WAYNE TING & ASSOCIATES, INC.
GEOTECHNICAL CONSULTANTS

Project No. 3846
5 May 2017

Mr. Tri Ton
55 Rogers Street
Los Gatos, California 95030

Subject: **GEOTECHNICAL INVESTIGATION**
Proposed One-Story Structure with A Basement
55 Rogers Street
Los Gatos, California

Dear Mr. Ton:

In accordance with your authorization, **Wayne Ting & Associates, Inc. (WTAI)** has completed a geotechnical investigation for the proposed one-story structure with a basement 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 structure. 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 2 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 55 Rogers Street, Los Gatos, California. The property is located to the south of Rogers Street. It is adjacent to other single-family homes. The ground surface with an inclination 3.5:1 (horizontal : vertical) was observed throughout the property sloping downward from north to south. An existing structure was present on the property at the time of our investigation.

PROPOSED STRUCTURE

The proposed structure consists of constructing a one-story structure with a basement cutting into the slope. We anticipate that the proposed structure will utilize wood-framed construction. We also anticipate that the existing structure will be demolished. Light to moderate building loads are typically associated with this type of construction.

FIELD INVESTIGATION

WTAI conducted the field investigation on May 2, 2017. The field investigation consisted of a site reconnaissance by the Project Engineer and an excavation of two exploratory borings. The borings were excavated using a portable drill-rig with a 3-inch solid stem auger. 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. These samples were then sealed and returned to the laboratory for testing. The classifications, descriptions, natural moisture contents, dry densities, and depths of the obtained samples are shown in the Boring Logs, Figures 2 and 3 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 and 3.

MOISTURE-DENSITY

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

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 and 3.

Boring 1 soils encountered at the site consisted of 3.0 feet of brown sandy silt with gravel, stiff, and moist, followed by orange-brown sandstone, severely weathered, fractured, and soft, very moist to the maximum refusal depth explored of 8.0 feet.

Boring 2 soils encountered at the site consisted of 3.0 feet of brown sandy silt, stiff, and moist, followed by orange-brown sandstone, severely weathered, fractured, and soft, very moist to the maximum refusal depth explored of 7.5 feet.

No groundwater was encountered in the exploratory borings at the time of our field study. 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
Monte Vista	0.1	Southwest
San Andreas	4.8	Southwest

CALIFORNIA BUILDING CODE SITE CHARACTERIZATION

The following design values are based on the geologic information, longitude and latitude of the site, and the USGS computer program. Furthermore, in accordance with Chapter 16 of the 2016 California Building Code (CBC), the site seismic design values are provided below:

CBC Category/Coefficient 2010 ASCE 7-10 (with March 2013 errata)	Design Value
Short-Period MCE at 0.2s, Ss	2.767
1.0s Period MCE, S1	0.984
Soil Profile Type, Site Class	Sd
Site Coefficient, Fa	1.0
Site Coefficient, Fv	1.5
S_{MS} = Fa x S_s Spectral Response Accelerations	2.767
S_{M1} = Fv x S_1Spectral Response Accelerations	1.476
S_{DS} = 2/3 x S_{MS} Design Spectral Response Accelerations	1.845
S_{D1}= 2/3 x S_{M1} Design Spectral Response Accelerations	0.984
** Latitude: 37.21871 Longitude: -121.97822	

LIQUEFACTION EVALUATION

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

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 rock underlying this 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 structure provided the recommendations presented in this report are incorporated into the project plans and specifications. The recommendations given in this report are applicable only for the design of the previously described one-story structure with a step basement and only at the location indicated on the site plan. They should not be used for any other purpose.

2. WTAI should review the 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.

SITE PREPARATION AND GRADING

5. Prior to grading, the proposed structure and pavement 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.

6. After the organic topsoil has been stripped, the proposed building pad and basement area can be excavated. The top 8 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. If bedrock is encountered, no compaction is needed.

7. It is our understanding that the proposed basement pad grade will be cut into the existing ground surface. No engineered fills are proposed.

EXCAVATION

8. In the event that more than 5 feet of soil must be cut into the existing ground surface for the proposed pad grade, WTAI recommends a temporary shoring system be constructed around the cut

area, for the safety of the construction workers. The general contractor should carefully implement the safety plan according the recommendations of California Occupational Safety and Health Administration (Cal OSHA.) The contractors should be responsible for the stability of all temporary cut slopes and trenches excavated at the site, and design and construction of any required shoring system. Unstable materials encountered on the slopes during the excavation and/or basement construction should be removed, even if this requires cutting the slope back at flatter inclinations.

9. The temporary shoring system should be designed by the general contractor and can be achieved by constructing soldier piers. The piers should have a minimum diameter of 16 inches and a minimum embedment of 12 feet below the pad subgrade and equally spaced at 6 feet on centers. Steel reinforcement will be determined by the Structural Engineer. These soldier piers can be filled with lean concrete. The piers should be designed to resist a lateral earth pressure of 45 p.c.f. (Equivalent fluid pressure). Resistance to lateral force may be provided by passive earth pressures mobilized along the pier length below the depth of the basement subgrade. Passive earth pressures may be computed as an equivalent fluid weighing of 300 pounds per cubic foot acting on 2 pier diameters.

10. If the location is suitable for a temporary open cut for the proposed basement, the lower 5.0 feet of excavation may be vertically cut. The upper part of the slope may be cut back at the maximum allowable slope gradient is 1.5:1 (horizontal: vertical).

FOUNDATION

11. The proposed single-family structure can satisfactorily be supported on a pier and grade beam foundation system located on the existing ground level and a mat foundation in the basement provided that the site is prepared as previously recommended.

Pier and Grade Beam Foundation

12. The proposed structure may be supported on a straight walled, auger excavated, cast-in-place, concrete friction pier and grade beam foundation. The drilled piers should have a minimum diameter of 16 inches and a minimum embedment of 14 feet below the lowest adjacent grade or 10 feet into rock, whichever is deeper. The piers located within 10 feet from the basement walls will be deepened during the construction. These piers should be designed for an allowable skin friction value of 500 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 3 feet below the lowest adjacent finished grade has been achieved. The validity of this value is based on a minimum spacing of 3 pier diameters measured center-to-center.

13. Resistance to lateral force may be provided by passive earth pressure mobilized along the pier length in the firm natural ground below a depth of 3 feet. Passive earth pressure may be computed as an equivalent fluid weighing of 300 pounds per cubic foot.

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

15. Depressions at the top of the piers resulting from drilling operations or from any other cause should be backfilled to prevent ponding of water.

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

Mat Foundation

17. The proposed structure can be supported by a mat slab foundation. The mat foundation must be interconnected and capable of spanning a minimum distance of 20 feet across zones of non-support. Corners and edges should be capable of cantilevering at least 10 feet along the intersecting members. Reinforcement of slabs will be determined by the Structural Engineer. The edges of the mat slabs should be deepened to a minimum 8 inches below the top of the proposed crushed rock recommended in item 21a.

18. The slabs should be designed based on the allowable bearing capacity of 1,800 p.s.f. due to dead loads plus design live loads, and 2,400 p.s.f. due to all loads which include wind or seismic forces.

19. The available resistance to lateral loads when utilizing a mat slab is limited to sliding resistance along the base of the slab. Sliding resistance between the base of the slab and the underlying soil may be taken as a friction value of 0.30.

20. Movements under the anticipated building loads are expected to be within tolerable limits for the proposed structure. We estimate that the total movement will be less than 1.0 inch, and post-construction differential movements across the building should not exceed approximately 0.5-inch during the life of the building following construction.

CONCRETE SLABS ON GRADE

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

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

b. A15-mil membrane serving as a vapor retarder should be placed over the above recommended crushed rock to minimize condensation caused by temperature differentials under the floor covering. It is recommended that a better impermeable membrane of such as, Buthuteme, Paraseal or equal should be placed according to the instruction of the manufacture and the specification of foundation plans.

c. Design waterproofing for the basement is not within the purview of WTAI. Waterproofing should be designed by a professional waterproofing designer.

RETAINING WALL

22. Retaining walls under 12 feet in height should be designed to resist lateral earth pressures from the backfill soils. The lateral earth pressures presented as an equivalent fluid weight for both unrestrained and restrained walls are shown as follows:

TABLE I

Slope Inclination Behind Wall (Horizontal : Vertical)	Equivalent Fluid Weight (Pounds Per Cubic Foot)	
	Unrestrained	Restrained
Flat	55	75
2:1	75	95

If surcharge loads are expected near the back of the basement wall, an additional uniform pressure equal to one-half of the surcharged pressure should be assumed to act against the back of the wall. For vehicle loads, the surcharged pressure of 200 p.s.f. should be used for the design.

Earthquakes induced lateral loads should be taken as that imposed by an equivalent fluid weight of 30 p.c.f. However, the distribution of this load should be considered as a triangle with resultant force acting at a point 0.6 of the wall height above the base of the wall.

23. The above criterion is based upon a sufficient drainage system to be constructed behind the wall to prevent the build-up of hydrostatic pressures. The wall drainage system should consist of a gravel blanket with a minimum width of 12 inches and should extend vertically to 18 inches below the ground surface. The top 18 inches should be backfilled with on-site soil to provide a surface seal and be graded away from the wall. The gravel blanket may consist of 3/4-inch clean crushed rock or pea gravel wrapped effectively with filter fabric.

24. Four-inch diameter perforated pipes should be placed on bedding at the bottom of the gravel blanket adjacent to the bottom of the mat slab. The perforations should be placed facing down toward the bottom of the excavation. The bedding should be at least 4-inch thick. The pipes should have a minimum gradient of 1.0 percent and should connect to an adequately controlled outlet facility away from the foundation. The drainage system behind the basement wall is shown in Figure 4.

GENERAL CONSTRUCTION REQUIREMENTS

25. All finished grading must be adjusted to provide positive drainage away from the structure to prevent ponding of water towards the building.

26. All roof drains should be collected by a system of gutters and downspouts and discharged to a splash box to carry storm water away from the building structure.

27. 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.

28. 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

29. Our client should recognize that this report is prepared for the exclusive use of the proposed one-story structure with step basement. 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.

30. 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.

31. 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.

Tri Nguyen. C.E.
Project Engineer

Copies: 1 to Mr. Ton

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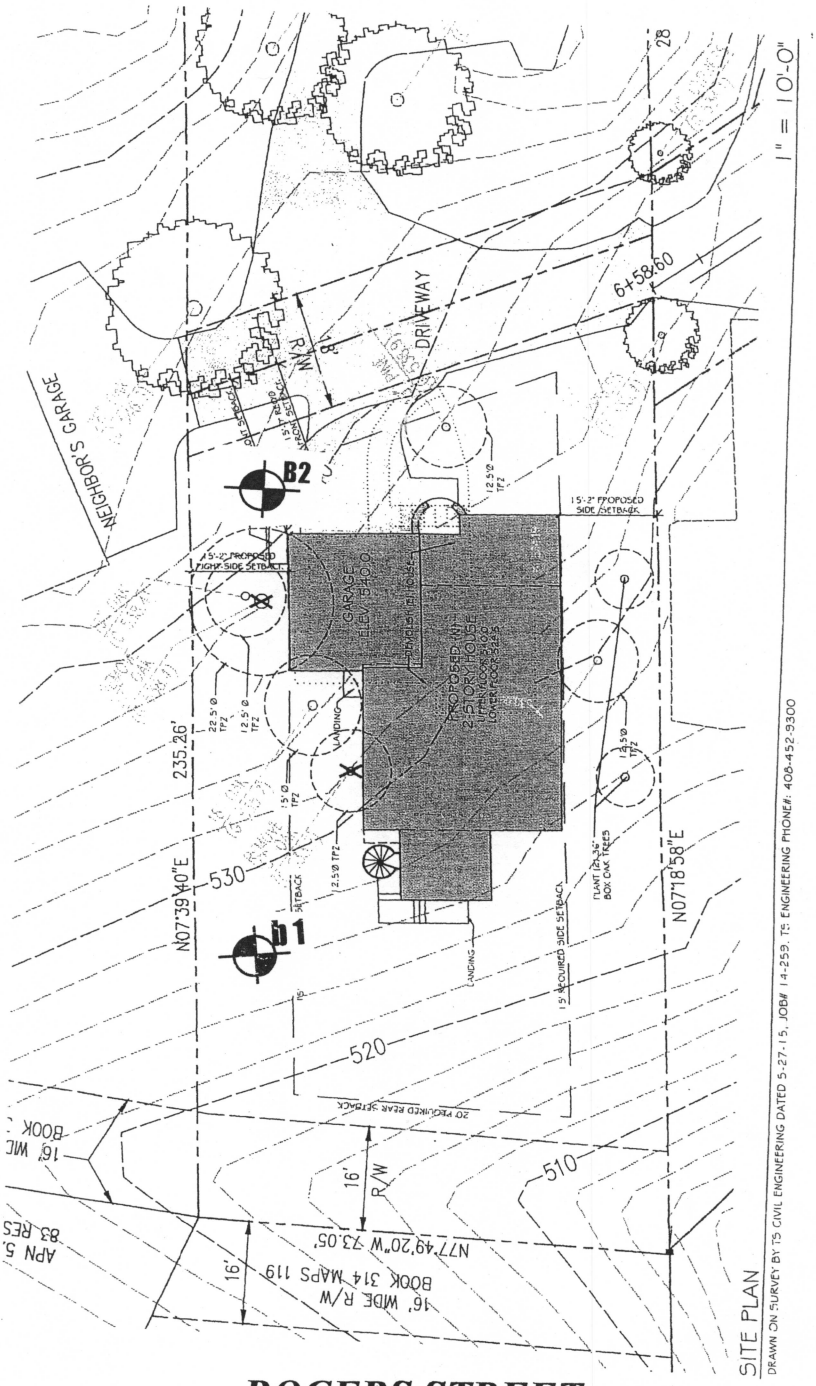
5 May 2017

APPENDIX A

Site Plan, Figure 1

Boring Logs, Figures 2 and 3

Drainage Behind Basement Wall, Figure 4



ROGERS STREET

WAYNE TING & ASSOCIATES, INC.	**Site Plan**	Figure No. 1
GEOTECHNICAL CONSULTANTS	Scale: 1"=30'	Page No. 10

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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
0	Brown sandy silt with gravel, stiff, moist		ML					
1		1-1		10	97.0	15.4	2.5	
2								
3	Orange, brown sandstone, severely weathered, fractured, and soft, very moist	1-2		47	127.5	11.1		
4								
5		1-3		50	111.9	13.6		
6								
7		1-4		>50				
8	Boring terminated at 8.0 feet due to refusal. No ground water encountered.							
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WAYNE TING & ASSOCIATES, INC.	***BORING LOG NO. 1***	*Figure No. 2*
GEOTECHNICAL CONSULTANTS	*Date Drilled:* 2 May 2017 *By:* T.B.	*Page No. 11*

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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
0	Brown sandy silt with gravel, stiff, moist		ML					
1		2-1		14		10.6		
2								
3	Orange, brown sandstone, severely weathered, fractured, and soft, very moist	2-2		45		12.6		
4								
5		2-3		48		19.6		
6								
7		2-4		>50				
8	Boring terminated at 7.5 feet due to refusal. No ground water encountered.							
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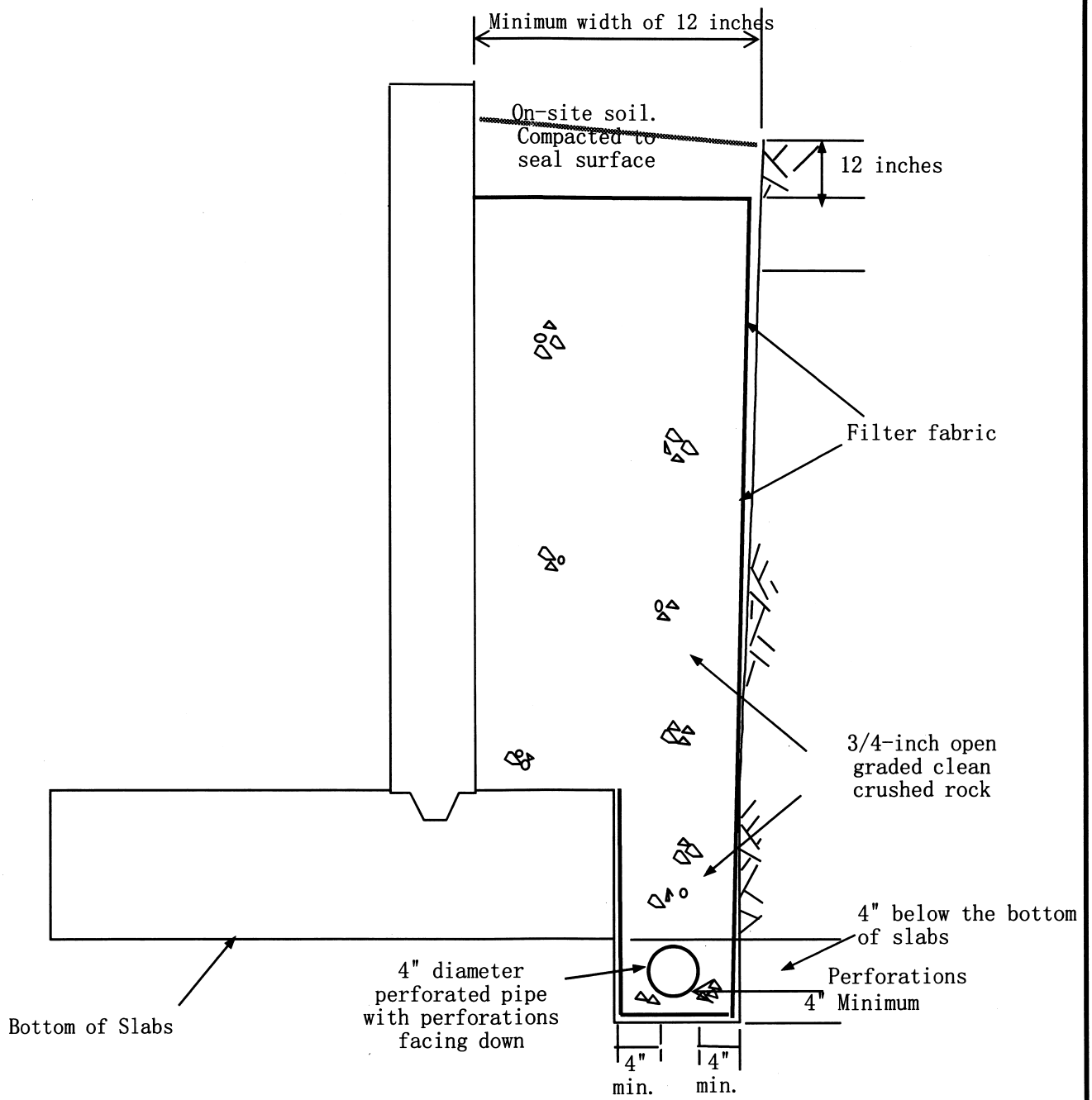
WAYNE TING & ASSOCIATES, INC.	***BORING LOG NO. 2***	*Figure No. 3*
GEOTECHNICAL CONSULTANTS	*Date Drilled:* 2 May 2017 *By:* T.B.	*Page No. 12*



Note: Bottom of the subdrain trench and pipe should be sloped at least 1.0 percent.

WAYNE TING & ASSOCIATES, INC.	***DRAIN BEHIND THE WALL***	*Figure No. 4*
GEOTECHNICAL CONSULTANTS	Scale: N/A	*Page No. 13*