PJC & Associates, Inc.
Consulting Engineers & Geologists

November 12, 2024
Revised January 21, 2025

Job No. S2524.01

Bolinas Parcel 56 LLC
Attention: Lily Roseman
P.O. Box 704
Bolinas, CA 94924

Subject: Geotechnical Investigation
Proposed Residence & Accessory Dwelling Unit
360 Horseshoe Hill Road
Bolinas, California

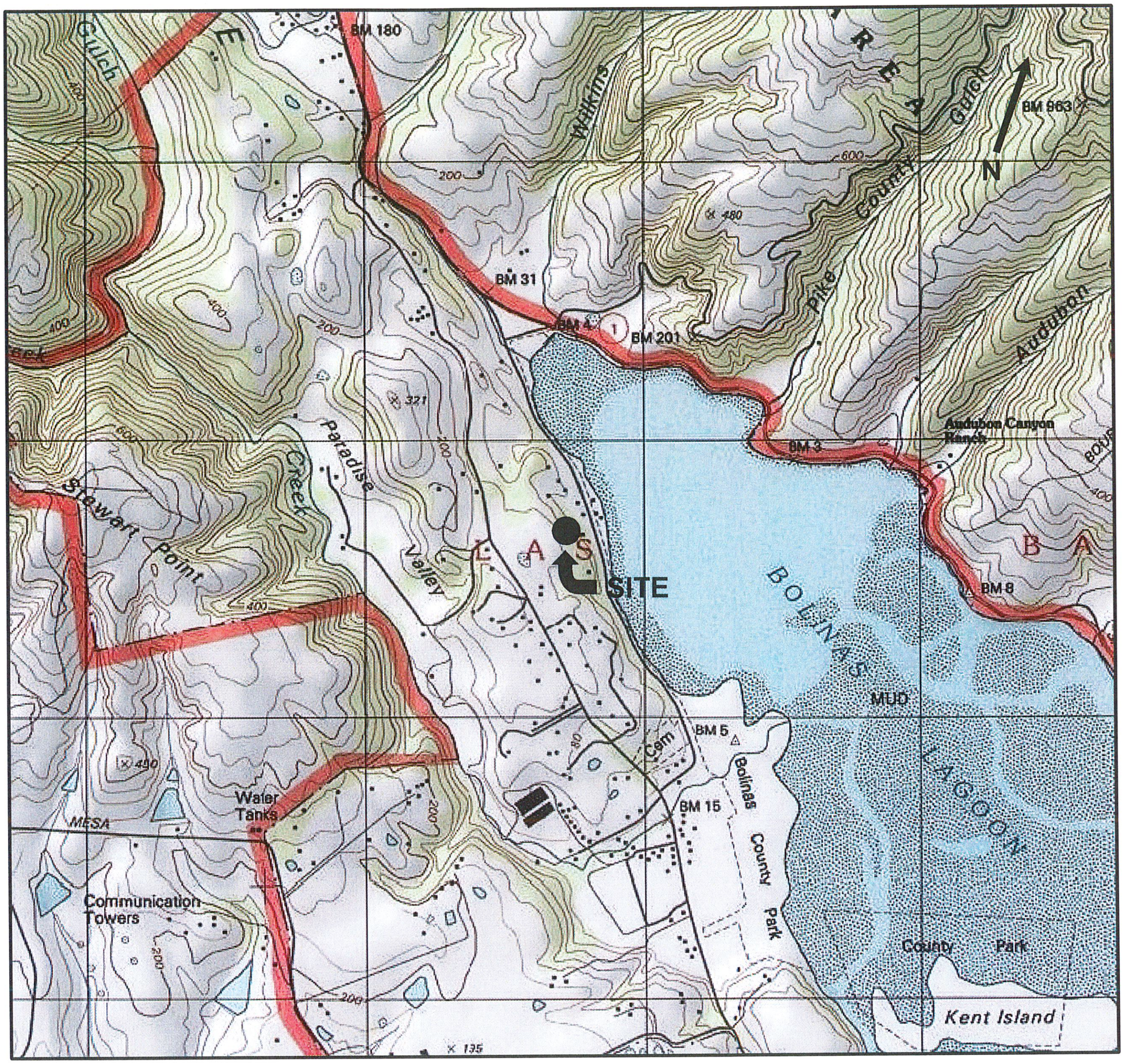
PJC & Associates, Inc. (PJC) is pleased to submit this report which presents the results of our geotechnical investigation for the proposed residence and accessory dwelling unit (ADU) located at 360 Horseshoe Hill Road in Bolinas, California. The approximate location of the site is shown on the Site Location Map, Plate 1. Our services were completed in accordance with our proposal for geotechnical engineering services, dated August 5, 2024. This report presents our engineering opinions and recommendations regarding the geotechnical aspects of the design and construction of the proposed project. Based on the results of this study, it is our opinion that the project is feasible from a geotechnical engineering standpoint provided the recommendations presented herein are incorporated in the design and carried out through construction.

1. PROJECT DESCRIPTION

Based on the preliminary site plan prepared by Arkin Tilt Architects, and information provided by you, it is our understanding that the project will consist of constructing a new single-family residence and detached ADU at the site. We anticipate that the buildings will consist of single story, wood framed or prefabricated construction with concrete slab-on-grade floors.

Structural foundation loading information for the project was not available at the time of this report. For our analysis, we anticipate that structural foundation loads will be light with dead plus live continuous wall loads less than two kips per lineal foot (plf) and dead plus live isolated column loads less than 50 kips. If these assumed loads vary significantly from the actual loads, we should be consulted to review the actual loading conditions and, if necessary, revise the recommendations of this report.

Grading plans were not available at the time of this report. However, we anticipate that the structures will be constructed at or near existing grade. Therefore, site grading will probably consist of minor cuts and fills to



SCALE 1:24,000

REFERENCE: USGS BOLINAS CALIFORNIA QUADRANGLE, DATED 1995.

PJC & Associates, Inc. Consulting Engineers & Geologists	SITE LOCATION MAP PROPOSED RESIDENCE & ADU APN 188-140-21 BOLINAS, CALIFORNIA	PLATE 1
	Proj. No: S2524.01 Date: 11/24 App'd by: AJD	

achieve the desired pad grades and to provide adequate gradients for site drainage.

2. SCOPE OF SERVICES

The purpose of this investigation was to evaluate the subsurface conditions at the site and to develop geotechnical criteria for design and construction of the project. Specifically, the scope of our services consisted of the following:

a. Excavate four exploratory test pits to depths between four and one-half and five feet below the existing ground surface to observe the soil, bedrock and groundwater conditions. Our engineering geologist was on site to observe the excavation, log the materials encountered in the test pits and to obtain representative samples for visual classification and laboratory testing.

b. Perform laboratory tests on selected samples to evaluate their index and engineering properties.

c. Review 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, lurching and lateral spreading, expansive soils, etc.).

d. Perform engineering analyses to develop geotechnical recommendations for site preparation and grading, foundation type(s) and design criteria, lateral earth pressures, site drainage, and construction considerations.

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

3. SITE CONDITIONS

a. General: The site is located in a rural residential area of Bolinas, approximately three-quarter miles south of the intersection of Highway 1 and Horseshoe Hill Road, and approximately 700 feet northeast from Horseshoe Hill Road via the private driveway easement. The parcel is generally bordered by relatively large residential parcels on all sides. At the time of our investigation, the site was occupied by prefabricated living structures and landscape areas. The remaining portions of the site were relatively undeveloped and covered in heavily forested land, and perennial grasses.

b. Topography and Drainage: The site is located on relatively level to steeply sloping topography, with a maximum estimated natural gradient of one and one-half horizontal to one vertical (1.5H:1V). However, the proposed building envelopes are located on relatively level to gently sloping topography. The steepest areas of the site are located along the eastern half of the property, which generally slope downward towards the Bolinas Lagoon. According to the United States Geological Survey (USGS) Bolinas, California, 7.5 Minute Quadrangle Map (Topographic), the site is situated near an elevation of 125 feet above mean sea level (MSL). No creeks or drainage swales pass through the building sites. However, the steeply sloping hillsides along the eastern portions of the site contain three seasonal drainage swales that generally discharge surface and subsurface flow toward the Bolinas Lagoon. Site drainage consists of sheet flow and surface infiltration, and is provided by the aforementioned seasonal drainage swales.

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 late Jurassic time. This process involved eastward thrusting of oceanic crust beneath the continental crust (Klamath Mountains and Sierra Nevada) and the scraping off of materials that were 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 in 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 published geologic literature, the site is mapped within the Pleistocene-Pliocene Merced Formation (QTm). The Merced Formation consists of sandy siltstone, silty sandstone, and interbedded pebble conglomerate. During our subsurface exploration, we encountered silty sandstone bedrock indicative of the Merced Formation.

5. FAULTING

Geologic structures in the region are primarily controlled by northwest trending faults. The site is located within the State of California Alquist-Priolo Earthquake Fault Studies Zone (AP Zone) designated for the San Andreas fault. Active traces of the San Andreas fault has been mapped northeast and southwest of the project site. The Alquist-Priolo Earthquake Zoning Act, formerly called the Alquist-Priolo Special Studies Zones Act, was signed into California law on December 22, 1972. Under this Act, earthquake fault zones were delineated along known active faults. An active fault is one that has shown evidence of surface displacement within Holocene time (about the last 11,000 years). Special studies are generally required in these zones for structures constructed for human occupancy. However, according to the Alquist-Priolo Special Studies Zones Act an exemption to this Act is a single-family wood or steel framed dwelling or barn not exceeding two stories when such dwelling is not a part of a development of four or more dwellings. According to the State of California, this exemption appears to apply to this project.

Based on our research, the three closest known potentially active faults to the site are the San Andreas, San Gregorio and Rodgers Creek faults. The site is located in the San Andreas Fault Zone with mapped traces of the fault to the northeast and southwest, the San Gregorio fault is located 12 miles to the south, and the Rodgers Creek fault is located 18 miles northeast of the site. Table 1 outlines the nearest known active faults and their associated maximum magnitude.

TABLE 1
CLOSEST KNOWN ACTIVE FAULTS

Fault Name	Distance from Site (Miles)	Maximum Earthquakes (Moment Magnitude)
San Andreas	<1	7.9
San Gregorio	12	7.5
Rodgers Creek	18	7.3

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 quality of construction. Seismic considerations and hazards are discussed in the following subsections of this report.

7. SUBSURFACE CONDITIONS

a. Soils & Bedrock. The subsurface conditions of the site were investigated by excavating four exploratory test pits (TP-1 through TP-4) near the proposed building envelopes to depths between four and one-half and five feet below the existing ground surface. The approximate test pit locations are shown on the Test Pit Location Plan, Plate 3. The test pits were excavated to observe the soil, bedrock and groundwater conditions, and obtain samples for visual examination and laboratory testing. The excavation and sampling procedures, and descriptive test pit logs are included in Appendix A of this report. The laboratory procedures are presented in Appendix B.

The exploratory test pits generally encountered young alluvial deposits and residual soils underlain bedrock deposits of the Merced Formation that extended to the maximum depths explored. At the surface, our exploration encountered young alluvial soil deposits consisting of sandy silts and silty sands that extended to depths between one and two and one-half feet below the existing ground surface. The fine grained young alluvial soils appeared dry to moist, stiff, porous and exhibited low plasticity characteristics. The granular young alluvial soils appeared slightly moist, medium dense, porous, and fine to coarse grained. Underlying the surface soils at TP-1, TP-3 and TP-4, our exploration encountered residual soil deposits consisting of sandy silts that extended to depths between three and three and one-half feet below the existing ground surface. The residual soils appeared dry to moist, very stiff to hard, slightly porous and exhibited low plasticity characteristics. Underlying the alluvial and residual soils, our exploration encountered sandstone bedrock of the Merced Formation that extended to the maximum depths explored. The bedrock appeared soft to slightly hard, plastic to friable and highly weathered.

b. Groundwater. No groundwater or seepage was encountered during our subsurface exploration on August 29, 2024. However, seepage within the upper soil layers and bedrock fractures should be anticipated in the winter and early spring, and may vary depending on the amount of 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 project. The following discussion reflects the possible earthquake effects which could result in damage to the proposed project.

a. Fault Rupture. Rupture of the ground surface is expected to occur along known active fault traces. No evidence of existing faults or previous ground displacement on the site due to fault movement was observed during our field exploration. However, the site is located in San Andreas fault zone with mapped traces to the southwest and northeast of the site. The current theory is that movement along a fault follows the trace of the most recent break. This is not always the case. Due to the close proximity to the fault, it should be considered that the risk of ground rupture at the site is moderate to high.

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. Our field exploration revealed no loose, saturated, granular soil stratums at the site. Furthermore, the site is underlain by relatively shallow bedrock. Additionally, according to the Association of Bay Area Governments (ABAG) liquefaction map, the site is located in an area of very low susceptibility to seismically induced liquefaction. Therefore, it is judged that liquefaction is not likely to occur at the site.

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. There are no exposed faces or a creek embankment at the site. Therefore, we judge that the potential for lateral spreading or lurching at the site is low.

e. Expansive Soils. Based on our laboratory testing (PI=2) and our visual observations, the onsite soils at the site are judged to have a low expansion potential.

9. SLOPE STABILITY

The structures will be constructed on relatively level to gently sloping topography. However, site gradients northeast of the site increase substantially to a maximum of 1.5H:1V. Based on the recent geologic literature, the site is nor mapped within an active landslide. However, based on our visual observations and review of aerial photographs and LiDAR imagery, there is a large area of instability located approximately 100 feet southeast of the nearest proposed building envelope. Additionally, the steeply sloping hillsides located along the eastern portions of the site could potentially become unstable over time due to excessive erosion resulting from the introduction of surface and subsurface water. Therefore, we recommend that surface and subsurface water be diverted away from the area of instability and the steeply sloping hillsides located east of the building sites. Additionally, in order to enhance the stability of the slopes, we recommend an interceptor subdrain be installed upslope of the crown of the steeply sloping, east facing hillsides and the proposed structures.

10. CONCLUSIONS

Based on our field and office studies, we judge that from a geotechnical engineering standpoint, the site is suitable for development provided the recommendations presented in this report are incorporated into the design and carried out through construction. The primary geotechnical concerns in design and construction of the project is the presence of weak and compressible surface and near surface soils.

The surface and near surface soils are porous and compressible, and not suitable for support of fills, foundations, or slabs. These soils could experience significant differential settlement under loads generated by new construction. Below the unsuitable surface and near surface soils are bedrock deposits of the Merced Formation adequate for support of the anticipated foundation loads. Therefore, it will be necessary to upgrade the upper weak and compressible soils by subexcavation and recompaction. Provided the weak and compressible surface and near surface soils are upgraded through subexcavation and recompaction, the structures may be supported by shallow spread footings and conventional concrete slabs-on-grade may be used. Furthermore, concrete slabs-on-grade should be provided with underslab drains to prevent hydrostatic uplift, as shown on Plate 2.

Detailed geotechnical engineering recommendations for use in design and construction of the project are presented in the subsequent sections of this report.

11. EARTHWORK AND GRADING

We anticipate site grading will probably consist of minor cuts and fills of three feet and less to achieve the desired pad grades and to provide adequate gradients for site drainage.

a. Stripping. Structural areas should be stripped of the surface vegetation, old fills, debris, underground utilities, etc. These materials should be moved off site; some of them, if suitable could be stockpiled for later use in landscape areas. If underground utilities pass through the site, we recommend that these utilities be removed in their entirety or rerouted where they exist outside an imaginary plane sloped one horizontal to one vertical (1H:1V) from the outside bottom edge of the nearest foundation element. Septic tanks and leach fields, if encountered, should be abandoned according to regulations as set forth by the County of Marin Health Department. Voids left from the removal of utilities or other obstructions should be replaced with compacted engineered fill under the observation of the project geotechnical engineer.

b. Excavation and Compaction. The compressible surface and near surface soils should be removed to their full depth within the building pads, and bedrock exposed. Based on our subsurface exploration, we estimate that the subexcavation will likely extend to depths between two and three and one-half feet below the existing ground surface. The actual depth of subexcavation should be determined by the geotechnical engineer in the field during construction. The lateral extent of the subexcavation should be a minimum of five feet beyond the foundations, and three feet beyond exterior flatwork.

After subexcavation, the exposed subgrade scheduled to receive fill should be scarified to minimum depth of eight inches, moisture conditioned to at least two percent over optimum moisture content, and recompacted to at least 90 percent of relative maximum dry density as determined by ASTM D-1557 test procedures. All fill material should be placed and compacted in accordance to the recommendations presented in Table 2. It is recommended that any import fill to be used on site 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 10% and 35%
Maximum Aggregate Size	4 inches

The existing on-site soils, free of organics and rocks larger than four inches in dimension, are suitable for use as compacted engineered fill. All fills should be placed in lifts no greater than eight inches in loose thickness and compacted to the general recommendations provided for engineered fill.

TABLE 2
SUMMARY OF COMPACTION RECOMMEDATIONS

Area	Compaction Recommendations*
General Engineered Fill (Import)	In lifts, a maximum of eight inches loose thickness, compact to a minimum of 90 percent relative compaction near optimum moisture content.
General Engineered Fill (Native)	In lifts, a maximum of eight inches loose thickness, compact to 90 percent relative compaction at or near optimum moisture content.

*All compaction requirements stated in this report refer to dry density and moisture content relationships obtained through the laboratory standard described by ASTM D-1557-91

A representative of PJC should observe all site preparation and fill placement. It is important that during the stripping, grading and scarification 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.

All cut and fill slopes should be no steeper than two horizontal to one vertical (2H:1V). Steeper slopes should be retained. The slopes should be covered with deep rooted ground cover to reduce and control erosion.

12. FOUNDATIONS: SPREAD FOOTINGS

a. Vertical Loads. Provided the recommendations contained in the earthwork and grading section of this report are followed, the structures may be adequately supported by spread footings founded at least 12 inches into compacted, engineered fill. All footings should be reinforced. The recommended soil bearing pressures, depths of embedment and minimum width of spread footings are presented in Table 3. The bearing values provided have been calculated assuming that all footings bear on at least 12 inches of compacted engineered fill.

TABLE 3
FOUNDATION DESIGN CRITERIA

Footing Type	Bearing Pressure (psf)*	Minimum Embedment (in)**	Minimum Width (in)
Continuous Wall	2000	12	12
Isolated Column	2500	12	18

*Dead plus live load
** Into compacted engineered fill

The allowable soil bearing pressures are net values. The weight of the foundation and backfill over the foundation may be neglected when computing dead loads. Allowable soil 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 or passive pressure. A friction factor of 0.35 is considered appropriate between the bottom of the concrete structures and the engineered fill. A passive pressure equivalent to that exerted by a fluid weighing 350 pounds per square foot per foot of depth (psf/ft) is recommended. Unless restrained at the surface, the upper six inches should be neglected for passive resistance. Furthermore, all footings should have at least seven feet of horizontal confinement, as measured from the bottom of the footing to the face of the nearest slope.

Footing concrete should be placed neat against engineered fill. 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 to close all cracks 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 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 are expected to be less than one-half of one inch. The majority of the settlement is expected to occur during construction and placement of dead loads.

13. SLAB-ON-GRADE

Concrete slabs-on-grade should be supported entirely on compacted, engineered fill, prepared in accordance with the earthwork and grading section of this report. Slabs-on-grade should be underlain by a four-inch layer of compacted clean gravel or crushed rock. The rock will serve as a capillary break. The rock should be graded so that 100 percent passes the one inch sieve and no more than five percent passes the No. 4 seive.

We recommend that the gravel be placed as soon as possible after compaction of the fill to prevent drying of the subgrade soils. If the subgrade is allowed to dry out prior to slab-on-grade construction, the subgrade soil should be moisture conditioned by sprinkling prior to slab construction.

We recommend that slabs be at least five inches thick and designed and reinforced as determined by the project structural engineer. Special care should be taken to insure that reinforcement is placed at the slab mid-height.

For slabs-on-grade with moisture sensitive surfacing, we recommend that an impermeable membrane be placed over the rock to prevent migration of moisture vapor through the concrete slab. Furthermore, concrete slabs-on-grade should be provided with underslab drains to prevent hydrostatic uplift, as shown on Plate 2.

14. SEISMIC DESIGN

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. Based on the data reviewed, it is concluded that the project site could be subjected to seismic shaking resulting from earthquakes on the active faults primarily in the Coast Ranges. Due to the presence of shallow bedrock, a site soil class type C is recommended for design.

15. DRAINAGE

We recommend that the roofs be provided with gutters and that the downspouts be connected to closed conduits discharging to a designated area away from foundations and slopes. Surface water should be channeled away from slopes and foundations.

We recommend foundation subdrains should be placed adjacent to all foundations, except the downhill side. The foundation subdrains should extend at least 12 inches below the interior subgrade. The bottom of the trench should be sloped to drain by gravity and lined with a few inches of three quarter to one and a half inch-drain rock. The subdrain should consist of a heavy walled, four-inch diameter, perforated pipe sloped to drain to outlets by gravity. The trench should then be backfilled to within six inches of finished surface with drain rock. The upper few inches should consist of compacted soil to reduce surface water inclusion. We recommend that a drainage filter cloth be placed between the soil and the drain rock or Class II permeable material be used in lieu of the filter fabric and drain rock. Furthermore, concrete slabs-on-grade should be provided with underslab drains to prevent hydrostatic uplift, as shown on Plate 2. Additionally, in order to enhance the stability of the steeply sloping, east facing hillsides downslope of the proposed structures, we recommend an interceptor subdrain be installed upslope of the crown of the slopes, and downslope from the proposed structures.

Roof downspouts and surface drains must be maintained entirely separate from the foundation subdrains. The outlets discharge onto erosion resistant areas.

16. LIMITATIONS

The data, information, interpretations and recommendations in this report are presented solely as bases and guides for the geotechnical design of the proposed residence and ADU located at 360 Horseshoe Hill Road in Bolinas, California. The conclusions and professional opinions presented herein were developed in accordance with generally accepted geotechnical engineering principles and practices. As with all geotechnical reports, the opinions expressed here are subject to revisions in light of new information, which may be developed in the future, and no warranties are either expressed or implied.

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 purpose 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 and approved in writing. This report and the drawings contained herein are intended only for the design of the proposed project. 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 the 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 PJC does not and cannot have complete knowledge of the subsurface conditions underlying the subject site. The criteria presented are based upon the findings at the points of exploration and upon 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 verify that the design is consistent with the recommendations of this report. During the course of this investigation, several assumptions were made regarding building loads and 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 be provided by PJC to verify that the intent of the plans and specifications is carried out during construction; these services should include observing the foundation excavations, field density testing of fill, and installation of the subsurface drainage facilities.

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

It has been a pleasure working with you on this project. Please call us if you have any questions regarding the results of this investigation, or if we can be of further assistance.

Sincerely,

PJC & Associates, Inc.

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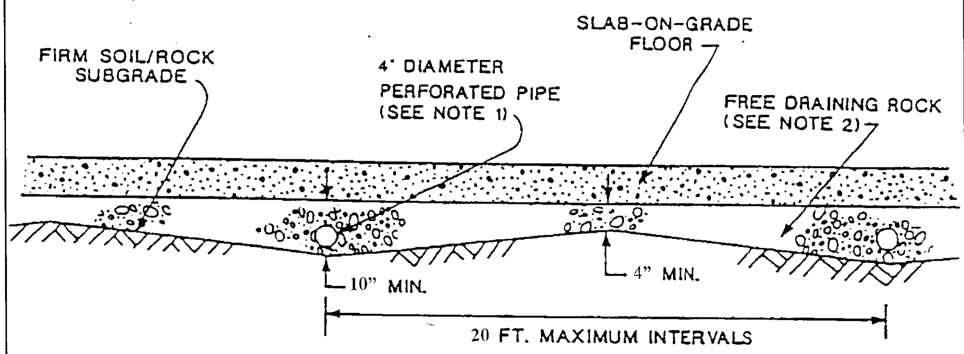

Notes:

1. PERFORATED PIPE (PVC OR EQUIVALENT) SHOULD BE PLACED WITH PERFORATIONS DOWN. THE PIPE SHOULD BE SLOPED FOR GRAVITY FLOW AND OUTLET THROUGH SOLID PIPE TO DAYLIGHT.

2. DRAIN ROCK SHOULD BE AT LEAST 4" THICK AND A MINIMUM OF 10" WHERE PIPES ARE LOCATED. THE DRAIN ROCK SHOULD BE ½ OR ¾ INCH DRAIN ROCK ON FILTER FABRIC OR CONSIST OF CLASS II PERMEABLE MATERIAL.

PJC & Associates, Inc. Consulting Engineers & Geologists	SLAB UNDERDRAIN SYSTEM PROPOSED RESIDENCE & ADU APN 188-140-21 BOLINAS, CALIFORNIA	PLATE 2
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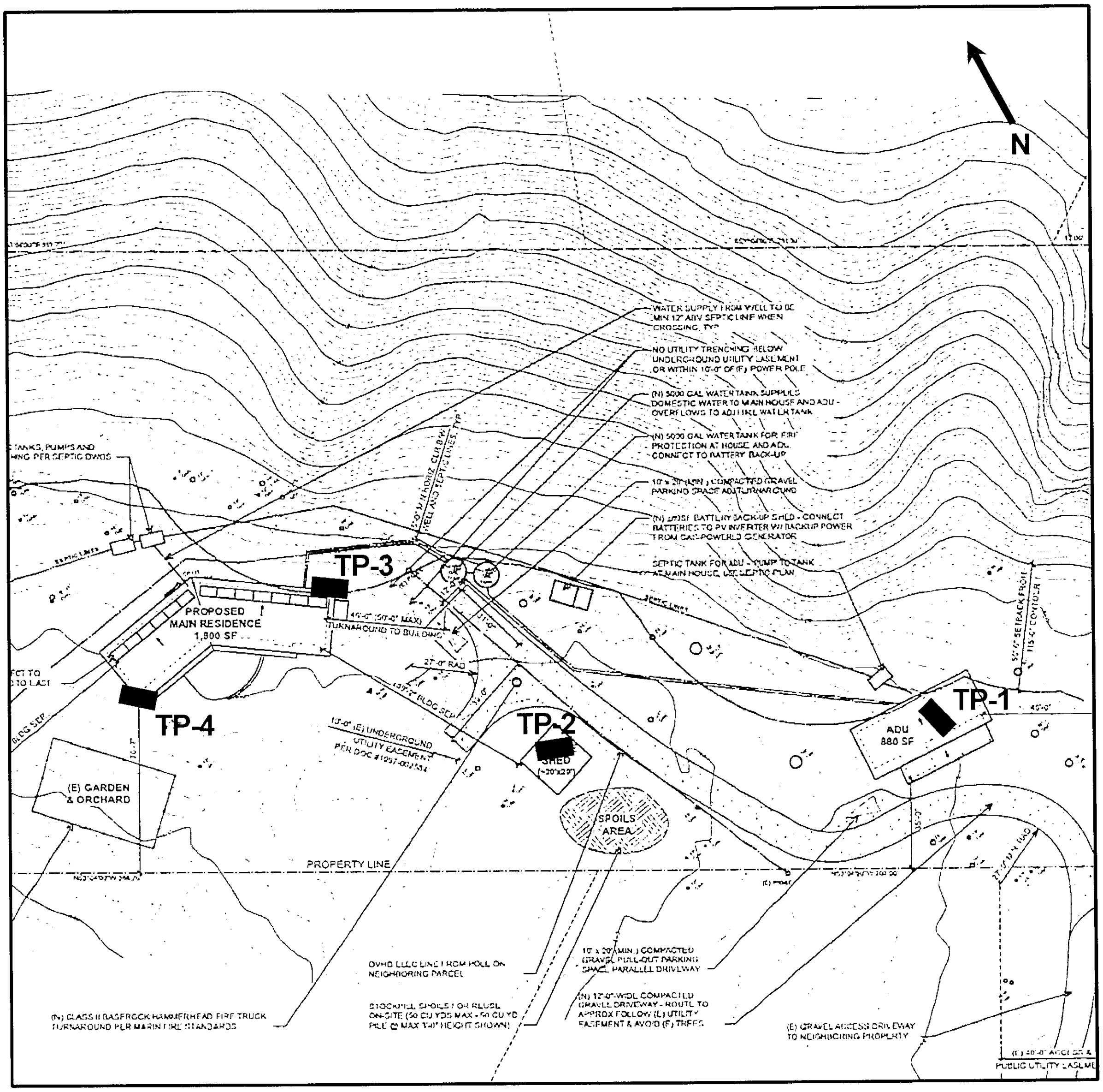
APPENDIX A
FIELD INVESTIGATION

1. INTRODUCTION

The field program performed for this study consisted of excavating four exploratory test pits (TP-1 through TP-4) in the vicinity of the proposed structures. The exploration was completed on August 29, 2024. The approximate test pit locations are shown on the Test Pit Location Plan, Plate 3. Descriptive logs of the test pits are presented in this appendix as Plates 4 through 7.

2. TEST PITS

The test pits were excavated using a track-mounted excavator with a 30-inch bucket. Disturbed samples were obtained for visual classification and laboratory testing. The soils were classified in accordance with the Unified Soil Classification System, as explained in Plate 8. The bedrock was classified according to Plate 9.



EXPLANATION

█ TEST PIT LOCATION AND DESIGNATION

NO SCALE

REFERENCE: SITE PLAN PROVIDED BY ARKIN TILT ARCHITECTS, DATED OCTOBER 25, 2024.

PJC & Associates, Inc. Consulting Engineers & Geologists	TEST PIT LOCATION PLAN PROPOSED RESIDENCE & ADU APN 188-140-21 BOLINAS, CALIFORNIA	PLATE 3
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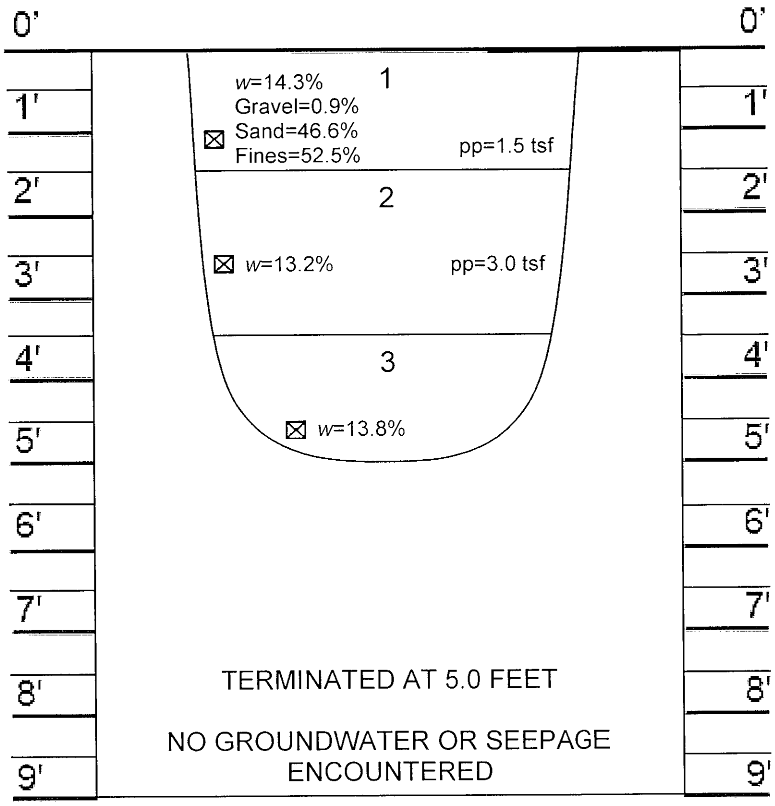


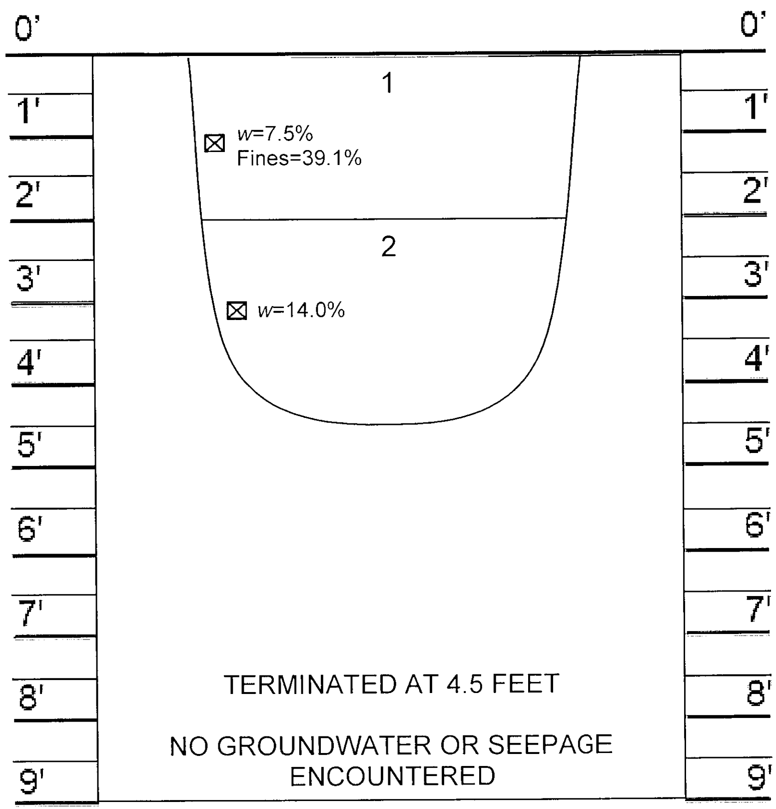
LITHOLOGY

1) 0.0-1.5'; SANDY SILT (ML); brown, moist, stiff, low plasticity. (YOUNG ALLUVIUM)

2) 1.5-3.0'; SANDY SILT (ML); buff, moist, very stiff, porous, low plasticity. (RESIDUAL SOIL)

3) 3.0-5.0'; SANDSTONE; pale yellow brown with orange brown, soft, friable, highly weathered. (MERCED FORMATION)

PJC & Associates, Inc. Consulting Engineers & Geologists	LOG OF TEST PIT 1 PROPOSED RESIDENCE & ADU APN 188-140-21 BOLINAS, CALIFORNIA	PLATE **4**
	Proj. No: S2524.01 Date: 11/24 App'd by: AJD	



LITHOLOGY

1) 0.0-2.0'; SILTY SAND (SM); pale brown, slightly moist, medium dense, porous, low plasticity. (YOUNG ALLUVIUM)

2) 2.0-4.5'; SANDSTONE; pale yellow brown to orange brown, soft to slightly hard, friable, highly weathered. (MERCED FORMATION)

PJC & Associates, Inc. Consulting Engineers & Geologists	LOG OF TEST PIT 2 PROPOSED RESIDENCE & ADU APN 188-140-21 BOLINAS, CALIFORNIA	PLATE 5
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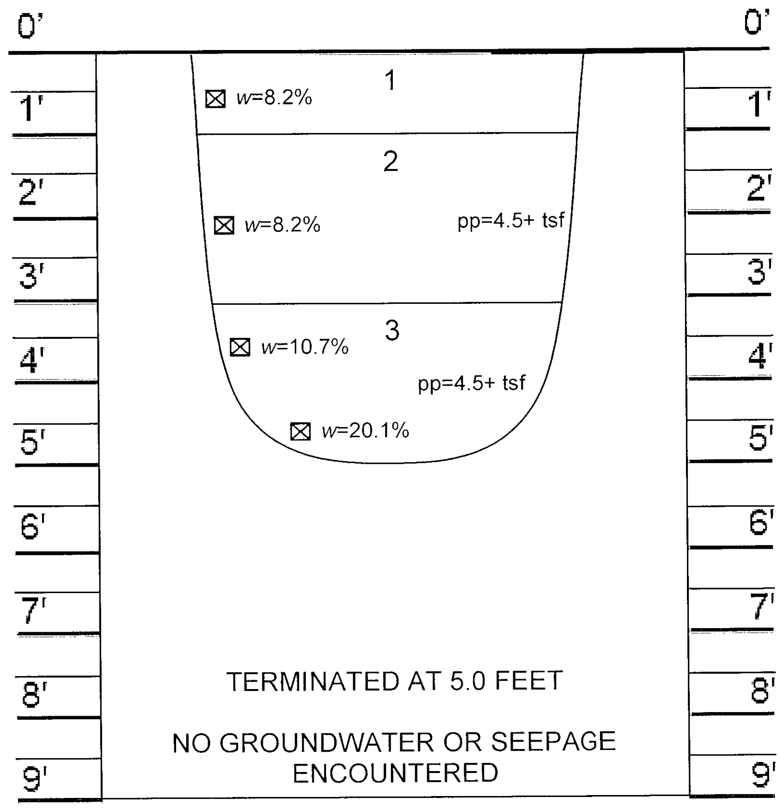

LITHOLOGY

1) 0.0-1.0'; SILTY SAND (SM); brown, slightly moist, medium dense, porous, fine to coarse grained. (YOUNG ALLUVIUM)

2) 1.0-3.0'; SANDY SILT (ML); light brown, dry, hard, porous, low plasticity. (RESIDUAL SOIL)

3) 3.0-5.0'; SANDSTONE; pale yellow to dark yellow brown with gray, soft, friable, highly weathered. (MERCED FORMATION)

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Consulting Engineers & Geologists

LOG OF TEST PIT 3
PROPOSED RESIDENCE & ADU
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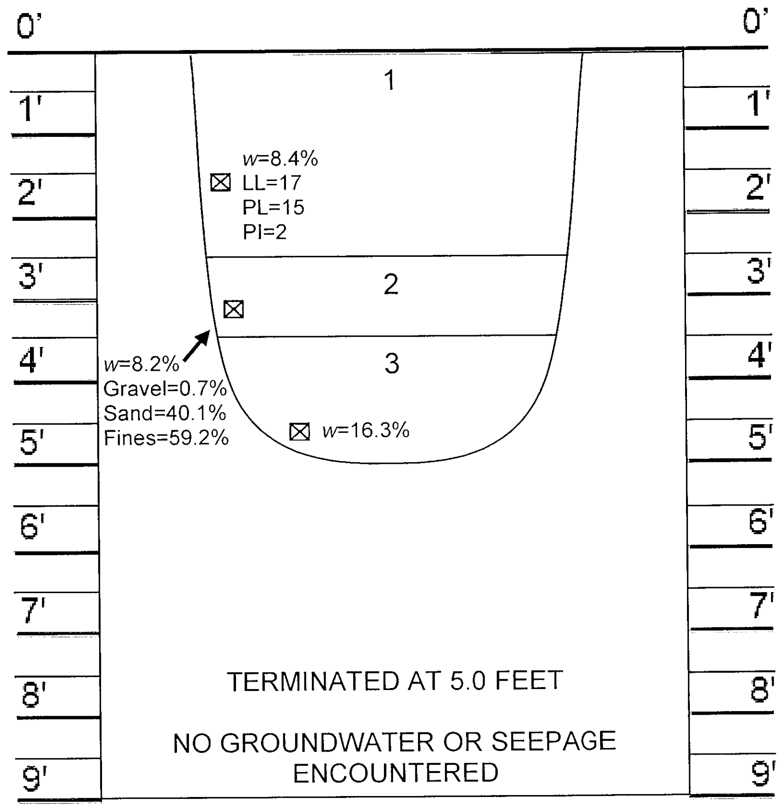
PLATE 6

Proj. No: S2524.01 Date: 11/24 App'd by: AJD



LITHOLOGY

1) 0.0-2.5'; SANDY SILT (ML); pale brown, slightly moist, stiff, porous, fine to coarse grained. (YOUNG ALLUVIUM)

2) 2.5-3.5'; SANDY SILT (ML); pale yellow brown, dry, very stiff, porous, low plasticity. (RESIDUAL SOIL)

3) 3.5-5.0'; SANDSTONE; yellow and orange brown mottling with gray, soft, plastic to friable, highly weathered. (MERCED FORMATION)

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LOG OF TEST PIT 4
PROPOSED RESIDENCE & ADU
APN 188-140-21
BOLINAS, CALIFORNIA

PLATE 7

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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 RESIDENCE & ADU
APN 188-140-21
BOLINAS, CALIFORNIA

PLATE 8

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ROCK TYPES

Conglomerate	Shale	Metamorphic Rocks Hydrothermally Altered Rocks
Sandstone	Sheared Shale Melange	Igneous Rocks
Meta-Sandstone	Chert	

Bedding Thickness		Joint, Fracture or Shear Spacing	
Massive	Greater than 6 feet	Very Widely Spaced	Greater than 6 feet
Thickly Bedded	2 to 6 feet	Widely Spaced	2 to 6 feet
Medium Bedded	8 to 24 inches	Moderately Widely Spaced	8 to 24 inches
Thinly Bedded	2-1/2 to 8 inches	Closely Spaced	2-1/2 inches
Very Thinly Bedded	3/4 to 2-1/2 inches	Very Closely Spaced	3/4 to 2-1/2 inches
Closely Laminated	1/4 to 3/4 inches	Extremely Closely Spaced	Less than 3/4 Inch
Very Closely Laminated	Less than 1/4 inch		

HARDNESS

Soft - Pliable, can be dug by hand

Slightly Hard - Can be gouged deeply or carved with a pocket knife

Moderately Hard - Can be readily scratched by a knife Blade; Scratch leaves heavy trace of dust and is readily visible after the powder has been blown away

Hard - Can be scratched with difficulty; scratch produced little powder and is faintly visible

Very Hard - cannot be scratched with pocket knife, leaves metallic streak

STRENGTH

Plastic- Capable of being molded by hand

Friable - Crumbles by rubbing with fingers

Weak - an unfractured specimen of such material will crumble under light hammer blows

Moderately Strong - Specimen will withstand a few heavy hammer blows before breaking

Strong - Specimen will withstand a few heaving ringing hammer blows and usually yields large fragments

Very Strong - Rock will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments

DEGREE OF WEATHERING

Highly Weathered - Abundant fractures coated with oxides, carbonates, sulphates, mud, etc., through discoloration, rock disintegration, mineral decomposition

Moderately Weathered - Some fracture coating, moderate or localized discoloration, little to no effect on cementation, slight mineral decomposition

Slightly Weathered - A few stained fractures, slight discoloration, little to no effect on cementation, no mineral decomposition

Fresh - Unaffected by weathering agents, no appreciable charge with depth

APPENDIX B
LABORATORY INVESTIGATION

1. INTRODUCTION

This appendix includes a discussion of test procedures and results of the laboratory investigation performed for the proposed project. The investigation program was carried out by employing currently accepted test procedures of the American Society of Testing and Materials (ASTM).

Disturbed samples used in the laboratory investigation were obtained during the course of the field investigation as described in Appendix A of this report. Identification of each sample is by test pit number and depth.

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 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.

The index properties tests discussed in this report include the determination of natural water content, pocket penetrometer, Atterberg Limits testing, and grain-size distribution.

a. Natural Water Content. Natural water content of the samples were determined on selected undisturbed samples. The samples were extruded, visually classified, and accurately measured to obtain wet weight. The samples were then dried, in accordance with ASTM D-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 water content results are summarized on the test pit logs, Plates 4 through 7.

b. Pocket Penetrometer. Pocket Penetrometer tests were performed on cohesive stratums encountered during excavation. The test estimates the unconfined compressive strength of a cohesive material by measuring the materials resistance to penetration by a calibrated, spring-loaded cylinder. The maximum capacity of the cylinder is 4.5 tons per square foot (tsf). The results of these tests are indicated on the test pit logs.

c. Atterberg Limits. Liquid and plastic limits were determined on a selected sample in accordance with ASTM D4318-83. The results of the limits are summarized on Plate 10.

d. Grain-Size Distribution. The gradation characteristics of a selected sample were determined in accordance with ASTM D422-63. The sample was soaked in water until individual soil particles were separated and then washed on the No. 200 mesh sieve. That portion of the material retained on the No. 200 mesh sieve was oven-dried and then mechanically sieved. The grain-size distribution test is presented on Plate 11.

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ATTERBERG LIMITS' RESULTS

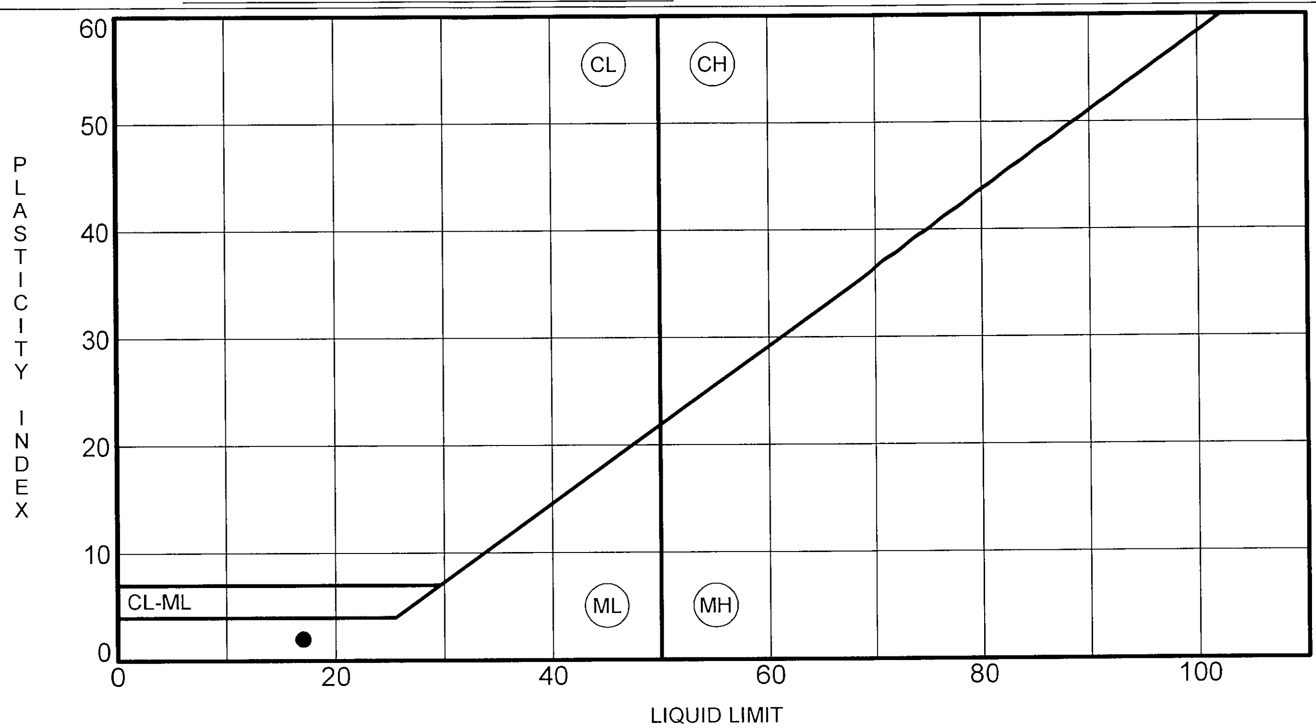
PLATE 10

CLIENT LILY ROSENMAN

PROJECT NUMBER S2524.01

PROJECT NAME PROPOSED RESIDENCE & ADU

PROJECT LOCATION APN 188-140-21, BOLINAS, CA



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**TP-4**	**1.5**	**17**	**15**	**2**		**PALE BROWN SANDY SILT (ML)**

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GRAIN SIZE DISTRIBUTION

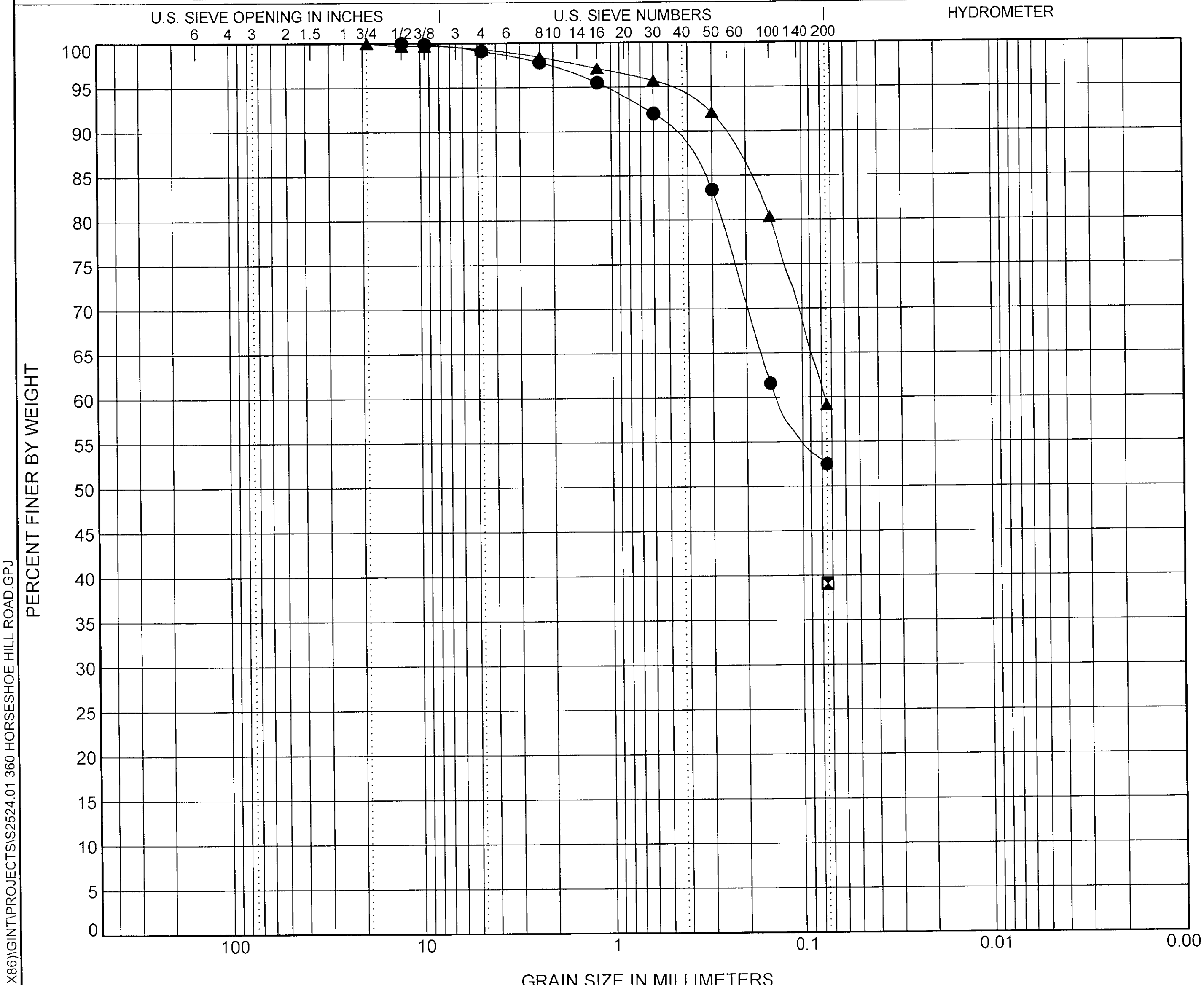
PLATE 11

CLIENT LILY ROSENMAN

PROJECT NAME PROPOSED RESIDENCE & ADU

PROJECT NUMBER S2524.01

PROJECT LOCATION APN 188-140-21, BOLINAS, CA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**TP-1**	**1.0**	**BROWN SANDY SILT (ML)**					
⊠	**TP-2**	**1.0**	**PALE BROWN SILTY SAND (SM)**					
▲	**TP-4**	**3.0**	**PALE YELLOW BROWN SANDY SILT (ML)**					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP-1**	**1.0**	**12.5**	**0.133**			**0.9**	**46.6**	**52.5**	
⊠	**TP-2**	**1.0**	**0.075**						**39.1**	
▲	**TP-4**	**3.0**	**19**	**0.077**			**0.7**	**40.1**	**59.2**	

APPENDIX C
REFERENCES

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4. Geologic Map of the Santa Rosa Quadrangle, Scale: 1:250,000, compiled by D.L Wagner and E.J. Bortugno, 1982.

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13. "Minimum Design Loads and Associated Criteria for Buildings and Other Structures" American Society of Civil Engineers (ASCE 7-16), dated 2017.

14. Preliminary Site Plan, Sheet A0.2 & A0.3, prepared by Arkin Tilt Architects, dated October 25, 2024.

15. Topographic Map, Sheet 1, prepared by Lescure Engineers, Inc., dated December 29, 2023.