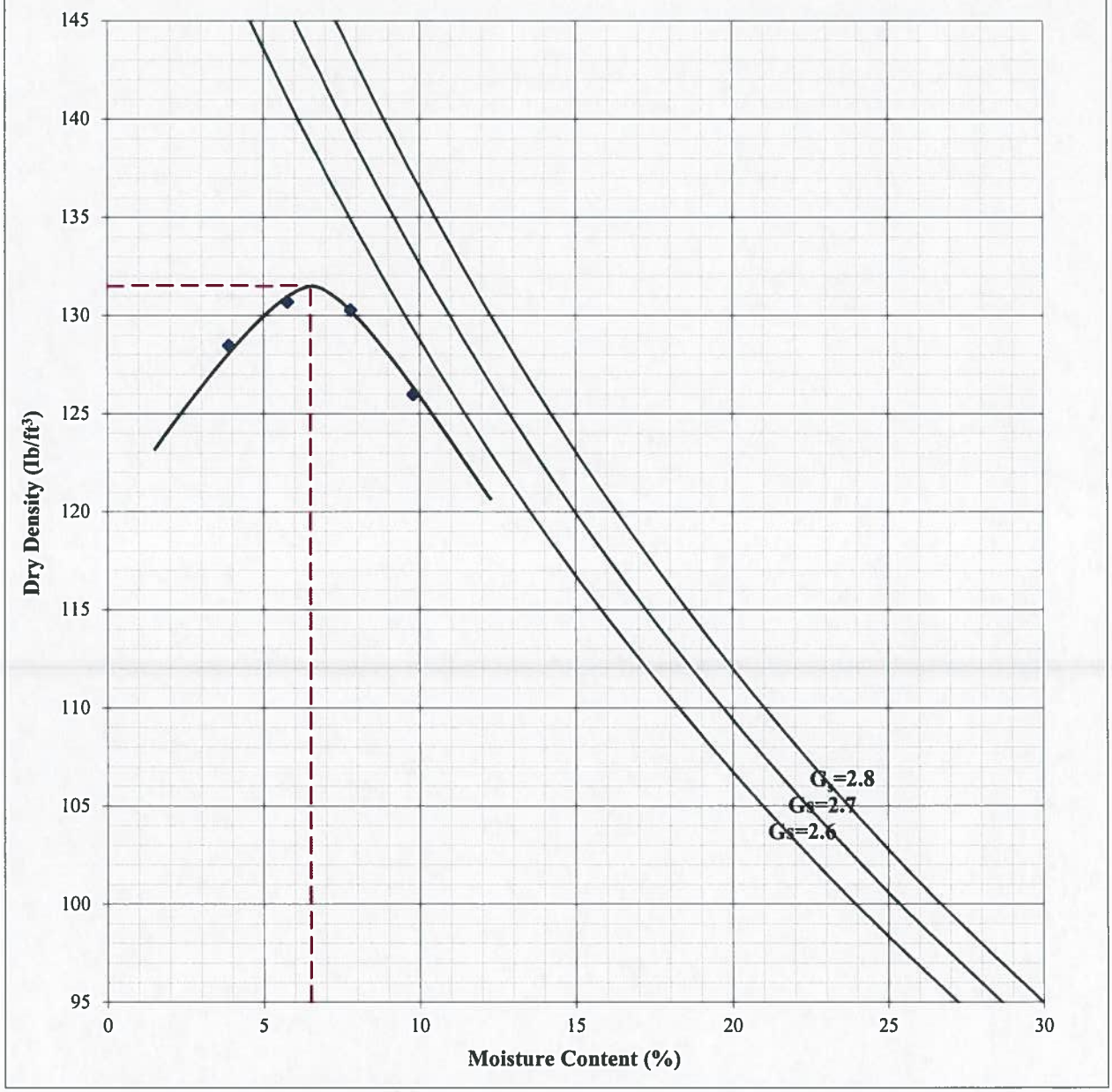
June 5, 2017 1100-A17.1

SUMMARY OF LABORATORY TEST RESULTS

PERCENT PASSING #200 SIEVE TEST RESULTS (ASTM D1140 Test Method)	
SAMPLE	PERCENT PASSING #200 SIEVE
T-2, 2.5'-3.0'	12
T-5, 1.5'-2.0'	16

PLATE NO. 11

HILLTOP GEOTECHNICAL, INC.

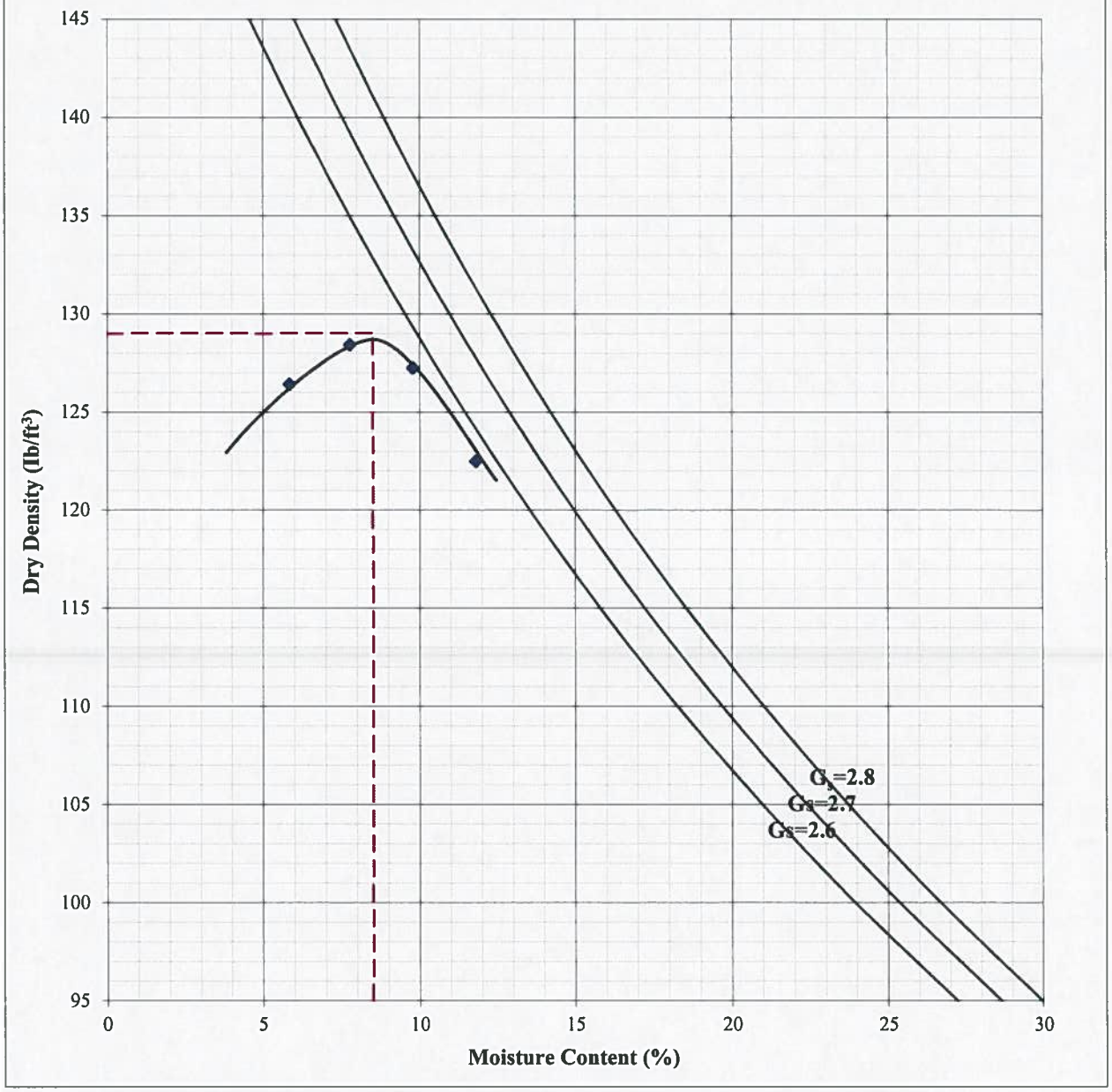


Maximum Dry Density (lb/ft^3)	131.5
Optimum Moisture Content (%)	6.5
Procedure	C
Corrected Maximum Dry Density for 16.9% +3/4" (lb/ft^3)	136.4
Corrected Optimum Moisture Content for 16.9% +3/4" (%)	5.6

HILLTOP GEOTECHNICAL INCORPORATED

MAXIMUM DRY DENSITY / OPTIMUM MOISTURE CONTENT RELATIONSHIP TEST RESULTS (ASTM D1557 Test Method)

SAMPLE:	T-2, 2.5'-3.0'		
SOIL DESCRIPTION:	Light brown, silty, fine to coarse sand, some gravel, a little cobbles, trace boulders (SM)		
BY:	DLC	DATE:	2/2014
JOB NO.:	950-A14.1	PLATE NO.:	12

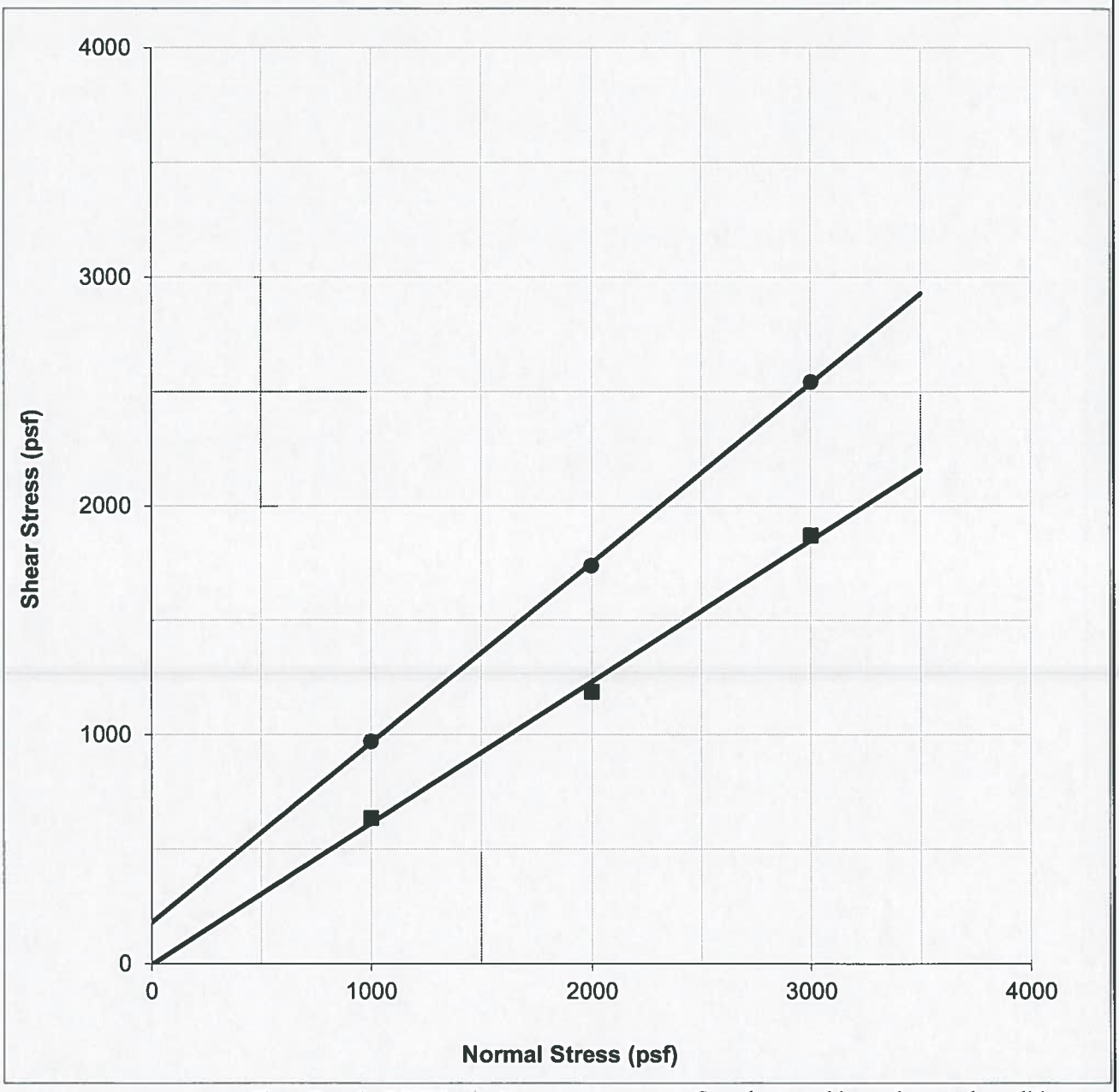


Maximum Dry Density (lb/ft^3)	129.0
Optimum Moisture Content (%)	8.5
Procedure	B
Corrected Maximum Dry Density for 5.8% +3/8" (lb/ft^3)	130.7
Corrected Optimum Moisture Content for 5.8% +3/8" (%)	8.1

HILLTOP GEOTECHNICAL INCORPORATED

MAXIMUM DRY DENSITY / OPTIMUM MOISTURE CONTENT RELATIONSHIP TEST RESULTS (ASTM D1557 Test Method)

SAMPLE:	T-5, 1.5'-2.0'		
SOIL DESCRIPTION:	Orange-brown, silty, fine to coarse sand, trace gravel, trace cobbles (SM)		
BY:	DLC	DATE:	2/2014
JOB NO.:	950-A14.1	PLATE NO.:	13



Shear Speed: 0.005 in. / min.

Samples tested in a submerged condition.

Average Dry Density (pcf)	116.9
Average Moisture Content (%)	8.2

Peak	Cohesion	180 psf
	Internal Friction Angle	38 degrees
Ultimate	Cohesion	0 psf
	Internal Friction Angle	32 degrees
Residual	Cohesion	psf
	Internal Friction Angle	degrees

HILLTOP GEOTECHNICAL
INCORPORATED

DIRECT SHEAR TEST RESULTS
(ASTM D3080 Test Method)

SAMPLE:	T-05, 1.5'-2.09' (Remolded to 90% of maximum dry density at optimum moisture content)		
SOIL DESCRIPTION:	Orange-brown, silty, fine to coarse sand, trace gravel, trace cobbles (SM)		
BY:	DLC	DATE:	2/2014
PROJECT NO.:	950-A14.1	PLATE NO.:	14

APPENDIX B

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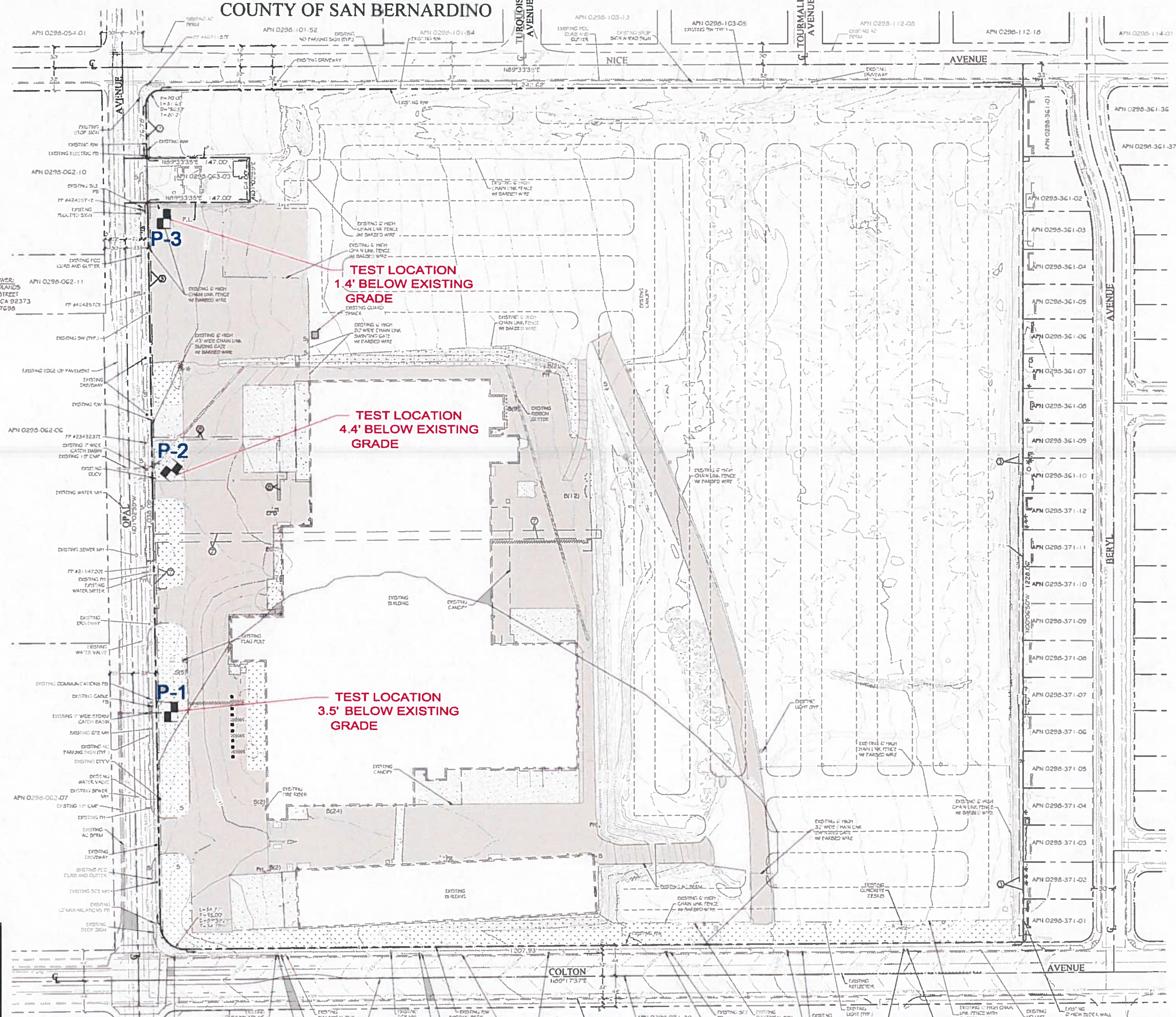
APPENDIX C

INFILTRATION TEST LOCATION EXHIBIT

APN 0298-063-07
801 OPAL AVENUE
COUNTY OF SAN BERNARDINO



UTILITIES

ELECTRIC:
SOUTHERN CALIFORNIA EDISON COMPANY 287 TENNESSEE STREET
REDLANDS, CA 92373
(909) 307-6731

GAS:
SOUTHERN CALIFORNIA GAS COMPANY
1981 WEST LUGONIA AVENUE
REDLANDS, CA 92373
(909) 335-7750

CABLE:
TIME WARNER CABLE
1971 W REDLANDS BLVD
REDLANDS, CA 92374
(800) 692-2253

TELEPHONE:
VERIZON
9 SOUTH 4TH STREET
REDLANDS, CA 92373
(909) 748-6676

WATER & SEWER:
CITY OF REDLANDS
35 CAJON STREET
REDLANDS, CA 92373
(909) 798-7698

LEGEND

EXISTING AC PAVING
EXISTING PCC PAVING
EXISTING LANDSCAPING

AC	ASPHALT CONCRETE
B	BOLLARD
BF	BACKFLOW
EC	ELECTRICAL CABINET
EX.	EXISTING
FH	FIRE HYDRANT
FR	FIRE RISER
MB	MAILBOX
PCC	PORTLAND CEMENT CONCRETE
PL	PROPERTY LINE
PP	POWER POLE
R/W	RIGHT-OF-WAY
S	SIGN
SMH	SEWER MANHOLE

SOURCE OF SURVEY

TOPOGRAPHIC SURVEY
DATED AUGUST 2013
AS CONDUCTED BY
ONPOINT LAND SURVEYING, INC.
1910 ORANGE TREE LANE, SUITE 344
REDLANDS, CALIFORNIA 92374
PHONE: (909) 792-2221

SCALE: 1"=60'
0 60 120 180

UNDERGROUND SERVICE ALERT
Call: Toll FREE
1-800-227-2600
TWO WORKING DAYS BEFORE YOU DIG

"CAUTION": Remember that the USA Center notifies only those utilities belonging to the center. There could be other utilities present at the work site. The center will inform you of whom they will notify.

VICINITY MAP

LEGAL DESCRIPTION

PARCEL A:

ALL THAT PORTION OF THE SOUTHEAST ¼ OF THE SOUTHWEST ¼ OF SECTION 19, TOWNSHIP 1 SOUTH, RANGE 2 WEST, SAN BERNARDINO MERIDIAN, DESCRIBED AS FOLLOWS:

BEING A STRIP OF LAND OF UNIFORM WIDTH OF 39 FEET ON AND ALONG THE SOUTH BOUNDARY LINE OF THE SOUTHEAST ONE QUARTER OF THE SOUTHWEST ONE QUARTER OF SECTION 19, TOWNSHIP 1 SOUTH, RANGE 2 WEST, SAN BERNARDINO MERIDIAN.

EXCEPTING AND RESERVING UNTO UNION PACIFIC RAILROAD COMPANY, A DELAWARE CORPORATION, ITS SUCCESSORS AND ASSIGNS, FOREVER, ALL MINERALS AND ALL MINERAL RIGHTS OF EVERY KIND AND CHARACTER NOW KNOWN TO EXIST OR HEREAFTER DISCOVERED UNDERLYING THE PROPERTY, INCLUDING, WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, OIL AND GAS AND RIGHTS THERETO, TOGETHER WITH THE SOLE, EXCLUSIVE AND PERPETUAL RIGHT TO EXPLORE FOR, REMOVE AND DISPOSE OF SAID MINERALS BY ANY MEANS OR METHODS SUITABLE TO GRANTOR, ITS SUCCESSORS AND ASSIGNS, BUT WITHOUT ENTERING UPON OR USING THE SURFACE OF THE PROPERTY, AND IN SUCH MANNER AS NOT TO DAMAGE THE SURFACE OF THE PROPERTY, OR TO INTERFERE WITH THE USE THEREOF BY GRANTEE, ITS SUCCESSORS OR ASSIGNS, AS RESERVED ON QUITCLAIM DEED RECORDED APRIL 07, 2006, AS INSTRUMENT NO. 2006-0239408, OF OFFICIAL RECORDS.

PARCEL B:

THE SOUTHEAST ONE-QUARTER OF THE SOUTHWEST ONE-QUARTER OF SECTION 19, TOWNSHIP 1 SOUTH, RANGE 2 WEST, SAN BERNARDINO MERIDIAN, IN THE COUNTY OF SAN BERNARDINO, STATE OF CALIFORNIA, ACCORDING TO THE OFFICIAL PLAT THEREOF.

EXCEPTING THE SOUTHERLY 39 FEET THEREOF, AS CONVEYED TO THE SOUTHERN PACIFIC RAILROAD BY DEED RECORDED OCTOBER 09, 1891, IN BOOK 139, PAGE 225 OF DEEDS.

ALSO SAVING AND EXCEPTING THE FOLLOWING DESCRIBED PROPERTY:

BEGINNING AT A POINT ON THE WEST LINE OF AFORESAID SOUTHEAST ONE-QUARTER OF THE SOUTHWEST ONE QUARTER OF SECTION 19, DISTANT THEREON 130 FEET SOUTH OF THE NORTHWEST CORNER THEREOF; THENCE EAST PARALLEL TO THE NORTH LINE OF SAID SOUTHEAST ONE-QUARTER OF THE SOUTHWEST ONE-QUARTER A DISTANCE OF 180 FEET; THENCE SOUTH PARALLEL TO THE WEST LINE OF SAID SOUTHEAST ONE-QUARTER OF THE SOUTHWEST ONE-QUARTER A DISTANCE OF 64 FEET; THENCE WEST PARALLEL TO THE NORTH LINE OF SAID SOUTHEAST ONE-QUARTER OF THE SOUTHWEST ONE-QUARTER A DISTANCE OF 180 FEET TO THE WEST LINE OF SAID SOUTHEAST ONE QUARTER OF THE SOUTHWEST ONE-QUARTER OF SECTION 19; THENCE NORTH ALONG SAID WEST LINE A DISTANCE OF 64 FEET TO THE POINT OF BEGINNING.

APN: 0298-063-07

EASEMENTS

1. AN EASEMENT FOR CARRIAGE OF WATER TO DIG AND LAY WATER WAYS, ALSO THE RIGHT TO BUILD CONSTRUCT AND MAINTAIN UPON SAID DAMS AND RESERVOIRS AND INCIDENTAL PURPOSES IN FAVOR OF THE MENTONE IRRIGATION COMPANY RECORDED DECEMBER 01, 1887, IN BOOK 69 OF DEEDS, PAGE 144.

   SAID EASEMENT IS NOT PLOTTABLE.

2. AN EASEMENT FOR HIGHWAY, ROADWAY AND INCIDENTAL PURPOSES IN FAVOR OF COUNTY OF SAN BERNARDINO, A BODY CORPORATE AND POLITIC OF THE STATE OF CALIFORNIA RECORDED JUNE 21, 2007 AS INSTRUMENT NO. 2007-0369493 OF OFFICIAL RECORDS.

   SAID EASEMENT IN CONTAINED WITHIN THE COLTON AVENUE RIGHT OF WAY.

3. AN EASEMENT FOR POLE LINES AND INCIDENTAL PURPOSES IN FAVOR OF SOUTHERN CALIFORNIA EDISON COMPANY RECORDED DECEMBER 30, 1953 IN BOOK 3302, PAGE 397 OF OFFICIAL RECORDS.

4. AN EASEMENT FOR STREET AND INCIDENTAL PURPOSES IN FAVOR OF LESTER C ALBERTON, ET UX. RECORDED JULY 02, 1956 IN BOOK 3976, PAGE 359 OF OFFICIAL RECORDS.

   SAID EASEMENT IS CONTAINED WITHIN APN 0298-063-03.

5. AN EASEMENT FOR THE DEDICATION FOR HIGHWAY AND ROAD AND INCIDENTAL PURPOSES IN FAVOR OF THE COUNTY OF SAN BERNARDINO, A BODY CORPORATE AND POLITIC OF THE STATE OF CALIFORNIA RECORDED OCTOBER 28, 1977 IN BOOK 9294, PAGE 1750 OF OFFICIAL RECORDS.

   SAID EASEMENT IS CONTAINED WITHIN THE NICE AVENUE RIGHT OF WAY.

6. AN EASEMENT FOR THE DEDICATION FOR HIGHWAY AND ROAD AND INCIDENTAL PURPOSES IN FAVOR OF THE COUNTY OF SAN BERNARDINO, A BODY CORPORATE AND POLITIC OF THE STATE OF CALIFORNIA RECORDED OCTOBER 28, 1977 IN BOOK 9294, PAGE 1752 OF OFFICIAL RECORDS.

   SAID EASEMENT IS CONTAINED WITHIN THE OPAL AVENUE RIGHT OF WAY.

7. AN EASEMENT FOR CONSTRUCT, USE, MAINTAIN, OPERATE, ALTER, AND TO REPAIR, REPLACE, RECONSTRUCT, INSPECT AND REMOVE AT ANY TIME AND FROM TIME TO TIME AND INCIDENTAL PURPOSES IN FAVOR OF SOUTHERN CALIFORNIA EDISON, A CORPORATION, RECORDED OCTOBER 31, 1977 IN BOOK 9295, PAGE 1491 OF OFFICIAL RECORDS.

8. AN EASEMENT FOR PUBLIC UTILITIES AND INCIDENTAL PURPOSES IN FAVOR OF SOUTHERN CALIFORNIA EDISON COMPANY, A CORPORATION, ITS SUCCESSORS AND ASSIGNS, RECORDED FEBRUARY 13, 1986 AS INSTRUMENT NO. 86-040551 OF OFFICIAL RECORDS.

9. AN EASEMENT FOR HIGHWAY AND ROAD AND INCIDENTAL PURPOSES IN FAVOR OF THE COUNTY OF SAN BERNARDINO, A BODY CORPORATE AND POLITIC OF THE STATE OF CALIFORNIA RECORDED JUNE 21, 2007 AS INSTRUMENT NO. 2007-0369494 OF OFFICIAL RECORDS.

   SAID EASEMENT IS CONTAINED WITHIN THE OPAL AVENUE RIGHT OF WAY.

10. AN EASEMENT FOR HIGHWAY AND ROAD AND INCIDENTAL PURPOSES IN FAVOR OF THE COUNTY OF SAN BERNARDINO, A BODY CORPORATE AND POLITIC OF THE STATE OF CALIFORNIA RECORDED JUNE 21, 2007 AS INSTRUMENT NO. 2007-0382735 OF OFFICIAL RECORDS.

    SAID EASEMENT IS CONTAINED WITHIN THE OPAL AVENUE AND NICE AVENUE RIGHT OF WAY.

HILLTOP GEOTECHNICAL INCORPORATED

Infiltration Test Location Plan	
By: AH	Date: 05/2017
Project No.: 1100-A17.1	Plate No.: 15

BENCHMARK

CITY OF REDLANDS BENCHMARK R-43:
BRASS DISK IN THE TOP OF CURB @ NE COR. BERYL AVE & COLTON AVE. EAST END OF RETURN.
ELEVATION=1,683.679

BASIS OF BEARING

CENTERLINE OF OPAL AVENUE PER RS 55/28 BEING: N01°02'59"W

PREPARED FOR:

WALDEN STRUCTURES
ATTN: CHARLES WALDEN & JOEL MINER
801 OPAL AVENUE
MENTONE, CA 92359
PHONE: (909) 389-9102

INFILTRATION TEST LOCATION EXHIBIT
APN 0298-063-07
801 OPAL AVENUE
COUNTY OF SAN BERNARDINO

thatcher engineering & associates, inc.
• land planning
• civil engineering
• landscape architecture
phone 909 748 7777
fax 909 748 7776
1461 ford street suite 105 redlands ca 92373

PATRICK C. FLANAGAN, JR. No. 86046 Exp. 9/30/18 CIVIL STATE OF CALIFORNIA

Patrick C. Flanagan, JR. R.C.E. 86046 EXP. Sep. 30, 2018

Job Number:	Date Prepared:	Drawn By:	Reference Number:
154801	4/5/17	PF	154801INFILTRATIONEXHIBIT

INFILTROMETER TEST **P-1** DATE OF TEST 11-May-17 DEPTH OF

PROJECT IDENTIFICATION: 1100-A17.1 AREA(CM2) LIQUID (CM)

TEST LOCATION: South INNER 699.6 INNER 15.24

LIQUID USED: Municipal H20 OUTER 2128.5 OUTER 15.24

TESTED BY AH LIQUID LEVEL MAINTAINED USING: __X__ MANUAL ADDITIONS (VISUAL)

DEPTH TO WATER TABLE: INNER RING AVERAGE RATE CM/H **11.50** IN/H **4.53**

OUTER RING AVERAGE RATE CM/H **9.70** IN/H **3.82**

Increment No.	DATE	TIME START= 09:19 AM HR: MM	ELAPSED TIME/ INCREMENT MIN	FLOW READINGS INNER FLOW CM3	FLOW READINGS OUTER FLOW CM3	LIQUID TEMP. F	INCREMENTAL INFILTRATION RATE INNER CM/H	INCREMENTAL INFILTRATION RATE ANNULAR CM/H	INCREMENTAL INFILTRATION RATE INNER IN/H	INCREMENTAL INFILTRATION RATE ANNULAR IN/H	GROUND TEMP = 72 F @ DEPTH OF 12 INCHES AIR TEMP, WEATHER
1	11-May-2017	9:34	15	3,360	7,687	72	19.21	14.45	7.57	5.69	62, Sunny
2	11-May-2017	9:49	15	3,270	6,530	72	18.70	12.27	7.37	4.83	63, Sunny
3	11-May-2017	10:04	15	2,790	6,660	72	15.95	12.52	6.29	4.93	63, Sunny
4	11-May-2017	10:19	15	2,350	5,610	73	13.44	10.54	5.29	4.15	63, Sunny
5	11-May-2017	10:49	30	4,000	12,000	70	11.44	11.28	4.51	4.44	68, Sunny
6	11-May-2017	11:19	30	2,600	9,000	71	7.43	8.46	2.93	3.33	74, Sunny
7	11-May-2017	12:19	60	5,300	18,000	72	7.58	8.46	2.98	3.33	78, Sunny
8	11-May-2017	13:19	60	5,200	14,000	77	7.43	6.58	2.93	2.59	84, Sunny
9	11-May-2017	14:19	60	5,000	13,500	80	7.15	6.34	2.82	2.50	88, Sunny
10	11-May-2017	15:19	60	4,700	13,000	78	6.72	6.11	2.65	2.41	86, Sunny

	CM/H Annular	CM/H Inner	IN/H Annular	IN/H Inner
Steady State Rates:	6.87	7.22	2.71	2.84

INFILTROMETER TEST **P-2** DATE OF TEST 11-May-17 DEPTH OF

PROJECT IDENTIFICATION: 1100-A17.1 AREA(CM2) LIQUID (CM)

TEST LOCATION: Middle INNER 699.6 INNER 15.24

LIQUID USED: Municipal H20 OUTER 2128.5 OUTER 15.24

TESTED BY AH LIQUID LEVEL MAINTAINED USING: __X__ MANUAL ADDITIONS (VISUAL)

DEPTH TO WATER TABLE: INNER RING AVERAGE RATE CM/H **18.17** IN/H **7.16**

OUTER RING AVERAGE RATE CM/H **19.52** IN/H **7.69**

Increment No.	DATE	TIME START= 09:52 AM HR: MM	ELAPSED TIME/ INCREMENT MIN	FLOW READINGS INNER FLOW CM3	FLOW READINGS OUTER FLOW CM3	LIQUID TEMP. F	INCREMENTAL INFILTRATION RATE INNER CM/H	INCREMENTAL INFILTRATION RATE ANNULAR CM/H	INCREMENTAL INFILTRATION RATE INNER IN/H	INCREMENTAL INFILTRATION RATE ANNULAR IN/H	GROUND TEMP = 72 F @ DEPTH OF 12 INCHES AIR TEMP, WEATHER
1	11-May-2017	10:07	15	5,780	16,570	72	33.05	31.14	13.02	12.27	62, Sunny
2	11-May-2017	10:22	15	5,400	16,280	72	30.87	30.59	12.16	12.05	63, Sunny
3	11-May-2017	10:37	15	2,000	9,000	71	11.44	16.91	4.51	6.66	68, Sunny
4	11-May-2017	10:52	15	4,000	13,500	71	22.87	25.37	9.01	10.00	68, Sunny
5	11-May-2017	11:22	30	6,000	21,300	74	17.15	20.01	6.76	7.89	72, Sunny
6	11-May-2017	11:52	30	5,500	16,500	75	15.72	15.50	6.19	6.11	75, Sunny
7	11-May-2017	12:52	60	9,700	33,000	78	13.87	15.50	5.46	6.11	78, Sunny
8	11-May-2017	13:52	60	8,500	27,500	78	12.15	12.92	4.79	5.09	88, Sunny
9	11-May-2017	14:52	60	8,700	30,000	79	12.44	14.09	4.90	5.55	87, Sunny
10	11-May-2017	15:52	60	8,500	28,000	80	12.15	13.15	4.79	5.18	88, Sunny

	CM/H Annular	CM/H Inner	IN/H Annular	IN/H Inner
Steady State Rates:	13.92	12.65	5.48	4.98

INFILTROMETER TEST **P-3**
PROJECT IDENTIFICATION: 1100-A17.1
TEST LOCATION: North
LIQUID USED: Municipal H20
TESTED BY AH
DEPTH TO WATER TABLE:

DATE OF TEST 12-May-17

	AREA(CM2)	DEPTH OF LIQUID (CM)
INNER	699.6	15.24
OUTER	2128.5	15.24

LIQUID LEVEL MAINTAINED USING: __X__ MANUAL ADDITIONS (VISUAL)

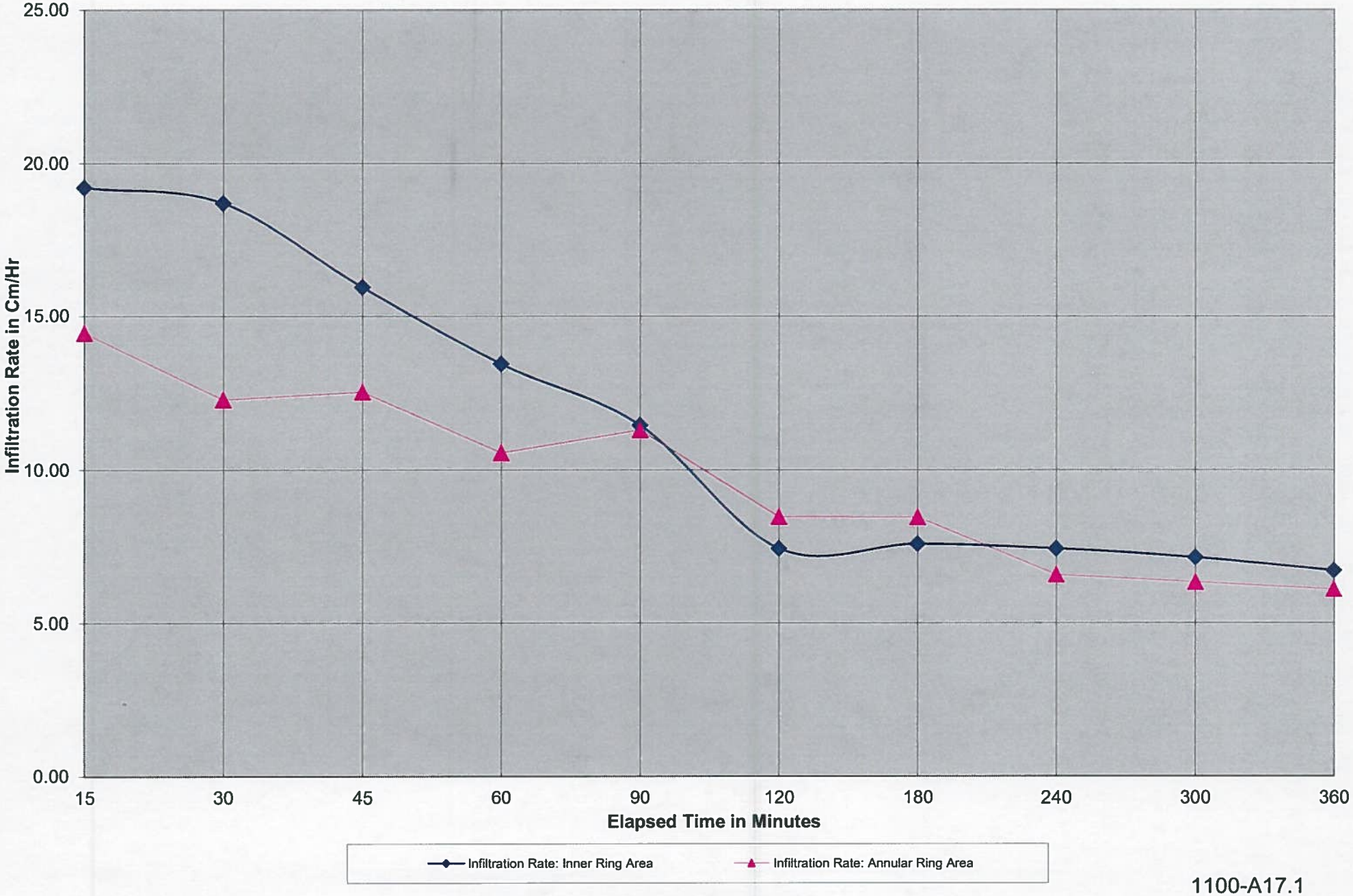
INNER RING AVERAGE RATE CM/H **7.00** IN/H **2.76**
OUTER RING AVERAGE RATE CM/H **8.00** IN/H **3.15**

Increment No.	DATE	TIME START= 07:58 AM HR: MM	ELAPSED TIME/ INCREMENT MIN	FLOW READINGS INNER FLOW CM3	FLOW READINGS OUTER FLOW CM3	LIQUID TEMP. F	INCREMENTAL INFILTRATION RATE INNER CM/H	INCREMENTAL INFILTRATION RATE ANNULAR CM/H	INCREMENTAL INFILTRATION RATE INNER IN/H	INCREMENTAL INFILTRATION RATE ANNULAR IN/H	GROUND TEMP = 72 F @ DEPTH OF 12 INCHES AIR TEMP, WEATHER
1	12-May-2017	8:13	15	2,200	9,000	72	12.58	16.91	4.96	6.66	62, Sunny
2	12-May-2017	8:28	15	1,200	4,000	72	6.86	7.52	2.70	2.96	64, Sunny
3	12-May-2017	8:43	15	1,100	4,200	72	6.29	7.89	2.48	3.11	64, Sunny
4	12-May-2017	8:58	15	1,100	4,000	71	6.29	7.52	2.48	2.96	65, Sunny
5	12-May-2017	9:28	30	2,100	8,000	74	6.00	7.52	2.37	2.96	70, Sunny
6	12-May-2017	9:58	30	2,200	8,000	74	6.29	7.52	2.48	2.96	72, Sunny
7	12-May-2017	10:58	60	4,300	14,400	75	6.15	6.77	2.42	2.67	74, Sunny
8	12-May-2017	11:58	60	4,600	12,600	75	6.58	5.92	2.59	2.33	80, Sunny
9	12-May-2017	12:58	60	4,400	13,500	79	6.29	6.34	2.48	2.50	86, Sunny
10	12-May-2017	13:58	60	4,700	13,000	78	6.72	6.11	2.65	2.41	85, Sunny

	CM/H Annular	CM/H Inner	IN/H Annular	IN/H Inner
Steady State Rates:	6.28	6.43	2.48	2.53

PROPOSED INFILTRATION BASIN

Infiltration Graph: Infiltration Rate vs. Time



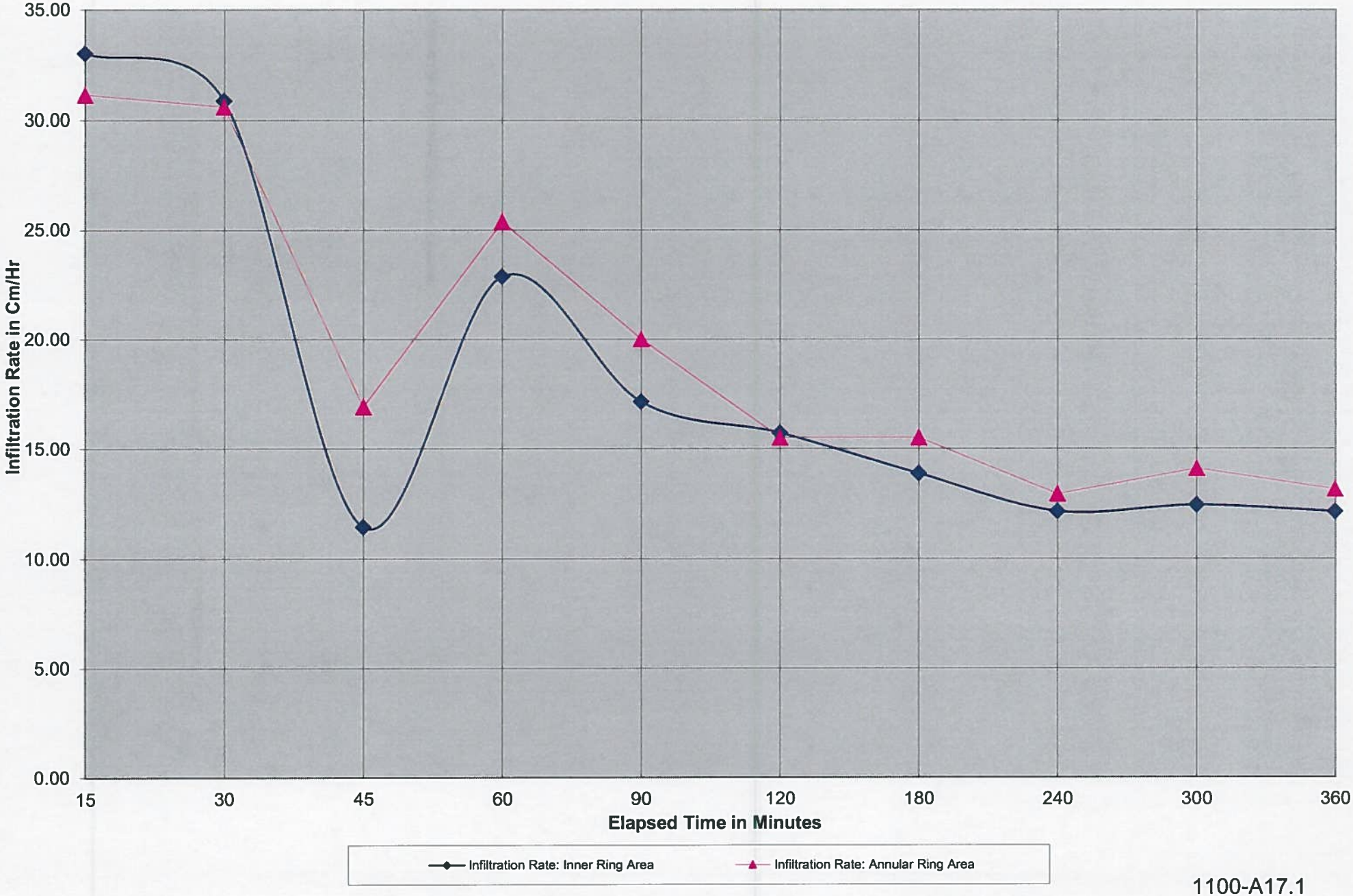
Hilltop Geotechnical, Inc.

INFITROMETER TEST P-1

1100-A17.1
Plate No. 19

PROPOSED INFILTRATION BASIN

Infiltration Graph: Infiltration Rate vs. Time



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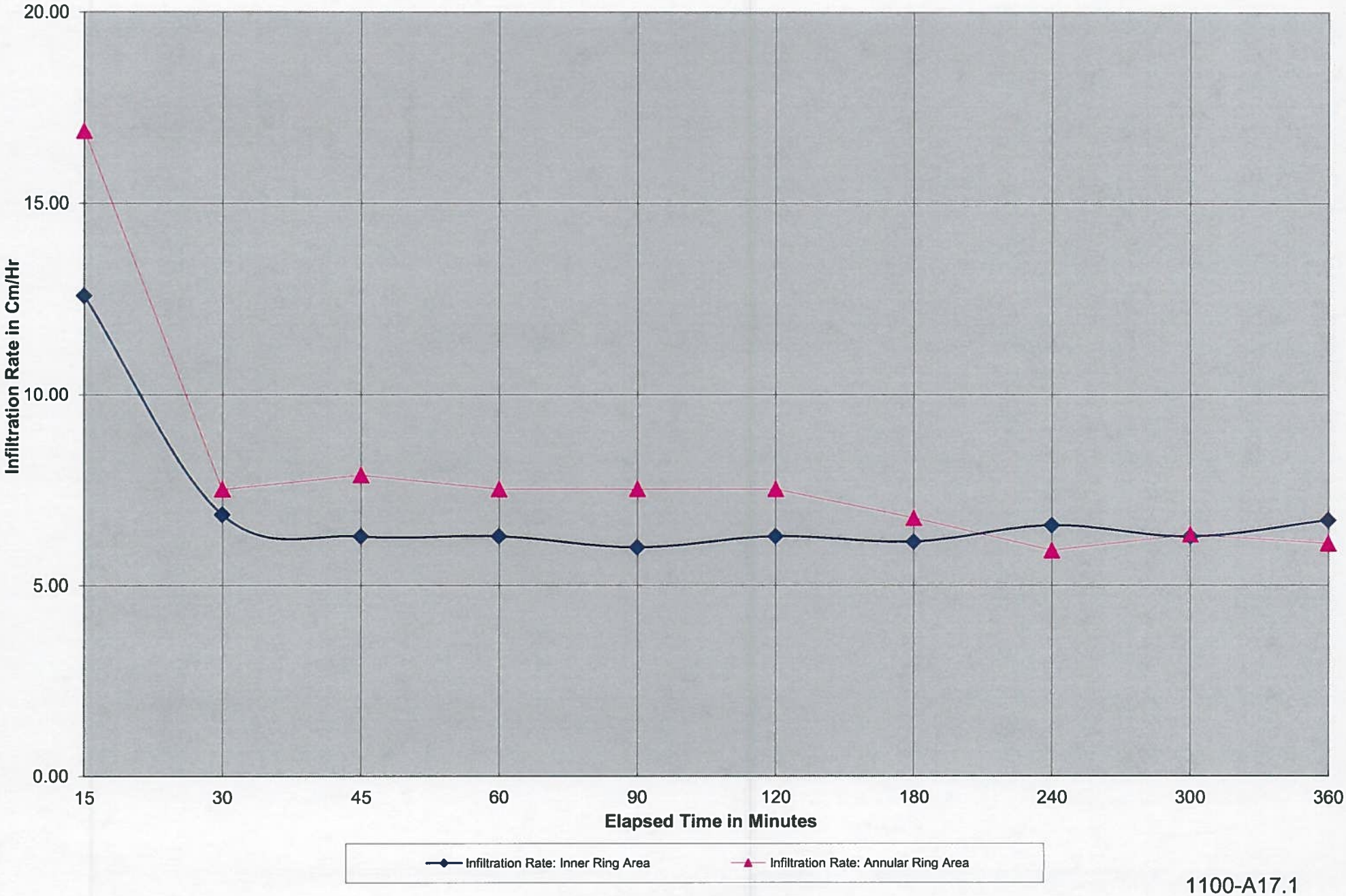
INFITROMETER TEST P-2

1100-A17.1
Plate No. 20

PROPOSED INFILTRATION BASIN

Infiltration Graph: Infiltration Rate vs. Time



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INFITROMETER TEST P-3

1100-A17.1
Plate No. 21