PJC & Associates, Inc.
Consulting Engineers & Geologists

March 4, 2024

Job No. R1160.01

Jake and Georgia Beyer
c/o G Design LLC
Attention: Lam Nguyen
lam@gdesignpro.com

Subject: Geotechnical Investigation
Proposed Residential Remodel
426 Pine Street
Sausalito, California

Dear Jake and Georgia:

PJC and Associates, Inc. (PJC) is pleased to submit this report which presents the results of our geotechnical investigation for the proposed residential remodel located at 426 Pine Street in Sausalito, California. The approximate location of the site is shown on the Site Location Map, Plate 1. The site corresponds to latitudinal and longitudinal coordinates of 37.8579°N and -122.4863°W, according to GPS measurements performed at the site. Our services were completed in accordance with our revised proposal for geotechnical engineering services, dated November 16, 2023, and your authorization to proceed with the work dated December 7, 2023. The purpose of our investigation was to explore the subsurface conditions at the site and provide geotechnical recommendations and criteria for 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 that the recommendations and criteria presented herein are incorporated in the design and carried out through construction.

1. PROJECT DESCRIPTION

Based on preliminary architectural plans prepared by G Design, LLC, dated October 27, 2023 and information provided, it is our understanding that the project will consist of remodeling the entire existing residence, including the construction of a new foundation to support the structure. As planned, the proposed remodel will consist of demolishing the majority of the existing single-story residence in order to convert it into a three-story structure with a concrete slab-on-grade first floor and raised wood upper floors. The project will also include various exterior landscape improvements and hardscape.

Structural loading information was not available at the time of this investigation. 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 and drainage plans or finish floor elevations were not available at the time of this report. We anticipate that grading will consist of cuts and fills of approximately two to seven feet, to construct the building pad, backfill the existing partial basement, and to provide adequate gradients for site drainage. We anticipate that engineered retaining walls will be not be required for the project.

2. SCOPE OF SERVICES

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

a. Drilling three exploratory boreholes to depths of between 7.0 and 8.0 feet below the existing ground surface to observe the soil, bedrock, and groundwater conditions underlying the site. Our geologist was 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 of representative samples obtained during the course of our field investigation to evaluate the index and engineering properties of the subsurface soils and bedrock at 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, etc.).

d. Perform engineering analyses to develop geotechnical recommendations for site preparation and earthwork, foundation type(s) and design criteria, lateral earth pressures, settlement, slab-on-grade design, surface and subsurface drainage control, and construction considerations.

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

3. SITE CONDITIONS

a. General. The project site is located in a residential area of the City of Sausalito, approximately 115 feet south of the intersection of Pine Street and Bonita Street. At the time of our exploration, the site was occupied by an existing one-story single-family residence with a partial basement. It is planned to demolish and back fill the basement. The site is bounded to the north, south, and west by residences, and to the east by Pine Street.

b. Topography and Drainage. The site is located on the lower gently descending slopes of Sausalito. The project area is situated on nearly level to gently sloping terrain. According to the United States Geological Survey (USGS) San Francisco North, California, 7.5 Minute Quadrangle Map (Topographic) the site is situated near an elevation of 32 feet above mean sea level (MSL).

Site drainage generally consists of sheet flow and surface infiltration. Run-off from the site is channeled into city-maintained storm water systems. Regional drainage is provided by Richardson Bay, located approximately 830 feet northeast of the site.

4. GEOLOGIC SETTING

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

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

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

b. Local Geology. According to published geologic literature prepared by the United States Geological Survey (USGS), the site has been mapped to be underlain by a mélange of bedrock units of the Jurassic-Cretaceous Franciscan Complex (fsr). This portion of the Franciscan Complex generally consists of bedrock units comprised of sheared shale and sandstone which contain generally resistant masses of chert, greenstone, high-grade metamorphic rocks and other assorted bedrock types, including less resistant serpentinite. These rocks were initially formed in the Jurassic Period and have undergone plate convergence and accretion. As a result of tectonic processes, the bedrock units tend to be highly sheared, fractured and pervasively shattered. Consequently, often the strength, degree of weathering and therefore the engineering characteristics of Franciscan Complex bedrock units can vary drastically over relatively short distances. Our site reconnaissance identified the project site is underlain by clayey sandstone bedrock of the Franciscan Complex. However, the bedrock is overlain by fill and residual soil strata.

5. FAULTING

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. According to the computer fault modeling program *EQFAULT*, the closest known active faults to the site are the San Andreas, San Gregorio, and Hayward faults. The

San Andreas is located 6.6 miles to the southwest, the San Gregorio is located 8.8 miles to the southwest, and the Hayward fault is located 11.2 miles northeast. Table 1 outlines the nearest known active faults and their associated maximum magnitudes.

TABLE 1
CLOSEST KNOWN ACTIVE FAULTS

Fault Name	**Distance from Site (Miles)**	**Maximum Earthquakes (Moment Magnitude)**
San Andreas	6.6	7.9
San Gregorio	8.8	7.3
Hayward	11.2	7.1

* Reference -, "EQFUALT" Ver 3.00, software program.

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 Section 8 of this report.

7. SUBSURFACE CONDITIONS

a. Soils and Bedrock. The subsurface conditions at the project site were investigated by drilling three exploratory boreholes (BH-1 through BH-3) to depths of 7.0 and 8.0 feet below the existing ground surface. The approximate borehole locations are shown on the Borehole Location Plan, Plate 2. The boreholes were excavated to collect soil and bedrock samples of the underlying strata for visual examination and laboratory testing. The borehole logs and sampling procedures are included in Appendix A. The laboratory procedures are included in Appendix B.

The boreholes generally encountered fill layers overlying residual soil and clayey sandstone bedrock which extended to the maximum depths explored.

At the surface, the boreholes encountered fill consisting of sandy silt, clayey sand, and silty clay which extended 1.5 to 4.25 feet below grade. The sandy silt was very moist, loosely compacted, and exhibited medium plasticity characteristics. The clayey sand appeared moist to very moist, loosely to moderately compacted, and fine-grained. The silty clay was moist, loosely to moderately compacted, and exhibited medium plasticity. Underlying the fill, silty and sandy clay residual soils were encountered which extended 5.25 to 7.0 feet below the surface. The silty clay was moist to very moist, stiff to hard, and exhibited medium plasticity. The sandy clay appeared moist to very moist, stiff to very stiff, and exhibited medium plasticity. Underlying the residual soils, clayey sandstone bedrock was encountered which extended to the maximum depths explored. The clayey sandstone appeared slightly hard, plastic to friable, and fine-grained.

b. Groundwater / Seepage. Groundwater or seepage was not encountered during our subsurface exploration on January 11, 2024. Subsurface seepage within the soil strata and between the soil and bedrock interface may occur at the site during and following prolonged rainfall. However, based on the subsurface conditions encountered, we judge that such conditions, if they develop, would likely dissipate following prolonged rainfall events.

8. GEOLGIC AND 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 and geologic conditions 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 is indicated in the geologic literature or field exploration. Therefore, the likelihood of ground rupture at the site due to faulting is considered to be low.

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

c. Liquefaction. According to the USGS Liquefaction Susceptibility Map, the site is located near an area which is considered to have very high liquefaction potential. Our subsurface exploration encountered cohesive soils and bedrock to the maximum depths explored. These materials are not considered prone to liquefaction. Therefore, we consider the risk of liquefaction at the site to be very low.

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

e. Expansive Soils and Bedrock. Based on our observations and laboratory testing (Atterberg Limits testing: PI= 18 & 22; Expansion Index testing: EI= 36), surface and near-surface soils at the site have low to medium plasticity and have low to expansion potential. Potentially expansive soils should be considered during design and construction of the project. The bedrock encountered does not appear to be prone to seasonal volumetric changes.

f. Slope Stability. No obvious indications of slope instability such as landslides, excessive erosion or soil creep were observed at the project site during our investigation or are present in our geologic literature review. Based on our site reconnaissance and the results of our investigation, we judge the project site is relatively stable due to low slope inclinations.

9. CONCLUSIONS AND RECOMMENDATIONS

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

a. The presence of weak and compressible surface and near-surface soils.

b. The presence of basement backfill.

c. Control of surface and subsurface drainage.

The boreholes encountered weak and compressible surface and near surface soils extending up to four feet below existing grade. Weak and compressible soils may appear hard and strong when dry. However, they could potentially collapse under the load of foundations, engineered fill, or concrete slabs when their moisture content increases and approaches saturation. These soils can undergo considerable strength loss and increased compressibility, thus causing irregular and differential ground settlement under loads. This ground movement manifests in the form of cracked foundations and slabs and could cause distress to the architectural features of the structure. Therefore, in their current state, these soils are not suitable for the support of foundations, concrete slabs-on-grade, or engineered fill.

We recommend that the proposed structure be supported on a rigid foundation capable of withstanding differential movements caused by the aforementioned geotechnical considerations. This can be accomplished with a mat slab foundation. If grading will be employed, we recommend that the fill soils be upgraded by subexcavation and recompaction. The top 30 inches of the material should consist of a low to non-expansive material. By upgrading the fill soils as described above, we judge that the structure can be supported on spread footings and non-structural slabs-on-grade may be used. Fill thicknesses underlying non-structural concrete slabs-on-grade should not vary more than two feet.

According to the information provided to us, there is no basement in the proposed plan. We therefore recommend that the basement be demolished, removed from the site and replaced with compacted engineered fill or controlled density fill (CDF) under the observation of the project geotechnical engineer. Footings over the backfilled basement should extend back through the compacted fill and into firm native materials or the foundation should be reinforced to resist differential movement between foundation elements.

We recommend that the weak and compressible soils underlying exterior flatwork areas be subexcavated to a depth of at least 18 inches and recompacted according to the earthwork and grading section of this report. Expansive soils encountered within the upper 18 inches of subgrade should be removed in their entirety. The engineered fill should extend at least three feet beyond the perimeter of the exterior slabs.

It is crucial that all final grades be provided with positive gradients away from all foundations to provide rapid removal of surface water runoff to an adequate discharge point. No ponding of water should be allowed adjacent to building foundations, slabs or slopes. Care must be taken so that discharges from the roof gutter and downspout systems are not allowed to infiltrate the subsurface near the structure or slopes.

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

10. SITE GRADING AND EARTHWORK

a. Demolition and Stripping. Existing structural materials to be removed should be completely demolished and removed from the site. Following removal of these materials, structural areas should be stripped of surface vegetation, old fills, debris, old foundations, slabs, pavements, underground utilities, etc. These materials should be moved off site; some of the stripped soils, if suitable, could be stockpiled for later use in landscape areas. The lateral extent of the stripping should extend at least five feet beyond the limits of the structure. Final stripping depths should be determined by the Geotechnical Engineer in the field during construction. 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 two horizontal to one vertical (2H:1V) from the outside bottom edge of the nearest foundation element. Previously abandoned utilities, if encountered during construction should be removed and replaced with compacted engineered fill under the observation of the project geotechnical engineer. Voids left from the removal of utilities or other obstructions should be replaced with compacted engineered fill or CDF under the observation of the project geotechnical engineer.

b. Excavation and Compaction. Following site stripping, the existing weak and expansive soils should be subexcavated in areas requiring fill and firm soils exposed as determined by the geotechnical engineer on site during construction. The exposed surface should be scarified to a depth of eight inches, moisture conditioned to three to five percent over the optimum moisture content and compacted to a minimum of 85 percent of the material's maximum dry density, as determined by ASTM D 1557 laboratory compaction test procedures. The excavated soils should not be used as engineered fill in structural areas. Low to non-expansive imported fill may be necessary. Imported fill should be evaluated and approved by the geotechnical engineer before importation. Further expansion testing maybe required during construction.

All concrete in the existing partial basement should be demolished and completely removed. The void should be backfilled with low to non-expansive engineered fill or CDF.

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 meet the following criteria:

Plasticity Index	less than 12
Liquid Limit	less than 38
Percent Soil Passing #200 Sieve	between 15% and 35%
Maximum Aggregate Size	4 inches

TABLE 2
SUMMARY OF COMPACTION RECOMMENDATIONS

Area	**Compaction Recommendations***
General Engineered Fill (Native)	In lifts, a maximum of eight inches in loose thickness, compact to at least 90 percent relative compaction at two percent over the optimum moisture content.
General Engineered Fill (Low to Non-Expansive Import)	In lifts, a maximum of eight inches in loose thickness, compact to at least 90 percent relative compaction at or within two percent of the optimum moisture content.
Trenches**	Compact to at least 90 percent relative compaction at or within two percent of the optimum moisture content. Moisture condition to two percent over the optimum moisture content if site soils are used.

*All compaction requirements stated in this report refer to dry density and moisture content relationships obtained through the laboratory standard described by ASTM D1557.

** Depths below finished subgrade elevations.

c. Cut and Fill Slopes. Generally, it is recommended that unretained cut slopes be constructed at an inclination no steeper than 2H:1V. This should be evaluated by the geotechnical engineer in the field during construction. Potentially unstable subsurface conditions, such as adverse bedding, joint planes, zones of weakness, clay zones, or exposed seepage, may require either flatter slopes than specified above or other treatment. It is recommended that a geotechnical engineer observe the cut slopes and provide final recommendations for the control of adverse conditions during construction, if encountered. During the rainy season, the cut slopes should be checked for springs or seepage areas. The surfaces of the cut slopes should be treated as needed in order to minimize the probability of slumping and erosion. Unreinforced fill slopes should not exceed 2H:1V. Steeper slopes should be retained or reinforced with geosynthetics. The fill slopes should be constructed at least two feet (horizontally) beyond the planned final face plane using proper compaction equipment and be compacted to a minimum of 90 percent relative compaction. The slope face should then be trimmed back to the final face plane. This operation should expose properly compacted material on the finished face of the slope.

d. Mitigations to Reduce Potential Foundation Undermining. The project will require excavations near the existing structure. To reduce potential undermining of the existing structure's and wall's foundations, we recommend that excavations within five feet of existing foundations be excavated in five-foot-long sections. The subexcavation sections should be backfilled or shored as soon as possible, and within the same day of the subexcavation. PJC can assist with design of the shoring during construction if needed.

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

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

11. FOUNDATIONS: MAT SLAB

a. Vertical Loads. The proposed structure may be supported on a reinforced concrete mat slab foundation. The mat should consist of a rigid, reinforced concrete slab and should be designed to impose a uniform load on the supporting soil. Due to the presence of expansive soils, the slab should be designed to resist both positive and negative moments and span areas of non-uniform support. An allowable bearing pressure of 2,000 psf may be used in design.

b. Settlement. The maximum and differential settlement of mat slabs is estimated to be within tolerable limits. The majority of the settlement is expected to occur during construction and placement of dead loads. Total settlement is expected to be less than one inch. A maximum differential settlement of one-half of one inch is anticipated.

c. Modulus of Subgrade Reaction. Based on the properties of the supporting soil, a maximum modulus of subgrade reaction value of 100 pounds per cubic inch (pci) is recommended for use in the mat foundation design.

d. Lateral Loads. Lateral loads resulting from wind or seismic forces may be resisted in the form of base adhesion between the base of the mat and the soil which it is supported. A coefficient of sliding friction of 0.30 may be used for neat concrete and the underlying material.

The slab subgrade should be scarified to a depth of eight inches and recompacted to at least 90 percent relative compaction. To aid in providing uniform support, the mat should be supported on a six-inch layer of compacted gravel at least ¾ to 1½ inches in size.

12. FOUNDATION: SPREAD FOOTINGS

a. Vertical Loads. Spread footings may be used for foundation support of the structure provided the grading and earthwork recommendations of this report are followed. Footings should extend a minimum of 12 inches into compacted engineered fill. 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 3. The bearing values provided have been calculated assuming that all footings uniformly bear on compacted engineered fill, as determined by the geotechnical engineer on site during construction.

TABLE 3
FOUNDATION DESIGN CRITERIA

Footing Type	Bearing Pressure (psf)*	Minimum Embedment (in)**	Minimum Width (in)
Continuous wall	2,000	12	18
Isolated Column	2,500	12	24

* Dead plus live load.
** Into compacted engineered fill.

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 and passive pressure. A friction factor of 0.30 is considered appropriate between the bottom of the concrete structures and the engineered fill. A passive pressure of 300 pounds per square foot per foot of depth (psf/ft) is recommended. Unless restrained at the surface, the top six inches should be neglected for passive resistance due to soil desiccation and disturbance.

c. Settlement. Provided the recommendations contained in this report are followed, the total and differential settlements for the structure should be one inch or less and one-half inch or less, respectively.

12. NON-STRUCTURAL CONCRETE SLABS-ON-GRADE

Non-structural slabs-on-grade may be used for the structure provided it is underlain by a uniform layer of compacted engineered fill according to the earthwork and grading recommendations of this report. The engineered fill should extend at least five feet beyond the structure and three feet beyond the exterior flatwork.

All slabs should be at least five inches thick and supported on at least four inches of clean gravel/crushed rock to provide a capillary break and provide uniform support for the slabs. The rock should be graded so that 100 percent passes the one-inch sieve and no more than five percent passes the No. 4 sieve.

We recommend that the rock be placed as soon as possible after compaction of the subgrade 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 before slab-on-grade construction.

For slabs with moisture sensitive surfacing, a 15-mil thick vapor barrier should be placed below the slab and over the top of the gravel layer. We recommend that slabs be designed and reinforced as determined by the project structural engineer. Special care should be taken to ensure that reinforcement is placed in the slab mid-height. The gravel should be moistened prior to placing concrete. The slabs should be provided with control and expansion joints according to ACI standards.

13. SEISMIC DESIGN

Based on criteria presented in the 2022 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:	C
b.	Mapped Acceleration Parameters:	S_S = 1.50 g S_1 = 0.60 g
c.	Spectral Response Acceleration Parameters:	S_{MS} = 1.80 g S_{M1} = 0.84 g
d.	Design Spectral Acceleration Parameters:	S_{DS} = 1.20 g S_{D1} = 0.56 g

14. DRAINAGE

a. Surface Drainage. Drainage control design should include provisions for positive surface gradients so that surface runoff is not permitted to pond, particularly above slopes or adjacent to retaining walls, structure foundations or slabs. Surface runoff should be directed away from slopes and foundations. If the drainage facilities discharge onto the natural ground, adequate means should be provided to control erosion and to create sheet flow. PJC should approve all drainage discharge locations.

b. Slab Subdrains. To reduce potential hydrostatic pressures below slab-on-grade structures, we recommend that slab-on-grade floors, that are lower than adjacent exterior grade, be provided with slab floor subdrains. Slab subdrain trenches should be constructed at a maximum of 20-foot intervals. The bottom of the trench should be sloped to drain by gravity. The bottom of the trench should be lined with a few inches of Class II permeable material. A four-inch diameter, PVC schedule 40 perforated pipe, with holes down and sloped to drain, should be placed on top of the thin layer of Class II permeable material. The trench should then be backfilled with compacted Class II permeable material. Slab subdrain detail is indicated on Plate 1A.

15. ADDITIONAL SERVICES

Upon completion of the project plans, they should be reviewed by our firm to determine that the design is consistent with the recommendations of this report. During the course of this investigation, several assumptions were made regarding development concepts. Should our assumptions differ significantly from the final intent of the project designers, our office should be notified of the changes to assess any potential need for revised recommendations. Observation and testing services should also be provided by PJC to verify that the intent of the plans and specifications are carried out during construction; these services should include observing grading and earthwork, approving foundation excavations, observing slab subgrades, and approving the construction of 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.

16. LIMITATIONS

The data, information, interpretations and recommendations contained in this report are presented solely as bases and guides to the geotechnical design of the proposed residential remodel located at 426 Pine Street in Sausalito, 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 and bedrock formations 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.

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.

Robert Di Jorio
Geotechnical Engineer
GE 3162, California

REGISTERED PROFESSIONAL ENGINEER
ROBERT B. DI JORIO
GE 3162
EXP. 12/31/24
GEOTECHNICAL
STATE OF CALIFORNIA

RD:tc

APPENDIX A
FIELD INVESTIGATION

1. INTRODUCTION

The field program performed for this study consisted of advancing three boreholes (BH-1 through BH-3) at the proposed building site. The exploration was completed on January 11, 2024. The borehole locations are shown on the Borehole Location Plan, Plate 2. Descriptive logs of the boreholes are presented in this appendix as Plates 3 through 5.

2. BOREHOLES

The boreholes were advanced using a portable powered drill rig with solid flight augers. The drilling was performed by our field geologist who maintained a continuous log of the soil and bedrock conditions and obtained samples suitable for laboratory testing. The soils were classified in accordance with the Unified Soil Classification System, as explained in Plate 6. Bedrock is described according to Plate 7.

Relatively undisturbed and disturbed samples were obtained from the exploratory boreholes. A 2.43 inch inside diameter (I.D.) California Modified Sampler and a 1.375-inch I.D. Standard Penetration Sampler were driven into the underlying soil and bedrock using a 70-pound hammer falling 30 inches to obtain an indication in the field of the density of the soil and to allow visual examination of at least a portion of the soil column. The number of blows required to drive the sampler at six-inch increments was recorded on each borehole log. All samples collected were labeled and transported to PJC's office for examination and laboratory testing.

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, whenever practical, currently accepted test procedures of the American Society of Testing and Materials (ASTM).

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

2. INDEX PROPERTY TESTING

In the field of soil mechanics and geotechnical engineering design, it is advantageous to have a standard method of identifying soils and classifying them into categories or groups that have similar distinct engineering properties. The most commonly used method of identifying and classifying soils according to their engineering properties is the Unified Soil Classification System described by ASTM D-2487. The USCS is based on 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 and Dry Density, Atterberg Limits, and expansion index testing.

a. Natural Water Content and Dry Density. The natural water content and dry density of the soils were determined on selected samples. The samples were extruded, visually classified, and accurately measured to obtain the volume and wet weight. The samples were then dried, in accordance with ASTM D-2216, 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 and dry density calculated. A similar procedure was used to determine the water content only for disturbed samples. The results of the tests are summarized on the borehole logs.

b. Atterberg Limits. Liquid and plastic limits were determined on selected samples in accordance with ASTM D4318. The results of the limits are indicated on the borehole logs.

c. Expansion Index Testing. An expansion index test was performed on a selected sample in accordance with ASTM D4829. The result is indicated on Plate 5.

3. ENGINEERING PROPERTY TESTING

a. Pocket Penetrometer. Pocket Penetrometer tests were performed on selected cohesive samples. 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 borehole logs.

b. Unconfined Compression Test. An unconfined compression test was performed on an intact sample obtained from the boreholes. The unconfined compression test is determined by axial loading the sample under a slow constant strain rate until failure is obtained. Failure stress is defined as the maximum stress at ten percent strain. The result of this test is presented on Plate 5.

APPENDIX C
REFERENCES

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

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

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

4. USGS San Francisco North, California Quadrangle 7.5-Minute Topographic Map, dated 1995.

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

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

7. California Building Code (CBC), 2022 edition.

8. Preliminary architectural plans, prepared by G Design, LLC, dated October 27, 2023

9. Geologic Map and map database of parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California compiled by M.C. Blake Jr., R.W. Graymer, and D.L. Jones, 2000.

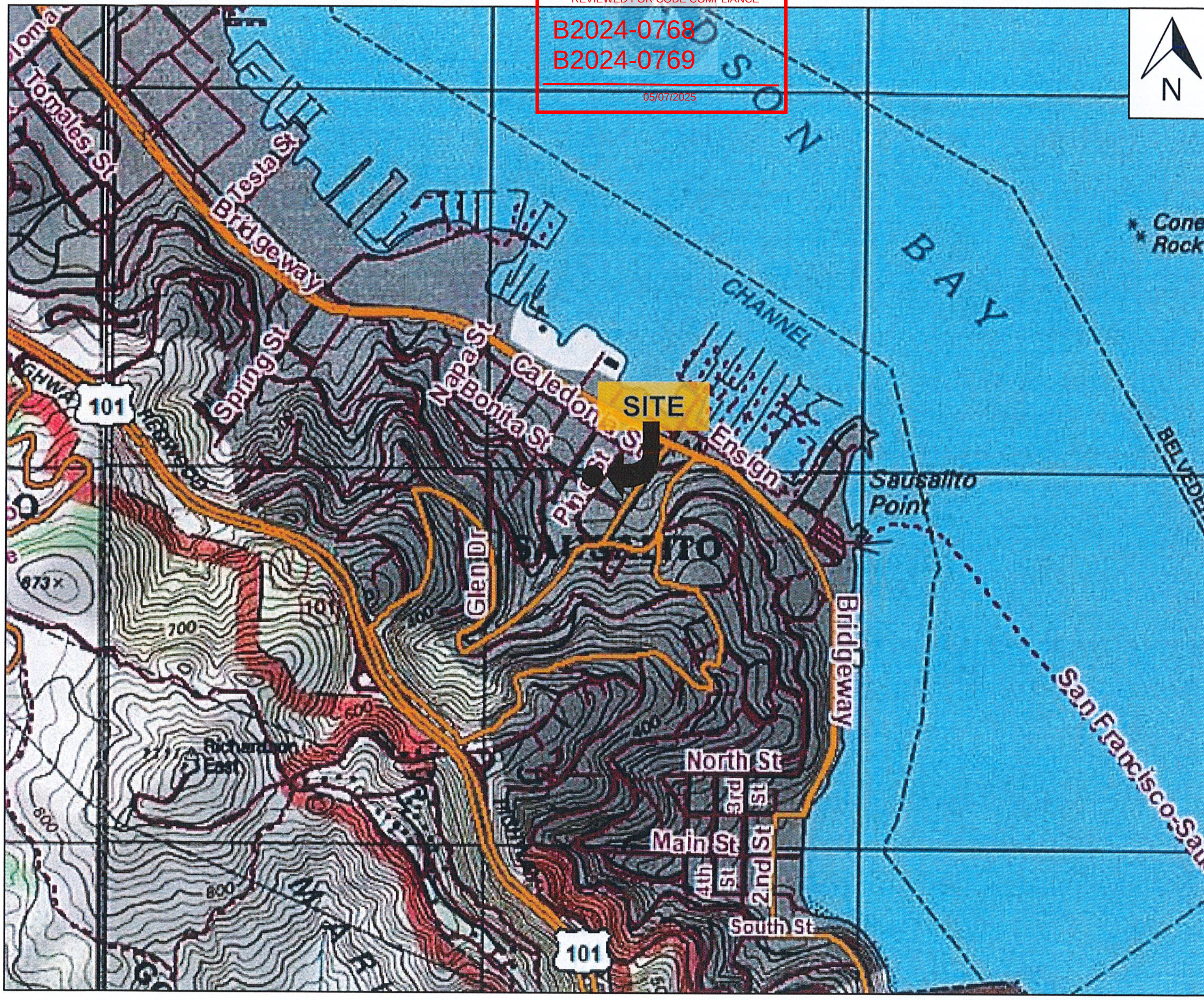
10. Geology for Planning in Central and Southeastern Marin County, California, OFR 76-2, Plate 2E, dated 1976.

11. "EQFAULT" Ver 3.00, software program.

12. ASCE STANDARD ASCE/SEI 7-16, prepared by the American Society of Civil Engineers.

13. USGS Liquefaction Susceptibility Map, 2023.

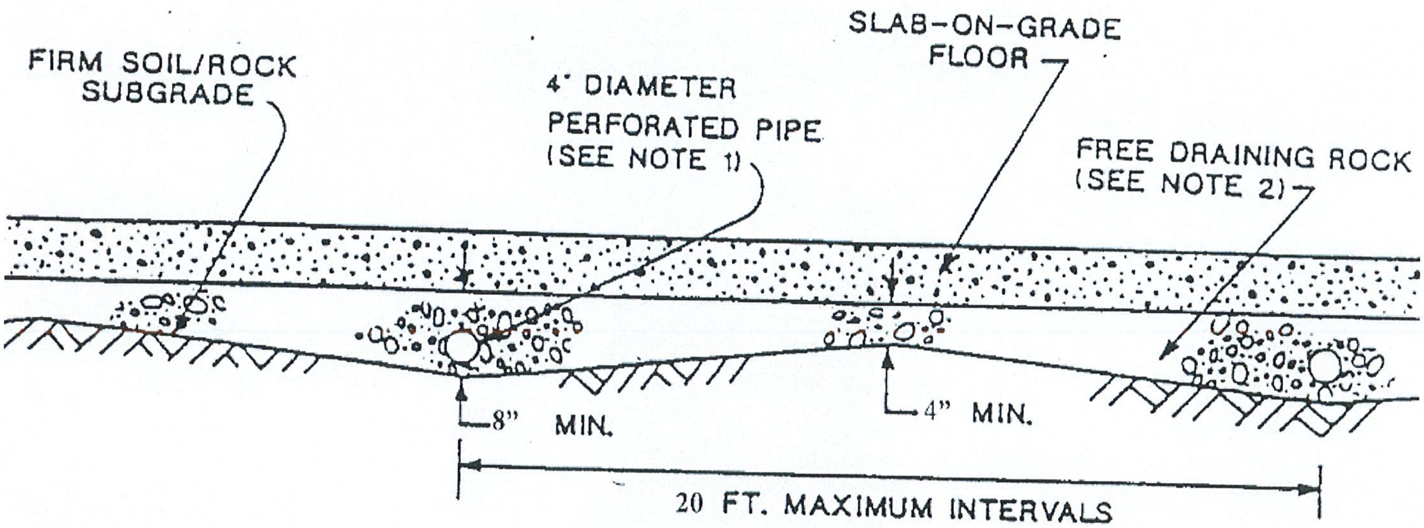
14. California Geological Survey Alquist-Priolo Earthquake Fault Zone Map, 2023.



SCALE: 1:24,000

REFERENCE: USGS SAN FRANCISCO NORTH, CALIFORNIA 7.5 MINUTE QUADRANGLE, DATED 1995.

PJC & Associates, Inc. *Consulting Engineers & Geologists*	**SITE LOCATION MAP** PROPOSED RESIDENTIAL REMODEL 426 PINE STREET SAUSALITO, CALIFORNIA	PLATE 1
	Proj. No: R1160.01 Date: 1/2024 App'd by: PJC	



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 8" 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.

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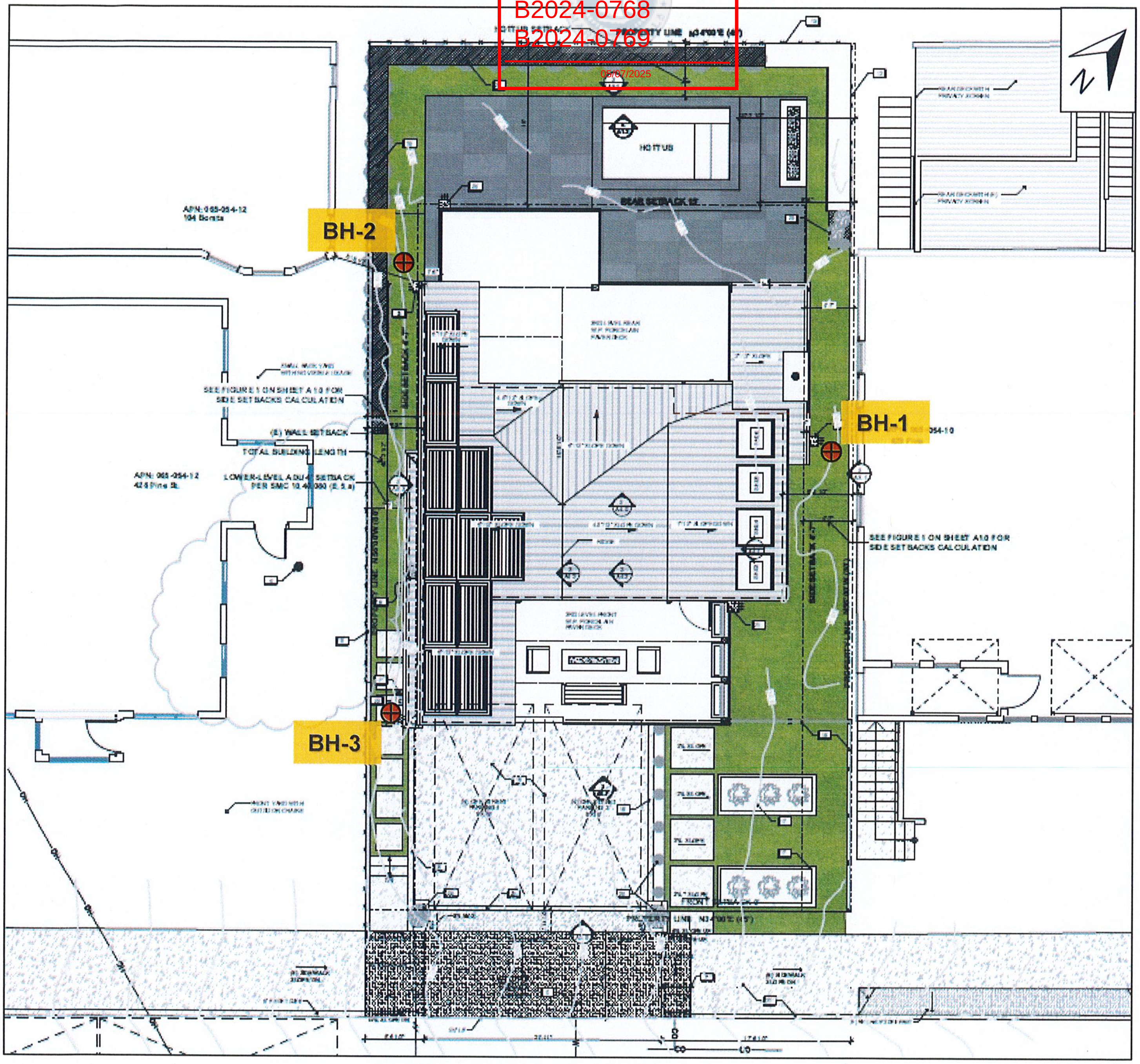
SLAB UNDERDRAIN SYSTEM
PROPOSED RESIDENTIAL REMODEL
426 PINE STREET
SAUSALITO, CALIFORNIA

PLATE
1A

Proj. No: R1160.01 Date: 2/2024 App'd by: PJC



NO SCALE

EXPLANATION

⊕ BOREHOLE LOCATION AND DESIGNATION

REFERENCE: SITE PLAN TITLED "THE BEYER RESIDENCE", SHEET A1.0, PREPARED BY G DESIGN, LLC., DATED OCTOBER 27, 2023.

PJC & Associates, Inc. *Consulting Engineers & Geologists*	**BOREHOLE LOCATION PLAN** PROPOSED RESIDENTIAL REMODEL 426 PINE STREET SAUSALITO, CALIFORNIA	PLATE **2**
	Proj. No: R1160.01 Date: 1/2024 App'd by: PJC	

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BORING NUMBER BH-1

CLIENT Jake and Georgia Beyer
PROJECT NAME Proposed Residential Remodel
JOB NUMBER R1160.01
LOCATION 426 Pine Street, Sausalito, California
DATE STARTED 1/11/24 **COMPLETED** 1/11/24
GROUND ELEVATION ____ **HOLE SIZE** 4"
DRILLING CONTRACTOR PJC
GROUND WATER LEVELS:
DRILLING METHOD Portable Flight Auger, 70lb Hammer
AT TIME OF DRILLING --- No groundwater encountered.
LOGGED BY TC **CHECKED BY** RD
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	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (%)
0		0.0' - 3.75'; SANDY SILT (MH); dark brown, very moist, loosely compacted, medium plasticity, with gravels, with organics (FILL).										
			MC		4-6-16 (22)		74	23	55	37	18	
		3.75' - 6.75'; SILTY CLAY (CH); light orangish brown with tan, very moist, very stiff, high plasticity, with gravels (RESIDUAL SOIL).	MC		24-20-24 (44)	2.0	91	20				
5												
			MC		25-50	4.5	97	18				
		6.75' - 8.0'; CLAYEY SANDSTONE (fsr); light orangish brown, slightly hard, plastic to friable, highly weathered, fine-grained, poorly indurated, with shale and chert fragments (BEDROCK).	SPT		30-50			17				

Refusal at 8.0 feet.
Bottom of borehole at 8.0 feet.

BUILDING APPROVED
REVIEWED FOR CODE COMPLIANCE
B2024-0768
B2024-0769
05/07/2025

PJC & Associates, Inc.

Consulting Engineers & Geologists

BORING NUMBER BH-2

CLIENT Jake and Georgia Beyer
PROJECT NAME Proposed Residential Remodel
JOB NUMBER R1160.01
LOCATION 426 Pine Street, Sausalito, California
DATE STARTED 1/11/24 **COMPLETED** 1/11/24
GROUND ELEVATION
HOLE SIZE 4"
DRILLING CONTRACTOR PJC
GROUND WATER LEVELS:
DRILLING METHOD Portable Flight Auger, 70lb Hammer
AT TIME OF DRILLING --- No groundwater encountered.
LOGGED BY TC **CHECKED BY** RD
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' - 4.25'; CLAYEY SAND (SC); dark brown, moist to very moist, loosely to moderately compacted, fine-grained, with abundant organics (FILL).	GB					19				
			MC		9-11-18 (29)	2.25	92	21				
5		4.25' - 5.25'; SILTY CLAY (CH); orangish brown with tan, very moist, very stiff, high plasticity, with abundant gravels (RESIDUAL SOIL).	MC		27-35-50 (85)	3.25	118	24				
		5.25' - 7.0'; CLAYEY SANDSTONE (fsr); reddish orange & tan, slightly hard, plastic to friable, highly weathered, poorly indurated, with rock fragments (BEDROCK).	SPT		22-35-40 (75)			22				

Bottom of borehole at 7.0 feet.

PJC & Associates, Inc.

Consulting Engineers & Geologists

BORING NUMBER BH-3

CLIENT Jake and Georgia Beyer
PROJECT NAME Proposed Residential Remodel
JOB NUMBER R1160.01
LOCATION 426 Pine Street, Sausalito, California
DATE STARTED 1/11/24 **COMPLETED** 1/11/24
GROUND ELEVATION **HOLE SIZE** 4"
DRILLING CONTRACTOR PJC
GROUND WATER LEVELS:
DRILLING METHOD Portable Flight Auger, 70lb Hammer
AT TIME OF DRILLING --- No groundwater encountered.
LOGGED BY TC **CHECKED BY** RD
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'; SILTY CLAY (CL); dark brown with reddish brown, moist, loosely to moderately compacted, medium plasticity, with organics (FILL).										
		1.5' - 2.5'; SANDY CLAY (CL); reddish brown, moist, hard, medium plasticity, with gravels (RESIDUAL SOIL).	MC		27-50	3.0	102	19				
		2.5' - 4.5'; SILTY CLAY (CL); reddish & orangish brown, moist, stiff, medium plasticity, with shale fragments (RESIDUAL SOIL). EI = 36	GB					14	41	19	22	
			MC		24-50	1.1 (U)	102	21				
5		4.5' - 7.0'; SANDY CLAY (CL); reddish & orangish brown, very moist to moist, stiff, medium plasticity, with shale fragments (RESIDUAL SOIL).	SPT		20-30-40 (70)			15				
		7.0' - 8.0'; CLAYEY SANDSTONE (fsr); light orangish brown, slightly hard, plastic to friable, highly weathered, fine-grained, poorly indurated, with shale (BEDROCK).	SPT		30-40-50 (90)			17				

Refusal at 8.0 feet.
Bottom of borehole at 8.0 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

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USCS SOIL CLASSIFICATION KEY
PROPOSED RESIDENTIAL REMODEL
426 PINE STREET
SAUSALITO, CALIFORNIA

PLATE **6**

Proj. No: R1160.01 Date: 1/2024 App'd by: PJC

ROCK TYPES

Conglomerate

Shale

Metamorphic Rocks
Hydrothermally Altered Rocks

Sandstone

Sheared Shale Melange

Igneous Rocks

Meta-Sandstone

Chert

Bedding Thickness

Massive	Greater than 6 feet
Thickly Bedded	2 to 6 feet
Medium Bedded	8 to 24 inches
Thinly Bedded	2-1/2 to 8 inches
Very Thinly Bedded	3/4 to 2-1/2 inches
Closely Laminated	1/4 to 3/4 inches
Very Closely Laminated	Less than 1/4 inch

Joint, Fracture or Shear Spacing

Very Widely Spaced	Greater than 6 feet
Widely Spaced	2 to 6 feet
Moderately Widely Spaced	8 to 24 inches
Closely Spaced	2-1/2 inches
Very Closely Spaced	3/4 to 2-1/2 inches
Extremely Closely Spaced	Less than 3/4 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