REPORT OF PRELIMINARY GEOTECHNICAL / GEOLOGIC STUDY PROPOSED RESIDENTIAL DEVELOPMENT APN:0394-031-02, 03, 04, NORTHEAST CORNER OF MOJAVE DRIVE AND AMETHYST ROAD, CITY OF VICTORVILLE, SAN BERNARDINO COUNTY

PROJECT NO.: 1448-01
REPORT NO.: 2

APRIL 21, 2022

SUBMITTED TO:

MOJAVE AMETHYST 40, L.P.
17802 LAKESIDE HAVEN DRIVE,
CYPRESS, TEXAS 77433

PREPARED BY:

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April 21, 2022

Mojave amethyst 40, L.P. Project No.: 1488-01
17802 Lakeside Haven Drive Report No.: 2
Cypress, Texas 77433

Attention: Mr. David Michelson

Subject: **Report of Preliminary Geotechnical / Geologic Study, Proposed Residential Development, APN 0394-031-02, 03, 04, Northeast Corner of Mojave Drive and Amethyst Road, City of Victorville, San Bernardino County, California.**

References:
1. **Ludwig Engineering Associates, Inc.**, January 2022, *Tentative Tract Map No. 20525, APN 0394-031-02, 03, 04,* Scale 1" = 100'.
2. Technical References – See Appendix 'B.'

Mr. Michelson:

According to your request, we have completed a preliminary geotechnical / geologic study for design and construction of the proposed residential development at the subject site. We are presenting, herein, our findings and recommendations.

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 incorporated into design of the project and implemented during 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. This report should be saved for submittal, 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.

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GEOTECHNICAL / GEOLOGIC STUDY
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NORTHEAST CORNER OF MOJAVE DRIVE AND AMETHYST ROAD,
CITY OF VICTORVILLE,
SAN BERNARDINO COUNTY CALIFORNIA

PROJECT NO.: 1448-01
REPORT NO.: 2

April 21, 2022

INTRODUCTION

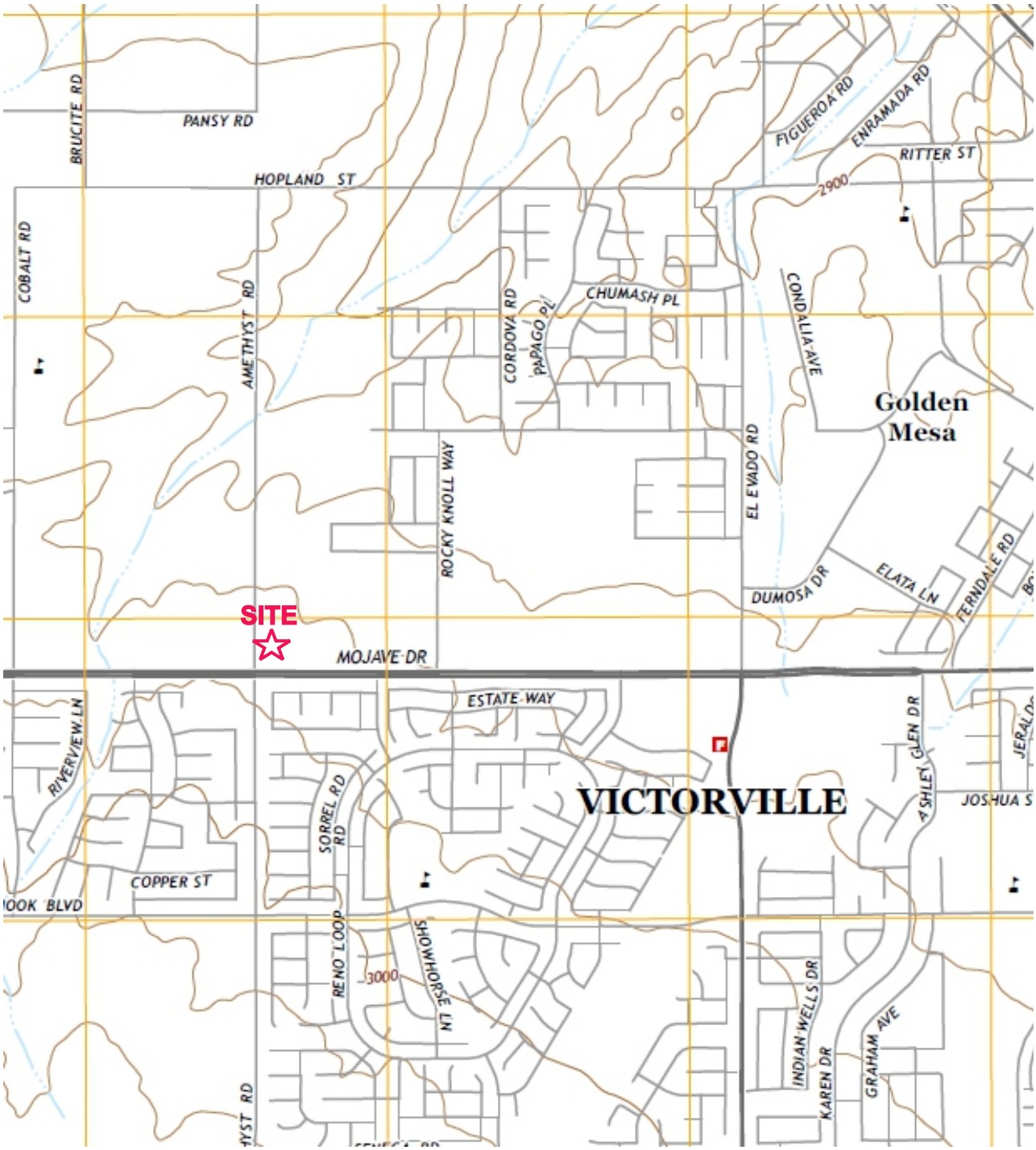
AUTHORIZATION

This report presents results of the preliminary geotechnical / geologic study conducted on the subject site for the proposed residential development to be located at the northeast corner of Mojave Drive and Amethyst Road area in the City of Victorville, 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 **Mojave Amethyst 40, L.P.** (Client), dated February 11, 2022, Proposal Number: P22065.

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 residences on the subject site with respect to geotechnical characteristics, including potential geologic hazards that may affect the development of the site,



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Source: Copied from USGS Topo Map- Victorville, Quadrangle 2015

HILLTOP GEOTECHNICAL INCORPORATED

SITE LOCATION MAP

Northeast Corner of Mojave Drive and Amethyst Road
APN 0394-031-02, 03, 04, Victorville, CA 92394

By: MC	Date: 3/2022
Project No.: 1448-01.2	**Figure 1**

and to provide geotechnical recommendations and criteria for use in the design and construction of the proposed development. 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'), available photographs via Google Earth, flood hazard maps, well data, etc. to ascertain earth material, geologic, and hydrologic conditions of the area.

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

- Site reconnaissance.

- Subsurface exploration by means of drill-rig borings to characterize the earth materials, geologic, and groundwater conditions that could influence the proposed development.

- Sampling of on-site earth materials from the exploratory excavations.

- Laboratory testing of selected earth material samples considered representative of the subsurface conditions to determine the engineering properties and characteristics.

- Define the general geology of the subject site and evaluate potential geologic hazards which would have an effect on the proposed site development.

- Determine seismic classification of the site to meet the requirements of the 2019 California Building Code (CBC), effective on January 1, 2020.

- Engineering and geologic analysis of field and laboratory data to provide a basis for geotechnical and geologic conclusions and recommendations regarding site grading and foundation, floor slab, retaining wall, pavement, etc. design parameters.
- Preparation of this report to present the geotechnical and geologic conclusions and recommendations for the proposed development at the site.

This report presents our conclusions and/or recommendations regarding:

- The geologic setting of the site.
- Potential geologic hazards (including landslides, seismicity, faulting, liquefaction potential, etc.)
- General subsurface earth conditions.
- Presence and effect of expansive, collapsible, and compressible earth materials.
- Groundwater conditions within the depth of our subsurface study.
- Excavation characteristics of the on-site earth materials.
- Characteristics and compaction requirements of proposed fill and backfill materials.
- Recommendations and guide specifications for earthwork.
- Seismic design coefficients for structural design purposes.
- Types and depths of foundations.
- Allowable bearing pressure and lateral resistance for foundations.
- Preliminary corrosion potential evaluation for concrete and buried metal in direct contact with the on-site earth materials.

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. In addition, an evaluation of on-site private sewage disposal systems for the proposed development was not conducted as part of this study.

This study was prepared for the exclusive use of Mojave Amethyst 40, L.P., and their consultants for specific application to the development of the tentative residential tract in accordance with generally accepted standards of the geotechnical and geologic professions and generally accepted geotechnical (soil and foundation) engineering and geologic 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

No previous geotechnical and/or geological studies for the subject site are known to have been performed or were made available for review at the time of this study, if any had been performed. Based on the existing foundation and pavement on the site, historically it might have a structure on the site.

PROJECT DESCRIPTION / PROPOSED DEVELOPMENT

As part of our study, we have been provided with the Referenced Topographic Map noted on the first page of the cover letter for this report.

Based upon information presented to this firm by the client, it is our understanding that the proposed project will consist of a tract of 109 single family residences and 2 basins associated with community streets. The proposed residences will be on ground surface. Subterranean construction is not anticipated for the development.

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.

FIELD EXPLORATION AND LAB TESTING

The field study performed for this report included a visual and geologic reconnaissance of existing surface conditions of the subject site. A study of the

property's subsurface condition was performed to evaluate underlying earth strata and the presence of groundwater. Subsurface conditions were explored on March 17 and 18, 2022.

The subsurface exploration consisted of excavating six (6) exploratory borings on the subject property using a truck mounted hollow-stem auger. The approximate locations of the exploratory excavations are shown on the 'Exploratory Excavation Location Plan,' Plate No. 1, presented in Appendix 'A' of this report. The exploratory excavations were observed and logged by a representative of **HGI**. 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 Appendix 'A' of this report. The results of the borings are presented on the 'Subsurface Exploration Log,' Plate Nos. 3 through 8, presented in Appendix 'A' of this report.

A more detailed explanation of the field study which was performed for this report is presented in Appendix 'A' of this report.

Representative ring and bulk samples of alluvium were collected during the field exploration and returned to the laboratory for testing. Laboratory tests were conducted to evaluate the engineering properties of on-site earth materials and included ring moisture density test, direct shear test, consolidation test, sieve analysis test, sand equivalent test, R-Value test, and a corrosivity test. A more detailed explanation of laboratory tests performed for this study and test results are presented in Appendix 'A' of this report, Plate Nos. 9 through 12.

FINDINGS

SITE DESCRIPTION

The subject property comprises approximately 27.2 acres and was approximately rectangular in shape as shown on the Reference No. 1 'Tentative Tract Map No. 20525" noted on the first page of the cover letter for this report. The subject property is located northeast corner of Mojave Drive and Amethyst Road in the City of Victorville, San Bernardino County, California, APN 0394-031-02, 03, 04. The subject property is bounded by an existing partial tract of residential buildings to the east along with vacant lots, a vacant lot to the north, Amethyst Road to the west, and by Mojave Drive to the south. The surface of the site was generally untouched for the exception of three, small dirt roads going through the subject site and various scattered piles of miscellaneous trash and debris. There were no existing structures on the subject property. Access to Amethyst Road was blocked off at the time of this study but could allow access to the site. A secondary utility maintenance dirt roadway parallel to Mojave Drive allowed access to the subject property. Vegetation was light to moderate and consisted of several Joshua trees, seasonal native grasses, weeds, and creosote bushes. The vegetation was less dense in the lower lying areas near the dirt paths.

Per the referenced 'Tentative Tract Map No. 20525", the immediate area of the subject site was sloping with a downward inclination toward the north at gradients from 10:1 to 15:1 (horizontal to vertical). The total on-site relief of the site was approximately 29 feet. On-site drainage was accomplished by sheet flow toward the north.

At the time of the field study, there was an existing water line on Amethyst Road. Other underground utilities were not observed but may be encountered during construction.

ENGINEERING GEOTECHNICAL ANALYSIS
Regional Geological Setting

The project site is situated near the southern margin of the Mojave Desert Geomorphic Province, one (1) of 11 provinces recognized in California. The Mojave Desert Geomorphic Province is a distinctive geologic and physiographic region encompassing much of southeastern California, extending from the Tehachapi Mountains on the west to an arbitrary boundary at the Colorado River on the east. The southern edge of the province abuts the east-west trending Transverse Ranges (combined San Gabriel, San Bernardino, Little San Bernardino, and Eagle Mountains), while the northern boundary is generally recognized to be the Garlock fault zone. Characteristic landforms of the province include relatively narrow, elongated ranges separated by wider, intervening valleys.

The arid climate of the Mojave Desert province demonstrates precipitation patterns commonly associated with such climates. That is, years to decades of little or no precipitation that are separated by brief periods of locally torrential rain and flash flooding. The brief, heavy precipitation over relatively small areas causes deep erosion in higher elevations, followed by rapid deposition of eroded sediments after the runoff leaves mountainous areas. Alluvial fans extending from isolated mountain ranges often coalesce to form bajadas. The bajadas, which form the margins of many relatively flat-floored valleys in this province, stand in topographic contrast to the deeply eroded and incised, often jagged mountain ranges.

Most of the province is internally draining; thus, many valleys typically include at least one (1) flat playa surface, many of which become shallow, ephemeral lakes in very wet years. The playa lakes and surrounding, alluvial fans and bajadas usually conceal much deeper, fault-controlled sedimentary basins that may contain thousands of feet of alluvium and soft rock. Topographic relief is subdued in the western Mojave but becomes increasingly greater to the east and north.

The orientations of the ranges and valleys in this province exhibit general northwesterly trends.

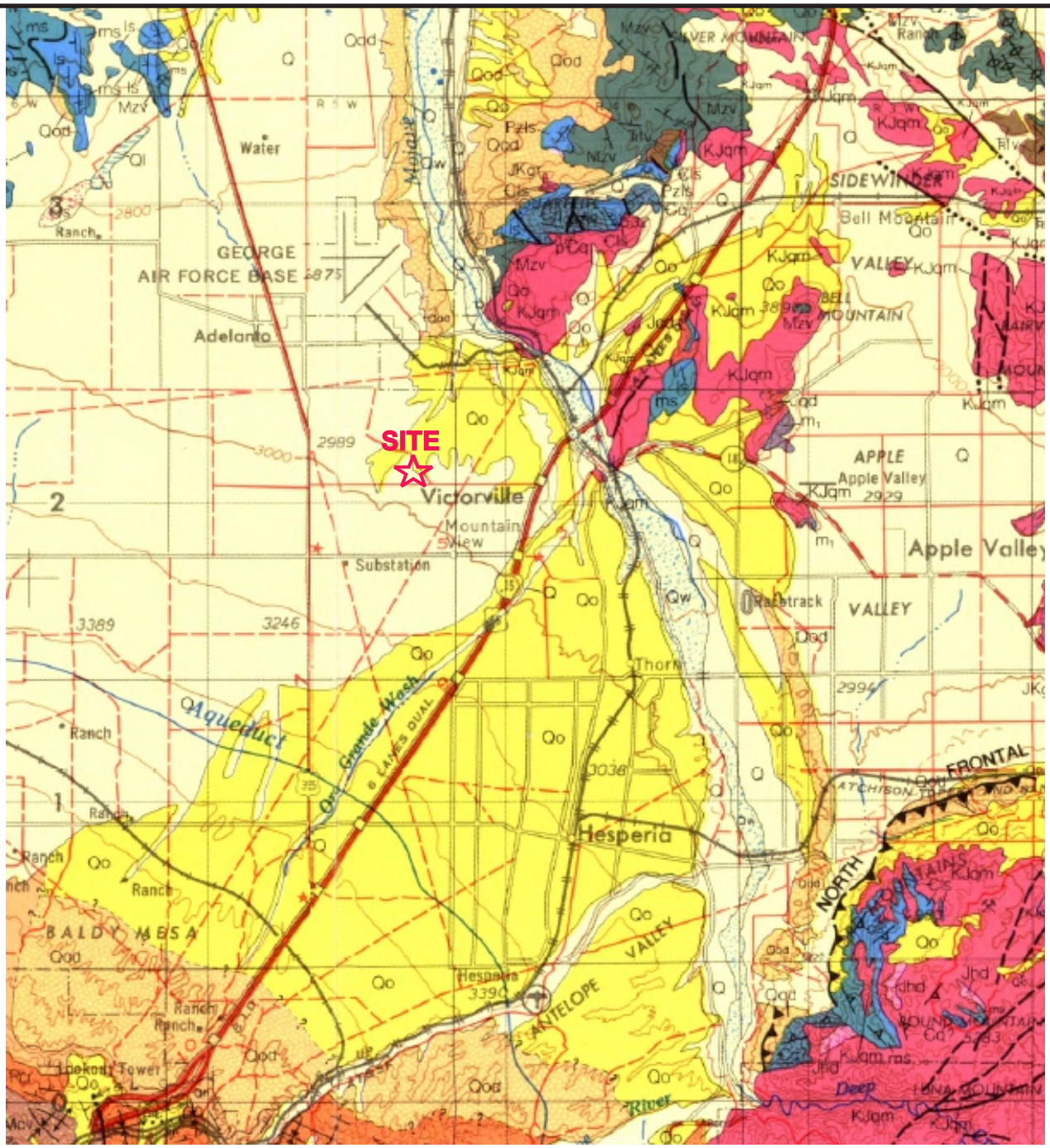
The province contains a diverse array of rock types. Mesozoic-age igneous intrusive granitic rocks are predominant in the western and southern portions of the province and are widely observed in the remainder. Quaternary and Holocene extrusive igneous rocks and volcanic formations may be observed throughout this province, though they are most common in the southern and western portions. Parts of the central and northern portions of the province include thick sequences of metavolcanic rocks, as well as a number of Paleozoic-age, sedimentary formations that can be correlated to similar rocks in Arizona and Nevada. Tertiary and Quaternary-age alluvial and lacustrine sediments fill the basins and occasionally form low hills. The sediments often host economically significant deposits of clay and evaporites including salts and borates. The general geology in the area of the subject site is shown on the 'Regional Geology Map,' Figure No. 2.

Locally, the project site was generally flat with some small ridges of eolan accumulations ranging from 1 foot to 5 feet in height relative to the surrounding areas and had a gentle slope to the north. The site was mainly untouched with the exception of three small dirt roads that ran east to west.

Local Subsurface Conditions

Earth Materials Description:

Presented as follows are brief descriptions of the earth materials encountered in the exploratory excavations. More detailed descriptions of encountered earth materials are presented on the 'Subsurface Exploration Logs,' Plate Nos. 3 through 8, 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



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Legend

- Q — Alluvium *(Undifferentiated)*
- Qod — Well dissected alluvial fans
- Qo — Older alluvium *(Undifferentiated)*
- KJqm — Cretaceous or Jurassic quartz monzonite; Quartz Monzonite of Pleasant View Ridge
- Mi — Miocene shallow intrusive rocks *(a-andesitic; d-dacitic and rhyolitic; b-basaltic)*

N

Source: Copied from Geologic Map of The San Bernardino Quadrangle, California by E.J. Bortugno and T.E. Spittler Publised 1986 (revised, 1998)

HILLTOP GEOTECHNICAL INCORPORATED

REGIONAL GEOLOGIC MAP

Northeast Corner of Mojave Drive and Amethyst Road, Victorville, CA 92394

By: MC	Date: 3/2022
Project No.: 1448-01.1	**Figure 2**

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 Alluvium.

Alluvium was encountered at all eight borings from the surface to 16.6 feet below ground surface (bgs). The alluvium consisted of light brown to brown sandy fine to medium sand (SM) with trace of gravel that was slightly moist and medium dense conditions. The alluvial sand was interbedded with layers of slightly moist sandy fine silt with trace amounts of gravel with some cementation (ML) and sandy fine clay (CL) with some cementation and was stiff in conditions.

Groundwater

Groundwater was not encountered in the exploratory excavations to the maximum depth explored of approximately 16.6 feet bgs at the boring locations at the time the field exploration was performed for this report.

No evidence of onsite springs or seeps was observed during the field study performed for this report. Though no groundwater was encountered during the field exploration performed for this report, a potential does exist that seeps and springs could occur during and following periods of heavy precipitation and prolonged landscape irrigation. Based on anticipated lot grading and the inferred groundwater depths, groundwater should not be a factor for project design or long-term performance.

Surface Water

Surface water was not observed on the subject site at the time the field exploration 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.

Groundwater observations were made in the exploratory excavations at times and under conditions stated on the logs. However, it should be noted that fluctuations in levels of groundwater, springs, and/or perched water may occur due to variations in precipitation, temperature, and other factors.

Faulting and Regional Seismicity

The site is situated in an area of active and potentially active faults, as is most of southern California. Active faults present a variety of potential risks to structures, the most common of which are strong ground shaking, dynamic densification, liquefaction, mass wasting, and surface rupture at the fault plane. Generally speaking, the following four (4) factors are the principal determinants of seismic risk at a given location:

- Distance to seismogenically capable faults.
- The maximum or "characteristic" magnitude earthquake for a capable fault.
- Seismic recurrence interval, in turn related to tectonic slip rates.
- Nature of earth materials underlying the site.

Surface rupture represents the primary potential hazard to structures built in an active fault zone. A review of official maps delineating State of California earthquake fault zones found that the subject site lay in the southern portion of the Victorville Quadrangle. No Alquist-Priolo fault study zones are located within this quadrangle. In addition, the site is not located within a zone of mandatory

study for active faulting per the **San Bernardino County Planning Department**, *San Bernardino County Land Use Plan, GENERAL PLAN, Geologic Hazard Overlays*, Sheet EHFH C Victorville/San Bernardino, Plot Date: 03/09/2010, Scale: 1:14,400 (http://www.sbcounty.gov/Uploads/lus/GeoHazMaps/EHFHC_20100309new.pdf).

Ground shaking is considered to be the primary hazard most likely to affect the site, based upon proximity to regionally significant active faults. Per https://maps.conservation.ca.gov/cgs/fam/, active faults include North Frontal Fault Zone (ORD Mountains Section), Helendale Fault Zone, and San Andreas Fault Zone. The North Frontal Fault Zone (ORD Mountains Section) is located approximately 12 miles to the southeast of the site. The Helendale Fault Zone is located approximately 13.5 miles to the northeast. The San Andreas Fault Zone is located approximately 17 miles to the south-southwest of the site.

Secondary Seismic Hazards

Secondary hazards include induced landsliding, liquefaction, subsidence as a result of soil densification, surface oscillations in larger lakes, or seismic sea waves, ground crack due to ground shaking, and flooding (from ruptured tanks and reservoirs).

Landslide

The subject site is not located within a designated area per **San Bernardino County Planning Department**, *San Bernardino County Land Use Plan, GENERAL PLAN, Geologic Hazard Overlays*, Sheet EHFH C Victorville/San Bernardino, Plot Date: 03/09/2010, Scale: 1:14,400 (http://www.sbcounty.gov/Uploads/lus/GeoHazMaps/EHFHC_20100309new.pdf). Due to topographic features on the site, the potential of landslide at the subject site and its vicinity is considered low.

Liquefaction

Liquefaction describes a phenomenon in which cyclic stresses produced by ground shaking induced excess pore water pressures in the cohesionless soils. These soils may thereby acquire a high degree of mobility leading to damages or deformations. In general, this phenomenon only occurs below the water table, but after liquefaction has developed, it can propagate upward into overlying non-saturated soil as excess pore water pressure. Liquefaction susceptibility under a given earthquake is related to the gradation and relative density characteristics of the soil, the in-situ stresses prior to ground motion, and the depth to the water table, as well as other factors.

The subject site is not located within a designated area as having a liquefaction potential per **San Bernardino County Planning Department**, *San Bernardino County Land Use Plan, GENERAL PLAN, Geologic Hazard Overlays*, Sheet EHFH C Victorville/San Bernardino, Plot Date: 03/09/2010, Scale: 1:14,400 (http://www.sbcounty.gov/Uploads/lus/GeoHazMaps/EHFHC_20100309new.pdf). The liquefaction potential is considered low.

Seiching

Seiching involves an enclosed body of water oscillating due to ground shaking, usually following an earthquake. Lakes and water towers are typical bodies of water affected by seiching. However, the site does not appear to be within the influence of large bodies of water and, as such, seiching is considered insignificant for the development of the subject site.

Tsunamis

Because of the inland geographic location of the site, tsunamis are not considered a geologic hazard for the development of the subject site.

Lurching

Lurching is a phenomenon in which ground cracking and/or secondary faulting occurs as a result of ground shaking. Generally, lurching primarily occurs in the immediate vicinity of faulting or steep slope areas. No known active or potential active faults pass through or by the subject site or its immediate vicinity, and no steep slope exists at the site; therefore, the likelihood for lurching to impact the site is considered to be low.

OTHER GEOLOGIC HAZARDS

Flooding

The subject site is not located within a designated area as having a flooding potential per **San Bernardino County Planning Department**, *San Bernardino County Land Use Plan, GENERAL PLAN, Hazard Overlays*, Sheet EH30 B Victorville, Plot Date: 03/09/2010, Scale: 1:14,400 (http://http//www.sbcounty.gov/Uploads/lus/HazMaps/EH30B_20100309.pdf).

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

In our opinion, the proposed residential building is feasible from a geotechnical engineering point of view provided the geotechnical recommendations presented in this report are followed. The main concerns from a geotechnical standpoint are the presence of relatively loose alluvium.

The proposed building can be supported on conventional shallow foundations. However, due to the anticipated high ground shaking, consideration should be given to tie all isolated footings to the strip footings or grade beams.

The following sections contain geotechnical recommendations for the design and construction of the proposed development and include our recommendations and discussions about bearing capacity, settlement, flatworks, slabs-on-grade, temporary excavations, and site drainage.

GRADING

The grading recommendations presented in this report are intended for: 1) the work of unsuitable, near-surface, documented fill materials to construct an engineered building pad and satisfactory foundation support for exterior hardscape (i.e., sidewalks, patios) and pavement; and 2) the use of a shallow foundation system and concrete slabs cast on-grade designed for the proposed structures.

If hardscape and pavement subgrade earth materials are prepared at the time of grading of the building sites, and the improvements are not constructed immediately, additional observations and testing of the subgrade earth material will have to be performed to locate areas which may have been damaged by construction traffic, construction activities, and/or seasonal wetting and drying. The additional observations and testing should be performed before placing aggregate base material, Hot Mix Asphalt (HMA) concrete, and/or Portland Cement concrete (PCC) in those areas.

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

Any additional 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 developer of the proposed project to observe the excavation and grading operations, foundation preparation, and to test the compacted fill and utility trench backfill. A pre-grading conference should be held at the site with representatives of the developer, the grading contractor, the City of Victorville, the Civil Engineer, and a representative of **HGI** (the Geotechnical / Geologic Consultant) 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 developer 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.

Clearing and Grubbing

Any debris, grasses, weeds, and other deleterious materials should be removed from the proposed lot pads, exterior hardscape and pavement areas and areas to receive structural fill, before grading is performed. Any organic material and miscellaneous / debris should be legally disposed of off-site. Any 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. Trees, bushes, etc. and their roots should be completely removed, ensuring that 95 percent or more of the root systems are extracted.

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 documented fills and alluvial materials on the subject site and should be accomplished with conventional earth-moving equipment. It is anticipated that no significant amount of oversized rock material (i.e., 3 inches in greatest dimension) will be generated during any removal, and the replacement process within the near-surface man-made fills will not require special handling during the development of the site.

Suitability of On-Site Materials as Fill

In general, the on-site earth 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 3 inches in maximum dimension. It is noted that the in-situ moisture contents of the near-surface fill materials on the subject site will be below the optimum moisture content for the on-site materials. It is anticipated that some moisture will have to be added to the near-surface, on-site earth materials if they are to be used as compacted fill material in the near future.

Removal and Recompaction

Uncontrolled or undocumented fills and/or unsuitable, loose, or disturbed near-surface alluvial earth material in proposed areas which will support structural fills, structures (i.e., buildings, decorative block walls, retaining walls, trash enclosure walls, etc.), fill slopes, exterior hardscape (i.e., sidewalks, patios, curb / gutters, etc.), and pavement should be prepared in accordance with the following recommendations for grading in such areas. If over excavation of undocumented fill or moisture sensitive, collapsible earth materials is elected not to be performed in hardscape, curb / gutter, pavement, and decorative block wall or fence 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 versus the risk of distress and cost of repairs to the structures needs to be evaluated by the project owner.

Grading recommendations are provided herein for the lots as follows:

- The near-surface fill and the loose, collapsible, near-surface alluvial materials on the site are recommended to be over-excavated and recompacted. Based upon our exploratory excavations borings and laboratory test results, we anticipate that the over excavation will extend to a depth of approximately 5.0 feet below existing ground surface in the areas which will receive structural fill, building structures, retaining walls,

and decorative concrete block walls. A relative compaction of 85 percent or greater for native soils or a relative compaction of 90 percent or greater for compacted fill should be obtained in the exposed earth material at the over-excavation depth prior to performing any scarification, moisture conditioning, and re-compaction. If 85 percent relative compaction for native is not present, the over-excavation should be deepened until a minimum of 85 percent relative compaction for native soils is present. Moreover, the depth of the over-excavation within the perimeter of the proposed lots for the structures should be to a uniform elevation throughout the limits of the structures. It is noted that fill placed to construct slopes and/or support sidewalks, patios, retaining walls, block walls, driveways, and pavement are considered to be structural fill.

- Where a cut / fill transition zone extends through a proposed building pad area, a compacted mat of fill will have to be constructed under the building area to prevent differential settlement between the two (2) dissimilar materials. This mat should be constructed by over-excavating the materials in the cut portion of the pad to a distance outside the proposed building limits of 5.0 feet or to the depth of the over-excavation below the finish pad grade, whichever is greater. The over-excavation should extend to a depth of 5.0 feet below the pad elevation or to a minimum depth of 0.5 times the depth of the deepest fill within the building pad, whichever is greater.

- In a total cut building pad for the proposed structures, over excavation and re-compaction is recommended to be performed to a depth of 5.0 feet below the proposed cut pad elevation. This will provide a uniformly compacted building pad for support of the structure.

- 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 to 12 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 over-excavated and properly compacted fill replaced to achieve proposed grades. Due to the collapsible nature of the near-surface earth materials on the subject site, if over-excavation and replacement is not performed under the exterior concrete slabs, hardscape, pavement, curb / gutters, etc., there is a risk of settlement and vertical differential movement if the subgrade earth materials are allowed to become saturated. Therefore, proper drainage should be established away from such improvements and minimal precipitation, or irrigation water allowed to percolate into the earth materials adjacent to the exterior concrete hardscape, pavement, curbs / gutters, etc.

- In landscape or non-structural fill areas where non-structural fill will be placed, over excavation will not need to be performed prior to placing non-structural fill materials. Proposed fill slopes are structural fills and do not fall under this provision. Any non-structural fill areas should be clearly designated on the project grading and/or site plan by the Civil Engineer or Architect.

The limits of over excavation for the building pads should extend to a distance of 5.0 feet or to the depth of the over excavation beneath the finish pad grade for the structure, whichever is greater, beyond the front, side, and rear building setback limits on the lots. The limits of over-excavation for fill slopes should extend to a distance of 5.0 feet beyond the toe of the slope or to the depth of the over excavation beneath the toe of the slope, whichever is greater.

The limits of over excavation for the decorative concrete block perimeter wall footings and/or retaining wall footings should extend to a distance of 4.0 feet beyond the footing edges or to the depth of the over excavation beneath the footing grade, whichever is greater.

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.

In areas where over excavation cannot be performed to the required distance beyond the foundations, (i.e., perimeter project block walls, retaining walls, etc.) along property lines, the foundations should be deepened to extend through the loose, near-surface earth materials and be founded to a minimum depth of 1.0 foot into the firm underlying material, which should be verified by the project Geotechnical/Geological consultant or his representative.

- It is noted that localized areas, once exposed, may warrant additional over excavation 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 be associated with the past usage of the site may not have been located during the field study performed for this report. Actual depths of removals and the competency of the exposed over excavation 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 over-excavation bottom surfaces should be scarified to a depth of 6.0 to 12 inches, brought to optimum moisture content within 3.0 percent

of optimum moisture content, and compacted to 90 percent or greater relative compaction before placement of fill. In landscape and non-structural fill areas, the scarified and moisture conditioned earth materials need only be compacted to 85 percent or greater relative compaction prior to placing fill. Maximum dry density and optimum moisture content for compacted materials should be determined according to current ASTM D1557 procedures. The scarification and re-compaction of the exposed over excavation bottoms in earth 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 earth materials indicate a relative compaction of 90 percent or greater.

Import Material

Import fill should be 'Non-Expansive' as defined in Section 1803.5.3, 'Expansive Soil,' in the 2019 CBC (i.e., Expansion Index ≤ 20) and as determined by current ASTM D4829 procedures and have strength parameters equivalent to or greater than the on-site earth materials. Import fill material should be approved by the project Geotechnical / Geologic 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. If fill material is needed, the fill should be free from vegetation, organic material, debris, and oversize material (i.e., 3 inches in maximum dimension). Approved fill material should be placed in horizontal lifts not-to-exceed 6 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 within 3.0 percent of 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, tree root removal, 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 6.0 feet of the site which will be removed and replaced will be approximately 14 to 21 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 14 percent shrinkage factor would mean that it would take 1.14 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. Any 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 0.13 to 0.17 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 over excavation and replacement) 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
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.

Fill Slopes

Finish fill slopes should not be inclined steeper than 2H:1V (Horizontal to Vertical). Fill slope surfaces should be compacted to 90 percent relative compaction to the face of the finished slope. Over excavation beneath proposed fill slopes should be performed in accordance with the recommendations presented in previous sections of this report. Fill slopes should be constructed in a skillful manner so that they are positioned at the design orientations and slope

ratio. Achieving a uniform slope surface by subsequent thin wedge filling should be avoided. Add-on correction to a fill slope should be conducted under the observation and recommendations of the project Geotechnical/Geologic Consultant. The proposed add-on correction procedures should be submitted in writing by the contractor before commencement of corrective grading and reviewed by the project Geotechnical / Geologic Consultant. Compacted fill slopes should be back rolled with appropriate equipment for the type of earth material being used during fill placement, at intervals not exceeding 4.0 feet in vertical height. As an alternative to the bankrolling of the fill slopes, over-filling of the slopes will be considered acceptable and preferred. The fill slope should be constructed by over-filling with compacted fill to a distance of 3.0 feet or greater horizontally, and then trimmed back to expose the dense inner core of the slope surface. Fill slopes steeper than 3H:1V are moderately susceptible to erosion due to the low cohesion parameters of the earth materials.

Loose Material on Slope Face

The grading contractor should take care to avoid spillage of loose material down the face of slopes during grading and during drainage terrace and down drain construction. Fine grading operations for benches and down drains should not deposit loose trimmed earth materials on the finished slope surfaces.

Slope Creep

Based on the provided grading plans, proposed slopes within project site would be relatively low and be graded 3 to 1 (horizontal to vertical), potentials of slope creep to be low or minor.

Slope Protection

Permanent slope maintenance and protection measures, as presented in the subsequent 'Slope Maintenance and Protection Recommendations' section of this report, should be initiated as soon as practicable after completion of cut and/or fill slope construction. Fill slopes and cut slopes in undocumented fill and alluvial

materials steeper than 3:1 (Horizontal to Vertical) are moderately susceptible to erosion due to the low cohesion parameters of the earth materials. The plant mix, method of application, and maintenance requirements are subject to the approval of a registered Landscape Architect or other qualified landscape professional. Construction delays, climate or weather conditions, and plant growth rates may be such that additional short-term non-plant erosion management measures may be needed. Examples include matting, netting, plastic sheets, deep staking (5.0 feet or deeper), and so on.

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 over-excavation 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 clean out and/or over-excavation bottoms are ready for observation and prior to scarification and re-compaction. 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 'Geotechnical Report of Grading' 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.

Earth Material Expansion Potential

Based on the tests performed during the grading, the expansion potential of the subgrade soils to be low. Upon completion of grading for the building pad areas, near-surface samples should be obtained for expansion potential testing to verify the preliminary expansion test results and the foundation / slab-on-grade recommendations presented in this report.

Earth Material Corrosion Potential

The preliminary corrosion potential of the on-site earth material is discussed in the subsequent corrosion recommendation sections of this report. Upon completion of grading for the building pad areas, near-surface samples should be obtained for corrosion potential testing to verify the preliminary chemical test results and the recommendations presented in this report for protection of concrete and bare metal which will be in direct contact with the on-site earth materials.

SEISMIC DESIGN PARAMETERS

Based on the field investigation, the California 2019 Building Code (CBC), and ASCE/SEI 7-16 Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE/SEI 7-16), the site could be designated as **Site Class "D"** per Table 20.3-1 of ASCE 7-16. The occupancy risk category can be designated as II. Other required seismic design parameters can be obtained from Section 1613 of the 2019 CBC or could be obtained from the California Structural

Engineers Association website: ***https://seismicmaps.org/*** below by entering the coordinates of the project site, the computer outputs are summarized in the following table:

Spectral Response Accelerations S_{MS} and S_{M1}	
Ss = 1.163 g, S_{MS} = Fa x Ss	S_1 = 0.452 g, S_{M1} = Fv x S_1
Site Class D: Fa = 1.035, Fv = 1.7	
Period (Sec.)	Sa (g)
0.2	1.204 (S_{MS}, Site Class D)
1.0	0.768 (S_{M1}, Site Class D)

Design Spectral Response Accelerations S_{DS} and S_{D1}	
S_{DS} = 2/3 x S_{MS}	S_{D1} = 2/3 x S_{M1}
PGA=0.5 g, F_{PGA}=1.1, PGA_M=0.55 g	
Period (Sec.)	Sa(g)
0.2	0.802 (S_{DS}, Site Class D)
1.0	0.512 (S_{D1}, Site Class D)
Seismic Design Category: D	

Site Coordinates: Longitude: W-117.363306° Latitude: N34.530369°
*Based on F_v of 1.7. See Section 11.4.8 of ASCE 7-16 for calculation requirements

CONVENTIONAL FOUNDATION DESIGN RECOMMENDATIONS

Building pad and continuous footings should have a minimum width of 24 inches and 18 inches, respectively. The bottom of footings should be at least 12 or 18 inches for one or two-story buildings, respectively, below the lowest adjacent grades, and embedded into the compacted fill. A net vertical bearing value of 2,000 psf may be used to design the footings. A one-third increase in the bearing value may be used when considering wind or seismic loads.

The footings should be reinforced with at least two No. 4 bars near top and bottom, or other reinforcement as determined by the Structural Engineer. Due to the potential seismic differential settlement, we recommend that any isolated footings be tied up to the continuous footings using grade beams. The grade beams should be designed as bearing elements, like the footings.

Minor fence wall footings or planter footings should have a minimum of 18 inches in width. The bottom of footings should be located at least 12 inches below the lowest adjacent grades and embedded into the compacted fill or competent native soils. A net vertical bearing value of 1,500 psf may be used to design the footings. A one-third increase in the bearing value may be used when considering wind or seismic loads.

FLOOR-ON-GRADE

Concrete slab-on-grade should consist of a nominal thickness of 4 inches concrete and contain as a minimum No. 4 bars spaced a maximum of 16 inches on centers, in both directions. Thicker slabs and additional reinforcement may be required depending on the floor loads and the structural requirements as determined by the Structural Engineer.

The subgrade preparations should follow the recommendations provide in the Grading Section above. It is recommended that the compacted subgrade be moistened prior to placement of the vapor retarder.

Lateral Design

Lateral load resistance may be derived from passive resistance along the vertical sides of the foundations, friction acting at the base of the foundations, or a combination of the two. A coefficient of friction of 0.30 may be used between the footings and the compacted fill. The passive resistance of level compacted fill in direct contact with the footings may be assumed to be equal to the pressure

developed by a fluid with a density of 250 pcf, to a maximum pressure of 2,500 pcf.

A one-third increase in the passive value may be used for wind or seismic loads. The frictional resistance and the passive resistance of the soils may be combined provided that the passive resistance is reduced by one third.

Estimated Settlement

Based on the results of our analyses and provided that our recommendations in preceding sections of this report are followed, we estimate that the total static settlement of isolated and/or continuous footings under sustained loads will be on the order of ¾ inch for the anticipated maximum structural loads. The maximum static differential settlement, over a horizontal distance of 30 feet, should be on the order of ½ inch for similarly loaded footings. The seismic differential settlement is expected to be on the order of ¾ inch over a horizontal distance of 30 feet.

Moisture Sensitive Floor Covering

Water vapor transmitted through floor slabs is a common cause of floor covering problems. In areas where moisture-sensitive floor coverings (such as tile, hardwood floors, linoleum, or carpeting) are planned, a vapor retarder should be installed below the concrete slabs to reduce excess vapor transmission through the slab.

The function of the recommended relatively impermeable membrane (vapor retarder) is to reduce the amount of soil moisture or water vapor that is transmitted through the floor slab. The membrane should be 10-mil thick, Class A, and care should be taken to preserve the continuity and integrity of the membrane beneath the floor slab. The vapor retarder should conform to ASTM E1745. The vapor retarder should be installed in strict conformance with the manufacture recommendations.

If a capillary break is used, at least 4 inches of free draining crushed rock, with no more than 2 percent passing the No. 200 sieve, should be placed below the vapor retarder. The crushed rock should be vibrated in place to achieve the compaction.

RETAINING WALLS

Retaining walls may be required to accommodate the proposed driveway and/or as a part of the building stem walls. Retaining walls should have a minimum of 18 inches in width. The bottom of footings should be located at least 12 inches below the lowest adjacent grades and embedded into the compacted fill or competent native soils. A net vertical bearing value of 1,500 psf may be used to design the footings. The pressure behind retaining walls depends primarily on the allowable wall movement, wall inclination, type of backfill materials, backfill slopes, surcharge, and drainage. Determination of whether the active or at-rest condition is appropriate for design will depend on the flexibility of the walls. Walls that are free to rotate at least 0.002 radians at the top (deflection at the top of the wall of at least 0.002 x H, where H is the unbalanced wall height) can be designed for active conditions. The recommended active and at-rest pressures for the site soil retaining backfill up to 6 feet in height are presented in the following table.

Table 1 - Earth Pressures for Retaining Walls

Wall Movement	Backfill Condition	Equivalent Fluid Pressure (onsite silty and poorly graded sand) (pcf)
Free to Deflect	Level	40
	2:1	62
Restrained	Level	60
	2:1	82

The above lateral earth pressures do not include the effects of surcharge (e.g. traffic, footings, hydrostatic pressure) or compaction. Any surcharge (live, including traffic, or dead load) located within a 1:1 plane drawn upward from the base of the excavation should be added to the lateral earth pressures. The lateral pressure addition of a uniform surcharge load located immediately behind walls may be calculated by multiplying the surcharge by 0.33 for cantilevered walls and 0.5 for restrained walls.

A drainage system should be provided behind the walls to reduce the potential for development of hydrostatic pressure. If a drainage system is not installed, the walls should be designed to resist the hydrostatic pressure in addition to the earth pressure.

Walls should be properly drained and waterproofed. Except for the upper 2 feet, the backfill immediately behind retaining walls (minimum horizontal distance of 12 inches) should consist of free-draining ¾-inch crushed rock wrapped with filter fabric. A 4-inch diameter perforated PVC pipe, placed perforations down at the bottom of the crushed rock backfill, leading to a suitable gravity outlet should be installed.

The retaining wall footings may be designed per lateral resistance parameters provided in the Foundation Design Recommendation above.

SOIL EXPANSIVITY

The subsurface soils encountered at shallow depths consist mostly of silty sand and poorly graded sand. These types of material generally have a low susceptibility to expansion and a low to medium susceptibility to collapse when facing seasonal cycles of saturation/desiccation. Consequently, the recommendations provided in this report regarding drainage, moisture content during compaction and other pertinent recommendations for site improvements should be incorporated into the design and construction.

CORROSION POTENTIAL EVALUATION

The recommendations for corrosion protection should be verified at the completion of grading of the building pads on the subject tracts. Bulk samples of the near surface, on-site earth materials should be obtained during the grading operations to evaluate the potential for corrosivity. A preliminary corrosion potential evaluation was performed for bulk samples obtained from our field exploration. The corrosivity test results are presented in Appendix 'A' of this report.

Concrete Corrosion

The corrosion potential of the onsite materials to steel and buried concrete was preliminarily evaluated. Laboratory testing was performed on a selected soil samples to evaluate pH, minimum resistivity, chloride, and soluble sulfate content. The test results are presented in Appendix A, Plate No. 9.

These tests are only an indicator of soil corrosivity for the samples tested. Other soils found on site may be more, less, or of a similar corrosive nature. Imported fill materials should be tested to confirm their corrosion potential. Based on the minimum resistivity results from the soil tested, some of the near-surface site soils are mildly corrosive towards buried ferrous metals. The soluble sulfate concentrations of less than 0.0005 percent indicate that the potential of sulfate attack on concrete in contact with the onsite soils is "negligible" based on ACI 318-14 Tables 19.3.1.1 and 19.3.2.1. Cement Type I or II may be used in the concrete. Maximum water-cement ratios are not specified for the sulfate concentrations; however, the Structural Engineer should select a type of concrete with appropriate strength. The soluble chloride concentrations of less than 5.0 ppm can be considered negligible for concrete per ACI 318-14 Tables 19.3.2.1. pH value measured in the soil sample was 9.19; and the resistivity values measured in the soil samples was 3,581 ohms-cm. The soil corrosion on the site is considered mild. Further interpretation of the corrosivity test results, including the

resistivity value, and providing corrosion design and construction recommendations are the purview of corrosion specialists/consultants.

Salt Crystallization Exposure

Damage of concrete, concrete masonry units, slump stone block, etc. surface can occur when evaporation of moisture takes place at the surface of the materials. As evaporation takes place, salts (i.e., carbonates, chloride, sulfur, sodium, potassium, etc.) are deposited in or form on the surfaces. As the salts crystalize, they can exert extreme pressures in the pore spaces of the materials they are deposited in and/or on. The formation of the crystals within the pore spaces of the material can result in what is generally called 'salt crystallization damage.' This results in the scaling and/or etching of the surface of the material on which they are deposited. The damaging effects of this phenomenon can be greatly reduced and/or even eliminated by the following or other such methods: 1) either using a higher strength concrete or a denser, low porosity product; 2) seal the surface of the material with a water proofing substance which will prevent the evaporation of the moisture from within the cementitious product. If 'salt crystallization damage' is considered to be an issue, an engineer or chemist specializing in this area should be consulted regarding the potential damage due evaporation and the deposition of salts. The engineer or chemist should recommend appropriate types of materials or protective measures where needed.

PRELIMINARY PAVEMENT RECOMMENDATIONS

The following are preliminary recommendations for the structural pavement sections for the proposed streets for the subject development. The Hot Mix Asphalt (HMA) pavement sections have been determined in general accordance with current **California Department of Transportation (CALTRANS)** design procedures and are based on an assumed Traffic Index (TI) of 5.5 for a 20-year design life and a R-Value of 62 based on the laboratory test results.

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**
Residential Streets.	≤5.5	62	3.0" Hot Mix Asphaltic Concrete (HMA) over 4.0" Aggregate Base (AB) or 4.0" PCC @ 2,500 psi over properly prepared subgrade.
* Traffic Index was assumed for the project.			

The City minimum guidelines may override the above pavement recommendations without prior City review and approval.

HMA concrete pavement materials should be as specified in the current CALTRANS 'Asphalt Pavement Standards,' or an equivalent substitute. Aggregate base should conform to Class II Material as specified in current CALTRANS 'Standard Specifications.'

The pavement section for individual lot driveways should be according to current City of Victorville, California standards.

HMA concrete pavement materials should be as specified in the current CALTRANS 'Asphalt Pavement Standards,' 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 California Test 216 procedures. The asphalt 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).

Where HMA pavement abuts concrete aprons, drives, walks, or curb and gutter sections, a thickened edge transition zone is recommended for the HMA section to minimize the effects of impact loading as vehicles transition from PCC paving to HMA paving. This thickened edge should consist of an increased thickness of 2.0 inches for parking areas and 4.0 inches for areas of heavy truck usage. This thickened edge should extend to a distance of 3.0 feet or greater from the edge of pavement and then gradually taper back to the design pavement thickness. 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.

Due to the collapsible nature of some of the near-surface earth materials on the subject site, if over excavation and replacement is not performed under the pavement areas, there is a risk of settlement and vertical differential movement of the pavement, curbs / gutters, etc. if the subgrade earth materials are allowed to become saturated. Therefore, proper drainage should be established away from such improvements and minimal precipitation, or irrigation water allowed to percolate into the earth materials adjacent to the pavement, curbs / gutters, etc.

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 II Aggregate Base material as the Standard Specifications for Public Works Construction, 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, and graded to produce a Class II 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 II Aggregate Base material. 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,' 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

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 site. 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 CALTRANS 'Standard Specifications,' an aggregate grading and Sand Equivalent test shall not represent more than 500 cubic yards or one (1) day 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 City of Victorville, California.

POST-GRADING CRITERIA

Earth materials generated from the excavation of foundations, utility trenches, swimming pools and/or spas, etc., to be used on-site, should be moisture conditioned to optimum moisture content to 3.0 percent within optimum moisture content and compacted to 90 percent or greater of the maximum dry density for the material type as determined by current ASTM D1557 procedures when it is to be placed under floor slabs, under hardscape areas, and/or in paved areas. The placement of the excess material should not alter positive drainage away from structures and/or off the lot and should not change the distance from the weep screed on the structure to the finished adjacent earth material grade per the 'Finish Surface Drainage Recommendations' presented in a subsequent section of this report, the project plans, and or the 2019 CBC.

SLOPE MAINTENANCE AND PROTECTION & RECOMMENDATIONS

Although the design and construction of slopes are planned to create slopes that possess stability against mass rotational failure, surficial slumping, creep, and pop-outs, certain factors are beyond the influence of the project Geotechnical / Geologic Consultant. Earth material slopes are subject to some erosion when subjected to sustained water application. To reduce long term erosion, the following recommendations for slope protection and maintenance should be considered when planning, designing, and implementing slope erosion methods:

- Surface water should not be allowed to flow over the on-site natural or proposed man-made slopes other than incidental rainfall and irrigation. Alterations of manufactured or natural slopes, terraces, top of slope berms, and/or pad gradients should not be allowed that will prevent pad and roof run-off from the structures from being expediently directed to approved disposal areas and away from the tops of slopes. Surface drainage should be positively maintained from the rear yard, through the side yards, and to the street or storm drain in a non-erosive manner.
- Top of slope berms should be constructed and compacted as part of finish grading of the lots and should be maintained by the individual lot owners and/or homeowners association. The recommended drainage patterns should be established at the time of finish grading and maintained throughout the life of the proposed development.

- Concentrated surface waters entering the subject lots from off-site sources should be collected and directed to a permanent drainage system.

- The individual lot owners and/or homeowners association are responsible for the maintenance and cleaning of the interceptor ditches, drainage terraces, down drains and other drainage devices that have been installed to promote slope stability.

- It is recommended that slopes be planted with light-weight ground cover, shrubs and trees that possess deep (5.0 feet or greater), dense root structures that require minimal of irrigation (drought resistance). It should be the responsibility of the Landscape Architect or other suitably qualified individual to provide such plants initially and of the individual lot owners and/or homeowners association to maintain such planting. Alteration of the planting scheme is at the individual lot owner's and/or homeowners association risk.

- If automatic sprinkler systems are installed their use should be adjusted to account for natural rainfall.

- The individual lot owners and/or homeowners association should establish a program for the elimination of burrowing animals. This should be an on-going program to protect slope stability.

- The individual lot owners and/or homeowners association should observe the lot drainage during heavy precipitation periods as this is often when trouble occurs. Problems such as gullying, or ponding should be corrected as soon as practicable.

- High moisture content in slope earth materials is a major factor in slope erosion and slope failures. Therefore, precautions should be taken to minimize earth material saturation. Leakage from pools, waterlines, irrigation systems, etc. or bypassing of clogged drains should be promptly repaired.

The above guidelines are provided to mitigate slope maintenance and protection problems and should be included in information packets to individual home buyers and/or homeowners association, when applicable, by the project developer. The above guidelines are general maintenance and design procedures but may be superseded under specific direction of a licensed Landscape Architect or other suitably qualified individual.

UTILITY TRENCH RECOMMENDATIONS

Utility trenches within the zone of influence of foundations or under building floor slabs, exterior hardscape, and/or pavement areas should be backfilled with documented, compacted earth material. Utility trenches within the building pad and extending to a distance of 5.0 feet beyond the building exterior footings should be backfilled with on-site or similar earth material. Where interior or

exterior utility trenches are proposed to pass beneath or parallel to building, retaining wall, and/or decorative concrete block perimeter wall footings, the bottom of the trench should not be located below a 1H:1V (Horizontal to Vertical) plane projected downward from the outside bottom edge of the adjacent footing unless the utility lines are designed for the footing surcharge loads.

Trench Excavation

It is recommended that utility trench excavations be designed and constructed in accordance with current OSHA regulations. These regulations provide trench sloping and shoring design parameters for trenches up to 20 feet in vertical depth based on a description and field verification of the earth material types encountered. Trenches over 20 feet in vertical depth should be designed by the Contractor's Engineer based on site specific geotechnical analyses. For planning purposes, we recommend that the following OSHA earth material type designations and temporary slope inclinations be used:

EARTH MATERIAL	OSHA SOIL TYPE*	TEMPORARY SLOPE INCLINATION (H:V)**
Undocumented Fill	C	1.5:1
Compacted Fill	C	1.5:1
Alluvium	C	1.5:1

* Type 'C': Cohesive soils with an unconfined compressive strength of 0.5 tsf or less: or Granular soils including sands, gravels, loamy, clayey, or silty sands, etc.

** Steepest allowable slopes for excavations less than 20 feet in vertical height. Slopes for excavations greater than 20 feet in vertical height should be designed by a Registered Professional Engineer with experience in Geotechnical Consulting and Soil Mechanics.

Excavations of less than 5.0 feet in depth may also be subject to collapse due to water, vibrations, previously disturbed earth materials, or other factors, and may require protection for workers such as temporary slopes, shoring, or a shielding

protective system. The excavations should be observed by a qualified, competent individual (as defined in the current OSHA regulations) looking for signs of potential cave-ins on a daily basis before start of work on an as-needed basis throughout the work shifts, and after every rainstorm or other hazard-increasing occurrence.

Surcharge loads (e.g., spoil piles, earthmoving equipment, trucks) should not be allowed within a horizontal distance measured from the top of the excavation slope equivalent to 1.5 times the vertical depth of the excavation in compacted fill or alluvial materials. Excavations should be initially observed by the project Geotechnical / Geologic Consultant and/or his representative to verify the recommendations presented or to make additional recommendations to maintain stability and safety. Moisture variations, differences in the cohesive or cementation characteristics, or changes in the coarseness of the deposits may require slope flattening or, conversely, permit steepening upon review and appropriate testing by the project Geotechnical / Geologic Consultant and/or his representative. The excavations should be observed by a qualified, competent person (as defined in the current OSHA regulations) looking for signs of potential problems on a daily basis before start of work, as needed throughout the work shifts, and after every rainstorm or other hazard-increasing occurrence. Deep utility trenches may experience caving, which will require special considerations to stabilize the walls and expedite trenching operations. Surface drainage should be controlled along the top of the construction slopes to preclude erosion of the slope face. If excavations are to be left open for long periods, the slopes should be sprayed with a protective compound and/or covered to minimize drying out, raveling, and/or erosion of the slopes.

Utility Line Foundation Preparation

Based on our sand equivalent test result, on-site earth material is not suitable for support of the utility pipe. The material should be removed to a minimum

depth of 1.0 foot below the bottom of the pipe and replaced with concrete slurry, sand, or crushed gravel meeting the following appropriate gradation limits.

SIEVE SIZE	CRUSHED ROCK OR GRAVEL (PERCENT PASSING)
1"	100
3/4"	90-100
½"	30-60
3/8"	0-20
No. 4	0-5

SIEVE SIZE	SAND (PERCENT PASSING)
3/8"	100
No. 4	75-100
No. 30	12-50
No. 100	5-20
No. 200	0-15

Most of the granular native earth materials encountered on the subject site are not expected to meet the above granular earth material criteria.

We recommend where the bottom of the pipe foundation excavation is loose or soft, the foundation earth materials be removed to firm materials as determined by the Engineer. This condition would likely only apply where fill underlies the pipe in localized areas along a utility alignment. If firm material is not encountered within 24 inches of the bottom of the pipe zone, the contractor may then elect to stabilize the trench bottom with 24 inches of crushed rock as described above. Alternately, soft, or loose material may be excavated to firm earth material and the over excavation replaced with select earth material.

The bottom of the utility trench excavation should be proof compacted to 90 percent or greater relative compaction prior to placement of compacted fill. Maximum dry density and optimum moisture content for compacted materials should be determined according to current ASTM D1557 procedures.

Prior to placement of trench slurry or crushed rock, the bottom need only be cleaned of loose materials created by the excavation process. Where the bottom of the trench contains rocks or hard objects protruding above a depth of 6.0 inches below the pipe bottom, such objects should be removed or broken, and any resulting cavities filled to produce a smooth surface.

Bedding Requirements

It is recommended that the pipe be bedded on either clean sand, gravel, crushed rock, or any approved suitable material in order to provide a smooth, firm, and uniform foundation for the pipe. The pipe bedding material, thickness, shaping, and placement should satisfy the design requirements as determined by the design Civil Engineer. The majority of the man-made fills and alluvial soils on the subject site may not be suitable to be used as bedding and pipe zone backfill materials depending upon the bedding and pipe zone backfill specifications required by the project designer and/or the agency having jurisdiction over the utility line.

Trench Zone Backfill

The excavated earth materials from the trench may be used as backfill in the trench zone unless more restrictive specifications are required by the design engineer or the permitting agency. The trench backfill material should consist of approved earth materials free of trash debris, vegetation, or other deleterious matter, and oversize particles (i.e., 12 inches in maximum dimension). Trench zone backfill should be compacted to 90 percent or greater relative compaction. Maximum density and optimum moisture content for compacted materials should be determined according to current ASTM D1557 procedures.

Trench backfill material should be placed in a lift thickness appropriate for the type of backfill material and compaction equipment used. Backfill material should be brought to optimum moisture content to 3.0 percent above optimum moisture content and compacted to 90 percent or greater relative compaction by mechanical means. Jetting or flooding of the backfill material will **not** be considered a satisfactory method for compaction. Maximum dry density and optimum moisture content for backfill material should be determined according to current ASTM D1557 procedures.

FINISH SURFACE DRAINAGE RECOMMENDATIONS

Positive drainage should be established away from the tops of slopes, the exterior walls of structures, the back of retaining walls, trash enclosure walls, decorative concrete block walls, and so forth. Finish surface gradients in unpaved areas should be provided next to tops of slopes and buildings to guide surface water away from foundations, hardscape, pavement, and from flowing over the tops of slopes. The surface water should be directed toward adequate drainage facilities. Ponding of surface water should not be allowed next to structures or on pavements. Design criteria for finish lot drainage away from structures and off the property should be determined by the project Structural Engineer designing the foundations and slabs, in conjunction with the project Civil Engineer designing the precise grading for lot drainage, respectively, in accordance with the 2019 CBC and/or the current City of Victorville, California codes and ordinances and the earth material types and expansion characteristics for the earth materials contained in this report. Finished landscaped and hardscape or pavement grades adjacent to the proposed structures should maintain a vertical distance below the bottom elevation of the weep screed per the 2019 CBC and/or the current City of Victorville Codes and ordinances.

Landscape plants with high water needs and trees should be planted at a distance away from the structure equivalent to, or greater than, the width of the canopy

of the mature tree or 6.0 feet, whichever is greater. Downspouts from roof drains should discharge to a permanent all-weather surface which slopes away from the structure. Downspouts from roof drains should not discharge into planter areas immediately adjacent to the building, unless there is positive drainage out of the planter and away from the structure, in accordance with the recommendations of the project foundation and slab designer and/or the project Civil Engineer designing the precise grades for the lot drainage.

PLANTER RECOMMENDATIONS

Planters around the perimeter of the structures should be designed so that adequate drainage is maintained, and minimal irrigation water is allowed to percolate into the earth materials underling the building. This should include enclosed or trapped planter areas that are created as a result of sidewalks. Planters with solid bottoms, independent of the underlying earth material, are recommended within a distance of 6.0 feet from the building. The planters should drain directly onto surrounding paved areas or into a designed subdrain system. If planters are raised above the surrounding finished grades, or are placed against the building structure, the interior walls of the planter should be waterproofed.

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 geologic reconnaissance of existing surface conditions of the subject site. Site observations and geologic mapping were conducted on March 17 and 18, 2022, by a representative of **HGI**.

A study of the property's subsurface condition was performed to evaluate underlying earth strata and the presence of groundwater. Six (6) exploratory borings were performed using a hollow stem drill rig on the area of the proposed development on the subject site on March 17 and 18, 2022. Locations of the exploratory excavations were determined in the field by pacing, tape measuring, and sighting from the adjacent existing streets, adjacent structures, and topographic features as shown on Plate No. 1, presented in this appendix. Approximate locations of the exploratory excavations are denoted on the 'Exploratory Excavation Location Plan,' Plate No. 1, presented in this Appendix. Approximate elevations at the locations of the exploratory excavations were determined from the Google Earth Website (http://www/google.com/earth). 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 borings were excavated by a hollow stem drill rig. The depths explored in the borings were approximately 16.5 feet below the existing ground surface at the excavation locations. Bulk and relatively undisturbed ring samples were obtained from cuttings developed during the excavation process and represent the earth materials within the depth indicated.

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 'Relative Density' of granular soils (SP, SW, SM, SC, GP, GW, GM, GC) is given as very loose, loose, medium dense, dense, or very dense and is based on the number of blows to drive the sampler 1.0 foot or fraction thereof. The 'Consistency' of silts or clays (ML, CL, MH, CH) is given as very soft, soft, medium stiff, stiff, very stiff, or hard and is also based on the number of blows to drive the sampler 1.0 foot or fraction thereof. 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.

LABORATORY TESTING PROGRAM

Laboratory tests were performed on selected, relatively undisturbed ring and 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 8, presented in this Appendix.

IN-SITU MOISTURE CONTENT AND DRY DENSITY

The in-situ moisture content and dry density were determined in general accordance with current ASTM D2216 (Moisture Content) and D1188 (Bulk Specific Gravity and Density of Paraffin Coated Specimens) procedures, respectively, for selected undisturbed samples obtained. This information was an aid to classification and permitted recognition of variations in material consistency with depth. The dry density is determined in pounds per cubic foot and the moisture content is determined as a percentage of the oven dry weight of the earth material. Test results are shown on the 'Subsurface Exploration Log,' Plate Nos. 3 through 8, presented in this Appendix.

CHEMICAL AND ELECTRICAL RESISTIVITY TESTS

The concentration of soluble chloride, sulfate, pH, as well as other chemical constituents and the minimum electrical resistivity were determined for a selected sample of near-surface earth material. The pH test was performed in general accordance with current EPA 9045C procedures. The test results are summarized in the 'Summary of Laboratory Test Results,' Plate No. 9, 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. 9, presented in this Appendix.

RESISTANCE (R-VALUE) TEST

A resistance (R-Value) test was performed on a selected samples of near-surface earth material that is anticipated to comprise the subgrade for proposed pavement areas. This test procedure measures the ability of earth materials and aggregate materials to resist lateral deformation under saturated conditions and applied vertical wheel loads. The R-Value is used in developing parameters for structural pavement sections. The R-Value is determined based on the following separate measurements:

- The exudation pressure test determines the thickness cover or pavement structure required to prevent plastic deformation of the soil under imposed wheel loads.

- The expansion pressure test determines the pavement thickness or weight of cover required to withstand the expansion pressure of the soil.

Testing was performed in general accordance with current California Test 301 procedures. The test results are summarized in the 'Summary of Laboratory Test Results,' Plate No. 9, presented in this Appendix.

SAND EQUIVALENT TEST

A sand equivalent test was performed on a sample of near-surface earth material in general accordance with current [California Test 217][ASTM D2419] procedures. The Sand Equivalent is an indicator of the relative proportion of fine materials in samples of earth material or aggregate which pass a No. 4 sieve. The Sand Equivalent value is a unit less number and is the ratio of the height of sand to the height of flocculated fine material in a sedimentation cylinder. The ratio is multiplied by 100 to obtain the Sand Equivalent Value. The test results are summarized in the 'Summary of Laboratory Test Results,' Plate No. 10, presented in this Appendix.

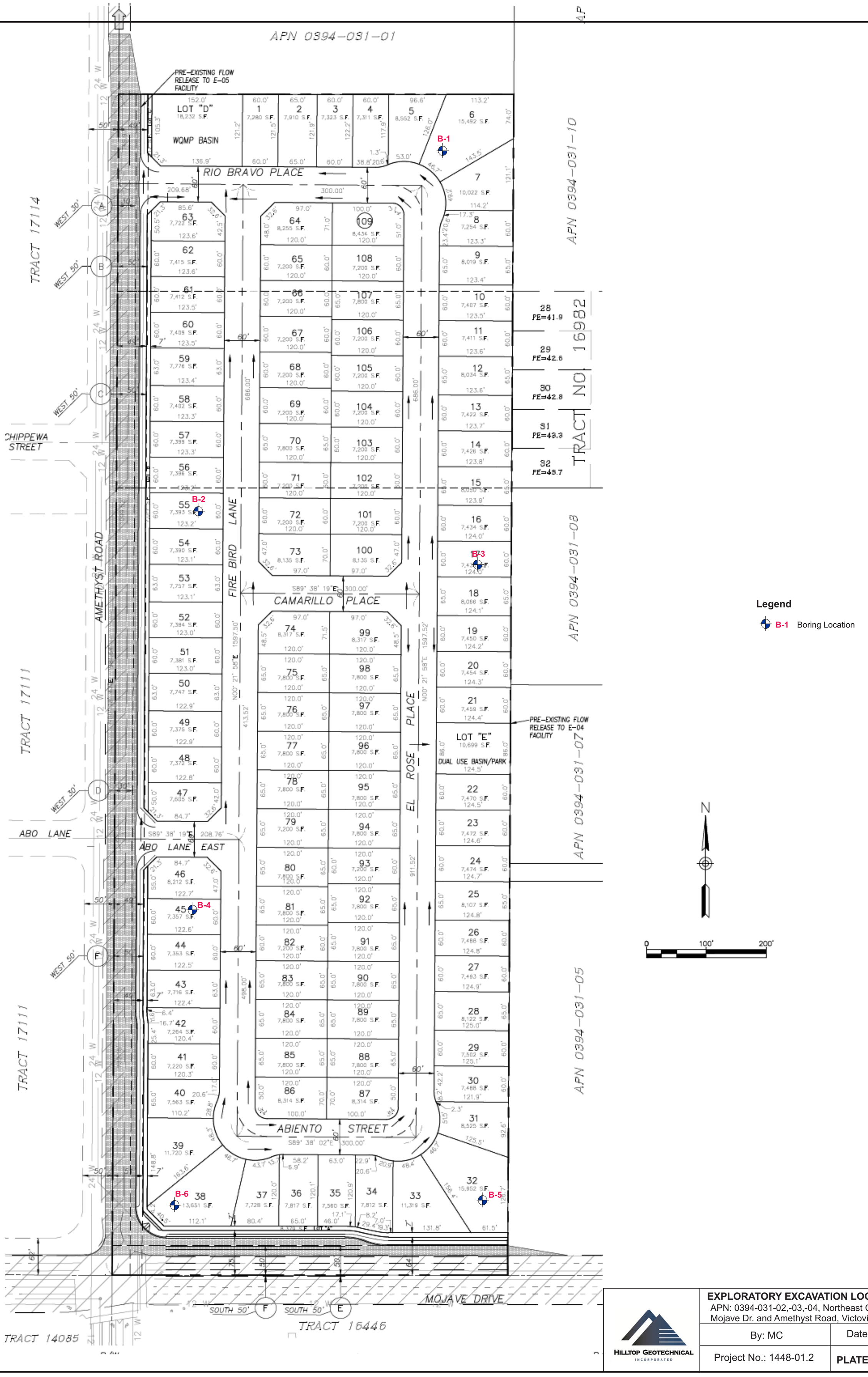
CONSOLIDATION TESTS

Hydroconsolidation or the Collapse Potential, I_C, of the on-site earth material behavior under load were made on the basis of consolidation tests that were performed on selected relatively undisturbed ring samples of the alluvial soils in general accordance with current ASTM D5333 procedures. The consolidation apparatus is designed to receive a 1-inch high, 2.416-inch diameter ring sample. Porous stones are placed in contact with the top and bottom of each specimen to permit addition and release of pore water. A load of 1,600 pounds per square foot (psf) was applied normal to the face of the specimen at field moisture condition and the sample was allowed to consolidate. Upon completion of the consolidation process, water was added to the test apparatus to create a submerged condition and to measure the collapse (hydroconsolidation) or expansion potential of the sample. The resulting change in sample thickness was recorded. The test results are summarized in the 'Summary of Laboratory Test Results,' Plate No. 10, presented in this Appendix.

DIRECT SHEAR TEST

A direct shear test was performed on a selected in-situ 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 in situ sample of earth material 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 'Summary of Laboratory Test Results,' Plate Nos. 11 and 12, presented in this Appendix.



EXPLORATORY EXCAVATION LOCATION

APN: 0394-031-02,-03,-04, Northeast Corner of Mojave Dr. and Amethyst Road, Victoville

By: MC	Date: 4/2022
Project No.: 1448-01.2	**PLATE NO. 1**

HILLTOP GEOTECHNICAL INCORPORATED

SUBSURFACE EXPLORATION LEGEND

UNIFIED SOIL CLASSIFICATION SYSTEM
Visual-Manual Procedure (ASTM D2488-09a)

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
Coarse-Grained Soils* More than 50 % Retained on No. 4 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
			GP	Poorly Graded Gravels and Gravel-Sand Mixtures, Little or no Fines
		Gravels with Fines	GM	Silty Gravels, Gravel-Sand-Silt Mixtures**
			GC	Clayey Gravel, Gravel-Sand-Clay Mixtures**
	Sands More than 50 % of Coarse Fraction Passes No. 4 Sieve	Clean Sands	SW	Well Graded Sands and Gravely Sands, Little or no Fines
			SP	Poorly Graded Sands and Gravelly Sands, Little or no Fines
		Sands with Fines	SM	Silty Sands, Sand-Silt Mixtures**
			SC	Clayey Sands, Sand-Clay Mixtures**
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
			CL	Inorganic Clays of Low to Medium Plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
			OL	Organic Silts and Organic silty Clays of Low Plasticity
	Silts and Clays Liquid Limits Greater than 50 %		MH	Inorganic Silts, Micaceous or Diatomaceous silts, Plastic Silts
			CH	Inorganic Clays of High Plasticity, Fat Clays
			OH	Organic Clays of Medium to High Plasticity
Highly Organic Soils			PT	Peat, Muck, or Other Highly Organic Soils

CONSISTENCY / RELATIVE DENSITY

Reference: 'Foundation Engineering', Peck, Hansen, Thornburn, 2nd Edition.

Standard Penetration Test
Granular Soils

Penetration Resistance, N, (Blows / Foot)	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

Standard Penetration Test
Cohesive Soils

Penetration Resistance, N, (Blows / Foot)	Consistency	Unconfined Compressive Strength, (Tons / Sq. Ft.)
		< 0.25
< 2	Very Soft	0.25 - 0.5
2 - 4	Soft	0.5 - 1.0
5 - 8	Firm (Medium Stiff)	1.0 - 2.0
9 - 15	Stiff	2.0 - 4.0
16 - 30	Very Stiff	> 4.0
> 31	Hard	

* 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	< 5 %
Few	5 - 10%
Little	15 - 25%
Some	30 - 45 %
Mostly	50-100%

Other Symbols

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

SUBSURFACE EXPLORATION LOG
BORING NO. B-1

HILLTOP GEOTECHNICAL INCORPORATED

Project Name:	Mojave & Amethyst				
Project No.	1448-01.2	Date:	3/17/2022	Logged By:	AB
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	2940 ± 25
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	16.6

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
0	B		SM			Qa		ALLUVIUM: Fine to medium sand, trace gravel; Moist; Light brown; Medium dense.
2	R	16 34 45		111.1	12.6			slight cementation.
5	S	9 16 21	ML		13.3			Sandy fine silt, trace gravel, some cementation; Moist; Light olive brown; Stiff.
10	R	9 15 20	CL					Sandy fine clay, slightly mottled, porous; Slightly moist to moist; Light brown; Stiff.
15	S	15 27 31	SP-SM		1.4			Fine to coarse sand, trace gravel; Slightly moist; Tan; Dense.
17								Bottom of boring 16.6 feet. No groundwater encountered. Backfilled with excavated materials.

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 3

SUBSURFACE EXPLORATION LOG
BORING NO. B-2

HILLTOP GEOTECHNICAL INCORPORATED

Project Name:	Mojave & Amethyst				
Project No.	1448-01.2	Date:	3/17/2022	Logged By:	AB
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	2940 ± 25
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	16.6

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
0	B		SM			Qa		ALLUVIUM: Silty fine to medium sand, trace gravel; Moist; Light brownish-yellow; Loose to medium dense.
1								
2	R	9						
3		11		111.6	2.6			
4		21	SP-SM					Poorly graded fine to coarse sand with silt, trace gravel; slightly moist; Light brownish yellow; Medium dense.
5	S	17	ML					Sandy fine silt, trace gravel, some cementation; Slightly moist; Light brown; Hard.
6		26						
7		39						
8								
9			CL					Sandy lean clay, trace concretions; Slightly moist; Light brown; Stiff.
10	R	21						
11		33		107.6	15.6			
12		39						
13								
14								
15	S	9						Less concretions.
16		16			17.4			
		23						
17								Bottom of boring 16.6 feet. No groundwater encountered. Backfilled with excavated materials.
18								
19								
20								
21								
22								
23								
24								
25								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 4

SUBSURFACE EXPLORATION LOG
BORING NO. B-3

HILLTOP GEOTECHNICAL INCORPORATED

Project Name:	Mojave & Amethyst				
Project No.	1448-01.2	Date:	3/17/2022	Logged By:	AB
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	2940 ± 25
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	16.6

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
1	B		SM			Qa		ALLUVIUM: Silty fine to medium sand, trace gravel; Moist; Dark brownish-yellow; Loose to medium dense.
2	R	34	SP-SM					Poorly graded fine to coarse sand with silt, trace gravel, slightly cemented; Slighty moist; Dark brownish yellow; Dense.
3		39		119.9	3.8			
4		35						
5	S	9	ML					Sandy fine silt, trace gravel, some cementation; Slightly moist; Light brown; Stiff.
6		15			2.2			
7		18						
8								
9			SM					Silty fine sand, trace gravel; Slightly moist; Olive brown; Hard.
10	R	10						
11		30		109.9	5.6			
12		50						
13			SM					Silty fine sand, trace gravel, Slightly moist; Light olive brown; Dense.
14								
15	S	13						
16		22			4.7			
		35						
17								Bottom of boring 16.6 feet. No groundwater encountered. Backfilled with excavated materials.
18								
19								
20								
21								
22								
23								
24								
25								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 5

SUBSURFACE EXPLORATION LOG
BORING NO. B-4

HILLTOP GEOTECHNICAL INCORPORATED

Project Name:	Mojave & Amethyst				
Project No.	1448-01.2	Date:	3/17/2022	Logged By:	AB
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	2940 ± 25
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	16.6

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
0	B		SM			Qa		ALLUVIUM: Silty fine to medium sand, trace gravel; Moist; Light brown; Loose to medium dense.
2	R	11 22 33		103.7	4.8			slightly cemented, some carbonate pockets.
4			ML					Sandy fine silt, trace concretions, Slightly moist, Light olive brown; Stiff.
5	S	12 19 28			6.3			
9			SM					Silty fine to medium sand, trace gravel; Slightly moist; Light brown; Dense
10	R	26 39		118.0	4.1			
11		44	CL					Clay; little concretions; Slightly moist; Brown; Stiff.
15	S	12 26 25			15.1			
17								Bottom of boring 16.6 feet. No groundwater encountered. Backfilled with excavated materials.

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 6

SUBSURFACE EXPLORATION LOG
BORING NO. B-5

HILLTOP GEOTECHNICAL INCORPORATED

Project Name:	Mojave & Amethyst				
Project No.	1448-01.2	Date:	3/17/2022	Logged By:	AB
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	2940 ± 25
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	16.6

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
0	B		SM			Qa		ALLUVIUM: Silty fine to medium sand;SLightly Moist; Light brown; Loose.
1								
2			SP-SM					Silty fine to medium sand, trace gravel; Slightly moist; Light Brown to brown; Medium dense.
3	R	10 17 19						
4								
5								
6	S	11 19 21			2.2			
7								
8			SM					Silty fine sand, cemented with trace concretions; slightly moist; Light olive brown; Dense.
9								
10	R	20 23 33		110.1	5.8			
11								
12								
13								
14			ML					Sandy fine silt; Slightly moist; Light olive brown; Stiff.
15	S	11 17 25			5.9			
16								
17								Bottom of boring 16.6 feet. No groundwater encountered. Backfilled with excavated materials.
18								
19								
20								
21								
22								
23								
24								
25								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 7

SUBSURFACE EXPLORATION LOG
BORING NO. B-6

HILLTOP GEOTECHNICAL INCORPORATED

Project Name:	Mojave & Amethyst				
Project No.	1448-01.2	Date:	3/17/2022	Logged By:	AB
Type of Rig:	Hollow-Stem Auger	Drive Wt.:	140 lb	Elevation:	2940 ± 25
Drill Hole Dia.:	8 in.	Drop:	30 in.	Depth of Boring (ft.):	16.6

Depth (ft.)	Sample Type	Penetration Resistance	Soil Classification	Dry Density (lb/ft3)	Moisture Content (%)	Lithology	Groundwater	Description
0	B		SM			Qa		ALLUVIUM: Silty fine to medium sand, trace gravel; Slightly moist; Dark yellowish brown; Medium dense.
1								
2	R	9						
3		15		115.1	2.4			
4		25						
5			SC					Clayey fine to medium sand, trace gavel, cemented; Slightly moist; Brown to light brown; Stiff.
6	S	19			4.3			
7		28						
8		25						
9			SC					Clayey fine to medium sand, trace gravel; Slightly moist; Brown to light brown; Stiff.
10	R	9						
11		15		104.4	9.6			
12		23						
13			ML					Sandy fine silt; Slightly moist; Brown; Stiff.
14								
15	S	11						
16		18	SM		3.8			Silty fine sand; Slightly moist; Light brown; Medium dense.
		25						
17								Bottom of boring 16.6 feet. No groundwater encountered. Backfilled with excavated materials.
18								
19								
20								
21								
22								
23								
24								
25								

S - SPT Sample R - Ring Sample B - Bulk Sample N - Nuclear Gauge Test D - Disturbed Sample

N.R. - No Recovery

Plate No. 8

SUMMARY OF LABORATORY TEST RESULTS
APN:0394-031-02, 03, 04, NORTHEAST CORNER OF MOJAVE DRIVE AND AMETHYST ROAD,
CITY OF VICTORVILLE,
SAN BERNARDINO COUNTY CALIFORNIA

CHEMICAL & ELECTRICAL RESISTIVITY TEST RESULTS

SAMPLE	RESISTIVITY Minimum (ohms-cm)	pH*	CHLORIDE (ppm)**	SULFIDE	SOLUBLE SULFATE (%)**
B-4@0-5'	3,581	9.19	<5.0	Negative	<0.0005

* Test performed by **A & R Laboratories** in accordance with EPA 9045C procedures.
** Test performed by **A & R Laboratories** in accordance with EPA 300.0 test procedures.

PERCENT PASSING #200 SIEVE TEST RESULTS (ASTM D1140 Test Method)

SAMPLE	EARTH MATERIAL DESCRIPTION	PERCENT PASSING #200 SIEVE
B-1, 15.0'	Silty, fine to coarse sand, trace gravel, Brown	7.0
B-3, 2.0'	Silty, fine to coarse sand, trace gravel, Brown	15.1

R-VALUE TEST RESULTS (California Test 301 Procedure)

SAMPLE	SOIL TYPE	R-Value
B4, 0-5"	silty fine sand, with medium and coarse sand, trace clay	20

PLATE NO. 9

HILLTOP GEOTECHNICAL, INC.

SUMMARY OF LABORATORY TEST RESULTS
APN:0394-031-02, 03, 04, NORTHEAST CORNER OF MOJAVE DRIVE AND AMETHYST ROAD,
CITY OF VICTORVILLE,
SAN BERNARDINO COUNTY CALIFORNIA

SAND EQUIVALENT TEST RESULTS (ASTM D2419 Test Method)

SAMPLE	SAND EQUIVALENT
B3, 0-5”	20

COLLAPSE POTENTIAL TEST RESULTS (ASTM D4546 Test Method)

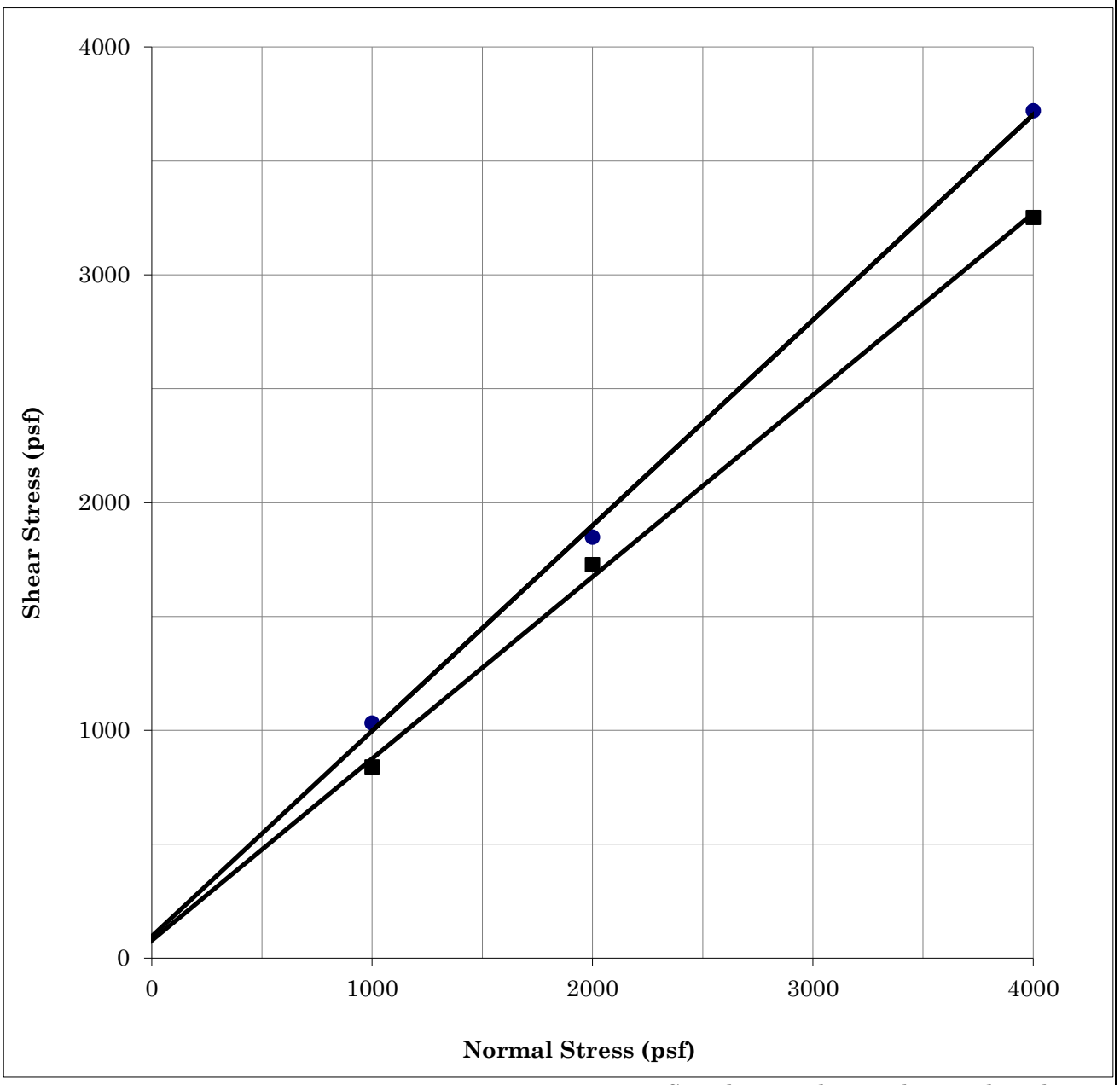
SAMPLE	SETTLEMENT AT 1,600 PSF LOAD (%)	COLLAPSE / SWELL* (%)	COLLAPSE INDEX, (I_C), (%)	DEGREE OF COLLAPSE**
B-1, 10’	12.5	+4.5	4.5	Moderate
B-5, 2’	1.1	-2.2	2.2	Moderate

* Percent collapse (-) or swell (+) measured when water added at 1,600 psf load during test procedure.

** Per Table 1, ‘Classification of Collapse Index, I_C,’ in ASTM Standard Test Method D5333-03.

None - 0%
Slight - 0.1 - 2.0%
Moderate - 2.1 - 6.0%
Moderately Severe - 6.1 - 10.0%
Severe - >10.0%

PLATE NO. 10



Shear Speed: 0.004 in. / min.

Samples tested in a submerged condition.

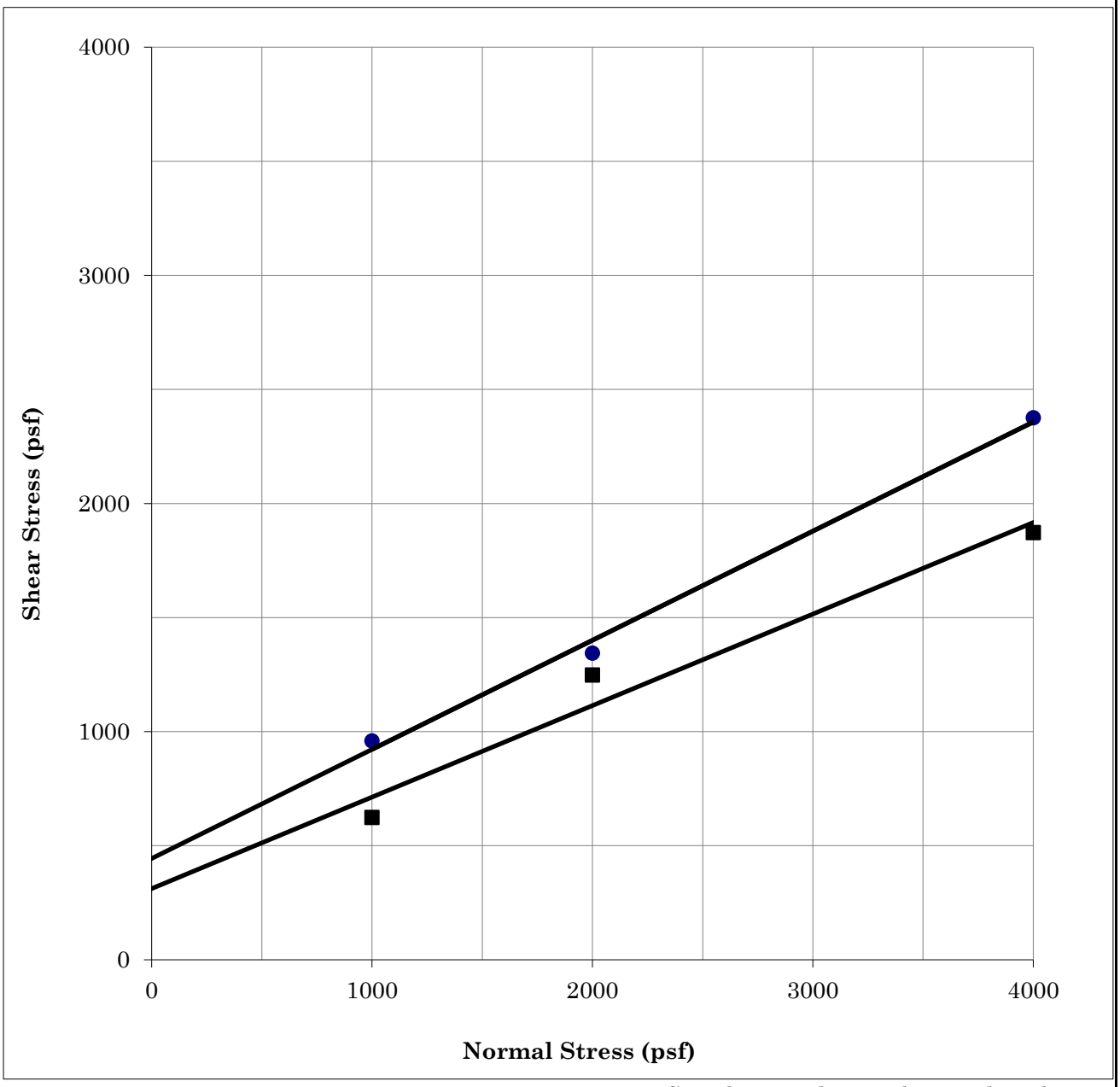
Average In-Situ Dry Density (pcf)	111.6	
Average In-Situ Moisture Content	2.6	
Saturated Moisture Content	13.6	

Peak •	Cohesion	96 psf
	Internal Friction Angle	42 degrees
Ultimate ■	Cohesion	78 psf
	Internal Friction Angle	39 degrees
Residual	Cohesion	
	Internal Friction Angle	

DIRECT SHEAR TEST RESULTS
(ASTM D3080 Test Method)

HILLTOP GEOTECHNICAL
INCORPORATED

SAMPLE:	B-2, 2.0'		
SOIL DESCRIPTION:	Silty, Fine to Coarse Sand, Tr. Gvl, Reddish Brown		
BY:	kb	DATE:	4/7/22
PROJECT NO.:	1448-01.2	PLATE NO.:	11



Shear Speed: 0.004 in. / min. Samples tested in a submerged condition.

Average In-Situ Dry Density (pcf)	103.7	
Average In-Situ Moisture Content	4.8	
Saturated Moisture Content	23.2	

Peak •	Cohesion	444 psf
	Internal Friction Angle	26 degrees
Ultimate ■	Cohesion	312 psf
	Internal Friction Angle	22 degrees
Residual	Cohesion	
	Internal Friction Angle	

DIRECT SHEAR TEST RESULTS
(ASTM D3080 Test Method)

HILLTOP GEOTECHNICAL INCORPORATED

SAMPLE:	B-4, 2.0'		
SOIL DESCRIPTION:	Silty, fine to coarse sand,trace clay, trace gravel to 3/4", Brown		
BY:	kb	DATE:	4/7/22
PROJECT NO.:	1448-01.2	PLATE NO.:	12

APPENDIX B

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