PETRA GEOSCIENCES INC.

SOLID AS A ROCK

PRELIMINARY GEOTECHNICAL EVALUATION
PROPOSED SHELF-STORAGE AND RV FACILITY
PARCEL 2 OF PARCEL MAP 20362, 9.6± ACRES AT THE SOUTHEAST CORNER OF SENECA ROAD AND PEARMAIN STREET, APN 3103-511-08
CITY OF ADELANTO, SAN BERNARDINO COUNTY, CALIFORNIA

ADELANTO SENECA LAND, LLC

November 17, 2023
J.N. 23-290

ENGINEERS + GEOLOGISTS + ENVIRONMENTAL SCIENTISTS

November 17, 2023
J.N. 23-290

ADELANTO SENECA LAND, LLC
10621 Civic Center Drive
Rancho Cucamonga, California 91730

Attention: Mr. Nolan Leggio

Subject: **Preliminary Geotechnical Evaluation: Proposed Shelf-Storage and RV Facility, Parcel 2 of Parcel Map 20362, 9.6± Acres at the Southeast corner of Seneca Road and Pearmain Street, APN 3103-511-08, City of Adelanto, San Bernardino County, California**

Dear Mr. Leggio:

Petra Geosciences, Inc. (Petra) is submitting herewith our preliminary geotechnical evaluation report for the proposed development of undeveloped land at the southeast corner of Seneca Road and Pearmain Street, in the city of Adelanto, San Bernardino County, California. This work was performed in general accordance with the scope of work outlined in our Proposal No. 23-290P, dated August 21, 2023. This report presents the results of our field explorations, infiltration evaluation, the requirements of the 2022 California Building Code (CBC) and our engineering judgment, opinions, conclusions, and recommendations pertaining to geotechnical design aspects for the proposed development.

It has been a pleasure to be of service to you on this project. Should you have questions regarding the contents of this report or should you require additional information, please contact this office.

Respectfully submitted,

PETRA GEOSCIENCES, INC.

Edward Lump, CEG
Associate Geologist

Grayson R. Walker, GE
Principal Engineer

TABLE OF CONTENTS

Page

INTRODUCTION 3
PURPOSE AND SCOPE OF SERVICES 3
SITE LOCATION AND DESCRIPTION 4
Historic Land Use 4
PROPOSED DEVELOPMENT 4
Literature Review 5
Subsurface Exploration 5
Laboratory Testing 5
FINDINGS 5
Regional Geologic Setting 5
Local Geology and Subsurface Soil Conditions 7
Surface Water 8
Groundwater 8
Faulting 9
Seismic Design Parameters 9
Discussion 12
CONCLUSIONS 13
Site Suitability 13
Primary Geologic/Geotechnical Considerations 13
Groundwater 13
Fault Rupture 13
Strong Ground Motions 13
Liquefaction, Landslides and Secondary Seismic Effects 13
Compressible Soils 14
Flooding 14
EARTHWORK RECOMMENDATIONS 14
General Earthwork Recommendations 14
Geotechnical Observations and Testing 15
Clearing and Grubbing 15
Excavation Characteristics 15
Ground Preparation - General 16
Ground Preparation - Building Pads and Canopy Foundations 16
Ground Preparation - Pavement 17
Suitability of Site Soils as Fill 17
Fill Placement 17
Import Soils for Grading 18
Shrinkage and Subsidence 18
Temporary Excavations 18
FOUNDATION DESIGN RECOMMENDATIONS 19
Allowable Soil Bearing Capacities 19
Estimated Footing Settlement 19
Lateral Resistance 19
Guidelines for Footings and Slab-on-Ground Design and Construction 20
Conventional Slab-on-Ground System 21
Footing Observations 23
PRELIMINARY PAVEMENT DESIGN RECOMMENDATIONS 23
Flexible Pavement 23

TABLE OF CONTENTS

Page

Rigid Pavement (Optional) 24
General Corrosivity Screening 24

INFILTRATION TEST RESULTS 26

POST-GRADING RECOMMENDATIONS 27
Site Drainage 27
Utility Trenches 27
Retaining Walls 28
Footing Embedment 28
Allowable Bearing Values and Lateral Resistance 28
Active Earth Pressures 28
Earthquake Loads 29
Backdrains 29
Waterproofing 30
Geotechnical Observation and Testing 30
Temporary Excavations 30
Wall Backfill 30
Masonry Block Screen Walls 31
Construction On or Near the Tops of Descending Slopes 31
Construction on Level Ground 31
Construction Joints 31

CONSTRUCTION SERVICES 31

LIMITATIONS 32

REFERENCES 33

ATTACHMENTS

FIGURES RW-1 – RW-3 – RETAINING WALL DETAILS

FIGURE 1 – SITE LOCATION MAP

FIGURE 2 – EXPLORATION LOCATION MAP

APPENDICES

APPENDIX A – FIELD EXPLORATION LOGS (TEST PITS)

APPENDIX B – LABORATORY TEST PROCEDURES / LABORATORY DATA SUMMARY

APPENDIX C – SEISMIC DESIGN PARAMETERS

APPENDIX D – INFILTRATION TEST RESULTS

APPENDIX E – STANDARD GRADING SPECIFICATIONS

PRELIMINARY GEOTECHNICAL EVALUATION
PROPOSED RV AND SELF- STORAGE FACILITY,
PARCEL 2 OF PARCEL MAP 20362, 9.6± ACRES AT THE
SOUTHEAST CORNER OF SENECA ROAD AND PEARMAIN STREET,
APN 3103-511-08, CITY OF ADELANTO,
SAN BERNARDINO COUNTY, CALIFORNIA

INTRODUCTION

Petra Geosciences, Inc. (Petra) is presenting herein the results of our preliminary geotechnical evaluation of the subject 9.6±-acre undeveloped property. Our geotechnical evaluation included a review of regional geological maps published by the California Geological Survey (CGS) and other sources that encompass the site, including review of limited historic aerial photos and online imagery (Google Earth Imagery, 1994-2022) in the vicinity of the project site. The scope of work included the excavation of six exploratory test pits and one infiltration test hole within the subject property.

PURPOSE AND SCOPE OF SERVICES

The purposes of this phase of evaluation were: to obtain information on the subsurface geologic and soil conditions within the project area; assess infiltration rates in anticipated basin locations; evaluate the field and laboratory data; and provide conclusions and recommendations for design and construction of the proposed building and other site improvements, as influenced by the subsurface conditions.

The scope of our evaluation consisted of the following:

- Reconnaissance of the site to evaluate existing conditions.
- Review of available published and unpublished data and maps concerning geologic and soil conditions within and adjacent to the site which could have an impact on the proposed improvements.
- Excavation of six exploratory test pits (TP-1 through TP-6), utilizing a conventional backhoe, to evaluate the stratigraphy of the subsurface soils and collect representative bulk samples for laboratory testing.
- Excavate one percolation test pit (P-1) by hand to conduct a percolation test in order to evaluate infiltration feasibility.
- Log and visually classify soil materials encountered in the borings in accordance with the Unified Soil Classification System.
- Conduct laboratory testing of representative samples (bulk) obtained from the test pits to determine their engineering properties.

- Perform engineering and geologic analysis of the data with respect to the proposed improvements.

- Preparation of this report, including pertinent figures and appendices, presenting the results of our evaluation and recommendations for the proposed improvements in general conformance with the requirements of the 2022 California Building Code (CBC), as well as in accordance with applicable local jurisdictional requirements.

SITE LOCATION AND DESCRIPTION

The subject property is an undeveloped, square-shaped property located west of Highway 395 and north of Highway 18 (Pearblossom Highway or Palmdale Road) in the city of Adelanto, California. The subject property is bounded on the north by Seneca Road with undeveloped property beyond; on the west by Pearmain Street with a residential tract beyond; and on the east and south by undeveloped land. Based upon topography provided on a conceptual basin plan by Encompass Associates, Inc. (2023), the site slopes gently to the north with existing elevations on the order of 3,098 feet above mean sea level (msl) to 3,108 feet above msl.

Overhead lines were noted offsite, on the north side of Seneca Road and on the west side of Highway 395. Concrete curb, gutter, and sidewalk do not exist along Seneca Road and Highway 395. A concrete curb and gutter exists on the east side of Pearmain Street. No above ground or underground utilities were observed within the perimeter of the subject property.

The subject property is covered with slightly to moderately dense native desert vegetation consisting of brush and short dry grasses. Dirt roads are common within the subject site, trending mostly northwest to southeast and extending offsite to the south toward commercial development. Dumped trash and debris is common within the subject property.

Historic Land Use

Information obtained from aerial photographs on Google Earth, the subject property was undeveloped land from at least May 1994 to May 2023. Site conditions appear to have been unchanged during this period.

PROPOSED DEVELOPMENT

Based upon a site conceptual plan by KTGY Architecture and Planning (dated May 31, 2023), the vacant land will be developed as an RV and self-storage facility. Development of the center of the subject site will be paved as site entry, driveways and 216 RV parking units, ranging in size from 12x30 feet to 13x80 feet, 56 of which will be covered, presumably by free-standing canopies supported on steel columns. The facility perimeter will include a total of 303 self-storage units, ranging in size from 5x5 feet to 10x40 feet, gated site access and the office are planned for the northeast corner of the parcel. Wash bays, an RV dump station, and stormwater basin are planned for the southeast portion of the site. Proposed elevations are not provided; however, we anticipate that the subject property will be graded for sheet flow to the water quality basin. A more recent preliminary storm water basin configuration plan by Encompass Associates, Inc. (2023), locates the proposed basin along the western portion of the north property boundary off Seneca Road.

Literature Review

It is our understanding that geotechnical reports pertaining to the subject property do not exist. Petra researched and reviewed available published and unpublished geologic data pertaining to regional geology, faulting, and geologic hazards that may affect the site. The results of this review are discussed under the Findings and Conclusions sections presented in this report.

Subsurface Exploration

A subsurface exploration program was performed, under the direction of an engineering geologist from Petra, on October 12, 2023. The exploration involved the excavation of six exploratory test pits (TP-1 through TP-6), utilizing a backhoe, to a maximum depth of approximately 8.5 feet below existing grade (bgs). An additional hand-dug test hole (P-1) was excavated to a depth of 3 feet for the purpose of conducting a shallow percolation test the same day. Earth materials encountered within the exploratory test pits were classified and logged by a geologist in accordance with the visual-manual procedures of the Unified Soil Classification System. Disturbed bulk samples of soil materials were collected for classification, laboratory testing and engineering analyses. The approximate locations of the exploratory borings are shown on Figure 2 (Field Exploration Map). The test pit and boring logs are presented in Appendix A.

Laboratory Testing

Maximum dry density and optimum moisture content, expansion index, and corrosion suite (sulfate content, chloride content, pH/resistivity) for selected samples of onsite soils materials was conducted. A description of laboratory test methods and summaries of the laboratory test data are presented in Appendix B.

FINDINGS

Regional Geologic Setting

Geologically, the site lies within the northern portion of the Mojave Desert Geomorphic Province (CGS, 2002), a broad interior region of isolated mountain ranges separated by expanses of desert plains. The province has interior enclosed drainage and many playas. This province is situated between the Garlock Fault (on the north) and the San Andreas Fault (on the west-southwest). The northern boundary of the Mojave Geomorphic Province is separated from the Basin and Range by the easterly extension of the Garlock Fault and is bounded by the Colorado Desert Geomorphic Province on the south and the Transverse Ranges Geomorphic Province on the west.

More specifically, the subject site is mapped as Recent unconsolidated silt, sand, and gravel derived from adjacent higher ground (Dibblee, Jr., 1960). A portion of this regional geologic map exhibiting the subject property location is provided below as Figure A. A more recent geologic map identifies the site as being underlain by Holocene-age Young Alluvial Fan deposits consisting of unconsolidated to slightly consolidated, boulder, cobble, sand, and silt deposits issued from a confined valley or canyon (Bedrossian, Hayhurst, and Roffers, 2010). The site does not lie within an Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007; CGS, 2023).

~Remainder of Page Intentionally Left Blank~

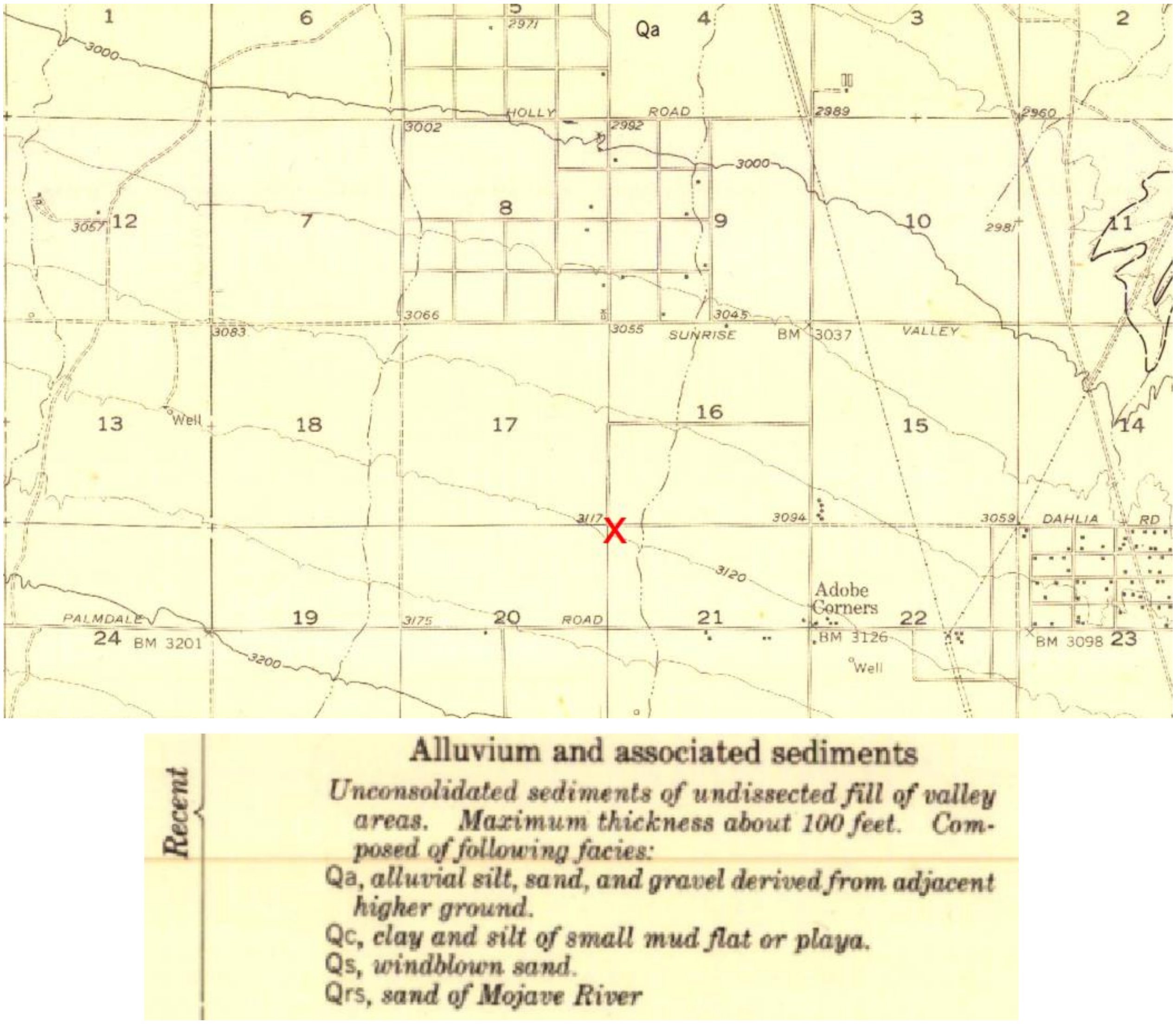


Figure A – Regional Geologic Map (Dibblee, Jr.,1960).

Local Geology and Subsurface Soil Conditions

Earth units encountered onsite consisted of a thin layer of topsoil overlying alluvial deposits. Where encountered onsite, the upper alluvial deposits consisting of yellowish brown, dry, silty fine-grain sand with trace coarse-grain sand and gravel up to 0.75 inch in dimension and contained common to trace concentrations of rootlets to a dept of approximately 3± feet. Between 3 and 7± feet bgs, soils consisted of mostly fine-to medium-grain sand with trace coarse-grain sand and gravel up to 0.50 inch in dimension. Hard, moderately cemented silty sand was commonly encountered below a depth of 7 feet bgs; although, this cemented layer was as shallow as 4 feet (TP-4) and as deep as 8 feet bgs (TP-2). The cemented layer was not encountered in TP-1. Logs of exploratory test pits are presented in Appendix A. Test pit locations are presented on the Test Pit Location Map (Figure 2).

Surface Water

No indication of surface water was observed on the property or in close proximity at the time of our site field exploration.

The subject property is situated within Flood Insurance Rate Map (FIRMette) 06071C5795H (dated August 28, 2008). The subject property is mapped within Zone D, an area defined as an area of undetermined flood hazard. The FIRMette map is provided below in Figure B.

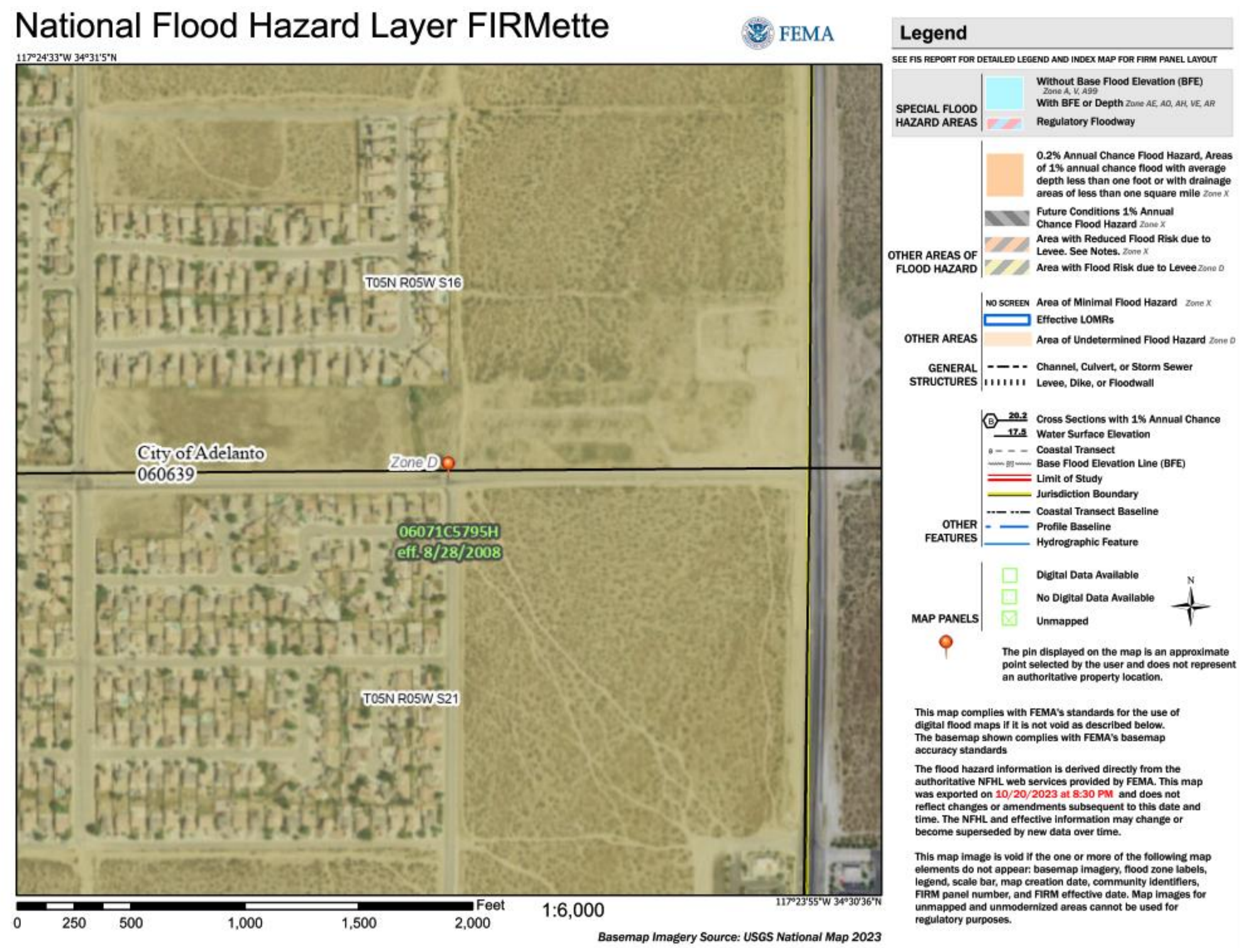


Figure B – National Flood Hazard Map (FEMA, 2023)

Groundwater

No groundwater was encountered in any of our test pits, excavated to the maximum depth of 9 feet below the ground surface (bgs). The site is located within the Upper Mojave River Valley Sub-basin 6-042

(California Department of Water Resources [CDWR, 2023], Water Data Library). No groundwater wells were observed or mapped on the property (CDWR, 2023).

Based on our review, the closest mapped well to the subject property (State Well ID: 05N05W22E002S) is reported approximately 1,900 feet to the southeast, near the corner of Highway 395 and Highway 18. Between February 1960 and April 2008, this well reported a depth to groundwater ranging from approximately 302 to 383 feet bgs.

In general, groundwater depth varies within the area and though flow direction specifically beneath the subject property is unknown, it is reasonable to estimate flow to follow regional topography to the north-northeast.

Faulting

Based on our review of the referenced geologic maps and literature, no active faults are known to project through the property. Furthermore, the site does not lie within the boundaries of an "Earthquake Fault Zone" as defined by the State of California in the Alquist-Priolo Earthquake Fault Zoning Act (CGS, 2018). The Alquist-Priolo Earthquake Fault Zoning Act (AP Act) defines an *active fault* as one that "has had surface displacement within Holocene time (about the last 11,000 years)." The main objective of the AP Act is to prevent the construction of dwellings on top of active faults that could displace the ground surface resulting in loss of life and property.

However, it should be noted that according to the USGS Unified Hazard Tool website, the 2010 CGS Fault Activity Map of California, and the CGS Earthquake Hazard Zones (EQZapp) interactive map (CGS, 2023), the San Bernardino North segment of the San Andreas Fault zone, located approximately 16 miles (25.63 kilometers) south of the site, would probably generate the most severe site ground motions and, therefore, is the majority contributor to the deterministic minimum component of the ground motion models.

Seismic Design Parameters

Earthquake loads on earthen structures and buildings are a function of ground acceleration which may be determined from the site-specific ground motion analysis. Alternatively, a design response spectrum can be developed for certain sites based on the code guidelines. To provide the design team with the parameters necessary to construct the design acceleration response spectrum for this project, we used two computer applications. Specifically, the first computer application, which was jointly developed by the Structural Engineering Association of California (SEAOC) and California's Office of Statewide Health Planning and Development (OSHPD), the SEAOC/OSHPD Seismic Design Maps Tool website, https://www.seismicmaps.org, is used to calculate the ground motion parameters. The second computer application, the United Stated Geological Survey (USGS) Unified Hazard Tool website, https://earthquake.usgs.gov/hazards/interactive/, is used to estimate the earthquake magnitude and the distance to surface projection of the fault.

To run the above computer applications, site latitude and longitude, seismic risk category and knowledge of site class are required. The site class definition depends on the direct measurement and the ASCE 7-16 recommended procedure for calculating average small-strain shear wave velocity, V_{s30}, within the upper 30 meters (approximately 100 feet) of site soils.

A seismic risk category of II was assigned for the proposed manager's residence building in accordance with 2022 CBC, Table 1604.5. No shear wave velocity measurement was performed at the site, however, the subsurface materials at the site appear to exhibit the characteristics of stiff soils condition for Site Class D designation. Therefore, an average shear wave velocity of 850 feet per second (259 meters per second) for the upper 100 feet was assigned to the site based on engineering judgment and geophysical experience. As such, in accordance with ASCE 7-16, Table 20.3-1, Site Class D (D- Default as per SEAOC/OSHPD software) has been assigned to the subject site.

The following table, Table 1, provides parameters required to construct the Seismic Response Coefficient – Natural Period, C_s – T, curve based on ASCE 7-16, Article 12.8 guidelines. A printout of the computer output is attached in Appendix C.

~Remainder of Page Intentionally Left Blank~

TABLE 1

Seismic Design Parameters

Ground Motion Parameters	Specific Reference	Parameter Value	Unit
Site Latitude (North)	-	34.5130	°
Site Longitude (West)	-	-117. 4029	°
Site Class Definition	Section 1613.2.2 (1), Chapter 20 (2)	D-Default (4)	-
Assumed Seismic Risk Category	Table 1604.5 (1)	II	-
M_w - Earthquake Magnitude	USGS Unified Hazard Tool (3)	7.99 (3)	-
R – Distance to Surface Projection of Fault	USGS Unified Hazard Tool (3)	25.63 (3)	km
S_s - Mapped Spectral Response Acceleration Short Period (0.2 second)	Figure 1613.2.1(1) (1)	1.244 (4)	g
S_1 - Mapped Spectral Response Acceleration Long Period (1.0 second)	Figure 1613.2.1(3) (1)	0.484 (4)	g
F_a – Short Period (0.2 second) Site Coefficient	Table 1613.2.3(1) (1)	1.2 (4)	-
F_v – Long Period (1.0 second) Site Coefficient	Table 1613.2.3(2) (1)	Null (4)	-
S_{MS} – MCE_R Spectral Response Acceleration Parameter Adjusted for Site Class Effect (0.2 second)	Equation 16-20 (1)	1.493 (4)	g
S_{M1} - MCE_R Spectral Response Acceleration Parameter Adjusted for Site Class Effect (1.0 second)	Equation 16-21 (1)	Null (4)	g
S_{DS} - Design Spectral Response Acceleration at 0.2-s	Equation 16-22 (1)	0.995 (4)	g
S_{D1} - Design Spectral Response Acceleration at 1-s	Equation 16-23 (1)	Null (4)	g
Domain of Constant Acceleration: $T_s = S_{D1}/S_{DS}$	Section 11.4.6 (2)	Null	s
Domain of Constant Acceleration: $T_o = 0.2\ S_{D1}/S_{DS}$	Section 11.4.6 (2)	Null	s
T_L - Long Period Transition Period	Figure 22-14 (2)	12 (4)	s
PGA - Peak Ground Acceleration Maximum Considered Earthquake Geometric Mean, MCE_G (*)	Figure 22-9 (2)	0.5	g
F_{PGA} - Site Coefficient Adjusted for Site Class Effect (2)	Table 11.8-1 (2)	1.2 (4)	-
PGA_M –Peak Ground Acceleration (2) Adjusted for Site Class Effect	Equation 11.8-1 (2)	0.6 (4)	g
Design PGA ≈ (⅔ PGA_M) - Slope Stability (†)	Similar to Eqs. 16-22 & 16-23 (2)	0.4	g
Design PGA ≈ (0.4 S_{DS}) – Short Retaining Walls (‡)	Equation 11.4-5 (2)	0.398	g
C_{RS} - Short Period Risk Coefficient	Figure 22-18A (2)	0.934 (4)	-
C_{R1} - Long Period Risk Coefficient	Figure 22-19A (2)	0.916 (4)	-
SDC - Seismic Design Category (§)	Section 1613.2.5 (1)	Null (4)	-

References:
(1) California Building Code (CBC), 2022, California Code of Regulations, Title 24, Part 2, Volume I and II.
(2) American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI), 2016, Minimum Design Loads and Associated Criteria for Buildings and Other Structures, Standards 7-16.
(3) USGS Unified Hazard Tool - https://earthquake.usgs.gov/hazards/interactive/ [Dynamic: Conterminous U.S. 2014 (update) (v4.2.0)]
(4) SEAOC/OSHPD Seismic Design Map Application – https://seismicmaps.org [Reference: ASCE 7-16]
Related References:
Federal Emergency Management Agency (FEMA), 2015, NEHRP (National Earthquake Hazards Reduction Program) Recommended Seismic Provision for New Building and Other Structures (FEMA P-1050).

Notes:
* PGA Calculated at the MCE return period of 2475 years (2 percent chance of exceedance in 50 years).
† PGA Calculated at the Design Level of ⅔ of MCE; approximately equivalent to a return period of 475 years (10 percent chance of exceedance in 50 years).
‡ PGA Calculated for short, stubby retaining walls with an infinitesimal (zero) fundamental period.
§ The designation provided herein may be superseded by the structural engineer in accordance with Section 1613.2.5.1, if applicable.

Discussion

General

Owing to the characteristics of the subsurface soils, as defined by Site Class D-Default designation, and proximity of the site to the sources of major ground shaking, the site is expected to experience strong ground shaking during its anticipated life span. Under these circumstances, where the code-specified design response spectrum may not adequately characterize site response, the 2022 CBC typically requires a site-specific seismic response analysis to be performed. This requirement is signified/identified by the "null" values that are output using SEAOC/OSHPD software in determination of short period, but mostly, in determination of long period seismic parameters, see Table 1.

For conditions where a "null" value is reported for the site, a variety of analytical design approaches are permitted by 2022 CBC and ASCE 7-16 (see Table 12.6-1)in lieu of a site-specific seismic hazard analysis. For any specific site, these alternative design approaches, which include Equivalent Lateral Force (ELF) procedure, Modal Response Spectrum Analysis (MRSA) procedure, Linear Response History Analysis (LRHA) procedure and Simplified Design procedure, among other methods, are expected to provide results that may or may not be more economical than those that are obtained if a site-specific seismic hazards analysis is performed. These design approaches and their limitations should be evaluated by the project structural engineer.

Seismic Design Category

Please note that the Seismic Design Category, SDC, is also designated as "null" in Table 1. For condition where the mapped spectral response acceleration parameter at 1 – second period, S_1, is less than 0.75, the 2022 CBC, Section 1613.2.5.1 allows that seismic design category to be determined from Table 1613.2.5(1) alone provided that all 4 requirements concerning fundamental period of structure, story drift, seismic response coefficient, and relative rigidity of the diaphragms are met. For this condition, Site Coefficient F_v, should be taken from Table 1613.2.3(2) for Site Class D, only for calculation of T_s.

Our interpretation of ASCE 7-16 is that for conditions where one or more of these 4 conditions are not met, seismic design category should be assigned based on: 1) 2022 CBC, Table 1613.2.5(1), 2) structure's risk category and 3) the value of S_{DS}, at the discretion of the project structural engineer.

Equivalent Lateral Force Method

As stated herein, the subject site is considered to be within a Site Class D-Stiff Soil. Per ASCE 7-16 Supplement 3, a site-specific ground motion hazard analysis is not required for structures on Site Class D-Stiff Soil with $S_1 \geq 0.2$ provided that the value of the parameter S_{M1} determined by Eq. (11.4-2) is increased by 50 percent for all applications of $S_{M1}$and structural design is performed in accordance with Equivalent Lateral Force (ELF) procedure.

CONCLUSIONS

Site Suitability

From a geotechnical engineering and engineering geologic point of view, the subject property is considered suitable for the proposed development provided the following conclusions and recommendations are incorporated into the design criteria and project specifications.

Primary Geologic/Geotechnical Considerations

Groundwater

Regional groundwater or perched groundwater was not encountered in any of our exploratory test pits or borings, excavated to a maximum depth of 8.5 feet below the ground surface. Data provided in nearby public wells indicates groundwater is at depths exceeding 200 feet bgs. As such, regional groundwater is not anticipated to affect the subject development.

Fault Rupture

The site is not located within a currently designated State of California Alquist-Priolo Earthquake Fault Zone (CGS, 2023), nor is it within a San Bernardino County Fault Zone (County of San Bernardino, 2010). In addition, no known active faults have been identified on the site. While fault rupture would most likely occur along previously established fault traces, fault rupture could occur at other locations. However, the potential for active fault rupture at the site is considered to be very low.

Strong Ground Motions

The site is located in a seismically active area of southern California and will likely be subjected to very strong seismically related ground shaking during the anticipated life span of the project. Structures within the site should therefore be designed and constructed to resist the effects of strong ground motion in accordance with the 2022 California Building Code (CBC) and the seismic parameters included in the recommendations section herein.

Liquefaction, Landslides and Secondary Seismic Effects

Groundwater exceed 200 feet below the ground surface and the proposed development is not mapped within a zone with an expected liquefaction susceptibility (County of San Bernardino, 2010). The potential for liquefaction is considered very unlikely.

The site and immediate area exhibit level topography that is not prone to landsliding. Secondary effects of seismic activity normally considered as possible hazards to a site include several types of ground failure. Such ground failures, which might occur as a consequence of severe ground shaking at the site, include ground subsidence, ground lurching and lateral spreading. The probability of occurrence of each type of ground failure depends on the severity of the earthquake, distance from faults, topography, subsoils, and groundwater conditions, in addition to other factors. Based on the site conditions, proposed grading, depth to groundwater exceeding 200 feet, and gentle topography across the site, landsliding, liquefaction, ground subsidence, ground lurching and lateral spreading are considered unlikely at the site. The potential for seismic flooding due to a tsunami or seiche is considered negligible.

Compressible Soils

The most significant geotechnical factor affecting the project site is the presence of near-surface compressible soil materials. Such native materials consist of surficial topsoil and alluvium and are not considered suitable for support of fill or structural loads. As such, the native soils in building and pavement areas are subject to remedial over-excavation and re-compaction, as noted in the Earthwork Recommendations section.

Flooding

As noted above, the subject property is situated within Flood Insurance Rate Map (FIRMette) 06071C5795H (dated August 28, 2008). The subject property is mapped within Zone D, an area defined as an area of undetermined flood hazard. The FIRMette map is provided in the Findings section as Figure B.

The California Department of Water Resources - Division of Dam Safety, Dam Breech Inundation Map Web Publisher (DDS, 2023) was reviewed for up-gradient dams that may represent a potential for flooding in the event of a breech. No dams were mapped and/or reported to affect the subject property.

EARTHWORK RECOMMENDATIONS

General Earthwork Recommendations

Earthwork should be performed in accordance with the Grading Code of the City of Adelanto and/or County of San Bernardino, in addition to the applicable provisions of the 2022 CBC. Grading should also be performed in accordance with the following site-specific recommendations prepared by Petra based on the proposed construction.

Geotechnical Observations and Testing

Prior to the start of earthwork, a meeting should be held at the site with the owner, contractor, and geotechnical consultant to discuss the work schedule and geotechnical aspects of the grading. Earthwork, which in this instance will generally entail removal and re-compaction of the near surface soils, should be accomplished under full-time observation and testing of the geotechnical consultant. A representative of the project geotechnical consultant should be present onsite during all earthwork operations to document proper placement and compaction of fills, as well as to document compliance with the other recommendations presented herein.

Clearing and Grubbing

All existing weeds, grasses, brush, shrubs, trees, tree stumps and root balls, and similar vegetation existing within areas to be graded should be stripped and removed from the site. Clearing operations should also include the removal of all trash, debris, vegetation, and similar deleterious materials. Any cavities or excavations created upon removal of existing brush or any unknown subsurface structures should be cleared of loose soil, shaped to provide access for backfilling and compaction equipment and then backfilled with properly compacted fill. Note that deleterious materials may be encountered within the site and may need to be removed by hand, i.e., root pickers, during the grading operations.

The project geotechnical consultant should provide periodic observation and testing services during clearing and grubbing operations to document compliance with the above recommendations. In addition, should unusual or adverse soil conditions or buried structures be encountered during grading that are not described herein, these conditions should be brought to the immediate attention of the project geotechnical consultant for corrective recommendations.

Excavation Characteristics

The existing site soil is expected to be excavated with conventional earthmoving equipment. However, zones of slightly to highly cemented soils were encountered at depths of 4 to 8 feet in five of the exploratory test pits, which may hamper excavation and/or require heavy duty equipment. Although oversize rocks (i.e., 12-inches in longest dimension or greater) were not encountered in our test pit or boring excavations, they may be locally associated with the native alluvial materials underlying the subject property and should be disposed of either offsite or properly buried within the planned deeper fills in an approved engineered fashion, a minimum of 5 feet below finish pad grades.

Ground Preparation - General

Our field evaluation revealed that near-surface soils within the areas of proposed construction generally exhibit low to moderate in-place densities and may contain some rootlets and other isolated organic material. These soils are typically subject to compression and settlement under the proposed foundation and slab loadings and, if left unmitigated and may result in excessive differential settlement beneath the proposed structures, associated foundations, and/or associated appurtenant improvements.

To create a uniform compacted fill mat below the proposed improvements and reduce the potential for distress due to excessive differential settlement, it is recommended that all near surface low-density native materials be removed to underlying competent alluvial materials and replaced as properly compacted fill materials.

It must be noted that the depths of remedial grading provided herein are estimates only and are based on conditions observed at the boring locations. Subsurface conditions can and usually do vary between points of exploration. For this reason, the actual removal depths will have to be determined on the basis of in-grading observations and testing performed by a representative of the project geotechnical consultant. The Client, civil engineer, and project grading contractor should allow contingencies for additional earthwork quantities should adverse conditions and deeper removals be required.

Ground Preparation - Building Pads and Canopy Foundations

Existing surficial native soils and any undocumented fill soils are considered unsuitable for support of proposed fills and structures, and should be removed to underlying competent native alluvial deposit materials. All existing low-density, compressible surficial soils in areas to receive compacted fill or to support the building pads should be removed to underlying competent soils as approved by the project geotechnical consultant.

Based on our subsurface assessment, remedial removal depths on the order of 3 to 4 feet below existing grades or proposed grades, whichever is deeper, are expected. Unsuitable soil removals may also need to be locally deeper, depending on the exposed conditions encountered during grading. Removals should extend at least 5 feet beyond the building or foundation limits. The actual depths and horizontal limits of removals and over-excavations should be evaluated during grading on the basis of observations and testing performed by the project geotechnical consultant.

Exposed competent bottom surfaces should have an in-situ density of at least 85 percent relative compaction and should be watered as necessary to achieve moisture conditions at least two percent above optimum and then compacted in-place to a relative compaction of 90 percent or more based on ASTM D 1557.

Prior to placing engineered fill, all exposed bottom surfaces in the removal areas should be approved by a representative of project geotechnical consultant and then scarified to a minimum depth of 12 inches, flooded with water and compacted with heavy vibratory equipment to achieve near-optimum moisture conditions and then compacted in-place to no less than 90 percent relative compaction.

Ground Preparation - Pavement

For proposed entry, driveways and RV stalls, the existing ground surfaces should be over-excavated to a minimum depth of 1.5 feet below the existing ground surface or 2 feet below the proposed subgrade elevations, whichever is deeper. After completion of over-excavation, the areas should be moisture-conditioned, and recompacted to a minimum 90 percent relative compaction. The excavated materials may be replaced as properly compacted fill. The horizontal limits of over-excavation should extend to a minimum horizontal distance of 1 foot beyond the perimeter of the proposed improvements.

All fills should be placed in 6- to 8-inch-thick maximum lifts, watered or air dried as necessary to achieve slightly above-optimum moisture conditions, and then compacted to a minimum relative compaction of 90 percent per ASTM D 1557. Note that the upper 12 inches of flexible or rigid pavement subgrade shall be compacted to no less than 95 percent relative compaction. The laboratory maximum dry density and optimum moisture content for each change in soil type should be determined in accordance with Test Method ASTM D 1557.

Suitability of Site Soils as Fill

Site soils are suitable for use in engineered fills provided they are clean from organics and/or debris. Wet alluvial soils may also be encountered during site grading (depending upon the time of year grading occurs) and may require drying back before being reused as fill. Oversize rock, exceeding 12 inches, should be excluded from placement in the upper 5 feet of the building pads.

Fill Placement

Fill materials should be placed in approximately 6- to 8-inch-thick loose lifts, watered or air-dried as necessary to achieve a moisture content approximately 2 percent above optimum moisture condition, and then compacted in-place to no less than 90 or 95 percent relative compaction, as indicated in the Ground

Preparation sections above. The laboratory maximum dry density and optimum moisture content for each major soil type should be determined in accordance with ASTM D 1557.

Import Soils for Grading

If imported soils are needed to achieve final design grades, import soils should be free of deleterious materials, oversize rock, and any hazardous materials. The soils should also be non-expansive and essentially non-corrosive and approved by the project geotechnical consultant *prior* to being brought onsite. The geotechnical consultant should inspect the potential borrow site and conduct testing of the soil at least three days before the commencement of import operations.

Shrinkage and Subsidence

Volumetric changes in earth quantities will occur when excavated onsite soils are replaced as properly compacted fill. A shrinkage factor of 10 to 15 percent may be assumed for the alluvial soil present onsite. Subsidence from scarification and re-compaction of exposed bottom surfaces in removal areas to receive fill is expected to vary from negligible to approximately 0.1 foot. The above estimates of shrinkage and subsidence are intended as an aid for project engineers in determining earthwork quantities. However, these estimates should not be considered as absolute values and should be used with some caution. Contingencies should be made for balancing earthwork quantities based on actual shrinkage and subsidence that occurs during the grading operations.

Temporary Excavations

Temporary excavations to a depth possibly as much as 4± feet below existing grades may be required to accommodate the recommended over-excavation of unsuitable materials. Based on the physical properties of the onsite cohesionless soils, temporary excavations which are constructed exceeding 4 feet in height should be cut back to a ratio of 1:1 (h:v) or flatter for the duration of the over-excavation of unsuitable soil material and replacement as compacted fill, as well as placement of underground utilities. However, the temporary excavations should be observed by a representative of the project geotechnical consultant for evidence of potential instability. Depending on the results of these observations, revised slope configurations may be necessary. Other factors which should be considered with respect to the stability of the temporary slopes include construction traffic and/or storage of materials on or near the tops of the slopes, construction scheduling, presence of nearby walls or structures on adjacent properties and weather conditions at the time of construction. Applicable requirements of the California Construction and General Industry Safety Orders, the Occupational Safety and Health act of 1970 and the Construction Safety Act should also be followed.

FOUNDATION DESIGN RECOMMENDATIONS

Allowable Soil Bearing Capacities

Pad Footings

An allowable soil bearing capacity of 1,500 pounds per square foot may be utilized for design of isolated 24-inch-square footings founded at a minimum depth of 12 inches below the lowest adjacent final grade for pad footings that are not a part of the slab system and are used for support of such features as roof overhang, second-story decks, patio covers, etc. This value may be increased by 20 percent for each additional foot of depth and by 10 percent for each additional foot of width, to a maximum value of 2,500 pounds per square foot. The recommended allowable bearing value includes both dead and live loads and may be increased by one-third for short duration wind and seismic forces.

Continuous Footings

An allowable soil bearing capacity of 1,500 pounds per square foot may be utilized for design of continuous footings founded at a minimum depth of 12 inches below the lowest adjacent final grade. This value may be increased by 20 percent for each additional foot of depth and by 10 percent for each additional foot of width, to a maximum value of 2,500 pounds per square foot. The recommended allowable bearing value includes both dead and live loads and may be increased by one-third for short duration wind and seismic forces.

Estimated Footing Settlement

Based on the allowable bearing values provided above, total static settlement of the footings under the anticipated loads is expected to be on the order of 3/4 inch. Differential settlement is expected to be less than 1/2 inch over a horizontal span of 20 feet. The majority of settlement is likely to take place as footing loads are applied or shortly thereafter.

Lateral Resistance

A passive earth pressure of 250 pounds per square foot per foot of depth, to a maximum value of 2,500 pounds per square foot, may be used to determine lateral bearing resistance for footings. The passive pressure values may be increased by one-third when designing for transient wind or seismic forces. In addition, a coefficient of friction of 0.30 times the dead load forces may be used between concrete and the supporting soils to determine lateral sliding resistance. It should be noted that the above values are based on the condition where footings are cast in direct contact with compacted fill or competent native soils. In cases where the footing sides are formed, all backfill placed against the footings upon removal of forms should be compacted to at least 90 percent of the applicable maximum dry density.

Guidelines for Footings and Slab-on-Ground Design and Construction

The results of our laboratory tests performed on representative samples of near-surface soils within the site during our evaluation indicate that these materials predominantly exhibit expansion indices that are less than 20. As indicated in Section 1803.5.3 of 2022 California Building Code (2022 CBC), these soils are considered non-expansive and, as such, the design of slabs on-ground is considered to be exempt from the procedures outlined in Sections 1808.6.2 of the 2022 CBC and may be performed using any method deemed rational and appropriate by the project structural engineer. However, the following minimum recommendations are presented herein for conditions where the project design team may require geotechnical engineering guidelines for design and construction of footings and slabs on-grade at the project site.

> *The design and construction guidelines that follow are based on the above soil conditions and may be considered for reducing the effects of variability in fabric, composition and, therefore, the detrimental behavior of the site soils such as excessive short- and long-term total and differential heave or settlement. These guidelines have been developed on the basis of the previous experience of this firm on projects with similar soil conditions. Although construction performed in accordance with these guidelines has been found to reduce post-construction movement and/or distress, they generally do not positively eliminate all potential effects of variability in soils characteristics and future heave or settlement.*
>
> *It should also be noted that the suggestions for dimension and reinforcement provided herein are performance-based and intended only as preliminary guidelines to achieve adequate performance under the anticipated soil conditions. However, they should not be construed as replacement for structural engineering analyses, experience, and judgment. The project structural engineer, architect and/or civil engineer should make appropriate adjustments to slab and footing dimensions, and reinforcement type, size and spacing to account for internal concrete forces (e.g., thermal, shrinkage and expansion), as well as external forces (e.g., applied loads) as deemed necessary. Consideration should also be given to minimum design criteria as dictated by local building code requirements.*

Conventional Slab-on-Ground System

Onsite soils exhibit an expansion index of less than 20 and are classified as non-expansive. Accordingly, we recommend that footings and floor slabs be designed and constructed in accordance with the following minimum criteria.

Footings

1. Exterior continuous footings supporting one- and two-story structures should be founded at a minimum depth of 12 inches below the lowest adjacent final grade. Interior continuous footings may be founded at a minimum depth of 10 inches below the top of the adjacent finish floor slabs. The width and spacing of interior continuous footings should be designed by the project structural engineer.

2. In accordance with Table 1809.7 of 2022 CBC for light-frame construction, all continuous footings should have minimum widths of 12 inches for one- and two-story construction. We recommend all continuous footings should be reinforced with a minimum of two No. 4 bars, one top and one bottom.

3. A minimum 12-inch-wide grade beam founded at the same depth as adjacent footings should be provided across the garage entrances or similar openings (such as large doors). The grade beam should be reinforced with a similar manner as provided above.

4. Interior isolated pad footings, if required, should be a minimum of 24 inches square and founded at a minimum depth of 12 inches below the bottoms of the adjacent floor slabs. Pad footings should be reinforced with No. 4 bars spaced a maximum of 18 inches on centers, both ways, placed near the bottoms of the footings.

5. Exterior isolated pad footings intended for support of colonnades, roof overhangs, upper-story decks, patio covers, and similar construction should be a minimum of 24 inches square and founded at a minimum depth of 18 inches below the lowest adjacent final grade. The pad footings should be reinforced with No. 4 bars spaced a maximum of 18 inches on centers, both ways, placed near the bottoms of the footings.

6. Exterior isolated pad footings may need to be connected to adjacent pad and/or continuous footings via tie beams at the discretion of the project structural engineer. Further, where excessive soils settlement issues have been identified for this site elsewhere in the report, it is strongly recommended to tie all footings both interior and exterior with a network of grade beams to reduce the potential differential settlement or isolated bearing distress issues below any independent footings.

7. The spacing and layout of the interior concrete grade beam system, if required below floor slabs, should be determined by the project structural engineer in accordance with the WRI publication.

8. The minimum footing dimensions and reinforcement recommended herein may be modified (increased or decreased subject to the constraints of Chapter 18 of the 2022 CBC) by the structural engineer responsible for foundation design based on his/her calculations, engineering experience, and judgment.

Building Floor Slabs

1. Concrete floor slabs should be a minimum of 4 inches thick and reinforced with a minimum of No. 3 bars spaced a maximum of 24 inches on centers, both ways. Alternatively, the structural engineer may recommend the use of prefabricated welded wire mesh for slab reinforcement. For this condition, the welded wire mesh should be of sheet type (not rolled) and should consist of 6x6/W2.9xW2.9 (per the Wire Reinforcement Institute, WRI, designation) or stronger. All slab reinforcement should be properly supported to ensure the desired placement near mid-depth. Care should be exercised to prevent warping of the welded wire mesh between the chairs in order to ensure its placement at the desired mid-slab position. Slab dimension, reinforcement type, size and spacing need to account for internal concrete forces (e.g., thermal, shrinkage and expansion) as well as external forces (e.g., applied loads), as deemed necessary.

   It should be noted that some of the non-climatic site parameters, which may impact slabs on-grade performance, are not known at this time, as it is the case for many projects at the design stage. Some of these site parameters include unsaturated soils diffusion conditions pre- and post-construction (e.g., casting the slabs at the end of long, dry or wet periods, maintenance during long, dry and wet periods, etc.), landscaping, alterations in site surface gradient, irrigation, trees, etc. While the effects of any or a combination of these parameters on slab performance cannot be accurately predicted, maintaining moisture content equilibrium within the soils mass and planting trees at a distance greater than half of their mature height away from the edge of foundation may reduce the potential for the adverse impact of these site parameters on slabs on-grade performance.

2. Concrete floor slabs to receive moisture sensitive floor covering should be underlain with a moisture vapor retarder consisting of a minimum 10-mil-thick polyethylene or polyolefin membrane that meets the minimum requirements of ASTM E96 and ASTM E1745 for vapor retarders (such as Husky Yellow Guard®, Stego® Wrap, or equivalent). All laps within the membrane should be sealed, and at least 2 inches of clean sand should be placed over the membrane to promote uniform curing of the concrete.

   In general, to reduce the potential for punctures, the membrane should be placed on a pad surface that has been graded smooth without any sharp protrusions. If a smooth surface cannot be achieved by grading, consideration should be given to lowering the pad finished grade an additional inch and then placing a 1-inch-thick leveling course of sand across the pad surface prior to the placement of the membrane. Foot traffic on the membrane should be reduced to a minimum. Additional steps would also need to be taken to prevent puncturing of the vapor retarder during concrete placement.

   At the present time, some slab designers, geotechnical professionals and concrete experts view the sand layer below the slab (blotting sand) as a place for entrapment of excess moisture that could adversely impact moisture-sensitive floor coverings. As a preventive measure, the potential for moisture intrusion into the concrete slab could be reduced if the concrete is placed directly on the vapor retarder. However, if this sand layer is omitted, appropriate curing methods must be implemented to ensure that the concrete slab cures uniformly. A qualified contractor with experience in slab construction and curing should provide recommendations for alternative methods of curing and supervise the construction process to ensure uniform slab curing.

3. Presaturation of the subgrade below floor slabs will not be required; however, prior to placing concrete, the subgrade below all dwelling and garage floor slab areas should be thoroughly moistened to achieve a moisture content that is at least equal to or slightly greater than optimum moisture content. This moisture content should penetrate to a minimum depth of 12 inches below the bottoms of the slabs.

4. The minimum dimensions and reinforcement recommended herein for building floor slabs may be modified (increased or decreased subject to the constraints of Chapter 18 of the 2022 CBC) by the structural engineer responsible for foundation design based on his/her calculations, engineering experience, and judgment.

Footing Observations

Foundation footing trenches should be observed by the project geotechnical consultant to document the trenches expose competent bearing-soils. The foundation excavations should be observed prior to the placement of forms, reinforcement, or concrete. The excavations should be trimmed neat, level, and square. Prior to placing concrete, all loose, sloughed, or softened soils and/or construction debris should be removed. Excavated soil derived from footing and utility trench excavations should not be placed in slab-on-grade areas unless the soils are compacted to a relative compaction of 90 percent or more.

PRELIMINARY PAVEMENT DESIGN RECOMMENDATIONS

Flexible Pavement

Based on experience with similar sites, an R-value of 50 was estimated for the subject site. Assumed traffic indices (TI) for the various pavement areas include: 5.0 for the RV parking stalls; 5.5 for the interior access and entry; and 6.5 for the widening of offsite Seneca Road and Pearmain Street. The traffic indices, along with the estimated design R-value, were utilized for preliminary pavement section design. The following pavement sections have been computed in accordance with Caltrans design procedures and presented in the following table, Table 2.

TABLE 2

Preliminary Pavement Sections

Location	Design R-value	Traffic Index	Pavement Section
RV Parking Stalls	50	5.0	3 in. AC / 4 in. AB
Entry and Interior Access	50	5.5	3 in. AC / 4 in. AB
Seneca Road and Pearmain Street	50	6.5	4 in. AC / 4 in. AB

Notes:
AC = Asphalt Concrete
AB = Aggregate Base

The upper 12 inches of subgrade soils immediately below the aggregate base (base) or full-depth asphalt concrete section should be compacted to 95 percent or more relative compaction based on ASTM D 1557 to a depth of 12 inches or more. Final subgrade compaction should be performed prior to placing base and after utility trench backfills have been compacted and tested. Subgrade shall be firm and unyielding, as exhibited by proof-rolling, prior to placement of asphalt concrete. Asphalt-concrete materials and construction should conform to Section 203 of the Greenbook.

Base materials should consist of Caltrans class 2 aggregate base. Base materials should be compacted to 95 percent or more relative compaction based on ASTM D 1557. The base materials should be near optimum-moisture content when compacted. Asphalt-concrete materials and construction should conform to Section 203 of the Greenbook.

Rigid Pavement (Optional)

Rigid pavement, i.e., portland cement concrete, may be used throughout the interior of the site as an alternative to flexible pavement. The concrete pavement may be constructed directly on compacted subgrade soils.

Concrete pavement should have a minimum thickness of 5 inches and be provided with control joints spaced at maximum 10-foot intervals. Reinforcement should consist of a minimum of #4 bars spaced 24 inches on centers, both ways. The reinforcement should be properly positioned near the middle of the slabs. The concrete should exhibit a minimum 28-day unconfined compressive strength of 3,250 psi.

The subgrade soils underlying the concrete pavement should be compacted as indicated in the prior Ground Preparation – Pavement section. Final preparation of the pavement subgrade shall consist of moisture-conditioning the upper 12 inches of the subgrade soils to attain a moisture content approximately equal to the optimum moisture content and then compacting to a minimum 95 percent relative compaction.

General Corrosivity Screening

As a screening level study, limited chemical and electrical tests were performed on samples considered representative of the onsite soils to identify potential corrosive characteristics of these soils. The common indicators that are generally associated with soil corrosivity, among other indicators, include water-soluble sulfate (a measure of soil corrosivity on concrete), water-soluble chloride (a measure of soil corrosivity on metals embedded in concrete), pH (a measure of soil acidity), and minimum electrical resistivity (a measure of corrosivity on metals embedded in soils). Test methodology and results are presented in Appendix B.

It should be noted that Petra does not practice corrosion engineering; therefore, the test results, opinion and engineering judgment provided herein should be considered as general guidelines only. Additional analyses, and/or determination of other indicators, would be warranted, especially, for cases where buried metallic building materials (such as copper and cast or ductile iron pipes) in contact with site soils are planned for the project. In many cases, the project geotechnical engineer may not be informed of these choices. Therefore, for conditions where such elements are considered, we recommend that other, relevant project design professionals (e.g., the architect, landscape architect, civil and/or structural engineer, etc.) to be involved. We also recommend considering a qualified corrosion engineer to conduct additional sampling and testing of near-surface soils during the final stages of site grading to provide a complete assessment of soil corrosivity. Recommendations to mitigate the detrimental effects of corrosive soils on buried metallic and other building materials that may be exposed to corrosive soils should be provided by the corrosion engineer as deemed appropriate.

In general, a soil's water-soluble sulfate levels and pH relate to the potential for concrete degradation; water-soluble chlorides in soils impact ferrous metals embedded or encased in concrete, e.g., reinforcing steel; and electrical resistivity is a measure of a soil's corrosion potential to a variety of buried metals used in the building industry, such as copper tubing and cast or ductile iron pipes. Table 3, below, presents test results with an interpretation of current code approach and guidelines that are commonly used in building construction industry. The table includes the code-related classifications of the soils as they relate to the various tests, as well as a general recommendation for possible mitigation measures in view of the potential adverse impact of corrosive soils on various components of the proposed structures in direct contact with site soils. The guidelines provided herein should be evaluated and confirmed, or modified, in their entirety by the project structural engineer, corrosion engineer and/or the contractor responsible for concrete placement for structural concrete used in exterior and interior footings, interior slabs on-ground, garage slabs, wall foundations and concrete exposed to weather such as driveways, patios, porches, walkways, ramps, steps, curbs, etc.

TABLE 3

Soil Corrosivity Screening Results

Test (Test Method Designation)	Test Results	Classification	General Recommendations
Soluble Sulfate (Cal 417)	SO_4^{2-} < 0.10 % by weight	**S0(1) - Not Applicable**	Type II cement; minimum f_c' = 2,500 psi; no water/cement ratio restrictions.
pH (Cal 643)	8.5 – 9.0	**Strongly Alkaline(3)**	No special recommendations
Soluble Chloride (Cal 422)	Cl^{1-} < 500 ppm	**C1(2) - Moderate**	Residence: No special recommendations; f_c' should not be less than 2,500 psi.
Resistivity (Cal 643)	5,000 – 10,000	**Moderately Corrosive(5)**	Protective wrapping/coating of buried pipes; corrosion resistant materials

Notes:
1. ACI 318-14, Section 19.3
2. ACI 318-14, Section 19.3
3. Pierre R. Roberge, "Handbook of Corrosion Engineering"
4. Exposure classification C2 applies specifically to swimming pools and appurtenant concrete elements
5. f_c', 28-day unconfined compressive strength of concrete

INFILTRATION TEST RESULTS

Detailed plans for development of the subject property were not available at the time of our initial field work; however, conceptual plans were subsequently provided with a tentative location for a water quality basin by the design civil engineer. One feasibility percolation test was conducted to assess infiltration rates of the near-surface onsite soils for preliminary design of detention basins to manage storm water runoff. The test location in presented in Figure 2.

Due to breakdown of the backhoe, the initial infiltration test hole (P-1) was excavated by hand on October 12, 2023. A 12-inch diameter hole was hand excavated to 2.6 feet bgs and 2.6 feet of perforated pipe embedded in pea gravel was placed to the surface in the hand excavation. Pre-soaking and testing were conducted at a depth of 0 to 2.6 feet using the Falling Head Test Method (RCFCD, 2011). The hole was pre-soaked immediately after excavation. The infiltration rate was then calculated using the Porchet Method (RCFCD, 2011), commonly called the "inversed auger-hole method."

Soils encountered in the test location consisted generally of fine- to medium-grained silty sand with minor gravel. The test location is shown in Figure 2. Test pit and boring logs are provided in Appendix A. The un-factored infiltration test rate result is presented below in Table 4, and test data are provided in Appendix D. The on-site geologic conditions and the feasibility test results indicate the site is feasible for onsite stormwater infiltration.

TABLE 4

Summary of Infiltration Rates

Percolation Test	Depth of Test (feet below surface)	Percolation Rate (minutes/inch)	Infiltration Rate (inches/hour)
P-1	0 to 2.6	21.9	1.9

POST-GRADING RECOMMENDATIONS

Site Drainage

Surface drainage systems consisting of sloping concrete flatwork, graded earth swales and/or an underground area drain system are anticipated to be constructed to collect and direct all surface waters to the adjacent streets and storm drain facilities. In addition, the ground surface around the proposed buildings should be sloped at a positive gradient away from the structures. The purpose of the precise grading is to prevent ponding of surface water within the level areas of the site and against building foundations and associated site improvements. The drainage systems should be properly maintained throughout the life of the proposed development.

It should be emphasized that the slopes away from the structures area drain inlets and storm drain structures to be properly maintained, not to be obstructed, and that future improvements not to alter established gradients unless replaced with suitable alternative drainage systems.

Utility Trenches

Utility-trench backfill within street rights-of-way, utility easements, under sidewalks, driveways and building-floor slabs should be compacted to a minimum relative compaction of 90 percent (or more). Where onsite soils are utilized as backfill, mechanical compaction should be used. Density testing, along with probing, should be performed by the project geotechnical consultant or his representative to document adequate compaction. Utility-trench sidewalls deeper than about 4 feet should be laid back at a ratio of 1:1 (h:v) or flatter or shored. A trench box may be used in lieu of shoring. If shoring is anticipated, the project geotechnical consultant should be contacted to provide design parameters.

For trenches with vertical walls, backfill should be placed in approximately 1- to 2-foot-thick loose lifts and then mechanically compacted with a hydra-hammer, pneumatic tampers, or similar compaction equipment. For deep trenches with sloped walls, backfill materials should be placed in approximately 8- to 12-inch-thick loose lifts and then compacted by rolling with a sheepsfoot tamper or similar equipment.

Where utility trenches are proposed in a direction that parallels any building footing (interior and/or exterior trenches), the bottom of the trench should not be located within a 1:1 (h:v) plane projected downward from the outside bottom edge of the adjacent footing.

Retaining Walls

In the event retaining walls are utilized in the development, the following design criteria is recommended.

Footing Embedment

The base of retaining-wall footings constructed on level ground may be founded at a depth of 12 inches or more below the lowest adjacent final grade for low height walls. Where retaining walls are proposed on or within 15 feet from the top of adjacent descending fill slope, the footings should be deepened such that a horizontal clearance of 7 feet or more is maintained between the outside bottom edges of the footings and the face of the slope. The above-recommended footing setback is preliminary and may be revised based on site-specific soil conditions. Footing trenches should be observed by the project geotechnical representative to document that the footing trenches have been excavated into competent bearing soils and to the embedment recommended above. These observations should be performed prior to placing forms or reinforcing steel.

Allowable Bearing Values and Lateral Resistance

Retaining wall footings may be designed using the allowable bearing values and lateral resistance values provided previously for building foundations; however, when calculating passive resistance, the resistance of the upper 6 inches of the soil cover in front of the wall should be ignored in areas where the front of the wall will not be covered with concrete flatwork.

Active Earth Pressures

As of the date of this report, it is uncertain whether the proposed retaining walls will be backfilled with on-site soils or imported granular materials. For this reason, active and at-rest earth pressures are provided below for both conditions. However, considering that the onsite earth materials have an expansion index of 0 to 20, the use of imported granular materials for backfilling behind the retaining walls as described in the following sections is optional.

1. Onsite Soils Used for Backfill

   Onsite soils have an expansion index of less than 20, classifying the material as non-expansive. Therefore, active earth pressures equivalent to fluids having a density of 35 psf/ft and 51 psf/ft should be used for design of cantilevered walls retaining a level backfill and ascending 2:1 backfill, respectively. For walls that are restrained at the top, at-rest earth pressures of 53 pounds per cubic foot (equivalent fluid pressures) should be used. The above values are for retaining walls that have been supplied with a suitable backdrain. All walls should be designed to support any adjacent structural surcharge loads imposed by other nearby walls or footings in addition to the above recommended active and at-rest earth pressures.

2. Imported Sand, Pea Gravel or Rock Used for Wall Backfill

   Imported clean sand exhibiting a sand equivalent value (SE) of 30 or greater, pea gravel or crushed rock may be used for wall backfill to reduce the lateral earth pressures provided these granular backfill materials extend behind the walls to a minimum horizontal distance equal to one-half the wall height. In addition, the sand, pea gravel or rock backfill materials should extend behind the walls to a minimum horizontal distance of 2 feet at the base of the wall or to a horizontal distance equal to the heel width of the footing, whichever is greater. For the above conditions, cantilevered walls retaining a level backfill and ascending 2:1 backfill may be designed to resist active earth pressures equivalent to fluids having densities of 30 and 41 pounds per cubic foot, respectively. For walls that are restrained at the top, at-rest earth pressures equivalent to fluids having densities of 45 and 62 pounds per cubic foot are recommended for design of restrained walls supporting a level backfill and ascending 2:1 backfill, respectively. These values are also for retaining walls supplied with a suitable backdrain. Furthermore, as with native soil backfill, the walls should be designed to support any adjacent structural surcharge loads imposed by other nearby walls or footings in addition to the recommended active and at-rest earth pressures.

All structural calculations and details should be provided to the project geotechnical consultant for verification purposes prior to grading and construction phases.

Earthquake Loads

Section 1803.5.12 of the 2022 CBC requires the determination of lateral loads on retaining walls from earthquake forces for structures in seismic design categories D through E that are supporting more than six feet of backfill height. Recommendations for design of walls exceeding six feet in height can be provided once retaining walls plans are available for review.

Backdrains

To reduce the likelihood of the entrapment of water in the backfill soils, weepholes or open vertical masonry joints may be considered for retaining walls not exceeding a height of 3 feet. Weepholes, if used, should be 3-inches minimum diameter and provided at intervals of 6 feet or less along the wall. Open vertical masonry joints, if used, should be provided at 32-inch intervals. A continuous gravel fill, 3 inches by 12 inches, should be placed behind the weepholes or open masonry joints. The gravel should be wrapped in filter fabric to prevent infiltration of fines and subsequent clogging of the gravel. Filter fabric may consist of Mirafi 140N or equivalent.

A perforated pipe-and-gravel backdrain should be constructed behind retaining walls exceeding a height of 3 feet. Perforated pipe should consist of 4-inch-minimum diameter PVC Schedule 40, or ABS SDR-35, with the perforations laid down. The pipe should be encased in a 1-foot-wide column of ¾-inch to 1½-inch open-graded gravel. If on-site soils are used as backfill, the open-graded gravel should extend above the wall footings to a minimum height equal to one-third the wall height or to a minimum height of 1.5 feet above the footing, whichever is greater. The open-graded gravel should be completely wrapped in filter fabric consisting of Mirafi 140N or equivalent. Solid outlet pipes should be connected to the subdrains and then routed to a suitable area for discharge of accumulated water.

Waterproofing

The backfilled sides of retaining walls should be coated with an approved waterproofing compound or covered with a similar material to inhibit migration of moisture through the walls.

Geotechnical Observation and Testing

All grading associated with retaining wall construction, including backcut excavations, observation of the footing trenches, installation of the backdrain systems, and placement of backfill should be provided by a representative of the project geotechnical consultant.

Temporary Excavations

Temporary slopes may be cut at a gradient no steeper than 1:1 (h:v). However, the project geotechnical engineer should observe temporary slopes for evidence of potential instability. Depending on the results of these observations, flatter slopes may be necessary. The potential effects of various parameters such as weather, heavy equipment travel, storage near the tops of the temporary excavations and construction scheduling should also be considered in the stability of temporary slopes.

Wall Backfill

Recommended active and at-rest earth pressures for design of retaining walls are based on the physical and mechanical properties of the onsite soil materials. The backfill behind the proposed retaining walls, they should be placed in approximately 6- to 8-inch-thick maximum lifts, watered as necessary to achieve near optimum moisture conditions, and then mechanically compacted in place to a minimum relative compaction of 90 percent. Flooding or jetting of the backfill materials should be avoided. A representative of the project geotechnical consultant should observe the backfill procedures and test the wall backfill to verify adequate compaction.

Masonry Block Screen Walls

Construction On or Near the Tops of Descending Slopes

Continuous footings for masonry walls proposed on or within 5 feet from the top of a descending cut or fill slope should be deepened such that a horizontal clearance of 5 feet is maintained between the outside bottom edge of the footing and the slope face. The footings should be reinforced with two No. 4 bars, one top and one bottom. Plans for top-of-slope masonry walls proposing pier and grade beam footings should be reviewed by the project geotechnical consultant prior to construction.

Construction on Level Ground

Where masonry walls are proposed on level ground and 5 feet or more from the tops of descending slopes, the footings for these walls may be founded 18 inches or more below the lowest adjacent final grade. These footings should also be reinforced with two No. 4 bars, one top and one bottom.

Construction Joints

In order to reduce the potential for unsightly cracking related to the effects of differential settlement, positive separations (construction joints) should be provided in the walls at horizontal intervals of approximately 20 to 25 feet and at each corner. The separations should be provided in the blocks only and not extend through the footings. The footings should be placed monolithically with continuous rebars to serve as effective "grade beams" along the full lengths of the walls.

CONSTRUCTION SERVICES

This report has been prepared for the exclusive use of Adelanto Seneca Land, LLC to assist the project engineers and architect in the design of the proposed development. It is recommended that Petra be engaged to review the final-design drawings and specifications prior to construction. This is to document that the recommendations contained in this report have been properly interpreted and are incorporated into the project specifications. If Petra is not accorded the opportunity to review these documents, we can take no responsibility for misinterpretation of our recommendations.

We recommend that Petra be retained to provide soil-engineering services during construction of the excavation and foundation phases of the work. This is to observe compliance with the design, specifications, or recommendations and to allow design changes if subsurface conditions differ from those anticipated prior to start of construction.

If the project plans change significantly (e.g., building loads or type of structures), we should be retained to review our original design recommendations and their applicability to the revised construction. If conditions are encountered during construction that appear to be different than those indicated in this report, this office should be notified immediately. Design and construction revisions may be required.

LIMITATIONS

This report is based on the project, as described, and the geotechnical data obtained from the field tests performed and our laboratory test data. The materials encountered on the project site and utilized in our laboratory evaluation are believed representative of the total area. However, soil materials can vary in characteristics between excavations, both laterally and vertically.

The conclusions and opinions contained in this report are based on the results of the described geotechnical evaluations and represent our professional judgment. The findings, conclusions and opinions contained in this report are to be considered tentative only and subject to confirmation by the undersigned during the construction process. Without this confirmation, this report is to be considered incomplete and Petra or the undersigned professionals assume no responsibility for its use. In addition, this report should be reviewed and updated after a period of 1 year or if the site ownership or project concept changes from that described herein.

The professional opinions contained herein have been derived in accordance with current standards of practice and no warranty is expressed or implied.

Respectfully submitted,
PETRA GEOSCIENCES, INC.

Edward Lump
Associate Geologist
CEG 1924

REGISTERED GEOLOGIST
EDWARD P. LUMP
No. 1924
Certified Engineering Geologist
STATE OF CALIFORNIA

11/17/23

Grayson R. Walker
Principal Engineer
GE 871

REGISTERED PROFESSIONAL ENGINEER
GRAYSON R. WALKER
GE 871
GEOTECHNICAL
STATE OF CALIFORNIA

EL/GRW/lv

Distribution: (1) Addressee
(1) Jake Sowder

W:\2020-2025\2023\200\23-290\Reports\23-290 110 Prelim Geotechnical Evaluation.docx

REFERENCES

American Concrete Institute, 2008, Building Code Requirements for Structural Concrete (ACI 318-08) and Commentary.

American Society for Testing and Materials (ASTM) – Standard – Section Four – Construction, Volume 04.08 Soil and Rock

American Society of Civil Engineers (ASCE) 7-05 Minimum Design Loads for Buildings and Other Structures.

Bedrossian, T.L., Hayhurst, C.A., and Roffers, P.D., 2010, Geologic Compilation of Quaternary Surficial Deposits in Southern California, San Bernardino 30' x 60' Quadrangle, CGS Special Report 217, Plate 13, July.

Bryant, W.A., and Hart, E.W., 2007, Fault-Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps, California Geological Survey, Special Publication 42.

California Building Code (2022), California Code of Regulations, Title 24, Par 2, Volume 2 of 2, Based on the 2021 International Building Code, California Building Standards Commission.

California Department of Water Resources, 2023, Water Data Library, http://www.water.ca.gov/waterdatalibrary/groundwater/.

California Geological Survey (CGS), 2023, California Earthquake Hazards Zone Application (EQ Zapp), https://www.conservation.ca.gov/cgs/geohazards/eq-zapp, searched October.

Cao, T., et al., 2003, Revised 2002 California Probabilistic Seismic Hazard Maps, June 2003: California Geological Survey.

Federal Emergency Management Agency (FEMA), 2008, Flood Insurance Rate Map (FIRMette), San Bernardino County, California and Incorporated Areas, Map Number 06071C8656H and 06071C8657H, revised August 28.

Dibblee, T.W., Jr, 1960, Preliminary Geologic Map of the Victorville Quadrangle, California, Mineral Investigations Field Studies Map, MF-229.

Google Earth™ 2023, by Google Earth, Inc., http://www.google.com/earth/index.html, accessed June.

Greenbook, 2012, Standard Specifications for Public Works Construction, by Public Works Standards, Inc., BNI Publishers.

International Conference of Building Officials, 1998, "Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada", California Division of Mines and Geology.

Jennings, C.W. and Bryant, W.A., 2010, *Fault Activity Map of California*: California Geological Survey, Geologic Data Map No. 6.

Office of Statewide Health Planning and Development (OSHPD), 2021, Seismic Design Maps, U.S. Seismic Design Maps (seismicmaps.org)

Riverside County Flood Control, 2011, Low Impact Development BMP Design Handbook, Appendix A, Infiltration Testing, dated September.

REFERENCES

San Bernardino County, 2010, County Land Use Plan, General Plan, Geologic Hazard Overlays, Devore Sheet, FH21 C, plot date March 9.

Southern California Earthquake Center (SCEC), 1999, Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction Hazards in California: organized through the Southern California Earthquake Center, University of Southern California.

Southern California Earthquake Data Center (SCEDC), 2014, http://www.data.scec.org/significant/index.html.
Tokimatsu, K.; Seed, H.B.; 1987; Evaluation of settlements in sands due to earthquake shaking; Journal of Geotechnical Engineering: Vol. 113, No. 8, p. 861-879.

United States Geologic Survey (U.S.G.S.), 1996a, Probabilistic Seismic Hazard Assessment for the State of California, Open-File Report 96-706.

______, 1996b, National Seismic-Hazards Maps, Open-File Report 96-532.

______, 2002, Documentations for the 2002 Update of the National Seismic Hazard Maps, Open-File Report 02-20.

______, 2007, Preliminary Documentation for the 2007 Update of the United States National Seismic Hazard Maps, Seismic Hazards Mapping Project, Open-File Report 2007-June Draft.

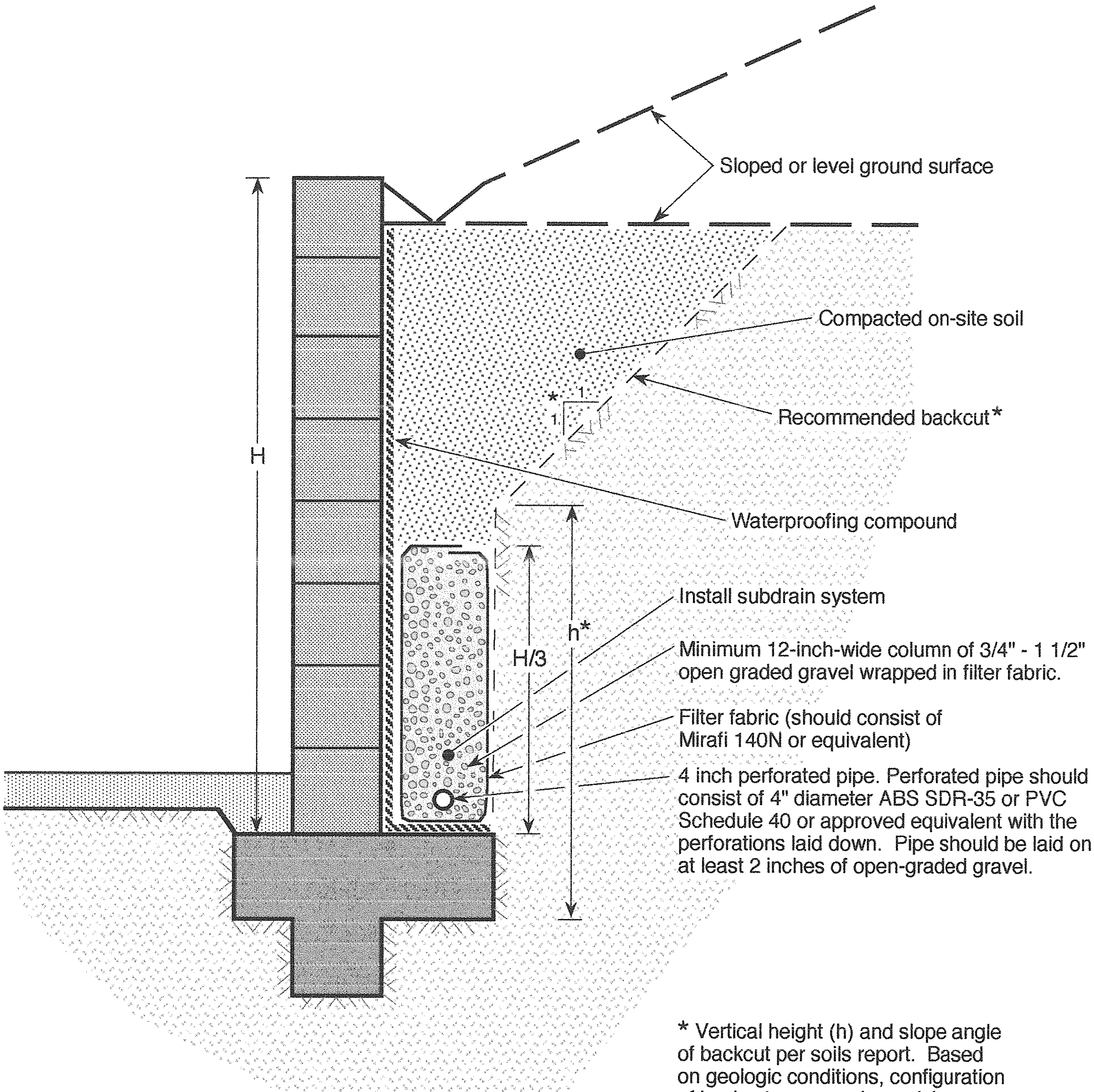
______, 2011, Earthquake Ground Motion Parameters, Version 5.1.0, utilizing ASCE 7 Standard Analysis Option, dated February 10.

______, 2021, Unified Hazard Tool Calculator, Unified Hazard Tool (usgs.gov)

Wire Reinforcement Institute (WRI), 1996, Design of Slabs on Ground.

FIGURES

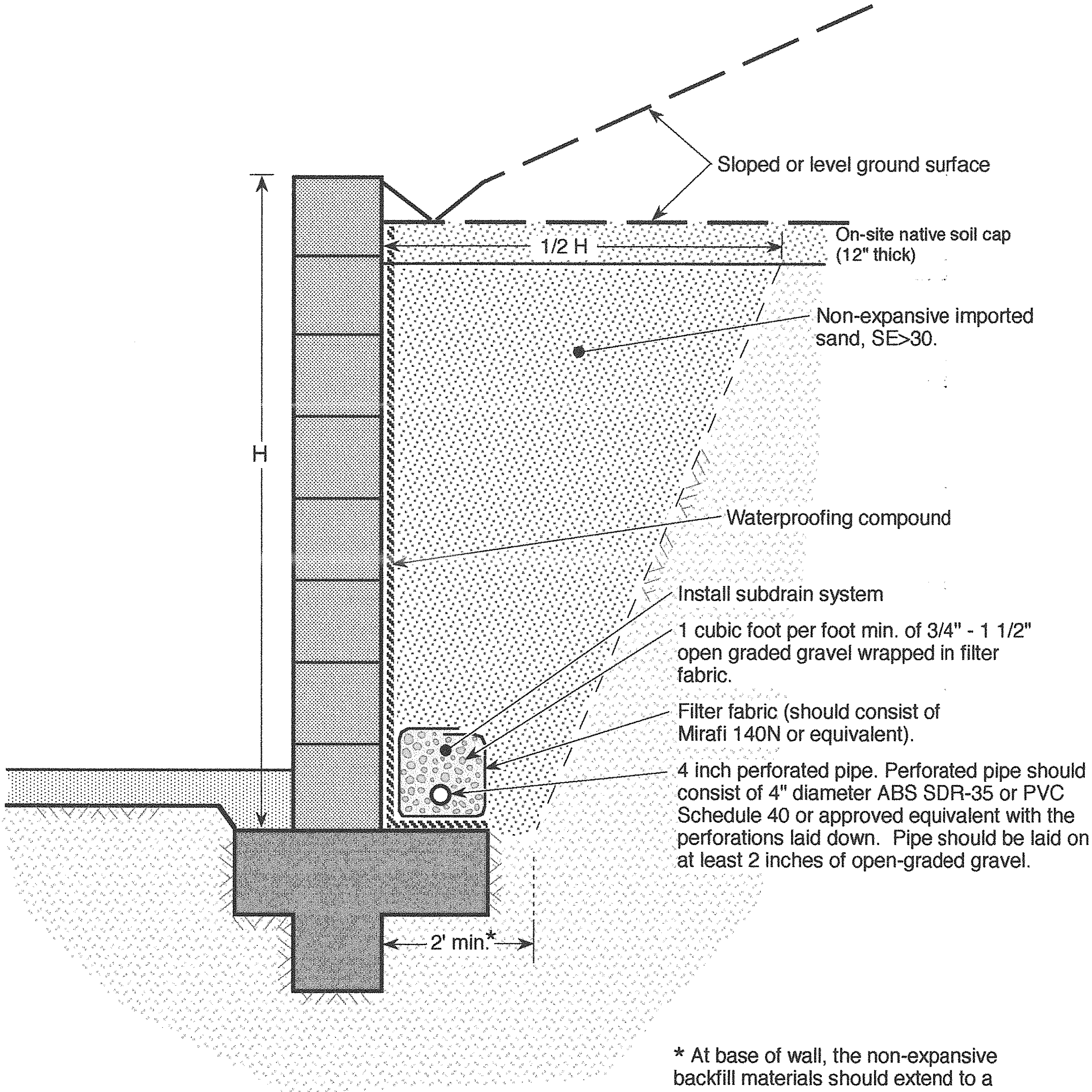
NATIVE SOIL BACKFILL



* Vertical height (h) and slope angle of backcut per soils report. Based on geologic conditions, configuration of backcut may require revisions (i.e. reduced vertical height, revised slope angle, etc.)

PETRA	RETAINING WALL BACKFILL AND SUBDRAIN DETAILS	FIGURE RW-1

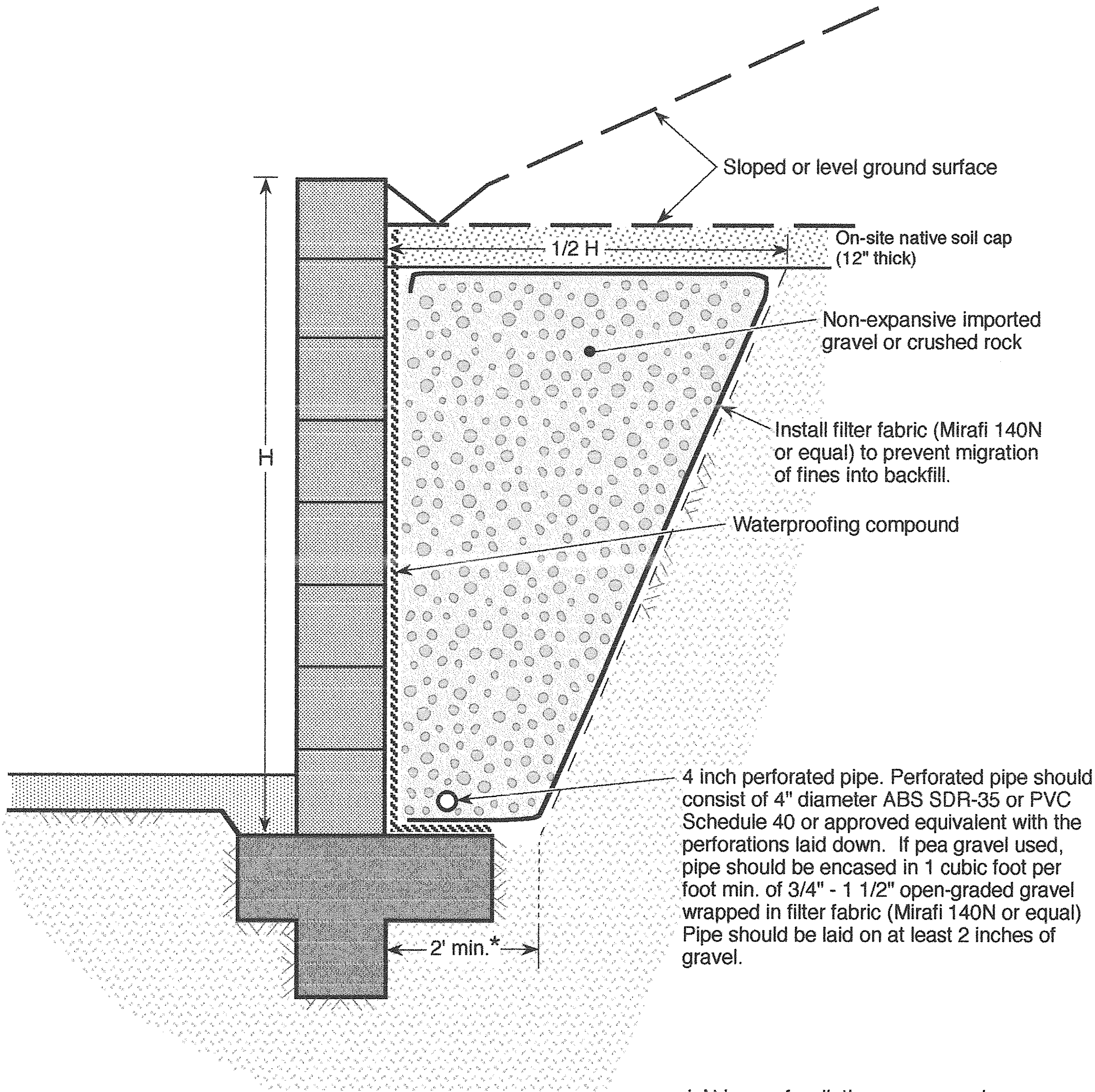
IMPORTED SAND BACKFILL



* At base of wall, the non-expansive backfill materials should extend to a min. distance of 2' or to a horizontal distance equal to the heel width of the footing, whichever is greater.

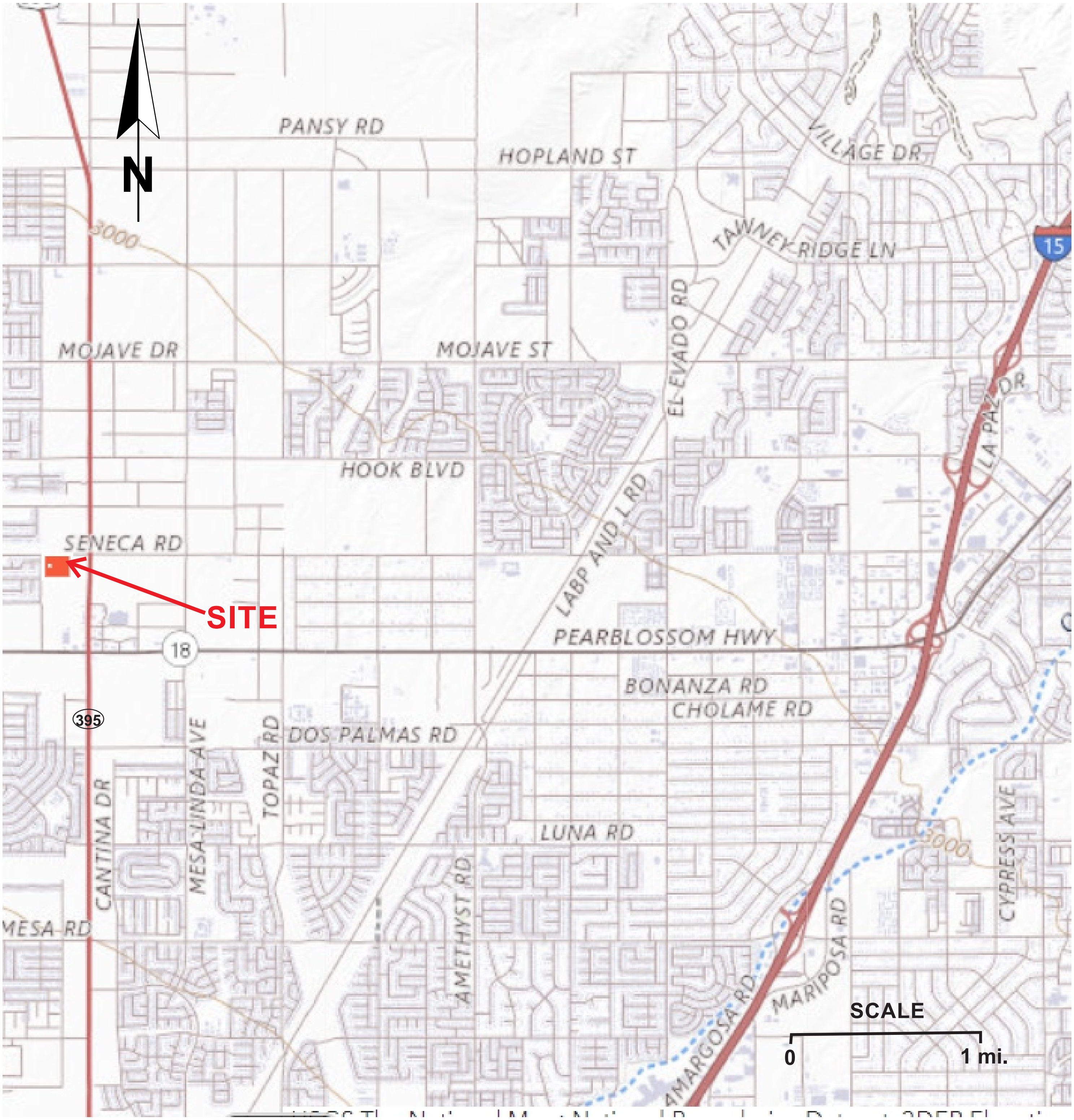
PETRA	RETAINING WALL BACKFILL AND SUBDRAIN DETAILS	FIGURE RW-2

IMPORTED GRAVEL OR CRUSHED ROCK BACKFILL



* At base of wall, the non-expansive backfill materials should extend to a min. distance of 2' or to a horizontal distance equal to the heel width of the footing, whichever is greater.

PETRA	RETAINING WALL BACKFILL AND SUBDRAIN DETAILS	FIGURE RW-3



Reproduced from: USGS, 2023, The National Map Viewer

LEGEND

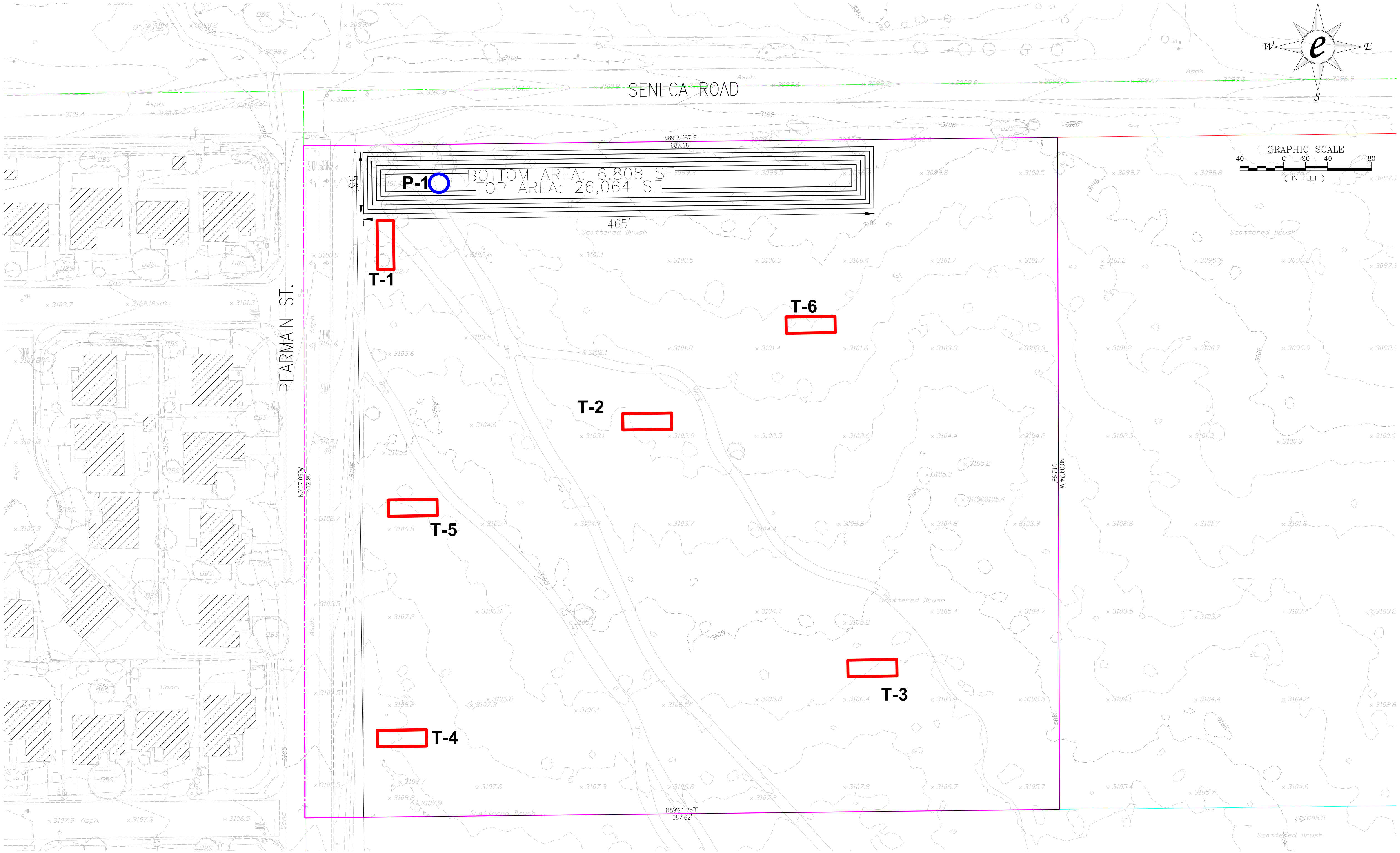
- Approximate Site Location

PETRA GEOSCIENCES, INC.
40880 COUNTY CENTER DRIVE, SUITE M
TEMECULA, CALIFORNIA 92591
PHONE: (951) 600-9271
COSTA MESA MURRIETA PALM DESERT SANTA CLARITA

Site Location Map

Adelanto RV Storage
Adelanto, San Bernardino County, California

DATE: November 2023	J.N.: 23-290	**Figure 1**
DWG BY: epl	SCALE: see map	



LEGEND

TP-6 - Approximate location of exploratory test pit

P-1 - Approximate location of feasibility percolation test pit

PETRA GEOSCIENCES, INC.
40880 County Center Drive, Suite M
Temecula, California 92591
PHONE: (714) 549-8921
COSTA MESA TEMECULA VALENCIA PALM DESERT CORONA

Test Pit Location Map

Adelanto RV Storage
Adelanto, San Bernardino County, California

PETRA GEOSCIENCES INC.

DATE:November, 2023

J.N.: 23-290

Figure 2

Base Map Reference: Encompass Associates, Inc., 2023, Preliminary Storm Water Basin Configuration, Adelanto RV Storage..

APPENDIX A

EXPLORATION LOGS

TEST PIT LOG

Project: **Senecca**		Boring No.: **T-1**
Location: **Adelanto**		Elevation: **±3110**
Job No.: **23-290**	Client: **Diviersified Pacific**	Date: **10/12/2023**
Drill Method: **Backhoe**	Driving Weight: **Not Applicable**	Logged By: **KTM**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty Sand (SM): Yellowish-brown, dry, medium dense, fine-grained sand, trace roots, trace medium-grained sand.				■ (0–5)			MAX EXP SO4 RES pH
		Sand (SP): Yellowish-gray, dry, medium dense, fine-grained, trace coarse-grained sand, trace gravel up to 1/4" in diameter, subrounded.							
5		@7.5': Becomes medium- to coarse-grained sand.							
		Total Depth= 8.5' No groundwater encountered Test pit backfilled with cuttings and rolled.							
10									
15									
20									
25									
30									
35									

Petra Geosciences, Inc.

TEST PIT LOG

Project: **Senecca**		Boring No.:	**T-2**
Location: **Adelanto**		Elevation:	**±3115**
Job No.: **23-290**	Client: **Diviersified Pacific**	Date:	**10/12/2023**
Drill Method: **Backhoe**	Driving Weight: **Not Applicable**	Logged By:	**KTM**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty Sand (SM): Yellowish-brown, dry, medium dense, fine-grained sand, trace roots, trace medium-grained sand.							
		Sand (SP): Yellowish-gray, dry, medium dense, fine-grained, trace coarse-grained sand, trace gravel up to 1/4" in diameter, subrounded.							
5						■			
		Silty Sand (SM): Brown, dry, dense, fine-grained, moderately cemented. Total Depth / Practical Refusal= 8' (very difficult to excavate) No groundwater encountered Test pit backfilled with cuttings and rolled.							
10									
15									
20									
25									
30									
35									

PLATE A-2

Petra Geosciences, Inc.

TEST PIT LOG

Project:	Senecca		Boring No.:	T-3
Location:	Adelanto		Elevation:	±3116
Job No.:	23-290	Client: Diviersified Pacific	Date:	10/12/2023
Drill Method:	Backhoe	Driving Weight: Not Applicable	Logged By:	KTM

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty Sand (SM): Yellowish-brown, slightly moist, medium-dense, fine-grained sand, trace roots, trace medium-grained sand.				■			
		Sand (SP): Yellowish-gray, dry, medium-dense, fine-to coarse-grained.				■			
5									
		Silty Sand (SM): Light brown, dry, dense, fine-grained sand, moderately cemented.							
		Total Depth= 8.5' No groundwater encountered Test pit backfilled with cuttings and rolled.							
10									
15									
20									
25									
30									
35									

PLATE A-3

T E S T P I T L O G

Project: **Senecca**		Boring No.:	**T-4**
Location: **Adelanto**		Elevation:	**±3114**
Job No.: **23-290**	Client: **Diviersified Pacific**	Date:	**10/12/2023**
Drill Method: **Backhoe**	Driving Weight: **Not Applicable**	Logged By:	**KTM**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty Sand (SM): Dark yellowish-brown, slightly moist, medium dense, fine-grained sand, trace roots, trace medium-grained sand.							
		Sand (SP): Yellowish-brown, dry, medium dense, fine- to coarse-grained sand.							
5		Silty Sand (SM): Yellowish-brown, dry, medium dense to dense, fine-grained sand, slightly cemented.							
10		Total Depth= 9' No groundwater encountered Test pit backfilled with cuttings and rolled.							
15									
20									
25									
30									
35									

Petra Geosciences, Inc.

TEST PIT LOG

Project: Senecca		Boring No.: T-5
Location: Adelanto		Elevation: ±3112
Job No.: 23-290	Client: Diviersified Pacific	Date: 10/12/2023
Drill Method: Backhoe	Driving Weight: Not Applicable	Logged By: KTM

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty Sand (SM): Yellowish-brown, slightly moist, medium dense, fine-grained sand, trace roots, trace medium-grained sand.							
		Sand (SP): Yellowish-brown, dry, medium dense, fine- to medium-grained sand, trace coarse-grained sand, trace gravel up to 1/2" in diameter, subrounded to subangular.							
5									
		Silty Sand (SM): Yellowish-brown, dry, dense, fine-grained sand, slightly cemented.							
		Total Depth= 8.5' No groundwater encountered Test pit backfilled with cuttings and rolled.							
10									
15									
20									
25									
30									
35									

PLATE A-5

TEST PIT LOG

Project: **Senecca**		Boring No.:	**T-6**
Location: **Adelanto**		Elevation:	**±3114**
Job No.: **23-290**	Client: **Diviersified Pacific**	Date:	**10/12/2023**
Drill Method: **Backhoe**	Driving Weight: **Not Applicable**	Logged By:	**KTM**

Depth (Feet)	Lith-ology	Material Description	WATER	Samples: Blows per 6 in.	Samples: Core	Samples: Bulk	Laboratory Tests: Moisture Content (%)	Laboratory Tests: Dry Density (pcf)	Laboratory Tests: Other Lab Tests
0		**ALLUVIUM (Qal)** Silty Sand (SM): Yellowish-brown, dry, medium dense, fine-grained sand, trace roots, trace coarse-grained sand, trace gravel up to 3/4" in diameter, subrounded. @1': Becomes fine- to medium-grained sand. @3': Becomes fine-grained sand.							
5									
		@7.5': Becomes moderately cemented and very dense.							
		Total Depth= 8.5' No groundwater encountered Test pit backfilled with cuttings and rolled.							
10									
15									
20									
25									
30									
35									

Petra Geosciences, Inc.

APPENDIX B

LABORATORY TEST PROCEDURES

LABORATORY DATA SUMMARY

LABORATORY TEST PROCEDURES

Soil Classification

Soils encountered within the exploratory borings were initially classified in the field in general accordance with the visual-manual procedures of the Unified Soil Classification System (ASTM D 2488). The samples were re-examined in the laboratory and the classifications reviewed and then revised where appropriate. The assigned group symbols are presented in the Boring Logs (Appendix A).

Maximum Dry Density and Optimum Moisture Content

The maximum dry density and optimum moisture content of the on-site soils were determined for selected bulk samples in accordance with current version of ASTM D 1557. The results of these tests are presented on Plate B-1.

Expansion Index

The expansion index of onsite soils was determined per ASTM D 4829. The expansion index and expansion potential are presented in Plate B-1.

Corrosivity Tests

Chemical analyses were performed on a selected sample to determine concentrations of soluble sulfate and chloride, as well as pH and resistivity. These tests were performed in accordance with California Test Method Nos. 417 (sulfate), 422 (chloride) and 643 (pH and resistivity). Test results are presented in Plate B-1.

Percent Passing No. 200 Sieve

Selected samples were run through a number 200 sieve in general accordance with the latest version of Test Method ASTM D 1140. The results of these tests are included on Plate B-1.

LABORATORY DATA SUMMARY

Laboratory Maximum Dry Density

Sample Location Depth (feet)	Soil Type	Optimum Moisture (%)	Max. Dry Density (pcf)	Optimum Moisture (RC) (%)	Max. Dry Density (RC) (pcf)
T-1 @ 0–5’	fine- to coarse-grain Silty SAND with gravel	7.0	132.5	6.5	134.0

per ASTM D 1557
RC – w/ Rock Correction per ASTM D 4718

Corrosivity

Sample Location Depth (feet)	Sulfate[1] (%)	Chloride[2] (ppm)	pH[3]	Resistivity[3] (ohm-cm)
T-1 @ 0 – 5’	0.0027	270	8.6	5,400

(1) per CALIFORNIA TEST METHOD NO. 417
(2) per CALIFORNIA TEST METHOD NO. 422
(3) per CALIFORNIA TEST METHOD NO. 643

Expansion Index

Sample Location Depth (feet)	Soil Type	Expansion[1] Index	Expansion Potential
T-1 @ 0 – 5’	fine- to coarse-grain Silty SAND with gravel	0	Very Low

(1) PER ASTM D 4829

Percent Passing No. 200 Sieve

Sample Location Depth (feet)	Soil Type	Passing No. 200 Sieve (Percent)
T-1 @ 0 – 5’	fine- to coarse-grain Silty SAND with gravel	25.4

(1) PER ASTM D 1140

APPENDIX C

SEISMIC DESIGN PARAMETERS

USGS web services were down for some period of time and as a result this tool wasn't operational, resulting in *timeout* error.
USGS web services are now operational so this tool should work as expected.

23-290 Adelanto, CA

Latitude, Longitude: 34.512997, -117.402892

Date	10/25/2023, 3:41:07 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	1.244	MCE_R ground motion. (for 0.2 second period)
S_1	0.484	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.493	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	0.995	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.6	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	1.244	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.331	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.484	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.528	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.536	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.934	Mapped value of the risk coefficient at short periods
C_{R1}	0.916	Mapped value of the risk coefficient at a period of 1 s
C_V	1.349	Vertical coefficient

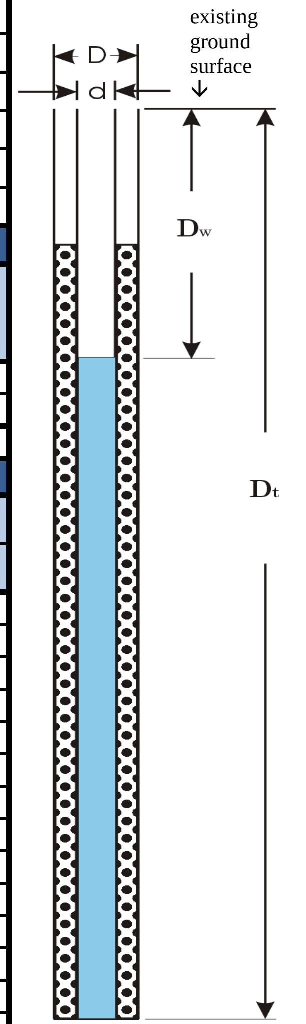
DISCLAIMER

APPENDIX D

INFILTRATION TEST RESULTS

Test Number: P-1

Total Depth of Boring, D_T (ft):	2.6	**Test Date:**	10/12/2023
Diameter of Hole, D (in):	12	**Tested By:**	KTM
Diameter of Casing, d (in):	2	**USCS Soil Type:**	SM
Depth of Slotted Casing (ft):	0 to 2.6	**Depth to Groundwater (ft):**	?
Porosity of Annulus Material, *n* :	0.42	**Ground Elevation (msl ft):**	3111
Depth from Existing Ground Surface to Bottom of Prop. Infiltration System (ft):			5



SANDY SOIL CRITERIA TEST

Trial No.	Time Interval Δt (min.)	Depth to Water, D_w		Change in Water Level ΔD (in.)	Change in Height of Water Greater Than or Equal to 6"? (Yes/No)*
		Initial, D_o (ft.)	Final, D_f (ft.)		
1	25	1.5	2.4	10.8	yes
2	25	1.50	2.4	10.8	yes
Standard Time Interval Between Readings (min.), [* if yes = 10, if no = 30]:					30

PERCOLATION TEST

Trial No.	Time Interval Δt (min.)	Depth to Water, D_w		Change in Water Level ΔH (in.)	Percolation Rate	
		Initial, D_o (ft.)	Final, D_f (ft.)		(min/in.)	(gal/day/ft^2)
1	10	1.50	1.88	4.56	2.19	38.47
2	10	1.50	1.83	3.96	2.53	32.71
3	10	1.50	1.75	3.00	3.33	23.97
4	10	1.50	1.73	2.76	3.62	21.87
5	10	1.50	1.73	2.76	3.62	21.87
6	10	1.50	1.73	2.76	3.62	21.87

TEST RESULTS**

Infiltration Rate [Porchet Method]# (inches/hour)	Percolation Rate	
	(min/in.)	(gal/day/ft^2)
1.92	**3.62**	**21.87**

**Raw Results. Does Not Include a Factor of Safety

FACTOR OF SAFETY

Testing Option	Testing Requirements	Factor of Safety per Reference
Option 2	**4 tests minimum with at least two borings per basin**	**3**

Where Infiltration Rate, $I_t = \Delta H\,(60r) / \Delta t\,(r + 2H_{avg})$

$r = D / 2$

$H_o = D_T - D_o$

$H_f = D_T - D_f$

$\Delta H = \Delta D = H_o - H_f$

$H_{avg} = (H_o + H_f) / 2$

Reference:
RCFCWCD, Design Handbook for LID, dated September, 2011

PETRA GEOSCIENCES, INC.
3186 Airway Avenue, Suite K
Costa Mesa, California 92626
PHONE: (714) 549-8921
COSTA MESA TEMECULA LOS ANGELES PALM DESERT CORONA ESCONDIDO

PERCOLATION TEST SUMMARY

Seneca Road
Adelanto, San Bernadino County, CA

PETRA GEOSCIENCES

DATE: October , 2023	J.N.: 23-290	**Appendix B**

APPENDIX E

STANDARD GRADING SPECIFICATIONS

STANDARD GRADING SPECIFICATIONS

These specifications present the usual and minimum requirements for projects on which Petra Geosciences, Inc. (Petra) is the geotechnical consultant. No deviation from these specifications will be allowed, except where specifically superseded in the preliminary geology and soils report, or in other written communication signed by the Soils Engineer and Engineering Geologist of record (Geotechnical Consultant).

I. GENERAL

A. The Geotechnical Consultant is the Owner's or Builder's representative on the project. For the purpose of these specifications, participation by the Geotechnical Consultant includes that observation performed by any person or persons employed by, and responsible to, the licensed Soils Engineer and Engineering Geologist signing the soils report.

B. The contractor should prepare and submit to the Owner and Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "spreads" and the estimated quantities of daily earthwork to be performed prior to the commencement of grading. This work plan should be reviewed by the Geotechnical Consultant to schedule personnel to perform the appropriate level of observation, mapping, and compaction testing as necessary.

C. All clearing, site preparation, or earthwork performed on the project shall be conducted by the Contractor in accordance with the recommendations presented in the geotechnical report and under the observation of the Geotechnical Consultant.

D. It is the Contractor's responsibility to prepare the ground surface to receive the fills to the satisfaction of the Geotechnical Consultant and to place, spread, mix, water, and compact the fill in accordance with the specifications of the Geotechnical Consultant. The Contractor shall also remove all material considered unsatisfactory by the Geotechnical Consultant.

E. It is the Contractor's responsibility to have suitable and sufficient compaction equipment on the job site to handle the amount of fill being placed. If necessary, excavation equipment will be shut down to permit completion of compaction to project specifications. Sufficient watering apparatus will also be provided by the Contractor, with due consideration for the fill material, rate of placement, and time of year.

F. After completion of grading a report will be submitted by the Geotechnical Consultant.

II. SITE PREPARATION

A. Clearing and Grubbing

1. All vegetation such as trees, brush, grass, roots, and deleterious material shall be disposed of offsite. This removal shall be concluded prior to placing fill.

2. Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipe lines, etc., are to be removed or treated in a manner prescribed by the Geotechnical Consultant.

III. FILL AREA PREPARATION

A. Remedial Removals/Overexcavations

1. Remedial removals, as well as overexcavation for remedial purposes, shall be evaluated by the Geotechnical Consultant. Remedial removal depths presented in the geotechnical report and shown on the geotechnical plans are estimates only. The actual extent of removal should be determined by the Geotechnical Consultant based on the conditions exposed during grading. All soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as determined by the Geotechnical Consultant.

2. Soil, alluvium, or bedrock materials determined by the Soils Engineer as being unsuitable for placement in compacted fills shall be removed from the site. Any material incorporated as a part of a compacted fill must be approved by the Geotechnical Consultant.

3. Should potentially hazardous materials be encountered, the Contractor should stop work in the affected area. An environmental consultant specializing in hazardous materials should be notified immediately for evaluation and handling of these materials prior to continuing work in the affected area.

B. Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide sufficient survey control for determining locations and elevations of processed areas, keys, and benches.

C. Processing

After the ground surface to receive fill has been declared satisfactory for support of fill by the Geotechnical Consultant, it shall be scarified to a minimum depth of 6 inches and until the ground surface is uniform and free from ruts, hollows, hummocks, or other uneven features which may prevent uniform compaction.

The scarified ground surface shall then be brought to optimum moisture, mixed as required, and compacted to a minimum relative compaction of 90 percent.

D. Subdrains

Subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency, and/or with the recommendations of the Geotechnical Consultant. (Typical Canyon Subdrain details are given on Plate SG-1).

E. Cut/Fill & Deep Fill/Shallow Fill Transitions

In order to provide uniform bearing conditions in cut/fill and deep fill/shallow fill transition lots, the cut and shallow fill portions of the lot should be overexcavated to the depths and the horizontal limits discussed in the approved geotechnical report and replaced with compacted fill. (Typical details are given on Plate SG-7.)

IV. COMPACTED FILL MATERIAL

A. General

Materials excavated on the property may be utilized in the fill, provided each material has been determined to be suitable by the Geotechnical Consultant. Material to be used for fill shall be essentially free of organic material and other deleterious substances. Roots, tree branches, and other matter missed during clearing shall be removed from the fill as recommended by the Geotechnical Consultant. Material that is spongy, subject to decay, or otherwise considered unsuitable shall not be used in the compacted fill.

Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

B. Oversize Materials

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches in diameter, shall be taken offsite or placed in accordance with the recommendations of the Geotechnical Consultant in areas designated as suitable for rock disposal (Typical details for Rock Disposal are given on Plate SG-4).

Rock fragments less than 12 inches in diameter may be utilized in the fill provided, they are not nested or placed in concentrated pockets; they are surrounded by compacted fine grained soil material and the distribution of rocks is approved by the Geotechnical Consultant.

C. Laboratory Testing

Representative samples of materials to be utilized as compacted fill shall be analyzed by the laboratory of the Geotechnical Consultant to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the Geotechnical Consultant as soon as possible.

D. Import

If importing of fill material is required for grading, proposed import material should meet the requirements of the previous section. The import source shall be given to the Geotechnical Consultant at least 2 working days prior to importing so that appropriate tests can be performed and its suitability determined.

V. FILL PLACEMENT AND COMPACTION

A. Fill Layers

Material used in the compacting process shall be evenly spread, watered, processed, and compacted in thin lifts not to exceed 6 inches in thickness to obtain a uniformly dense layer. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Consultant.

B. Moisture Conditioning

Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly above optimum moisture content.

C. Compaction

Each layer shall be compacted to 90 percent of the maximum density in compliance with the testing method specified by the controlling governmental agency. (In general, ASTM D 1557-02, will be used.)

If compaction to a lesser percentage is authorized by the controlling governmental agency because of a specific land use or expansive soils condition, the area to received fill compacted to less than 90 percent shall either be delineated on the grading plan or appropriate reference made to the area in the soils report.

D. Failing Areas

If the moisture content or relative density varies from that required by the Geotechnical Consultant, the Contractor shall rework the fill until it is approved by the Geotechnical Consultant.

E. Benching

All fills shall be keyed and benched through all topsoil, colluvium, alluvium or creep material, into sound bedrock or firm material where the slope receiving fill exceeds a ratio of 5 horizontal to 1 vertical, in accordance with the recommendations of the Geotechnical Consultant.

VI. SLOPES

A. Fill Slopes

The contractor will be required to obtain a minimum relative compaction of 90 percent out to the finish slope face of fill slopes, buttresses, and stabilization fills. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure that produces the required compaction.

B. Side Hill Fills

The key for side hill fills shall be a minimum of 15 feet within bedrock or firm materials, unless otherwise specified in the soils report. (See detail on Plate SG-5.)

C. Fill-Over-Cut Slopes

Fill-over-cut slopes shall be properly keyed through topsoil, colluvium or creep material into rock or firm materials, and the transition shall be stripped of all soils prior to placing fill. (see detail on Plate SG-6).

D. Landscaping

All fill slopes should be planted or protected from erosion by other methods specified in the soils report.

E. Cut Slopes

1. The Geotechnical Consultant should observe all cut slopes at vertical intervals not exceeding 10 feet.

2. If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature, unfavorably inclined bedding, joints or fault planes are encountered during grading, these conditions shall be evaluated by the Geotechnical Consultant, and recommendations shall be made to treat these problems (Typical details for stabilization of a portion of a cut slope are given in Plates SG-2 and SG-3.).

3. Cut slopes that face in the same direction as the prevailing drainage shall be protected from slope wash by a non-erodible interceptor swale placed at the top of the slope.

4. Unless otherwise specified in the soils and geological report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.

5. Drainage terraces shall be constructed in compliance with the ordinances of controlling governmental agencies, or with the recommendations of the Geotechnical Consultant.

VII. GRADING OBSERVATION

A. General

All cleanouts, processed ground to receive fill, key excavations, subdrains, and rock disposals must be observed and approved by the Geotechnical Consultant prior to placing any fill. It shall be the Contractor's responsibility to notify the Geotechnical Consultant when such areas are ready.

B. Compaction Testing

Observation of the fill placement shall be provided by the Geotechnical Consultant during the progress of grading. Location and frequency of tests shall be at the Consultants discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations may be selected to verify adequacy of compaction levels in areas that are judged to be susceptible to inadequate compaction.

C. Frequency of Compaction Testing

In general, density tests should be made at intervals not exceeding 2 feet of fill height or every 1000 cubic yards of fill placed. This criteria will vary depending on soil conditions and the size of the job. In any event, an adequate number of field density tests shall be made to verify that the required compaction is being achieved.

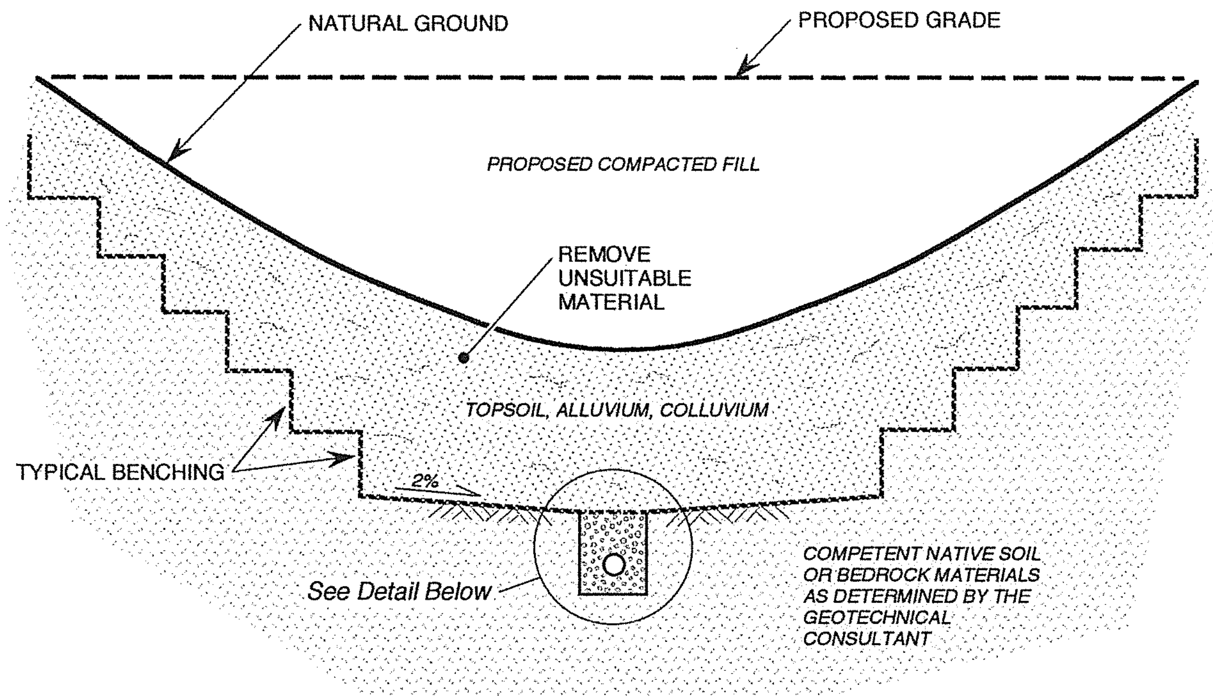
VIII. CONSTRUCTION CONSIDERATIONS

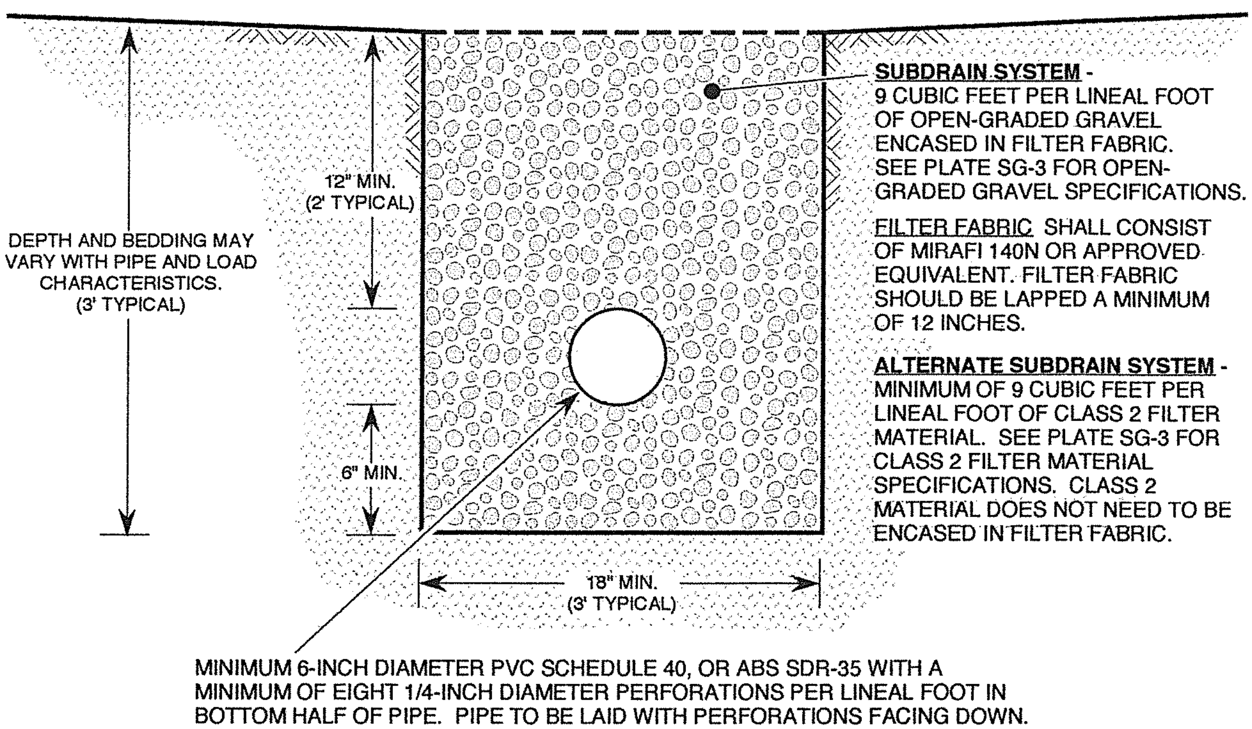
A. Erosion control measures, when necessary, shall be provided by the Contractor during grading and prior to the completion and construction of permanent drainage controls.

B. Upon completion of grading and termination of observations by the Geotechnical Consultant, no further filling or excavating, including that necessary for footings, foundations, large tree wells, retaining walls, or other features shall be performed without the approval of the Geotechnical Consultant.

C. Care shall be taken by the Contractor during final grading to preserve any berms, drainage terraces, interceptor swales, or other devices of permanent nature on or adjacent to the property.

S:\!BOILERS-WORK\REPORT INSERTS\STANDARD GRADING SPECS

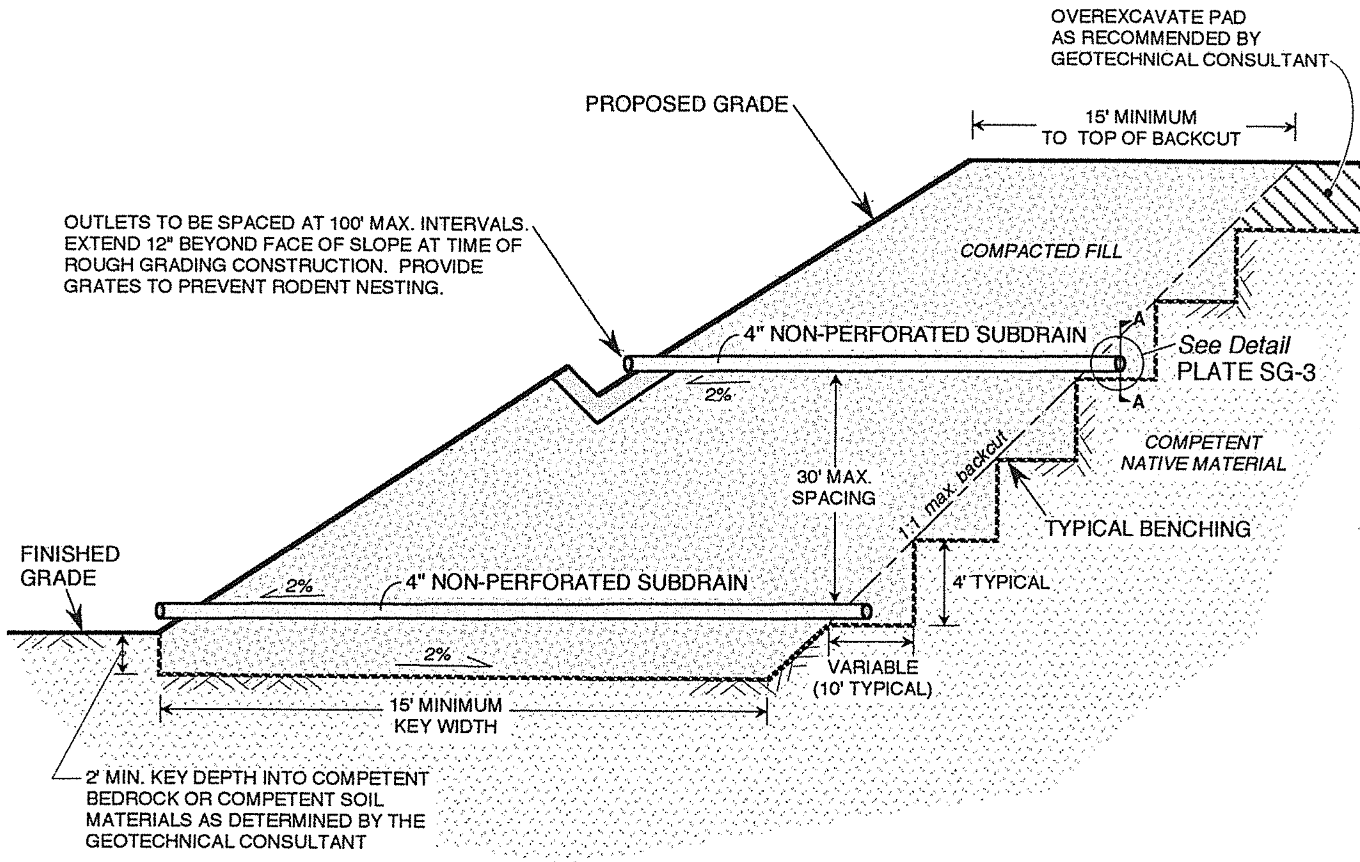




NOTES:

1. FOR CONTINUOUS RUNS IN EXCESS OF 500 FEET USE 8-INCH DIAMETER PIPE.
2. FINAL 20 FEET OF PIPE AT OUTLET SHALL BE NON-PERFORATED AND BACKFILLED WITH FINE-GRAINED MATERIAL.

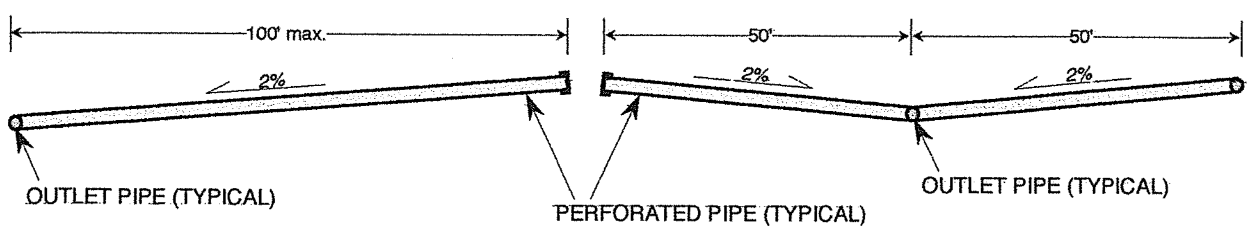
PETRA	CANYON SUBDRAIN DETAIL	PLATE SG-1



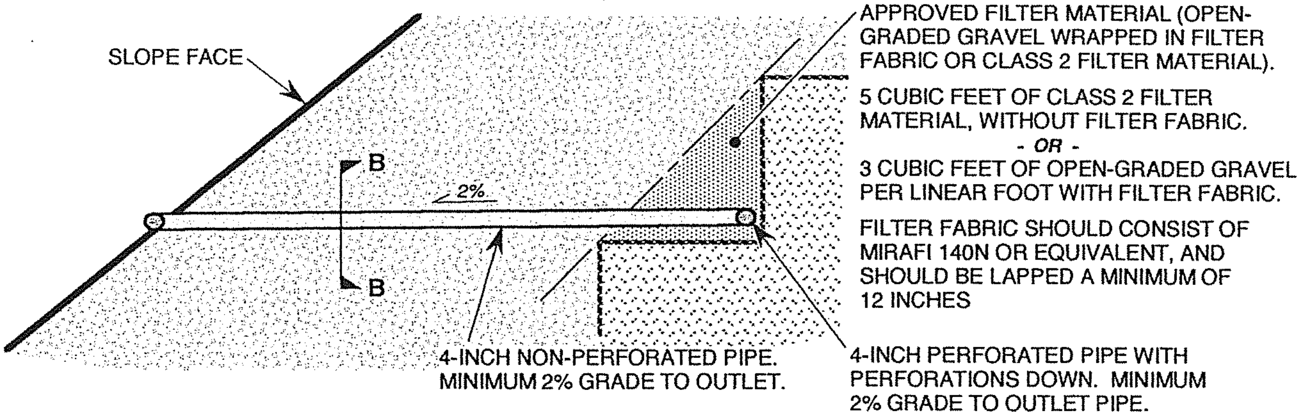
NOTES:

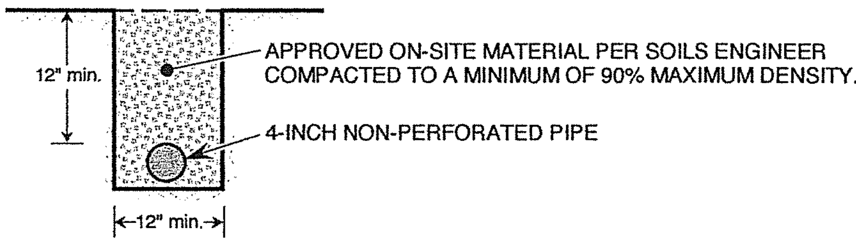
1. 30' MAXIMUM VERTICAL SPACING BETWEEN SUBDRAIN SYSTEMS.
2. 100' MAXIMUM HORIZONTAL DISTANCE BETWEEN NON-PERFORATED OUTLET PIPES. *(See Below)*
3. MINIMUM GRADIENT OF 2% FOR ALL PERFORATED AND NON-PERFORATED PIPE.

SECTION A-A (PERFORATED PIPE PROFILE)



PETRA	BUTTRESS OR STABILIZATION FILL DETAIL	PLATE SG-2





SECTION B-B (OUTLET PIPE)

PIPE SPECIFICATIONS:

1. 4-INCH MINIMUM DIAMETER, PVC SCHEDULE 40 OR ABS SDR-35.
2. FOR PERFORATED PIPE, MINIMUM 8 PERFORATIONS PER FOOT ON BOTTOM HALF OF PIPE.

FILTER MATERIAL/FABRIC SPECIFICATIONS:

OPEN-GRADED GRAVEL ENCASED IN FILTER FABRIC.
(MIRAFI 140N OR EQUIVALENT)

OPEN-GRADED GRAVEL

SIEVE SIZE	PERCENT PASSING
1 1/2-INCH	88 - 100
1-INCH	5 - 40
3/4-INCH	0 - 17
3/8-INCH	0 - 7
No. 200	0 - 3

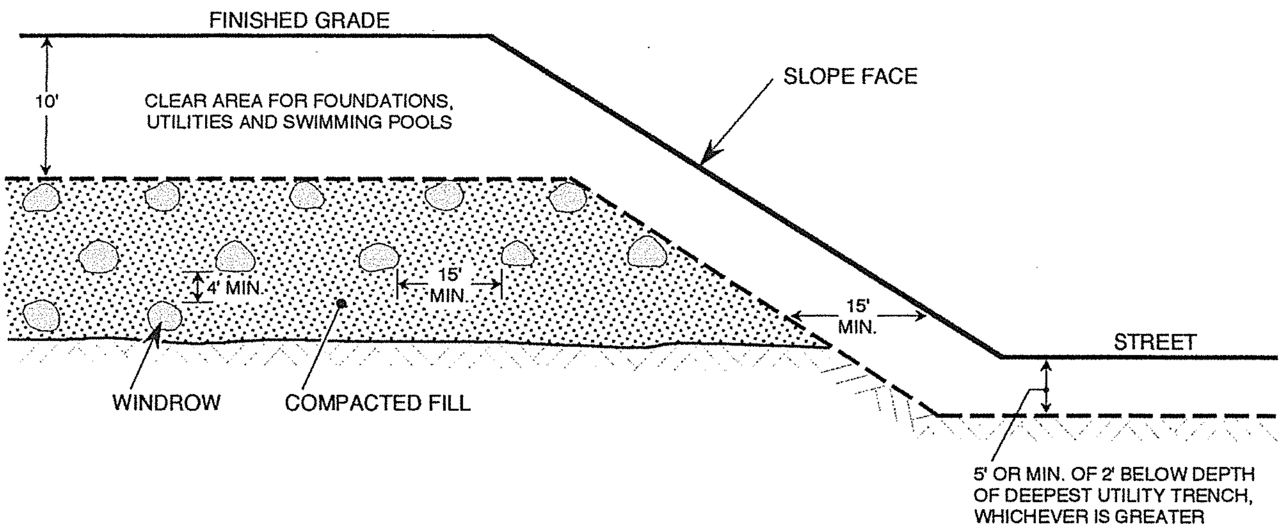
ALTERNATE:

CLASS 2 PERMEABLE FILTER MATERIAL PER CALTRANS STANDARD SPECIFICATION 68-1.025.

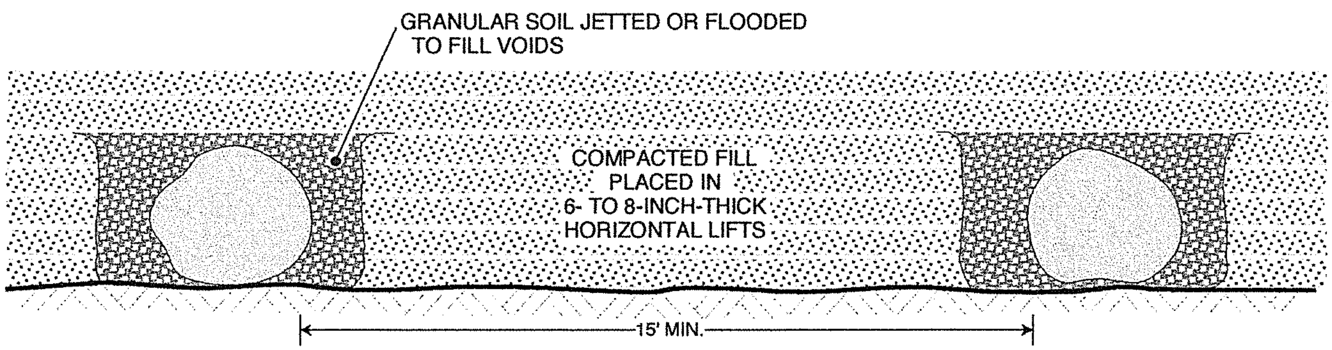
CLASS 2 FILTER MATERIAL

SIEVE SIZE	PERCENT PASSING
1-INCH	100
3/4-INCH	90 - 100
3/8-INCH	40 - 100
No. 4	25 - 40
No. 8	18 - 33
No. -30	5 - 15
No. -50	0 - 7
No. 200	0 - 3

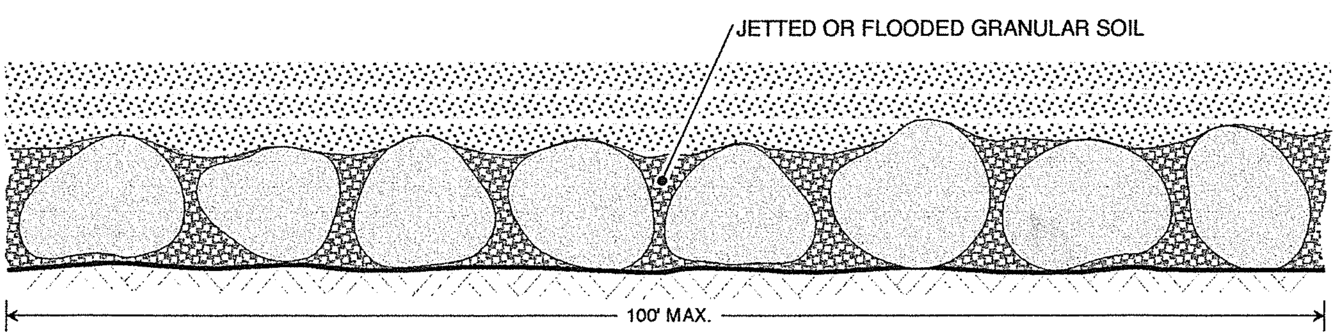
PETRA | BUTTRESS OR STABILIZATION FILL SUBDRAIN | PLATE SG-3



TYPICAL WINDROW DETAIL (END VIEW)

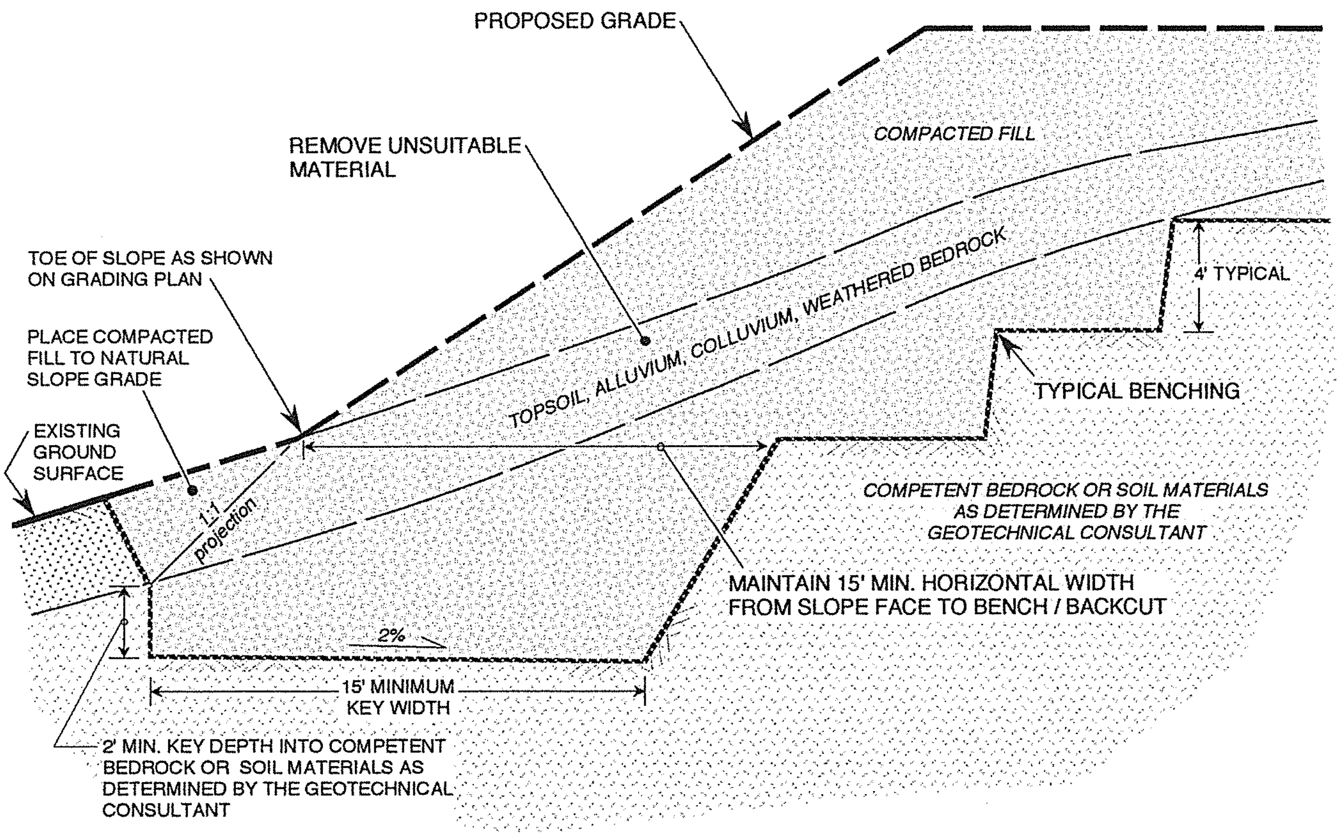


TYPICAL WINDROW DETAIL (PROFILE VIEW)



NOTE: OVERSIZE ROCK IS DEFINED AS CLASTS HAVING A MAXIMUM DIMENSION OF 12" OR LARGER

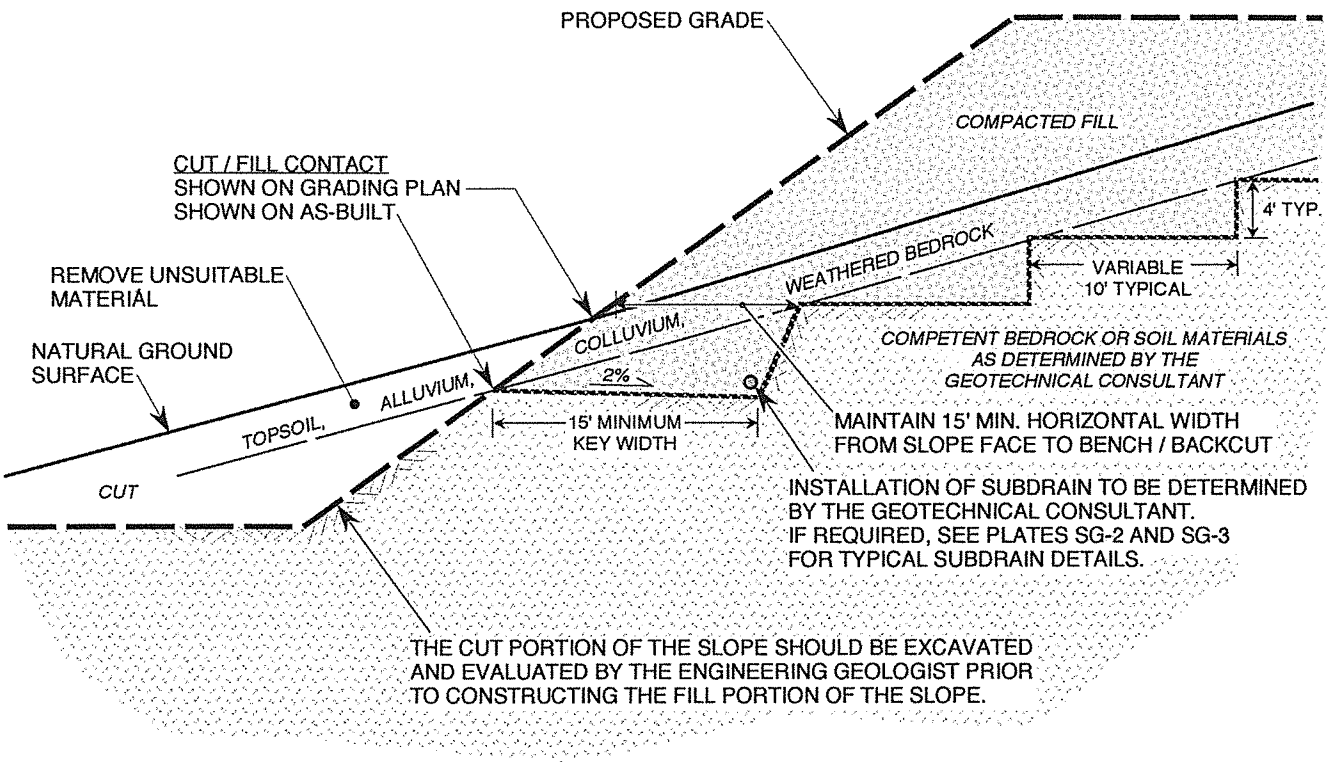
PETRA	TYPICAL ROCK DISPOSAL DETAIL	PLATE SG-4



NOTES:

1. WHERE NATURAL SLOPE GRADIENT IS 5:1 OR LESS, BENCHING IS NOT NECESSARY; HOWEVER, FILL IS NOT TO BE PLACED ON COMPRESSIBLE OR UNSUITABLE MATERIAL.
2. SOILS ENGINEER TO DETERMINE IF SUBDRAIN IS REQUIRED.

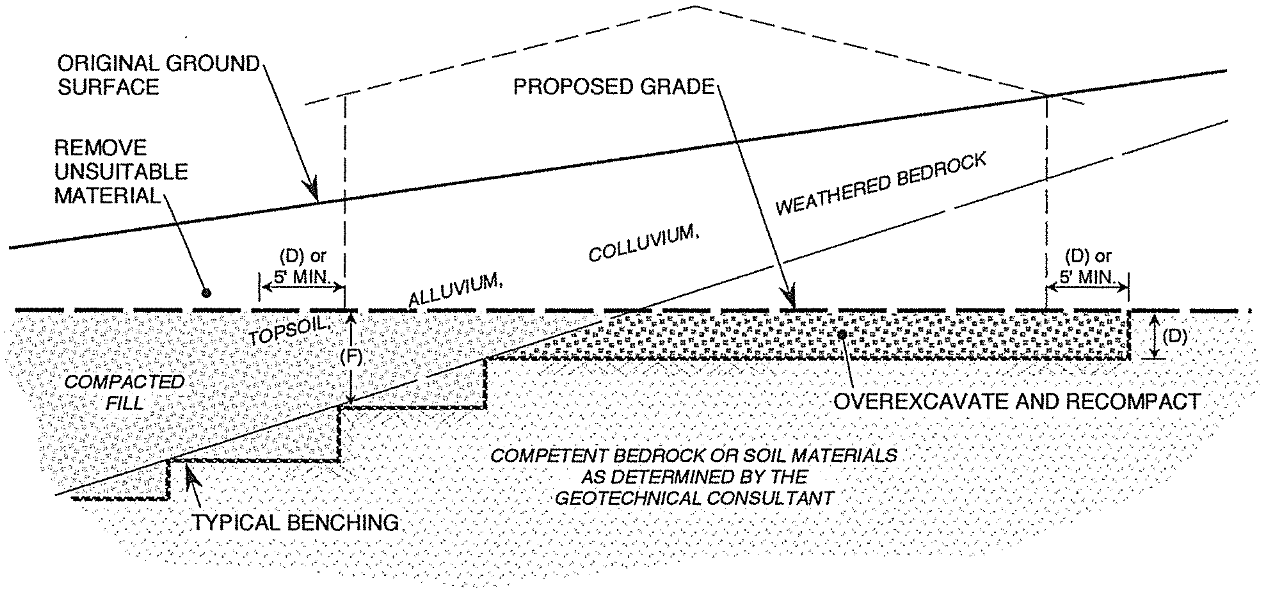
PETRA	FILL SLOPE ABOVE NATURAL SLOPE	PLATE SG-5



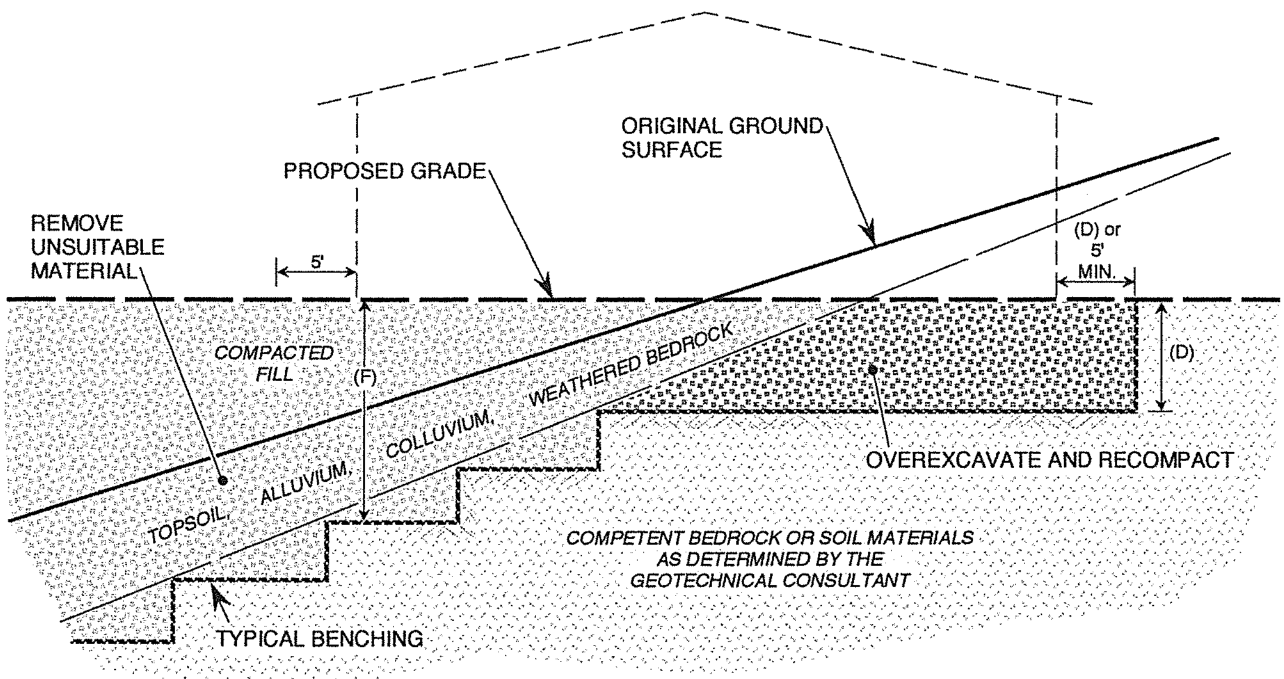
PETRA	FILL SLOPE ABOVE CUT SLOPE	PLATE SG-6

CUT LOT

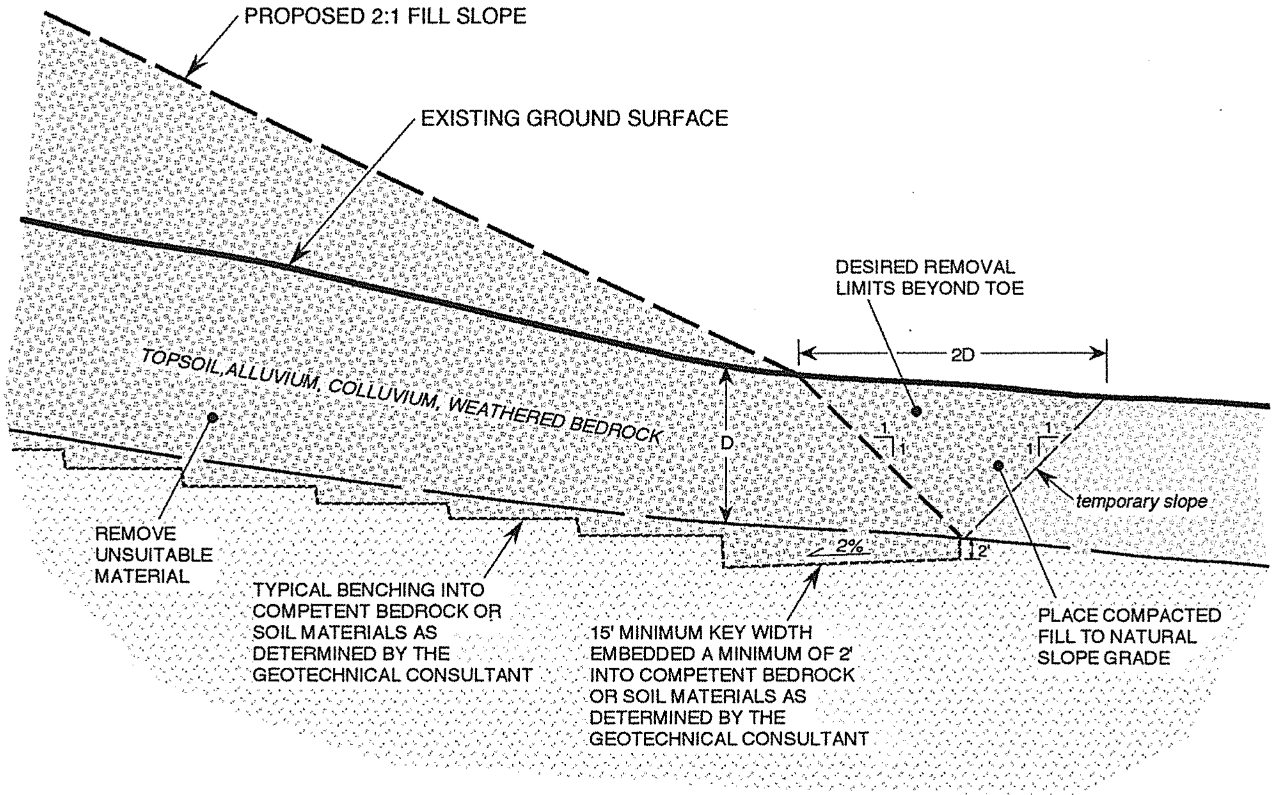
UNSUITABLE MATERIAL EXPOSED IN PORTION OF CUT PAD



CUT-FILL TRANSITION LOT

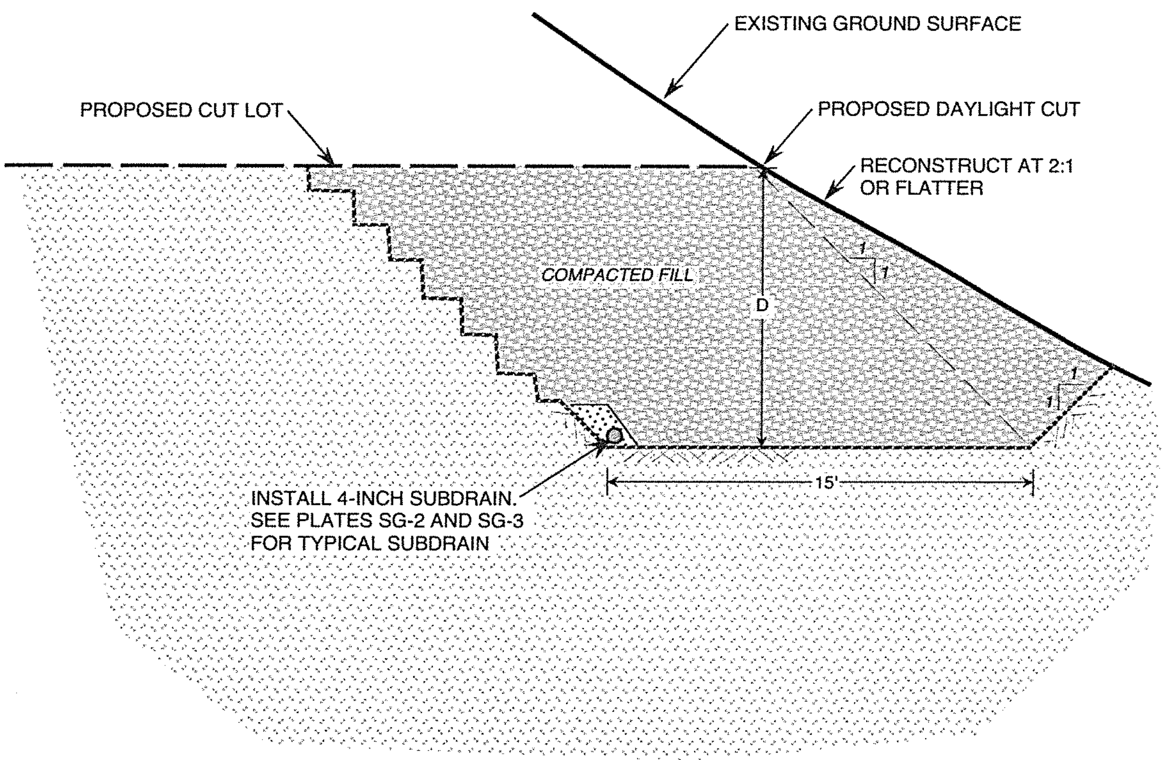


MAXIMUM FILL THICKNESS (F)	DEPTH OF OVEREXCAVATION (D)
FOOTING DEPTH TO 3 FEET	EQUAL DEPTH
3 TO 6 FEET	3 FEET
GREATER THAN 6 FEET	1/2 THE THICKNESS OF DEEPEST FILL PLACED WITHIN THE "FILL" PORTION (F) TO 15 FEET MAXIMUM



D = RECOMMENDED DEPTH OF REMOVAL
PER GEOTECHNICAL REPORT

PETRA	TYPICAL REMOVALS BEYOND TOE OF PROPOSED FILL SLOPE	PLATE SG-8



<u>NOTE</u>:

1. "D" SHALL BE 10 FEET MINIMUM OR AS DETERMINED BY SOILS ENGINEER.

PETRA	SHEAR KEY ON DAYLIGHT CUT LOTS	PLATE SG-9