

UPDATED GEOTECHNICAL INVESTIGATION REPORT
PROPOSED TOWNHOUSES
197 W. GRAND AVE (APN 060-203-006)
GROVER BEACH, CALIFORNIA

July 11, 2024
PROJECT
23-0900

FOR

CAM BOYD
COASTAL COMMUNITY BUILDERS
330 JAMES WAY, SUITE 200
PISMO BEACH, CA 93449

BY

PACIFIC COAST TESTING
P.O. BOX 6835
SANTA MARIA, CA 93456
PH 805-631-5108, FAX 805-631-5937



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Cam Boyd
Coastal Community Builders
330 James Way, Suite 200
Pismo Beach, CA 93449

P.O. Box 6835
Santa Maria, CA 93456
Tel: (805) 631-5108
Fax: (805) 631-5937

Subject: Updated Geotechnical Investigation, Proposed Townhomes, 197 W. Grand Avenue (APN 060-203-006), Grover Beach, California.

Dear Cam:

Pacific Coast Testing (PCT) is pleased to submit this Updated Geotechnical Investigation Report for the proposed townhomes at 197 W. Grand Avenue (APN 060-203-006), Grover Beach, California. This report was prepared in accordance with the scope of services presented in our proposal. The report provides geotechnical recommendations for site preparation, foundations, slabs-on-grade, retaining walls, pavement sections etc.

As discussed in the report, the primary concerns from a geotechnical standpoint are the potential for liquefaction, the shallow depth to groundwater and the loose condition of the near surface soils. Recommendations are provided herein for support of the townhomes on a structural mat foundation system. The recommendations provided assume that the structural engineer can accommodate the potential liquefaction induced settlements into the foundation and building design with the primary goal to protect life and not to avoid structural damage.

On June 19, 2024 three (3) percolation borings were drilled to determine an infiltration rate at the proposed underground chamber locations. The results show that infiltration below a depth of 7 feet is not possible due to the shallow depth to groundwater. It is our understanding that additional permeable pavers will be installed as an alternative to the chambers.

If you require additional assistance, please do not hesitate to contact me at (805) 631-5108.

Sincerely,

PACIFIC COAST TESTING INC.



Ron J. Church
GE #2184



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PROPOSED TOWNHOMES
197 W. GRAND AVENUE (APN 060-203-006)
GROVER BEACH, CALIFORNIA**

PROJECT 23-0900

1.0 INTRODUCTION

This report presents the results of our updated geotechnical investigation for the proposed townhomes at 197 W. Grand Avenue (APN 060-203-006) in Grover Beach, California. A site location map is presented in Figure 1. A geotechnical report was previously prepared for the property in 2023 (dated July 21, 2023). Three (3) additional borings were drilled at the site on June 19, 2024 to determine infiltration rates for underground storage chambers.

The property is located north of W. Grand Avenue and west of North 2nd Street, approximately 150 feet east of Cabrillo Highway (Hwy 1) and 2000 feet east of the Pacific Ocean. The Southern Pacific Railroad tracks border the property to the west. This area of Grover Beach contains mostly commercial properties. Topographically, the terrain is relatively level with gradients of less than 10 percent. Site elevations are around 20 feet above mean sea level (MSL). The property covers an area of approximately 0.94 acres. Several structures are located on the property. The boring locations were generally void of vegetation.

It is our understanding that the new townhomes will be wood-framed structures with slab-on-grade floors. Footing loads for the townhomes are presently unavailable. For the purpose of this report, maximum loads on the order of 25 kips (columns) and 1.5 kips per lineal foot (continuous) have been estimated.

The project description is based on a site reconnaissance performed by a Pacific Coast Testing, Inc., engineer and information provided by Cam Boyd of Coastal Community Builders. An aerial photograph forms the basis for the "Site Plan", Figure 2.

In the event that there is change in the nature, design or location of improvements, or if the assumed loads are not consistent with actual design loads, the conclusions and recommendations contained in this report should be reviewed and modified, if required. Evaluations of the soils for hydrocarbons or other chemical properties are beyond the scope of the investigation.

2.0 PURPOSE AND SCOPE

The purpose of this study was to explore and evaluate the surface and subsurface soil conditions at the site and to develop updated geotechnical information and design criteria for the proposed project. The scope of this study included the following items.

1. A review of available soil and geologic information for this area of Grover Beach.
2. A field study consisting of a site reconnaissance and an exploratory boring program to formulate a description of the subsurface conditions.
3. A laboratory testing program performed on representative soil samples collected during our field study.
4. Engineering analysis of the data gathered during our field study, laboratory testing, and literature review. Development of recommendations for site preparation and grading, and geotechnical design criteria for foundations, retaining walls, pavement design and underground facilities.
5. Preparation of this report summarizing our findings, conclusions, and recommendations regarding the geotechnical aspects of the project site.

3.0 SUBSURFACE SOIL CONDITIONS

The near surface soils encountered in our exploratory borings consisted of dark brown to brown sands extending to a depth of 4 to 6 feet below existing grades. These soils were encountered in a moist to near saturated state and in a loose condition. Below these materials, brown to light brown sands were encountered in a very moist to saturated state and in a loose to medium dense condition to a depth of 20 feet. Similar materials (sands) in a medium dense to dense condition were encountered to a depth of 35 feet. Laboratory testing indicates that the near surface sands have very low expansivity. Free groundwater was first encountered at approximately 11 feet below existing grade in 2023 with near saturated conditions below a depth of 5 feet due to capillary rise. In our recent percolation borings (June 2024) free groundwater was first encountered at 7 to 8 feet below existing grades.

A more detailed description of the soils encountered is presented graphically on the "Exploratory Boring Logs," B-1 to B-4 and P-1 to P-3, Appendix A. An explanation of the symbols and descriptions used on these logs are presented on the "Soil Classification Chart.

The soil profile described above is generalized; therefore, the reader is advised to consult the boring logs (Appendix A) for soil conditions at specific locations. Care should be exercised in interpolating or extrapolating subsurface conditions between or beyond borings. On the boring logs, we have indicated the soil type, moisture content, grain size, dry density, and the applicable Unified Soil Classification System Symbol.

The locations of our exploratory borings, shown on Site Plan, Figure 2, were approximately determined from features at the site. Hence, accuracy can be implied only to the degree that this method warrants. Surface elevations at boring locations were not determined.

4.0 SEISMIC CONSIDERATIONS

4.1 Seismic Coefficients

Structures should be designed to resist the lateral forces generated by earthquake shaking in accordance with the building code and local design practice. This section presents seismic design parameters for use with the California Building Code (CBC) and ASCE 7-16. The site coordinates and ASCE 7 Hazard Tool were used to obtain the seismic design criteria. The peak ground acceleration was estimated for a 2 percent probability of occurrence in 50 years using the USGS online deaggregation tool.

Seismic Data

California Building Code Seismic Parameter	Values for Site Class F (E)^
Latitude, degrees	35.122400
Longitude, degrees	-120.629300
S _s Seismic Factor	1.031
S ₁ Seismic Factor	0.376
Site Class	Sf
F _a , Short-Period Site Coefficient (@ 0.2-s Period)	1.200*
F _v , Long-Period Site Coefficient (@ 1.0-s Period)	1.924*

California Building Code Seismic Parameter	Values for Site Class F (E) [^]
S_{MS} , Site Specific Response Parameter for Site Class at 0.2 sec	1.237
S_{M1} , Site Specific Response Parameter for Site Class at 1 sec	0.723
$S_{DS} = 2/3 S_{MS}$	0.825
$S_{D1} = 2/3 S_{M1}$	0.483
Peak Ground Acceleration (2% probability in 50 years)	0.586
Likely Magnitude (M)	6.8
[^] The values were estimated for a Site Class E - soft soil site based on the estimated residual shear strength of liquefiable soils. * F_a is based on Table 11.4.1 of ASCE 7-16 (for Site Class C). F_v is based on Table 11.4.2. The fundamental period (T) for the proposed structure is taken to be less than or equal to T_s (S_{D1}/S_{DS}) and the equivalent static force procedure is used for design. See Section 12.8 of ASCE 7-16 (exceptions of 11.4.8).	

4.2 Liquefaction Analysis

Liquefaction is described as the sudden loss of soil shear strength due to a rapid increase of pore water pressures caused by cyclic loading from a seismic event. In simple terms, it means that the soil acts more like a fluid than a solid in a liquefiable event. In order for liquefaction to occur, the following are generally needed; granular soils (sand, silty sand and sandy silt), groundwater and low density (very loose to medium dense) conditions. A liquefaction study was not part of our scope for this project; however, a preliminary analysis has been performed based on the results of our soil borings and experience in this area of Grover Beach. As indicated above, loose to medium dense sands were found below a depth of 5 feet. Below a depth of 20 feet medium dense to dense sands and silty sands were found to a depth of 35 feet. Below a depth of 5 feet the soils can generally be considered saturated with free groundwater at approximately 7 to 8 feet below existing grade. Overall (total) seismic settlements on the order of 4 to 5 inches can be anticipated. Differential movements should be limited by the clay layers with settlements on the order of 2 to 3 inches.

4.3 Lateral Spreading

Due to the near level terrain, the potential for lateral spreading displacements would be low to negligible.

4.4 Slope Stability

The property is located in near level terrain with gradients of less than ten (10) percent. There was no visual evidence of instability at the site and the potential for gross slope movement to influence the proposed construction would be negligible.

4.5 Faulting

There are no active or potentially active faults in the direct vicinity of the property. The nearest known active fault (Los Osos Fault) is located north and west of the site. The site is not within a State of California Fault Hazards Zone (Alquist-Priolo). It is our opinion that there is a negligible potential for fault rupture to impact the proposed construction based on review of the published maps.

5.0 CONCLUSIONS AND RECOMMENDATIONS

1. Based on our investigation of the subsurface soil conditions, the site is suitable for the proposed construction provided the recommendations presented in this report are incorporated into the project plans and specifications.
2. It is important that the owner understand the potential for liquefaction induced settlements in a seismic event and the related movements and damage to the proposed construction. Supporting the proposed townhomes on deep foundations would be the most effective method of reducing the potential for liquefaction induced settlements. The main drawbacks of deep foundations would be cost of and the potential depth to competent materials. As an alternative, a structural mat foundation system is proposed. The site soils should be overexcavated such that all footings are supported on compacted materials. The foundation for the townhomes should be designed to bridge or cantilever over a loss in soil support of 7 feet. We would also recommend that the utilities to the townhomes be constructed with automatic shut-off capabilities and be designed with flexible connections.

3. The results of our limited analysis indicate differential settlements from soil liquefaction could be on the order of 2 to 3 inch over a distance of 30 feet. The foundation recommendations provided herein assume that the structural engineer can accommodate these settlements into the foundation and building design with the primary goal to protect life and not to avoid structural damage.
4. All grading and foundation plans should be reviewed by Pacific Coast Testing Inc., hereinafter described as the Geotechnical Engineer, prior to contract bidding. This review should be performed to determine whether the recommendations contained within this report are incorporated into the project plans and specifications.
5. The Geotechnical Engineer should be notified at least two (2) working days before site clearing or grading operations commence and should be present to observe the stripping of deleterious material and provide consultation to the Grading Contractor in the field.
6. Field observation and testing during the grading operations should be provided by the Geotechnical Engineer so that a decision can be formed regarding the adequacy of the site preparation, the acceptability of fill materials, and the extent to which the earthwork construction and the degree of compaction comply with the project geotechnical specifications. Any work related to grading performed without the full knowledge of, and under direct observation of the Geotechnical Engineer, may render the recommendations of this report invalid.

5.1 Clearing and Stripping

1. After removal of all existing structures, all surface and subsurface deleterious materials should be removed from the proposed building area and disposed of off-site. This includes, but is not limited to any, rootballs, buried utility lines, loose fills, septic systems, debris, building materials, and any other surface and subsurface structures within proposed building area. Voids left from site clearing should be cleaned and backfilled as recommended for structural fill.

2. Once the site has been cleared, the exposed ground surface should be stripped to remove surface vegetation and organic soil. The surface may be disced, rather than stripped, if the organic content of the soil is not more than three percent by weight. If stripping is required, depths should be determined by a member of our staff in the field at the time of stripping. Strippings may be either disposed of off-site or stockpiled for future use in landscape areas if approved by the landscape architect.

5.2 Site Preparation

1. The intent of these recommendations is to remove the loose soils in the upper six (6) feet and support the foundation systems on native and/or select non-expansive import materials.
2. After clearing and stripping, the building pad areas should be excavated to a minimum depth of six (6) feet below lowest existing grade, finish pad grade or four (4) feet below the bottom of the deepest footing, whichever is greater. A layer of stabilization fabric such as Mirafi HP570 or equivalent should then be placed at the bottom of the excavation. To tension the fabric 12 to 18 inches of Class II/III Base should be placed, wheel rolled and compacted to 90 percent of ASTM D1557-12. The removed native sands (with approval of the geotechnical engineer) or a suitable non-expansive import such as decomposed granite of Class II/III Base can be replaced and similarly compacted to pad grade. The lateral limits of excavation, scarification and fill placement should be at least 5 feet beyond the perimeter building and footing lines. Cut and fill slopes should not exceed 2:1 (horizontal:vertical) and should be properly compacted to 90 percent.
3. If perched water conditions occur, dewatering of the excavations will be required. Design and installation of site dewatering should be the responsibility of the *Contractor*. To obtain a stable bottom and allow for stabilization fabric placement a 12 to 24 inch layer of 3 to 4 inch rock may also be required.

4. In order to help minimize potential settlement problems associated with structures supported on non-uniform materials, the soils engineer should be consulted for specific site recommendations during site excavation.
5. The above recommendations are based on the strength characteristics of the materials under conditions of normal moisture that would result from rain water and do not take into consideration the activating forces applied by seepage from springs or subsurface water. Areas of observed seepage should be provided with subsurface drains to release the hydrostatic pressures.
6. The near-surface soils may become partially or completely saturated during the rainy season. Excavation operations during this time period may be difficult since the saturated materials may not be compactable, and they may not support construction equipment. Consideration should be given to the seasonal limit of the construction operations on the site.
7. All final grades should be provided with a positive drainage gradient away from foundations. Final grades should provide for rapid removal of surface water runoff. Ponding of water should not be allowed on building pads or adjacent to foundations.

5.3 Preparation of Paved Areas

1. After clearing and grubbing, the existing soils should be removed to a depth of at least two (2) feet below the existing ground surface or one (1) foot below the proposed structural section, whichever is deeper. The bottom of the excavation should then be scarified, moisture-conditioned and compacted to at least 90 percent. Native fill materials can then be placed and similarly compacted.
2. The upper 12 inches of subgrade beneath all paved areas should be compacted to at least 95 percent relative compaction. Subgrade soils should not be allowed to dry out or have excessive construction traffic between the time of water conditioning and compaction, and the time of placement of the pavement structural section.

5.4 Structural Fill

1. On-site sand soils can be used a fill provided they can be moisture conditioned to near optimum moisture. The native materials should be sampled and tested by the geotechnical engineer to determine their suitability. These fills should not contain rocks larger than 3 inches in greatest dimension and should have no more than 15 percent larger than 1.5 inches in greatest dimension.
2. Select import (decomposed granite, Class II/III Base or equivalent) should be free of organic and other deleterious material and should be non-expansive with a plasticity index of 10 or less and a sand equivalent of at least 30. Before delivery to the site, a sample of the proposed import should be tested in our laboratory to determine its suitability for use as structural fill.
3. Structural fill using on-site inorganic soil or approved import should be placed in layers, each not exceeding eight inches in thickness before compaction. On-site inorganic or imported soil should be conditioned with water, or allowed to dry, to produce a soil water content at approximately optimum value and should be compacted to at least 90 percent relative compaction based on ASTM D1557-12.

5.5 Foundations

1. Conventionally reinforced structural mat foundations (mat slabs) can be utilized to support the townhomes. Using beam on elastic foundation methods, the mat slab should be designed using a uniform modulus of subgrade reaction (K_v) of 30 pci. The mat slabs should also be designed to span or cantilever over a horizontal distance of 7 feet. A bearing capacity of 1200 psf dead plus live load may be used for cantilever and direct loads.
2. Based on experience, we would expect a conventional mat slab to be at least 10 to 12 inches thick and reinforced with at least two (2) mats of #5 or #6 rebar located 12 inches on-center, each way. The perimeter footings and grade beams should be at least 18 inches wide and embedded 18 inches below pad grade or below adjacent finished grade, whichever is lower. The reinforcement for the continuous footings and grade beams should be designed by the structural

engineer, however, a minimum of three (3) No. 5 rebar should be provided top to bottom with dowels to tie the slab to the footings and grade beams (min. #5 @ 12" o.c.). The longitudinal reinforcing steel should be held in place by stirrups at appropriate spacing to ensure proper positioning of the steel. A simple U-shaped stirrup, #4 bars at 30 inches on-center, minimum, should be sufficient.

3. The above allowable pressures are for support of dead plus live loads and may be increased by one-third for short-term wind and seismic loads.
4. Lateral forces on structures may be resisted by passive pressure acting against the sides of shallow footings and/or friction between the soil and the bottom of the footing. For resistance to lateral loads, a friction factor of 0.35 may be utilized for sliding resistance at the base of the footings in engineered fill. A passive resistance of 350 pcf equivalent fluid weight may be used against the side of shallow footings. If friction and passive pressures are combined, the lesser value should be reduced by 33 percent.

5.6 Slab-On-Grade Construction

1. Concrete slabs-on-grade and flatwork should not be placed directly on unprepared loose fill materials. Preparation of subgrade to receive concrete slabs-on-grade and flatwork should be processed as discussed in the preceding sections of this report.
2. To minimize floor dampness a section of capillary break material at least 4 inches thick and covered with a 15-mil Stego-type vapor barrier should be provided between slabs-on-grade and compacted soil subgrade. The capillary break should be a clean free-draining material such as clean gravel or permeable aggregate complying with Caltrans Standard Specifications 68, Class I, Type A or Type B, to service as a cushion and a capillary break. Clean gravel should have less than 3% passing the No. 200 sieve. All seams through the vapor barrier should be overlapped and sealed. Where pipes extend through the vapor barrier, the barrier should be sealed to the pipes. Tears or punctures in the moisture barrier should be completely repaired. It is suggested that a 2-inch

thick sand layer be placed on top of the membrane to assist in the curing of the concrete. The sand should be lightly moistened prior to placing concrete.

3. As discussed above, concrete mat slabs should be at least 10 to 12 inches thick and be reinforced with at least two (2) mats of #5 or #6 rebar located 12 inches on-center each way. Reinforcing bars should have a minimum clear cover of 1.5 inches, and hot bars should be cooled prior to placing concrete. The aforementioned slab thickness may be used for anticipated uniform floor loads not exceeding 100 psf.

5.7 Retaining Walls

1. Retaining walls should be designed to resist lateral pressures from adjacent soils and surcharge loads applied behind the walls.

Lateral Pressure and Condition (Compacted Fill)		Equivalent Fluid Pressure, pcf	
		Unrestrained Wall	Rigidly Supported Wall
Active Case, Drained	Level-native soils	40	--
	Level-granular backfill	30	--
At-Rest Case, Drained	Level-native soils	--	60
	Level-granular backfill		50
Passive Case, Drained	Level	250	--
	2:1 Sloping Down	150	
For sloping backfill add 1 pcf for every 2 deg. (Active case) and 1.5 pcf for every 2 deg. (At-rest case)			

2. For retaining walls greater than 6 feet, as measured from the top of the foundation, a seismic horizontal surcharge of $10H^2$ (pounds per linear foot of wall) may be assumed to act on retaining walls. The surcharge will act at a height of $0.33H$ above the wall base (where H is the height of the wall in feet). This surcharge force shall be added to an active design equivalent fluid pressure of 40 pounds per square foot of depth for the seismic condition.

3. In addition to the lateral soil pressure given above, retaining walls should be designed to support any design live load, such as from vehicle and construction surcharges, etc., to be supported by the wall backfill. If construction vehicles are required to operate within 10 feet of a wall, supplemental pressures will be induced and should be taken into account through design.
4. The above-recommended pressures are based on the assumption that sufficient subsurface drainage will be provided behind the walls to prevent the build-up of hydrostatic pressure. To achieve this, we recommend that a filter material be placed behind all proposed walls. The blanket of filter material should be a minimum of 12 inches thick and should extend from the bottom of the wall to within 12 inches of the ground surface. The top 12 inches should consist of water conditioned, compacted native soil. A 4-inch diameter drain pipe should be installed near the bottom of the filter blanket with perforations facing down. The drain pipe should be underlain by at least 4 inches of filter type material. Adequate gradients should be provided to discharge water that collects behind the retaining wall to an adequately controlled discharge system with suitably projected outlets. The filter material should conform to Class I, Type B permeable material as specified in Section 68 of the California Department of Transportation Standard Specifications, current edition. A typical 1" x #4 concrete coarse aggregate mix approximates this specification.
5. For hydrostatic loading conditions (i.e., no free drainage behind walls), an additional loading of 45 pcf equivalent fluid weight should be added to the above soil pressures. If it is necessary to design retaining structures for submerged conditions, allowed bearing and passive pressures should be reduced by 50 percent. In addition, soil friction beneath the base of the foundations should be neglected.
6. Precautions should be taken to ensure that heavy compaction equipment is not used immediately adjacent to walls, so as to prevent undue pressure against, and movement of, the walls. The use of water-stops/impermeable barriers

should be considered for any basement construction, and for building walls, which retain earth.

5.8 Pavement Design

- The following table provides recommended pavement sections based on an R-Value of 30 for the near surface sands encountered at the site.

RECOMMENDED MINIMUM ASPHALT CONCRETE PAVEMENT SECTIONS DESIGN THICKNESS		
T.I.	A.C.-in.	A.B.-in.
4.5	2.0	6.0
5.0	2.75	6.5
5.5	2.5	7.0
6.0	3.25	8.0
T.I. =	Traffic Index	
A.C. =	Asphaltic Concrete - must meet specifications for Caltrans Type A Asphalt Concrete	
A.B. =	Aggregate Base - must meet specifications for Caltrans Class II Aggregate Base (R-Value = minimum 78)	

- R-value samples should be obtained and tested at the completion of rough grading and the pavement sections confirmed or revised. All asphaltic concrete pavement sections and all sections should be crowned for good drainage.
- All asphalt pavement construction and materials used should conform with Sections 26 and 39 of the latest edition of the Standard Specifications, State of California, Department of Transportation. Aggregate bases and sub-bases should also be compacted to a minimum relative compaction of 95 percent based on ASTM D1557-12.

5.9 Underground Facilities Construction

- The attention of contractors, particularly the underground contractors, should be drawn to the State of California Construction Safety Orders for "Excavations, Trenches, Earthwork". Trenches or excavations greater than 5 feet in depth

should be shored or sloped back in accordance with OSHA Regulations prior to entry.

2. For purposes of this section of the report, bedding is defined as material placed in a trench up to 1 foot above a utility pipe and backfill is all material placed in the trench above the bedding. Unless concrete bedding is required around utility pipes, free-draining sand should be used as bedding. Sand proposed for use as bedding should be tested in our laboratory to verify its suitability and to measure its compaction characteristics. Sand bedding should be compacted by mechanical means to achieve at least 90 percent relative compaction based on ASTM Test D1557-12.
3. On-site inorganic soil, or approved import, may be used as utility trench backfill. Proper compaction of trench backfill will be necessary under and adjacent to structural fill, building foundations, concrete slabs and vehicle pavements. In these areas, backfill should be conditioned with water (or allowed to dry), to produce a soil water content of about 2 to 3 percent above the optimum value and placed in horizontal layers each not exceeding 8 inches in thickness before compaction. Each layer should be compacted to at least 90 percent relative compaction based on ASTM Test D1557-12. The top lift of trench backfill under vehicle pavements should be compacted to the requirements given in report section 5.3 for vehicle pavement subgrades. Trench walls must be kept moist prior to and during backfill placement.

5.10 Surface and Subsurface Drainage

1. Concentrated surface water runoff within or immediately adjacent to the site should be conveyed in pipes or in lined channels to discharge areas that are relatively level or that are adequately protected against erosion.
2. Water from roof downspouts should be conveyed in pipes that discharge in areas a safe distance away from structures. Surface drainage gradients should be planned to prevent ponding and promote drainage of surface water away from

building foundations, edges of pavements and sidewalks. For soil areas, we recommend that a minimum of five (5) percent gradient be maintained.

3. Maintenance of slopes is important to their long-term performance. It is recommended that slope surfaces be planted with appropriate drought-resistant vegetation as recommended by a landscape architect, and not over-irrigating, a primary source of surficial failures. In addition, an erosion control blanket (American Excelsior Company, AEC Premier Coconut or equivalent) should be placed over the slopes to protect the vegetation while it becomes established. The blanket should be installed in accordance with manufacturers requirements.
4. Careful attention should be paid to erosion protection of soil surfaces adjacent to the edges of roads, curbs and sidewalks, and in other areas where "hard" edges of structures may cause concentrated flow of surface water runoff. Erosion resistant matting such as Miramat, or other similar products, may be considered for lining drainage channels.
5. Subdrains should be placed in established drainage courses and potential seepage areas. The location of subdrains should be determined during site preparation. The subdrain outlet should extend into a suitable protected area or could be connected to the proposed storm drain system. The outlet pipe should consist of an unperforated pipe the same diameter as the perforated pipe.

5.11 Percolation Testing & Permeable Pavers

1. Three (3) percolation tests were performed on the property to a depth of 10 to 15 feet. The percolation tests were conducted in general conformance with County of San Luis Obispo requirements. The percolation results are summarized in the following table. As noted in the table, no percolation was measure in the borings due to the shallow depth to groundwater (7' to 8' below grade)

Test No.	Depth (feet)	Soil Description	Percolation Rate
P-1	15	Sand (SM-SP)	No Percolation
P-2	10	Sand (SM-SP)	No Percolation
P-3	10	Sand (SM-SP)	No Percolation

2. Due to the shallow depth to groundwater, the infiltration rate below depth of 7 feet will be essentially zero. Underground storage chambers will therefore not be installed at the property. It is our understanding that additional permeable pavers will be used to provide site infiltration. The proposed permeable paver section is shown to be 3-1/8 inch (80 mm) permeable concrete pavers over 3 inches of #57 stone base over 35 inches of #2 stone base (Bethel Engineering Sheet 2, Section C). We would recommend that the permeable concrete pavers be underlain by a 2 inch thick ASTM #8 stone bedding (also as a joint filler) over at least 6 inches of #57 stone base over the #2 stone base. Before placing the #2 stone base, the subgrade should be scarified to a depth of 12 inches and compacted to 90 percent of ASTM D1557-12. The prepared subgrade should be covered with a geofabric (Tensar NX850-NG or equivalent) prior to placing the #2 stone base.
3. To limit moisture intrusion adjacent to the foundations it is recommended that an impermeable barrier (20-mil HDPE liner or equivalent) be installed below all permeable pavers extending five (5) feet from the building perimeters. In addition, water from roof downspouts should be conveyed in pipes that discharge in areas a safe distance away from structures.

5.12 Geotechnical Observation and Testing

1. Field exploration and site reconnaissance provides only a limited view of the geotechnical conditions of the site. Substantially more information will be revealed during the excavation and grading phases of the construction. Stripping & clearing of vegetation, overexcavation, scarification, fill and backfill placement and compaction should be reviewed by the geotechnical professional during

construction to evaluate if the materials encountered during construction are consistent with those assumed for this report.

2. Special inspection of grading should be provided in accordance with California Building Code Section 1705.6 and Table 1705.6. The special inspector should be under the direction of the engineer.

CBC TABLE 1705.6 REQUIRED VERIFICATION AND INSPECTION OF SOILS		
VERIFICATION AND INSPECTION TASK	CONTINUOUS DURING TASK LISTED	PERIODIC DURING TASK LISTED
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity		X
2. Verify excavations are extended to proper depth and have reached proper material		X
3. Perform classification and testing of compacted fill		X
4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill	X	
5. Prior to placement of compacted fill, observe subgrade and verify that site has been prepared properly.		X

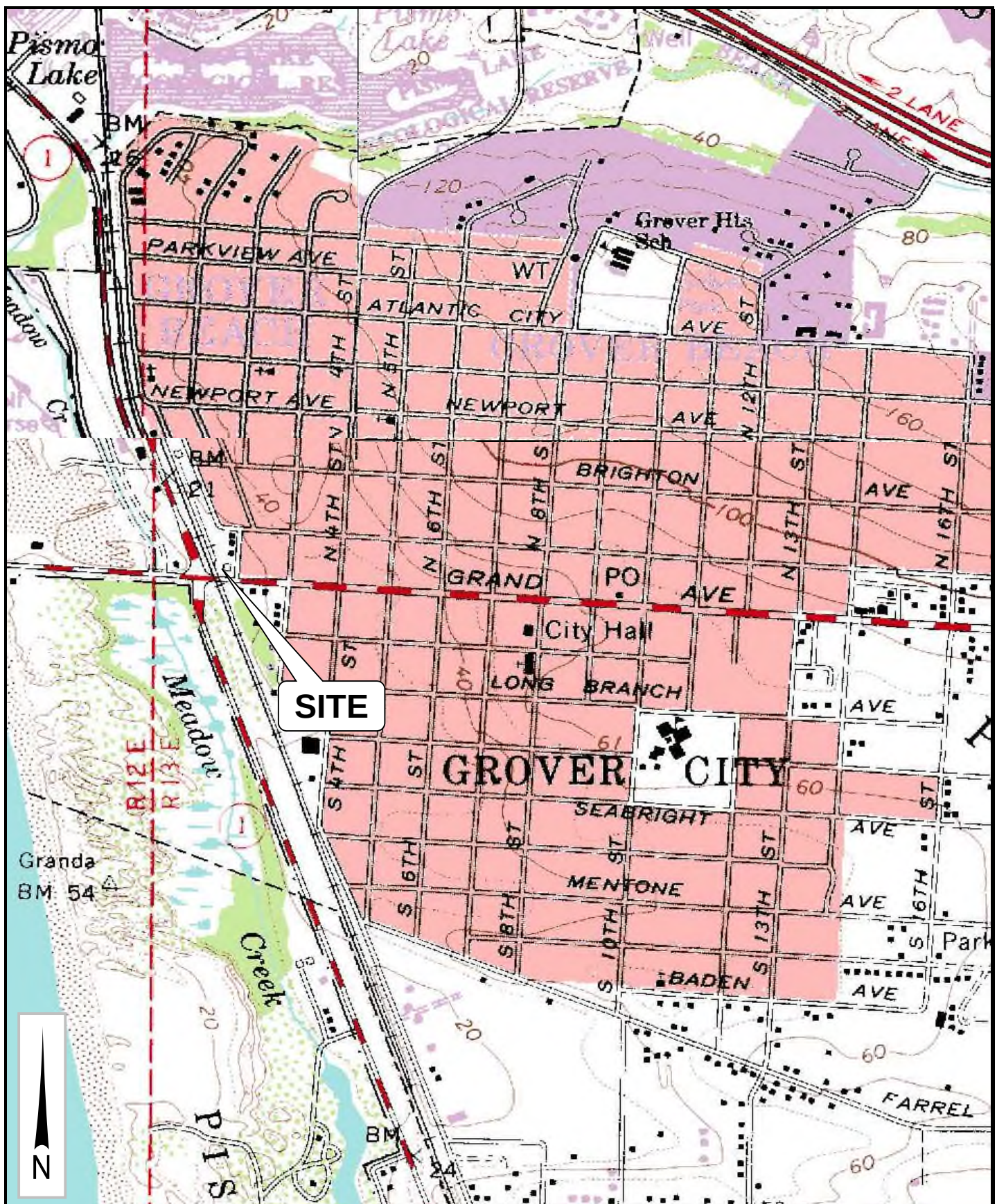
6.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. It should be noted that it is the responsibility of the owner or his/her representative to notify Pacific Coast Testing Inc. a minimum of 48 hours before any stripping, grading, or foundation excavations can commence at this site.
2. The recommendations of this report are based upon the assumption that the soil conditions do not deviate from those disclosed during our study. Should any variations or undesirable conditions be encountered during grading of the site, Pacific Coast Testing Inc. will provide supplemental recommendations as dictated by the field conditions.
3. This report is issued with the understanding that it is the responsibility of the owner or his/her representative to ensure that the information and recommendations contained herein are brought to the attention of the architect

and engineer for the project and incorporated into the project plans and specifications. The owner or his/her representative is responsible for ensuring that the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

4. As of the present date, the findings of this report are valid for the property studied. With the passage of time, changes in the conditions of a property can occur whether they are due to natural processes or to the works of man on this or adjacent properties. Legislation or the broadening of knowledge may result in changes in applicable standards. Changes outside of our control may find this report to be invalid, wholly or partially. Therefore, this report should not be relied upon after a period of one (1) year without our review nor is it applicable for any properties other than those studied.
5. Validity of the recommendations contained in this report is also dependent upon the prescribed testing and observation program during the site preparation and construction phases. Our firm assumes no responsibility for construction compliance with these design concepts and recommendations unless we have been retained to perform continuous on-site testing and review during all phases of site preparation, grading, and foundation/slab construction. The Geotechnical Engineer should be notified at least two (2) working days before site clearing or grading operations commence to develop a program of quality control.

FIGURES





Pacific Coast Testing, Inc.

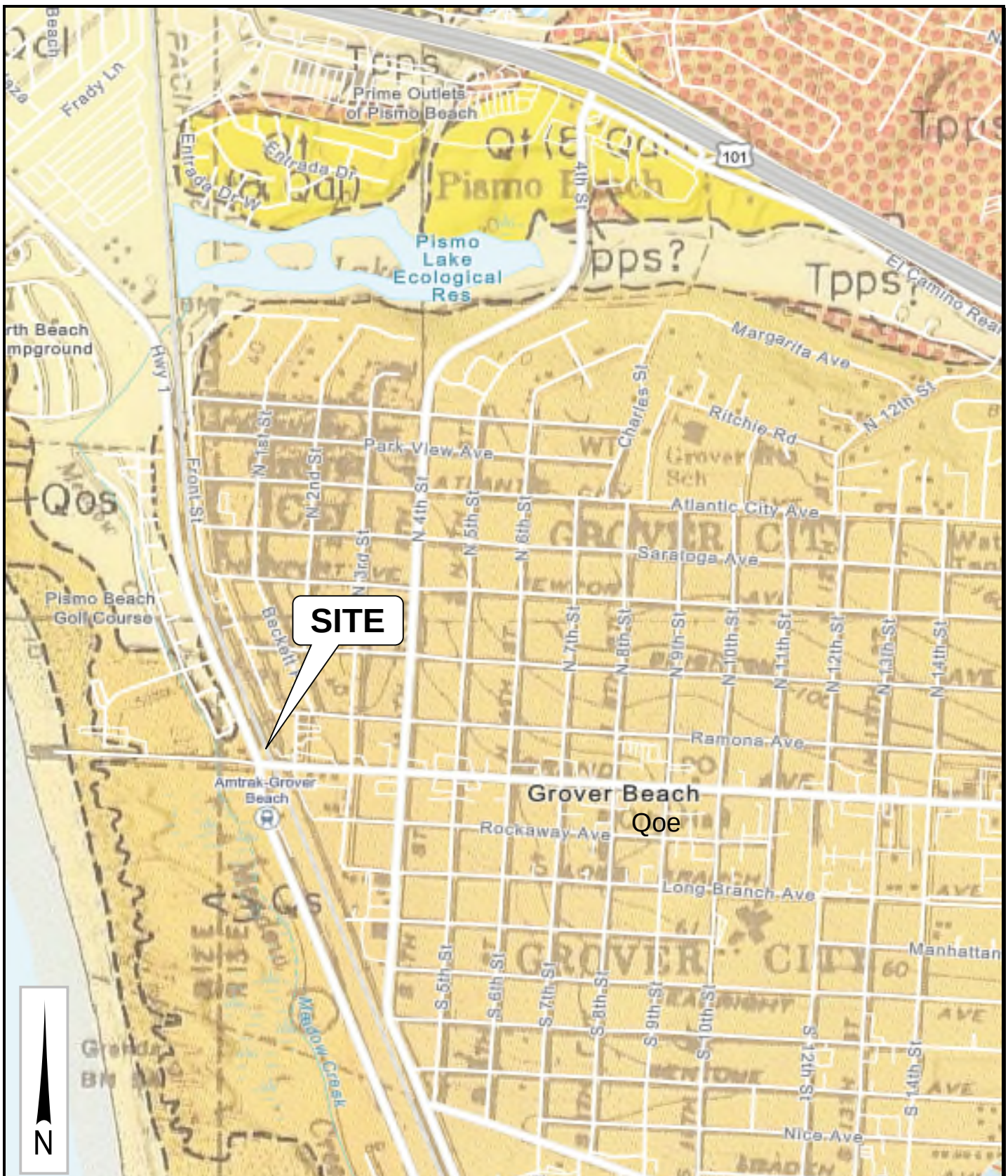
**SITE PLAN
PROPOSED TOWNHOUSES
197 W. GRAND AVE (APN 060-203-006)
GROVER BEACH, CALIFORNIA**

Project No.

23-0900

Figure No.

2



Reference - Geologic Map of Oceano Quadrangle, Holland 2013, Qa - Alluvial Deposits, Qoe - Older Eolian Deposits, Qye - Young Eolian Deposits

 Pacific Coast Testing, Inc.	GEOLOGIC MAP PROPOSED TOWNHOUSES 197 W. GRAND AVE (APN 060-203-006) GROVER BEACH, CALIFORNIA	Project No.	Figure No.
		23-0900	3

APPENDIX A

Field Investigation
Key to Boring Logs
Boring Logs

FIELD INVESTIGATION

Test Hole Drilling

The field investigation was conducted on April 27, 2023 and June 19, 2024. Four (4) exploratory borings and three (3) percolation borings were drilled at the approximate locations indicated on the Site Plan, Figure 2. The locations of these borings were approximated in the field.

Undisturbed and bulk samples were obtained at various depths during test hole drilling. The undisturbed samples were obtained by driving a 2.4-inch inside diameter sampler into soils.

Logs of Boring

A continuous log of soils, as encountered in the borings was recorded at the time of the field investigation. The Exploration Boring Logs are attached.

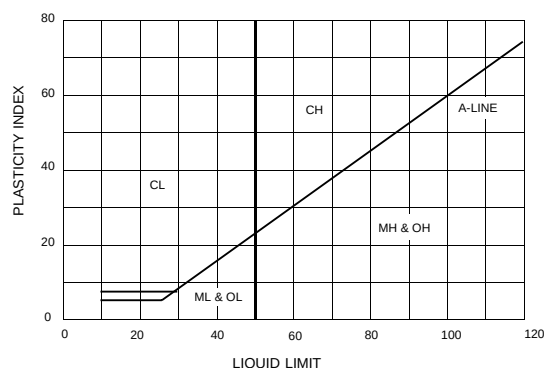
Locations and depth of sampling, in-situ soil dry densities and moisture contents are tabulated in the Boring Logs.

UNIFIED SOIL CLASSIFICATION SYSTEMS

UNITED SOIL CLASSIFICATION SYSTEMS					
MAJOR DIVISION			SYMBOLS	TYPICAL NAMES	
COARSE GRAINED SOILS Over 50% > #200 sieve	GRAVELS Over 50% > #4 sieve	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-SILT MIXTURES	
			GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES	
	SANDS Over 50% < #4 sieve	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS	
			SP	POORLY GRADED SANDS, GRAVELLY SANDS	
		SANDS WITH OVER 12% FINES	SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES	
			SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES	
FINE GRAINED SOILS Over 50% < #200 sieve	SILTS AND CLAYS Liquid limit < 50	ML	INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY		
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS		
		OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
		MH	INORGANIC SILTS , MICAEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS		
	SILTS AND CLAYS Liquid limit > 50	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS		
		HIGHLY ORGANIC CLAYS		Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

PLASTICITY CHART

USED FOR CLASSIFICATION OF FINE GRAINED SOILS



SOIL GRAIN SIZE

BOULDERS		COBBLES		GRAVEL		SAND			SILT	CLAY
				COARSE	FINE	COARSE	MEDIUM	FINE		
150		75		19	4.75	2.0	0.425	0.075	0.002	

SOIL GRAIN SIZE IN MILLIMETERS

SAMPLE DRIVING RECORD

BLOWS PER FOOT	DESCRIPTION
25	25 BLOWS DROVE SAMPLER 12 INCHES, AFTER INITIAL 6 INCHES OF SEATING
50/7"	50 BLOWS DROVE SAMPLER 7 INCHES, AFTER INITIAL 6 INCHES OF SEATING
Ref/3"	50 BLOWS DROVE SAMPLER 3 INCHES DURING OR AFTER INITIAL 6 INCHES OF SEATING

NOTE: TO AVOID DAMAGE TO SAMPLING TOOLS, DRIVING IS LIMITED TO 50 BLOWS PER 6 INCHES DURING OR AFTER SEATING INTERVAL

KEY TO TEST DATA

	Bag Sample	CONS	Consolidation (ASTM D2435)
	Drive, No Sample Collected	DS	Cons. Drained Direct Shear (ASTM D3080)
	2 1/2" O.D. Mod. California Sampler, Not Tested	PP	Pocket Penetrometer
	2 1/2" O.D. Mod. California Sampler, Tested	GSD	Grain Size Distribution (ASTM D422)
	Standard Penetration Test	CP	Compaction Test (ASTM D1557)
	Sample Attempted with No Recovery	EI	Expansion Index (ASTM D4829)
	Water Level at Time of Drilling	LL	Liquid Limit (in percent)
	Water Level after Drilling	PI	Plasticity Index

RELATIVE DENSITY

SANDS, GRAVELS, AND NON PLASTIC SILTS	BLOWS/FOOT
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	OVER 50

RELATIVE DENSITY

CLAYS AND PLASTIC SILTS	STRENGTH	BLOWS/FOOT
VERY SOFT	0 - 1/4	0 - 2
SOFT	1/4 - 1/2	2 - 4
FIRM	1/2 - 1	4 - 8
STIFF	1 - 2	8 - 16
VERY STIFF	2 - 4	16 - 32
HARD	OVER 4	OVER 32



PROJECT NO.: 23-0900

DATE DRILLED: 4/27/2023

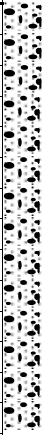
**SOIL CLASSIFICATION CHART
AND BORING LOG LEGEND**

**PROPOSED TOWNHOUSES
GROVER BEACH, CALIFORNIA**

FIGURE NO.

A-1

LOGGED BY: JM			DRILL RIG: Hand Auger			BORING NO.: B-1						
ELEVATION: 20'			BORING DIAMETER (INCH): 4			DATE DRILLED: 27 April 2023						
GROUNDWATER DEPTH (FT): 6.0												
ELEVATION (FT)	DEPTH (FT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION	SOIL TYPE	SAMPLE	CONV. SPT BLOW COUNT	WATER CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASIT. INDEX	UNC. COMP. STRENGTH (PSF)	COMMENTS AND ADDITIONAL TESTS
19	1		Sand w/Gravel: dark brown, moist, fine to coarse grained, some silt, loose	SP-GP	B		9.1					
18	2											
17	3											
16	4		II	9	10.4							
15	5											
14	6			Sand: dark brown, very moist to saturated, fine grained with trace medium, some silt, loose to medium dense	SP	B						
13	7											
12	8											
11	9		II	10	17.6							
10	10			Boring terminated at 10 feet								
9	11											
8	12											
7	13											
6	14											
5	15											
4	16											
3	17											
2	18											
1	19											
0	20											
EXPLORATORY BORING LOGS												
 Pacific Coast Testing, Inc.					PROPOSED TOWNHOUSES 197 W. GRAND AVE (APN 060-203-006)							
					PROJECT NO. 23-0900			DATE July-24		FIGURE NO. A-2		

LOGGED BY: JM			DRILL RIG: Hand Auger			BORING NO.: B-2						
ELEVATION: 20'			BORING DIAMETER (INCH): 4			DATE DRILLED: 27 April 2023						
GROUNDWATER DEPTH (FT):												
ELEVATION (FT)	DEPTH (FT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION	SOIL TYPE	SAMPLE	CONV. SPT BLOW COUNT	WATER CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASIT. INDEX	UNC. COMP. STRENGTH (PSF)	COMMENTS AND ADDITIONAL TESTS
19	1		Sand: dark brown, moist to very moist, fine grained, some silt, loose	SP-SM								
18	2											
17	3				B		9.7					
16	4		saturated									
15	5											
14	6		Sand: dark brown, very moist to saturated, fine to coarse grained, some gravel & silt, medium dense	SP			11.7					
13	7				B							
12	8	Boring terminated at 5 feet										
11	9											
10	10											
9	11											
8	12											
7	13											
6	14											
5	15											
4	16											
3	17											
2	18											
1	19											
0	20											
EXPLORATORY BORING LOGS												
 Pacific Coast Testing, Inc.					PROPOSED TOWNHOUSES 197 W. GRAND AVE (APN 060-203-006)							
					PROJECT NO. 23-0900			DATE July-24		FIGURE NO. A-3		

LOGGED BY: JM			DRILL RIG: Hand Auger			BORING NO.: B-3						
ELEVATION: 20'			BORING DIAMETER (INCH): 4			DATE DRILLED: 27 April 2023						
GROUNDWATER DEPTH (FT): 5.0												
ELEVATION (FT)	DEPTH (FT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION	SOIL TYPE	SAMPLE	CONV. SPT BLOW COUNT	WATER CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASIT. INDEX	UNC. COMP. STRENGTH (PSF)	COMMENTS AND ADDITIONAL TESTS
19	1		Sand: dark brown, moist to very moist, fine grained, some silt, loose	SP-SM	B		17.6					
18	2											
17	3											
16	4											
15	5											
14	6											
13	7											
12	8											
11	9		Sand: dark brown, saturated, fine to medium grained, some gravel & silt, medium dense	SP	B		23.4					
10	10											
9	11											
8	12											
7	13											
6	14											
5	15											
4	16											
3	17											
2	18											
1	19											
0	20											
Boring terminated at 8 feet												
EXPLORATORY BORING LOGS												
 Pacific Coast Testing, Inc.					PROPOSED TOWNHOUSES 197 W. GRAND AVE (APN 060-203-006)							
					PROJECT NO. 23-0900			DATE July-24		FIGURE NO. A-4		

LOGGED BY: JM		DRILL RIG: Simco 2400		BORING NO.: B-4								
ELEVATION: 20'		BORING DIAMETER (INCH): 5		DATE DRILLED: 27 April 2023								
GROUNDWATER DEPTH (FT): 11.0												
ELEVATION (FT)	DEPTH (FT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION	SOIL TYPE	SAMPLE	CONV. SPT BLOW COUNT	WATER CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASIT. INDEX	UNC. COMP. STRENGTH (PSF)	COMMENTS AND ADDITIONAL TESTS
19	1		Sand: dark brown, moist to very moist, fine to medium grained, some silt, loose	SP-SM								EI = 0
18	2											
17	3					8	19.4					
16	4											
15	5		near saturation									
14	6											
13	7		Sand: brown to yellowish brown, very moist to saturated, fine grained, loose to medium dense	SP								
12	8											
11	9					9	21.6					
10	10											
9	11		saturated									
8	12											
7	13											
6	14					11	23.9					
5	15											
4	16											
3	17											
2	18											
1	19											
0	20				14	20.2						
EXPLORATORY BORING LOGS												
 Pacific Coast Testing, Inc.				PROPOSED TOWNHOUSES 197 W. GRAND AVE (APN 060-203-006)								
				PROJECT NO. 23-0900			DATE July-23			FIGURE NO. A-5		

LOGGED BY: JM		DRILL RIG: Simco 2400		BORING NO.: B-4 cont'd								
ELEVATION: 20'		BORING DIAMETER (INCH): 5		DATE DRILLED: 27 April 2023								
GROUNDWATER DEPTH (FT):												
ELEVATION (FT)	DEPTH (FT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION	SOIL TYPE	SAMPLE	CONV. SPT BLOW COUNT	WATER CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASIT. INDEX	UNC. COMP. STRENGTH (PSF)	COMMENTS AND ADDITIONAL TESTS
-1	21		Sand: light yellowish brown, saturated, trace gravels, medium dense	SP								
-2	22											
-3	23											
-4	24											
-5	25											
-6	26											
-7	27											
-8	28			increasing silt (SP-SM)								
-9	29											
-10	30											
-11	31											
-12	32			dense								
-13	33											
-14	34											
-15	35		Boring terminated at 35 feet									
-16	36											
-17	37											
-18	38											
-19	39											
-20	40											
EXPLORATORY BORING LOGS												
 Pacific Coast Testing, Inc.				PROPOSED TOWNHOUSES 197 W. GRAND AVE (APN 060-203-006)								
				PROJECT NO. 23-0900			DATE July-23			FIGURE NO. A-6		

LOGGED BY: JM		DRILL RIG: Simco 2400		BORING NO.: P-1									
ELEVATION: 20'		BORING DIAMETER (INCH): 5		DATE DRILLED: 19 June 2024									
GROUNDWATER DEPTH (FT): 9.0													
ELEVATION (FT)	DEPTH (FT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION	SOIL TYPE	SAMPLE	CONV. SPT BLOW COUNT	WATER CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASIT. INDEX	UNC. COMP. STRENGTH (PSF)	COMMENTS AND ADDITIONAL TESTS	
19	1		Sand: dark brown, moist, fine to coarse grained, some silt, trace gravel, loose	SP									
18	2				B		8.1						
17	3												
16	4												
15	5		Sand: light brown, very moist, fine grained with trace medium, some silt, loose to medium dense	SP									
14	6												
13	7												
12	8				B		20.3						
11	9												
10	10												
9	11												
8	12												
7	13												
6	14				B		30.7						
5	15		Boring terminated at 15 feet										
4	16												
3	17												
2	18												
1	19												
0	20												
EXPLORATORY BORING LOGS													
 Pacific Coast Testing, Inc.				PROPOSED TOWNHOUSES 197 W. GRAND AVE (APN 060-203-006)									
				PROJECT NO. 23-0900			DATE July-24			FIGURE NO. A-7			

LOGGED BY: JM			DRILL RIG: Simco 2400			BORING NO.: P-2							
ELEVATION: 20'			BORING DIAMETER (INCH): 5			DATE DRILLED: 19 June 2024							
GROUNDWATER DEPTH (FT): 7.0													
ELEVATION (FT)	DEPTH (FT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION	SOIL TYPE	SAMPLE	CONV. SPT BLOW COUNT	WATER CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASIT. INDEX	UNC. COMP. STRENGTH (PSF)	COMMENTS AND ADDITIONAL TESTS	
19	1		Sand: dark brown, moist, fine to coarse grained, some silt, trace gravel, loose	SP									
18	2				B		7.7						
17	3												
16	4												
15	5		Sand: light brown, very moist, fine to medium grained, some silt, loose to medium dense	SP									
14	6												
13	7		saturated										
12	8				B		38.4						
11	9												
10	10		Boring terminated at 10 feet										
9	11												
8	12												
7	13												
6	14												
5	15												
4	16												
3	17												
2	18												
1	19												
0	20												
EXPLORATORY BORING LOGS													
 Pacific Coast Testing, Inc.					PROPOSED TOWNHOUSES 197 W. GRAND AVE (APN 060-203-006)								
					PROJECT NO. 23-0900			DATE July-24		FIGURE NO. A-8			

LOGGED BY: JM			DRILL RIG: Simco 2400			BORING NO.: P-3						
ELEVATION: 20'			BORING DIAMETER (INCH): 5			DATE DRILLED: 19 June 2024						
GROUNDWATER DEPTH (FT): 7.0												
ELEVATION (FT)	DEPTH (FT)	GRAPHIC LOG	GEOTECHNICAL DESCRIPTION	SOIL TYPE	SAMPLE	CONV. SPT BLOW COUNT	WATER CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASIT. INDEX	UNC. COMP. STRENGTH (PSF)	COMMENTS AND ADDITIONAL TESTS
19	1		Sand: dark brown, moist, fine to coarse grained, some silt, trace gravel, loose	SP								
18	2				B		7.1					
17	3											
16	4											
15	5		Sand: light brown, very moist, fine to medium grained, some silt, loose to medium dense	SP								
14	6											
13	7		saturated									
12	8				B		38.0					
11	9											
10	10		Boring terminated at 10 feet									
9	11											
8	12											
7	13											
6	14											
5	15											
4	16											
3	17											
2	18											
1	19											
0	20											
EXPLORATORY BORING LOGS												
 Pacific Coast Testing, Inc.					PROPOSED TOWNHOUSES 197 W. GRAND AVE (APN 060-203-006)							
					PROJECT NO. 23-0900			DATE July-24		FIGURE NO. A-9		

APPENDIX B

Moisture-Density Tests
Direct Shear Test
R-Value Test
Expansion Index Test

LABORATORY TESTING

Moisture-Density Tests

The field moisture content, as a percentage of the dry weight of the soil, was determined by weighing samples before and after oven drying. Dry densities, in pounds per cubic foot, were also determined for the undisturbed samples. Results of these determinations are shown in the Exploration Boring Logs.

Direct Shear Test

Direct shear tests were performed on undisturbed samples, to determine strength characteristics of the soil. The test specimens were soaked prior to testing. Results of the shear strength tests are attached.

Resistance (R) Value Test

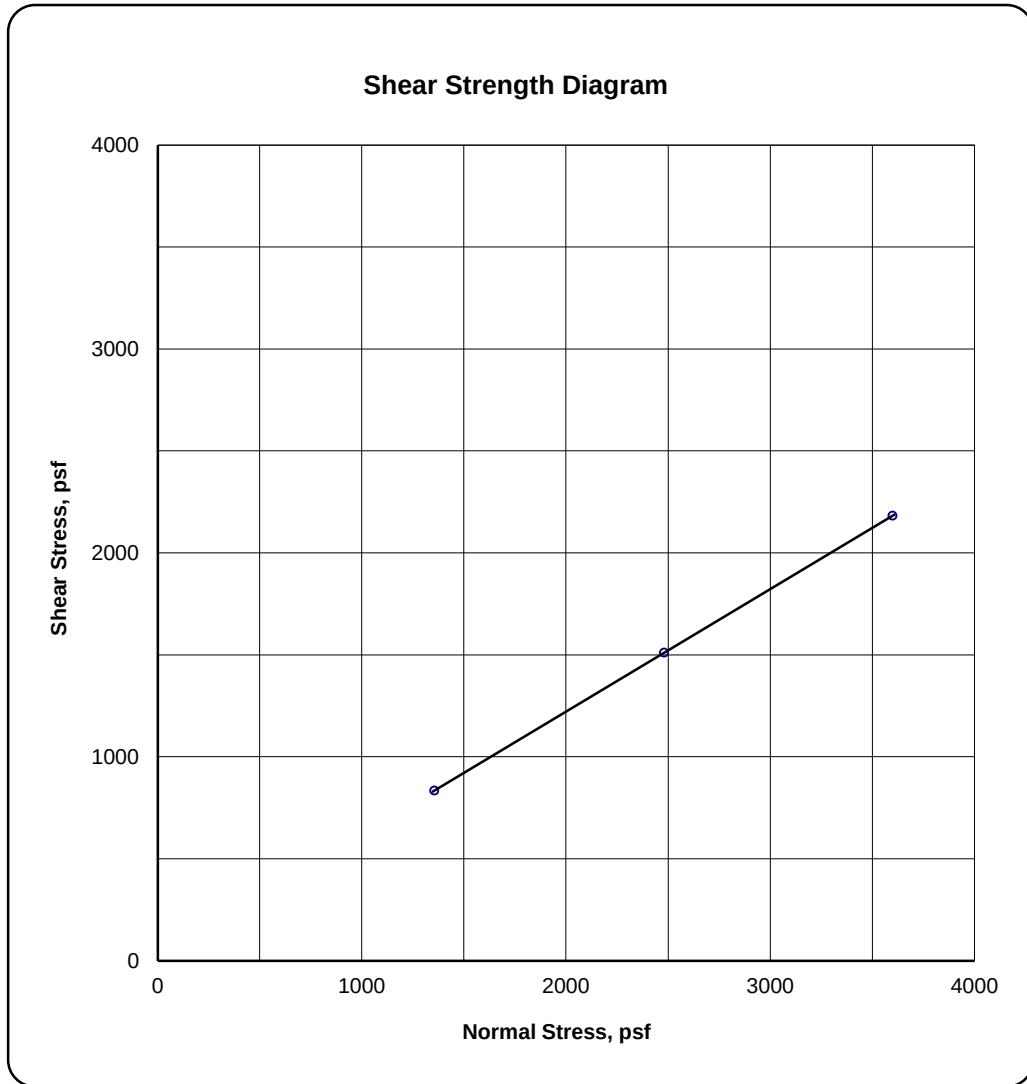
An R-Value test was estimated based on seive analysis and plasticity on a bulk sample obtained from boring B-2. The results of the tests indicate that the sand soils have an R-Value of 30.

Expansion Index Test

An expansion index of 0 was obtained for the native sand soils encountered in boring B-1. The test procedure was performed in accordance with ASTM D4829 – Standard Test Method for Expansion Index of Soils.

DIRECT SHEAR TEST

ASTM D3080-11 (Modified for unconsolidated-undrained conditions)



Project: Proposed Townhomes

Project No. 23-0900

Sample Location: B-4 @ 3 Feet

Initial Dry Density (pcf) 93.8

Soil Description: Sand

Initial Moisture (%) 19.4

Sample Type: ☐ Remolded
☒ Ring

Peak Shear Angle 31
Cohesion (psf) 20