PJC & Associates, Inc.
Consulting Engineers & Geologists

April 23, 2019 Job No. 9023.01

U.A. Local 38 Convalescent Trust Fund
1625 Market Street
San Francisco, CA 94103
ATTN: Maria Jacini (Admin)
c/o Bill Vanderwall
bill@vdwengr.com

Subject: Geotechnical Investigation
Proposed Access Road
8810 Soda Bay Road
Kelseyville, California
APN:009-002-036

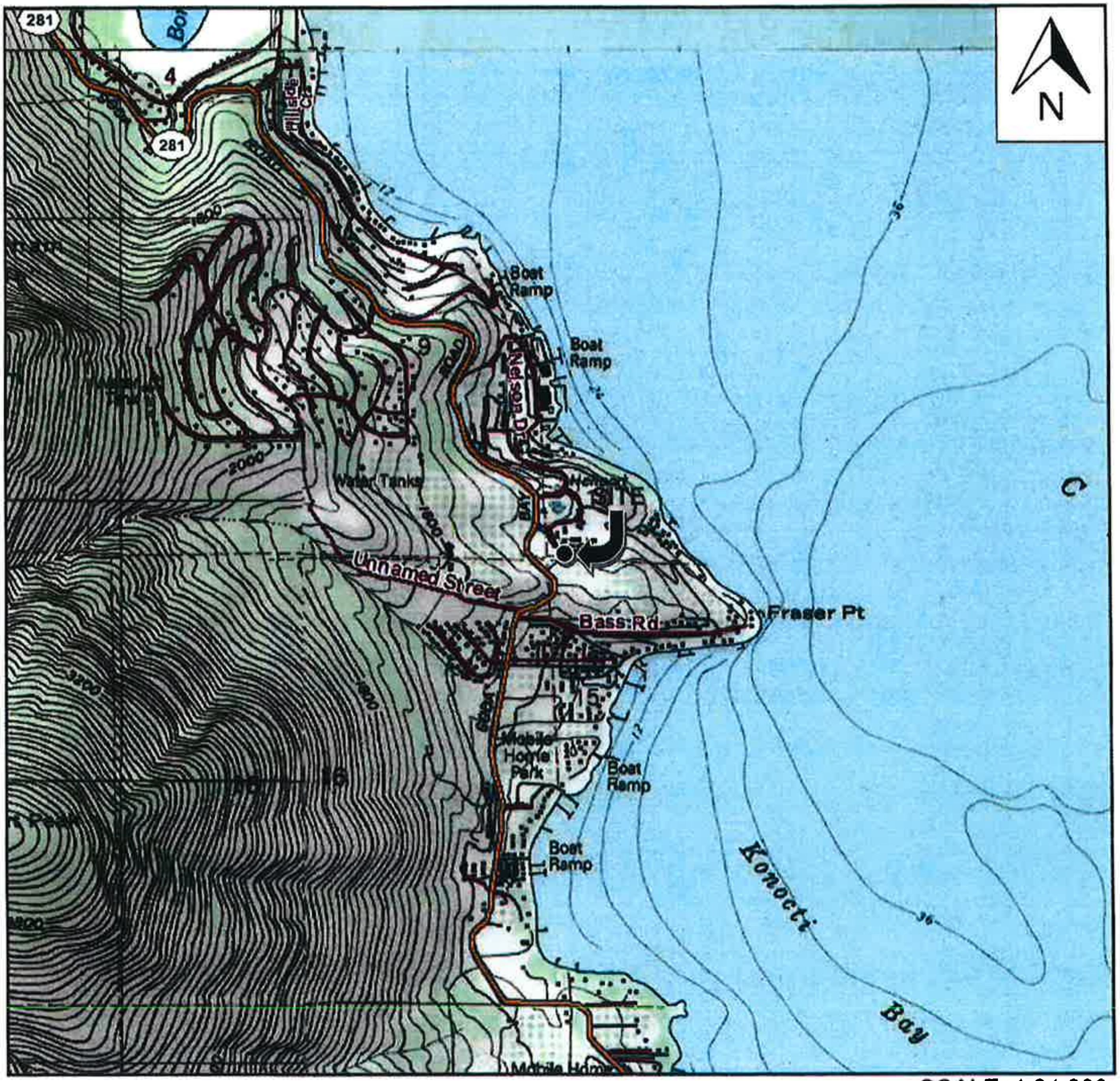
Dear Maria:

PJC & Associates, Inc. (PJC) is pleased to submit this report presenting the results of our geotechnical investigation for the proposed access road located at 8810 Soda Bay Road in Kelseyville, California. The approximate location of the site is shown on the Site Location Map. Plate 1. Our services were completed in accordance with our proposal for geotechnical engineering services dated January 9, 2019, and your authorization to proceed with the work, dated January 22, 2019. This report presents our opinions and recommendations regarding the geotechnical engineering aspects of the design and construction of the proposed project. Based on the results of this study, we judge that the project is feasible from a geotechnical engineering standpoint provided the recommendations and criteria presented in this report are incorporated in the design and carried out through construction.

1. PROJECT DESCRIPTION

Based on our review of the preliminary site plan and information provided by you, it is our understanding that the project will consist of constructing a 1,370 lineal foot access road on the property. We anticipate that the access road will be 20 feet in width and be asphalt paved with two-foot wide shoulders and drainage facilities.

Grading and drainage plans were unavailable at the time of this report. Based on site topography and the preliminary information provided, we anticipate site grading will include cuts and fills up to five feet or less in order to upgrade the existing soil conditions, achieve the desired finished grades for the road and provide adequate gradients for site drainage. To clear a path for the access road, a fair number of trees and vegetation will be removed. We anticipate that retaining walls will be required for the project. However, their locations have not been determined at this time.



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REFERENCE: USGS CLEARLAKE HIGHLANDS, CALIFORNIA 7.5 MINUTE QUADRANGLE, DATED 1990.

PJC & Associates, Inc. Consulting Engineers & Geologists	SITE LOCATION MAP PROPOSED ACCESS ROAD 8810 SODA BAY ROAD KELSEYVILLE, CALIFORNIA	PLATE 1
	Proj. No: 9023.01 Date: 3/19 App'd by: PJC	

2. SCOPE OF SERVICES

The purpose of this study is to provide geotechnical criteria for the design and construction of the proposed project as described above. Specifically, the scope of our services included the following:

a. Surface reconnaissance and subsurface exploration using a track-mounted excavator to observe the soil and groundwater conditions underlying the access road alignment. Our project engineer was on site to log the materials encountered in the test pits and to obtain representative samples for visual classification and laboratory testing.

b. Laboratory observation and testing of representative samples obtained during the course of our field investigation to evaluate the engineering properties of the soils and bedrock underlying the site.

c. Reviewed seismological and geologic literature on the site area, discuss site geology and seismicity, and evaluate potential geologic hazards and earthquake effects (i.e., liquefaction, ground rupture, settlement, expansive soils, lurching and lateral spreading, slope stability, etc.).

d. Perform engineering analyses to develop geotechnical recommendations for excavation and site earthwork, retaining wall design criteria, preliminary pavement section design criteria, surface and subsurface drainage control and construction considerations.

e. Preparation of this report summarizing our work on this project.

3. SITE CONDITIONS

a. General. The proposed site is located on the southwestern shore of Clear Lake within the Konocti Harbor Resort. The site is just north of Konocti Bay and Fraser Point. Within the Konocti Harbor Resort, the proposed access road will be utilized to provide improved access to the Kid's Camp portion of the resort. The existing ground surface for the access road varies from a gravel parking lot to thick timbered terrain.

b. Topography and Drainage. The site is located on the southwestern shoreline of Clear Lake near the eastern base of Mount Konocti. Topography for the access road varies from nearly level at Soda Bay Road to moderately sloping at the northeast portion of the access road. The site is located near an approximate elevation of 1,480 feet above mean sea level, according to USGS Clearlake Highlands, California Quadrangle. Site drainage generally consists of sheet flow and surface infiltration that migrates in a northeasterly direction towards Clear Lake.

4. GEOLOGIC SETTING

The site is located in the Coast Ranges Geomorphic Province of California. This province is characterized by northwest trending topographic and geologic features, and includes many separate ranges, coalescing mountain masses and several major structural valleys. The province is bounded on the east by the Great Valley and on the west by the Pacific Ocean. It extends north into Oregon and south to the Transverse Ranges in Ventura County.

The structure of the northern Coast Ranges region is extremely complex due to continuous tectonic deformation imposed over a long period of time. The initial tectonic episode in the northern Coast Ranges was a result of plate convergence, which is believed to have begun during the late Jurassic period. This process involved eastward thrusting of oceanic crust beneath the continental crust (Klamath Mountains and Sierra Nevada) and the scraping off of materials that are now accreted to the continent (northern Coast Ranges). East-dipping thrust and reverse faults were believed to be the dominant structures formed.

Right lateral, strike slip deformation was superimposed on the earlier structures beginning mid-Cenozoic time, and has progressed northward to the vicinity of Cape Mendocino in Southern Humboldt County (Hart, Bryant and Smith, 1983). Thus, the principal structures south of Cape Mendocino are northwest trending, nearly vertical faults of the San Andreas system.

According to a geologic map prepared by the Unites States Geological Survey (USGS), the site is underlain by Young pyroclastic deposits (yp) and Dacite of Fraser Point deposits (df). Our subsurface exploration confirmed that the project site is underlain by these deposits. These deposits likely extend to a great depth below the site. A detailed explanation of the site soil characteristics is provided in Section 7 of this report.

5. FAULTING

Geologic structures in the region are primarily controlled by northwest trending faults. No known active fault passes through the site. The site is not located in the Alquist-Priolo Earthquake Fault Studies Zone. According to published geologic literature, the site is located near the Konocti Bay fault zone. However, according to the 2008 National Seismic Hazard Maps prepared by the USGS, the three closest known potentially active faults to the site are the Collayomi, the Bartlett Springs and the Hunting Creek-Berryessa faults. The Collayomi fault is located 5.19 miles to the southwest, the Bartlett Springs fault is located approximately 8.58 miles to the north, and the Hunting Creek-Berryessa fault is located approximately 13.12 miles southeast of the site. Table 1 outlines the nearest known active faults and their associated maximum estimated magnitudes.

TABLE 1
CLOSEST KNOWN ACTIVE FAULTS

Fault Name	Distance from Site (Miles)	Maximum Earthquakes (Moment Magnitude)
Collayomi	5.19	6.70
Bartlett Springs	8.58	7.30
Hunting Creek-Berryessa	13.12	7.10

Reference: USGS National Seismic Hazard Maps, 2008

6. SEISMICITY

The site is located within a zone of high seismic activity related to the active faults that transverse through the surrounding region. Future damaging earthquakes could occur on any of these fault systems during the lifetime of the proposed project. In general, the intensity of ground shaking at the site will depend upon the distance to the causative earthquake epicenter, the magnitude of the shock, the response characteristics of the underlying earth materials, and the design and quality of construction. Seismic considerations and hazards are discussed in the following subsections of this report.

7. SUBSURFACE CONDITIONS

a. Soils and Bedrock. The subsurface conditions at the site were investigated by excavating five exploratory test pits (TP-1 through TP-5) in the proposed access road. The approximate test pit locations are shown on the Test Pit Location Plan, Plate 2. The test pits were used to collect samples of the underlying strata for visual classification and laboratory testing. The excavation and sampling procedures and descriptive test pit logs are included in Appendix A. The laboratory procedures are included in Appendix B.

The test pits generally encountered a fine-grained soil matrix consisting of sandy clays and clayey silts, with roots and very large hard boulders. The fine-grained soils appeared moist, soft to stiff and exhibited low to medium plasticity characteristics. Several of the test pits encountered very large and hard boulders which caused excavation refusal. The actual size of these boulders is unknown and should be considered during planning and construction of the access road. Difficult excavation will likely be encountered. Complete lithologic descriptions with approximate contacts are presented as Plates 3 through 7 in Appendix A of this report.

b. Groundwater. Groundwater or seepage was not encountered in the exploratory test pits at the time of our field exploration on February 20, 2019. No active springs or surface seeps were observed at or near the access road. Perched groundwater or seepage zones could develop at the site during and following prolonged rainfall. However, based on the subsurface conditions encountered at the site, these conditions, if they develop, would dissipate following seasonal rainfall.

8. GEOLOGIC HAZARDS & SEISMIC CONSIDERATIONS

The site is located within a region subject to a high level of seismic activity. Therefore, the site could experience strong seismic ground shaking during the lifetime of the proposed project. The following discussion reflects the possible earthquake effects and geologic hazards, which could result in damage to the improvements at the site.

a. Fault Rupture. Rupture of the ground surface is expected to occur along known active fault traces. As previously mentioned, published geologic literature has the Konocti Bay fault zone mapped near the site. However, according to the 2008 Seismic Hazards Map, the closest known active fault is located approximately five miles away. No evidence of previous ground displacement on the site due to fault movement is indicated in the geologic literature or was observed during our field exploration. Therefore, the likelihood of ground rupture at the site due to faulting is considered to be low.

b. Ground Shaking. The site has been subjected in the past to ground shaking by earthquakes on the active fault systems that traverse the region. It is believed that earthquakes with significant ground shaking will occur in the region within the next several decades. Therefore, it must be assumed that the site will be subjected to strong ground shaking during the design life of the project.

c. Liquefaction/Densification. The site is located in an area which is considered to have low liquefaction and densification potential. Therefore, we judge that the risk of liquefaction or densification at the site is low.

d. Lateral Spreading and Lurching. Lateral spreading is normally induced by vibration of near horizontal alluvial soil layers adjacent to an exposed face. Lurching is an action, which produces cracks or fissures parallel to streams or banks when the earthquake motion is at right angles to them. No vertical banks exist near the project site. Therefore, we judge that the potential for lateral spreading and lurching at the site is low.

e. Expansive Soils. The site surface and near surface soils exhibit low to medium plasticity characteristics (PI= 21 and 17 and EI= 49). The site soils are considered to have a low to moderate expansion potential.

f. Slope Stability. Evidence of slope instability was not observed at or near the site. The risk of landsliding at the site is low, due to low slope inclinations.

9. CONCLUSIONS

Based on the results of our investigation, it is our professional opinion that the project is feasible from a geotechnical engineering standpoint provided the recommendations contained in this report are incorporated into design and carried out through construction. The primary geotechnical considerations in the design and construction of the project are:

- The presence of weak and compressible surface and near surface soils.
- Potentially moderately expansive soils.
- The presence of large and hard boulders that may require larger than normal excavation equipment and hoe-rams to achieve excavation depths greater than four to six feet.

The top one to three feet of soils at the site are weak and compressible. Weak and compressible soils may appear hard and strong when dry. However, they could potentially collapse under the load of foundations, engineered fill, or asphaltic pavements when their moisture content increases and approaches saturation. The moisture content of these soils can increase as the result of rainfall, or when the natural upward migration of water vapor through the soils is impeded by fills, pavements, and foundations. These soils can undergo considerable strength loss and increased compressibility, thus causing irregular and erratic ground settlement under loads. This ground movement manifests in the form of cracked foundations and pavements. The detrimental effects of such movements can be significantly reduced by removing the weak soils and artificial fill and replacing them as compacted engineered fill or by extending the foundations below the weak zone. The weak soils should be subexcavated and recompacted according to the recommendations provided in the earthwork and grading section of this report.

Moderately expansive soils exist at the site and it is possible that isolated pockets of highly expansive soils could be encountered. Expansive soils experience volumetric variation with changes in moisture content. The resulting volumetric changes could cause differential movement and cracking to foundations and pavements. If expansive clays are encountered, mitigation measures should be implemented as determined by the geotechnical engineer during construction. If expansive clays remain at planned finish grade, the soils will shrink and swell and cause cracking of the asphalt which could be severe.

Large boulders were encountered during our subsurface exploration. Several of the test pits encountered refusal as a result of the boulders. Larger than normal excavation equipment and/or hoe-rams should be anticipated for use during grading of the access road. This should be accounted for in the overall budget. Additionally, removal of the boulders will cause large voids in the underlying soil strata. If not mitigated, the differential settlement of the voids and surrounding soils could have detrimental effects of the access road and retaining walls. The voids should be backfilled with compacted engineered fill as observed by the geotechnical engineer on-site during grading.

Alternatively, exceptionally large boulders could be doweled into as part of the foundation of the retaining wall. This should be determined by the geotechnical engineer in the field during construction and the doweling design should be determined by the structural engineer.

Based on the site geotechnical conditions, we judge that the proposed access road may be supported on a uniform layer of compacted engineered fill. The site retaining walls could be supported on a spread footing foundation system that extends at least 12 inches into firm native soils, bedrock or compacted engineered fill.

The following section provides geotechnical recommendations and criteria for design and construction of the project.

10. SITE GRADING AND EARTHWORK

Grading and drainage plans were not available at the time of this report. Therefore, the amount of grading to be performed for the project is unknown. We anticipate that project grading will consist of cuts and fills up to five feet to upgrade the existing soil conditions, achieve finish pad grades and provide adequate gradients for site drainage.

a. <u>Stripping</u>. Structural and pavement areas should be stripped of surface vegetation, tree stumps, roots and the upper few inches of soil containing organic matter. These materials should be moved off site. Relatively large roots were encountered during our exploration. These should be cut away and removed along with the trees and vegetation scheduled to be cleared. If underground utilities or any other obstructions pass through new construction areas, we recommend that these utilities or obstructions be removed in their entirety or rerouted where they exist outside an imaginary plane sloped two horizontal to one vertical (2H:1V) from the outside bottom edge of the nearest foundation element. Any existing wells or septic systems not included in the project should be abandoned in accordance with the requirements of the Lake County health department. Voids left from the removal of utilities or other obstructions, such as large boulders, should be replaced with compacted engineered fill under the observation of the project geotechnical engineer.

b. <u>Excavation and Compaction</u>. Following site stripping, excavation should be performed to upgrade the existing soil conditions, achieve finish grade or prepare areas to receive fill. For estimating purposes, we recommend the upper three feet of soil at the site be subexcavated and replaced as compacted engineered fill. However, subexcavation depths may be increased during grading in areas that encounter deeper layers of weak and compressible soils. The exposed surface scheduled to receive fill should be scarified to a depth of eight inches, moisture conditioned to within two percent of the optimum moisture content and compacted to a minimum of 90 percent of the maximum dry density of the materials, as determined by the ASTM D 1557-12e1 laboratory compaction test procedures. The excavated material, free of organics and rocks greater than six inches is suitable for use as engineered fill. Expansive clays, if encountered, should not be used for compacted engineered fill. The lateral extent of the subexcavation and compacted engineered fill should be a minimum of three feet beyond the edges of pavements and five feet beyond foundations. The fill material should be spread in eight-inch thick loose lifts, moisture conditioned to within two percent of the optimum moisture content, and compacted to at least 90 percent of the maximum dry density of the materials. Voids created by the removal of large boulders or other obstructions should be replaced with compacted engineered fill as recommended by the geotechnical engineer.

It is recommended that any import fill to be used on site should be of a low to non-expansive nature and should meet the following criteria:

Plasticity Index	less than 12
Liquid Limit	less than 35
Percent Soil Passing #200 Sieve	between 15% and 35%
Maximum Aggregate Size	4 inches

The top eight inches in pavement areas should be compacted to be a minimum of 95 percent relative compaction.

c. Cut and Fill Slopes. Cut and fill slopes should be graded to an inclination no steeper than 2H:1V. Steeper slopes should be retained. If potentially unstable subsurface conditions are encountered, it may be necessary to flatten slopes or provide other treatment. It is recommended that a geotechnical engineer observe the cut slopes and provide final recommendations for the control of adverse conditions during grading operations, if encountered. During the rainy season, the cut slopes should be checked for springs or seepage areas. The surfaces of the cut slopes should be treated as needed in order to minimize the possibility of slumping and erosion.

We do not anticipate the placement of fill on slopes greater than 20 percent. If fill is required on slopes greater than 20 percent, we should be consulted to provide specific recommendations for placement.

Hard bedrock conditions exist along the alignment. Larger than normal excavating equipment and/or hoe-rams may be necessary to achieve depths greater than four feet. This should be accounted for in the over all project budget.

All site preparation and fill placement should be observed by a representative of PJC. It is important that during the stripping, subexcavation and grading/scarifying processes, a representative of our firm be present to observe whether any undesirable material is encountered in the construction area.

Generally, grading is most economically performed during the summer months when on-site soils are usually dry of optimum moisture content. Delays should be anticipated in site grading performed during the rainy season or early spring due to excessive moisture in the on-site soils. Special and relatively expensive construction procedures should be anticipated if grading must be completed during the winter and early spring.

11. RETAINING WALL FOUNDATIONS: SPREAD FOOTINGS

a. Vertical Loads. We judge that the proposed site retaining walls may be supported by spread footings extending a minimum of 12 inches into firm native soils, bedrock or compacted engineered fill. Footing depths may be increased or decreased based on bearing conditions encountered during construction. If boulders deemed too large for removal are encountered, doweling into the rock could be considered. This should be determined by the geotechnical and structural engineers in the field during construction. Footing excavations should be observed and approved by the geotechnical engineer before reinforcing steel is placed. The recommended bearing pressures, depth of embedment and minimum widths of footings are presented in Table 2. The bearing values provided have been calculated assuming that all footings uniformly bear on firm native soils, bedrock or compacted engineered fill.

TABLE 2
FOUNDATION DESIGN CRITERIA

Footing Type	Allowable Bearing Pressure (psf)*	Minimum Embedment (in)**	Minimum Width (in)
Continuous wall	2,000	12	12
Isolated Column	2,500	12	18

* Dead plus live load.
**Into firm native soils, bedrock or compacted engineered fill.

The allowable bearing pressures are net values. The weight of the foundation and backfill over the foundation may be neglected when computing dead loads. Allowable bearing pressures may be increased by one-third for transient applications such as wind and seismic loads.

b. Lateral Loads. Resistance to lateral forces may be computed by using friction and passive pressure. A friction factor of 0.30 is considered appropriate between the bottom of the concrete structures and the bearing materials. A passive pressure of 300 pounds per square foot per foot of depth (psf/ft) is recommended. Unless restrained at the surface, the top six inches should be neglected for passive resistance.

Footing concrete should be placed neat against firm native soils. Footing excavations should not be allowed to dry before placing concrete. If shrinkage cracks appear in the footing excavations, the soil should be thoroughly moistened prior to concrete placement.

c. Settlement. Total settlement of individual foundations will vary depending on the width of the foundation and the actual load supported. Foundation settlements have been estimated based on the foundation loads and bearing values provided. Maximum settlements of shallow foundations designed and constructed in accordance with the preceding recommendations are estimated to be less than one inch. Differential settlement between similarly loaded, adjacent footings is expected to be less than one-half inch. The majority of the settlement is expected to occur during construction and placement of dead loads.

We should be retained to review the spread footing excavations, to review the actual soil conditions exposed, and provide modifications in the field, if necessary.

12. RETAINING WALLS

a. Static Lateral Earth Pressures. Retaining walls free to rotate on the top should be designed to resist active lateral earth pressures. If walls are restrained by rigid elements to prevent rotation or supporting compacted engineered fill, they should be designed for "at rest" lateral earth pressures.

Retaining walls should be designed to resist the following earth equivalent fluid pressures (triangular distribution):

Active Pressure (level backfill) (5H:1V or less)........................35 psf/ft
At Rest Pressure (level backfill) (5H:1V or less)....................55 psf/ft

Active Pressure (2H:1V maximum slope backfill)..................50 psf/ft
At Rest Pressure (2H:1V maximum slope backfill) ....65 psf/ft

b. Lateral Earth Pressures from Surcharge Loads. If the access road is located within a distance equal to the total wall height from the top back face of retaining walls, retaining walls should be designed to resist additional induced lateral earth pressures due to traffic surcharge loads.

Retaining walls should be designed to resist the following additional earth pressure generated from vehicular surcharge loads (rectangular distribution):

Traffic Surcharge Load..240 psf

The use of heavy, multi-ton compaction equipment such as large sheepsfoot rollers should not be allowed within a distance equal to one-half of the total wall height from the back face of retaining walls or the walls should be designed for additional induced lateral earth pressures.

c. Drainage. We recommend that a backdrain be provided behind all retaining walls or that the walls be designed for full hydrostatic pressures. The backdrains should consist of four-inch diameter SDR 35 perforated pipe sloped to drain to outlets by gravity, and of clean, free-draining, Class II permeable material. The Class II permeable material should extend 12 inches horizontally from the back face of the wall and extend from the bottom of the wall to one foot below the finished ground surface. The upper 12 inches should be backfilled with compacted fine-grained soil to exclude surface water. We recommend that the ground surface behind retaining walls be sloped to drain. Under no circumstances should surface water be diverted into retaining wall backdrains. Where migration of moisture through walls would be detrimental, the walls should be waterproofed

13. ASPHALTIC CONCRETE PAVEMENTS

Based on laboratory testing, an R-value of 27 was assigned to the site soils. We recommend that the pavements base rock section should be underlain by a uniform layer of compacted engineered fill. Asphaltic pavement sections should be constructed according to Table 3.

Asphaltic pavement thicknesses were computed from Chapter 633 of the Caltrans Highway Design Manual and are based on a pavement life of 20 years. The Traffic Indexes (TI) used are judged representative of the anticipated traffic but are not based on actual vehicle counts. The actual traffic indexes should be determined and provided by the project civil engineer.

Prior to placement of the aggregate base material, the top eight inches of the pavement subgrade should be scarified to at least eight inches deep, moisture conditioned to within two percent of the optimum moisture content, and compacted to a minimum of 95 percent relative compaction. Aggregate base material should be spread in thin layers, moisture conditioned to near optimum and compacted to at least 95 percent relative compaction to form a firm and unyielding base. The subgrade and aggregate base section should visually pass a firm unyielding proof-roll inspection.

The material and methods used should conform to the requirements of the Caltrans Standard Specifications, except that compaction requirements for the soil subgrade and aggregate baserock should be based on ASTM D-1557-12e1. Aggregate used for the base coarse should comply with the minimum requirements specified in Caltrans Standard Specifications, Section 26, for Class 2 aggregate base.

In general, the pavements should be constructed during the dry season to avoid the saturation of the subgrade and base materials, which often occurs during the wet winter months. If pavements are constructed during the winter and early spring, a cost increase relative to drier weather construction should be anticipated. The geotechnical engineer should be consulted for recommendations at the time of construction.

If pavements will abut irrigated landscaped areas, water can seep below the pavements and into the base rock within the pavement section. Continued saturation of the base rock leads to permanent wetness towards the lower elevation of the pavement where water ponds. Soft subgrade conditions and pavement damage such as potholes can occur as a result.

Several precautionary measures can be taken to minimize the intrusion of water into the base rock; however, the cost to install the protective measures should be balanced against the cost of repairing damaged pavement sections. An alternative, which can be taken to extend the life of the pavement, would be to construct a cutoff wall along the perimeter edge of the pavement. The wall should consist of a lean concrete mix. The trench should be four inches wide and extend at least 36 inches deep.

Where trees are located adjacent to pavement areas, we recommend that a suitable impervious root barrier be included to minimize water mitigation into the pavement layer.

TABLE 3
ASPHALTIC CONCRETE PAVEMENT DESIGN FOR PAVEMENT AREAS
(Subgrade R-Value = 27)

Traffic Index	Asphaltic Concrete (in.)	Class II Aggregate Base (in.)
4.0	2.0	6.0
5.0	2.5	7.0
6.0	3.0	9.0
7.0	3.5	11.0

14. DRAINAGE

a. Surface Drainage. Drainage control design should include provisions for positive surface gradients so that surface runoff is not permitted to pond, particularly above slopes or adjacent to foundations or pavements. Surface runoff should be directed away from slopes and foundations. If the drainage facilities discharge onto the natural ground, adequate means should be provided to control erosion and to create sheet flow. Care must be taken so that discharges from downspout systems are not allowed to infiltrate the subsurface near foundations, pavements or in the vicinity of slopes. Downspouts should be connected to closed conduits and discharged away from structures and pavements. Storm water must not be discharged on or near slopes; or it will cause erosion and slope stability problems.

b. Erosion Control. The discharge of channelized water flow will increase the potential for erosion and slope instability. Riprap or other means are recommended to dissipate energy and to create sheet flow. Slopes should be adequately planted or provided with erosion blankets or approved equivalent to retard erosion. The construction of underground bioswales should be avoided.

15. SEISMIC DESIGN

Based on criteria presented in the 2016 edition of the California Building Code (CBC) and ASCE (American Society of Civil Engineers) STANDARD ASCE/SEI 7-10, the following minimum criteria should be used in seismic design:

a.	Site Class:	D
b.	Mapped Acceleration Parameters:	S_S = 1.500 g
		S_1 = 0.584 g
c.	Site Adjusted Spectral Response Acceleration Parameters:	S_{MS} = 1.500 g
		S_{M1} = 0.876 g
d.	Design Spectral Acceleration Parameters:	S_{DS} = 1.000 g
		S_{D1} = 0.584 g

16. LIMITATIONS

The data, information, interpretations and recommendations contained in this report are presented solely as bases and guides to the geotechnical design of the proposed access road located at 8810 Soda Bay Road in Kelseyville, California. The conclusions and professional opinions presented herein were developed by PJC in accordance with generally accepted geotechnical engineering principles and practices. No warranty, either expressed or implied, is intended.

This report has not been prepared for use by parties other than the designers of the project. It may not contain sufficient information for the purposes of other parties or other uses. If any changes are made in the project as described in this report, the conclusions and recommendations contained herein should not be considered valid, unless the changes are reviewed by PJC and the conclusions and recommendations are modified or approved in writing. This report and the figures contained herein are intended for design purposes only. They are not intended to act by themselves as construction drawings or specifications.

Soil deposits may vary in type, strength, and many other important properties between points of observation and exploration. Additionally, changes can occur in groundwater and soil moisture conditions due to seasonal variations or for other reasons. Therefore, it must be recognized that we do not and cannot have complete knowledge of the subsurface conditions underlying the subject site. The criteria presented are based on the findings at the points of exploration and on interpretative data, including interpolation and extrapolation of information obtained at points of observation.

17. ADDITIONAL SERVICES

Upon completion of the project plans, they should be reviewed by our firm to determine that the design is consistent with the recommendations of this report. During the course of this investigation, several assumptions were made regarding development concepts. Should our assumptions differ significantly from the final intent of the project designers, our office should be notified of the changes to assess any potential need for revised recommendations. Observation and testing services should also be provided by PJC to verify that the intent of the plans and specifications are carried out during construction; these services should include but not limited to observing grading and earthwork, approving foundation excavations and approving slab subgrade preparation.

These services will be performed only if PJC is provided with sufficient notice to perform the work. PJC does not accept responsibility for items we are not notified to observe.

We appreciate the opportunity to be of service. If you have any questions concerning the content of this report, please contact us.

Sincerely,

PJC & ASSOCIATES, INC.

Patrick J. Conway
Geotechnical Engineer
GE 2303, California

REGISTERED PROFESSIONAL ENGINEER
PATRICK J. CONWAY
No. 2303
Exp. 3/31/20
GEOTECHNICAL
STATE OF CALIFORNIA

PJC:bc

APPENDIX A
FIELD INVESTIGATION

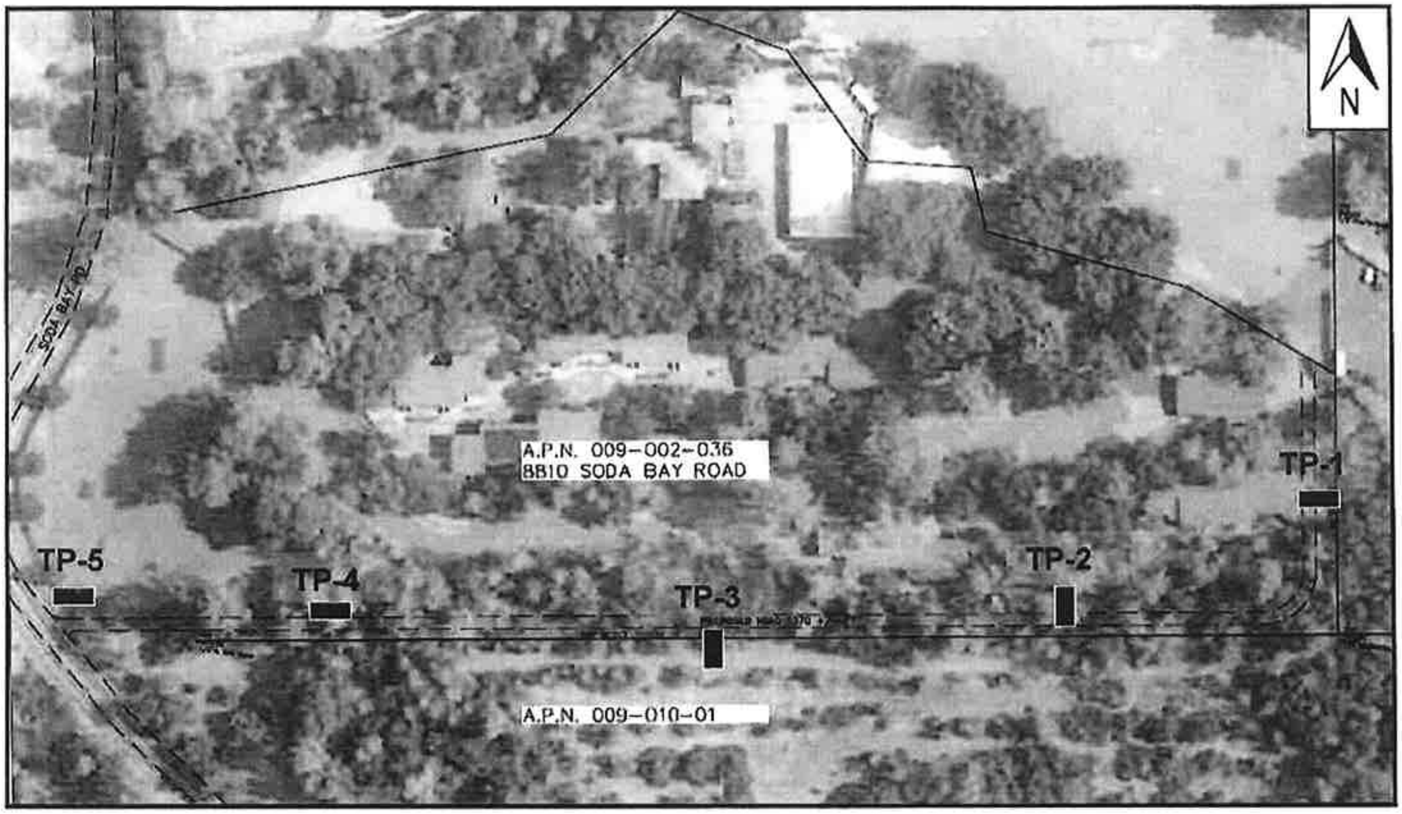
1. INTRODUCTION

The field program performed for this study consisted of excavating five exploratory test pits (TP-1 through TP-5) around the project site. The exploration was completed on February 20, 2019. The test pit locations are shown on the Test Pit Location Plan, Plate 2. Descriptive logs of the test pits are presented in this appendix as Plates 3 through 7.

2. TEST PITS

The test pits were excavated with a track-mounted mini excavator equipped with 18-inch bucket. Disturbed samples for logging and laboratory testing were collected. The excavation was performed under the observation of a project engineer of PJC who maintained a continuous log of soil conditions and obtained samples suitable for laboratory testing. The soils were classified according to Unified Soil Classification System as presented on Plate 8.

Disturbed samples used in the laboratory investigation were obtained from various locations during the course of the field investigation, as discussed in Appendix A of this report. Identification of each sample is by pit number, sample number and depth. All of the various laboratory tests performed during the course of the investigation are described below in Appendix B.



NO SCALE

EXPLANATION

▮ TEST PIT LOCATION AND DESIGNATION

REFERENCE: OVERALL SITE PLAN TITLED, "KIDS CAMP PROPOSED ACCESS ROAD", NOT AUTHORED, NOT DATED.

PJC & Associates, Inc.
Consulting Engineers & Geologists

TEST PIT LOCATION PLAN
PROPOSED ACCESS ROAD
8810 SODA BAY ROAD
KELSEYVILLE, CALIFORNIA

PLATE 2

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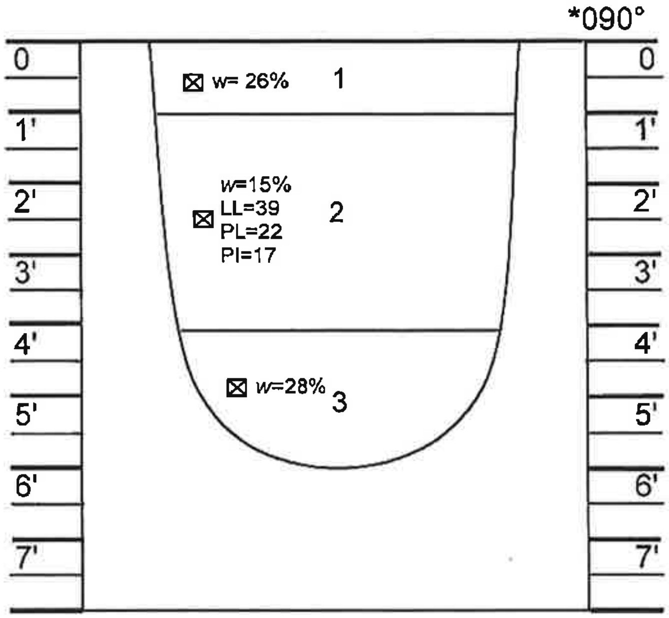


BUCKET/BOULDER REFUSAL AT
6.0 FEET

NO GROUNDWATER OR SEEPAGE
ENCOUNTERED

***Orientation of Test Pit**

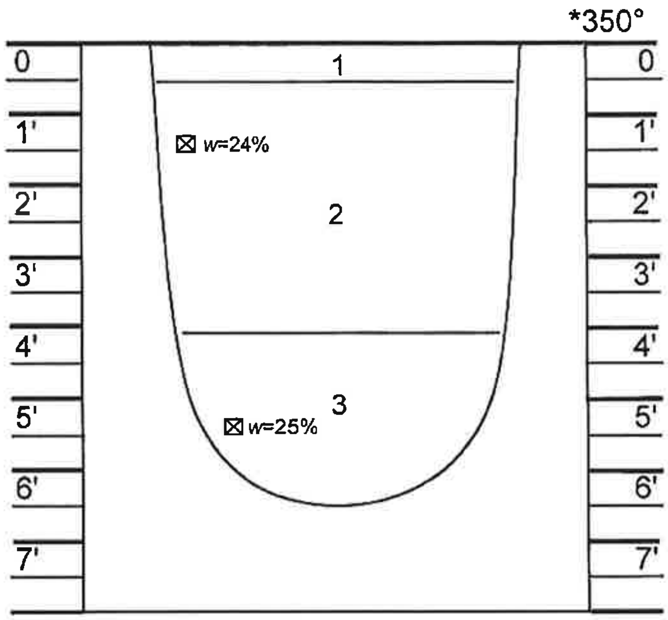
LITHOLOGY

1) 0.0-1.0'; CLAYEY SILT (ML); brownish gray, very moist, soft, low plasticity, with gravels and cobbles, small to large tree roots (TOPSOIL).

2) 1.0'-4.0'; SANDY CLAY (CL); reddish brown, moist, stiff, medium plasticity, with cobbles and large boulders (df).

3) 4.0'-6.0'; SANDY CLAY (CL); pale yellowish gray, very moist, stiff, low plasticity, large cobbles and boulders (df).

PJC & Associates, Inc. Consulting Engineers & Geologists	LOG OF TEST PIT 1 PROPOSED ACCESS ROAD 8810 SODA BAY ROAD KELSEYVILLE, CALIFORNIA	PLATE **3**
	Proj. No: 9023.01 Date: 3/19 App'd by: PJC	



TERMINATED AT 6.5 FEET

NO GROUNDWATER OR SEEPAGE ENCOUNTERED

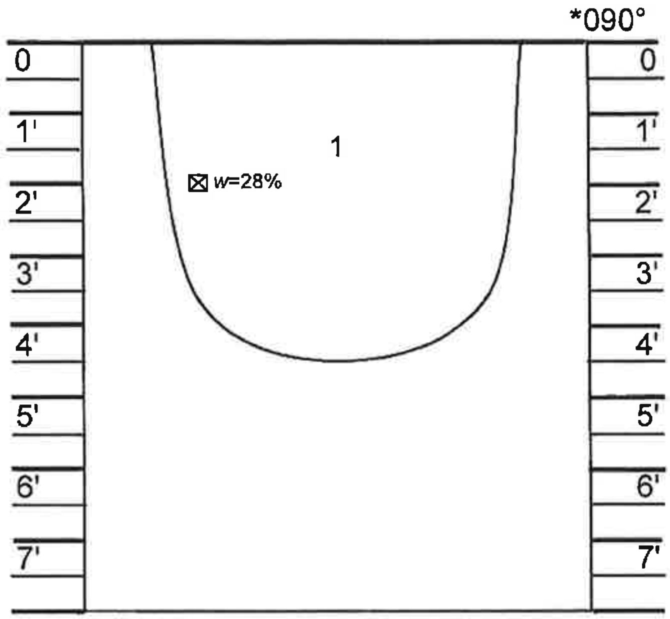
***Orientation of Test Pit**

LITHOLOGY

1) 0.0-0.5'; ORGANIC DEBRIS; pine needles, leaves, roots and other decomposing organics (SURFACE MATERIAL).

2) 0.5'-4.0'; SANDY CLAY (CL); orangish brown, very moist, medium stiff to stiff, medium plasticity, with small and large roots, few gravels and cobbles (df).

3) 4.0'-6.5'; SANDY CLAY (CL); pale yellowish gray, very moist, stiff, medium plasticity, large cobbles and boulders (df).



BUCKET/BOULDER REFUSAL AT
4.5 FEET

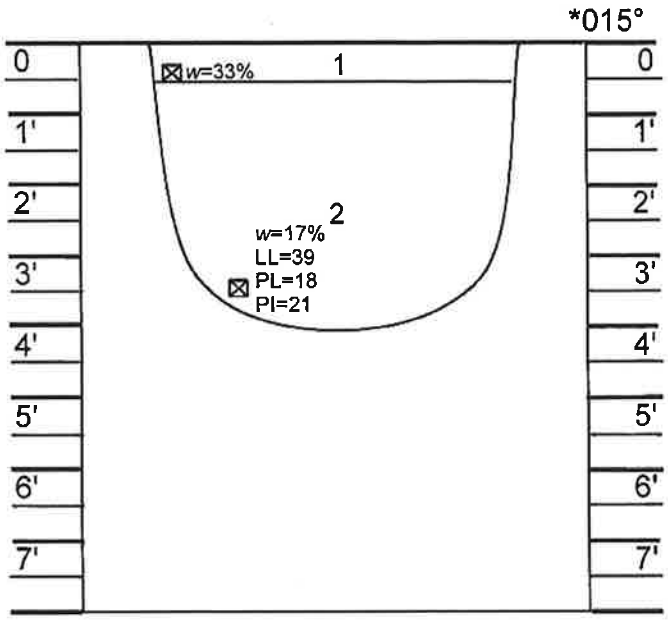
NO GROUNDWATER OR SEEPAGE
ENCOUNTERED

***Orientation of Test Pit**

LITHOLOGY

1) 0.0-4.5'; SANDY CLAY; reddish orangish brown, very moist, medium stiff, low plasticity, with small and large roots and cobble and boulders (yp).

PJC & Associates, Inc. Consulting Engineers & Geologists	LOG OF TEST PIT 4 PROPOSED ACCESS ROAD 8810 SODA BAY ROAD KELSEYVILLE, CALIFORNIA	PLATE 6
	Proj. No: 9023.01 Date: 3/19 App'd by: PJC	



BUCKET/BOULDER REFUSAL AT
4.0 FEET

NO GROUNDWATER OR SEEPAGE
ENCOUNTERED

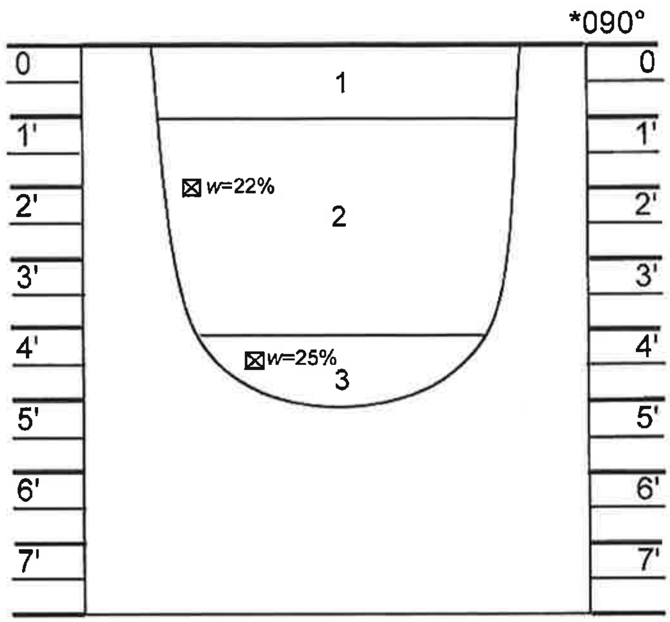
***Orientation of Test Pit**

LITHOLOGY

1) 0.0-0.5'; CLAYEY SILT; grayish brown, very moist, soft, low plasticity, with organics (TOPSOIL).

2) 0.5'-4.0'; SANDY CLAY (CL); brownish red, moist, medium stiff, medium plasticity, with large cobbles and boulders (yp).

PJC & Associates, Inc. Consulting Engineers & Geologists	LOG OF TEST PIT 3 PROPOSED ACCESS ROAD 8810 SODA BAY ROAD KELSEYVILLE, CALIFORNIA	PLATE 5
	Proj. No: 9023.01 Date: 3/19 App'd by: PJC	



TERMINATED AT 5.0 FEET

NO GROUNDWATER OR SEEPAGE ENCOUNTERED

***Orientation of Test Pit**

LITHOLOGY

1) 0.0-1.0'; SANDY GRAVEL (GW); pale gray, moist, loosely compacted, medium to coarse grained, parking area topper (FILL).

2) 1.0'-4.0'; SANDY CLAY (CL); reddish brown, very moist, medium stiff to stiff, low plasticity, few gravels and cobbles (yp).

3) 4.0'-5.0'; SANDY CLAY (CL); brownish orange, very moist, stiff to very stiff, low plasticity, with gravels (yp).

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LOG OF TEST PIT 5
PROPOSED ACCESS ROAD
8810 SODA BAY ROAD
KELSEYVILLE, CALIFORNIA

PLATE 7

Proj. No: 9023.01 Date: 3/19 App'd by: PJC

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS More than half is larger than #200 sieve	GRAVELS more than half coarse fraction is larger than no. 4 sieve size	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES
		GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, POORLY GRADED GRAVEL-SAND MIXTURES
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND MIXTURES
	SANDS more than half coarse fraction is smaller than no. 4 sieve size	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
			SP	POORLY GRADED SANDS, GRAVEL-SAND MIXTURES
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS More than half is smaller than #200 sieve	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, VERY FINE SANDS, ROCK FLOUR, CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS OR LEAN CLAYS
			OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

KEY TO TEST DATA

LL — Liquid Limit (in %)
PL — Plastic Limit (in %)
G — Specific Gravity
SA — Sieve Analysis
Consol — Consolidation
■ "Undisturbed" Sample
☒ Bulk or Disturbed Sample
☐ No Sample Recovery

	Shear Strength, psf	Confining Pressure, psf	
*Tx	320	(2600)	Unconsolidated Undrained Triaxial
Tx CU	320	(2600)	Consolidated Undrained Triaxial
DS	2750	(2000)	Consolidated Drained Direct Shear
FVS	470		Field Vane Shear
*UC	2000		Unconfined Compression
LVS	700		Laboratory Vane Shear

Notes: (1) All strength tests on 2.8" or 2.4" diameter sample unless otherwise indicated
(2) * Indicates 1.4" diameter sample

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USCS SOIL CLASSIFICATION KEY
PROPOSED ACCESS ROAD
8810 SODA BAY ROAD
KELSEYVILLE, CALIFORNIA

PLATE
8

Proj. No: 9023.01 Date: 03/19 App'd by: PJC

APPENDIX B
LABORATORY INVESTIGATION

1. INTRODUCTION

This appendix includes a discussion of the test procedures of the laboratory tests performed by PJC for use in the geotechnical study. The testing was carried out employing, whenever practical, currently accepted test procedures of the American Society for Testing and Materials (ASTM).

Disturbed samples used in the laboratory investigation were obtained from various locations during the course of the field investigation, as discussed in Appendix A of this report. Identification of each sample is by test pit number, sample and depth. All of the various laboratory tests performed during the course of the investigation are described below.

2. INDEX PROPERTY TESTING

In the field of soil mechanics and geotechnical engineering design, it is advantageous to have a standard method of identifying soils and classifying them into categories or groups that have similar distinct engineering properties. The most commonly used method of identifying and classifying soils according to their engineering properties is the Unified Soil Classification System as described by ASTM D-2487-83. The USCS is based on a recognition of the various types and significant distribution of soil characteristics and plasticity of materials.

a. Natural Water Content. Natural water content was determined, often in conjunction with other tests, on selected disturbed samples. The samples were visually classified and accurately measured for wet weight. The samples were then dried in accordance with the procedures of ASTM 2216-80 for a period of 24 hours in an oven, maintained at a temperature of 100 degrees C. After drying, the weight of each sample was determined and the moisture content calculated. The results of these test are indicated on the test pit logs

b. Atterberg Limits. Liquid and plastic limits were determined on selected samples in accordance with ASTM D4318-83. The results of the limits are summarized in the body of this report and on the test pit logs.

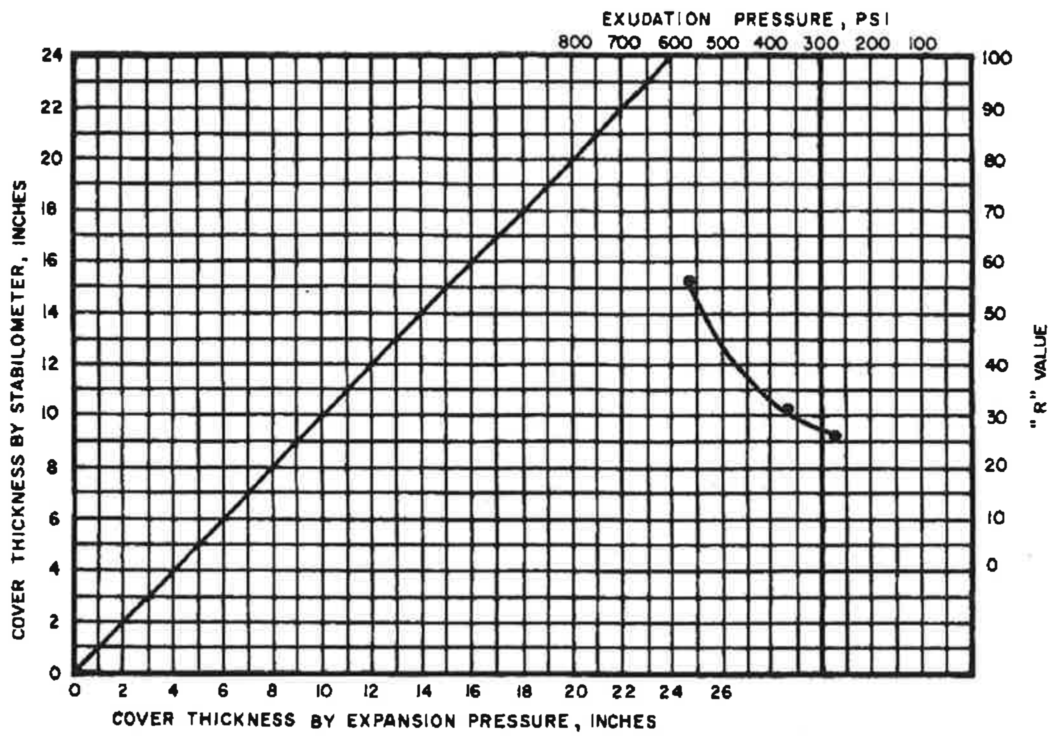
c. Expansion Index Testing. An expansion index test was performed on a selected sample in accordance with ASTM D4829. The results are summarized in the body of this report indicated on the test pit logs.

3. ENGINEERING PROPERTIES TESTING

a. R-Value. An R-value test was performed on a representative sample of the surface soils to develop criteria for the design of pavement sections. The test was conducted in accordance with the California Division of Highways Test Method No. 310. The results are shown on Plate 9.

RESISTANCE VALUE TEST RESULTS

SAMPLE NO. 1



SAMPLE DESCRIPTION :	COMPOSITE BULK; 0.0'-3.5'		
Specimen	A	B	C
Exudation Pressure, psi	279	367	567
Expansion Dial (0.0001")	0	3	29
Expansion Pressure, psf	0	13	126
Resistance Value, "R"	26	31	56
Moisture at test, %	20.14	19.81	19.41
"R" Value at 300 psi, Exudation Pressure	**27**		
"R" Value by Expansion Pressure-T.I. = Gf=	--------------------------		

APPENDIX C
REFERENCES

1. "Soil Mechanics" Department of the Navy Design Manual 7.1 (NAVFAC DM-7.1), dated May 1982.

2. "Foundations and Earth Structures" Department of the Navy Design Manual 7.2 (NAVFAC DM-7.2), dated May 1982.

3. "Soil Dynamics, Deep Stabilization, and Special Geotechnical Construction" Department of the Navy Design Manual 7.3 (NAVFAC DM-7.3), dated April 1983.

4. Geologic Map titled, Geologic Map and Structure Sections of Clear Lake Volcanics, Northern California, prepared by the USGS, dated 1995.

5. USGS Clearlake Highlands, California Quadrangle 7.5-Minute Topographic Map, dated 1990.

6. McCarthy, David. Essential of Soil Mechanics and Foundations. 5th Edition, 1998.

7. Bowels, Joseph, Engineering Properties of Soils and Their Measurement. 4th Edition, 1992.

8. California Building Code (CBC), 2016 edition.

9. USGS National Seismic Hazard Maps, 2008.

10. Overall site plan titled, "Kids Camp Proposed Access Road," not authored, not dated.