PJC & Associates, Inc.
Consulting Engineers & Geologists

November 2, 2021 Job No. 9730.03

Pioneer Contracting, Inc.
Attention: David Hillmer
P.O. Box 382
Sea Ranch, CA 95497
DavidHillmer@mac.com
cc: MKM & Associates
Attention: Eric Kreager
Eric@mkmassociates.com

Subject: Soil and Foundation Investigation
Proposed Historic Barn Retrofit
Sea Ranch Lodge
60 Sea Walk Drive
Sea Ranch, California

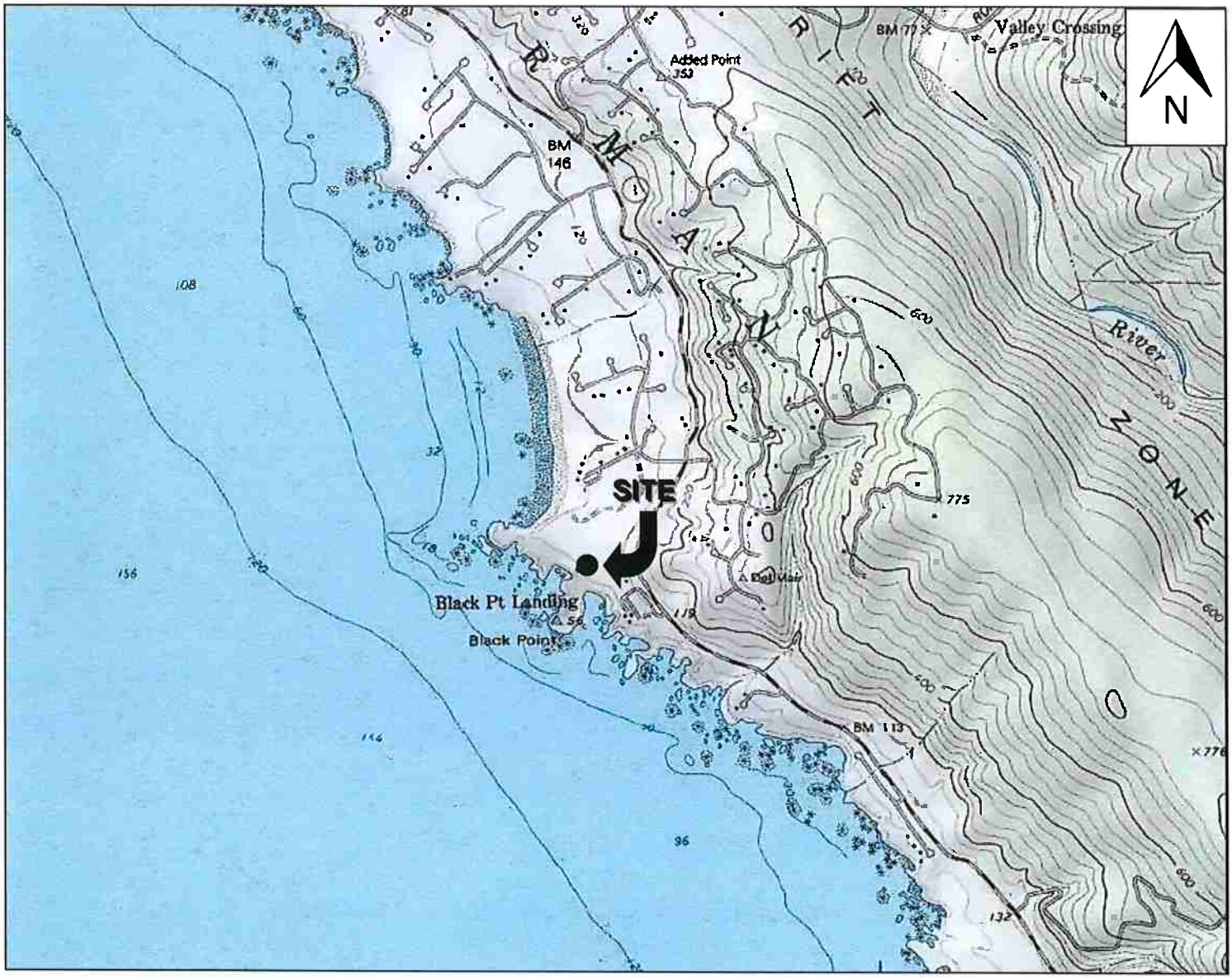
Dear David:

PJC & Associates, Inc. (PJC) is pleased to submit this report which presents the results of our soil and foundation investigation for the proposed historic barn retrofit project located behind the Sea Ranch Lodge at 60 Sea Walk Drive the Sea Ranch Community Area, in Sonoma County, California. The location of the site is shown on the Site Location Map, Plate 1. According to our field GPS measurements, the site corresponds to the geographical coordinates of north 38.6809° and west -123.4313°. 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 site can be developed from a geotechnical engineering standpoint provided the recommendations presented herein are incorporated in the design and carried out through construction.

1. PROJECT DESCRIPTION

Project plans were unavailable at the time of this report. Based on information provided by you, it is our understanding that it is planned to retrofit the dilapidated historic barn at the property. The structure will not be used for human occupancy but will be retrofitted to preserve the structure as a living museum. The structure consists of a wood-frame building with earthen floors. The structure is located 23 to 45 feet way from the descending bluff edge down the Pacific Ocean.

Structural foundation loading information for the structure 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



SCALE: 1:24,000

REFERENCE: USGS STEWARTS POINT, CALIFORNIA
7.5 MINUTE QUADRANGLES, DATED 1975.

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SITE LOCATION MAP
PROPOSED HISTORIC BARN RETROFIT
60 SEA WALK DRIVE
SEA WALK, CALIFORNIA

Proj. No: 9730.03 Date: 11/21 App'd by: PJC

PLATE
1

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.

Aside from excavations for new foundations, we do not anticipate grading or earthwork will be required for the project.

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 proposed project. Specifically, the scope of our services consisted of the following:

a. Drilling two shallow exploratory boreholes to a depth of three and one-half feet below the existing ground surface to observe the soil and groundwater conditions underlying the site. Our certified engineering geologist and staff geologist were on site to log the materials encountered in the boreholes and to obtain representative samples for visual classification and laboratory testing.

b. Laboratory observation and testing were performed on representative samples obtained during the course of the field investigation to evaluate the appropriate index and engineering properties of the soils underlying the site.

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, slope stability, etc.).

d. Perform engineering analyses to develop geotechnical recommendations for site preparation and earthwork, foundation types 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 historic wood barn is located in a grass covered meadow west of the Sea Ranch Lodge adjacent to Black Point. The structure consists of a wood-frame building with earthen floors.

b. Topography. The site is located on an elevated coastal terrace approximately 23 to 45 away from the descending bluff edge down to the Pacific Ocean. The building footprint is situated on nearly level terrain. According to the United States Geological Survey (USGS) Gualala, California, 7.5 Minute Quadrangle Map (Topographic), the project site is

situated near an elevation of 75 feet above mean sea level (MSL).

c. Drainage. Site drainage consists of surface infiltration and sheet flow towards the bluff edge to the west. Control of site drainage should be considered during design and construction of the project.

d. Geologic Setting. According to the California Division of Mines and Geology, Geology for Planning in Sonoma County, Special Report 120 (SR-120, 1980), the site is underlain by Quaternary terrace deposits (Qt). Quaternary terrace deposits were originally deposited in a marine tidal environment and consist of near horizontal layers of sands, silts, and gravels. These terraces were initially formed during long periods of stable sea level when wave action and other erosion cut relatively low angle wave cut platforms into the bedrock of the coastline. Subsequent marine deposition formed the original terrace deposits. These deposits were then exposed to the surface by a combination of tectonic uplift and sea level drop, resulting from long term climate change and fluctuation of global ice caps/glacier water storage. These wave cut terraces extend discontinuously along much of the west coast from the Oregon border to southern California. The process of erosion and uplift occurred many times in the past as indicated by areas of stair stepped terraces ascending away from the coast and inland. Our subsurface exploration confirms that the site is underlain by generally granular terrace deposits. However, the terrace deposits are overlain by a relatively thin topsoil deposit.

As observed in the nearby by bluff face, underlying the terrace deposits are Cretaceous bedrock deposits of the Black Point Spilite, a sodic basalt. The spilite likely is a result of the alteration of ocean floor basalts, as indicated by pillow structures and flow banding. Published paleomagnetic studies indicate that these rocks, found west of the San Andreas Fault Zone, originated at low latitudes and exhibit different chemistry than typical basalt bedrock of the Franciscan Complex. The basaltic bedrock is pervasively shattered.

e. Faulting and Seismicity. Geologic structures in the region are primarily controlled by northwest-trending dextral faults. The site is not located within the current Alquist-Priolo Earthquake Fault Zone boundaries. However, the site is located in relatively close proximity to the active San Andreas Fault zone. According the USGS National Seismic Hazard Map, the closest known active faults to the site are the San Andreas, the Maacama, and the Rodgers Creek faults. The San Andreas Fault is located approximately 2.2 miles to the east, the Maacama Fault is located approximately 26.4 miles to the east, and the Rodgers Creek Fault is located approximately 35.5 miles to the southeast.

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.

4. SUBSURFACE CONDITIONS

a. Soils. The subsurface conditions at the project site were investigated by drilling two shallow exploratory boreholes (BH-1 and BH-2) at the site to a depth three and one-half feet below the existing ground surface. The boreholes were advanced to observe the subsurface conditions and to collect soil samples of the underlying strata for visual examination and laboratory testing. The drilling procedures are included in Appendix A of this report. The laboratory procedures are included in Appendix B. The descriptive boreholes are included in Plates 3 and 4.

The exploratory boreholes generally encountered topsoil overlying terrace deposits which extended to the maximum depths explored. The topsoil encountered at the site extended to a maximum depth of one and one-half to two and one-half feet below the ground surface and consisted of clayey sand. The topsoil appeared slightly moist to moist and loose to medium dense. The terrace deposits consisted of a clayey sand and silty sand strata which extended to the maximum depths explored. The terrace deposits appeared moist and medium dense to dense.

b. Groundwater. No seepage or free ground water was encountered at the time of our investigation on October 5, 2021. No springs or surface seepage were observed at or near the sites. Shallow seepage or perched groundwater zones could develop at the site during and following prolonged rainfall. However, we judge that such conditions, if they develop, would dissipate following seasonal rainfall.

5. SEISMIC CONSIDERATIONS AND GEOLOGIC HAZARDS

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 structure.

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 is indicated in the geologic literature or field exploration. However, the active San Andreas Fault is

located 2.2 miles east of the site. Fault rupture most often occurs along known active fault breaks. However, fault rupture could also occur on planes of weakness including bedding planes, fractures, previously considered dormant faults or even previously unfaulted ground. We judge that the risk of ground rupture at the site is relatively low.

b. Ground Shaking. The site has been subjected in the past to ground shaking by earthquakes on the active fault systems that traverse the region. Based on this data and the anticipated life expectancy of the project, it is judged that there is a high potential that the site will be subjected to very strong seismic shaking. The severity of the shaking depends on many complex factors. Among these factors are the moment magnitude, focal depth, distance from the causative fault, source mechanism, duration of shaking, type of surficial deposits, type and quality of building construction.

c. Liquefaction/Densification. Based on our review of the relative liquefaction susceptibility map prepared by the USGS, the site is not located in an area which is considered not to have liquefaction susceptibility. Our subsurface exploration identified soil strata which did not appear to be prone to liquefaction and densification.

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. It is possible lateral spreading and lurching could occur within the topsoil and terrace deposit strata exposed along the face of the nearby bluff. Since the structure will not be used for human occupancy, we believe the planned retrofit project is still acceptable to preserve the historic integrity of structure, provided the owners are aware and accept this risk.

e. Expansive Soils. Based on our subsurface findings, the site soils are not considered to be prone to significant seasonal shrink and swell cycles.

f. Tsunami. According to our review of the Association of Bay Area Governments (ABAG), it does not appear the site is at risk of being inundated by a tsunami wave with a run up of 20 feet or less.

g. Bluff Stability. The historic barn footprint is situated approximately 23 to 45 feet away from the descending bluff edge. We observed erosion, small slump failures, and overhanging terrace deposits exposed on the nearby bluff face. We reviewed historic aerial photographs dating back to 1979. Our photograph analysis concludes that possibly several feet of bluff retreat has occurred on the nearby bluff in the past 42 years. We also observed a rapidly retreating bluff face approximately 300 feet northwest of the site. We have concern that bluff retreat adjacent to the building could potentially

become a serious geologic hazard for the structure over the next 75 years, especially with the forecasted sea level rise. Since the structure will not be used for human occupancy, we believe the planned retrofit project is acceptable to preserve the historic integrity of structure, provided the owners are aware and accept this risk. As a precautionary measure, we recommend that drainage from the structure be directed away from the bluff edge.

6. CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our investigation, we judge that the project is feasible from a geotechnical engineering standpoint provided the recommendations presented herein are incorporated in design and carried out through construction of the project. The primary geotechnical consideration in design and construction of the project is the presence of weak and compressible surface and near-surface soils.

The upper approximately one and one-half to two and one-half feet of the site soils are considered weak and compressible, and unsuitable for foundations. Weak soils appear hard and strong when dry but will lose their strength rapidly and collapse under load of new foundations as their moisture increases and approaches saturation. The moisture content of these soils can increase as a result of rainfall, flooding, or when the natural upward migration of water vapor through the pores of the soils is impeded by foundations.

Underlying the weak and compressible topsoil, our exploration encountered medium dense to dense terrace deposits which should adequately support the anticipate foundation loads. We recommend that the retrofit structural elements be supported by spread footings which extend through the weak soils and into firm native soils.

The following sections present geotechnical recommendations and criteria for design and construction of the project

7. FOUNDATIONS: SPREAD FOOTINGS INTO FIRM TERRACE DEPOSITS

a. Vertical Loads. The retrofit structural features may be supported by spread footings extending a minimum of 30 inches below the ground surface and 12 inches into firm native terrace deposits. Footing excavations should be observed and approved by the geotechnical engineer before reinforcing steel is placed. All footings should be reinforced. The recommended bearing pressures, depth of embedment and minimum widths of spread footings are presented in Table 1. The bearing values provided have been calculated assuming that all footings uniformly bear on firm native soils, as determined by the geotechnical engineer on site during construction.

TABLE 1
FOUNDATION DESIGN CRITERIA

Footing Type	Bearing Pressure (psf)*	Minimum Embedment (in)**	Minimum Width (in)
Continuous Wall	2,000	30	12
Isolated Column	2,500	30	18

* Dead plus live load.
** Below the ground surface and at least 12 into firm native terrace deposits.

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

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

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

c. Settlement. Total settlement of individual foundations will vary depending on the width of the foundation and the actual load supported. Foundation settlements have been estimated based on the foundation loads and bearing values provided. Maximum settlements of shallow foundations designed and constructed in accordance with the preceding recommendations are estimated to be less than one inch.

Differential settlement between similarly loaded, adjacent footings is expected to be less than one-half inch. The majority of the settlement is expected to occur during construction and placement of dead loads, and occur within a few weeks upon application of the loads.

8. SEISMIC DESIGN

Based on criteria presented in the 2019 edition of the California Building Code (CBC) and ASCE (American Society of Civil Engineers) STANDARD ASCE/SEI 7-16, the following minimum criteria should be used in seismic design:

a. Site Class: D

b. Mapped Acceleration Parameters: Ss = 2.266 g

S_1 = 0.946 g

c. Spectral Response Acceleration Parameters: S_{Ms} = 2.266 g
S_{M1} = Null

d. Design Spectral Acceleration Parameters: S_{DS} = 1.511 g
S_{D1} = Null

9. DRAINAGE

As a precautionary measure, we recommend that drainage from the structure be directed away from the bluff edge. In lieu of gutters and downspouts daylighting to an approved stable location, we recommend a trench drain around the perimeter of structure which captures roof discharge. The outlets should discharge onto erosion resistant areas as far away from the structure and the bluff edge as possible. PJC should approve the drainage discharge locations.

10. LIMITATIONS

The data, information, interpretations and recommendations contained in this report are presented solely as bases and guides to the geotechnical design of the proposed historic barn retrofit project located at behind the Sea Ranch Lodge at 60 Sea Walk Drive the Sea Ranch Community Area, in Sonoma County, California. The conclusions and professional opinions presented herein were developed by PJC in accordance with generally accepted geotechnical engineering principles and practices. No warranty, either expressed or implied, is intended.

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

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

11. ADDITIONAL SERVICES

Upon completion of the project plans, they should be reviewed by our firm to determine that the design is consistent with the recommendations of this report. During the course of this investigation, several assumptions were made regarding 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 also 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, and observing the installation of the drainage facilities.

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

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

Sincerely,

PJC & ASSOCIATES, INC.

Patrick J. Conway
Geotechnical Engineer
GE 2303, California

PJC/sms

APPROXIMATE SCALE: 1"=80'

EXPLANATION

O BOREHOLE LOCATION AND DESIGNATION

REFERENCE: GOOGLE EARTH PRO ACCESSED OCTOBER 28, 2021.

PJC & Associates, Inc.
Consulting Engineers & Geologists

BOREHOLE LOCATION MAP
PROPOSED HISTORIC BARN RETROFIT
60 SEA WALK DRIVE
SEA RANCH, CALIFORNIA

PLATE
2

Proj. No: 9730.03 Date: 11/21 App'd by: PJC

PJC & Associates, Inc.

Consulting Engineers & Geologists

BORING NUMBER BH-1

CLIENT The Sea Ranch Lodge
PROJECT NAME Proposed Historic Barn Retrofit
JOB NUMBER 9730.03
LOCATION 60 Sea Walk Drive, Sea Ranch, California
DATE STARTED 10/5/21
COMPLETED 10/5/21
GROUND ELEVATION
HOLE SIZE 4"
DRILLING CONTRACTOR PJC
GROUND WATER LEVELS:
DRILLING METHOD Hand Auger
AT TIME OF DRILLING --- No free groundwater encountered
LOGGED BY SS
CHECKED BY PJC
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		0.0' - 1.5'; CLAYEY SAND (SC); dark blackish brown, moist, loose, fine-grained, porous and organic rich (TOPSOIL).	GB					19		16		
		1.5' - 2.5'; CLAYEY SAND (SC); orange with black seams, moist, medium dense, fine to medium grained, trace gravel (TERRACE DEPOSIT).										
		2.5' - 3.5'; CLAYEY SAND (SC); reddish orange, moist, dense, fine to medium grained, gravel increasing with depth, partially cemented (TERRACE DEPOSIT).	GB					20				
		Bottom of borehole at 3.5 feet.										

PJC & Associates, Inc.

Consulting Engineers & Geologists

BORING NUMBER BH-2

CLIENT The Sea Ranch Lodge **PROJECT NAME** Proposed Historic Barn Retrofit

JOB NUMBER 9730.03 **LOCATION** 60 Sea Walk Drive, Sea Ranch, California

DATE STARTED 10/5/21 **COMPLETED** 10/5/21 **GROUND ELEVATION** _____ **HOLE SIZE** 4"

DRILLING CONTRACTOR PJC **GROUND WATER LEVELS:**

DRILLING METHOD Hand Auger **AT TIME OF DRILLING** --- No free groundwater encountered

LOGGED BY SS **CHECKED BY** PJC **AT END OF DRILLING** ---

NOTES _____ **AFTER DRILLING** ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		0.0' - 2.5'; SILTY SAND (SM); dark to moderate brown, slightly moist, loose to medium dense, fine to medium grained, porous and organic rich (TOPSOIL).										
		2.5' - 3.5'; SILTY SAND (SM); yellowish orange, moist, dense, fine to coarse grained (TERRACE DEPOSIT).										

Bottom of borehole at 3.5 feet.

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