Earth Solutions NW LLC
Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

February 5, 2019
Updated October 3, 2019
ES-6510

Mr. Amir and Mrs. Sarah Bastawrous
4909 East Mercer Way
Mercer Island, Washington 98040

Subject: **Geotechnical Evaluation**
Proposed Retaining Wall
4909 East Mercer Way
Mercer Island, Washington

Reference: Kathy G. Troost and Aaron P. Wisher
Geologic Map of Mercer Island, dated October 2006

Kathy G. Troost and Aaron P. Wisher
Mercer Island Erosion, Landslide, and Seismic Hazard Area Maps, dated April 2009

SCJ Studio Landscape Architecture
Permit Plans, dated August 2018
Conceptual Site Plan, dated June 2019

Swenson Fey Faget
Conceptual Site Plan, undated

Site Surveying, Inc.
Topographic Survey, dated May 21, 2018

Mercer Island City Code (MICC)

United States Department of Agriculture (USDA)
Web Soil Survey (WSS) online resource.

Dear Mr. and Mrs. Bastawrous:

As requested, Earth Solutions NW, LLC (ESNW) has prepared this letter providing geotechnical recommendations for the retaining wall that is proposed for construction at the subject property. We performed our work in general accordance with the scope of services outlined in our proposal dated December 28, 2018 and authorized on January 3, 2019. This report has been updated to consider new construction methods for the proposed retaining wall.

Project Description

The southern side-yard of the property, located at 4909 East Mercer Way, in Mercer Island, Washington, includes multiple timber railroad-tie retaining walls (timber walls) built during construction of the single-family residence. One timber wall is failing and actively moving. The proposal includes removal of the failing timber wall and construction of a new retaining wall. The proposed wall will include a maximum exposed height of approximately 12 feet, and less. Construction will include minimal cuts along the wall alignment and installation of the following elements: two-inch-diameter schedule 80 pipe piles along the proposed wall base; eight-inch-wide concrete facing, cast in place; retaining wall backfill using suitable structural fill; and installation of helical tiebacks, once the concrete has cured. The purpose of the pipe piles and helical tiebacks is to transfer vertical and lateral loads to dense soils at depth, which meet refusal criteria.

Following removal of the existing wall and preparation of benches and toe slope cuts to install pipe piles, the existing fill soils present behind the existing wall should be sloped back at gradients of 1.5H:1V. Following installation of the pipe piles and retaining wall, the void may be backfilled with clean crushed rock or a suitable structural fill compacted to 95%. After backfill, helical tieback anchors can be installed once the retaining wall facing has cured; and a planting soil cap and landscaping plants will be placed above the proposed wall.

The entirety of the site includes erosion, landslide, and seismic geologic hazard areas, as defined by the City of Mercer Island (City). Further discussion can be found in the *Geologic Hazard Areas* section of this letter.

This letter has been prepared for the exclusive use of Mr. Amir and Mrs. Sarah Bastawrous and their representatives. A warranty is neither expressed nor implied. The recommendations and conclusions provided in this letter are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. ESNW should reevaluate the contents of this letter if variations are encountered.

Subsurface Conditions

An ESNW representative observed, logged, and sampled three shallow borings, advanced at accessible locations near the area of the proposed retaining wall, on January 10, 2019 using hand tools. The hand auger borings were completed for purposes of assessing and classifying site soils as well as characterizing groundwater conditions. The approximate locations of the hand auger borings are depicted on Plate 2 (Hand Auger Boring Location Plan). Please refer to the attached hand auger boring logs for a more detailed description of subsurface conditions. Representative soil samples collected at the exploration locations were evaluated in general accordance with Unified Soil Classification System (USCS) and United States Department of Agriculture (USDA) methods and procedures.

Fill

Fill was encountered within hand auger borings extending to depths of at least four feet below the existing ground surface (bgs). The fill was characterized primarily as very soft to stiff silt with sand (USCS: ML) containing scattered burnt wood fragments. Based on our field observations, we estimate fill will be limited to a depth of about six feet bgs. The majority of encountered fills were within the relatively level southern side-yard and eastern backyard of the property.

Native Soil and Geologic Setting

Underlying fill, native soil consisting of very stiff silt (USCS: ML) was encountered at HA-2, beginning at depths of about three feet bgs. The observed native soils appeared consistent with Lawton clay deposits. The remainder of hand auger borings did not encounter a transition to native soil during exploration, which was limited to about four feet bgs. Lawton clay (Qvlc) typically consists of laminated to massive clay-rich silt, which was deposited in lowland proglacial lakes during the Frasier glaciation. Such material typically displays poor permeability characteristics and is prone to erosion. Lawton clay is commonly found along topographically lower areas along the Puget Sound and has historically been sensitive to localized and shallow failures in the greater Seattle area.

The referenced WSS resource identifies Kitsap silt loam (Map Unit Symbol: KpD) as the primary soil unit underlying the subject site and surrounding area. Soils of the Kitsap series are associated with stratified silt deposited in lacustrine settings. Such material typically takes the landform of terraces and is commonly found along the margins of Mercer Island as steep slopes.

Groundwater

During our subsurface exploration completed on January 10, 2019, perched groundwater seepage was not encountered at the boring locations. Seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the winter, spring, and early summer months.

Geologic Hazard Areas

Based on our review of the MICC and City mapping, the subject site and surrounding area is situated within erosion, landslide, and seismic hazard areas, as defined by the City. While geologic hazard areas are present on the site and surrounding area, construction of the proposed retaining wall will stabilize the fill soils on site, which exacerbate potential geologic hazards.

Erosion Hazard Areas

Erosion hazard areas are defined as those areas of the City which are greater than 15 percent in slope and subject to a severe risk of erosion due to wind, rain, water, slope, and other natural agents, as identified by the USDA Natural Resource Conservation Service.

As outlined in the *Native Soil and Geologic Setting* section of this letter, Kitsap series soils are mapped across the site and surrounding area. These soils are associated with high erosion hazard potential when disturbed. The proposed project will help mitigate some of the risk associated with erosion hazard areas by removing the majority of loose fills present on the site. As such, it is our opinion the project poses very low to low risk of erosion occurrence related to grading activity, provided proper Best Management Practices (BMPs) are established and maintained during construction. Temporary approaches for controlling surface water runoff should be established prior to beginning earthwork activities. Further discussion on erosion control can be found in the *Temporary Erosion Control* section of this letter.

Landslide Hazard Areas

Landslide hazard areas are defined as those areas of the City which are subject to landsliding based on a combination of geologic, topographic, and hydrologic factors. The slopes near where development will occur include gradients of about 40 to 70 percent. Based on our field observations, native slopes in the area are stable in their current condition and configuration, whereas fill soils are unstable (as evidenced by the failing timber wall).

Per MICC 19.07.060.B, buffers are not required for geologic hazard areas where a geotechnical report supports alteration to geologic hazard areas. It is our opinion that much of the instability associated with the site is related to the existing fill; construction of the concrete retaining wall will result in stabilization of the looser fills. Therefore, it is our opinion buffers should not be required with respect to landslide hazard areas.

Seismic Hazard Areas

Seismic hazard areas are defined as those areas of the City which are subject to severe risk of damage as a result of earthquake induced ground shaking, slope failure, settlement, soil liquefaction, or surface faulting.

The area of the site proposed for development is largely underlain by fine-grained fill overlying native silt. Because fine-grained soils are not typically susceptible to liquefaction, it is our opinion site susceptibility to liquefaction may be considered low. The relative density of native soils, as well as the absence of a uniformly established, shallow groundwater table, were the primary bases for this interpretation.

In our opinion, mitigation measures regarding the seismic hazard are unnecessary. We are not aware of any faults within 200 feet of the site. Construction of the proposed concrete retaining wall will stabilize the looser surficial fill soils and the overall site.

Allowed Alterations

Per MIC 19.07.060.2, alterations within geologic hazard areas may only occur if the geotechnical professional provides a statement of risk that one of the following conditions can be satisfied:

a. The geologic hazard area will be modified, or the development has been designed so that the risk to the lot and adjacent property is eliminated or mitigated such that the site is determined to be safe;

b. Construction practices are proposed for the alteration that would render the development as safe as if it were not located in a geologic hazard area;

c. The alteration is so minor as not to pose a threat to the public health, safety and welfare, or;

d. An evaluation of site-specific subsurface conditions demonstrates that the proposed development is not located in a geologic hazard area.

Based on our review of the referenced plans, it is our opinion the proposal meets criterion "a" and "c" above. In consideration of project objectives, the proposed alteration to the subject property is minimal and is a necessity given the failing timber wall. The timber wall is not embedded, does not include drainage, and has been failing continuously since construction. The proposal will remove much of the looser fill soils which could mobilize downslope and affect adjacent properties. Modification of the geologic hazard area will design the lot so that risk to adjacent properties are mitigated to a safe condition.

The entirety of the surrounding area is mapped within erosion, landslide, and steep slope hazard areas. The proposal will be completed primarily by limited and controlled cuts, followed by backfill with suitable structural fill. Following installation of the new retaining wall, helical tiebacks will be installed, and a thin planting soil cap and landscaping shrubbery will be placed above the wall. It is our opinion that construction will not adversely impact other critical areas provided both proper BMPs are in place during construction and the recommendations provided in this letter are incorporated, as necessary. ESNW should be retained to observe earthwork processes at the site, additional recommendations may be provided during construction based on encountered site conditions.

Temporary Erosion Control

The site will utilize the existing asphalt driveway as a temporary construction entrance and drive lane. Erosion control measures should include silt fencing placed along the clearing limits. Soil stockpiles should be covered or otherwise protected to reduce soil erosion. Soil stockpiles should be sited as far away as possible from the top of any slope, and ESNW should confirm stockpile siting during construction.

Per MICC 19.07.060.5, land clearing, grading, filling, and foundation work within geologic hazard areas is not permitted between October 1 and April 1, unless a waiver is submitted to and approved by the City. Temporary approaches for controlling surface water runoff should be established prior to beginning earthwork activities. Site clearing should be performed only where necessary. Additional BMPs, as specified by the project civil engineer and indicated on the plans, should be incorporated into construction activities.

Existing Timber Wall

The failing timber wall is located approximately 20 feet south of the southeastern corner of the existing residence. The timber wall extends in a northeast-southwest direction and includes maximum exposed heights of about five feet. Based on our field observations, tension cracks exist behind the timber wall and the wall is bulging, in part due to loose fills placed during construction of the single-family residence. The timber wall does not include toe embedment, and drainage provisions were not provided behind the timber panels. Because of these construction deficiencies, the timber wall will require removal and replacement.

Proposed Retaining Wall

A new retaining wall is proposed along the southern side-yard, extending along the eastern site margin. The purpose of the new retaining wall is to create level yard grades and replace the failing timber wall. The new retaining wall will be up to approximately 12 feet in exposed height, and less. The wall must be designed to resist earth pressures and applicable surcharge loads. Competent native soil suitable for foundation support will likely be encountered beginning at depths of about three to four feet bgs across the majority of the site. To ensure sufficient end bearing is provided, grouted pipe piles will be driven to refusal along the base of the proposed retaining wall, and helical tieback anchors will be utilized to resist lateral earth pressures. The new wall will include at least two feet of embedment along the wall toe. The following parameters may be used for design:

- Active earth pressure (yielding condition) — 35 pcf (equivalent fluid)*
- At-rest earth pressure (unyielding condition) — 55 pcf
- Passive earth pressure — 250 pcf (equivalent fluid)**
100 pcf (equivalent fluid)***
- Coefficient of friction — 0.30
- Seismic surcharge — 6H psf****

* *Where clean crushed rock or suitable structural fill compacted to 95% is utilized for wall backfill*
** *Where grades in front of the proposed wall are relatively level (wall section paralleling eastern site margin)*
*** *Where grades in front of the wall include sloping conditions (wall section paralleling southern site margin)*
**** *Where H equals the retained height (in feet)*

The above design parameters are based on a level backfill condition and a sloping condition at the wall toe. Revised design values will be necessary if sloping grades are to be used above the retaining walls. Additional surcharge loading from adjacent foundations, sloped backfill, or other relevant loads should be included in the retaining wall design. A one-third increase in the allowable soil bearing capacity may be assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a factor-of-safety of 1.5. With structural loading as expected, total settlement in the range of one inch and differential settlement of approximately one-half inch is anticipated. The majority of anticipated settlement should occur during construction, as dead loads are applied.

The retaining wall should be backfilled with an 18 inch zone free-draining material that extends along the back of the wall; suitable structural fill compacted in place to 95% may be utilized for backfill purposes elsewhere if feasible. Backfill placement should be evaluated by ESNW during construction.

Pipe Piles

Based on the results of our investigation and our understanding of the project, the proposed retaining wall should be supported on grouted pipe piles driven to refusal in dense native soil. Based on the soil conditions encountered during our fieldwork, we anticipate competent native soils that will provide adequate refusal will be encountered beginning at depths of about six feet bgs. Ultimately, however, pile lengths will be determined by final design grades and depths at which adequate refusal is achieved. As such, longer pile lengths may be required to achieve acceptable refusal criteria. In our opinion, the contractor should be prepared to drive piles in excess of 20 feet if site conditions require longer lengths to achieve refusal. Due to the encountered soil conditions, in our opinion, the pipe piles should consist of galvanized steel to reduce the potential for corrosion.

Where conventional installation machinery cannot access portions of the proposed building envelope, a 90-pound pneumatic jackhammer will likely be necessary for pipe pile installation. If utilized, the allowable axial load capacity listed below may be used for design:

- Pile diameter — 2 inches
- Load capacity — 3 tons*
- Refusal criteria — 60 seconds-per-inch
- Pneumatic hammer — 90 pounds

* *Including a factor-of-safety of at least 2.0*

With structural loading as expected, total settlement in the range of one-half inch and differential settlement of about one-quarter inch is anticipated. The majority of the settlements should occur during construction, as dead loads are applied. ESNW should evaluate the keyway of the proposed retaining wall during construction and prior to pipe pile installation. An ESNW representative should observe and document pile installation to confirm adequate refusal during pile installation.

Helical Tieback Anchors

Helical tieback anchor design will be prepared by a structural engineer specializing in the design of anchors. Anchors will be designed to resist lateral earth pressures and applicable surcharge loading. Tieback anchors will be installed at a batter of 20 degrees from horizontal. Helical plate sizing and number of plates will ultimately be dictated by the allowable design tension and compression load demands, as determined by the project structural engineer.

ESNW should have the opportunity to review final plans to confirm that our geotechnical recommendations have been incorporated. In our opinion, helical tieback anchors will be an adequate method to reinforce the proposed wall. ESNW can provide additional recommendations pertaining to wall reinforcement as project plans develop. ESNW should be retained to observe and document tieback anchor installation. Areas of unsuitable soil will require remedial measures, such as overexcavation to bearing conditions and replacement with suitable clean crushed rock, as recommended by ESNW.

Seismic Design Parameters

The 2015 International Building Code recognizes the American Society of Civil Engineers (ASCE) for seismic site class definitions. Based on the soil conditions encountered at the subject site, in accordance with Table 20.3-1 of the ASCE Minimum Design Loads for Buildings and Other Structures manual, Site Class D should be used for design.

Temporary Excavations and Permanent Slopes

Excavation activities are likely to expose very soft to stiff fill and/or stiff to very stiff native silt. Based on the soil conditions observed at the boring locations, the following allowable temporary slope inclinations, as a function of horizontal to vertical (H:V) inclination, may be used. The applicable Federal Occupation Safety and Health Administration (OSHA) and Washington Industrial Safety and Health Act (WISHA) soil classifications are also provided:

- Areas containing groundwater seepage — 1.5H:1V (Type C)
- Fills and native soil — 1.5H:1V (Type C)

Permanent slopes should be planted with vegetation to enhance stability and to minimize erosion and should maintain a gradient of 2H:1V or flatter. An ESNW representative should observe temporary and permanent slopes to confirm the slope inclinations are suitable for the exposed soil conditions and to provide additional excavation and slope recommendations, as necessary.

Structural Fill

Structural fill placed and compacted as backfill for the proposed retaining wall during site grading activities should meet the following specifications and guidelines:

• Structural fill material	Clean crushed rock or Imported granular soils*
• Moisture content	At or slightly above optimum**
• Relative compaction (minimum)	95 percent (Modified Proctor)
• Loose lift thickness (maximum)	12 inches

* *On-site soils should not be used as structural fill. Imported granular soils should contain less than 5 percent fines content.*

** *Soils shall not be placed dry of optimum moisture content and should be evaluated by ESNW during construction.*

Areas of unsuitable material and debris should be removed from structural areas and replaced with structural fill. Topsoil and organic-rich soil is neither suitable for foundation support nor for use as structural fill but may be used in non-structural areas, if desired.

Drainage

Zones of perched groundwater seepage should be anticipated in site excavations depending on the time of year grading operations take place. Temporary measures to control surface water runoff during construction would likely involve passive elements such as interceptor trenches and sumps. ESNW should be consulted during preliminary grading to identify areas of seepage and to provide recommendations to reduce the potential for instability related to seepage effects, if necessary.

In our opinion, the proposed retaining wall should include a drainage system. A perforated drainpipe should be placed along the base of the wall and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 3. If drainage is not provided, hydrostatic pressures should be included in the wall design. Weep holes may also be considered to discharge stormwater in a controlled fashion.

Limitations

The recommendations and conclusions provided in this letter are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is not expressed or implied. Variations in the soil and groundwater conditions observed at the boring locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this letter if variations are encountered.

Additional Services

ESNW should have an opportunity to review the final design with respect to the geotechnical recommendations provided in this letter. ESNW should also be retained to provide testing and consultation services during the earthwork phase of construction.

We appreciate the opportunity to be of service to you and trust this letter meets your current needs. Should you have questions, or require additional information, please call.

Sincerely,

EARTH SOLUTIONS NW, LLC

KYLE R. CAMPBELL
STATE OF WASHINGTON
27674
REGISTERED
PROFESSIONAL ENGINEER
10/3/19

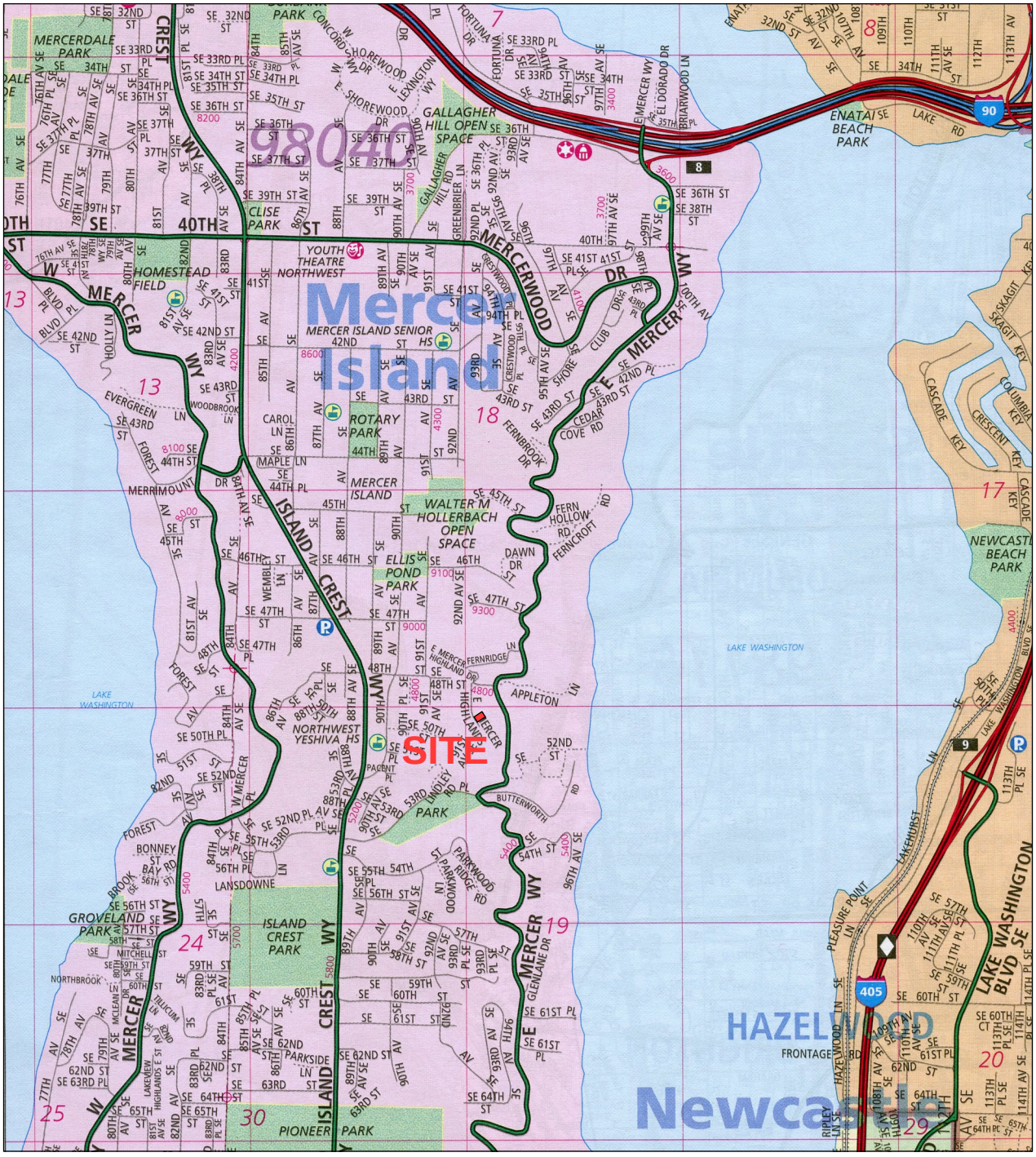
Bogdan S. Tirtu, G.I.T.
Senior Staff Geologist

Kyle R. Campbell, P.E.
Principal Engineer

Attachments: Plate 1 – Vicinity Map
Plate 2 – Hand Auger Boring Location Plan
Plate 3 – Retaining Wall Drainage Detail
Hand Auger Boring Logs
Grain Size Distribution

cc: SCJ Studio Landscape Architecture
Attention: Mr. Keith Jankovsky (Email only)

Swenson Say Faget
Attention: Mr. Blaze Bresko (Email only)



Reference:
King County, Washington
Map 596
By The Thomas Guide
Rand McNally
32nd Edition

NORTH

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
Bastawrous SFR Deck
Mercer Island, Washington

Drwn. MRS	Date 01/21/2019	Proj. No. 6510
Checked BST	Date Jan. 2019	Plate 1

LEGEND

HA-1 — Approximate Location of ESNW Hand Auger Boring, Proj. No. ES-6510, Jan. 2019

Subject Site

Existing Building

Proposed Concrete Wall

Proposed Deck

NORTH

1"=30'

0 15 30 60

Scale in Feet

NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

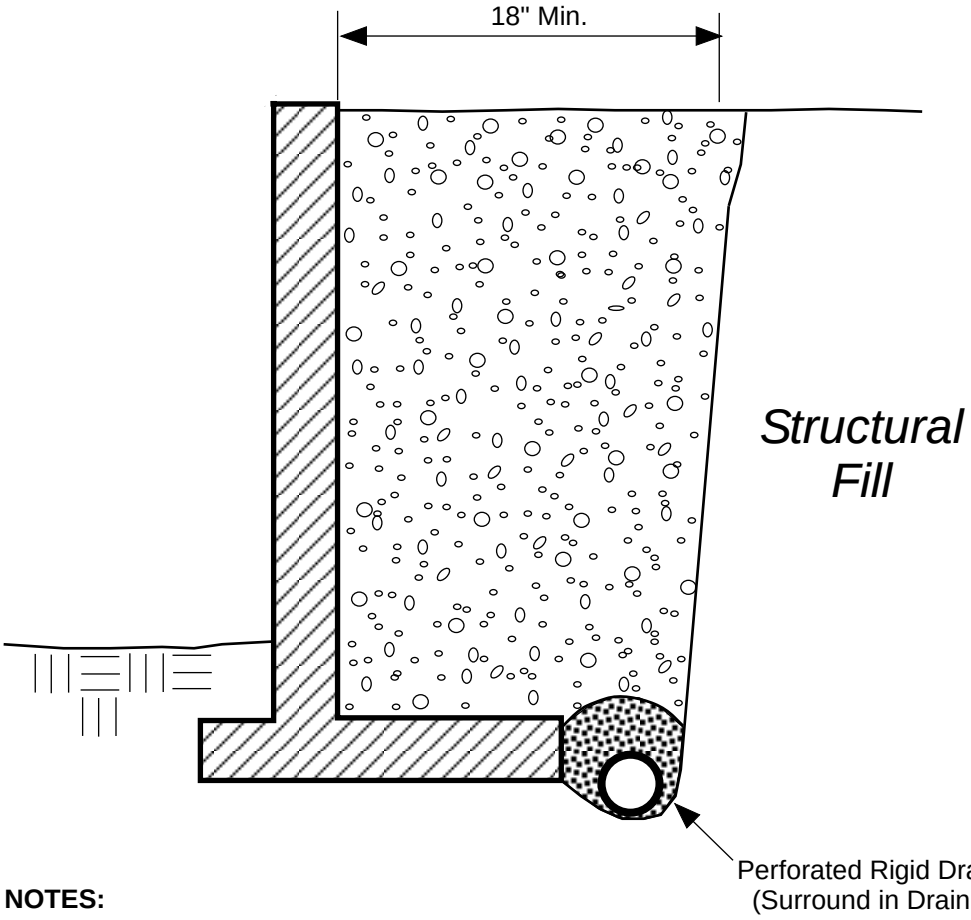
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Hand Auger Boring Location Plan
Bastawrous SFR Deck
Mercer Island, Washington

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Drwn. By	MRS
Checked By	BST
Date	01/18/2019
Proj. No.	6510
Plate	2



NOTES:

- Free-draining Backfill should consist of soil having less than 5 percent fines. Percent passing No. 4 sieve should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free-draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1-inch Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:

Free-draining Structural Backfill

1-inch Drain Rock

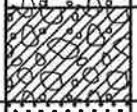
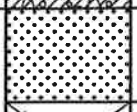
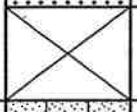
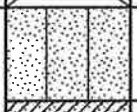
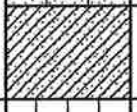
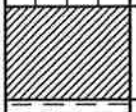
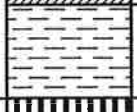
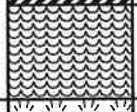
Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Retaining Wall Drainage Detail
Bastawrous SFR Deck
Mercer Island, Washington

Drwn. MRS	Date 01/21/2019	Proj. No. 6510
Checked BST	Date Jan. 2019	Plate 3

Earth Solutions NW LLC

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

DUAL SYMBOLS are used to indicate borderline soil classifications.

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.

Earth Solutions NW
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

BORING NUMBER HA-1

PROJECT NUMBER ES-6510 **PROJECT NAME** Bastawrous SFR Deck

DATE STARTED 1/10/19 **COMPLETED** 1/10/19 **GROUND ELEVATION** 483 ft **HOLE SIZE**

DRILLING CONTRACTOR ESNW Rep **GROUND WATER LEVELS:**

DRILLING METHOD Hand Auger **AT TIME OF DRILLING** ---

LOGGED BY BST **CHECKED BY** KDH **AT END OF DRILLING** ---

NOTES Surface Conditions: bare soil **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					Brown SILT with sand, very soft to soft, moist (Fill)
					-scattered burnt wood fragments
		MC = 20.90%	ML		
					-becomes medium stiff to stiff
		MC = 20.80% Fines = 75.10%		4.0	[USDA Classification: slightly gravelly LOAM] 479.0
					Hand auger boring terminated at 4.0 feet below existing grade. No groundwater encountered during excavation. No caving observed. Bottom of hole at 4.0 feet.

Earth Solutions NW
15365 N.E. 90th Street, Suite 100
Redmond, Washington 98052
Telephone: 425-449-4704
Fax: 425-449-4711

BORING NUMBER HA-2

PROJECT NUMBER ES-6510 **PROJECT NAME** Bastawrous SFR Deck

DATE STARTED 1/10/19 **COMPLETED** 1/10/19 **GROUND ELEVATION** 488 ft **HOLE SIZE**

DRILLING CONTRACTOR ESNW Rep **GROUND WATER LEVELS:**

DRILLING METHOD Hand Auger **AT TIME OF DRILLING** ---

LOGGED BY BST **CHECKED BY** KDH **AT END OF DRILLING** ---

NOTES Surface Conditions: bare soil **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0		MC = 25.10%	ML		Brown to gray SILT with sand, soft to medium stiff, moist (Fill) -brick fragment -scattered burnt wood fragments
					-becomes stiff
3.5					484.5
3.8		MC = 10.70%	ML		Gray SILT, stiff, damp
					484.3
					Hand auger boring terminated at 3.75 feet below existing grade due to root obstruction. No groundwater encountered during excavation. No caving observed. Bottom of hole at 3.8 feet.

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BORING NUMBER HA-3

PROJECT NUMBER ES-6510 **PROJECT NAME** Bastawrous SFR Deck

DATE STARTED 1/10/19 **COMPLETED** 1/10/19 **GROUND ELEVATION** 479 ft **HOLE SIZE**

DRILLING CONTRACTOR ESNW Rep **GROUND WATER LEVELS:**

DRILLING METHOD Hand Auger **AT TIME OF DRILLING** ---

LOGGED BY BST **CHECKED BY** KDH **AT END OF DRILLING** ---

NOTES Surface Conditions: brambles **AFTER DRILLING** ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					Brown SILT, medium stiff, moist (Fill)
		MC = 33.20%	ML		-scattered burnt wood fragments
		MC = 10.90% MC = 14.60% Fines = 92.20%			-becomes medium stiff to stiff, damp [USDA Classification: slightly gravelly LOAM]
3.5					475.5 Hand auger boring terminated at 3.5 feet below existing grade. No groundwater encountered during excavation. No caving observed. Bottom of hole at 3.5 feet.

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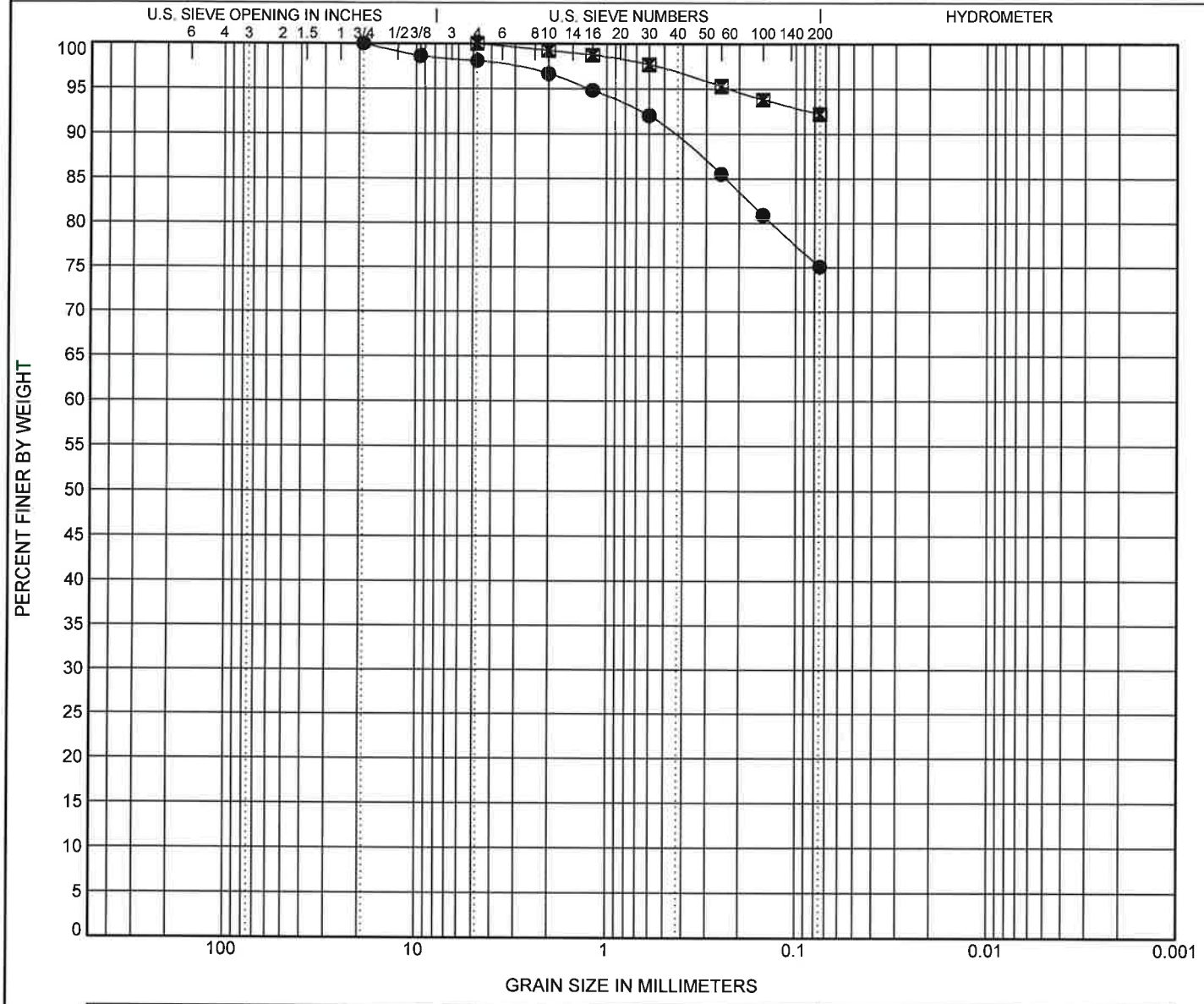
GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-6510 **PROJECT NAME** Bastowrous SFR Deck



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification	Cc	Cu
● HA-01	4.00ft.	**USDA: Brown Slightly Gravelly Loam. USCS: ML with Sand.**		
⊠ HA-03	3.50ft.	**USDA: Brown Slightly Gravelly Loam. USCS: ML.**		

Specimen Identification		D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
● HA-01	4.0ft.	19							75.1	
⊠ HA-03	3.5ft.	4.75							92.2	

GRAIN SIZE USDA ES-6510 PROPOSED DECK.GPJ GINT US LAB.GDT 1/14/19