

# GEOTECHNICAL ENGINEERING REPORT

**Proposed Remodel  
3424 76<sup>th</sup> Place Southeast  
Mercer Island, WA 98040**

**Project No. 24-472  
January, 2025**



Prepared for:

**Chris and Harmony Long**

**PanGEO**  
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January 23, 2025  
File No. 24-472

Chris and Harmony Long  
3424 76<sup>th</sup> Pl SE  
Mercer Island, WA 98040

**Subject: Geotechnical Engineering Report  
Proposed Remodel  
3424 76<sup>th</sup> Place Southeast, Mercer Island, WA 98040**

Dear Chris and Harmony,

Please find attached our geotechnical engineering report for the proposed remodel project at the subject site in Mercer Island, Washington. This report documents the subsurface conditions at the site and presents our geotechnical engineering recommendations for the proposed improvements to the existing house foundation.

In summary, the test borings advanced at the property generally encountered up to about 5 to 6 feet of loose fill, overlying loose/stiff to medium stiff silt and silty sand (colluvium/mass wastage deposits) to about 23 feet deep, overlying stiff to very stiff silt (recessional lacustrine deposits).

In our opinion, the proposed additions may be supported by conventional footings bearing on improved subgrade, or by driven small diameter pin piles (all footings, new and existing).

We appreciate the opportunity to be of service. Please call if there are any questions.

Sincerely,



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### ATTACHMENTS:

- Figure 1      Vicinity Map  
Figure 2      Site and Exploration Plan

- Appendix A    Summary Boring Logs  
    Figure A-1    Terms and Symbols for Boring and Test Pit Logs  
    Figure A-2    Logs of Test Boring PG-1  
    Figure A-3    Logs of Test Boring PG-2

**GEOTECHNICAL ENGINEERING REPORT**  
**PROPOSED REMODEL**  
**3424 76<sup>TH</sup> PLACE SOUTHEAST**  
**MERCER ISLAND, WASHINGTON**

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**1.0 INTRODUCTION**

This report presents the results of a geotechnical engineering study that was undertaken to support the design and construction of the proposed remodel to the existing residence at the subject site, in Mercer Island, Washington. This study was performed in general accordance with our mutually agreed scope of services outlined in our proposal dated November 18, 2024, which was subsequently approved by you on November 22, 2024. Our scope of services included reviewing readily available geologic and geotechnical data, drilling two test borings, conducting a site reconnaissance, performing engineering analysis, and developing the conclusions and recommendations presented in this report.

**2.0 SITE AND PROJECT DESCRIPTION**

The project site is located at 3424 76<sup>th</sup> Place Southeast on Mercer Island, Washington (see Figure 1 – Vicinity Map). The site is a rectangular property with an area of about 8,400 square feet, spanning about 120 feet from east to west and about 70 feet from north to south. The site is bordered to the north, east, and south by single-family residences, and to the west by 76<sup>th</sup> Place Southeast. The site is occupied by a one-story house with a basement that daylights to the east and is generally located in the middle of the property.

We understand that you plan to remodel the current house. The remodel includes the construction of a new addition at the basement level on the southeast corner of the house, a deck at the main level on the northeast corner of the house, and a new entryway with an extended roof on the west side of the house. We understand that the existing foundation consisting of spread footings are planned to be reused where there are no new buildings loads. New foundations will be needed for the new deck and additions. We understand that there are no new retaining or basement walls planned as part of the proposed remodel.

The site is located on an east-facing slope. A site-specific topographic survey was not available at the time of this report. However, based on our review of the Mercer Island GIS Map elevation contours, the site has a vertical relief of about 16 to 18 feet with slopes ranging from 15 to 25 percent. There are level yards immediately east and west of the existing house with slopes generally located along the north and south sides of the house

(descending from first floor to daylit basement level) and on the east side of the backyard. Site conditions at the time of our site visits are shown on Plates 1 and 2 below.



*Plate 1. View of the front yard of subject property near the proposed new entryway, looking northeast from the driveway.*



*Plate 2. View of the east side of the house near the proposed basement level additions, looking south.*

Based on our review of the Mercer Island GIS Map, the site has three mapped geologic hazards on the property: potential landslide, erosion, and seismic hazard. As a result, the City has requested a Critical Area Study to address the mapped geologic hazards. Considerations regarding the mapped geologic hazards are presented in [Section 5.0](#).

The conclusions and recommendations in this report are based on our understanding of the proposed project, which is in turn based on the project information provided. If the above project description is incorrect, or the project information changes, we should be consulted to review the recommendations contained in this study and make modifications, if needed. In any case, PanGEO should be retained to provide a review of the final design to confirm that our geotechnical recommendations have been correctly interpreted and adequately implemented in the construction documents.

### **3.0 SUBSURFACE EXPLORATIONS**

Two test borings (PG-1 and PG-2) were drilled at the project site on December 6, 2024. The test borings were advanced to about 30½ to 31½ feet below the existing ground

surface. The approximate boring locations are shown on the attached Figure 2 – Site and Exploration Plan.

The drill rigs were equipped with 5-inch outside diameter hollow stem augers. Soil samples were obtained from the borings in general at 2½- and 5-foot depth intervals using Standard Penetration Test (SPT) sampling methods in general accordance with ASTM D1586, *Standard Test Method for Penetration Test and Split Barrel Sampling of Soils*, in which the samples are obtained using a 2-inch outside diameter split-spoon sampler. The sampler was driven into the soil a distance of 18 inches below the tip of the augers using a 140-pound weight falling a distance of 30 inches using an automated hammer. The number of blows required for each 6-inch increment of sampler penetration was recorded. The number of blows required to achieve the last 12 inches of sample penetration is defined as the SPT N-value. The N-value provides an empirical measure of the relative density of cohesionless soil, or the relative consistency of fine-grained soils.

An engineer from PanGEO was present throughout the field exploration program to observe the drilling, assist in sampling, and to document the soil samples obtained from the borings. The soil samples retrieved from the borings were described using the system outlined on Figure A-1 of Appendix A and the summary boring logs are included as Figures A-2 and A-3.

## **4.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS**

### **4.1 SITE GEOLOGY**

Based on our review of *The Geologic Map of Mercer Island* (Troost and Wisher, 2006), the subject property is underlain by Pre-Olympia fine-grained glacial deposits (Map Unit Qpogf) with recessional lacustrine deposits (Map Unit Qvrl) mapped immediately east of the site. Pre-Olympia fine-grained glacial deposits are described by Troost and Wisher as hard, silt and clay deposited by proglacial lakes in front of the continental ice sheet. Recessional lacustrine deposits are described as very soft to stiff, laminated silt and clay with localized sand, peat and other organics deposited by slow-moving water and lakes. The geologic map also indicates possible mass wastage, or landslide debris, at the project site originating from steep slopes west of the site.

Pre-Olympia fine-grained glacial deposits have been glacially overridden and thus typically exhibit low compressibility and high strength characteristics in their undisturbed

state. Recessional lacustrine and mass wastage deposits have not been glacially overridden and typically have a softer consistency than the Pre-Olympia deposits.

#### **4.2 SOIL CONDITIONS**

In summary, the soils observed in our test borings appear consistent with the mapped geology. For simplicity, we have divided the encountered soils into three distinct soil units. A description of the soil units encountered in our test borings is presented below. Detailed descriptions of the encountered soils in our test borings can be seen in our boring logs included in Appendix A.

***Fill:*** In both PG-1 and PG-2, we encountered a surficial soil unit of very loose to loose, silty sand with gravel and organics. We interpret this soil unit as fill, which extended to about 5 to 6 feet deep in both test borings.

***Colluvium/Mass Wastage Deposits:*** Below the fill in both borings, we encountered about 6 to 10 feet of loose/medium stiff to stiff silty sand and sandy silt interbeds, overlying loose to medium dense, very silty sand. We interpret these soil units as colluvium/mass wastage deposits based on the disturbed and nonuniform consistency. The colluvium/mass wastage deposits extended to about 23 and 25 feet deep in borings PG-1 and PG-2, respectively.

***Recessional Lacustrine Deposits:*** Below the colluvium/mass wastage deposits in both borings, we encountered medium stiff to very stiff, massive, low plasticity silt with sand. We interpret this soil unit as the mapped recessional lacustrine deposits. The recessional lacustrine deposits extended to the bottom of both test borings.

Our subsurface descriptions are based on the conditions encountered at the specific locations at the time of our exploration. Soil conditions between our exploration locations may vary from those encountered. The nature and extent of variations between our exploratory locations may not become evident until construction. If variations do appear, PanGEO should be requested to reevaluate the recommendations in this report and to modify or verify them in writing prior to proceeding with earthwork and construction.

#### **4.3 GROUNDWATER CONDITIONS**

Perched groundwater was observed in PG-1 from about 25 to 29 feet deep. A continuous groundwater layer was not encountered in PG-2 but interbeds of moist and wet silty sand were observed from about 16 to 25 feet deep. Groundwater levels will vary depending on

the season, local subsurface conditions, and other factors. Groundwater levels are normally highest during the winter and early spring (typically October through May).

## **5.0 GEOLOGIC HAZARDS EVALUATION**

As part of our study, we conducted an assessment of potential geologic hazards within the subject site as defined in Mercer Island City Code (MICC) Chapter 19.07.160. The MICC specifies four different geologic hazards a: potential landslide, steep slope, seismic and erosion. Based on our review of the City of Mercer Island GIS Map, there are potential landslide, seismic, and erosion geologic hazard areas mapped on the project site. No other geologic hazards (i.e. steep slope) are mapped at the site. The City’s criteria for those various hazard areas and our assessment of the hazard areas with respect to the planned project are provided in the following sections of this report.

### **5.1 LANDSLIDE HAZARDS**

The site is not mapped by the City of Mercer Island as containing a steep slope (40% or greater); however, the site is mapped as a landslide hazard area due to the mapped geology and proximity to historic landslide scarps west of the property.

During our site reconnaissance, we did not observe evidence of past slope instability or ground movement at the site. The west side of the property adjacent to 76<sup>th</sup> Place Southeast and the backyard east of the basement level are practically flat. About 25 feet from the west side of the existing house, the grade descends about 6 feet at an approximate 20 to 25 percent slope to the adjacent east property.

We understand that the proposed developments on the east side of the house consist of a deck and addition that extend about 14 feet from the existing east perimeter wall, about 10 feet from the edge of the east slope.

Based on our observations, the site appears globally stable and the vertical relief on the east side of the property is minor relative to the overall site. In our opinion, the proposed developments should not adversely affect the overall stability of the site or adjacent properties, provided our recommendations contained in this report are properly incorporated into the project design and construction.

## **5.2 SEISMIC HAZARDS**

Based on review of the City of Mercer Island Seismic Hazard Map, the property is mapped as having soil liquefaction potential.

Liquefaction is a process that can occur when soil loses shear strength for short periods of time during a seismic event. Ground shaking of sufficient strength and duration can result in the loss of grain-to-grain contact and an increase in pore water pressure, causing the soil to behave as a fluid. Soils with a potential for liquefaction are typically cohesionless, with a predominately silt and sand grain size, must be loose to medium dense, and be below the groundwater table.

Based on the results from our test borings, perched groundwater was encountered in PG-1 from about 25 to 29 feet deep in the low plasticity silt (recessional lacustrine deposits), which are considered a low potential for liquefaction. We encountered discontinuous layers of moist and wet, very silty sand in PG-2 from 16 to 25 feet deep. While some of the interlayers may be prone to liquefaction, we do not anticipate bearing capacity failure due to the depth to the wet soils relatively to the proposed addition foundations located near the ground surface. Additionally, we do not anticipate significant settlements during the IBC level seismic event due to the discontinuous nature of the wet silty sand layers encountered in PG-2.

Based on these conditions, in our opinion the risk of soil liquefaction at the site is generally low. However, to fully mitigate the risk of liquefaction induced settlement, we recommend that the proposed additions bear on improved subgrade to mitigate the risk of differential settlement during the seismic event. Small diameter pin piles may also be considered for foundation support.

## **5.3 EROSION HAZARDS**

Based on our review of the Mercer Island GIS Map, portions of the site are mapped as erosion hazard areas. According to the USDA Soil Survey Map, the site is mapped as Kitsap Silt Loam, 15 to 30 percent (Map Unit KpD). Based on the USDA Soil Survey data and soils observed in our explorations, the site soils are anticipated to exhibit moderate erosion potential when disturbed and left unprotected. In our opinion, the erosion hazards at the site can be effectively mitigated with the best management practice during construction and with properly designed and implemented landscaping for permanent erosion control. During construction, the temporary erosion hazard can also be effectively

managed with an appropriate erosion and sediment control plan, including but not limited to installing a silt fence at the construction perimeter, placing quarry spalls or hay bales at the disturbed and traffic areas, covering stockpiled soil or cut slopes with plastic sheets, constructing a temporary drainage pond to control surface runoff and sediment trap, placing rocks at the construction entrance, etc.

Permanent erosion control measures should be applied to the disturbed areas as soon as feasible. These measures may include but are not limited to planting and hydroseeding. The use of permanent erosion control mats may also be considered in conjunction with planting/hydroseeding to protect the soil from erosion.

Additional recommendations and considerations for surface drainage and wet weather construction are provided in Section 8.4 and Section 8.5, respectively.

Provided that proper erosion control measures are implemented during construction, in our opinion the risk of off-site soil transport during and after construction of the project is minimal.

## **6.0 GEOTECHNICAL DESIGN RECOMMENDATIONS**

### **6.1 SEISMIC DESIGN CONSIDERATIONS**

The seismic design of the project may be accomplished using the 2018 or 2021 International Building Code (IBC), which specifies a design earthquake having a 2 percent probability of occurrence in 50 years (return interval of 2,475 years). The IBC seismic design parameters are in part based on the site soil conditions and site classifications defined in Chapter 20 of ASCE 7-16. According to Chapter 20 of ASCE 7-16, based on the results from our test borings, the site soil should be classified as Site Class E for soft soil.

### **6.2 FOUNDATION DESIGN ALTERNATIVES**

Based on the results of our test borings, the soils in the vicinity of the existing house generally consist of 5 to 6 feet of very loose to loose fill overlying loose/medium stiff to stiff silt and silty sand, which generally and not considered suitable for bearing. Although the soil is very loose to loose, based on the apparently satisfactory performance of the existing basement foundation, the soils have provided adequate support for the shallow spread footing foundations. However, we anticipate undesirable settlements of the existing

foundation, or new footings if they are constructed on the very loose soil, once the loads are applied to the foundations.

In our opinion there are several feasible alternatives to mitigate the potential settlement that may occur to new foundations for the proposed additions on the east and west sides of the house. One option is to utilize small diameter driven pipe piles, often referred to as “pin piles” to support the foundations. The pin piles would be driven through the upper loose soils and derive support from the stiffer recessional lacustrine deposits about 30 feet deep. However, to reduce the potential of differential settlement, all new and existing foundations would need to be supported by pin piles.

In our opinion another feasible alternative, which would likely be less costly, would be to locally improve the soils below the new foundations with over-excavation and replacement with properly compacted structural fill. The over-excavations will only need to occur below the footings, not below the entire footprint of the structure.

The following sections present our recommendations for spread footings over improved subgrade.

### ***6.2.1 New Footing Subgrade Preparation***

Over-excavation – We recommend that the footing excavation extend a minimum of 2 feet below the design footing elevation. The over-excavation should extend horizontally out from the edge of the footing a distance equal to 12 inches.

Subgrade Compaction – At an elevation at least 18 inches below the footings, we recommend the exposed subgrade be compacted to a dense condition using a jumping-jack type compactor. We do not recommend compaction using an excavator mounted compactor, such as a hoe-pac, which can induce large vibrations of the existing subgrade soil and damage the existing foundations.

Structural Fill & Compaction – After the subgrade has been compacted, we recommend that 2 feet of structural fill be placed in at least three lifts below the footings and compacted to a dense condition using a jumping jack-type compactor. If density tests will be performed, the test results should indicate at least 95 percent of the maximum dry density, as determined using test method ASTM D 1557. Recommendations for structural fill are provided in Section 8.3.

Final Footing Subgrade Preparation - All footing subgrades should be compacted to a dense condition prior to placement of concrete formwork and reinforcing steel. The footing subgrade should be in a firm/dense condition prior to concrete placement. Footing subgrades should be observed by PanGEO to confirm that the exposed footing subgrade is consistent with the expected conditions and adequate to support the design bearing pressure.

### ***6.2.2 New Footing Design***

Allowable Bearing Pressure – For footings bearing on the prepared subgrade as described above, we recommend that an allowable bearing pressure of 1,500 psf be used to size the footings. All footings should be founded at a minimum depth of 18 inches below the adjacent finish grade, or for interior footings, 12 inches below floor slabs. For allowable stress design, the recommended allowable bearing pressure may be increased by 1/3 for transient conditions such as wind and seismic loadings.

Lateral Resistance – Lateral forces from wind or seismic loading may be resisted by a combination of passive earth pressures acting against the embedded portions of the foundations and walls, and by friction acting on the base of the foundations. Passive resistance values may be determined using an equivalent fluid weight of 300 pounds per cubic foot (pcf). This value includes a geotechnical factor of safety of at least 1.5 assuming that properly compacted structural fill will be placed adjacent to the sides of the footings. An allowable friction coefficient of 0.4 may be used to determine the frictional resistance at the base of the footings. This value also includes a geotechnical factor of safety of at least 1.5.

Settlement Estimate – Total and differential settlements are anticipated to be within tolerable limits for footings designed and constructed as discussed in this report. Footing settlement under static loading conditions is estimated to be less than approximately one inch, and differential settlement across the house should be less than about ½-inch. Most settlement will occur during construction as loads are applied.

Footing Drains – Perimeter footing drains should be installed to provide permanent control of subsurface water adjacent to the new structure. As a minimum, 4-inch diameter perforated drainpipes should be installed at the base of the footings and embedded in 12 to 18 inches of washed gravel. The gravel should be wrapped in a geotextile filter fabric to

prevent the migration of fines into the drain system. The drainpipe should be graded to direct water to a suitable outlet.

### ***6.2.3 Existing Footings***

We do not recommend additional loads from the addition be added to the existing spread and strip footings. Because it will not be practical to improve the soil below the existing footings, if additional loads must be applied to an existing footing, we recommend removing the footing, improving the subgrade soils as described above, and constructing a new footing at that location.

## **6.3 CONCRETE SLAB ON GRADE**

Slab on Grade Preparation – A conventional slab-on-grade may be used for the floor of the new addition. However, due to the existing loose soil, some settlement of the floor slab, and associated distress, may occur if a slab-on-grade is constructed on the existing loose fill. The risk of the settlement will depend on how much of the existing loose soil is excavated out from under the footprint of the structure during construction. To reduce the potential of slab settlement and distress, where loose fill is present below the proposed slab, we recommend removing a minimum of 1 foot of existing fill below the slab, heavily re-compacting the exposed soils to a dense and unyielding condition, and placing 1 foot of properly compacted structural fill to create a firm surface for the slab. For the subgrade improvement described above, and for slab areas bearing on the native medium dense soils, the floor slab design may be accomplished using a modulus of subgrade reaction of 125 pci.

Capillary Break - We recommend that the slabs be constructed on a minimum 4-inch-thick capillary break. The capillary break should consist of free-draining, clean crushed rock or well-graded gravel compacted to a firm and unyielding condition. The capillary break material should have no more than 10 percent passing the No. 4 sieve and less than 5 percent by weight of the material passing the U.S. Standard No. 100 sieve. We also recommend that a 10-mil polyethylene vapor barrier be placed below the slab.

## **7.0 STATEMENT OF RISK**

As outlined above, the site is mapped as a geologic hazard area. Per Mercer Island City Code Section 19.07.060.B.3, development within geologic hazard areas and critical slopes

may occur if the geotechnical engineer provides a statement of risk with supporting documentation indicating that one of the following conditions can be met:

- 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; or
- b. An evaluation of site-specific subsurface conditions demonstrates that the proposed development is not located in a geologic hazard area; or
- c. Development practices are proposed for the alteration that would render the development as safe as if it were not located in a geologic hazard area; or
- d. The alteration is so minor as not to pose a threat to public health, safety, and welfare.

The proposed developments are generally located near the west entryway where the site is practically flat, and in the east backyard where the tallest slope below the basement level has a vertical relief of about 6 feet. We recommend that the new foundations bear on at least 2 feet of improved subgrade that will improve the stability of the backyard. No significant changes are being proposed to the existing house which appears stable in its current condition.

As such, it is our opinion that Criterion A and D applies to the proposed development, provided our recommendations contained within this report are adequately incorporated into the projects plans.

## **8.0 CONSTRUCTION CONSIDERATIONS**

### **8.1 TEMPORARY EXCAVATIONS**

We anticipate that excavations up to a maximum of about 4 feet deep may be needed for the construction of the new foundations. The excavation is anticipated to encounter very loose sandy soils.

Temporary excavations greater than 4 feet deep should be properly sloped or shored, however, vertical excavations 4 feet deep or less will likely not remain stable, and will slough or collapse, due to the very loose nature of the sandy soils anticipated at the site. All temporary excavations should be performed in accordance with Part N of WAC

(Washington Administrative Code) 296-155. The contractor is responsible for maintaining safe excavation slopes and/or shoring.

For planning purposes, we recommend that temporary excavations less than 4 feet for the footing over-excavation, as well as for other site features, be sloped no steeper than 1H:1V (horizontal:vertical). Cuts deeper than 4 feet, if needed, will likely need to be cut back at a shallower angle of 2H:1V, to maintain stability. All cuts must be re-evaluated in the field during construction based on actual observed soil conditions and the presence of groundwater seepage. If groundwater seepage is encountered the temporary slope will likely need to be cut to shallower angles to maintain stability. During wet weather, runoff water should be prevented from entering excavations. We also recommend that heavy construction equipment, building materials and excavated soil should not be allowed within a distance equal to 1/3 the slope height from the top of any excavation.

## **8.2 MATERIAL REUSE**

In the context of this report, structural fill is defined as compacted fill placed under footings, concrete stairs, landings, slabs, or other load-bearing areas. In our opinion, the on-site soils are not suitable to be reused as structural fill due to the relatively high fines content. Suitable materials for use as structural fill are described in Section 8.3 below.

The on-site soil can be used as general fill in the non-structural and landscaping areas. If use of the on-site soil is planned, the excavated soil should be stockpiled and protected with plastic sheeting to prevent softening from rainfall in the wet season.

## **8.3 STRUCTURAL FILL PLACEMENT AND COMPACTION**

For planning purposes, structural fill should consist of imported, well-graded, granular material such as Seattle Type 17 Mineral Aggregate (*Seattle Standards and Specifications*, 2024, Section 9-03.14), WSDOT Gravel Borrow (*WSDOT Standards and Specifications*, 2024, Section 9-03.14(1)), or an approved equivalent. Based on the absence of groundwater anticipated within the proposed excavation, recycled crushed concrete (1¼-inch with fines) may also be used as structural fill. However, the use of recycled crushed concrete should be approved by PanGEO prior to installation.

Structural fill should be moisture conditioned to within about 3 percent of optimum moisture content, placed in loose, horizontal lifts less than 8 inches in thickness, and systematically compacted to a dense and relatively unyielding condition and to at least 95 percent of the maximum dry density, as determined using test method ASTM D 1557.

Depending on the type of compaction equipment used and depending on the type of fill material, it may be necessary to decrease the thickness of each lift in order to achieve adequate compaction. PanGEO can provide additional recommendations regarding structural fill and compaction during construction.

#### **8.4 SURFACE DRAINAGE CONSIDERATIONS**

Adequate drainage provisions are imperative to improve the performance of the proposed developments and adjacent structures. We recommend both short-term and long-term drainage measures be incorporated into the project design and construction. Surface runoff can be controlled during construction by careful grading practices. Typically, this includes the construction of shallow, upgrade perimeter ditches or low earthen berms to collect runoff and prevent water from entering the excavation or to prevent runoff from the construction area leaving the immediate work site. Collected water should be directed to a positive and permanent discharge system.

Permanent control of surface water and roof runoff should be incorporated in the final grading design. In addition to these sources, irrigation and rainwater infiltrating into landscape and planter areas adjacent to paved areas or building walls should also be controlled. All collected runoff should be directed into conduits that carry the water away from the proposed developments and existing structures and into the storm drain systems or other appropriate outlets. Adequate surface gradients should be incorporated into the grading design such that surface runoff is directed away from structures. Collected water from surface runoff should not drain into retaining wall drain systems.

#### **8.5 WET WEATHER CONSTRUCTION**

It is our opinion that construction of the project can be accomplished during the wet season (October to April). However, performing earthwork activities during the wet season is anticipated to be costlier than during dry weather conditions. The following procedures are best management practices recommended for use in wet weather construction:

- All footing surfaces should be protected against inclement weather unless the footings can be poured immediately after the design subgrade is prepared. It is the contractor's responsibility to protect the footing subgrade from disturbance.
- Earthwork should be performed in small areas to minimize subgrade exposure to wet weather. Excavation or the removal of unsuitable soil should be followed promptly by the placement and compaction of clean structural fill. The size and

- type of construction equipment used may have to be limited to prevent soil disturbance.
- During wet weather, the allowable fines content of the structural fill should be reduced to no more than 5 percent by weight based on the portion passing the 0.075-mm sieve. The fines should be non-plastic.
  - The ground surface within the construction area should be graded to promote run-off of surface water and to prevent the ponding of water.
  - Geotextile silt fences should be installed at strategic locations around the site to control erosion and the movement of soil.
  - Excavation slopes and soils stockpiled on site should be covered with plastic sheeting.

## **9.0 ADDITIONAL SERVICES**

To confirm that our recommendations are properly incorporated into the design and construction of the proposed project, PanGEO should be retained to conduct a review of the final project plans and specifications, and to monitor the construction of geotechnical elements. The City of Mercer Island, as part of the permitting process, may also require geotechnical construction inspection services. PanGEO can provide a cost estimate for construction monitoring services after the design has been finalized.

## **10.0 UNCERTAINTY AND LIMITATIONS**

We have prepared this report for Chris and Harmony Long and the project design team. Recommendations contained in this report are based on a site reconnaissance, a subsurface exploration program, review of pertinent subsurface information, and our understanding of the project. The study was performed using a mutually agreed-upon scope of services.

Variations in soil conditions may exist between the locations of the explorations and the actual conditions underlying the site. The nature and extent of soil variations may not be evident until construction occurs. If any soil conditions are encountered at the site that are different from those described in this report, we should be notified immediately to review the applicability of our recommendations. Additionally, we should also be notified to review the applicability of our recommendations if there are any changes in the project scope.

The scope of our work does not include services related to construction safety precautions. Our recommendations are not intended to direct the contractors' methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design. Additionally, the scope of our services specifically excludes the assessment of environmental characteristics, particularly those involving hazardous substances. We are not mold consultants nor are our recommendations to be interpreted as being preventative of mold development. A mold specialist should be consulted for all mold-related issues.

This report may be used only by the client and for the purposes stated within a reasonable time from its issuance. Land use, site conditions (both off and on-site), or other factors including advances in our understanding of applied science, may change over time and could materially affect our findings. Therefore, this report should not be relied upon after 24 months from its issuance. PanGEO should be notified if the project is delayed by more than 24 months from the date of this report so that we may review the applicability of our conclusions considering the time lapse.

It is the client's responsibility to see that all parties to this project, including the designer, contractor, subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk. Any party other than the client who wishes to use this report shall notify PanGEO of such intended use and for permission to copy this report. Based on the intended use of the report, PanGEO may require that additional work be performed and that an updated report be reissued. Noncompliance with any of these requirements will release PanGEO from any liability resulting from the use of this report.

Within the limitation of scope, schedule, and budget, PanGEO engages in the practice of geotechnical engineering and endeavors to perform its services in accordance with generally accepted professional principles and practices at the time the Report or its contents were prepared. No warranty, express or implied, is made.

We appreciate the opportunity to be of service to you on this project. Please feel free to contact our office with any questions you have regarding our study, this report, or any geotechnical engineering related project issues.

Sincerely,

**PanGEO, Inc.**



Bryce C. Townsend, P.E.  
Senior Geotechnical Engineer

## 10.0 REFERENCES

ASTM D1557, 2012, *Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort*, [www.astm.org](http://www.astm.org).

ASTM D1586 / D1586-18, 2018, *Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils*, [www.astm.org](http://www.astm.org).

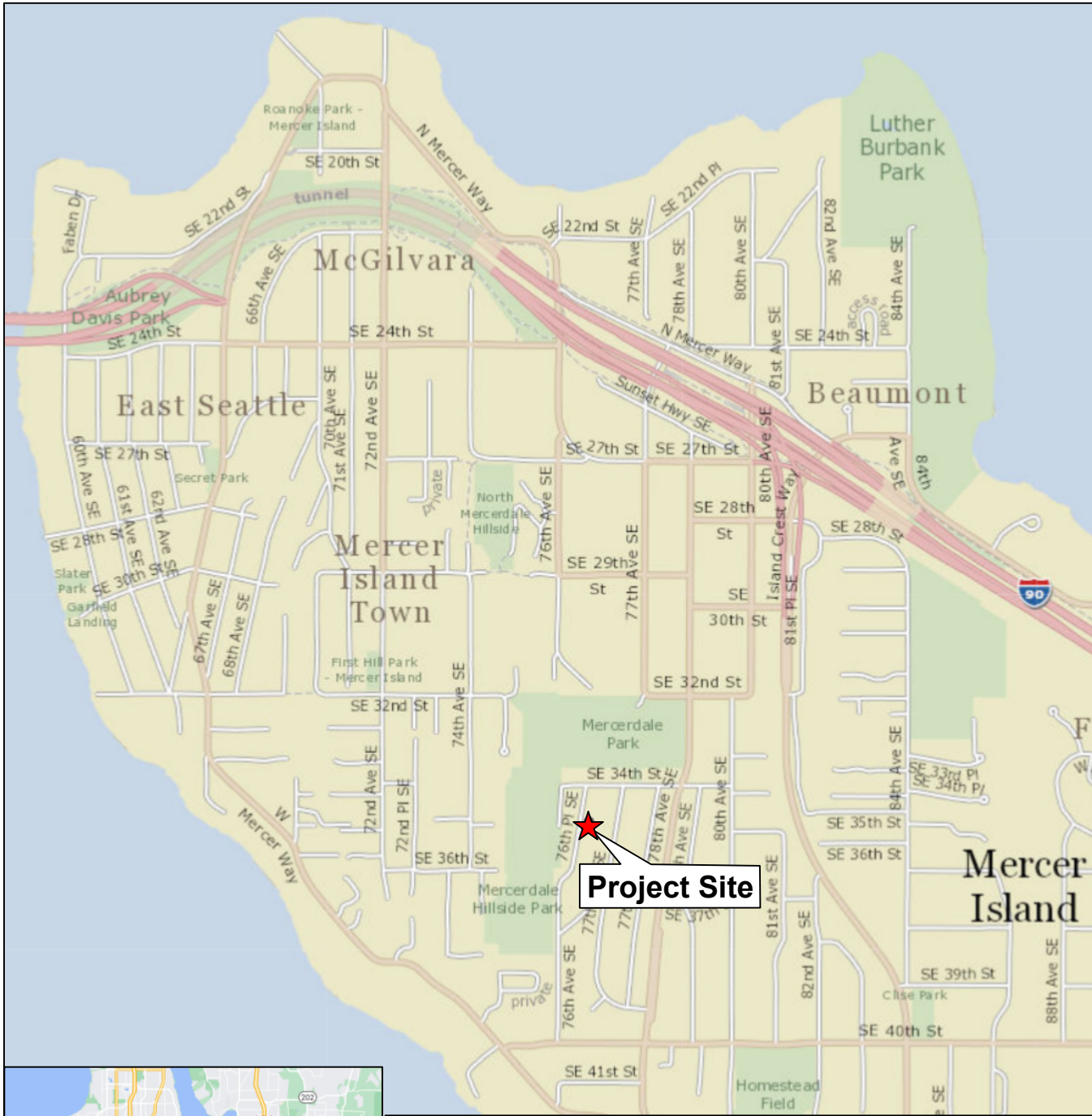
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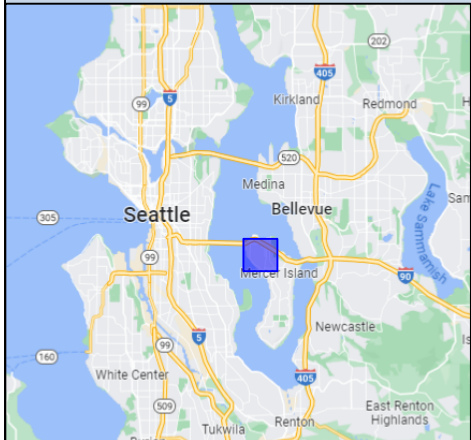
Troost, K.G., and Wisher, A. P, 2006. *Geologic Map of Mercer Island, Washington, scale 1:24,000*.

Washington Administration Code (WAC), 2019, *Part N – Excavation, Trenching, and Shoring*.


WSDOT, 2024, *Standard Specifications for Road, Bridges, and Municipal Construction, M41-10*.

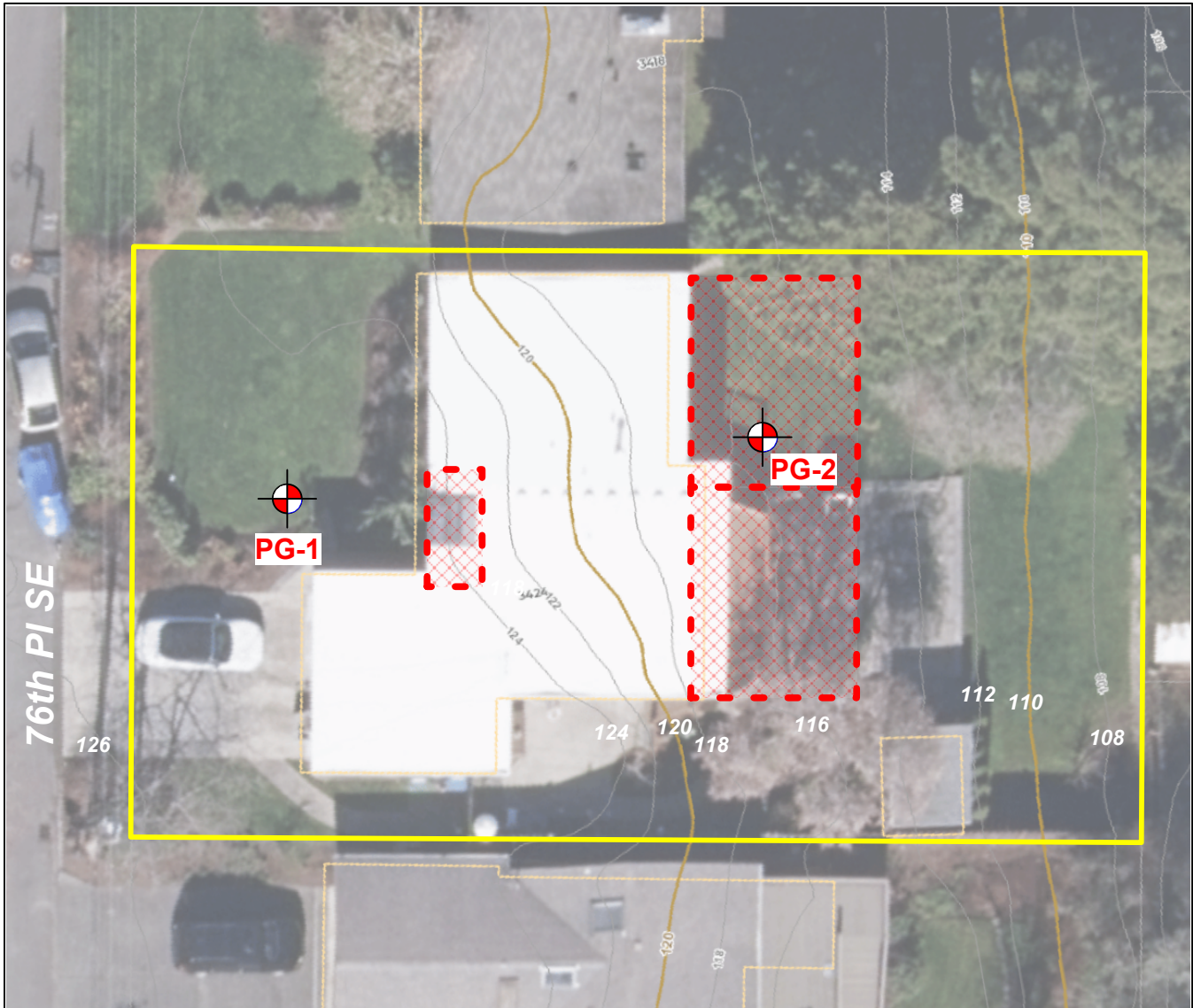


Base Map: King County iMap






Not to Scale

	<p><b>Proposed Remodel</b>  <b>3424 76th Place Southeast</b>  <b>Mercer Island, Washington</b></p>	<b>VICINITY MAP</b>	
		<p>Project No. <b>24-472</b></p>	<p>Figure No. <b>1</b></p>



**LEGEND**

-  Approximate Location of Explorations by PanGEO, Inc. (March 2024)
-  Property Boundary
-  Proposed Additions



Approx. Scale  
1 inch = 20 feet



**Proposed Remodel**  
3424 76th Place Southeast  
Mercer Island, Washington

**SITE AND EXPLORATION PLAN**

Project No. **24-472**

Figure No. **2**

# **APPENDIX A**

## **SUMMARY BORING LOGS**

**RELATIVE DENSITY / CONSISTENCY**

SAND / GRAVEL			SILT / CLAY		
Density	SPT N-values	Approx. Relative Density (%)	Consistency	SPT N-values	Approx. Undrained Shear Strength (psf)
Very Loose	<4	<15	Very Soft	<2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Med. Dense	10 to 30	35 - 65	Med. Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	>50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	>30	>4000

**UNIFIED SOIL CLASSIFICATION SYSTEM**

MAJOR DIVISIONS		GROUP DESCRIPTIONS	
Gravel 50% or more of the coarse fraction retained on the #4 sieve. Use dual symbols (eg. GP-GM) for 5% to 12% fines.	GRAVEL (<5% fines)		GW: Well-graded GRAVEL
	GRAVEL (>12% fines)		GP: Poorly-graded GRAVEL
Sand 50% or more of the coarse fraction passing the #4 sieve. Use dual symbols (eg. SP-SM) for 5% to 12% fines.	SAND (<5% fines)		GM: Silty GRAVEL
			GC: Clayey GRAVEL
	SAND (>12% fines)		SW: Well-graded SAND
			SP: Poorly-graded SAND
Silt and Clay 50% or more passing #200 sieve	Liquid Limit < 50		SM: Silty SAND
			SC: Clayey SAND
			ML: SILT
	Liquid Limit > 50		CL: Lean CLAY
			OL: Organic SILT or CLAY
			MH: Elastic SILT
Highly Organic Soils			CH: Fat CLAY
			OH: Organic SILT or CLAY
			PT: PEAT

**TEST SYMBOLS**

for In Situ and Laboratory Tests listed in "Other Tests" column.

- ATT Atterberg Limit Test
- Comp Compaction Tests
- Con Consolidation
- DD Dry Density
- DS Direct Shear
- %F Fines Content
- GS Grain Size
- Perm Permeability
- PP Pocket Penetrometer
- R R-value
- SG Specific Gravity
- TV Torvane
- TXC Triaxial Compression
- UCC Unconfined Compression

**SYMBOLS**

Sample/In Situ test types and intervals

- 2-inch OD Split Spoon, SPT (140-lb. hammer, 30" drop)
- 3.25-inch OD Split Spoon (300-lb hammer, 30" drop)
- Non-standard penetration test (see boring log for details)
- Thin wall (Shelby) tube
- Grab
- Rock core
- Vane Shear

- Notes:**
- Soil exploration logs contain material descriptions based on visual observation and field tests using a system modified from the Uniform Soil Classification System (USCS). Where necessary laboratory tests have been conducted (as noted in the "Other Tests" column), unit descriptions may include a classification. Please refer to the discussions in the report text for a more complete description of the subsurface conditions.
  - The graphic symbols given above are not inclusive of all symbols that may appear on the borehole logs. Other symbols may be used where field observations indicated mixed soil constituents or dual constituent materials.

**DESCRIPTIONS OF SOIL STRUCTURES**

<b>Layered:</b> Units of material distinguished by color and/or composition from material units above and below	<b>Fissured:</b> Breaks along defined planes
<b>Laminated:</b> Layers of soil typically 0.05 to 1mm thick, max. 1 cm	<b>Slickensided:</b> Fracture planes that are polished or glossy
<b>Lens:</b> Layer of soil that pinches out laterally	<b>Blocky:</b> Angular soil lumps that resist breakdown
<b>Interlayered:</b> Alternating layers of differing soil material	<b>Disrupted:</b> Soil that is broken and mixed
<b>Pocket:</b> Erratic, discontinuous deposit of limited extent	<b>Scattered:</b> Less than one per foot
<b>Homogeneous:</b> Soil with uniform color and composition throughout	<b>Numerous:</b> More than one per foot
	<b>BCN:</b> Angle between bedding plane and a plane normal to core axis

**COMPONENT DEFINITIONS**

COMPONENT	SIZE / SIEVE RANGE	COMPONENT	SIZE / SIEVE RANGE
Boulder:	> 12 inches	Sand	
Cobbles:	3 to 12 inches	Coarse Sand:	#4 to #10 sieve (4.5 to 2.0 mm)
Gravel	3 to 3/4 inches	Medium Sand:	#10 to #40 sieve (2.0 to 0.42 mm)
		Fine Sand:	#40 to #200 sieve (0.42 to 0.074 mm)
Coarse Gravel:	3 to 3/4 inches	Silt	0.074 to 0.002 mm
Fine Gravel:	3/4 inches to #4 sieve	Clay	<0.002 mm

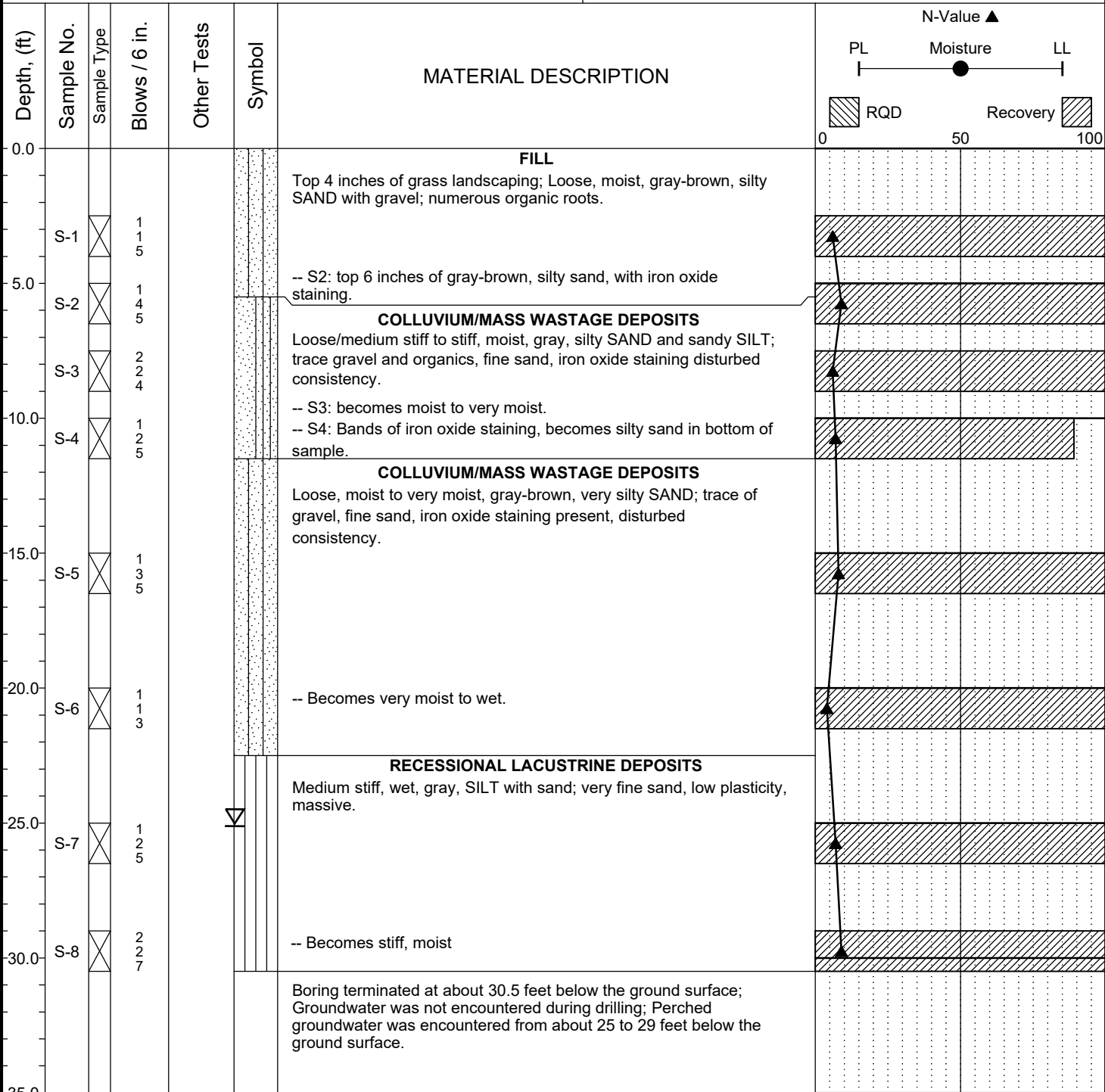
**MONITORING WELL**

- Groundwater Level at time of drilling (ATD)
- Static Groundwater Level
- Cement / Concrete Seal
- Bentonite grout / seal
- Silica sand backfill
- Slotted tip
- Slough
- Bottom of Boring

**MOISTURE CONTENT**

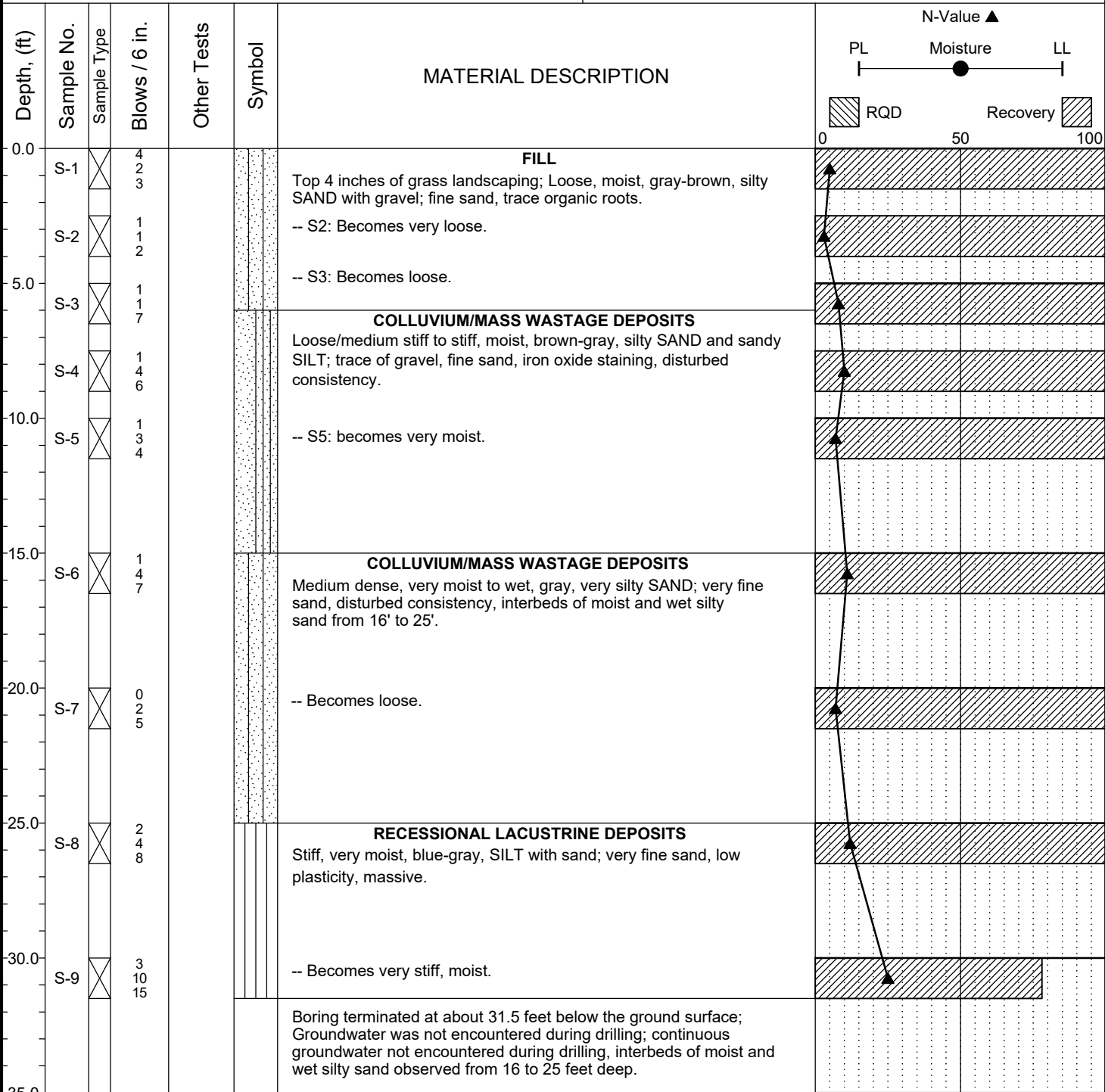
Dry	Dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water

Project:	Proposed Remodel	Surface Elevation:	~125 ft
Job Number:	24-472	Top of Casing Elev.:	N/A
Location:	3424 76th Place Southeast, Mercer Island, Washington	Drilling Method:	Portable Acker, hollow stem auger
Coordinates:	Northing: 47.57922, Easting: -122.23685	Sampling Method:	SPT



Completion Depth:	30.5ft	Remarks: Standard penetration test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. Elevation is approximated from the Mercer Island GIS elevation contours. Coordinates are approximated based on their relative location to known site features. This information is provided for relative information only and is not a substitution for field survey. <b>Datum: WGS84/NAVD88.</b>
Date Borehole Started:	12/6/24	
Date Borehole Completed:	12/6/24	
Logged By:	H. Wang	
Drilling Company:	CN Drilling	

Project:	Proposed Remodel	Surface Elevation:	~116 ft
Job Number:	24-472	Top of Casing Elev.:	N/A
Location:	3424 76th Place Southeast, Mercer Island, Washington	Drilling Method:	Portable Acker, hollow stem auger
Coordinates:	Northing: 47.57921, Easting: -122.2366	Sampling Method:	SPT



Completion Depth:	31.5ft	Remarks: Standard penetration test (SPT) sampler driven with a 140 lb. safety hammer. Hammer operated with a rope and cathead mechanism. Elevation is approximated from the Mercer Island GIS elevation contours. Coordinates are approximated based on their relative location to known site features. This information is provided for relative information only and is not a substitution for field survey. <b>Datum: WGS84/NAVD88.</b>
Date Borehole Started:	12/6/24	
Date Borehole Completed:	12/6/24	
Logged By:	H. Wang	
Drilling Company:	CN Drilling	