WAYNE TING & ASSOCIATES, INC.
GEOTECHNICAL CONSULTANTS

Project No. 5932
2 November 2021

Mr. T.J. Singh
655 Miramar Drive Parcel #1
Half Moon Bay, CA 94019

Subject: **GEOTECHNICAL INVESTIGATION**
Proposed One Small House
655 Miramar Drive Parcel #1
Half Moon Bay, California

Reference: 1. Seismic Hazard Zones Official Map, Half Moon Bay Quadrangle, September 23, 2021.

Dear Mr. Singh:

In accordance with your authorization, **Wayne Ting & Associates, Inc. (WTAI)** has completed a geotechnical investigation for the proposed one small house at the subject site. The purpose of this study was to investigate the subsurface conditions and obtain geotechnical data for use in the design and construction of the proposed small house. The scope of this investigation included the following:

a. A site and area reconnaissance by the Project Engineer.
b. An excavation, logging, and sampling of four exploratory borings.
c. Laboratory testing of selected soil samples.
d. An engineering analysis of the data and information obtained.
e. Preparation and writing of this report which presents our findings, conclusions, and recommendations.

SITE LOCATION AND DESCRIPTION

The subject site is located at 655 Miramar Drive Parcel #1, Half Moon Bay, California. The property is located to the east of Miramar Drive, south of Hermosa Avenue, and north of Alto Avenue. It is adjacent to other single-family homes. The ground is sloping downward from east to west along the property with an inclination of 4:1(Horizontal:Vertical). The subject property is an empty lot at the time of our investigation.

PROPOSED PROJECT

The proposed project consists of constructing a new small house. We anticipate that the proposed structure will utilize wood-framed construction. Light to moderate building loads are typically associated with this type of construction.

FIELD INVESTIGATION

WTAI conducted the field investigation on October 5, 2021. The field investigation consisted of a site reconnaissance by the Project Engineer and an excavation of four exploratory borings. The borings were excavated using a truck-mounted drill-rig with 4-inch stem augers. The approximate locations of the borings are shown on the Site Plan, Figure 1.

Soils encountered during the excavation operation were continuously logged in the field. Relatively undisturbed samples were obtained by dynamically driving 18 inches using a 3.0-inch outside diameter Modified California Sampler with a 140-pound hammer free falling 30 inches. Blow counts were recorded for every 6-inch penetration interval, and reported corresponding to the last 12 inches of penetration. A correction factor of 0.6 was used to convert the blows for the last 12 inches of penetration for Modified California samples to corrected SPT values presented in the boring log. The classifications, descriptions, natural moisture contents, dry densities, and depths of the obtained samples are shown in the Boring Logs, Figures 2 through 5 of Appendix A.

LABORATORY TESTING

CLASSIFICATION

The field classifications of the samples were visually verified in the laboratory in accordance with the Unified Soil Classification System. These classifications are presented in the Boring Logs, Figures 2 through 5.

MOISTURE-DENSITY

The natural moisture contents and/or dry weights were determined for selected soil samples obtained during our field investigation. The data is presented in the aforementioned Boring Log.

SUBSURFACE SOIL CONDITIONS

The following soil descriptions were derived from our site reconnaissance and information obtained from our exploratory boring samples. Detailed descriptions of the materials encountered in the exploratory borings and results of the laboratory testing are presented in the Boring Logs, Figures 2 through 5.

Borings 1 through 4, soils encountered at the site consisted of brown to light brown granodiorite with clay, completely weathered to severely weathered, soft, and moist to the maximum depth explored of 20.0 feet below the ground surface.

No groundwater is encountered in the exploratory borings at the time of our investigation. Fluctuations in the groundwater table are anticipated to vary with respect to seasonal rainfall.

SEISMIC CONSIDERATIONS

According to the published maps by the International Conference of Building Officials (I.C.B.O.), in February 1998, the distances from active faults to the subject site are listed in the following table.

Fault Name	Distance (kilometers)	Direction From Site
San Gregorio North	3.2	West
San Andreas	8.4	Northeast

CALIFORNIA BUILDING CODE SITE CHARACTERIZATION

The following design values are base on the geologic information, longitude and latitude of the site, and the USGS computer program. Furthermore, in accordance with California Building Code 2019 (ASCE 7-16), the site seismic design values are provided as follow:

CBC Category/Coefficient ASCE 7-16	Design Value
Short-Period MCE at 0.2s, Ss	1.983
1.0s Period MCE, S1	0.752
Soil Profile Type, Site Class	D
Site Coefficient, Fa:	1.0
Site Coefficient, Fv:	null or See section 11.4.8 or 1.7
S_{MS} = Spectral Response Accelerations	1.983
S_{M1} = Spectral Response Accelerations	null or See section 11.4.8
S_{DS} = Design Spectral Response Accelerations	1.322
S_{D1} = Design Spectral Response Accelerations	null or See section 11.4.8
** Latitude: 37.4965603 Longitude: -122.4500572	

It is noted that final values should be determined by the project structural engineer according to site class, risk categories of the proposed structures, and ASCE 7-16 Table 11.4-1 and 11.4-2.

SITE GEOLOGY

Slope Instability

The site is on a sloping ground. Due to the consistent presence of granodiorite, there is not any apparent hazard from landsliding throughout the property.

Soil Liquefaction

Soil liquefaction is a phenomenon in which saturated (submerged) cohesionless soils can be subjected to a temporary loss of strength due to the buildup pore water pressures, especially as a result of cyclic loadings such as induced by earthquakes. In the process, the soil acquires a mobility sufficient to permit both horizontal and vertical deformations, if not confined. Soils that are most susceptible to liquefaction are clean, loose, saturated, uniformly graded, fine sands.

It is noted that this project is located outside the potential liquefiable site zone in the Seismic Hazard Map, Half Moon Bay Quadrangle, State of California, 2021 (Reference 1).

Based on our review of this data, the boring logs, and the absence of ground water, it is the opinion of WTAI that the probability of liquefaction of the soil within our boring depth underlying this site is low.

Total and Differential Settlement

During moderate and large earthquakes, soft or loose, natural or fill soils can become densified and consolidate, often unevenly across a site. This earthquake-induced consolidation can result in differential settlement of structures supported in these soils. Based on our subsurface exploration, the majority of the subsurface materials encountered in our boring at the site appear to be dense to very dense. Therefore, in our opinion, differential compaction should not constitute a significant hazard to the proposed structures provided that they are supported on foundations designed in accordance with the recommendations presented in this report.

Surface Displacement due to Seismically Induced Lateral Spreading or Lateral Flow

The site is on a sloping ground. From the above discussion of liquefaction, there is low to no potential liquefaction at the subject site. Therefore, potential lateral spreading or lateral flows occur at the site is low.

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

1. Based on the results of our investigation, WTAI concludes that the subject site is geotechnically suitable for the proposed small house provided the recommendations presented in this report are incorporated into the project plans and specifications.

2. WTAI should review the grading and foundation plans and specifications so that comments can be made regarding the interpretation and implementation of our geotechnical recommendations in the design and specifications.

3. It is recommended that WTAI be retained for observation during foundation construction phases to help determine that the design requirements are fulfilled. Our firm should be notified at least two working days prior to grading and/or foundation operations on the property.

4. Any work related to the grading and foundation operations performed without the direct observation of WTAI will invalidate the recommendations of this report.

5. The recommendations given in this report are applicable only for the design of the previously described small house and only at the location indicated on the site plan. They should not be used for any other purpose.

SITE PREPARATION AND GRADING

6. Prior to grading, the proposed structure areas should be cleared of all obstructions and deleterious materials. After clearing, these areas should be stripped of all organic topsoil. The predominantly organic materials generated from the stripping should be removed from the site.

7. After the organic topsoil has been stripped, the proposed pad areas can be excavated. The top 10 inches of the subgrade soil should be scarified, watered or aerated as necessary to bring the soil to about 2 percent above the optimum moisture content. The subgrade should then be uniformly recompacted to at least 90 percent relative compaction. Relative compaction is based on the maximum dry density as determined by ASTM D1557 Latest Version Laboratory Test Procedure.

FOUNDATION

8. Due to onsite sloping condition, the proposed small house can be satisfactorily supported on a continuous footing foundation or a pier and grade beam foundation system.

Continuous Footing Foundation

9. The interior footings should be interconnected so there are no isolated footings. The footings should be designed for allowable bearing pressures of 2,100 p.s.f. due to dead loads plus design live loads, and 2,800 p.s.f. due to all loads which include wind or seismic forces. The bottom of the interior and exterior footings should be founded at least 24 inches below the lowest adjacent pad grade (trench depth). In addition, the bottom of any footings should be compacted to a minimum relative compaction of 90%. A representative of WTAI should inspect the bottom of the footings to determine whether the compaction of the bottom of the footings is adequate. Steel reinforcement should be designed by the Project Structural Engineer.

10. The available resistance to lateral loads when utilizing a footing system is limited to the sliding resistance along the base of the footing. Sliding resistance between the bottom of the footing and the underlying soil should be based on a friction value of 0.30. Passive earth pressure may be computed as an equivalent fluid weighing of 200 p.c.f. below the first 12 inches of the footing below the soil subgrade. For footings located on the slope, the recommended passive resistance of 200 p.c.f. is not mobilized until a minimum of 10 feet lateral distance between the edge of foundation and face of the slope is achieved.

Pier and Grade Beam Foundation

11. The drilled piers should have a minimum diameter of 16 inches and a minimum embedment of 10 feet below the bottom of grade beam. The piers should be designed for an allowable skin friction value of 550 pounds per square foot for dead plus live loads. This value can be increased by one-third for total loads which include wind or seismic forces. This value is only applicable after a minimum penetration of 2 feet below the lowest adjacent pad grade has been achieved. The validity of this value is based on a minimum pier spacing of 3 pier diameters measured center-to-center.

12. Resistance to lateral force may be provided by passive earth pressure mobilized along the pier length below the depth of 2 feet. Passive earth pressure may be computed as an equivalent fluid weighing of 300 pounds per cubic foot acting on 2 pier diameters.

13. Due to the slope gradient, any piers located near or on the slope may be subject to creep loads imposed by the soils. For all piers constructed at or within 10 feet from the top of any slope, an inverted triangular pressure distribution of 50 p.c.f. equivalent fluid weights should be designed against the side of these piers over 2 pier diameters along the length in the upper 2 feet of the piers.

14. After the pier drilling completed, the bottom of pier holes should be cleaned of excessive loose materials prior to placing the reinforcing steel and concrete.

15. Care should be exercised during concrete placement to prevent concrete from spilling around pier shafts. If excess spillage occurs, the fresh concrete should be removed.

16. Regardless of either foundation system selected, movements under the anticipated building loads are expected to be within tolerable limits for the proposed structures. We estimate that the total movement for each structure will be less than 1.0-inches, and post-construction differential settlements across each structure should not exceed approximately 0.5-inches during the life of each of the structures following construction.

CONCRETE SLABS ON GRADE

17. To reduce the potential cracking of the concrete slabs, the following recommendations are made:

a. Slabs at garage door openings should be constructed with a thickened edge extending a minimum of 8 inches into the native ground or compacted fill.

b. Any concrete slab-on-grade should be underlain by at least 4 inches of clean crushed, 3/4-inch size rock, to act as a cushion and capillary break between the subsoil and the slab.

c. In areas where moisture transmission through slabs is undesirable, a waterproofing membrane of such as, Bituthene, Paraseal or equal should be placed according to the instruction of the manufacture and the specification of foundation plans. Design waterproofing for the concrete slab is not within the purview of WTAI. Waterproofing should be designed by a professional waterproofing designer.

GENERAL CONSTRUCTION REQUIREMENTS

18. All finished grading must be adjusted to provide positive drainage away from the structure to prevent ponding of water toward the structure.

19. All roof drains should be collected by a system of gutters and downspouts and discharged to a closed pipe system to carry storm water away from the structure.

20. Backfill of utility trenches under the building areas should be compacted to at least 90 percent compaction to ensure against water migration underneath the building structure.

21. Flowerbeds and planting are not recommended along the building perimeter. Only drip systems can be installed where they may cause saturation of the foundation soils. Landscape mounds or concrete flatwork should not block or obstruct the surface drainage measures.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

22. Our client should recognize that this report is prepared for the exclusive use of the proposed small house. Our professional services, findings, and recommendations were prepared in accordance with generally accepted engineering principles and practices. No other warranty, expressed or implied, is made.

23. The conclusions and recommendations contained in this report will not be considered valid after a period of two years unless the changes are reviewed, and the conclusions of this report are modified or verified in writing.

24. This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure the information and recommendations contained in this report are brought to the attention of the Architect, Engineer, and Contractor. In all cases, the contractor shall retain responsibility for the quality of the work and for repairing defects regardless of when they are found. It is also the responsibility of the contractor for conforming to the project plans and specifications.

Should you have any questions relating to the contents of this report, please contact our office at your convenience.

Very truly yours,

WAYNE TING & ASSOCIATES, INC.

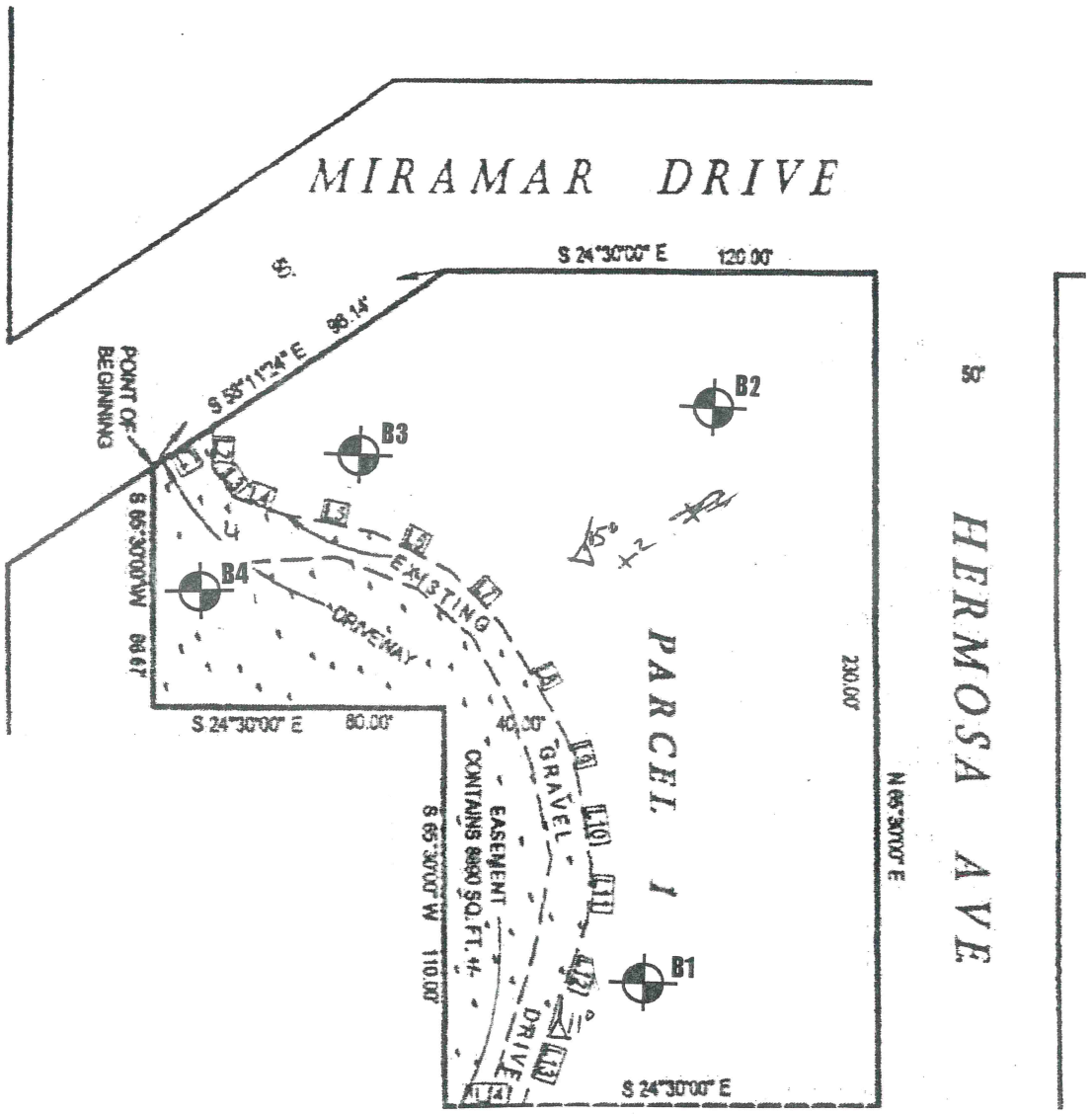
Tyler Brown, C.E.
Project Engineer

Copy: 1 to Mr. Singh

APPENDIX A

Site Plan, Figure 1

Boring Logs, Figures 2 through 5



WAYNE TING & ASSOCIATES, INC.	***Site Plan***	*Figure No. 1*
GEOTECHNICAL CONSULTANTS	No Scale	*Page No. 10*

Depth (Feet)	Description	Sample No.	Unified Soil Classification	Blows/Foot (350 Ft.-Lbs)	Dry Density (P.C.F)	Moisture (% Dry Density)	Pocket Penet. (T.S.F)	Remarks
1	Brown granodiorite with clay, completely weathered, soft, moist							
2								
3		1-1		31	113.2	15.2		
4								
5								
6								
7	grades to light brown granodiorite, severely weathered							
8		1-2		33	115.2	11.6		
9								
10								
11								
12								
13		1-3		41	111.8	7.2		
14								
15								
16								
17								
18								
19								
20	Boring terminated at 20.0 feet. No groundwater encountered.							
21								
22								
23								
24								
25								

WAYNE TING & ASSOCIATES, INC.	***BORING LOG NO. 1***	*Figure No. 2*
GEOTECHNICAL CONSULTANTS	*Date Drilled:* 5 October 2021 *By:* D.V.	*Page No. 11*

Depth (Feet)	Description	Sample No.	Unified Soil Classification	Blows/Foot (350 Ft.-Lbs)	Dry Density (P.C.F)	Moisture (% Dry Density)	Pocket Penet. (T.S.F)	Remarks
1	Brown granodiorite with clay, completely weathered, soft, moist							
2								
3		2-1		32	101.6	15.5		
4	grades to light brown granodiorite, severely weathered							
5								
6								
7								
8		2-2		>50	105.9	5.1		
9								
10								
11								
12								
13		2-3		>50	105.8	8.5		
14								
15								
16								
17								
18								
19								
20	Boring terminated at 20.0 feet.							
21	No groundwater encountered.							
22								
23								
24								
25								

WAYNE TING & ASSOCIATES, INC.	***BORING LOG NO. 2***	*Figure No. 3*
GEOTECHNICAL CONSULTANTS	*Date Drilled:* 5 October 2021 *By:* D.V.	*Page No. 12*

Depth (Feet)	Description	Sample No.	Unified Soil Classification	Blows/Foot (350 Ft.-Lbs)	Dry Density (P.C.F)	Moisture (% Dry Density)	Pocket Penet. (T.S.F)	Remarks
1	Brown granodiorite with clay, completely weathered, soft, moist							
2								
3		3-1		31	114.0	13.5		
4								
5	grades to light brown granodiorite, severely weathered							
6								
7								
8								
9								
10								
11								
12								
13		3-2		40	123.0	7.7		
14								
15								
16								
17								
18								
19								
20	Boring terminated at 20.0 feet.							
21	No groundwater encountered.							
22								
23								
24								
25								

WAYNE TING & ASSOCIATES, INC.	***BORING LOG NO. 3***	*Figure No. 4*
GEOTECHNICAL CONSULTANTS	*Date Drilled:* 5 October 2021 *By:* D.V.	*Page No. 13*

Depth (Feet)	Description	Sample No.	Unified Soil Classification	Blows/Foot (350 Ft.-Lbs)	Dry Density (P.C.F)	Moisture (% Dry Density)	Pocket Penet. (T.S.F)	Remarks
1	Brown granodiorite with clay, completely weathered, soft, moist							
2								
3		4-1		47	128.4	7.3		
4								
5	grades to light brown granodiorite, severely weathered							
6								
7								
8								
9								
10								
11								
12								
13		4-2		50	125.6	5.3		
14								
15								
16								
17								
18								
19								
20	Boring terminated at 20.0 feet. No groundwater encountered.							
21								
22								
23								
24								
25								

WAYNE TING & ASSOCIATES, INC.	***BORING LOG NO. 4***	*Figure No. 5*
GEOTECHNICAL CONSULTANTS	*Date Drilled:* 5 October 2021 *By:* D.V.	*Page No. 14*