Ages Engineering

A Geotechnical Engineering Services Company

P.O. Box 935
Puyallup, WA. 98371

(253) 845-7000

www.agesengineering.com

# GEOTECHNICAL REPORT

## Scharhon Residence

**9150 – SE 54th Street**
**Mercer Island, Washington**
**Parcel Number: 6672900150**

**Project No. A-1709**

**Prepared For:**

**Alan Scharhon**
**9150 SE 54th Street**
**Mercer Island, Washington 98040**

**September 19, 2024**

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September 19, 2024
Project No. A-1709

Alan Scharhon
9150 SE 54th Street
Mercer Island, WA 98040

Subject: Geotechnical Report
Scharhon Residence
9150 SE 54th Street
Mercer Island, Washington
Parcel Number: 6672900150

Dear Mr. Scharhon,

As requested, we have conducted a geotechnical study for the subject project. The attached report presents our findings and recommendations for the geotechnical aspects of project design and construction.

Our field exploration indicates the site is underlain with 0.0 to 1.0 feet of old fill soils overlying sand with silt and gravel consistent with Advance Outwash. We did not observe groundwater seepage in any of the explorations on the site.

In our opinion, the soil and groundwater conditions at the site are suitable for the planned development. The new structure can be supported on either Pin Piles or typical spread footing foundations bearing on the existing organic-free native soils observed immediately below the ground surface or on structural fill placed above these soils. The development storm water should discharge to the existing storm water system located on the subject site.

Detailed recommendations addressing these issues and other geotechnical design considerations are presented in the attached report. We trust the information presented is sufficient for your current needs. If you have any questions or require additional information, please call.

Respectfully Submitted,
**Ages Engineering**

BERNARD P. KNOLL II
STATE OF WASHINGTON
38917
REGISTERED PROFESSIONAL ENGINEER

9-19-2024

Bernard P. Knoll, II
Principal

BPK:bpk

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# Geotechnical Report
# Scharhon Residence
# 9150 SE 54th Street
# Mercer Island, Washington

## 1.0 PROJECT DESCRIPTION

The project will consist of a residential development. We were provided with 39 sheets of project plans showing the planned development. Based on our review of the documents provided to us, we understand the existing single-family residence on the site will be remodeled. The remodel will entail an addition with new foundations along the east side of the basement. Access to the site will remain from SE 54th Street located along the west side of the site.

The new addition will be a two-story wood-framed structure with slab-on-grade floors. Foundation loads will be relatively light, in the range of 10 to 25 kips for isolated column footings.

The conclusions and recommendations presented in this report are based on our understanding of the above-stated site and the planned project design features. If actual site conditions differ, the planned project design features are different than we expect, or if changes are made, we should review them to modify or supplement our conclusions and recommendations as necessary.

## 2.0 SCOPE

On September 18, 2024, we excavated two hand-augured test holes to a maximum depth of 6.0 feet below surface grades. Using the information obtained from our subsurface exploration, we developed geotechnical design and construction recommendations for the project. Specifically, this report addresses the following:

- viewing the available geologic, hydrogeologic and geotechnical data for the site area, and conducting a geologic reconnaissance of the site area.
- Addressing the appropriate geotechnical regulatory requirements for the planned site development, including a Geologic Hazard evaluation.
- Advancing two hand-augured test holes in the planned new development area to a maximum depth of approximately 6.0 feet below surface grades.
- Providing geotechnical recommendations for site grading including site preparation, subgrade preparation, fill placement criteria, suitability of on-site soils for use as structural fill, temporary and permanent cut and fill slopes, and drainage and erosion control measures.
- Providing geotechnical recommendations for design and construction of new foundations and floor slabs, including allowable bearing capacity and estimates of settlement.

- Providing geotechnical recommendations for lower-level building or retaining walls, including backfill and drainage requirements, lateral design loads, and lateral resistance values.
- Providing preliminary recommendations for the discharge of the development storm water.
- Providing recommendations for site drainage.

It should be noted that our work does not include services related to environmental remediation or design and performance issues related to moisture intrusion through walls. An appropriate design professional or qualified contractor should be contacted to address these issues. Our work does not include infiltration testing.

## 3.0 SITE CONDITIONS

### 3.1 Surface

The subject site area is a rectangular-shaped, 0.58-acre, residential parcel located at 9150 SE 54th Street in Mercer Island, Washington. The subject site is currently occupied with a single-family residence located in the approximate center of the site. The site is bordered by single-family residential lots to the south, east and west, and by the SE 53rd Open Space to the north. Access to SE 54th Street is at the SW site corner. The location of the site is shown on the Site Vicinity Map provided in Figure 1. The current site layout is shown on the Exploration Location Plan provided in Figure 2.

A concrete retaining wall with a maximum exposed height of about 6 feet extends along the sites' northern property line. The wall creates a grade break between the side yard of the residence and the driveway to the adjacent residence to the east. The wall is vertical along most of its alignment. The top of the wall at the east end appears to lean out towards the driveway. We observed several vertical cracks along the alignment. However, these were spaced far apart and were relatively minor cracks with very little separation. Another concrete wall exists along the south side of the eastern backyard area. The wall faces north and provides a grade break between the eastern yard area and the flat open space in front of the daylight basement. This wall appeared straight and level and had a few relatively minor vertical cracks. The tile walkways around the exterior of the residence were in serviceable condition. However, we did observe some dislodged tiles and raveling in places due to long tern erosion. The remaining ground surfaces appeared generally stable from a geotechnical perspective.

In general surface grades in the vicinity of the site slope down to the east. The subject site is located at the end of a short ridgeline. Surface grades slope down from the residence along the east, north, and west sides. Surface grades to the south are flat. Surface grades along the west side of the residence slope down to the west at an approximate 5 to 10 percent inclination. Surface grades along the north side of the residence are generally flat. The northern property line has a north-facing retaining wall providing a grade break. The slope to the north of the residence slopes down to the north at inclinations ranging from 20 to 50 percent. Surface grades along the east side of the residence slope down to the east at inclinations ranging from 8 to 12 percent. Site vegetation around the existing residence consists of typical landscape bushes and trees.

## 3.2 Mapped Soils

According to *The Geologic Map of Mercer Islan*, the soil in the vicinity of the site is mapped as Glacial Till (Qvt). However, based on our subsurface explorations, the site soils would be better described as Advance Outwash (Qva). The Advance Outwash was deposited during the Vashon Stade of the Fraser Glaciation approximately 12,000 to 15,000 years ago. The Advance Outwash was deposited by meltwaters and streams that emanated from the Advancing glacial ice mass during brief periods of intense warming. The Advance Outwash will typically be found in a dense condition where undisturbed. The near surface soils at the site have been disturbed by natural weathering processes that have occurred since their deposition. No springs or groundwater seepage was observed on the surface of the site at the time of our site visit. A copy of the Geologic Map for the subject site is provided in Figure 3.

The United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) maps the soils in the vicinity of the site as Alderwood Gravelly Sandy Loam (AgC) soils that form on 8 to 15 percent slopes. According to the USDA NRCS, the site soil will have a "moderate" potential erosion when exposed. A copy of the USDA NRCS Map for the subject site is provided in Figure 4.

## 3.3 Soils

The soils we observed on the site consist of 0.0 to 1.0 feet of old fill soils overlying sand with silt and gravel consistent with Advance Outwash.

In Test Hole TH-1, located near the NE corner of the residence, we encountered 2 inches of bark mulch overlying medium dense, moist, tan sand with silt and gravel consistent with Advance Outwash.

In Test Hole TH-2, located near the center of the back of the residence, we encountered 1.0 feet of old fill soil overlying medium dense, moist, tan sand with silt and gravel consistent with Advance Outwash.

Figures A-1 through A-2 present more detailed descriptions of the subsurface conditions encountered in the test holes. The approximate test hole locations are shown on the Exploration Location Plan provided in Figure 2.

## 3.4 Groundwater

We did not encounter groundwater seepage in any of the test holes advanced on the site. We expect a water table to exist beneath the site at relatively deep depths. The groundwater levels and flow rates will fluctuate seasonally and typically reach their highest levels during and shortly following the wet winter months (October through May).

## 4.0 GEOLOGIC HAZARDS

### 4.1 General

According to Chapter 19.07.160 in the City of Mercer Island Municipal Code (MIMC) geologic hazard areas are defined as … lands that are susceptible to erosion, landslides, seismic events, or other factors as identified by WAC 365-190-120. These areas may not be suited for development activities because they may pose a threat to public health and safety. Areas susceptible to one or more of the following types of hazards shall be designated as geologically hazardous areas: landslide hazard areas, seismic hazard areas, and erosion hazard areas.

### 4.2 Erosion

According to Chapter 19.16.010, the City of Mercer Island defines Erosion Hazard Areas as "Those areas greater than 15 percent slope and subject to a severe risk of erosion due to wind, rain, water, slope and other natural agents including those soil types and/or areas identified by the U.S. Department of Agriculture's Natural Resources Conservation Service as having a "severe" or "very severe" rill and inter-rill erosion hazard.

The site has no slopes that exceed 15 percent. Additionally, the USDA NRCS maps the soil on the site as having a "moderate" potential for erosion. According to the City of Mercer Island, the site does not contain Erosion Hazard Areas.

### 4.3 Landslide

According to Chapter 19.16.010, the City of Mercer Island defines landslide prone areas as:

"Landslide hazard area, deep-seated: Landslide hazard area with a failure depth more than 15 feet thick.

Landslide hazard area, shallow: Landslide hazard area with a failure depth of 15 feet or less thick.

Landslide hazard areas: Those areas subject to landslides based on a combination of geologic, topographic, and hydrologic factors, including:

1. Areas of historic failures;
2. Areas with all three of the following characteristics:
    a. Slopes steeper than 15 percent; and
    b. Hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; and
    c. Springs or ground water seepage;
3. Areas that have shown evidence of past movement or that are underlain or covered by mass wastage debris from past movements;
4. Areas potentially unstable because of rapid stream incision and stream bank erosion; or

5. Steep slope. Any slope of 40 percent or greater calculated by measuring the vertical rise over any 30-foot horizontal run."

We did not find evidence of any recent landslides on the site. There are no recent landslides mapped on or near the site. We observed no landslide headscarps and sidescarps, hummocky terrain, areas with geologic conditions that can promote earth movement, or areas with signs of current landsliding, such as springs, groundwater seepage, and bowed or backtilted trees. We did not observe any areas with topographic expression of runout zones, such as fans and colluvial deposition at the toes of hillsides. We did not observe slopes steeper than 40 percent with at least 10 feet of vertical relief on the site. We reviewed several USGS maps for the subject site. Based on our review, the site does not contain any known or documented landslides.

It is our opinion, the site does not contain any active landslide hazard areas. The site is underlain with medium dense to dense sand with silt and gravel consistent with Advance Outwash that will exhibit a high shear strength,and low compressibility in a sloping environment were undisturbed. Provided surface water is controlled on the site, and all structures are provided with proper subsurface drainage measures, the potential for a landslide to occur at this site should be considered negligible.

According to the Mercer Island code, the site is not classified as a landslide hazard area.

## 4.4 Seismic

According to Chapter 19.16.010, the City of Mercer Island defines seismic hazard areas as, "...areas subject to severe risk of damage as a result of earthquake induced ground shaking, slope failure, settlement, soil liquefaction or surface faulting."

**Liquefaction,**

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in pore water pressure. The increase in water pressure is typically induced by vibrations. Liquefaction mainly affects geologically recent deposits of loose, fine-grained sands that are below the groundwater table.

Based on the relative density and well graded nature of the soils underlying the site, the risk for liquefaction to occur at the site should be considered negligible.

**Seismic Classification,**

The site is located within the Seattle Fault zone. The site is also located in an area underlain with medium dense soil. According to the City of Mercer Island Municipal Code, the site is located in a seismic hazard area.

The state of Washington has adopted the International Building Code (IBC). Based on the soil conditions encountered and the local geology, per the (IBC) site class "D" can be used in structural design. This is based on the inferred range of SPT (Standard Penetration Test) blow counts for the upper 100 feet of the site relative to hand excavation progress and probing with a

½-inch diameter steel probe rod. The presence of glacially consolidated soil conditions were assumed to be representative for the site conditions beyond the depths explored.

### 4.5 Steep Slope Areas

According to Chapter 19.16.010, the City of Mercer Island defines a steep slope area as, "Any slope of 40 percent or greater calculated by measuring the vertical rise over any 30-foot horizontal run. Steep slopes do not include artificially created cut slopes or rockeries."

Based on our observations on the site, there are no slopes at or more than forty (40) percent with a vertical change of at least 10.0 feet on the site. According to the City of Mercer Island Municipal Code, the site does not contain a steep slope erosion hazard areas.

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

### 5.1 General

Based on our study, in our opinion, the soil and groundwater conditions at the site are suitable for the planned development. The new addition can be supported on typical spread footing foundations bearing on the existing organic-free native soils observed immediately below the ground surface or on structural fill placed above these soils. The development storm water should discharge to the existing storm water system located on the subject site.

The native soils encountered at the site contain a high enough percentage of fines (silt and clay-size particles) that will make them difficult to compact as structural fill when too wet. Accordingly, the ability to use the soils from site excavations as structural fill will depend on their moisture content and the prevailing weather conditions at the time of construction. If grading activities will take place during the winter season, the owner should be prepared to import free-draining granular material for use as structural fill and backfill.

The following sections provide detailed recommendations regarding these issues and other geotechnical design considerations. These recommendations should be incorporated into the final design drawings and construction specifications.

### 5.2 Site Preparation and Grading

To prepare the site for construction, all vegetation, organic surface soils, and other deleterious materials including any existing structures, foundations or abandoned utility lines should be stripped and removed from the new development areas. Organic topsoil will not be suitable for use as structural fill, but may be used for limited depths in non-structural areas. The existing old fill soils on the site contain a significant amount of topsoil and are in a loose to medium dense condition and will not be suitable for support of structural elements in their current state. Prior to construction, these existing old fill soils should be removed from under new structural elements.

Once clearing and stripping operations are complete, cut and fill operations can be initiated to establish desired grades. In order to achieve proper compaction of structural fill, and to provide adequate foundation and floor slab support, the native subgrade must be in a stable condition.

Prior to placing structural fill, and to prepare the foundation subgrade, all exposed surfaces should be compacted with heavy vibratory compaction equipment to determine if any isolated soft and yielding areas are present.

If excessively soft or yielding areas are present, and cannot be stabilized in place by compaction, they should be cut to firm bearing soil and filled to grade with structural fill. If the depth to remove the unsuitable soil is excessive, using a geotextile fabric can be considered, such as Mirafi HP270 or an equivalent approved by us, in conjunction with structural fill. In general, a minimum of 18-inches of clean, granular structural fill over the geotextile fabric should establish a stable bearing surface.

A representative of Ages Engineering should observe the foundation subgrade compaction operations to verify that stable subgrades are achieved for support of structural elements.

Our study indicates the native surface soils encountered at the site contain a sufficient enough percentage of fines (silt and clay-size particles) that will make them difficult to compact as structural fill when too wet. Accordingly, the ability to use the soils from site excavations as structural fill will depend on their moisture content and the prevailing weather conditions at the time of construction. If grading activities are planned during the wet winter months, or the on-site soils become too wet to achieve adequate compaction, the owner should be prepared to import a wet-weather structural fill. For wet weather structural fill, we recommend importing a granular soil that meets the following gradation requirements:

| U. S. Sieve Size | Percent Passing |
|---|---|
| 6 inches | 100 |
| No. 4 | 75 maximum |
| No. 200 | 5 maximum* |

* Based on the ¾ inch fraction

Prior to use, Ages Engineering should examine and test all materials to be imported to the site for use as structural fill.

Structural fill should be placed in uniform loose layers not exceeding 12 inches and compacted to a minimum of 95 percent of the soils' laboratory maximum dry density as determined by American Society for Testing and Materials (ASTM) Test Designation D-1557 (Modified Proctor). The moisture content of the soil at the time of compaction should be within two percent of its optimum, as determined by this same ASTM standard. In non-structural areas, the degree of compaction can be reduced to 90 percent.

## 5.3 Excavations

***General,***

The inclination for a safe and stable excavation slope cut is determined based on two factors, the current Washington State Safety and Health Administration (WSHA) regulations for confined spaces and global stability of the slope cut. Most often, the WSHA regulations are more conservative than the global stability requirements.

According to WAC 296-809-099, a confined space is defined as: "A space that is all of the following:

(a) Large enough and arranged so an employee could fully enter the space and work.

(b) Has limited or restricted entry or exit. Examples of spaces with limited or restricted entry are tanks, vessels, silos, storage bins, hoppers, vaults, excavations, and pits.

(c) Not primarily designed for human occupancy."

In the context of site excavation and grading, the Washington State Department of Labor and Industries considers a confined space as a space in which a worker enters an excavation that is tall enough and/or narrow enough to inundate the worker and cause bodily harm if a cave-in occurs. This does not include excavations that are less than 4.0 feet in depth.

***WSHA Approved Slopes***

All excavations at the site associated with confined spaces, such as utility trenches and lower level building and retaining walls, must be completed in accordance with local, state, and/or federal requirements. Based on current Washington State Safety and Health Administration (WSHA) regulations, the existing near-surface loose to medium dense silty sand, sand with silt and the medium stiff silt soils would be classified as Type C soils. The deeper stiff sand with silt and gravel soils would be classified as Type B soils.

According to WSHA, for temporary excavations of less than 20 feet in depth, the side slopes in Type C soils should be laid back at a slope inclination of 1.5:1 (Horizontal:Vertical) or flatter from the toe to the crest of the slope and the side slopes in Type B soils should be laid back at a slope inclination of 1:1 (Horizontal:Vertical) or flatter from the toe to the crest of the slope. All exposed slope faces should be covered with a durable reinforced plastic membrane during construction to prevent slope raveling and rutting during periods of precipitation. These guidelines assume that all surface loads are kept at a minimum distance of at least one half the depth of the cut away from the top of the excavation slope and that significant seepage is not present on the slope face. Flatter cut slopes will be necessary where significant raveling or seepage occurs, or if construction materials will be stockpiled along the slope crest. If these safe temporary slope inclinations cannot be achieved due to property line constraints, shoring may be necessary.

***Non-WSHA Approved Slopes***

Based on the composition and consistency of the site soils, stable slope cuts to provide adequate global stability can be steeper than WSHA standards in areas that are not considered confined spaces. Excavations into the native site soils that will not result in WSHA regulated confined spaces can be cut to an inclination of 0.75:1. Some raveling of the gravel and cobbles exposed on the slope surface may occur at an inclination of 0.75:1. Due to the potential for raveling to occur, and to prevent erosion, the slope face should be covered with durable plastic sheeting.

This information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Ages Engineering assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project contractor.

## 5.4 Foundations

Based on our evaluation, to prevent post-construction differential settlements from affecting the new addition, we recommend using Pin Piles to support the new foundation loads. The post-construction settlements for new foundations constructed over pin piles will be zero. Post-construction settlements over new foundations constructed as conventional spread footing foundations supported on the native soils may have settlements of up to ½ inch total and up to ¼ inch differential. If these settlements can be tolerated, then spread footing foundations can be utilized. If post construction foundation settlement is not tolerable, pin piles should be used.

***Pin Piles,***

Based on the depth of topsoil and old fill, and the consistency and geologic nature of the native soils underlying the site, we recommend utilizing either 2-inch or 3- inch diameter Pin Piles. Pin Piles larger than 2 inches in diameter will typically require load testing prior to installation, and performance testing during installation.

Small diameter steel pipe piles are commonly referred to as Pin Piles, due to their relatively thin width in relation to their long length. Very little site or subgrade preparation is necessary when supporting a foundation on Pin Piles. Pin Piles are hollow steel pipes that are mechanically driven into the ground along the outside of the existing foundation line with either a pneumatic device that essentially vibrates the pipe into the ground, or by a pneumatic hammer that successively pounds the pile into the ground. The piles are driven until their progress slows down to a pre-determined rate that is based on the pile size and pile driving mechanism. After installation, the piles are capped and connected to the existing foundation with either a steel anchor, or additional rebar and concrete. Pin Piles require a minimum embedment depth of at least 10.0 feet to achieve their design capacities. Due to the existence of topsoil, old fill and medium dense sandy native soils underlying the development area, we expect pile embedment depths of 10.0 to 15.0 feet will be necessary.

The structural engineer should be contacted to provide the exact pile diameter, location, number, and spacing, and to determine how many and where the battered piles, if any, will be necessary. With the anticipated building loads, we expect building settlements will be negligible. The allowable pile capacities for each pile size are provided in the following table.

| Pin Pile Options | | |
|---|---|---|
| **Pile Diameter (inches)** | **Pile Type** | **Pile Capacity (kips)** |
| 2 | Schedule 80 Steel | 4 |
| 3 | Schedule 40 Steel | 12 |
| 4 | Schedule 40 Steel | 20 |

***Conventional Spread Footing Foundations,***

The new residential foundations may be supported on conventional spread footing foundations bearing on the existing organic-free native soils, or on new structural fill placed above the existing site soils. Foundation subgrades should be prepared as recommended in the "Site Preparation and Grading" section of this report.

Perimeter foundations exposed to the weather should bear at a minimum depth of 1.5 feet below final exterior grades for frost protection. Interior foundations can be constructed at any convenient depth below the floor slab. We recommend designing new foundations for a net allowable bearing capacity of 2,500 pounds per square foot (psf). For short-term loads, such as wind and seismic, a one-third increase in this allowable capacity can be used. With the anticipated loads and this bearing stress applied, building settlements should be less than one-half inch total and one-quarter inch differential.

For designing foundations to resist lateral loads, a base friction coefficient of 0.35 can be used. Passive earth pressures acting on the sides of the footings can also be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 300 pounds per cubic foot (pcf). We recommend not including the upper 12 inches of soil in this computation because it can be affected by weather or disturbed by future grading activity. This value assumes the foundations will be constructed neat against competent soil and backfilled with structural fill, as described in the "Site Preparation and Grading" section of this report. The values recommended include a safety factor of 1.5.

| **Foundation Parameter Summary** | |
|---|---|
| **Description** | ***Design Value** |
| Net Allowable Bearing Capacity | 2,500 psf |
| Friction Coefficient | 0.35 |
| Lateral Resistance | 300 pcf |

*Details regarding the use of these parameters are provided in the section above.

## 5.5 Storm Water

Based on our subsurface investigation of the site, it is our opinion, the development storm water should discharge to the existing storm water system on the subject site.

## 5.6 Permanent Slopes and Embankments

All permanent cut and fill slopes should be graded with a finished inclination of no greater than 2:1 (Horizontal:Vertical). Upon completion of grading, the slope face should be appropriately vegetated or provided with other physical means to guard against erosion. Final grades at the top of the slope must promote surface drainage away from the slope crest. Water must not be allowed to flow in an uncontrolled fashion over the slope face. If it is necessary to direct surface runoff towards the slope, it should be controlled at the top of the slope, piped in a closed conduit installed on the slope face, and taken to an appropriate point of discharge beyond the toe.

All fill used for slope and embankment construction should meet the structural fill requirements described in the Site Preparation and Grading section of this report. In addition, if new fills will be placed over existing slopes of 20 percent or greater, the structural fill should be keyed and benched into competent slope soils.

### 5.7 Site Drainage

***Surface,***

Final exterior grades should promote free and positive drainage away from the building area. All ground surfaces, pavements, and sidewalks should be sloped away from the structure. We recommend providing a gradient of at least three percent for a minimum distance of ten feet from the building perimeter, except in paved locations. In paved locations, a minimum gradient of one percent should be provided, unless provisions are included for collection and disposal of surface water adjacent to the structure.

***Subsurface,***

A typical footing drain surrounding the new foundation area is not necessary. Subsurface drains must be laid with a gradient sufficient to promote positive flow to the point of discharge. All drains should be provided with cleanouts at easily accessible locations. These cleanouts should be serviced at least once every year.

## 6.0 ADDITIONAL SERVICES

Ages Engineering should review the final project designs and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and incorporated into project design. If changes are made in the loads, grades, locations, configurations or types of facilities to be constructed, the conclusions and recommendations presented in this report may not be fully applicable. If such changes are made, we should be given the opportunity to review our recommendations and provide written modifications or verifications, as necessary.

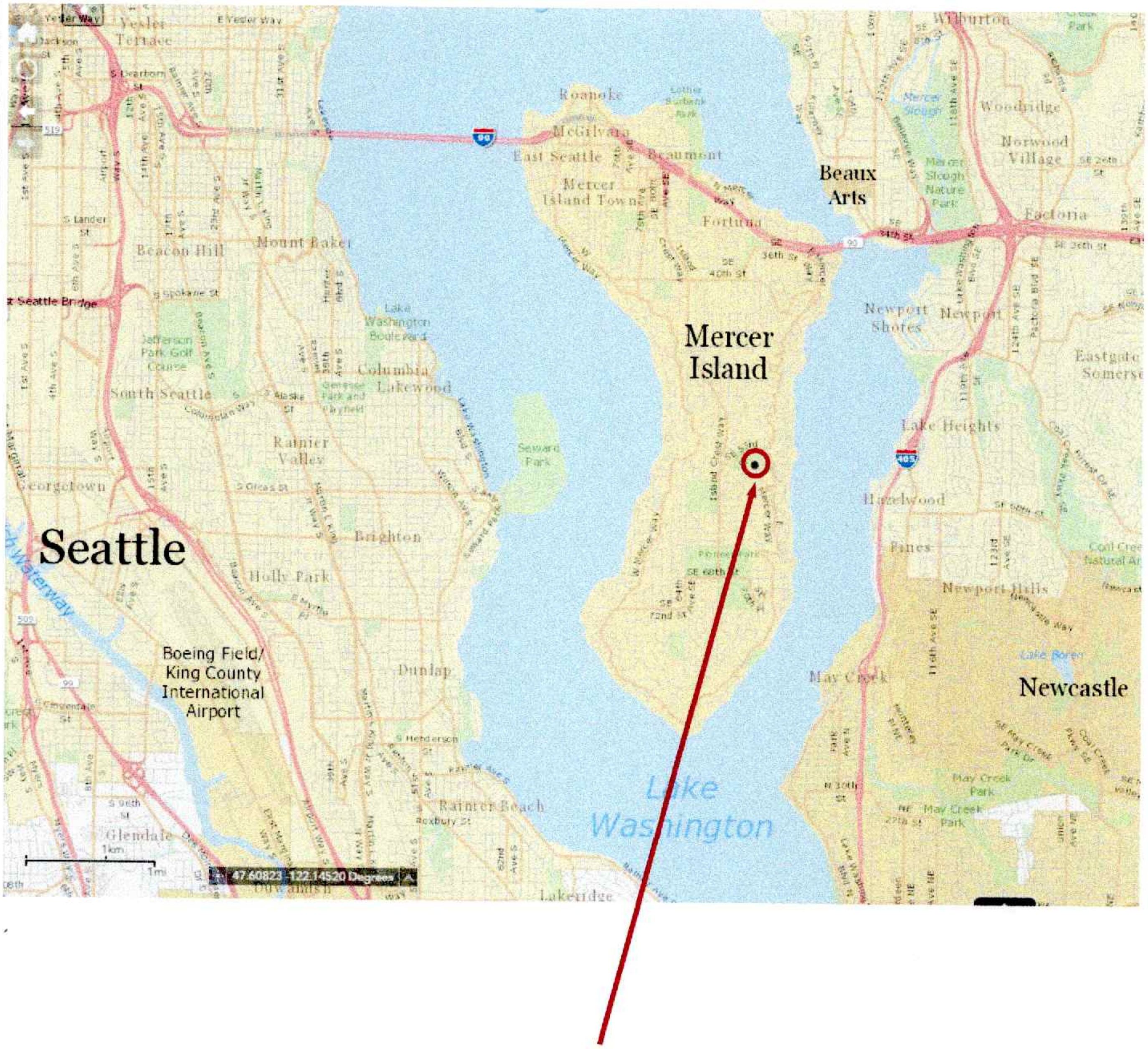
We should also provide geotechnical services during construction to observe compliance with our design concepts, specifications, and recommendations. This will allow for expedient design changes if subsurface conditions differ from those anticipated prior to the start of construction.

## 7.0 LIMITATIONS

We prepared this report in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made. This report is the copyrighted property of Ages Engineering and is intended for the exclusive use of Mr. Alan Scharhon and their authorized representatives for use in the design, permitting, and construction portions of this project.

The analysis and recommendations presented in this report are based on data obtained from others and our site explorations and should not be construed as a warranty of the subsurface conditions. Variations in subsurface conditions are possible. The nature and extent of which may not become evident until the time of construction. If variations appear evident, Ages Engineering should be requested to reevaluate the recommendations in this report prior to proceeding with construction. A contingency for unanticipated subsurface conditions should be included in the budget and schedule. Sufficient monitoring, testing and consultation should be provided by our firm during construction to confirm that the conditions encountered are consistent with those indicated during our exploration, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork and foundation installation activities comply with contract plans and specifications.

The scope of our services does not include services related to environmental remediation and construction safety precautions. Our recommendations are not intended to direct the contractor's methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design.




Approximate Site Location


Ages Engineering
P. O. Box 935
Puyallup, WA. 98371

Main (253) 845-7000
www.agesengineering.com


**Site Vicinity Map**
Scharhon Residence
9150 SE 54th Street
Mercer Island, Washington

| Project No.: A-1709 | September 2024 | **Figure 1** |
|---|---|---|


KEY:

APPROXIMATE LOCATION OF TEST HOLE TH-1 ♦

Ages Engineering
P. O. Box 935
Puyallup, WA. 98371

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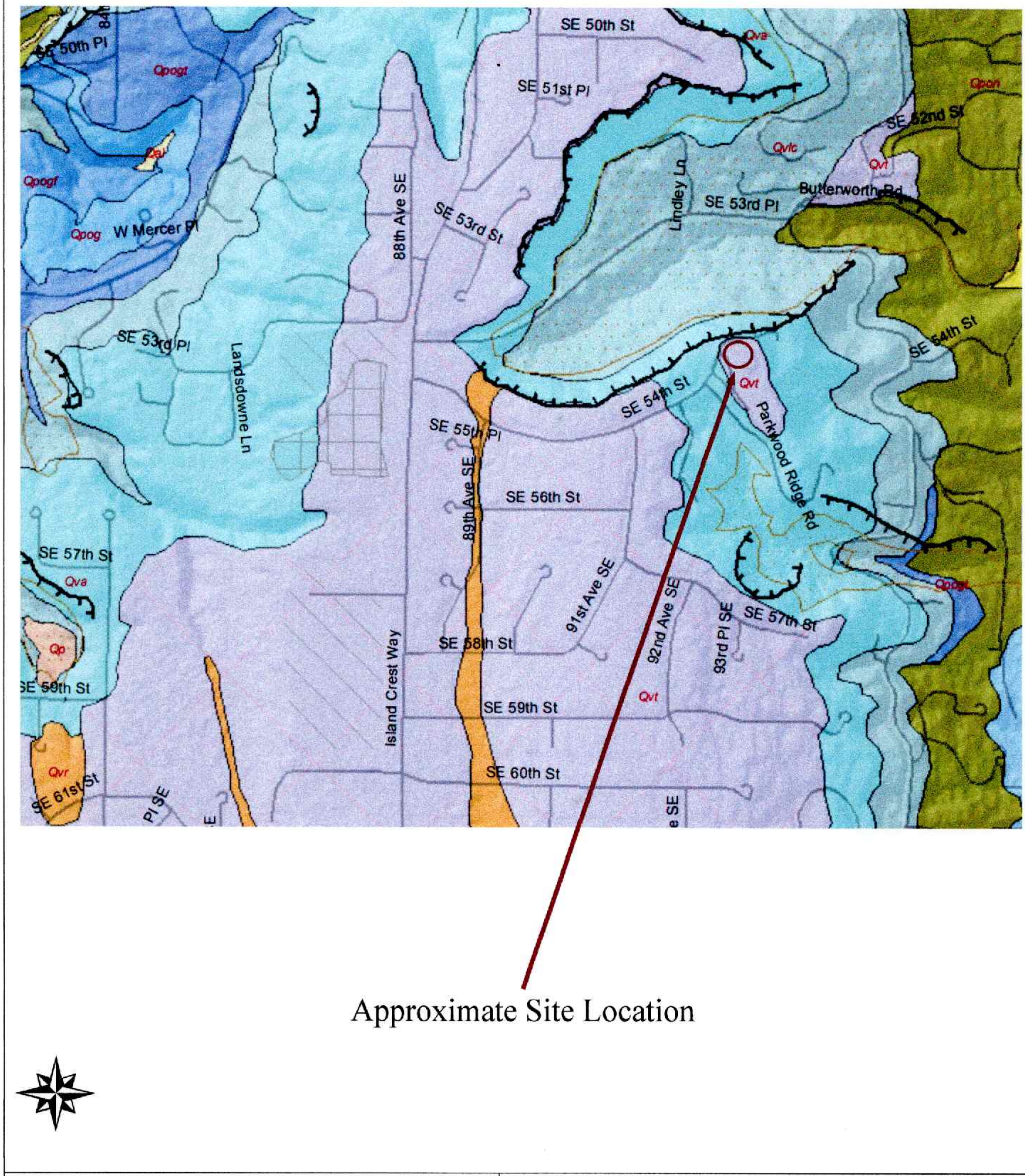
www.agesengineering.com

**Exploration Location Plan**
Scharhon Residence
9150 SE 54th Street
Mercer Island, Washington

| Project No.: A-1707 | September 2024 | **Figure 2** |
|---|---|---|

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**Geologic Map**
Scharhon Residence
9150 SE 54th Street
Mercer Island, Washington

| Project No.: A-1709 | September 2024 | **Figure 3** |
|---|---|---|


Approximate Site Location

| Ages Engineering<br>P. O. Box 935<br>Puyallup, WA. 98371<br>Main (253) 845-7000<br>www.agesengineering.com | **USDA NRCS Map**<br>Scharhon Residence<br>9150 SE 54th Street<br>Mercer Island, Washington | |
|---|---|---|
| | Project No.: A-1709 | September 2024 | **Figure 4** |

# APPENDIX A

## FIELD EXPLORATION AND LABORATORY TESTING

**Scharhon Residence**
**Mercer Island, Washington**

On September 18, 2024, we explored subsurface conditions at the site by excavating two hand-augured test holes to a maximum depth of 5.0 feet below surface grades. The approximate location of the site is shown on the Site Vicinity map provided in Figure 1. The approximate test hole locations are shown on the Exploration Location Plan provided in Figure 2.

A geotechnical engineering representative from our office conducted the field exploration, maintained a log of each test hole and classified the soils encountered, collected representative soil samples, and observed pertinent site features. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS) described on Figure A-1. The test hole logs are presented on Figure A-2.

Representative soil samples obtained from the test holes were placed in sealed containers and taken to our laboratory for further examination and testing. The moisture content of each sample was measured and is reported on the test hole logs.

# UNIFIED SOIL CLASSIFICATION SYSTEM

| MAJOR DIVISIONS | | | GROUP SYMBOL | GROUP NAME |
|---|---|---|---|---|
| COARSE GRAINED SOILS<br><br>More than 50% Retained on No. 200 Sieve | GRAVEL<br><br>More than 50% Of Coarse Fraction Retained on No. 4 Sieve | GRAVEL WITH < 5 % FINES | GW | Well-Graded GRAVEL |
| | | | GP | Poorly-Graded GRAVEL |
| | | GRAVEL WITH BETWEEN 5 AND 15 % FINES | GW-GM | Well-Graded GRAVEL with silt |
| | | | GW-GC | Well-Graded GRAVEL with clay |
| | | | GP-GM | Poorly-Graded GRAVEL with silt |
| | | | GP-GC | Poorly-Graded GRAVEL with clay |
| | | GRAVEL WITH > 15 % FINES | GM | Silty GRAVEL |
| | | | GC | Clayey GRAVEL |
| | SAND<br><br>More than 50% Of Coarse Fraction Passes No. 4 Sieve | SAND WITH < 5 % FINES | SW | Well-Graded SAND |
| | | | SP | Poorly-Graded SAND |
| | | SAND WITH BETWEEN 5 AND 15 % FINES | SW-SM | Well-Graded SAND with silt |
| | | | SW-SC | Well-Graded SAND with clay |
| | | | SP-SM | Poorly-Graded SAND with silt |
| | | | SP-SC | Poorly-Graded SAND with clay |
| | | SAND WITH > 15 % FINES | SM | Silty SAND |
| | | | SC | Clayey SAND |
| FINE GRAINED SOILS<br><br>More than 50% Passes No. 200 Sieve | SILT AND CLAY | Liquid Limit Less than 50 | ML | Inorganic SILT with low plasticity |
| | | | CL | Lean inorganic CLAY with low plasticity |
| | | | OL | Organic SILT with low plasticity |
| | | Liquid Limit 50 or more | MH | Elastic inorganic SILT with moderate to high plasticity |
| | | | CH | Fat inorganic CLAY with moderate to high plasticity |
| | | | OH | Organic SILT or CLAY with moderate to high plasticity |
| HIGHLY ORGANIC SOILS | | | PT | PEAT |

**NOTES:**

**(1)** Soil descriptions are based on visual field and laboratory observations using the classification methods described in ASTM D-2488. Where laboratory data are available, classifications are in accordance with ASTM D-2487.

**(2)** Solid lines between soil descriptions indicate a change in the interpreted geologic unit. Dashed lines indicate stratigraphic change within the unit.

**(3)** Fines are material passing the U.S. No. 200 Sieve.


Ages Engineering
P. O. Box 935
Puyallup, WA. 98371

Main (253) 845-7000
www.agesengineering.com


**Unified Soil Classification System (USCS)**
Scharhon Residence
9150 SE 54th Street
Mercer Island, Washington

| Project No.: A-1709 | September 2024 | **Figure A-1** |
|---|---|---|

P.O. Box 935
Puyallup, WA. 98371
Office (253) 845-7000

## Test Hole TH-1

DATE: September 18, 2024 LOGGED BY: SAK ELEV:

| Depth (feet) | Soil Description | Notes M% | Notes Other |
|---|---|---|---|
| 0 | 2 inches bark. | | |
| | Tan SAND with silt and gravel, medium dense, moist. SP-SM (Advance Outwash) | | |
| 5 | Test hole terminated at 6.0 feet below surface grades. No groundwater seepage encountered | | |

## Test Hole TH-2

DATE: September 18, 2024 9 SAK ELEV:

| Depth (feet) | Soil Description | Notes M% | Notes Other |
|---|---|---|---|
| 0 | FILL; Dark brown sand with silt and topsoil. Loose, wet. | | |
| | Tan SAND with silt and gravel, medium dense, moist. SP-SM (Advance Outwash) | | |
| 5 | Test hole terminated at 4.0 feet below surface grades. No groundwater seepage encountered | | |

**FIGURE A-2**