



Geotechnical Engineering, Construction  
Observation/Testing and Environmental Services

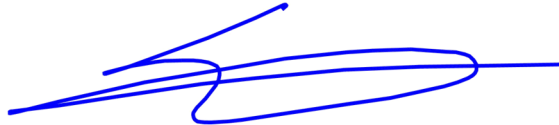
**GEOTECHNICAL ENGINEERING STUDY  
78<sup>TH</sup> AVENUE SOUTHEAST SINGLE-FAMILY RESIDENCE  
4115 – 78<sup>TH</sup> AVENUE SOUTHEAST  
MERCER ISLAND, WASHINGTON**

**ES-10099**

**15365 NE 90<sup>th</sup> Street, Suite 100 • Redmond, WA 98052 • (425) 449-4704  
3130 Varney Lane, Suite 105 • Pasco, WA 99301 • (509) 905-0275  
esnw.com**

**PREPARED FOR**  
**RKK CONSTRUCTION, INC.**

**November 15, 2024**



---

**Stephen H. Avril**  
**Project Manager**



11/15/2024

---

**Kyle R. Campbell, P.E.**  
**Senior Principal Engineer**

**GEOTECHNICAL ENGINEERING STUDY**  
**78<sup>TH</sup> AVENUE SOUTHEAST SINGLE-FAMILY RESIDENCE**  
**4115 – 78<sup>TH</sup> AVENUE SOUTHEAST**  
**MERCER ISLAND, WASHINGTON**

**ES-10099**

**Earth Solutions NW, LLC**  
**15365 NE 90<sup>th</sup> Street, Suite 100 • Redmond, WA 98052 • (425) 449-4704**  
**3130 Varney Lane, Suite 105 • Pasco, WA 99301 • (509) 905-0275**  
**esnw.com**

# Important Information about This

# Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

**The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.**

## Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

## Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer

will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

## Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

## You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

### Most of the “Findings” Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site’s subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

### This Report’s Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

### This Report Could Be Misinterpreted

Other design professionals’ misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals’ plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

### Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note*

*conspicuously that you’ve included the material for information purposes only.* To avoid misunderstanding, you may also want to note that “informational purposes” means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

### Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled “limitations,” many of these provisions indicate where geotechnical engineers’ responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

### Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a “phase-one” or “phase-two” environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

### Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer’s services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, *proper implementation of the geotechnical engineer’s recommendations will not of itself be sufficient to prevent moisture infiltration.* **Confront the risk of moisture infiltration** by including building-envelope or mold specialists on the design team. **Geotechnical engineers are not building-envelope or mold specialists.**



Telephone: 301/565-2733  
e-mail: [info@geoprofessional.org](mailto:info@geoprofessional.org) [www.geoprofessional.org](http://www.geoprofessional.org)



November 15, 2024  
ES-10099

RKK Construction, Inc.  
3056 – 70<sup>th</sup> Avenue Southeast  
Mercer Island, Washington 98040

## Earth Solutions NW LLC

Geotechnical Engineering, Construction  
Observation/Testing and Environmental Services

Attention: Jason Koehler

Greetings:

Earth Solutions NW, LLC (ESNW) is pleased to present this geotechnical engineering study to support the proposed residential construction at the subject address. Based on the results of our investigation, the proposed project is feasible from a geotechnical standpoint. The site is underlain by glacial till based on our subsurface exploration (September 26, 2024).

The site will be graded to create a building pad following site clearing. After completing earthwork activities in accordance with recommendations in this report, the proposed structure can be supported on conventional spread and continuous foundations bearing on undisturbed, competent native soil, re-compacted existing fill, or new structural fill. If structural building pads are disturbed during wet weather, remediation measures such as cement treatment or overexcavation and replacement with rock may be necessary in some areas.

From a geotechnical standpoint, infiltration on the subject site should be considered infeasible in most areas of the site due to the glacial till which presents an impervious layer in the subsurface. However, infiltration may be feasible where sands are present such as at test location TP-3 at depths below four feet. Further exploration will be necessary in these areas to determine the limits of the sands and if there is adequate vertical separation from a confining layer of soil or groundwater. There are steep slopes on the site which could be adversely affected by lateral migration of subsurface water, and ESNW must be allowed the opportunity to evaluate the feasibility of infiltration for the project. Additionally, if infiltration is to be pursued, ESNW recommends in-situ infiltration testing be performed to determine a design infiltration rate for the subject site.

Pertinent geotechnical recommendations are provided in this study. We appreciate the opportunity to be of service to you on this project. If you have any questions regarding the content of this geotechnical engineering study, please contact us.

Sincerely,

**EARTH SOLUTIONS NW, LLC**

Stephen H. Avril  
Project Manager

## Table of Contents

ES-10099

	<u>PAGE</u>
<b><u>INTRODUCTION</u></b> .....	1
<u>General</u> .....	1
<u>Project Description</u> .....	1
<b><u>SITE CONDITIONS</u></b> .....	2
<u>Surface</u> .....	2
<u>Subsurface</u> .....	2
Topsoil .....	2
Fill .....	2
Native Soil .....	3
Geologic Setting .....	3
Groundwater .....	3
<b><u>GEOLOGIC HAZARD AREAS EVALUATION</u></b> .....	3
<b><u>DISCUSSION AND RECOMMENDATIONS</u></b> .....	4
<u>General</u> .....	4
<u>Site Preparation and Earthwork</u> .....	4
Temporary Erosion Control .....	5
Stripping .....	5
Excavations and Slopes .....	6
In-situ and Imported Soil .....	6
Structural Fill .....	7
<u>Foundations</u> .....	7
<u>Seismic Design</u> .....	8
Liquefaction .....	9
<u>Slab-on-Grade Floors</u> .....	9
<u>Retaining Walls</u> .....	9
<u>Drainage</u> .....	10
Preliminary Infiltration Evaluation .....	10
<u>Preliminary Pavement Sections</u> .....	11
<u>Utility Support and Trench Backfill</u> .....	12
<b><u>LIMITATIONS</u></b> .....	12
<u>Additional Services</u> .....	12
<b><u>REFERENCES</u></b> .....	12

## **Table of Contents**

**Cont'd**

**ES-10099**

### **GRAPHICS**

<b>Plate 1</b>	<b>Vicinity Map</b>
<b>Plate 2</b>	<b>Test Pit Location Plan</b>
<b>Plate 3</b>	<b>Retaining Wall Drainage Detail</b>
<b>Plate 4</b>	<b>Footing Drain Detail</b>

### **APPENDICES**

<b>Appendix A</b>	<b>Subsurface Exploration Logs</b>
<b>Appendix B</b>	<b>Laboratory Test Results</b>
<b>Appendix C</b>	<b>Photos and Site Plan</b>

**GEOTECHNICAL ENGINEERING STUDY  
78<sup>TH</sup> AVENUE SOUTHEAST SINGLE-FAMILY RESIDENCE  
4115 – 78<sup>TH</sup> AVENUE SOUTHEAST  
MERCER ISLAND, WASHINGTON**

**ES-10099**

**INTRODUCTION**

**General**

This geotechnical engineering study (study) was prepared for the proposed residential development to be constructed at 4115 – 78<sup>th</sup> Avenue Southeast in Mercer Island, Washington. The purpose of this study was to develop geotechnical recommendations for the project. The following tasks were completed as part of our scope of services for this project:

- Excavation, logging, and sampling of test pits to characterize soil and groundwater conditions.
- Laboratory testing of soil samples collected at the test locations.
- Engineering analyses and recommendations for the proposed development.
- Preparation of this report.

**Project Description**

The proposed project consists of development of the existing non-developed parcel with construction of a single-family residence. Infiltration is being investigated to aid in stormwater mitigation of new impervious surfaces; and ESNW has provided a preliminary infiltration opinion based on observations of the geologic and surface conditions on and around the subject site.

Based on our experience with similar projects, we anticipate cuts and fills of up to five feet will be necessary to achieve the proposed finish grade elevations for driveway and building footprint based on the gently sloped nature of the site where grades descend towards the south. Block retaining walls and rockeries can be utilized to facilitate grade changes where necessary. ESNW can provide retaining wall and rockery designs upon request.

Based on our experience with similar projects, the proposed residential structure is anticipated to be two to three stories in height and constructed utilizing relatively lightly loaded wood framing supported on conventional foundations. Perimeter footing loads are anticipated be 1 to 2 kips per linear foot, isolated footing loads will be less than 20 kips, and we anticipate slab-on-grade loading of 150 pounds per square foot (psf).

If the above design assumptions either change or are incorrect, ESNW should be contacted to review the recommendations provided in this report. ESNW should review final designs to confirm that our geotechnical recommendations have been incorporated into the plans.

## **SITE CONDITIONS**

### **Surface**

The subject site is located on the southwest corner of the intersection between West Mercer Way and 78<sup>th</sup> Avenue Southeast in Mercer Island, Washington (parcel number 3623500210). The site is currently undeveloped. The site is vegetated with trees and undergrowth typical of the area.

### **Subsurface**

An ESNW representative observed, logged, and sampled a series of three test pits in September of 2024. The test pits were excavated at accessible site locations using a limited-access, client-provided excavator and operator. The subsurface exploration was completed to evaluate soil conditions, classify site soils, perform an infiltration investigation based on subsurface observations, and characterize groundwater conditions within the proposed development area. The maximum exploration depth was six feet below the existing ground surface (bgs) due to the limitations of a smaller excavator. The approximate locations of the explorations are depicted on Plate 2 (Test Pit Location Plan). Please refer to the logs provided in Appendix A for a more detailed description of subsurface conditions. Representative soil samples collected at the exploration locations were analyzed in general accordance with both Unified Soil Classification System (USCS) and United States Department of Agriculture (USDA) methods and procedures.

### **Topsoil**

Topsoil was observed at the test locations, and was observed in thicknesses up to 12 inches. Topsoil is characterized by its dark brown color, the presence of fine organic material, and small root intrusions. ESNW anticipates topsoil to be present on the site, however, and will typically be encountered in areas where limited to no past grading has taken place.

### **Fill**

Fill was not encountered during the site exploration. The client should anticipate some fill may be encountered adjacent to road and potential utility alignments.

## **Native Soil**

Underlying the topsoil, native soils encountered at the test locations were observed to be medium dense grading to dense silty sand with gravel (Unified Soil Classification, SM) and poorly graded sand with gravel (SP). These soils are consistent with the typical makeup of glacial till with the exception of the poorly graded sand with gravel which could represent the advance outwash layer typically observed below a till cap in glacial depositional environments. ESNW was unable to explore deeper to determine the thickness of the outwash sands due to the limits of the excavation equipment provided by the client. Density was observed to increase with depth. In general, the native soil was generally encountered in a moist condition during the time of exploration.

## **Geologic Setting**

Geologic mapping identifies Younger gravel deposits (Qyg) with glacial till (Qt) mapped nearby.

The referenced Web Soil Survey (WSS) identifies Kitsap silt loam (KpC) 2 to 8 percent slopes as the primary unit underlying the subject site, with Arents, Alderwood (AmC) 6 to 15 percent slopes mapped for northwest portion of the subject site. Kitsap series of soils consist of lacustrine deposits. Whereas Arents Alderwood soils are typified by glacial till. Based on our field observations, on-site native soils are representative primarily of till deposits rather than lacustrine, with advance outwash encountered at four feet in depth at test location TP-3.

## **Groundwater**

Groundwater seepage was not observed at the test locations. Groundwater seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. Groundwater seepage flow rates are typically higher during the winter, spring, and early summer months. Therefore, perched groundwater seepage at the contact with the unweathered till should be expected in site excavations, particularly if excavations are made in winter, spring, and early summer months.

## **GEOLOGIC HAZARD AREAS EVALUATION**

A review of the City of Mercer Island information was completed to evaluate whether geologically hazardous areas are present within the subject site. The city provides geologic hazard information based on-line in the form of maps. Based on a review of the site conditions, mapping, and site exploration, the subject site is mapped within geologic hazard area consisting of an erosion hazard (known or suspect) with slopes of 15 to 39 percent, and landslide hazard area (known or suspect) with slopes 15 percent and higher (Slope Class ix and v). Additionally, the site is mapped within a seismic hazard area (known or suspect) with a scarp mapped as terminating just to the northwest of the subject site.

Based on ESNW observation of the subsurface conditions consisting of glacial till, the site possesses a very low erosion and liquefaction risk. Glacial till is glacially consolidated and presents a very dense and stable state. In regards to erosion hazards, where disturbance is planned on the site, best management practices (BMP) must be utilized, and should consist of silt fencing, site grading which limits surface water from flowing towards and over slopes, and interceptor trenches where necessary.

Final site plans including grading plans with topography were not available at the time of this report production, and the client wishes to address landslide hazards at a later date should it be necessary after site grades are planned to be altered, which could reduce slope inclination and overall relief to where landslide hazards are no longer present. ESNW can provide slope stability analysis following the finalizing of grading plans.

ESNW has addressed the liquefaction hazard potential within the Seismic Design section of this study.

## **DISCUSSION AND RECOMMENDATIONS**

### **General**

Based on the results of our investigation, construction of the proposed residential development is feasible from a geotechnical standpoint. The primary geotechnical considerations associated with the proposed development include site grading, stormwater control, and the suitability of using on-site soils as structural fill.

After completing earthwork activities in accordance with recommendations in this report, the proposed structure(s) can be supported on conventional spread and continuous foundations bearing on undisturbed, competent native soil, re-compacted native soil, re-compacted existing fill or new structural fill. If structural building pads are disturbed during wet weather, remediation measures such as cement treatment or overexcavation and replacement with rock may be necessary in some areas. COMI should be consulted prior to cement usage on the project for moisture conditioning.

From a geotechnical standpoint, infiltration on the subject site should be considered infeasible based on the presence of the glacial till on the subject site. Glacial till represents a confining layer of soil which retards stormwater infiltration.

### **Site Preparation and Earthwork**

Initial site preparation activities will consist of installing temporary erosion control measures, establishing grading limits, and site clearing and stripping activities. Subsequent earthwork activities will involve mass site grading and installation of infrastructure and stormwater management improvements.

## **Temporary Erosion Control**

The following temporary erosion and sediment control (TESC) BMPs are offered:

- Temporary construction entrances and drive lanes, consisting of at least six inches of quarry spalls, should be considered to both minimize off-site soil tracking and provide a stable access entrance surface. Placing geotextile fabric underneath the quarry spalls will provide greater stability, if needed.
- Silt fencing should be placed around the construction site perimeter.
- When not in use, soil stockpiles should be covered or otherwise protected.
- Temporary measures for controlling surface water runoff, such as interceptor trenches, sumps, or swales, should be installed prior to beginning earthwork activities.
- Dry soils disturbed during construction should be wetted to minimize dust and airborne soil erosion.
- When appropriate, permanent planting or hydroseeding will help to stabilize on-site soil.

Additional TESC BMPs, as specified by the project civil engineer and indicated on the plans, should be incorporated into construction activities. TESC BMPs may be modified during construction as site conditions require and as approved by the site erosion control lead.

## **Stripping**

Topsoil will be encountered within the upper foot on the subject site. Topsoil is not suitable for load bearing, and should be removed where encountered within building footprints and other structural areas to be developed. Topsoil is not suitable for use as structural fill material, but may be considered for placement in landscape zones of the site. Particularly where water quality treatment is required by the city. Root intrusions generally extend below the topsoil into the upper weathered soil. The organic-rich topsoil should be stripped and segregated into a stockpile for later use on site or to haul off site. The material remaining immediately below the topsoil may have some root zones and will likely be variable in composition, density, and/or moisture content. The material exposed after initial topsoil stripping will likely be suitable for direct structural support as is but will need to be evaluated during construction for load-bearing capacities as it is exposed. ESNW should observe initial stripping activities to provide recommendations regarding stripping depths and material suitability.

## Excavations and Slopes

Excavation activities on site are likely to expose medium dense to dense native soil. Based on the soil conditions observed at the test locations, the following maximum allowable temporary slope inclinations may be used. The applicable Federal Occupation Safety and Health Administration and Washington Industrial Safety and Health Act soil classifications are also provided:

- Areas exposing groundwater seepage or fill 1.5H:1V (Type C)
- Loose soil 1.5H:1V (Type C)
- Medium dense soil 1H:1V (Type B)
- Dense unweathered till 0.75H:1V (Type A)

Permanent slopes should be planted with vegetation to both enhance stability and minimize erosion and should maintain a gradient of 2H:1V or flatter. The presence of perched groundwater may cause localized sloughing of temporary slopes. 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.

Care must be taken when considering the placement of any structures on the site requiring temporary excavations. ESNW recommends excavations not extend into an area where the roadway or other neighboring structures will be creating a surcharge on the excavation walls. If the recommended temporary slope inclinations cannot be achieved, temporary shoring may be necessary to support excavations.

## In-situ and Imported Soil

The on-site till soil is moisture sensitive, and successful use of the on-site soil as structural fill will largely be dictated by the moisture content at the time of placement and compaction. Remedial measures may be necessary as part of site grading and earthwork activities. Remedial measures would include aeration or cement modification of the site soils in order to moisture-condition the targeted soils for use as structural fill. If the on-site soil cannot be successfully compacted in its natural moisture or through moisture conditioning, the use of an imported soil may be necessary. In our opinion, a contingency should be provided in the project budget for the export of soil that cannot be successfully compacted as structural fill, particularly if grading activities take place during periods of rainfall. In general, soils with appreciable fines contents (greater than 5 percent) typically degrade rapidly when exposed to periods of rainfall.



Provided the structures will be supported as described above, the following parameters may be used for design of the new foundations:

- Allowable soil bearing capacity 2,500 psf
- Passive earth pressure 300 pcf
- Coefficient of friction 0.40

A one-third increase in the allowable soil bearing capacity may be assumed for short-term wind and seismic loading conditions. The passive earth pressure and coefficient of friction values include a safety factor of 1.5. With structural loading as expected, total settlement in the range of one inch is anticipated, with differential settlement of about one-half inch. Most of the anticipated settlement should occur during construction as dead loads are applied.

**Seismic Design**

The 2018 International Building Code (2018 IBC) recognizes the most recent edition of the Minimum Design Loads for Buildings and Other Structures manual (ASCE 7-16) for seismic design, specifically with respect to earthquake loads. Based on the soil conditions encountered at the test pit and boring locations, the parameters and values provided below are recommended for seismic design per the 2018 IBC.

<b>Parameter</b>	<b>Value</b>
Site Class	D*
Mapped short period spectral response acceleration, $S_s (g)$	1.42
Mapped 1-second period spectral response acceleration, $S_1 (g)$	0.49
Short period site coefficient, $F_a$	1.00
Long period site coefficient, $F_v$	1.95
Adjusted short period spectral response acceleration, $S_{MS} (g)$	1.42
Adjusted 1-second period spectral response acceleration, $S_{M1} (g)$	0.96
Design short period spectral response acceleration, $S_{DS} (g)$	0.95
Design 1-second period spectral response acceleration, $S_{D1} (g)$	0.64

\* Assumes dense soil conditions, encountered to a maximum depth of six feet bgs during the field exploration, remain dense to at least 100 feet bgs. Based on our experience with the project geologic setting (glacial till) across the Puget Sound region, soil conditions are likely consistent with this assumption.

## **Liquefaction**

Liquefaction is a phenomenon that can occur within a soil profile as a result of an intense ground shaking or loading condition. Most commonly, liquefaction is caused by ground shaking during an earthquake. Sand or silt soil profiles that are loose, cohesionless, and present below the groundwater table are most susceptible to liquefaction. During the ground shaking, the soil contracts, and porewater pressure increases. The increased porewater pressure occurs quickly and without sufficient time to dissipate, resulting in water flowing upward to the ground surface and a liquefied soil condition. Soil in a liquefied condition possesses very little shear strength in comparison to the drained condition, which can result in a loss of foundation support for structures.

In our opinion, the liquefaction potential for the site should be considered negligible to low. The relative density of the soil underlying the site is the primary basis for this opinion.

## **Slab-on-Grade Floors**

Slab-on-grade floors for the proposed structures should be supported on firm and unyielding subgrades. Unstable or yielding subgrade areas should be recompacted or overexcavated and replaced with suitable structural fill prior to slab construction.

A capillary break consisting of a minimum of four inches of free-draining crushed rock or gravel should be placed below each slab. The free-draining material should have a fines content of 5 percent or less (percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction). In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. If a vapor barrier is to be utilized, it should be a material specifically designed for use as a vapor barrier and should be installed per manufacturer specifications.

## **Retaining Walls**

Retaining walls must be designed to resist earth pressures and applicable surcharge loads. Retaining wall subgrade must be prepared in the same fashion as is recommended within the "Foundations" section of this report. The following parameters may be used for design:

- Active earth pressure (unrestrained condition)                      35 pcf (equivalent fluid)
- At-rest earth pressure (restrained condition)                              55 pcf
- Traffic surcharge\* (passenger vehicles)                                      70 psf (rectangular distribution)
- Passive earth pressure    300 pcf (equivalent fluid)
- Coefficient of friction    0.40
- Seismic surcharge    8H psf\*\*
- Allowable soil bearing capacity    2,500 psf

\* Where applicable.

\*\* Where H equals the retained height (in feet).

The above passive earth pressure and coefficient of friction values include a safety factor of 1.5 and are based on a level backfill condition and level grade at the wall toe. Revised design values will be necessary if sloping grades are to be used above or below retaining walls. Additional surcharge loading from adjacent foundations, sloped backfill, or other relevant loads should be included in the retaining wall design.

Retaining walls should be backfilled with free-draining material that extends along with the height of the wall and a distance of at least 18 inches behind the wall. The upper 12 inches of the wall backfill may consist of less permeable soil if desired. A sheet drain may be considered instead of free-draining backfill. 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.

### **Drainage**

Based on our field observations, groundwater seepage should be anticipated within site excavations. Temporary measures to control surface water runoff and groundwater seepage during construction will be critical to minimizing the potential for on-site soils to degrade. ESNW should be consulted during preliminary grading to identify areas of seepage and provide recommendations to reduce the potential for seepage-related instability.

Finish grades must be designed to direct surface drain water away from structures and slopes. Water must not be allowed to pond adjacent to structures or slopes. Grades adjacent to buildings should be sloped away from the buildings at a gradient of either at least 2 percent for a horizontal distance of 10 feet or the maximum allowed by adjacent structures and right-of-ways. In our opinion, foundation drains should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 4. If footing drains are omitted, there is a higher potential for moisture issues for slabs-on-grade or crawl space areas.

If construction will incorporate crawl spaces rather than slab-on-grade, in our opinion, a crawl space drain system can be used in lieu of perimeter footing drains. The crawl space drain must provide positive drainage to an appropriate outlet.

### **Preliminary Infiltration Evaluation**

As indicated in the *Subsurface* section of this report, the native soil encountered during our fieldwork was primarily characterized as glacial till. Per our scope of services, infiltration testing was not included in the fieldwork, but ESNW has provided an infiltration opinion based on the observation of the subsurface conditions and experience on sites underlain by similar geology.

From a geotechnical standpoint, stormwater infiltration on the subject site should be considered infeasible in areas where glacial till is present. Glacial till represents a confining layer of soil in regards to infiltration. Infiltration may be feasible where sands are present such as at test location TP-3 at depths below four feet. Further exploration will be necessary in these areas to determine the limits of the sands and if there is adequate vertical separation from a confining layer of soil or groundwater. There are steep slopes on the site which could be adversely affected by lateral migration of subsurface water, and ESNW must be allowed the opportunity to evaluate the feasibility of infiltration for the project. Additionally, if infiltration is to be pursued, ESNW recommends in-situ infiltration testing be performed to determine a design infiltration rate for the subject site.

### **Preliminary Pavement Sections**

The performance of site pavements is largely related to the condition of the underlying subgrade. To ensure adequate pavement performance, the subgrade should be in a firm and unyielding condition when subjected to proof rolling with a loaded dump truck. Structural fill in pavement areas should be compacted to the specifications previously detailed in this report. Soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas containing unsuitable or yielding subgrade conditions will require remedial measures, such as overexcavation and/or placement of thicker crushed rock or structural fill sections, prior to pavement.

We anticipate new pavement sections will be subjected primarily to passenger vehicle traffic. For lightly loaded pavement areas subjected primarily to passenger vehicles, the following preliminary pavement sections may be considered:

- A minimum of two inches of hot-mix asphalt (HMA) placed over four inches of crushed rock base (CRB).
- A minimum of two inches of HMA placed over three inches of asphalt-treated base (ATB).

The HMA, ATB, and CRB materials should conform to WSDOT and/or the City of Mercer Island specifications. All soil base material should be compacted to a relative compaction of 95 percent, based on the laboratory maximum dry density as determined by ASTM D1557. Final pavement design recommendations, including recommendations for heavy traffic areas, access roads, and frontage improvement areas, can be provided once final traffic loading has been determined. Road standards utilized by the county may supersede the recommendations provided in this report.

If an inverted crown will be used for paved surfaces, drainage measures should be included in the design to drain water in the subgrade adjacent to catch basins. Such measures can consist of finger drains extending from the catch basins.

### **Utility Support and Trench Backfill**

In our opinion, the on-site native soil will generally be suitable for support of utilities, however, existing fill may be unsuitable in its current condition, if encountered. Remedial measures may be necessary in some areas to provide support for utilities, such as overexcavation and replacement with structural fill or placement of geotextile fabric. Groundwater seepage may be encountered within utility excavations, and caving of trench walls may occur where groundwater or unsuitable fill are encountered. Depending on the time of year and conditions encountered, dewatering or temporary trench shoring may be necessary during utility excavation and installation.

The on-site soil may not be suitable for use as structural backfill throughout utility trench excavations unless the soil is at (or slightly above) the optimum moisture content at the time of placement and compaction. Moisture conditioning of the soil may be necessary at some locations prior to use as structural fill. Each section of the utility lines must be adequately supported in the bedding material. Utility trench backfill should be placed and compacted to the structural fill specifications previously detailed in this report or to the applicable specifications of the presiding jurisdiction.

### **LIMITATIONS**

This study has been prepared for the exclusive use of RKK Construction Inc., and their representatives. The recommendations and conclusions provided in this study 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. No warranty, express or implied, is made. Variations in the subsurface conditions observed at the test locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this study 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 report. ESNW should also be retained to provide testing and consultation services during construction.

### **REFERENCES**

The following documents were reviewed as part of the preparation of this study:


- City of Mercer Island municipal code and critical areas maps
- Preliminary Geologic Map of Seattle and Vicinity, Washington, prepared by Waldron et al., dated 1962
- WSS, provided by the USDA, Natural Resources Conservation Service



Reference:  
King County, Washington  
OpenStreetMap.org



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.

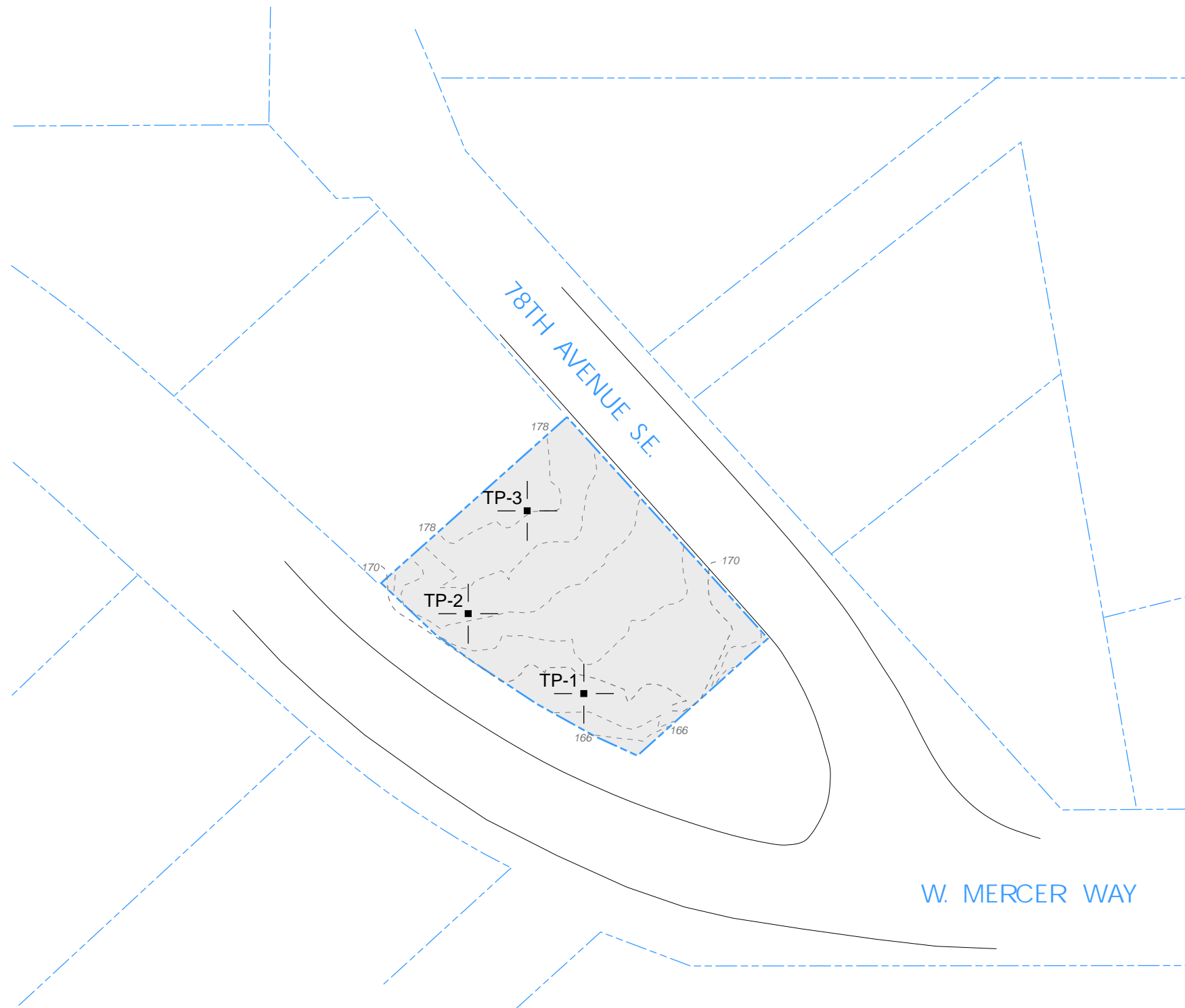


**Earth Solutions NW LLC**

Geotechnical Engineering, Construction  
Observation/Testing and Environmental Services

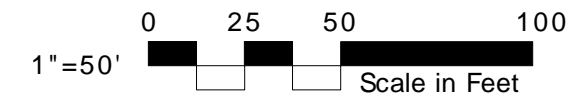
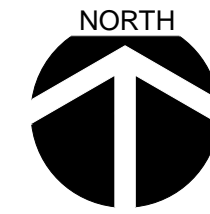
Vicinity Map  
78th Avenue S.E. SFR  
Mercer Island, Washington

Drawn MRS	Date 10/15/2024	Proj. No. 10099
Checked SHA	Date Oct. 2024	Plate 1



**LEGEND**

- TP-1 | ■ | Approximate Location of ESNW Test Pit, Proj. No. ES-10099, Sept. 2024
- ▭ | Subject Site



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.

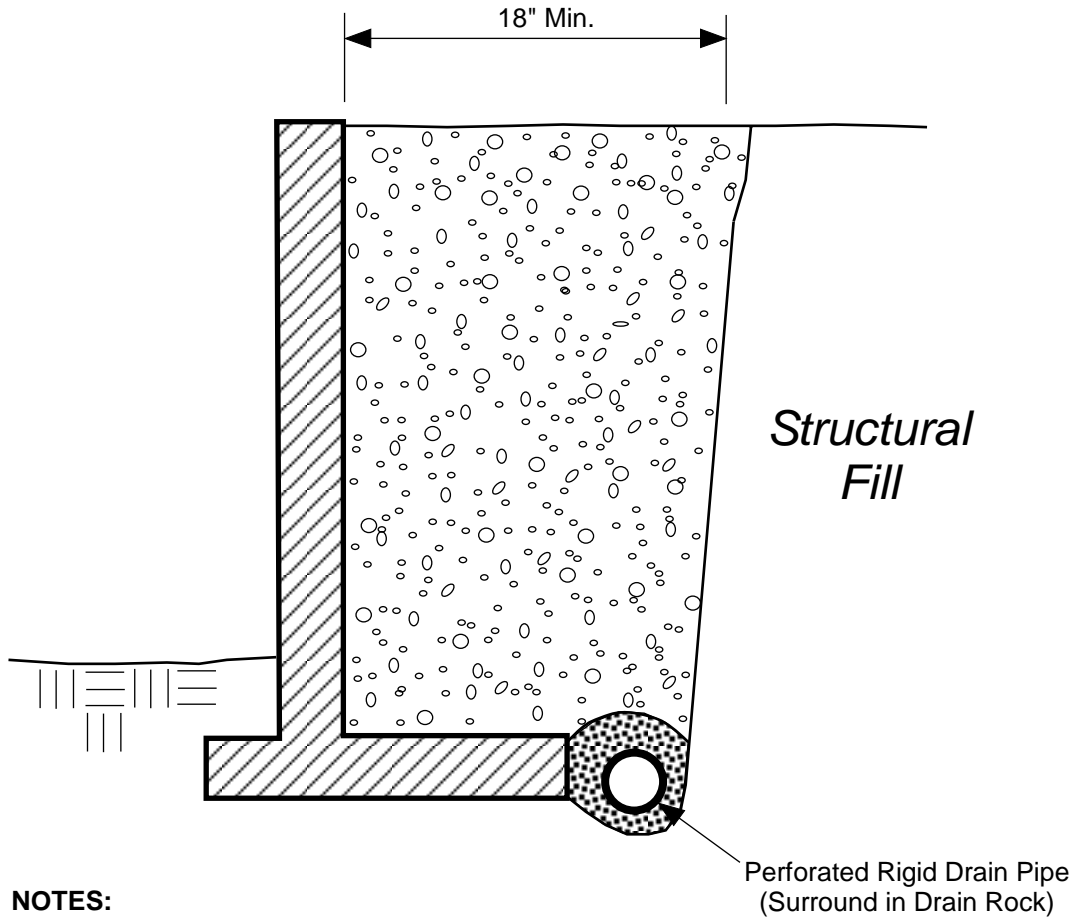
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Test Pit Location Plan  
78th Avenue S.E. SFR  
Mercer Island, Washington

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



Drawn MRS
Checked SHA
Date 10/15/2024
Proj. No. 10099
Plate 2

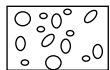


**NOTES:**

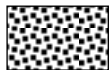
- Free-draining Backfill should consist of soil having less than 5 percent fines. Percent passing No. 4 sieve should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free-draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with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

SCHEMATIC ONLY - NOT TO SCALE  
NOT A CONSTRUCTION DRAWING

**LEGEND:**

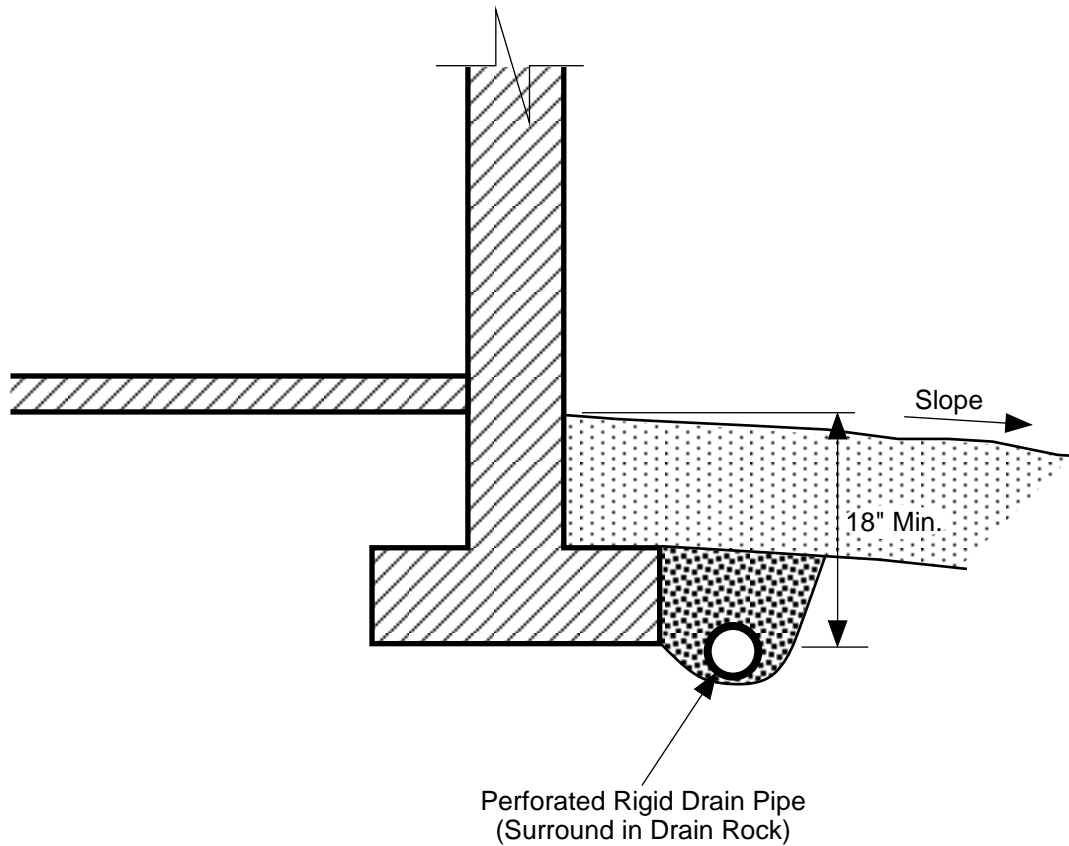


Free-draining Structural Backfill



1-inch Drain Rock

		<b>Earth Solutions NW<sub>LLC</sub></b> Geotechnical Engineering, Construction Observation/Testing and Environmental Services	
<b>Retaining Wall Drainage Detail</b> 78th Avenue S.E. SFR Mercer Island, Washington			
Drawn CAM	Date 11/15/2024	Proj. No.	10099
Checked SHA	Date Nov. 2024	Plate	3

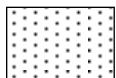


**NOTES:**

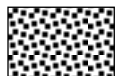
- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

SCHMATIC ONLY - NOT TO SCALE  
NOT A CONSTRUCTION DRAWING

**LEGEND:**



Surface Seal: native soil or other low-permeability material.



1-inch Drain Rock

	<b>Earth Solutions NW<sub>LLC</sub></b> Geotechnical Engineering, Construction Observation/Testing and Environmental Services	
	<b>Footing Drain Detail</b> 78th Avenue S.E. SFR Mercer Island, Washington	
Drawn CAM	Date 11/15/2024	Proj. No. 10099
Checked SHA	Date Nov. 2024	Plate 4

## **Appendix A**

### **Subsurface Exploration Logs**

#### **ES-10099**

Subsurface conditions at the subject site were explored in September 2024. A total of three test pits were excavated using a drill rig and operator contracted by the ESNW. The approximate locations of the explorations are illustrated on Plate 2 of this study. The test logs are provided in this Appendix. The maximum exploration depth was six feet bgs.

The final logs represent the interpretations of the field logs and the results of laboratory analyses. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

Coarse-Grained Soils - More Than 50% Retained on No. 200 Sieve		Moisture Content		Symbols	
Gravels - More Than 50% of Coarse Fraction Retained on No. 4 Sieve		<b>GW</b>	Well-graded gravel with or without sand, little to no fines	Dry - Absence of moisture, dusty, dry to the touch	
		<b>GP</b>	Poorly graded gravel with or without sand, little to no fines	Damp - Perceptible moisture, likely below optimum MC	
		<b>GM</b>	Silty gravel with or without sand	Moist - Damp but no visible water, likely at/near optimum MC	
		<b>GC</b>	Clayey gravel with or without sand	Wet - Water visible but not free draining, likely above optimum MC	
Sands - 50% or More of Coarse Fraction Passes No. 4 Sieve		<b>SW</b>	Well-graded sand with or without gravel, little to no fines	Saturated/Water Bearing - Visible free water, typically below groundwater table	
		<b>SP</b>	Poorly graded sand with or without gravel, little to no fines		
		<b>SM</b>	Silty sand with or without gravel		
		<b>SC</b>	Clayey sand with or without gravel		
Fine-Grained Soils - 50% or More Passes No. 200 Sieve		Terms Describing Relative Density and Consistency			
Silt and Clays Liquid Limit Less Than 50		<b>ML</b>	Silt with or without sand or gravel; sandy or gravelly silt	<b>Coarse-Grained Soils:</b> <u>Density</u> <u>SPT blows/foot</u> Very Loose                      < 4 Loose                              4 to 9 Medium Dense                    10 to 29 Dense                                30 to 49 Very Dense                        ≥ 50	
		<b>CL</b>	Clay of low to medium plasticity; lean clay with or without sand or gravel; sandy or gravelly lean clay	<b>Fine-Grained Soils:</b> <u>Consistency</u> <u>SPT blows/foot</u> Very Soft                              < 2 Soft                                        2 to 3 Medium Stiff                        4 to 7 Stiff                                        8 to 14 Very Stiff                              15 to 29 Hard                                        ≥ 30	
		<b>OL</b>	Organic clay or silt of low plasticity	<b>Test Symbols &amp; Units</b> Fines = Fines Content (%) MC = Moisture Content (%) DD = Dry Density (pcf) Str = Shear Strength (tsf) PID = Photoionization Detector (ppm) OC = Organic Content (%) CEC = Cation Exchange Capacity (meq/100 g) LL = Liquid Limit (%) PL = Plastic Limit (%) PI = Plasticity Index (%)	
		<b>MH</b>	Elastic silt with or without sand or gravel; sandy or gravelly elastic silt		
Silt and Clays Liquid Limit 50 or More		<b>CH</b>	Clay of high plasticity; fat clay with or without sand or gravel; sandy or gravelly fat clay	<b>Component Definitions</b> <u>Descriptive Term</u> <u>Size Range and Sieve Number</u> Boulders                                      Larger than 12" Cobbles                                        3" to 12" Gravel                                        3" to No. 4 (4.75 mm) Coarse Gravel                        3" to 3/4" Fine Gravel                              3/4" to No. 4 (4.75 mm) Sand                                        No. 4 (4.75 mm) to No. 200 (0.075 mm) Coarse Sand                            No. 4 (4.75 mm) to No. 10 (2.00 mm) Medium Sand                            No. 10 (2.00 mm) to No. 40 (0.425 mm) Fine Sand                                No. 40 (0.425 mm) to No. 200 (0.075 mm) Silt and Clay                                Smaller than No. 200 (0.075 mm)	
		<b>OH</b>	Organic clay or silt of medium to high plasticity		
Highly Organic Soils		<b>PT</b>	Peat, muck, and other highly organic soils	<b>Modifier Definitions</b> <u>Percentage by Weight (Approx.)</u> <u>Modifier</u> < 5    Trace (sand, silt, clay, gravel) 5 to 14    Slightly (sandy, silty, clayey, gravelly) 15 to 29    Sandy, silty, clayey, gravelly > 30    Very (sandy, silty, clayey, gravelly)	
Fill		<b>FILL</b>	Made Ground	Classifications of soils in this geotechnical report and as shown on the exploration logs are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates, and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D2487 and D2488 were used as an identification guide for the Unified Soil Classification System.	





15365 NE 90th Street, Suite 100  
 Redmond, WA 98052  
 Office (425) 449-4704 | esnw.com  
 Branch Office: Pasco, WA

# TEST PIT NUMBER TP-1

PROJECT NUMBER ES-10099 PROJECT NAME 78th Ave SE SFR  
 DATE STARTED 9/26/24 COMPLETED 9/26/24 GROUND ELEVATION \_\_\_\_\_  
 EXCAVATION CONTRACTOR Client Provided LATITUDE 47.57247 LONGITUDE -122.23472  
 LOGGED BY SES CHECKED BY SHA GROUND WATER LEVEL:  
 NOTES \_\_\_\_\_ ∇ AT TIME OF EXCAVATION \_\_\_\_\_  
 SURFACE CONDITIONS Duff AFTER EXCAVATION \_\_\_\_\_

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
			TPSL		Dark brown TOPSOIL, root intrusions to 2'
			SM		Brown silty SAND with gravel, medium dense, damp  -probed 3"  -probed 1"  -becomes weakly cemented, dense  [USDA Classification: very gravelly sandy LOAM]
2.5					
5.0					
	GB	MC = 4.0 Fines = 22.5			

Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.



15365 NE 90th Street, Suite 100  
 Redmond, WA 98052  
 Office (425) 449-4704 | esnw.com  
 Branch Office: Pasco, WA

# TEST PIT NUMBER TP-2

PROJECT NUMBER ES-10099 PROJECT NAME 78th Ave SE SFR  
 DATE STARTED 9/26/24 COMPLETED 9/26/24 GROUND ELEVATION \_\_\_\_\_  
 EXCAVATION CONTRACTOR Client Provided LATITUDE 47.57260 LONGITUDE -122.23488  
 LOGGED BY SES CHECKED BY SHA GROUND WATER LEVEL:  
 NOTES \_\_\_\_\_ ∇ AT TIME OF EXCAVATION \_\_\_\_\_  
 SURFACE CONDITIONS Duff AFTER EXCAVATION \_\_\_\_\_

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
			TPSL		Dark brown TOPSOIL, root intrusions to 2'
				1.0	
	GB	MC = 4.2 Fines = 22.9			Brown silty SAND with gravel, medium dense, damp [USDA Classification: very gravelly sandy LOAM] -probed 3"
2.5					
			SM		-probed 1" -becomes dense -weakly cemented
5.0					
	GB	MC = 4.1		6.0	

Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.



15365 NE 90th Street, Suite 100  
 Redmond, WA 98052  
 Office (425) 449-4704 | esnw.com  
 Branch Office: Pasco, WA

# TEST PIT NUMBER TP-3

PROJECT NUMBER ES-10099 PROJECT NAME 78th Ave SE SFR  
 DATE STARTED 9/26/24 COMPLETED 9/26/24 GROUND ELEVATION \_\_\_\_\_  
 EXCAVATION CONTRACTOR Client Provided LATITUDE 47.57269 LONGITUDE -122.23472  
 LOGGED BY SES CHECKED BY SHA GROUND WATER LEVEL:  
 NOTES \_\_\_\_\_ ∇ AT TIME OF EXCAVATION \_\_\_\_\_  
 SURFACE CONDITIONS Duff AFTER EXCAVATION \_\_\_\_\_

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					
			TPSL		Dark brown TOPSOIL, root intrusions to 1'
				0.5	
					Brown silty SAND with gravel, medium dense, damp
	GB	MC = 3.5			-probed 3"
2.5			SM		
				4.0	
					Brown poorly graded SAND with gravel, medium dense, damp
5.0			SP		
	GB	MC = 2.6 Fines = 3.0		5.5	[USDA Classification: very gravelly coarse SAND]

Test pit terminated at 5.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.

LIMITATIONS: Ground elevation (if listed) is approximate; the test location was not surveyed. Coordinates are approximate and based on the WGS84 datum. Do not rely on this test log as a standalone document. Refer to the text of the geotechnical report for a complete understanding of subsurface conditions.

**Appendix B**  
**Laboratory Test Results**  
**ES-10099**

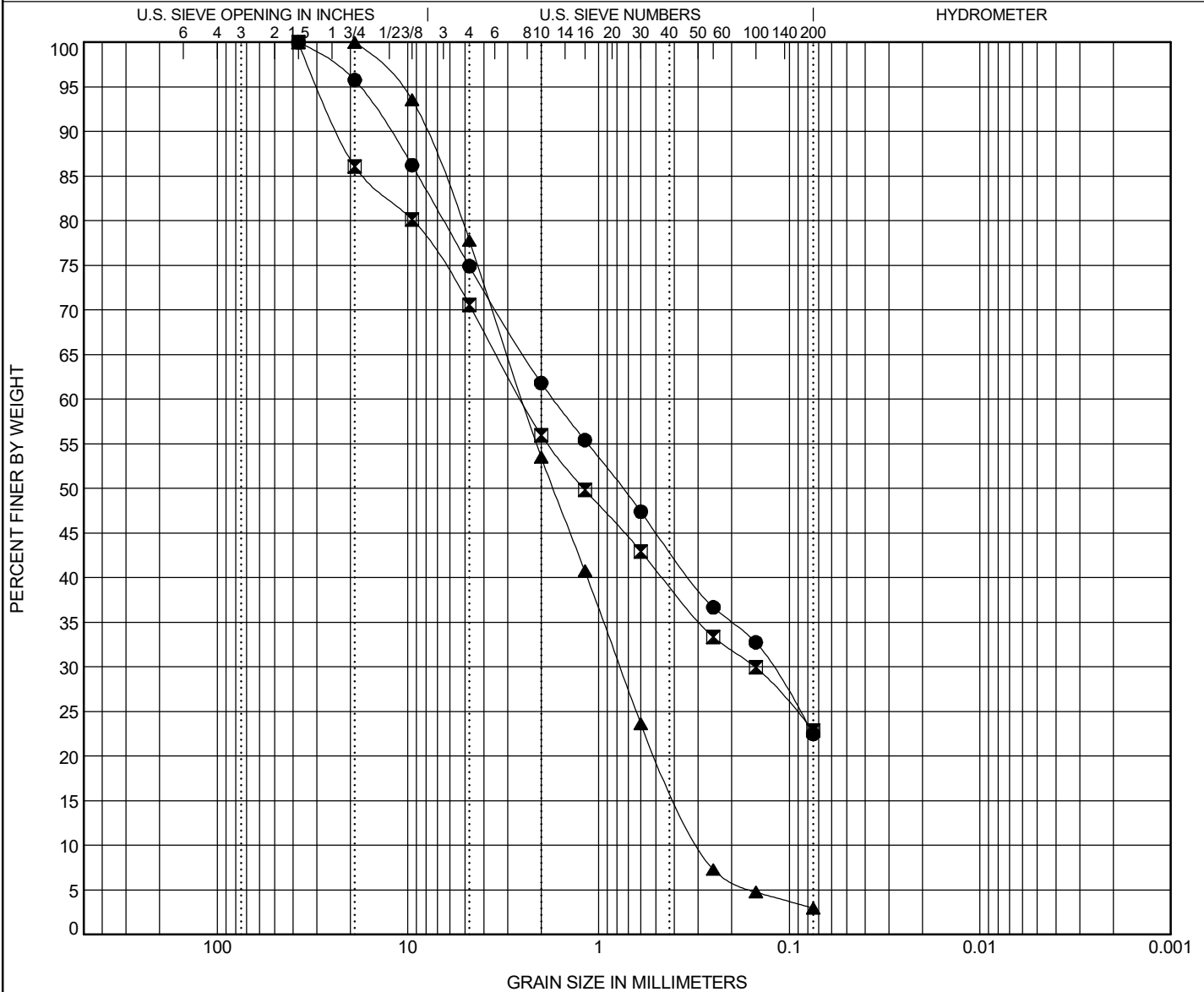


15365 NE 90th Street, Suite 100  
 Redmond, WA 98052  
 Office (425) 449-4704 | esnw.com  
 Branch Office: Pasco, WA

# GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-10099

PROJECT NAME 78th Avenue S.E. SFR



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification							Cc	Cu
● TP-01 6.00ft.	USDA: Brown Very Gravelly Sandy Loam. USCS: SM with Gravel.								
☒ TP-02 1.50ft.	USDA: Brown Very Gravelly Sandy Loam. USCS: SM with Gravel.								
▲ TP-03 5.50ft.	USDA: Brown Very Gravelly Coarse Sand. USCS: SP with Gravel.							0.82	8.72

Specimen Identification	D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
● TP-01 6.0ft.	37.5	1.721	0.125					22.5	
☒ TP-02 1.5ft.	37.5	2.535	0.151					22.9	
▲ TP-03 5.5ft.	19	2.52	0.772	0.289				3.0	

GRAIN SIZE USDA ES-10099 78TH AVENUE S.E. SFR.GPJ GINT US LAB.GDT 10/10/24

**Appendix C**  
**Photos and Site Plan**  
**ES-10099**







