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Prepared for **Eden Housing**

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL DEVELOPMENT
RENOVATION AND IMPROVEMENTS
POINT REYES COAST GUARD HOUSING
POINT REYES STATION, CALIFORNIA

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July 14, 2022
Project No. 21-2050

ROCKRIDGE
GEOTECHNICAL

July 14, 2022
Project No. 21-2050

Mr. Jeremy Hoffman
Associate Director of Real Estate Development
Eden Housing
22645 Grand Street
Hayward, California 94541

Subject: Final Report
Geotechnical Investigation
Proposed Residential Development Renovation and Improvements
Point Reyes Coast Guard Housing
Point Reyes Station, California

Dear Mr. Hoffman,

This report presents the results of our geotechnical investigation for the proposed residential development renovations to be performed at the Point Reyes Coast Guard Housing in Point Reyes Station, California. Our geotechnical investigation was performed in accordance with our proposal dated June 10, 2021.

The subject property is located at the terminus of Commodore Webster Road, approximately one-quarter mile east of downtown Point Reyes Station. The site is currently occupied by 10 townhome buildings, two administrative buildings, parking lots, a tennis court, and landscaped areas.

Plans are to renovate the existing buildings, including adding 14 one-bedroom apartments, installing an elevator, and constructing an enlarged community kitchen/gathering space at Building 50. Other proposed improvements include upgrades to wastewater treatment facilities, constructing additional community spaces, and upgrading outdoor common spaces, roadways, pedestrian paths, and sidewalks.

From a geotechnical standpoint, we conclude the proposed improvements can be constructed as planned. We conclude the proposed improvements may be supported on conventional spread footings bearing on the existing fill or on new fill if placement of new fill is required to raise grades

The recommendations contained in our report are based on a limited subsurface exploration and laboratory testing program. Consequently, variations between expected and actual subsurface conditions may be found in localized areas during construction. Therefore, we should be engaged to observe excavation, grading, and installation of foundations, during which time we may make changes in our recommendations, if deemed necessary.

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

Sincerely,
ROCKRIDGE GEOTECHNICAL, INC.

REGISTERED PROFESSIONAL ENGINEER
CRAIG S. SHIELDS
GE2116
3/31/23
GEOTECHNICAL
STATE OF CALIFORNIA

Craig S. Shields, P.E., G.E.
Principal Geotechnical Engineer

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POINT REYES COAST GUARD HOUSING
100 COMMODORE WEBSTER DRIVE
Point Reyes Station, California

1.0 INTRODUCTION

This report presents the results of the geotechnical investigation performed by Rockridge Geotechnical, Inc. for the proposed residential development renovation and improvements to be performed at the Point Reyes Coast Guard Housing at 100 Commodore Webster Drive in Point Reyes Station, California. The project site is at the terminus of Commodore Webster Drive, east of its intersection with Mesa Road, as shown on the Site Location Map, Figure 1.

The site is relatively level and located approximately one-quarter mile east of downtown Point Reyes Station. It is currently occupied by 10 at-grade, wood-framed, two- to three-story townhome buildings and two administrative buildings, as well as parking lots and landscaped areas.

Plans are to renovate the existing buildings, including adding 14 one-bedroom apartments, installing an elevator, and constructing an enlarged community kitchen/gathering space at Building 50. Other proposed improvements include improvements to wastewater treatment facilities, constructing additional community spaces, and upgrading outdoor common spaces, roadways, pedestrian paths, and sidewalks.

2.0 SCOPE OF SERVICES

Our investigation was performed in accordance with our proposal dated June 10, 2021. Our scope of services consisted of exploring subsurface conditions at the site by drilling four test borings, performing laboratory testing on selected soil samples, and performing engineering analyses to develop conclusions and recommendations regarding:

- site seismicity and seismic hazards, including potential for liquefaction and liquefaction-induced ground failure

- the most appropriate foundation type(s) for the proposed improvements
- design criteria for the recommended foundation type(s), including vertical and lateral capacities
- estimates of foundation settlement under static and seismic conditions
- design groundwater elevation
- lateral earth pressures for design of the retaining walls, including below-grade walls for the proposed elevator pit
- subgrade preparation for slab-on-grade floors and exterior flatwork
- site grading and excavation, including criteria for fill quality and compaction
- flexible and rigid pavement sections
- corrosivity of the near-surface soil and the potential effects on buried concrete and metal structures and foundations
- 2019 California Building Code (CBC) site class and design spectral response acceleration parameters
- construction considerations.

3.0 PREVIOUS GEOTECHINCAL INVESTIGATION

Questa Engineering Corporation (Questa) previously performed subsurface investigations at the site in November 2000 and December 2020. Questa's investigation in 2020 included drilling four test borings to depths ranging from 21 to 40 feet below the ground surface (bgs). In 2000, Questa installed seven monitoring wells to depths ranging from 13 to 40 feet bgs. Monitoring wells MW-1 and MW-2 were drilled east and northeast of the project site, respectively, and were not considered for our investigation. The approximate locations of Questa's test borings and monitoring wells MW-3 through MW-7 are shown on Figure 2. The logs of the borings and monitoring wells are attached in Appendix C.

4.0 FIELD INVESTIGATION AND LABORATORY TESTING

Our field investigation consisted of drilling four test borings and performing laboratory testing on selected soil samples. Prior to advancing the borings, we obtained a drilling permit from the Marin County Environmental Health Services (MCEHS). We also contacted Underground

Service Alert (USA) to notify them of our work, as required by law, and retained a private utility locator, Precision Locating, LLC, to reduce the potential for encountering existing buried utilities in the boreholes. Details of the field investigation and laboratory testing are described below.

4.1 Test Borings

Subsurface conditions at the site were explored by drilling four test borings, designated as B-1 through B-4. at the approximate locations shown on Figure 2. The borings were advanced on July 6, 2021 by Benevent Building of Concord, California to a depth of 21-1/2 feet below the existing ground surface (bgs) using a limited-access drill rig equipped with four-inch-diameter solid-stem flight augers. During drilling, our field engineer logged the soil encountered and obtained representative samples for visual classification and laboratory testing. The logs of the borings are presented in Appendix A on Figures A-1 through A-4. The soil and bedrock encountered in the borings were classified in accordance with the classification charts shown on Figures A-5 and A-6, respectively.

Soil samples were obtained using the following samplers:

- Modified California (MC) split-barrel sampler with a 3.0-inch outside diameter and 2.5-inch inside diameter, lined with 2.43-inch inside diameter stainless steel tubes.
- Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch outside and 1.5-inch inside diameter; the sampler was designed to accommodate liners, but liners were not used.

The type of sampler used was selected based on material type and the desired sample quality for laboratory testing. The MC and SPT samplers were driven with a 140-pound safety hammer falling 30 inches per drop using a rope-and-cathead system. The samplers were driven up to 18 inches and the hammer blows required to drive the samplers were recorded every six inches and are presented on the boring logs. A "blow count" is defined as the number of hammer blows per six inches of penetration or 50 blows for six inches or less of penetration. The blow counts required to drive the MC and SPT samplers were converted to approximate SPT N-values using factors of 0.7 and 1.2, respectively, to account for sampler type and approximate hammer energy.

The blow counts used for this conversion were the last two blow counts. The converted SPT N-values are presented on the boring logs.

Upon completion, the boreholes were backfilled with cement grout in accordance with MCEHS requirements. Soil cuttings generated from the soil borings were spread near the boring locations.

4.2 Laboratory Testing

We re-examined each soil and bedrock sample obtained from our borings to confirm the field classifications and selected representative samples for laboratory testing. Soil samples were tested by Construction Materials Testing, Inc. of Livermore, California to measure moisture content, dry density, Atterberg limits, particles passing the No. 200 sieve, and resistance value (R-value). Soil samples were also tested by Project X Corrosion Engineering of Murrieta, California to measure corrosivity potential. The results of the laboratory tests are presented on the boring logs and in Appendix B.

5.0 SUBSURFACE CONDITIONS

Regional geologic information (Figure 3) indicates the site is underlain by Holocene-age alluvium (Qhy). The site is near the geologic contact of Pleistocene-age alluvium, Holocene-age alluvium, and Pleistocene-age marine terrace deposits. A review of an aerial photograph from 1965, which was prior to development of the site, indicates the site sloped gently down to the southeast prior to development.

Based on the results of our field investigation and the previous field investigations by Questa, we conclude the site is blanketed by fill ranging in thickness from approximately 1-1/2 feet at the Boring B-1 location to about six feet at the Boring B-2 location. The logs of the Questa borings drilled in 2020 indicate fill ranging in thickness from from 3 to 4 feet was encountered in Borings CG-2 through CG-4. No fill was noted on the log of Boring CG-1. The fill in our borings consisted of medium dense to dense clayey sand and very stiff to hard clay with varying sand and gravel content. Based on the SPT N-values, the fill appears to be well compacted. Atterberg limits tests performed on two samples of the near-surface clay at depths of 1.5 and 4 feet bgs resulted in plasticity indices (PI) of 4 and 9, respectively indicating the clay has a low expansion potential.

At the locations of Borings B-1, B-2, and B-4, the fill is underlain by native soil consisting of terrace deposits and old alluvium that extends to depths ranging from about 8 to 18 feet bgs. The native soil encountered in our borings consisted of medium dense to dense clayey sand with varying gravel content, dense clayey gravel with sand, dense sand, and hard sandy clay with gravel. Below the native soil, we encountered either residual soil (i.e., decomposed bedrock) consisting of very stiff to hard sandy clay or deeply to completely weathered Franciscan mélange bedrock. At the Boring B-3 location, moderately weathered sandstone was encountered below the fill at a depth of approximately five feet bgs. The Franciscan mélange bedrock encountered in our borings was moderately to completely weathered and included sandstone, shale/serpentinite, and greenstone.

5.1 Groundwater

Groundwater was encountered in borings B-1 and B-2 at depths of 12 feet and 11 feet bgs, respectively. The groundwater levels measured in the borings may not have stabilized at the time when the measurements were taken. During Questa Engineering's field investigation in 2000, groundwater was encountered between 8 and 33 feet bgs. To further estimate the highest potential groundwater level at the site, we reviewed information on the State of California Water Resources Control Board GeoTracker website (https://geotracker.waterboards.ca.gov/). From the GeoTracker website, we obtained information from monitoring wells installed for a former Chevron storage facility located at 11095 State Route 1, located about 0.25 miles southwest of the site. Summary of groundwater level measurements presented in the *2010 Annual Groundwater Monitoring Report, Former Redwood Oil/Chevron Bulk Terminal 20-6457, 11095 State Route 1, Point Reyes, California* prepared by Conestoga-Rovers & Associates (CRA) indicate the groundwater level was measured between May 2004 to May 2010. Measured groundwater levels ranged from 4.37 to 14.18 feet bgs.

The depth to groundwater is expected to vary several feet annually depending on rainfall amounts. We estimate the historic high groundwater at the site to be about five feet bgs.

6.0 SEISMIC CONSIDERATIONS

6.1 Regional Seismicity

The site is in the Coast Ranges geomorphic province of California that is characterized by northwest-southeast trending valleys and ridges. These topographic features are controlled by folds and faults that resulted from the collision of the Farallon and North American plates and subsequent strike-slip faulting along the San Andreas Fault system. The San Andreas Fault is more than 600 miles long from Point Arena in the north to the Gulf of California in the south. The Coast Ranges province is bounded on the east by the Great Valley and on the west by the Pacific Ocean.

The major active faults in the area are the San Andreas, San Gregorio and Hayward faults. These and other faults of the region are shown on Figure 4. For these and other active faults within a 50-kilometer radius of the site, the distance and direction from the site and characteristic moment magnitude[1] [Petersen et al. (2014) & Thompson et al. (2016)] are summarized in Table 1. These references are based on the Third Uniform California Earthquake Rupture Forecast (UCERF3), prepared by Field et al. (2013).

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[1] Moment magnitude is an energy-based scale and provides a physically meaningful measure of the size of a faulting event. Moment magnitude is directly related to average slip and fault rupture area.

TABLE 1
Regional Faults and Seismicity

Fault Segment	Approximate Distance from Site (km)	Direction from Site	Characteristic Moment Magnitude
Total North San Andreas (SAO+SAN+SAP+SAS)	1.3	Southwest	8.04
North San Andreas (North Coast, SAN)	1.3	Southwest	7.52
San Gregorio (North)	17	Southeast	7.44
North San Andreas (Peninsula, SAP)	22	Southeast	7.38
Total Hayward + Rodgers Creek (RC+HN+HS+HE)	31	East	7.58
Hayward (North, HN)	31	East	6.90
Rodgers Creek - Healdsburg	31	Northeast	7.19
West Napa	48	East	6.97
Maacama	50	Northeast	7.55

In the past 200 years, four major earthquakes have been recorded on the San Andreas Fault. In 1836, an earthquake with an estimated maximum intensity of VII on the Modified Mercalli (MM) scale occurred east of Monterey Bay on the San Andreas Fault (Toppozada and Borchardt 1998). The estimated moment magnitude, M_w, for this earthquake is about 6.25. The San Francisco Earthquake of 1906 caused the most significant damage in the history of the Bay Area in terms of loss of lives and property damage. This earthquake created a surface rupture along the San Andreas Fault from Shelter Cove to San Juan Bautista approximately 470 kilometers in length. It had a maximum intensity of XI (MM), an M_w of about 7.9, and was felt 560 kilometers away in Oregon, Nevada, and Los Angeles. The Loma Prieta Earthquake of October 17, 1989 had an M_w of 6.9 and occurred approximately 140 kilometers south of the site.

In 1868, an earthquake with an estimated maximum intensity of X on the MM scale occurred on the southern segment (between San Leandro and Fremont) of the Hayward Fault. The estimated M_w for the earthquake is 7.0. In 1861, an earthquake of unknown magnitude (probably an M_w of about 6.5) was reported on the Calaveras Fault. The most recent significant earthquake on this fault was the 1984 Morgan Hill earthquake which had an M_w of 6.2.

In the North Bay, on August 24, 2014, an earthquake occurred on a splay of the West Napa fault about 48 kilometers northeast of the site. The epicenter of this earthquake was located about 10 kilometers southwest of the Town of Napa, California. The earthquake had an M_w of 6.0 and a maximum intensity of VIII on the MM scale.

As a part of the UCERF3 project, researchers estimate that the probability of at least one $M_w \geq 6.7$ earthquake occurring in the greater San Francisco Bay Area during a 30-year period (starting in 2014) is 72 percent. The highest probabilities are assigned to sections of the Hayward (South), Calaveras (Central) and the North San Andreas (Santa Cruz Mountains) faults. The respective probabilities are approximately 25, 21, and 17 percent.

6.2 Geologic Hazards

Because the project site is in a seismically active region, we evaluated the potential for earthquake-induced geologic hazards including ground shaking, ground surface rupture, liquefaction,[2] lateral spreading,[3] and cyclic densification[4]. We used the results of our field investigation to evaluate the potential of these phenomena occurring at the project site.

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[2] Liquefaction is a phenomenon where loose, saturated, cohesionless soil experiences temporary reduction in strength during cyclic loading such as that produced by earthquakes.

[3] Lateral spreading is a phenomenon in which surficial soil displaces along a shear zone that has formed within an underlying liquefied layer. Upon reaching mobilization, the surficial blocks are transported downslope or in the direction of a free face by earthquake and gravitational forces.

[4] Cyclic densification is a phenomenon in which non-saturated, cohesionless soil is compacted by earthquake vibrations, causing ground-surface settlement.

6.2.1 Ground Shaking

The seismicity of the site is governed by the activity of the San Andreas fault, which is located approximately 1.3 kilometers southwest of the site, although ground shaking from future earthquakes on other faults will also be felt at the site. The intensity of earthquake ground motion at the site will depend upon the characteristics of the generating fault, distance to the earthquake epicenter, and magnitude and duration of the earthquake. We judge that strong to very strong ground shaking could occur at the site during a large earthquake on one of the nearby faults.

6.2.2 Ground Surface Rupture

Historically, ground surface displacements closely follow the trace of geologically young faults. The site is not within an Earthquake Fault Zone, as defined by the Alquist-Priolo Earthquake Fault Zoning Act, and no known active or potentially active faults exist on the site. We therefore conclude the risk of fault offset at the site from a known active fault is very low. In a seismically active area, the remote possibility exists for future faulting in areas where no faults previously existed; however, we conclude the risk of surface faulting and consequent secondary ground failure from previously unknown faults is also very low.

6.2.3 Liquefaction and Associated Hazards

When a saturated, cohesionless soil liquefies, it experiences a temporary loss of shear strength created by a transient rise in excess pore pressure generated by strong ground motion. Soil susceptible to liquefaction includes loose to medium dense sand and gravel, low-plasticity silt, and some low-plasticity clay deposits. Flow failure, lateral spreading, differential settlement, loss of bearing strength, ground fissures and sand boils are evidence of excess pore pressure generation and liquefaction.

The site is located within a “low” level of liquefaction susceptibility as shown on the map titled *Liquefaction Susceptibility Hazards Map 2-11, San Francisco Bay Region, California*, dated 2000 (see Figure 5). We evaluated the liquefaction potential of soil encountered below groundwater at the site using data collected in our borings and the methodology proposed by

Youd et al. (2001). Our analysis was performed using a high groundwater depth of five feet bgs. In accordance with the 2019 California Building Code (CBC), we used a peak ground acceleration of 1.12 times gravity (g) in our liquefaction evaluation; this peak ground acceleration is consistent with the Maximum Considered Earthquake Geometric Mean (MCE_G) peak ground acceleration adjusted for site effects (PGA_M) for a Site Class D. We also used a moment magnitude 8.04 earthquake, which is consistent with the mean characteristic moment magnitude for the San Andreas Fault, as presented in Table 1.

Based on the results of our analyses, we conclude the potential for liquefaction and ground failures associated with liquefaction, including lateral spreading, to occur at the site during a seismic event is low due to the high relative density and/or cohesion of the soil below the design groundwater level.

6.2.4 Cyclic Densification

Cyclic densification (also referred to as differential compaction) of non-saturated sand (sand above groundwater table) can occur during an earthquake, resulting in settlement of the ground surface and overlying improvements. Based on our investigation, we conclude the granular soil above the groundwater table is not susceptible to cyclic densification because of its cohesion and/or relative density. Therefore, we conclude the potential for settlement of the ground surface and the site improvements due to cyclic densification is very low.

8.0 RECOMMENDATIONS

Our recommendations for site preparation and grading, foundation design, pavement design, seismic design, and other geotechnical aspects of the project are presented in this section.

8.1 Site Preparation and Grading

Site demolition for any new construction, including the addition at Building 50, should include the removal of all existing pavements, underground utilities and buried foundations that will interfere with new construction. In general, abandoned underground utilities should be removed to the property line or service connections and properly capped or plugged with concrete. Where existing utility lines are outside of the proposed addition footprint and will not interfere with the proposed construction, they may be abandoned in-place provided the lines are filled with lean concrete or cement grout to the property line. It may be feasible to leave existing foundations in place if they will not interfere with new construction; however, this should be evaluated on a case-by-case basis. Voids resulting from demolition activities should be properly backfilled with compacted fill under the observation of our field engineer and following the recommendations provided in this section.

In areas that will receive fill or improvements (i.e., pavement, foundations, or concrete flatwork), the soil subgrade should be scarified to a depth of at least eight inches, moisture-conditioned to above optimum moisture content, and compacted to at least 90 percent relative compaction[5]. The upper eight inches of soil subgrade for vehicular pavements should be compacted to at least 95 percent relative compaction and be non-yielding. The soil subgrade should be kept moist until it is covered by fill or improvements.

Fill should consist of on-site soil or imported soil (select fill) that is free of organic matter, contains no rocks or lumps larger than three inches in greatest dimension, has a liquid limit of less than 40 and a plasticity index lower than 12, and is approved by the Geotechnical Engineer. Samples of proposed imported fill material should be submitted to the Geotechnical Engineer at least three business days prior to use at the site. The grading contractor should provide analytical test results or other suitable environmental documentation indicating the imported fill is free of hazardous materials at least three days before use at the site. If this data is not available, up to two weeks should be allowed to perform analytical testing on the proposed imported material.

Fill should be placed in horizontal lifts not exceeding eight inches in uncompacted thickness, moisture-conditioned to near optimum moisture content, and compacted to at least 90 percent

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[5] Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material, as determined by the ASTM D1557 laboratory compaction procedure.

relative compaction. Fill consisting of clean sand or gravel (defined as poorly-graded soil with less than five percent fines by weight) should be compacted to at least 95 percent relative compaction. Fill greater than five feet in thickness should also be compacted to at least 95 percent relative compaction.

8.1.1 Utility Trench Backfill

Excavations for trenches can readily be made with a backhoe. All trenches should conform to the current CAL-OSHA requirements. To provide uniform support, pipes or conduits should be bedded on a minimum of four inches of clean sand or fine gravel. After the pipes and conduits are tested, inspected (if required) and approved, they should be covered to a depth of six inches with clean sand or fine gravel, which should be mechanically tamped. Backfill for utility trenches and other excavations is also considered fill and should be placed and compacted according to the recommendations previously presented. Special care should be taken when backfilling utility trenches within the building footprint and beneath pavements. Poor compaction may result in excessive settlement and damage to the building and/or pavements. If imported clean sand or gravel (defined as poorly-graded soil with less than five percent fines by weight) is used for trench backfill, it should be compacted to at least 95 percent relative compaction. Jetting of trench backfill should not be permitted.

8.1.2 Exterior Concrete Flatwork

Exterior concrete flatwork that will not receive vehicular traffic (i.e. sidewalk) should be underlain by at least four inches of Class 2 aggregate base compacted to at least 90 percent relative compaction. Prior to placement of the aggregate base, the upper eight inches of the subgrade soil should be scarified, moisture-conditioned to near optimum moisture content, and compacted to at least 90 percent relative compaction.

8.1.3 Drainage and Landscaping

Positive surface drainage should be provided around the buildings to direct surface water away from foundations and below-grade walls. To reduce the potential for water ponding adjacent to the buildings, we recommend the ground surface within a horizontal distance of five feet from the buildings slope down away from the buildings with a surface gradient of at least two percent in unpaved areas and one percent in paved areas. In addition, roof downspouts should be discharged into controlled drainage facilities to keep the water away from the foundation and below-grade walls.

8.2 Spread Footings

We anticipate the existing buildings, which are relatively light, are supported on spread footings bottomed in the existing fill, although some footings may extend into the native soil. If new loads will be imposed on the existing footings, test pits should be excavated to determine the depth and width of the footings. Assuming the footings are bottomed at least 18 inches below the lowest adjacent grade, an allowable bearing pressure of 2,500 pounds per square foot (psf) may be used to evaluate existing footings for dead-plus-live-load conditions. The value may be increased by one-third for total load conditions. We estimate settlement of existing footings will not exceed 1/2 inch.

Proposed improvements may be supported on conventional spread footings bearing on the existing fill or on new fill if placement of new fill is required to raise grades. Continuous footings should be at least 16 inches wide and isolated footings should be at least 18 inches wide. Footings should be bottomed at least 18 inches below the lowest adjacent soil subgrade. Spread footings should be designed using an allowable bearing pressure of 2,500 psf for dead-plus-live loads; this value may be increased by one-third for total design loads, which include wind or seismic forces; these values include factors of safety of at least 2.0 and 1.5, respectively. We estimate total settlement of new footings under static loads will not exceed 3/4 inch and differential settlement will be less than 1/2 inch over a horizontal distance of 30 feet.

Lateral loads may be resisted by a combination of passive pressure on the vertical faces of the footings and friction between the bottoms of the footings and the supporting soil. To compute lateral resistance provided by footings, we recommend using an equivalent fluid weight of 260 pounds per cubic foot (pcf). Passive pressure in the upper one foot of soil should be neglected unless confined by a slab or pavement. Frictional resistance should be computed using a base friction coefficient of 0.30. The passive pressure and frictional resistance values include a factor of safety of at least 1.5 and may be used in combination without reduction.

We should check footing excavations prior to the placement of reinforcing steel. Footing excavations should be free of standing water, debris, and disturbed materials prior to placing concrete. If unsuitable bearing material is encountered at the bottom of footing excavations, as determined by our field engineer, the unsuitable material should be removed until competent bearing soil is reached. The overexcavation should be backfilled with lean concrete or controlled low-strength material (CLSM). If the unsuitable bearing material is less than one foot thick, the soil may be compacted in place to at least 90 percent relative compaction using a jumping-jack-type compactor.

If footings are excavated during the rainy season, they should incorporate a rat slab to protect the footing subgrade. This will involve over-excavating the footing by about 2 to 3 inches and placing lean concrete or CLSM in the bottom (following an inspection by our engineer). A rat slab will help protect the footing subgrade during the placement of reinforcing steel. Water, if present, can then be pumped from the excavations prior to the placement of structural concrete. The bottoms and sides of the footing excavations should be moistened following excavation and maintained in a moist condition until the concrete is placed.

8.3 Concrete Slab-on-Grade Floors

The subgrade for new slab-on-grade floors should be prepared in accordance with our recommendations in Section 8.1. Where water vapor transmission through the new floor slab is not desirable, we recommend installing a capillary moisture break and water vapor retarder beneath the floor slab. A capillary moisture break consists of at least four inches of clean, free-draining gravel or crushed rock. The particle size of the capillary break material should meet the gradation requirements presented in Table 2.

TABLE 2
Gradation Requirements for Capillary Moisture Break

Sieve Size	Percentage Passing Sieve
1 inch	90 – 100
3/4 inch	30 – 100
1/2 inch	5 – 25
3/8 inch	0 – 6

The vapor retarder should meet the requirements for Class B vapor retarders stated in ASTM E1745. The vapor retarder should be placed in accordance with the requirements of ASTM E1643. These requirements include overlapping seams by six inches, taping seams, and sealing penetrations in the vapor retarder.

Concrete mixes with high water/cement (w/c) ratios result in excess water in the concrete, which increases the cure time and can result in excessive vapor transmission through the slab/mat. Where the concrete is poured directly over the vapor retarder, we recommend the w/c ratio of the concrete not exceed 0.45. Water should not be added to the concrete mix in the field. If necessary, workability should be increased by adding plasticizers. In addition, the slab/mat should be properly cured. Before the floor covering is placed, the contractor should check that the concrete surface and the moisture emission levels (if emission testing is required) meet the manufacturer’s requirements.

8.4 Permanent Retaining Walls

Retaining walls should be designed to resist static lateral earth pressures, lateral pressures caused by earthquakes, and traffic loads (if vehicular traffic is expected within a horizontal distance equal to 1.5 times the wall height). All on-site walls, including low retaining walls in landscaped areas, should be designed in accordance with the recommendations presented in this section, although checking the walls for seismic loading is not required for walls less than six feet high.

Retaining walls that are restrained from movement at the top or sides (e.g., a wall with a 90-degree turn) should be designed using the at-rest pressure presented in Table 3. Walls that are not restrained from rotation may be designed using the active pressure presented in Table 3.

TABLE 3
Lateral Earth Pressures for Retaining Wall Design

Wall Restraint Condition	Wall Drainage	Static Equivalent Fluid Weight	Seismic Equivalent Fluid Weight[2]
Unrestrained	Drained	35 pcf[1]	35 pcf + 19 pcf
Unrestrained	Undrained	80 pcf	80 pcf + 9 pcf
Restrained	Drained	55 pcf	35 pcf + 47 pcf
Restrained	Undrained	90 pcf	80 pcf + 23 pcf

1. Equivalent fluid weight (triangular distribution); pcf = pounds per cubic foot)
2. Seismic condition to be checked for walls that retain more than six feet of soil

The recommended pressures above are based on a level backfill condition with no additional surcharge loads. To avoid surcharging the elevator pit walls with lateral pressures imposed by the proposed footings, the footings should be bottomed below a zone-of-influence line projected upward at an inclination of 1.5:1 (horizontal:vertical) from the bottom of the below-grade walls. Where there will be vehicular traffic behind the top of a permanent wall within a horizontal distance equal to 1.5 times the height of the wall, the wall should be designed for vehicular surcharge of 50 psf, applied over the entire wall height.

To protect against moisture migration, below-grade walls should be waterproofed and water stops should be placed at all construction joints. Although the below-grade walls will be above the design groundwater level, water can accumulate behind the walls from other sources, such as rainfall, irrigation, and broken water lines, etc. If the “drained” earth pressures (i.e., pressures for above design groundwater table) presented above are used to design the walls, they will need to incorporate a drainage system. Alternatively, the walls may be designed for the recommended "undrained" earth pressures (i.e., pressures for below the groundwater table) presented above over their entire height, in which case the drainage system may be omitted.

One acceptable method for back-draining a retaining wall is to place a prefabricated drainage panel against the back of the wall. The drainage panel should extend down to a perforated PVC collector pipe. The pipe should be surrounded on all sides by at least four inches of Caltrans Class 2 permeable material or 3/4-inch drain rock wrapped in filter fabric (Mirafi NC or equivalent). A proprietary, prefabricated collector drain system, such as Tremdrain Total Drain or Hydroduct Coil (or equivalent), designed to work in conjunction with the drainage panel may be used in lieu of the perforated pipe surrounded by gravel described above. The pipe should be connected to a suitable discharge point; a sump and pump system may be required to drain the collector pipes if the grades do not permit draining by gravity to the storm drain system.

If backfill is required behind walls, it should consist of engineered fill. Placement of the engineered fill may impose unacceptable surcharges on the walls. The project structural engineer should determine when the concrete has sufficient strength to resist surcharges imposed by compaction equipment. Bracing may be used to mitigate construction-related surcharge pressures. We recommend lightweight, hand-compaction equipment be used to minimize the potential for damage.

8.5 Flexible (Asphaltic Concrete) Pavement Design

The State of California flexible pavement design method was used to develop the recommended asphaltic concrete (AC) pavement sections. Results of laboratory tests indicate the near surface clay has an R-value of 44. Recommended pavement sections for traffic indices (TIs) ranging from 4.5 to 6.5 are presented in Table 4. The project civil engineer should determine the appropriate design TI based on the anticipated vehicular traffic the pavement will experience. We can provide additional pavement sections for different TIs upon request.

TABLE 4
Asphalt Concrete Pavement Sections

Traffic Index	Asphaltic Concrete (inches)	Class 2 Aggregate Base R = 78 (inches)
4.5	2.5	6.0[1]
5.0	3.0	6.0
5.5	3.0	6.0
6.0	3.5	6.0
6.5	4.0	6.0

1. The minimum recommended AB thickness beneath AC pavements is six inches.

The soil subgrade beneath AC pavements should be scarified to a depth of eight inches, moisture-conditioned to near optimum moisture content, and compacted to at least 95 percent relative compaction. In addition, the subgrade should be a firm and non-yielding surface. The subgrade should be proof-rolled to confirm it is non-yielding prior to placing the aggregate base. The Class 2 aggregate base should be moisture-conditioned to near optimum moisture content and compacted to at least 95 percent relative compaction and be non-yielding

8.6 Portland Cement Concrete Pavement

Concrete pavement design is based on a maximum single-axle load of 20,000 pounds and a maximum tandem axle load of 32,000 pounds and moderate truck traffic (i.e., several trucks per week). The recommended rigid pavement section for these axle loads is six inches of Portland cement concrete (PCC) over six inches of Class 2 aggregate base. For areas that will receive fire truck traffic, the PCC thickness should be increased to seven inches. For areas that will experience only passenger vehicle traffic, the recommended pavement section is five inches of PCC over six inches of Class 2 aggregate base.

The modulus of rupture and unconfined compressive strength of the concrete should be at least 500 and 4,000 pounds per square inch (psi) at 28 days, respectively. Contraction joints should be placed at maximum 15-foot spacing. Where the outer edge of concrete pavement meets asphalt pavement, the concrete slab should be thickened by 50 percent at a taper not to exceed a slope of 1 in 10. The pavement should be reinforced with a minimum of No. 4 bars at 18 inches on center in both directions.

The subgrade and aggregate base should be compacted in accordance with the recommendations for asphalt pavement in Section 8.1.

8.7 Soil Corrosivity

Corrosivity analyses were performed by Project X Corrosion Engineering to evaluate the corrosivity of the near-surface soil from Boring B-1 at a depth of 3.25 feet bgs and B-2 at a depth of 1 feet bgs, the results of which are presented in Appendix B.

The resistivity test results (3,350 ohm-cm and 12,730 ohm-cm) indicate the near-surface soil is “mildly corrosive to corrosive[6]” to buried metallic structures. The pH (6.3 and 6.8) indicate the soil is “mildly to moderately corrosive” to buried metal. The chloride ion concentration (42.8 mg/kg and 47.5 mg/kg) and sulfate ion concentration (34.1 mg/kg and 114.5 mg/kg) indicate the near-surface soil is “negligibly corrosive” to buried metallic structures and reinforcing steel in concrete structures below ground.

Despite the soil apparently having a relatively low corrosion potential, we believe it would be prudent to protect buried iron, steel, cast iron, ductile iron, galvanized steel, and dielectric-coated steel or iron to reduce the potential for corrosion. If it is necessary to have metal in contact with soil, a corrosion engineer should be consulted to provide recommendations for corrosion protection.

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[6] Roberge, Pierre R. (2018). *Corrosion Basics, an Introduction, Third Edition*. NACE International, P. 189.

8.8 Seismic Design

For design in accordance with the 2019 California Building Code (CBC), we recommend Site Class D be used. The latitude and longitude of the site are 38.0682° and -122.8004°, respectively. Hence, in accordance with the 2019 CBC, we recommend the following:

- $S_S = 2.381g$, $S_1 = 0.997g$

The 2019 CBC is based on the guidelines contained within ASCE 7-16 which stipulates that where S_1 is greater than 0.2 times gravity (g) for Site Class D, a ground motion hazard analysis is needed unless the seismic response coefficient (C_s) value will be calculated as outlined in Section 11.4.8, Exception 2. Assuming the C_s value will be calculated as outlined in Section 11.4.8, Exception 2, we recommend the following seismic design parameters:

- $F_a = 1.0$, $F_v = 1.7$
- $S_{MS} = 2.381g$, $S_{M1} = 1.695g$
- $S_{DS} = 1.587g$, $S_{D1} = 1.130g$
- Seismic Design Category E (for Risk Categories I, II and III).

8.9 Construction Considerations

The near-surface soil at the site consists mainly of clayey and silty sand and sandy clay with varying amounts of gravel that can be excavated with conventional earth-moving equipment such as loaders and backhoes. Removal of existing foundations will require equipment capable of breaking up reinforced concrete, such as a hoe-ram. All disturbed soil resulting from demolition activities that will be below the building pad or footing subgrade should be overexcavated and recompacted in accordance with the recommendations in Section 8.1 under the observation of our field engineer.

Excavations that will be deeper than five feet or will extend below groundwater and will be entered by workers should be sloped or shored in accordance with CAL-OSHA standards (29 CFR Part 1926). The contractor should be responsible for the construction and safety of temporary slopes.

Groundwater may be encountered when excavating utility trenches. Dewatering should be the responsibility of the contractor. The dewatering system selected by the contractor should be capable of providing a dry subgrade to allow proper placement and compaction of fill.

9.0 ADDITIONAL GEOTECHNICAL SERVICES

Prior to construction, Rockridge Geotechnical should review the project plans and specifications to verify that they conform to the intent of our recommendations. During construction, our field engineer should provide on-site observation and testing during site preparation, placement and compaction of fill, and preparation of building foundations. These observations will allow us to compare actual with anticipated subsurface conditions and to verify that the contractor's work conforms to the geotechnical aspects of the plans and specifications.

10.0 LIMITATIONS

This geotechnical investigation has been conducted in accordance with the standard of care commonly used as state-of-practice in the profession. No other warranties are either expressed or implied. The recommendations made in this report are based on the assumption that the subsurface soil and groundwater conditions do not deviate appreciably from those disclosed in the exploratory borings. If any variations or undesirable conditions are encountered during construction, we should be notified so that additional recommendations can be made. The foundation recommendations presented in this report are developed exclusively for the proposed development described in this report and are not valid for other locations and construction in the project vicinity.

REFERENCES

American Concrete Institute (2001), “Guide for Design and Construction of Concrete Parking Lots”, report ACI 330R-01.

California Building Code (2019).

California Geological Survey (2007). Fault-Rupture Hazard Zones in California, Special Publication 42, Interim Revision 2007.

Cao, T., Bryant, W.A., Rowshandel, B., Branum, D., and Wills, C.J. (2003). “The Revised 2002 California Probabilistic Seismic Hazards Maps.”

Conestoga-Rovers and Associates (2010). 2010 Annual Groundwater Monitoring Report, Former Redwood Oil/Chevron Bulk Terminal 20-6457, 11095 State Route 1, Point Reyes, California, dated July 27, 2010.

Field, E.H., Biasi, G.P., Bird, P., Dawson, T.E., Felzer, K.R., Jackson, D.D., Johnson, K.M., Jordan, T.H., Madden, C., Michael, A.J., Milner, K.R., Page, M.T., Parsons, T., Powers, P.M., Shaw, B.E., Thatcher, W.R., Weldon, R.J., II, and Zeng, Y., (2013). Uniform California earthquake rupture forecast, version 3 (UCERF3)—The time-independent model: U.S. Geological Survey Open-File Report 2013–1165, 97 p.

Graymer, R.W., Moring, B.C., Saucedo, G.J., Wentworth, C.M., Brabb, E.E., and Knudsen, K.L. (2006). Geologic Map of the San Francisco Bay Region, U.S. Geological Survey Scientific Investigations Map 2918.

Petersen, M.D., Moschetti, M.P., Powers, P.M., Mueller, C.S., Haller, K.M., Frankel, A.D., Zeng, Y., Rezaeian, S., Harmsen, S.C., Boyd, O.S., Field, E.H., Chen, R., Rukstales, K.S., Luco, N., Wheeler, R.L., Williams, R.A., and Olsen, A.H., (2014). Documentation for the 2014 update of the United States national seismic hazard maps: U.S. Geological Survey Open-File Report 2014–1091, 243 p.

Roberge, Pierre R. (2018). Corrosion Basics, an Introduction, Third Edition. NACE International, P. 189.

SEAOC/OSHPD (2021), “Seismic Design Maps”, https://seismicmaps.org/

Sitar, Nicholas, Roozbeh Geraili Mikola, and Gabriel Candia (2012), "Seismically induced lateral earth pressures on retaining structures and basement walls." *Geotechnical Engineering State of the Art and Practice* (2012): 335-358.

Toppazada, T.R., and Borchardt, G. (1998). "Re-evaluation of the 1936 "Hayward Fault" and the 1838 San Andreas Fault Earthquakes." Bulletin of Seismological Society of America, 88(1), 140-159.

FIGURES

Base map: Google Maps, 2021

POINT REYES COAST GUARD HOUSING
100 COMMODORE WEBSTER DRIVE
Point Reyes Station, California

ROCKRIDGE
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SITE LOCATION MAP

Date 06/30/22 | Project No. 21-2050 | Figure 1

Reference: Base map from a drawing titled "A.L.T.A./ N.S.P.S. Land Title Survey, 100 Commodore Webster Drive", by cbg Surveyors, December 23, 2021.

EXPLANATION

B-1	Approximate location of boring by Rockridge Geotechnical, Inc., July 6, 2021
CG-1 ●	Approximate location of boring by Questa Engineering, December 2020
MW-3	Approximate location of monitoring wells by Questa Engineering, November 2000

0 200 Feet

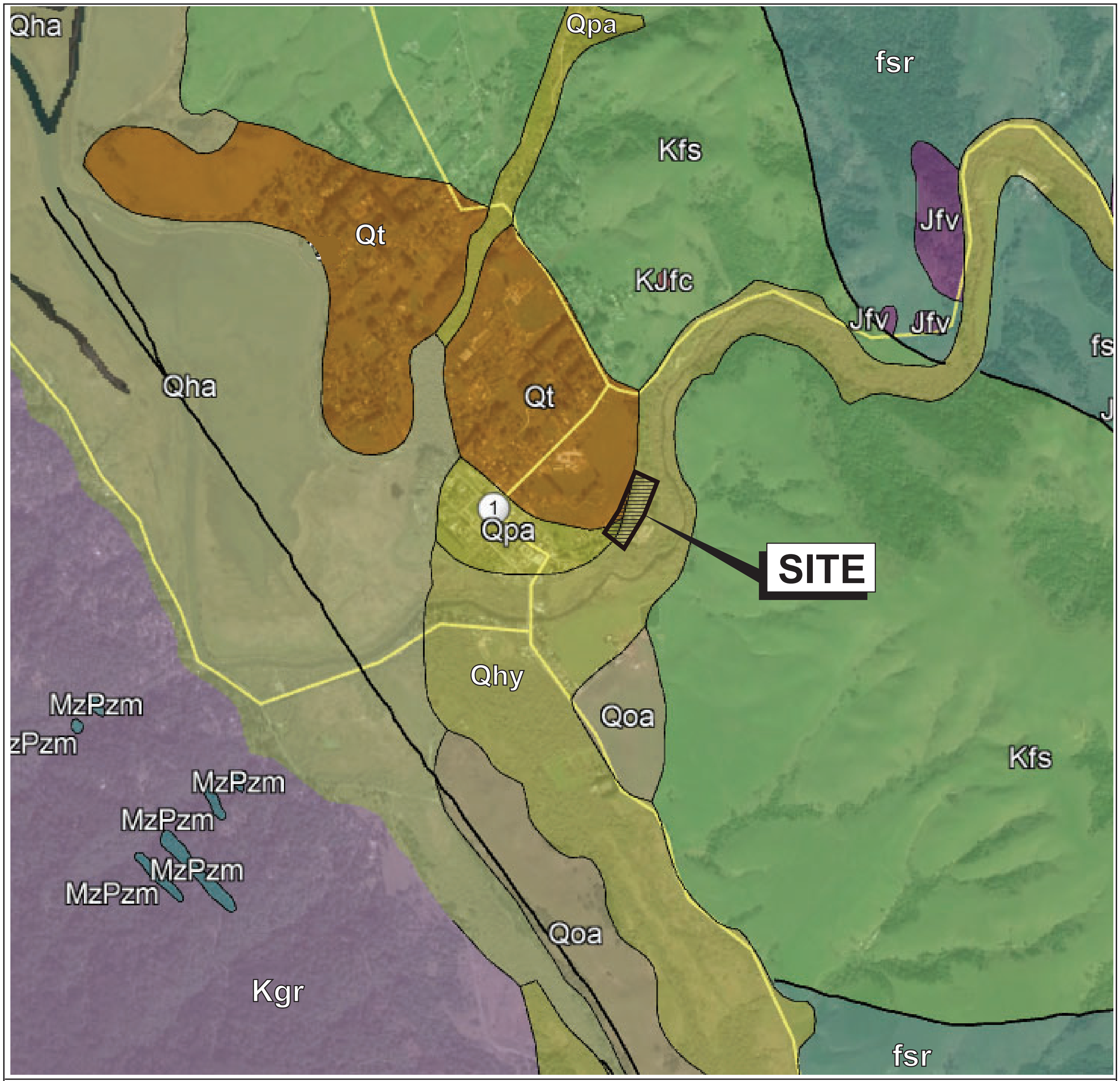
Approximate scale

POINT REYES COAST GUARD HOUSING
100 COMMODORE WEBSTER DRIVE
Point Reyes Station, California

SITE PLAN

Date 07/13/22 | Project No. 21-2050 | Figure 2

ROCKRIDGE GEOTECHNICAL



Base map: Google Earth with U.S. Geological Survey (USGS), Marin County, 2021

Qhy	Alluvium (late Holocene)
Qpa	Alluvium (Pleistocene)
Qha	Alluvium (Holocene)
Qt	Marine terrace deposits (Pleistocene)
Qoa	Alluvium (early (Pleistocene)
fsr	Franciscan Complex melange (Eocene, Paleocene, and (or) Late Cretaceous)
Kgr	Salinian complex plutonic (granite) rocks (Cretaceous)
Kfs	Franciscan Complex sedimentary rocks (Cretaceous)
KJfc	Franciscan Complex chert (Early Cretaceous and (or) Late Jurassic)
Jfv	Franciscan Complex volcanic rocks (Jurassic)
MzPzm	Salinian complex metamorphic rocks (Mesozoic and (or) Paleozoic)

Geologic contact: dashed where approximate and dotted where concealed, queried where uncertain

0 2,000 4,000 Feet

Approximate scale

POINT REYES COAST GUARD HOUSING
100 COMMODORE WEBSTER DRIVE
Point Reyes Station, California

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REGIONAL GEOLOGIC MAP

Date 06/30/22 | Project No. 21-2050 | Figure 3

Base Map: U.S. Geological Survey (USGS), National Seismic Hazards Maps - Fault Sources, 2014.

EXPLANATION

🟥 Strike slip

🟨 Thrust (Reverse)

🟦 Normal

0 10 20 Miles

Approximate scale

POINT REYES COAST GUARD HOUSING
100 COMMODORE WEBSTER DRIVE
Point Reyes Station, California

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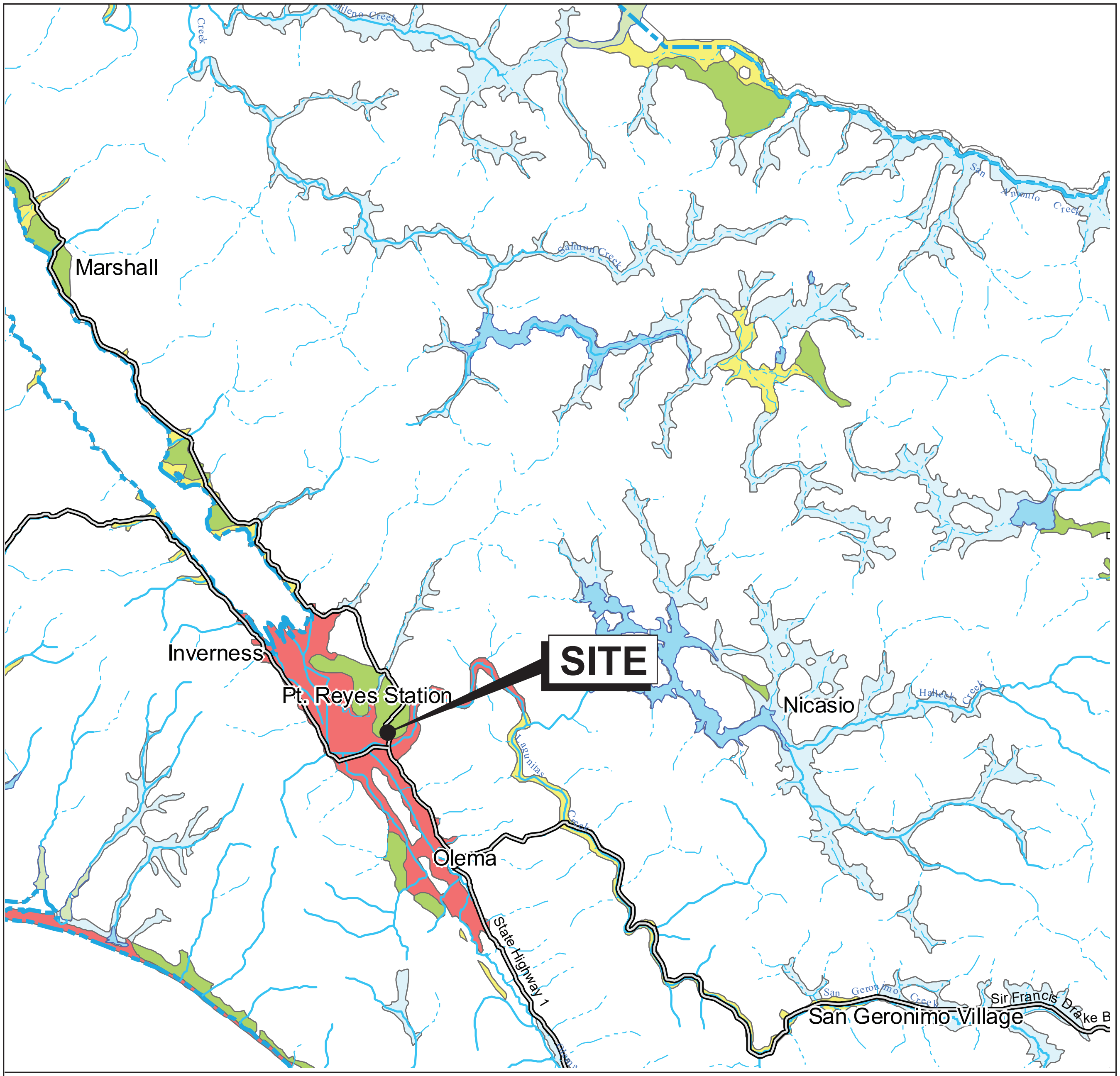
REGIONAL FAULT MAP

Date 06/30/22	Project No. 21-2050	Figure 4



Legend

▭ County Boundary

☐ City Boundary

═ Highways and Major Roads

Streams

— Perennial

-·- Intermittent

-·- Ephemeral

Water Bodies

🟦 Lakes

🟩 Lagoons

Level of Liquefaction Susceptibility*

🟥 Very High

🟨 High

🟦 Moderate

🟩 Low

☐ Very Low

Reference:
Liquefaction Susceptibility Hazards Map 2-11
San Francisco Bay Region, California:
A Digital Database, Open-File Report 00-44,
Online Version 1.0, U.S. Geological Survey, 2000.

0 2 4 Miles

Approximate scale

POINT REYES COAST GUARD HOUSING
100 COMMODORE WEBSTER DRIVE
Point Reyes Station, California

ROCKRIDGE
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LIQUEFACTION SUSCEPTIBILITY MAP

Date 06/30/22 | Project No. 21-2050 | Figure 5

APPENDIX A

Logs of Test Borings

PROJECT: **POINT REYES COAST GUARD HOUSING**
100 COMMODORE WEBSTER DRIVE
Point Reyes Station, California

Log of Boring B-1

PAGE 1 OF 1

Boring location: See Site Plan, Figure 2
Date started: 07/06/2021
Date finished: 07/06/2021
Drilling method: 4-inch-diameter solid stem auger
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Rope & cathead safety hammer
Sampler: Modified California (MC), Standard Penetration Test (SPT)

Logged by: A. Limpert
Drilled by: Benevent Building
Rig: Portable Hydraulic Rig

DEPTH (feet)	Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION		Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
0						SANDY CLAY (CL) yellow grades to brown with yellow-brown mottling, very stiff, moist, fine sand	FILL						
1	MC	■	14 15 24	27									
2					CL	SANDY CLAY (CL) yellow-brown to red-yellow with gray veins, hard, moist Soil Corrosivity Test; see Appendix B	TERRACE DEPOSITS						
3	MC	■	17 27 40	47									
5	SPT	◪	10 13 20	40		trace gravel							
6					SC	CLAYEY SAND with GRAVEL (SC) red-yellow with yellow-brown and light brown, medium dense to dense, moist, fine angular gravel							
7	SPT	◪	16 14 11	30									
9.5					SC	CLAYEY SAND (SC) brown, medium dense, moist, fine to coarse sand Particle Size Distribution; see Appendix B	OLD ALLUVIUM						
10	SPT	◪	12 8 9	20							36	20.4	
12					▽	(07/06/2021; 9:10 AM)							
15					SP	SAND (SP) brown, dense, wet							
15	SPT	●	11 15 15	36									
17	SPT	◪	10 14 14	34		decreasing coarse sand							
18					CL	SANDY CLAY (CL) blue to gray with black, hard, wet, fine sand melange, serpentinite and sheared	RESIDUAL SOIL						
20	SPT	◪	13 14 17	37									

Boring terminated at a depth of 21.5 feet below ground surface.
Boring backfilled with cement grout.
Groundwater encountered at a depth of 12 feet during drilling.

[1] MC and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.7 and 1.2, respectively, to account for sampler type and hammer energy.

ROCKRIDGE GEOTECHNICAL

Project No.: 21-2050
Figure: A-1

PROJECT: **POINT REYES COAST GUARD HOUSING**
100 COMMODORE WEBSTER DRIVE
Point Reyes Station, California

Log of Boring B-2

PAGE 1 OF 1

Boring location: See Site Plan, Figure 2
Date started: 07/06/2021
Date finished: 07/06/2021
Drilling method: 4-inch-diameter solid stem auger
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Rope & cathead safety hammer
Sampler: Modified California (MC), Standard Penetration Test (SPT)

Logged by: A. Limpert
Drilled by: Benevent Building
Rig: Portable Hydraulic Rig

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: Blows/ 6"	SAMPLES: SPT N-Value¹	LITHOLOGY	MATERIAL DESCRIPTION		LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
0–2.5	MC		10 12 14	18	CL	SANDY CLAY (CL) dark brown with trace red veins, very stiff, moist, trace fine gravel, rootlets Soil Corrosivity Test; see Appendix B	FILL						
3–4.5	MC		18 24 28	36		brown, hard, increasing gravel content LL = 25, PI = 9; see Appendix B						11.8	118
5–6.5	MC		16 26 34	42		brown grades to dark brown mottled with brown, increasing sand content							
6–8.5					SC	CLAYEY SAND with GRAVEL (SC) brown with black gravel pieces, dense, moist, medium sand, fine subrounded gravel	TERRACE DEPOSITS						
8.5–10						CLAYEY SAND with GRAVEL (SC) brown with black gravel pieces, dense, moist to wet, medium sand, fine subrounded gravel	OLD ALLUVIUM (?)						
10–11.5	SPT		21 19 11	36	SC	∇ (07/06/2021; 12:55 PM)							
16–20					CL	SANDY CLAY (CL) gray, very stiff, wet, trace sand and gravel melange, sheared sandstone, shale, and serpentinite	RESIDUAL SOIL						
20–21.5	SPT		8 10 13	28									

Boring terminated at a depth of 21.5 feet below ground surface.
Boring backfilled with cement grout.
Groundwater encountered at a depth of 11 feet during drilling.

[1] MC and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.7 and 1.2, respectively, to account for sampler type and hammer energy.

ROCKRIDGE GEOTECHNICAL

Project No.: 21-2050
Figure: A-2

PROJECT: **POINT REYES COAST GUARD HOUSING**
100 COMMODORE WEBSTER DRIVE
Point Reyes Station, California

Log of Boring B-3

PAGE 1 OF 1

Boring location: See Site Plan, Figure 2
Date started: 07/06/2021
Date finished: 07/06/2021
Drilling method: 4-inch-diameter solid stem auger
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Rope & cathead safety hammer
Sampler: Modified California (MC), Standard Penetration Test (SPT)

Logged by: A. Limpert
Drilled by: Benevent Building
Rig: Portable Hydraulic Rig

DEPTH (feet)	SAMPLES				LITHOLOGY	MATERIAL DESCRIPTION		LABORATORY TEST DATA					
	Sampler Type	Sample	Blows/ 6"	SPT N-Value[1]				Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
1						SILTY CLAY with GRAVEL (CL-ML) brown to yellow-brown with light brown, very stiff, moist, medium sand, fine to medium subrounded subangular gravel LL = 24, PI = 4; see Appendix B							
2	MC		26 19 16	25	CL-ML		FILL					7.6	113
3						CLAYEY SAND with GRAVEL (SC) brown with yellow-brown, medium dense, moist, fine to medium sand, fine to medium subrounded to subangular gravel							
4	MC		13 11 14	18	SC								
5						SANDSTONE yellow-brown with black grades to olive with gray and brown, low hardness, friable to weak, moderately weathered							
6	MC		14 21 17	27									
7													
8													
9						GREENSTONE olive with brown and gray, low hardness, weak, deeply to moderately weathered							
10	SPT		19 18 32	60									
11													
12							FRANCISCAN MELANGE						
13						SHALE/SERPENTINITE olive-gray, sheared, low hardness, weak, completely weathered, prune pits present							
14													
15													
16	SPT		4 6 9	18									
17													
18													
19													
20													
21	SPT		5 9 8	20									
22													
23													
24													
25													
26													
27													
28													
29													
30													

Boring terminated at a depth of 21.5 feet below ground surface.
Boring backfilled with cement grout.
Groundwater not encountered during drilling.

[1] MC and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.7 and 1.2, respectively, to account for sampler type and hammer energy.

ROCKRIDGE GEOTECHNICAL

Project No.: 21-2050

Figure: A-3

PROJECT: **POINT REYES COAST GUARD HOUSING**
100 COMMODORE WEBSTER DRIVE
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Log of Boring B-4

PAGE 1 OF 1

Boring location: See Site Plan, Figure 2
Date started: 07/06/2021
Date finished: 07/06/2021
Drilling method: 4-inch-diameter solid stem auger
Hammer weight/drop: 140 lbs./30 inches
Hammer type: Rope & cathead safety hammer
Sampler: Modified California (MC), Standard Penetration Test (SPT)

Logged by: A. Limpert
Drilled by: Benevent Building
Rig: Portable Hydraulic Rig

SAMPLES Sampler Type	Blows/ 6"	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	
MC	28 40 25	46	SC	CLAYEY SAND with GRAVEL (SC) brown grades to dark brown, dense, dry to moist, broken 2-inch-diameter gravel in shoe	**FILL**
MC	13 23 39	43	CL	SANDY CLAY with GRAVEL (CL) brown to yellow-brown, hard, moist, fine gravel, rootlets	**TERRACE DEPOSITS**
SPT	16 15 14	35	GC	CLAYEY GRAVEL with SAND (GC) brown with gray gravel, dense, dry to moist, resistan sandstone gravel	**TERRACE DEPOSITS**
SPT	13 14 14	34		SHALE/SERPENTINITE olive with brown, black, and light gray, sheared, low hardness, friable to weak, deeply to completely weathered to clay locally	**FRANCISCAN MELANGE**
SPT	33 20 12	38		1-inch-diameter gravel stuck in shoe	**FRANCISCAN MELANGE**
SPT	15 21 15	43		dark gray	**FRANCISCAN MELANGE**

LABORATORY TEST DATA Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft

DEPTH (feet): 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Boring terminated at a depth of 21.5 feet below ground surface.
Boring backfilled with cement grout.
Groundwater not encountered during drilling.

[1] MC and SPT blow counts for the last two increments were converted to SPT N-Values using factors of 0.7 and 1.2, respectively, to account for sampler type and hammer energy.

ROCKRIDGE GEOTECHNICAL

Project No.: 21-2050
Figure: A-4

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		Symbols	Typical Names
Coarse-Grained Soils (more than half of soil > no. 200 sieve size)	Gravels (More than half of coarse fraction > no. 4 sieve size)	**GW**	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than half of coarse fraction < no. 4 sieve size)	**SW**	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
Fine -Grained Soils (more than half of soil < no. 200 sieve size)	Silts and Clays LL = < 50	**ML**	Inorganic silts and clayey silts of low plasticity, sandy silts, gravelly silts
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silt-clays of low plasticity
	Silts and Clays LL = > 50	**MH**	Inorganic silts of high plasticity
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic silts and clays of high plasticity
Highly Organic Soils		**PT**	Peat and other highly organic soils

GRAIN SIZE CHART

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	Grain Size in Millimeters
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel coarse fine	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
Sand coarse medium fine	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.075 4.76 to 2.00 2.00 to 0.420 0.420 to 0.075
Silt and Clay	Below No. 200	Below 0.075

▽ Unstabilized groundwater level

▼ Stabilized groundwater level

SAMPLE DESIGNATIONS/SYMBOLS

- ⬒ Sample taken with California or Modified California split-barrel sampler. Darkened area indicates soil recovered
- ◪ Classification sample taken with Standard Penetration Test sampler
- ◨ Undisturbed sample taken with thin-walled tube
- ☒ Disturbed sample
- ◎ Sampling attempted with no recovery
- ◫ Core sample
- ◉ Analytical laboratory sample
- ▥ Sample taken with Direct Push sampler
- ▥ Sonic

SAMPLER TYPE

C	Core barrel
CA	California split-barrel sampler with 2.5-inch outside diameter and a 1.93-inch inside diameter
D&M	Dames & Moore piston sampler using 2.5-inch outside diameter, thin-walled tube
O	Osterberg piston sampler using 3.0-inch outside diameter, thin-walled Shelby tube
PT	Pitcher tube sampler using 3.0-inch outside diameter, thin-walled Shelby tube
MC	Modified California sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter
SPT	Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch outside diameter and a 1.5-inch inside diameter
ST	Shelby Tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure

POINT REYES COAST GUARD HOUSING
100 COMMODORE WEBSTER DRIVE
Point Reyes Station, California

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CLASSIFICATION CHART

Date 06/30/22 | Project No. 21-2050 | Figure A-5

I FRACTURING

Intensity	**Size of Pieces in Feet**
Very little fractured	Greater than 4.0
Occasionally fractured	1.0 to 4.0
Moderately fractured	0.5 to 1.0
Closely fractured	0.1 to 0.5
Intensely fractured	0.05 to 0.1
Crushed	Less than 0.05

II HARDNESS

1. **Soft** - reserved for plastic material alone.
2. **Low hardness** - can be gouged deeply or carved easily with a knife blade.
3. **Moderately hard** - can be readily scratched by a knife blade; scratch leaves a heavy trace of dust and is readily visible after the powder has been blown away.
4. **Hard** - can be scratched with difficulty; scratch produced a little powder and is often faintly visible.
5. **Very hard** - cannot be scratched with knife blade; leaves a metallic streak.

III STRENGTH

1. **Plastic** or very low strength.
2. **Friable** - crumbles easily by rubbing with fingers.
3. **Weak** - an unfractured specimen of such material will crumble under light hammer blows.
4. **Moderately strong** - specimen will withstand a few heavy hammer blows before breaking.
5. **Strong** - specimen will withstand a few heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.
6. **Very strong** - specimen will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.

IV WEATHERING - The physical and chemical disintegration and decomposition of rocks and minerals by natural processes such as oxidation, reduction, hydration, solution, carbonation, and freezing and thawing.

D. **Deep** - moderate to complete mineral decomposition; extensive disintegration; deep and thorough discoloration; many fractures, all extensively coated or filled with oxides, carbonates and/or clay or silt.

M. **Moderate** - slight change or partial decomposition of minerals; little disintegration; cementation little to unaffected. Moderate to occasionally intense discoloration. Moderately coated fractures.

L. **Little** - no megascopic decomposition of minerals; little of no effect on normal cementation. Slight and intermittent, or localized discoloration. Few stains on fracture surfaces.

F. **Fresh** - unaffected by weathering agents. No disintegration of discoloration. Fractures usually less numerous than joints.

ADDITIONAL COMMENTS:

V CONSOLIDATION OF SEDIMENTARY ROCKS: usually determined from unweathered samples. Largely dependent on cementation.

U = unconsolidated
P = poorly consolidated
M = moderately consolidated
W = well consolidated

VI BEDDING OF SEDIMENTARY ROCKS

Splitting Property	**Thickness**	**Stratification**
Massive	Greater than 4.0 ft.	very thick-bedded
Blocky	2.0 to 4.0 ft.	thick bedded
Slabby	0.2 to 2.0 ft.	thin bedded
Flaggy	0.05 to 0.2 ft.	very thin-bedded
Shaly or platy	0.01 to 0.05 ft.	laminated
Papery	less than 0.01	thinly laminated

POINT REYES COAST GUARD HOUSING
100 COMMODORE WEBSTER DRIVE
Point Reyes Station, California

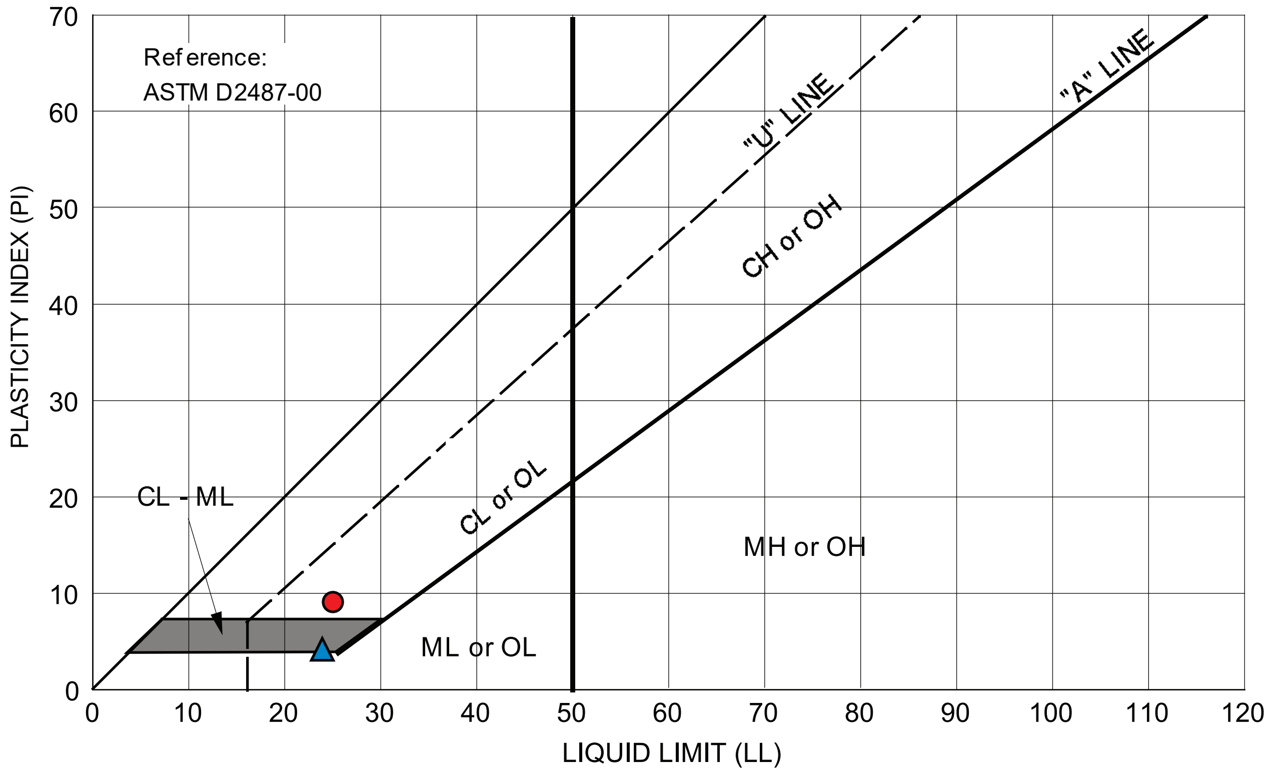
ROCKRIDGE
GEOTECHNICAL

PHYSICAL PROPERTIES CRITERIA FOR ROCK DESCRIPTIONS

Date 06/30/22 | Project No. 21-2050 | Figure A-6

APPENDIX B

Laboratory Test Results



Symbol	Source	Description and Classification	Natural M.C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
●	B-2 at 4.0 feet	SANDY CLAY (CL), dark brown with trace red veins	11.8	25	9	--
▲	B-3 at 2.0 feet	SILTY CLAY with GRAVEL (CL-ML), brown to yellow-brown with light brown	7.6	24	4	--

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PLASTICITY CHART

Date 06/30/22 | Project No. 21-2050 | Figure B-1

Sample No.	Description	Elev.	Dry Weight [g]	Wt. Retained on #200 [g]	% Retained on #200	% Passing #200
B-1-5	CLAYEY SAND (SC), brown	10.0'	601	387	64.4	35.6

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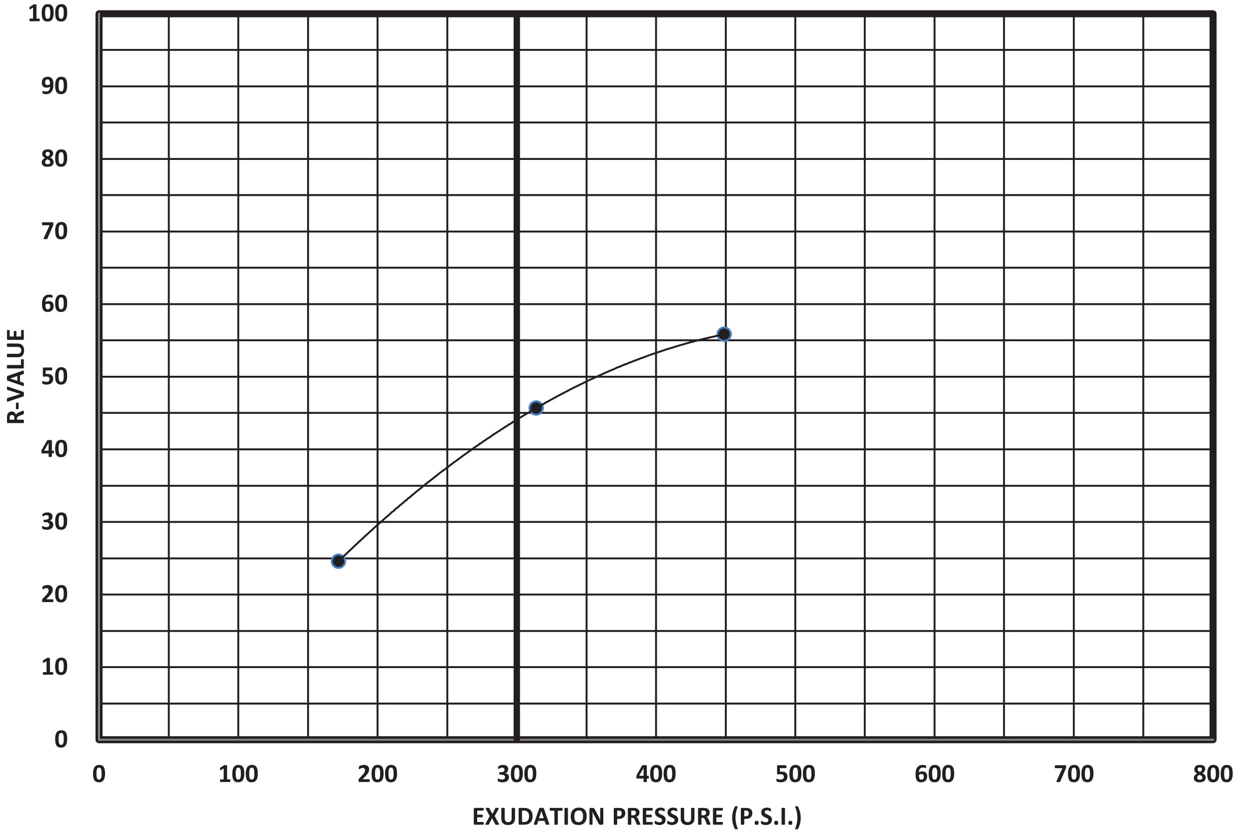
MATERIAL FINER THAN -200 SIEVE

Date 06/30/22 | Project No. 21-2050 | Figure B-2

R-VALUE CAL-TEST 301



Exudation (psi)	Compaction (psi)	Expansion (0.0001")	Expansion (psf)	Moisture %	Dry Density	Resistance Value
449	295	65	281	16.4	110.5	56
314	218	60	260	17.8	110.1	46
172	155	30	130	19.5	104.8	25

Test Results	Material Description
R-Value at 300 psi exudation pressure = 44	SANDY CLAY (CL), dark brown with trace red veins
	Sample Source: B-2 at 0.5-5 feet

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100 COMMODORE WEBSTER DRIVE
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ROCKRIDGE
GEOTECHNICAL

RESISTANCE VALUE TEST REPORT

Date 06/30/22 | Project No. 21-2050 | Figure B-3

Project X
Corrosion Engineering
Corrosion Control – Soil, Water, Metallurgy Testing Lab

REPORT S210708C

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM D4972	ASTM G200	ASTM D4658	ASTM D4327	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D4327	ASTM D4327
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity**		**pH**	**Redox**	**Sulfide** S^{2-}	**Nitrate** NO_3^-	**Ammonium** NH_4^+	**Lithium** Li^+	**Sodium** Na^+	**Potassium** K^+	**Magnesium** Mg^{2+}	**Calcium** Ca^{2+}	**Fluoride** F_2^-	**Phosphate** PO_4^{3-}
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	As Rec'd (Ohm-cm)	Minimum (Ohm-cm)		(mV)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
B-1: SANDY CLAY (CL) yellow-brown to red-yellow with gray veins	3.25	34.1	0.0034	42.8	0.0043	6,700	3,350	6.3	86	<0.01	0.4	5.4	0.02	69.5	1.9	90.5	189.0	1.9	0.5
B-2: SANDY CLAY (CL) dark brown with trace red veins	1	114.5	0.0114	47.5	0.0048	107,200	12,730	6.8	92	<0.01	0.3	7.5	0.02	104.0	3.0	64.6	228.0	2.6	0.3

Cations and Anions, except Sulfide and Bicarbonate, tested with Ion Chromatography
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract
PPM = mg/kg (soil) = mg/L (Liquid)

POINT REYES COAST GUARD HOUSING
100 COMMODORE WEBSTER DRIVE
Point Reyes Station, California

ROCKRIDGE
GEOTECHNICAL

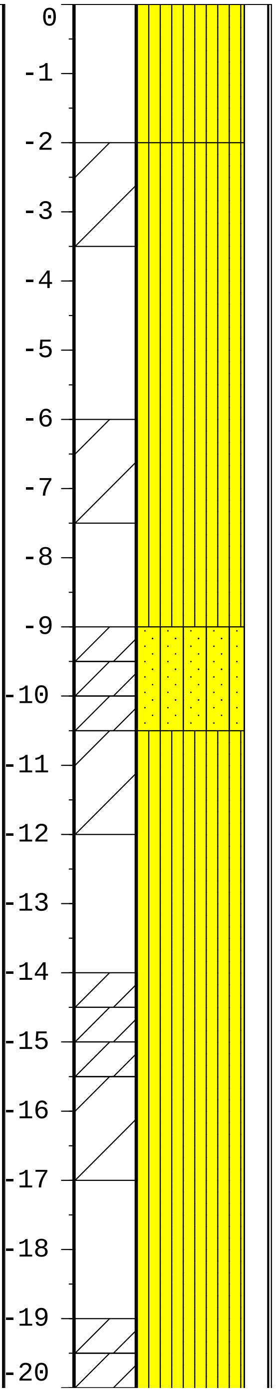
SOIL CORROSIVITY
TEST RESULTS

Date
Project No. 21-2050
Figure B-4

APPENDIX C

Logs of Previous Borings and Monitoring Wells by Questa

Lab Tests	Torvane, tsf	Sampler Type	% Passing #200 Sieve	Dry Density, pcf	Moisture %	Penetrometer, tsf	Blows/Foot * (Converted to SPT N-value)
		SPT		122	14.5		15
		SPT					14
		CAM					30*
		SPT		125	16.3		25
		CAM					22*
		SPT		130	16.8		21
		CAM					25*



USCS Symbol	Lithologic Description
ML	ML: Dark Yellowish Brown Sandy Silt (10YR 3/6), Dry, Loose
ML	ML: Dark Yellowish Brown Sandy Silt with Gravel (10YR 4/4), Moist, Stiff
SM	SM: Dark Yellowish Brown Silty Sand with Gravel, Moist, Stiff
ML	ML: Greenish Black Silt with Sand (GLEY 1 2.5/1), Moist, Very Stiff

Drilling Performed by Pearson Drilling Using a B-53 Drill Rig

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LOG OF BOREHOLE CG-1

Coast Guard 2020

Point Reyes Station

Figure A-1

Lab Tests	Torvane, tsf	Sampler Type	% Passing #200 Sieve	Dry Density, pcf	Moisture %	Penetrometer, tsf	Blows/Foot * (Converted to SPT N-value)	Depth	Sample Location	Graphical Symbol	Groundwater Depth	USCS Symbol	Lithologic Description
								20	▨	🟨			
		SPT		131	16.1		31	21	▨	🟨		ML	ML: Greenish Black Silt with Sand (GLEY 1 2.5/1), Moist, Very Stiff, Rare Gravel
								22		🟨			
								23		🟨			
								24	▨	🟨		ML	ML: Greenish Black Silt with Sand (GLEY 1 2.5/1), Moist, Very Stiff
		CAM					23*	25	▨	🟨			
		SPT		134	15.8		28	26	▨	🟨			
								27		🟨			
								28		🟨			
								29		🟨			
								30		🟨			
								31		🟨			
								32	▨	🟩		CL	CL: Greenish Black Clay with Sand (GLEY 1 2.5/1), Moist, Very Stiff, Rare Gravel
		SPT		123	15.9		29	33	▨	🟩			
								34		🟩			
								35		🟩			
								36		🟩			
								37		🟩			
								38		🟩			
								39	▨	🟩			Bottom of Hole at 40' BGS. No Groundwater or Bedrock Found.
		CAM					39*	40	▨	🟩			

Drilling Performed by Pearson Drilling Using a B-53 Drill Rig

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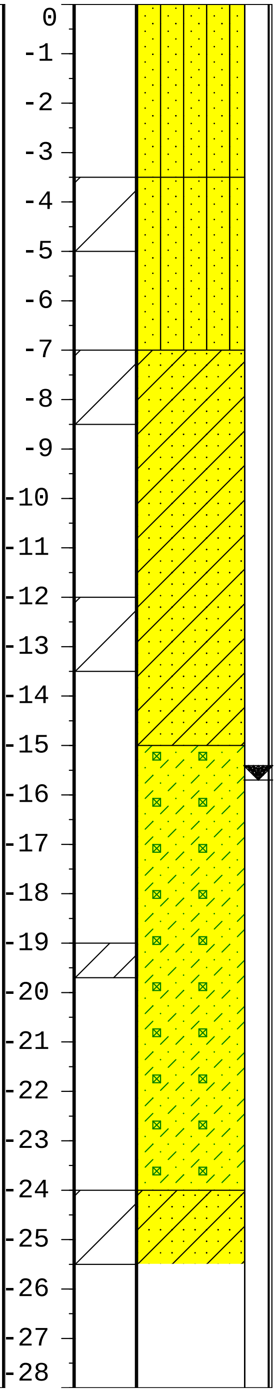
LOG OF BOREHOLE CG-1

Coast Guard 2020

Point Reyes Station

Figure A-1

Lab Tests	Torvane, tsf	Sampler Type	% Passing #200 Sieve	Dry Density, pcf	Moisture %	Penetrometer, tsf	Blows/Foot * (Converted to SPT N-value)
		SPT					23
		SPT					44
		SPT		97	14.1		81
		CAM				>4.5	16*/ 1.5"
		SPT		123	14.0		40



USCS Symbol	Lithologic Description
SM	SM: Dark Yellowish Brown Silty Sand with Gravel (Fill) (10YR 4/4), Dry to Moist, Loose
SM	SM: Yellowish Brown Silty Sand with Gravel (10YR 5/4), Dry to Moist, Dense
SC	SC: Yellowish Brown Clayey Sand with Gravel (10YR 5/8), Dry to Moist, Dense, Rounded Gravel
GC	GC: Dark Yellowish Brown Clayey Gravel with Sand (10YR 4/6), Moist, Very Dense
SC	SC: Dark Yellowish Brown Clayey Sand with Gravel (10YR 4/4), Moist to Wet, Dense
	Bottom of Hole at 25.5', Bottom of Well at 24', Groundwater Found at 24', Rose to 15.7' on 12/4/20. Resistance to drilling at 24'.

Drilling Performed by Pearson Drilling Using a B-53 Drill Rig

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LOG OF BOREHOLE CG-2

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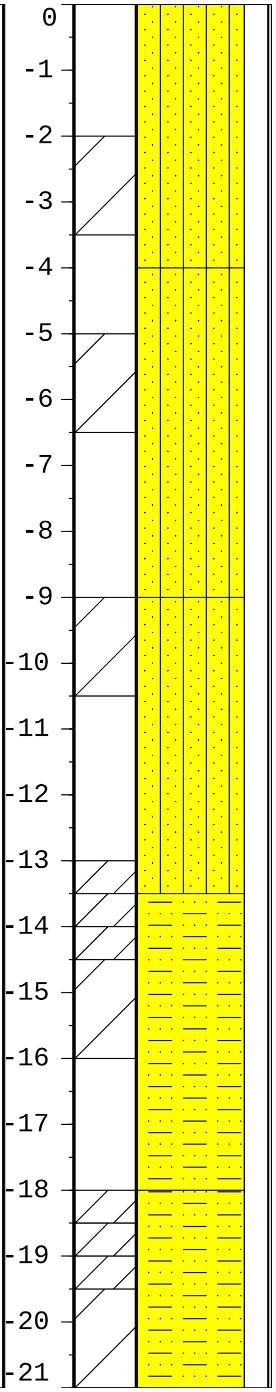
Figure

A-2

Lab Tests	Torvane, tsf	Sampler Type	% Passing #200 Sieve	Dry Density, pcf	Moisture %	Penetrometer, tsf	Blows/Foot * (Converted to SPT N-value)
		SPT					23
		SPT					32
		SPT		116	12.5		33
		CAM				3.75 >4.5	22*
		SPT		123	15.0		38
		CAM				>4.5	37*
		SPT		129	12.4		31



USCS Symbol	Lithologic Description
SM	SM: Brown Silty Sand with Gravel (Fill) (10YR 4/3), Dry, Loose
SM	SM: Dark Yellowish Brown Silty Sand with Gravel (10YR 4/4), Dry to Moist, Dense
SM	SM: Dark Yellowish Brown Silty Sand (10YR 4/4), Dry to Moist, Med. Dense to Dense
	Siltstone: Dark Greenish Grey Siltstone (GLEY 1 3/1), Moist, Closely Fractured, Low to Med. Hardness, Soft to Weak Strength, Deep Weathering
	Siltstone: Dark Grey Siltstone (GLEY 1 4/N), Moist, Intensely Fractured, Low Hardness, Weak Strength, Deep Weathering Bottom of Hole at 21' BGS, No Groundwater Found

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LOG OF BOREHOLE CG-3

Coast Guard 2020

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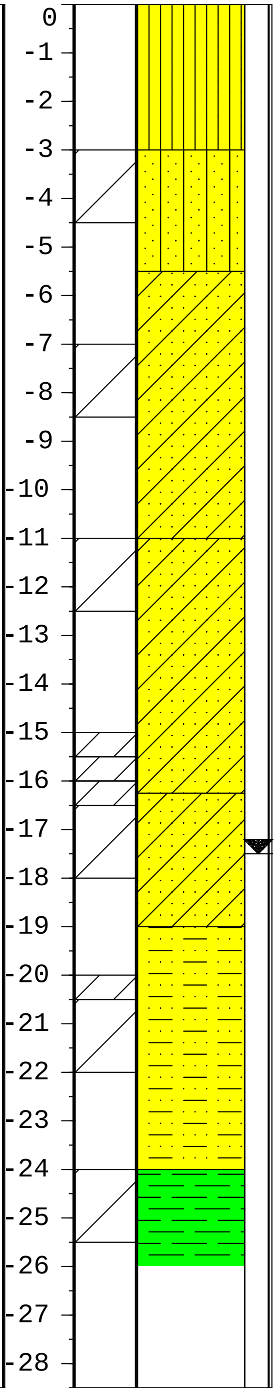
Figure

A-3

Lab Tests	Torvane, tsf	Sampler Type	% Passing #200 Sieve	Dry Density, pcf	Moisture %	Penetrometer, tsf	Blows/Foot * (Converted to SPT N-value)
		SPT		120	13.3		22
		SPT			13.6		28
		SPT			13.3		37
		CAM				>4.5	30*
		SPT		118	16.9		44
		CAM				>4.5	16*/ 3"
		SPT			15.7		47
		SPT		139	13.7		27



USCS Symbol	Lithologic Description
ML	ML: Dark Brown Sandy Silt with Gravel (Fill) (10YR 3/3), Moist, Med. Stiff
SM	SM: Dark Brown Silty Sand with Gravel (7.5YR 3/4), Moist, Dense
SC	SC: Strong Brown Clayey Sand with Gravel (7.5YR 4/6), Moist, Dense
SC	SC: Dark Yellowish Brown Clayey Sand with Gravel (10YR 4/4), Moist to Wet, Dense
SC	SC: Dark Greenish Grey Clayey Sand with Gravel (GLEY 1 3/1), Moist to Wet, Dense
	Siltstone: Dark Greenish Grey Siltstone (GLEY 1 3/1), Moist, Intensely Fractured, Soft, Friable, Deep Weathering
	Shale: Dark Grey Shale (GLEY 1 4/N), Moist, Crushed, Soft, Plastic/ Friable, Deep Weathering
	Bottom of Hole at 25.5' BGS, Bottom of Well at 24' BGS. Groundwater Found at 16'BGS and Stabilized at 17.5' at 12:00pm.

Drilling Performed by Pearson Drilling Using a B-53 Drill Rig

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LOG OF BOREHOLE CG-4

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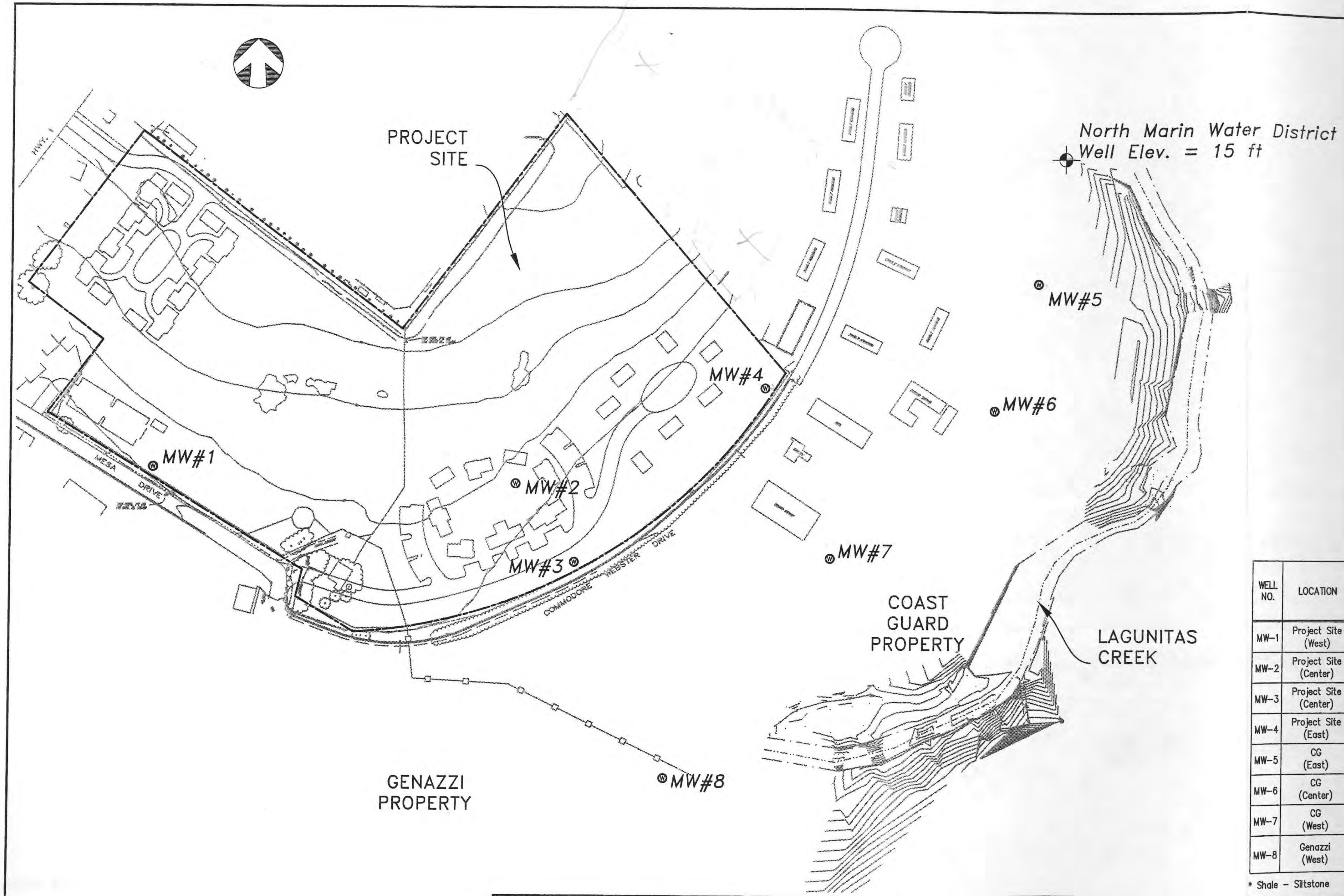
Figure

A-4

From 2001 Hydrogeologic Investigation
by Questa Engineering

APPENDIX A

Monitoring Well Completion Logs



WELL NO.	LOCATION	WELL HEAD ELEVATION (ft, msl)	GROUND SURFACE ELEVATION (ft, msl)	TOTAL DEPTH (ft)	SCREENED INTERVAL	DEPTH TO BEDROCK* (ft)
MW–1	Project Site (West)	41.79	42.0	33	13–33	28
MW–2	Project Site (Center)	47.11	47.6	35	20–35	32
MW–3	Project Site (Center)	32.27	32.6	34	14–34	16
MW–4	Project Site (East)	30.07	30.2	26.5	13–26.5	22
MW–5	CG (East)	12.39	12.5	40	20–40	>40
MW–6	CG (Center)	14.18	14.4	34	14–34	25
MW–7	CG (West)	21.16	21.4	34	14–34	29
MW–8	Genazzi (West)	12.94	13.2	13 (Caving)	3–10	>38

* Shale – Siltstone

200′ 0′ 200′ 400′

GRAPHIC SCALE

Date: 11/22 / 00
Drawn: M.M.M.
Appr'd: N.H.
Dwg. No: 99190_11x17.DWG

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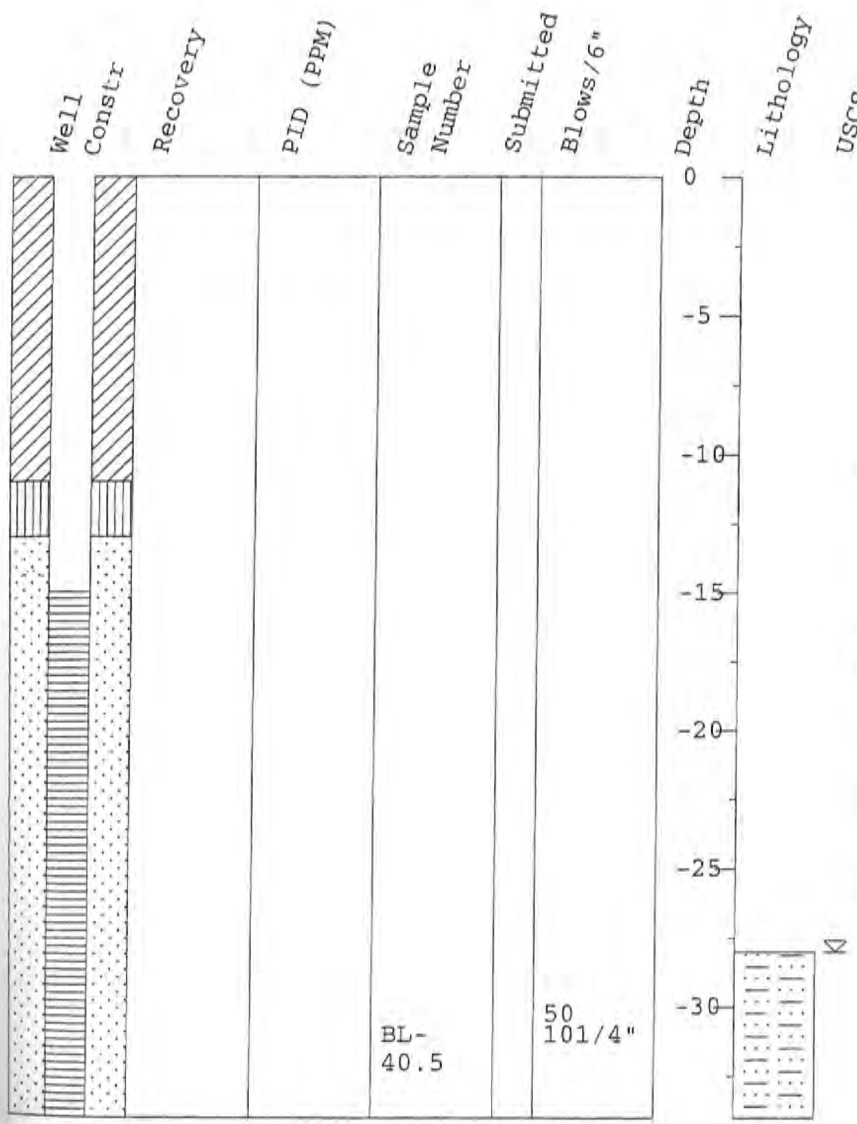
MONITORING WELL LOCATIONS

POINT REYES AFFORDABLE HOUSING PROJECT
POINT REYES STATION, CALIFORNIA

FIGURE
2



USCS Symbol	Soil Description / Field Notes
SM	GRAVELLY LOAM: brown, loose, damp; change in color to reddish-brown and increase in sand with depth
CL	SANDY CLAY: reddish-brown, medium stiff, damp; change in color to yellow-brown and increase in gravel with depth
SP	LOAMY GRAVEL: grey-brown, medium dense, moist
CL	GRAVELLY SANDY CLAY: grey-brown, stiff, increase in sand to 25 feet
GC	CLAYEY GRAVEL: grey, moist, dense,
	SILTSTONE: grey, very hard. Groundwater @ 28 feet

Date: 11-15-2000
Job Name: EAH- Pt. Reyes
Job No: 99190

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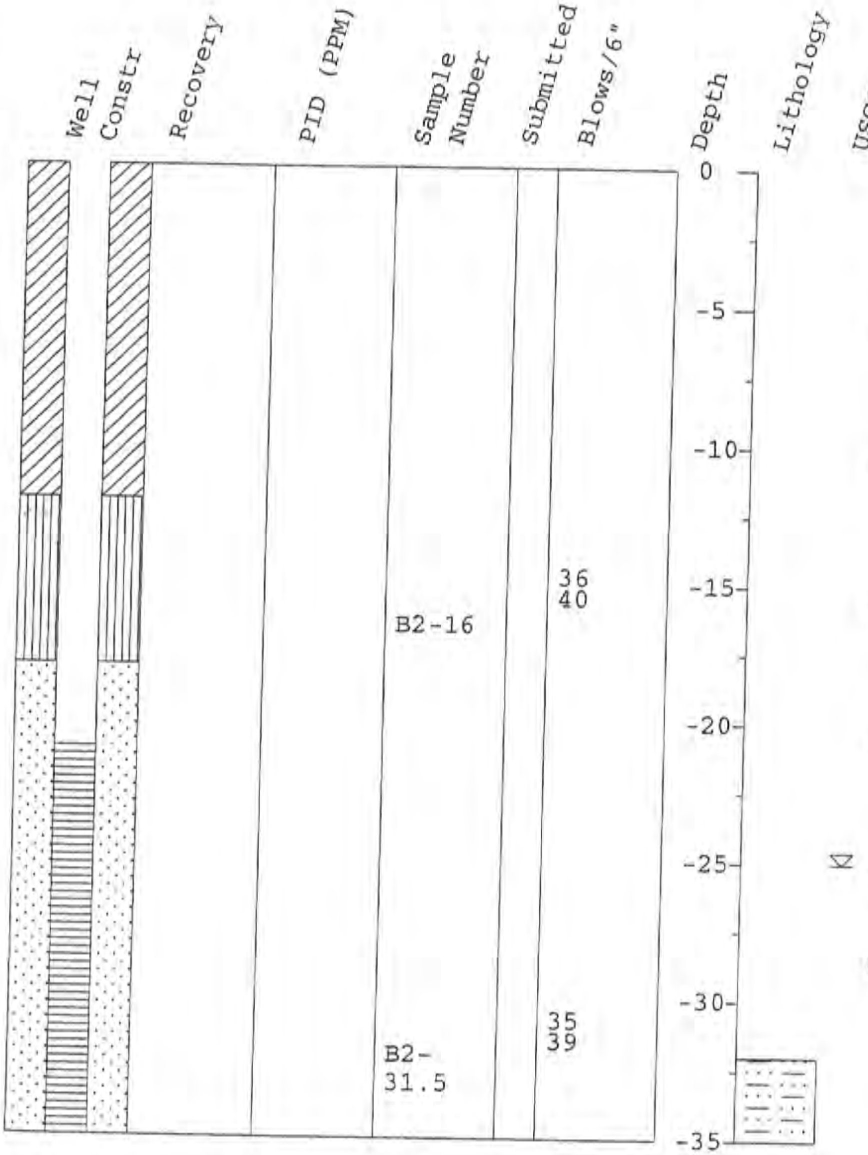
Log of Monitoring Well 1
Pt. Reyes Affordable Housing Proj.
Point Reyes, California

FIGURE
A-1



USCS Symbol	Soil Description / Field Notes
SM	GRAVELLY LOAM: dark brown, loose, damp; change in color to brown at 1.5 -2.0 feet
SM	CLAY LOAM w/GRAVEL: reddish-brown, damp, slightly sticky
SM	GRAVEL LOAM: light brown, medium dense, damp; some blue-grey rock
GP	SANDY GRAVEL: brown, dense
CL	SANDY CLAY: brown, damp, medium stiff, slightly plastic
SC	CLAYEY SAND: dark to medium brown, dense, moist; increase in moisture @ 25-27 feet
GW	SANDY GRAVEL: yellow-brown(some orange-brown), wet, dense
	SILTSTONE: dark gray

Date:	11-15-2000
Job Name :	EAH- Pt. Reyes
Job No.	99190

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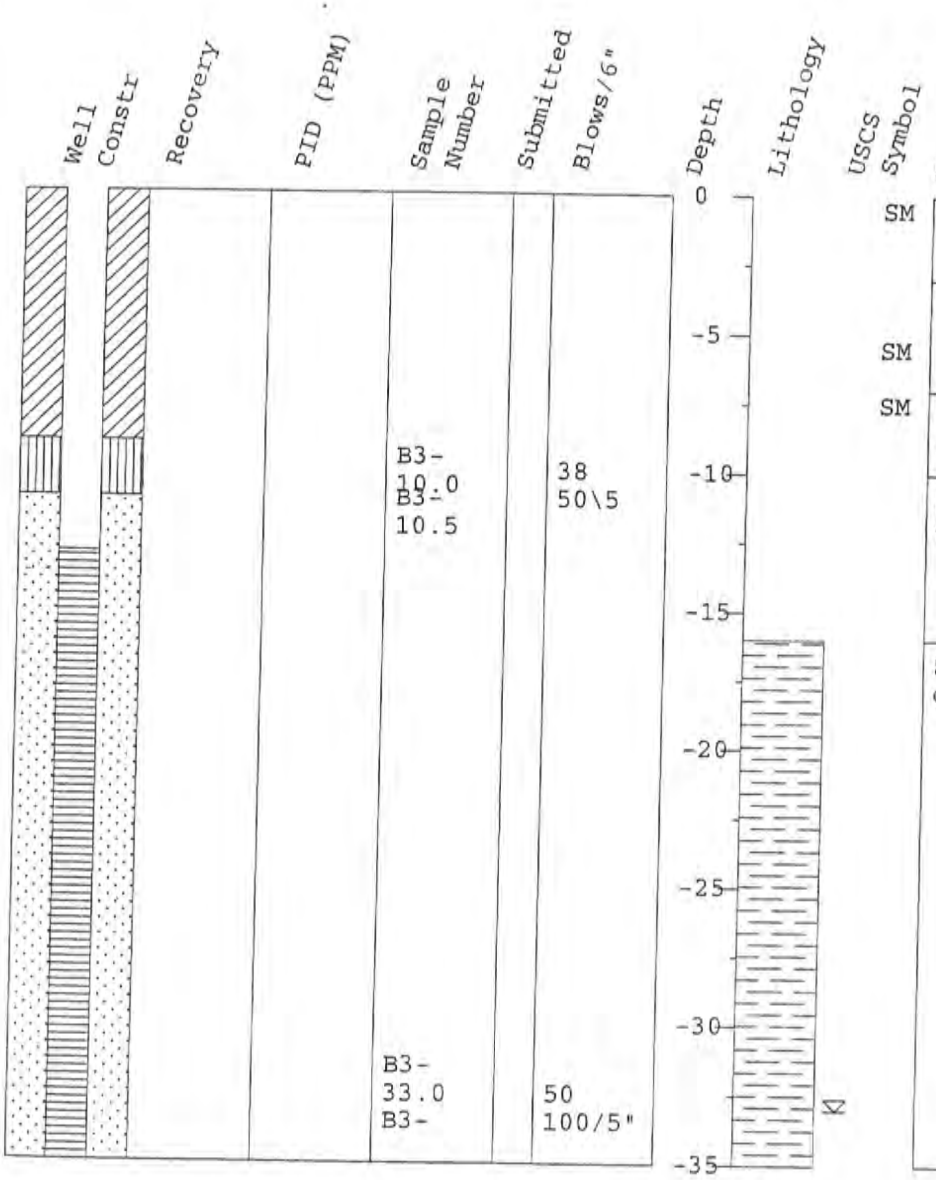
Log of Monitoring Well 2
Pt. Reyes Affordable Housing Proj.
Point Reyes, California

FIGURE
A-2



Soil Description / Field Notes

GRAVELLY LOAM: brown, loose, damp

LOAMY GRAVEL: light brown, medium dense, damp

GRAVELLY LOAM: tan, medium dense, damp

SANDY GRAVEL: light brown, very dense, damp

SHALE: grey, moderately hard, slow drilling groundwater @ 33 feet

Date: 11-15-2000
Job Name: EAH- Pt. Reyes
Job No. 99190

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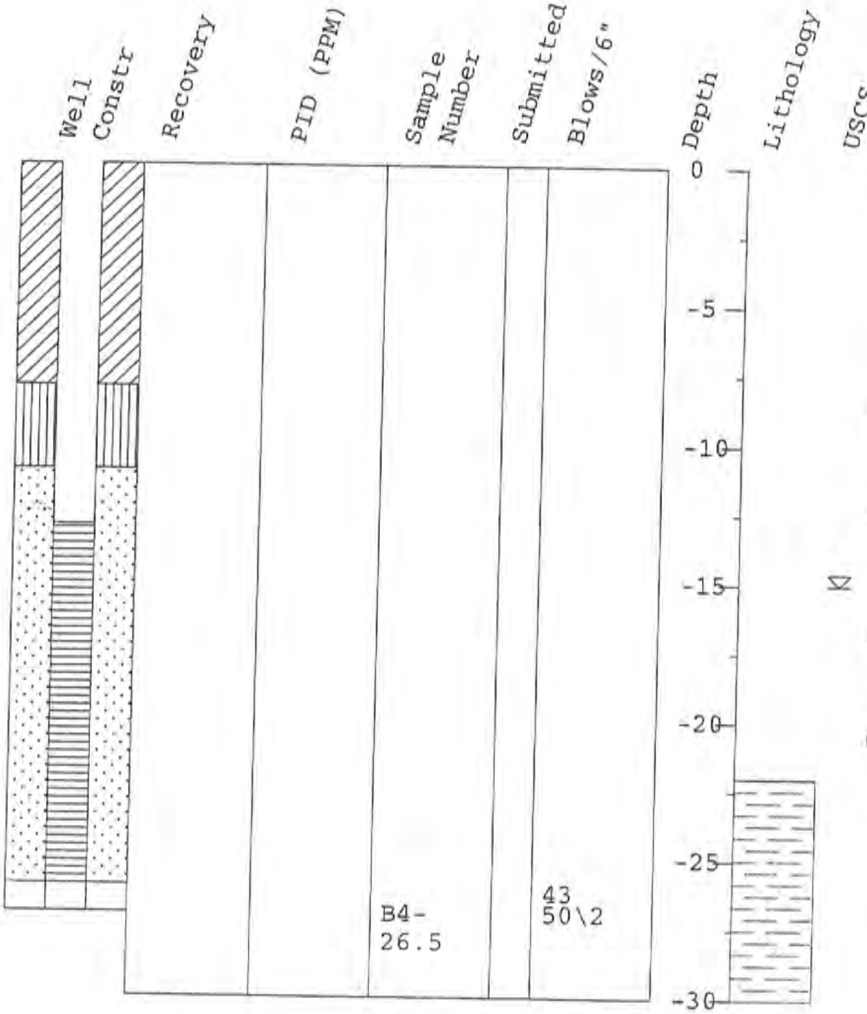
Log of Monitoring Well 3
Pt. Reyes Affordable Housing Proj.
Point Reyes, California

FIGURE
A-3



USCS Symbol	Soil Description / Field Notes
SM	GRAVELLY LOAM: brown, loose, damp
	LOAMY GRAVEL: light brown, medium dense, damp
SM	GRAVELLY LOAM: tan, medium dense,
CL	SANDY CLAY: brown to reddish brown, medium stiff, moist, low to no plasticity
SM	GRAVELLY LOAM ground water @ 15-20 feet: light brown, damp, dense
CL	SANDY CLAY: brown, stiff, moist; some gravel
	SHALE: grey, hard

Date:	11-15-2000
Job Name:	EAH- Pt. Reyes
Job No.	99190

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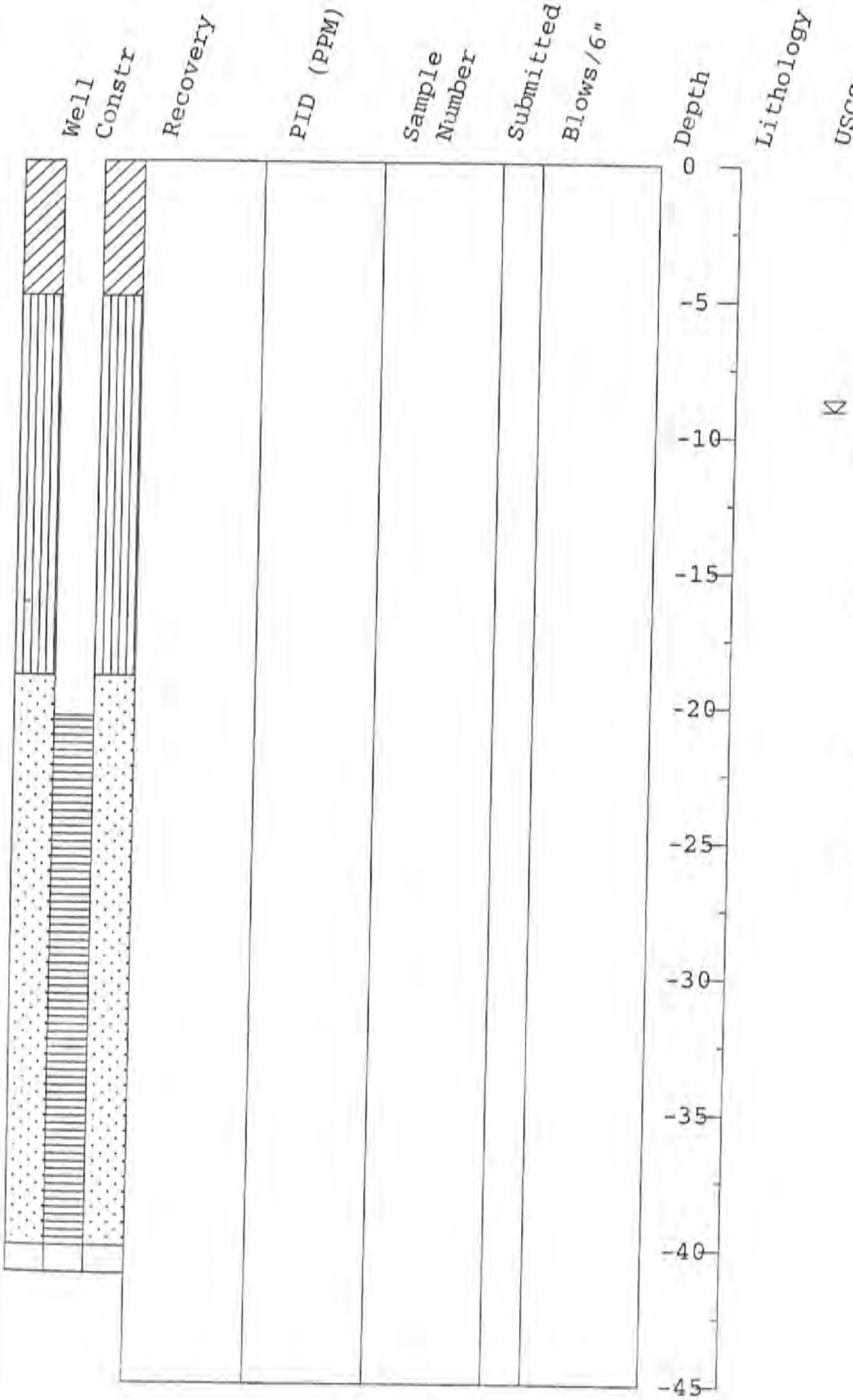
Log of Monitoring Well 4
Pt. Reyes Affordable Housing Proj.
Point Reyes, California

FIGURE
A-4



USCS Symbol	Soil Description / Field Notes
SM	SANDY LOAM: reddish-brown, loose,
SM	SILTY SANDY LOAM: brown, medium dense(soft), very moist
SM	SILTY SANDY LOAM to CLAYEY SILTY SAND: brown to dark brown, medium dense, very moist to wet groundwater @ 9-10 feet
SC	CLAYEY SAND: dark brown to dark grey, wet, sticky, very soft(flowing); interbeds of sand and clayey sand with depth, becomes denser at 18 to 19.5 feet.
SC	
CL	SANDY CLAY: grey, very moist, sticky and plastic, relativelt soft-firms up with depth
SC	CLAYEY SAND: dark grey-brown, very moist to wet

Date: 11-15-2000
Job Name : EAH- Pt. Reyes
Job No. 99190

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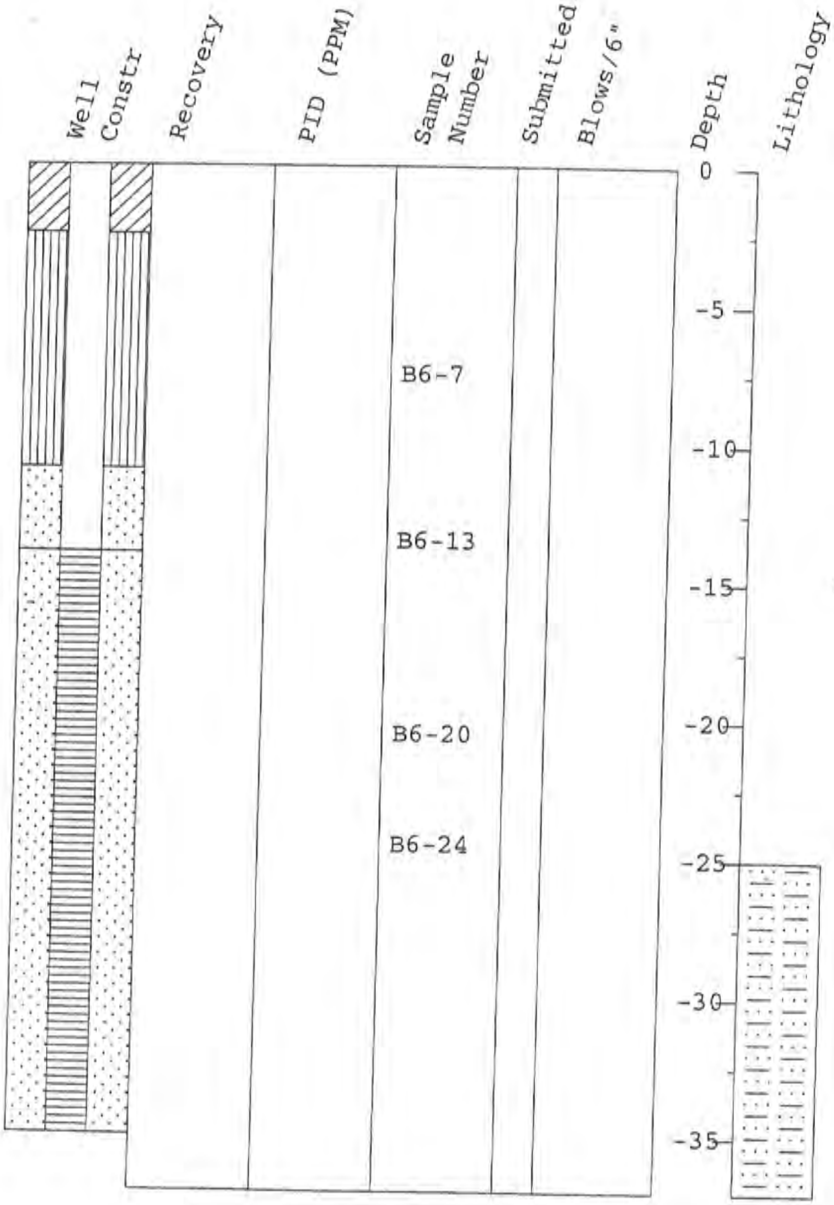
Log of Monitoring Well 5
Pt. Reyes Affordable Housing Proj.
Point Reyes, California

FIGURE
A-5



USCS Symbol	Soil Description / Field Notes
SC	SANDY CLAY LOAM: reddish-grey brown, loose, damp; more dense with depth
CL	CLAY LOAM: reddish-brown, medium dense, damp
SP	SAND TO LOAMY SAND: orange-yellow, loose, damp;becomes clayey with
▽ SM	GRAVELLY SANDY LOAM: light brown, loose, damp; increaseing fines with depth; some gravel smooth and rounded, some angular
CL	SANDY CLAY: dark brown, medium
SP	GRAVELLY SAND: grey, very fine, damp, medium dense
	SILTSTONE: grey, very hard

Date:	11-15-2000
Job Name :	EAH- Pt. Reyes
Job No.	99190

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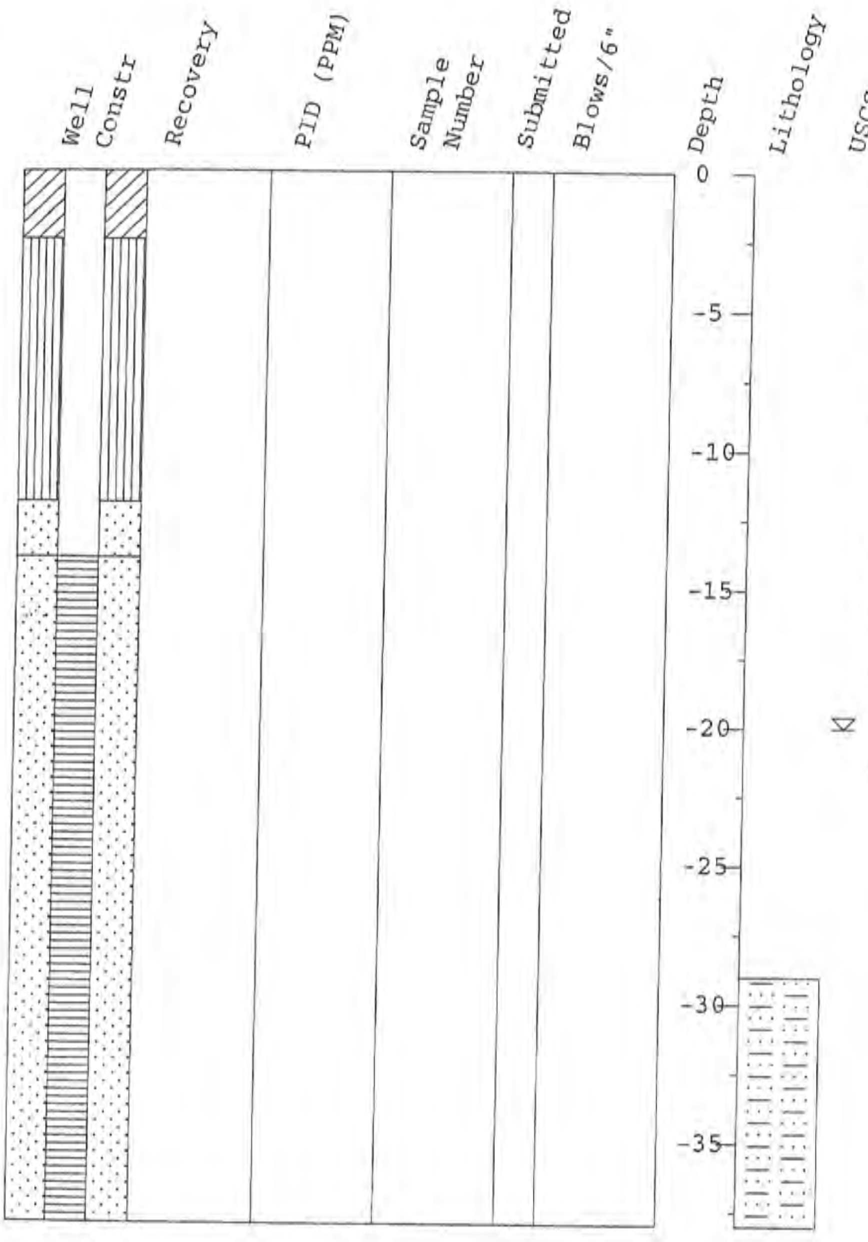
Log of Monitoring Well 6
Pt. Reyes Affordable Housing Proj.
Point Reyes, California

FIGURE
A-6



USCS Symbol	Soil Description / Field Notes
SM	SANDY LOAM: brown, loose, damp
SC	SANDY CLAY LOAM: light brown, damp; increase in clay content to almost sandy clay with depth
SC	CLAY LOAM: orange brown, loose to medium dense, damp; has 4-6 inch sand lenses
SP	LOAMY SAND: grey-brown, loose, damp;some gravel with depth
SC	SANDY CLAY LOAM: grey brown, damp
SM	SANDY LOAM: grey brown, loose, damp
GP	GRAVELLY SAND: grey-brown, very dense, wet; interbeds of sand and gravelly san, some fractured siltstone with depth
	SILTSTONE: grey, hard

Date: 11-15-2000
Job Name : EAH: Pt. Reyes
Job No. 99190

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Log of Monitoring Well 7
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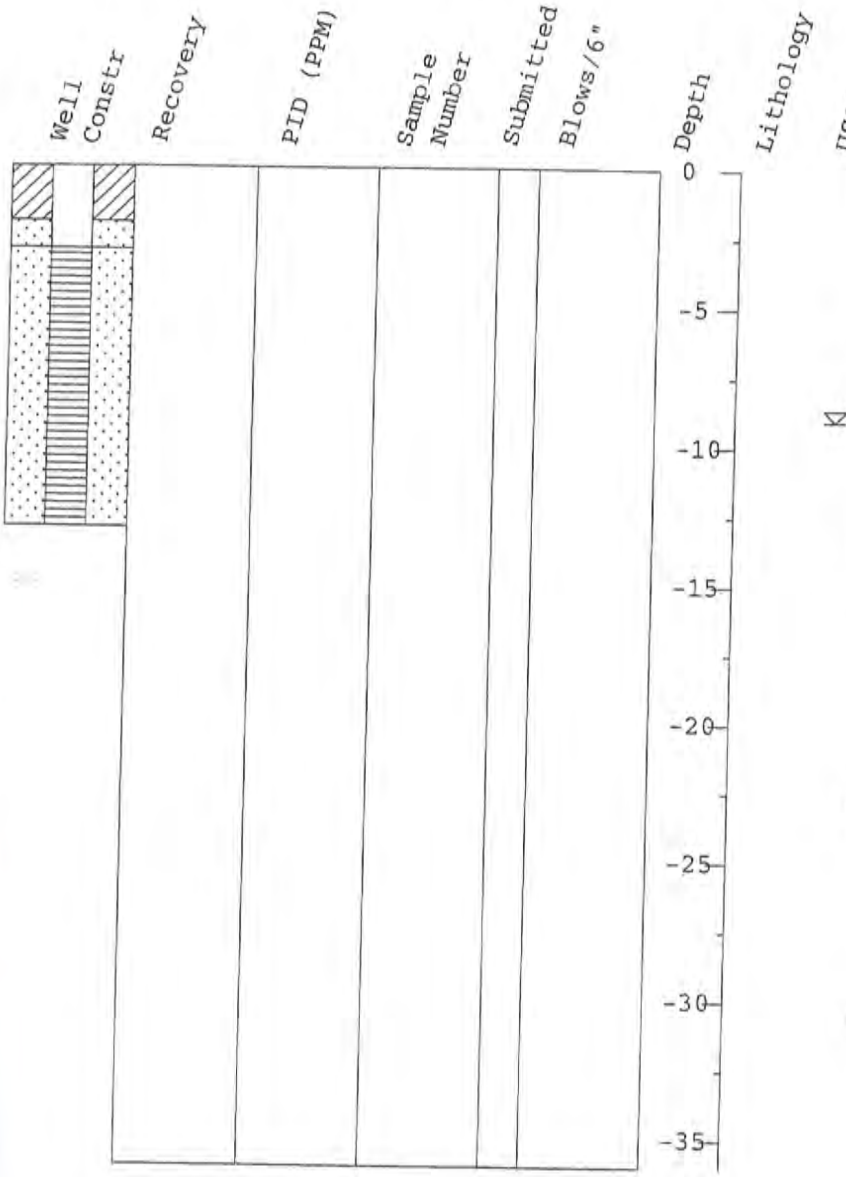
FIGURE
A-7



USCS Symbol	Soil Description / Field Notes
SM	SANDY LOAM: light reddish-brown, loose, damp
SC	SANDY CLAY LOAM: dark reddish-brown, moist, soft
CL	SANDY CLAY: brown, soft, low plasticity, moist to wet
SM	SILTY SAND: grey, very loose, wet; becomes flowing sands
SC	SANDY CLAY LOAM: grey brown, damp
	SANDY LOAM: grey brown, loose, damp; denser with depth-21-22 feet
SP	GRAVELLY SAND: grey, interspersed with silty sands, grey wet, sticky
GP	SANDY GRAVEL: grey-brown, larger pieces of fractured bedrock at 35-36 feet

Date:	11-15-2000
Job Name:	EAH- Pt. Reyes
Job No.	99190

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Log of Monitoring Well 8
Pt. Reyes Affordable Housing Proj.
Point Reyes, California

FIGURE
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