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Geotechnical Engineering Evaluation
Rudd Residential Addition
8032 SE 57th Street
Mercer Island, Washington
NGA File No. 1482723

Dear Chiara:

We are pleased to submit the attached report titled ***"Geotechnical Engineering Evaluation – Rudd Residential Addition – 8032 SE 57th Street – Mercer Island, Washington."*** This report summarizes our observations of the existing surface and subsurface conditions within the site, our observations and provides general recommendations for the proposed site development. Our services were completed in general accordance with the proposal signed by you on January 26, 2024.

The site is currently occupied by a single-family residence within the central portion of the property. The ground surface within the property is generally gently to moderately sloping down from the south towards the north. A moderate to steep north-facing slope is located within the northern portion of the property. Review of the City of Mercer Island GIS website indicates that the property is located within a mapped landslide area. The moderate to steep north-facing slope within the northern portion of the property is also designated as a protected slope area. We understand the proposed improvements will consist of developing an addition on the northwestern side of the existing residence as well as a second story addition on the eastern side of the residence.

We observed the excavation of two test pits and conducted two hand auger explorations within the proposed development area. Our explorations extended to depths in the range of 5.1 to 8.0 feet below the existing ground surface. Our explorations indicated that the proposed development area is generally underlain by surficial undocumented fill soils with competent native Pre-Olympia non-glacial deposits at depth.

It is our opinion that the proposed site development is feasible from a geotechnical engineering standpoint, provided that our recommendations for site development are incorporated into the project plans. It is also our opinion that the soils that underlie the site and form the core of the site slopes within the site should be stable with respect to deep-seated earth movements, due to their inherent strength and slope geometry. However, shallow failures could occur on the slopes in the loose surficial soil, especially during adverse weather or a significant seismic event. In general, the native glacial soils underlying the proposed development area should adequately support the planned structures.

Foundations should be advanced through any loose and/or undocumented fill soils down to the competent glacial soils interpreted to underlie the site, for bearing capacity and settlement considerations. These soils should generally be encountered approximately 2.0 to 5.0 feet below the existing ground surface, based on our explorations. If undocumented fill is encountered in unexplored areas of the site, it should be removed and replaced with structural fill for foundation support. We recommend that NGA be retained to review the proposed grading plans once they are developed.

In the attached report, we have also provided general recommendations for site grading, slabs-on-grade, structural fill placement, erosion control, and drainage. We should be retained to review and comment on final development plans and observe the earthwork phase of construction. We also recommend that NGA be retained to provide monitoring and consultation services during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications.

It has been a pleasure to provide service to you on this project. Please contact us if you have any questions regarding this report or require further information.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Khaled M. Shawish, PE
Principal Engineer

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INTRODUCTION

The site is currently occupied by a single-family residence within the central portion of the property. The ground surface within the property is generally gently to moderately sloping down from the east to west and moderately to steeply sloping down from south to north in the northern portion. A moderate to steep north-facing slope is located within the northern portion of the property that descends from the subject property north through the neighboring property. Review of the City of Mercer Island GIS website indicates that property is located within a landslide area. The moderate steep north-facing slope within the northern portion of the property is also designated as a protected slope area. We understand the plans for development include We understand the proposed improvements will consist of developing an addition on the northwestern side of the existing residence as well as a second story addition on the eastern side of the residence.

SCOPE

The purpose of this study is to explore and characterize the site surface and subsurface conditions and provide general recommendations for site development. Specifically, our scope of services included the following:

1. Reviewing available soil and geologic maps of the area, as well as other documentation pertaining to the site.
2. Exploring the subsurface soil and groundwater conditions within the site using trackhoe-excavated test pits. Excavation services to be subcontracted by NGA.
3. Mapping the conditions on the site slopes using shallow, hand-tool explorations where necessary to construct geological cross sections and qualitatively evaluate slope stability.
4. Performing laboratory grain-size sieve analysis on soil samples, as necessary.
5. Providing recommendations for structure setbacks from geologic hazards, as necessary.
6. Providing recommendations for earthwork and foundation support.
7. Providing recommendations for temporary and permanent slopes.
8. Providing recommendations for subsurface utilities and pavement subgrade preparation.
9. Providing recommendations for site drainage and erosion control.
10. Documenting the results of our findings, conclusions, and recommendations in a written geotechnical report.

SITE CONDITIONS

Surface Conditions

The site consists of a roughly square-shaped parcel covering approximately 0.22 acres. The site is currently occupied by a single-family residence within the central portion of the property. The ground surface within the property is generally gently to moderately sloping down from the east to west and moderately to steeply sloping from the south to north. A moderate to steep north-facing slope is located within the northern portion of the property that descends from the subject property north through the neighboring property at inclinations of 24 to 27 degrees (44.5 to 51.0 percent), as shown in Cross-Section A-A' in Figure 3.

The site is vegetated with grass, landscaping plants, bamboo, shrubs, and few young to mature trees. The site is bordered by SE 57th Street to the south, an undeveloped strip of land to the north, and residential properties to the west and east. We did not observe any standing water within the site or groundwater seepage within the site slopes during our site visit on February 5, 2024. We also did not observe significant signs of recent slope movement within the site slopes during our site visit. The existing site conditions and proposed development areas are shown on the Site Plan in Figure 2.

Subsurface Conditions

Geology: The geologic units for this area are shown on the Geologic Map of Mercer Island, Washington, by Kathy G. Troost & Aaron P. Wisher, et al. (USGS, October 2006). The site is mapped as Lawton Clay (Qvlc) with Pre-Olympia non-glacial deposits mapped nearby (Qpon). Lawton Clay is described as laminated to massive silt, clayey silt, and silty clay with scattered dropstones. The Pre-Olympia non-glacial deposits are described as sand, gravel, silt, clay, and organics deposits. Our explorations generally encountered fine to coarse sand with gravel, roots, and varying amounts of silt, consistent with the description of Pre-Olympia non-glacial deposits.

Explorations: We visited the site on February 5, 2024, to explore the subsurface conditions within the proposed development area with two test pits and two hand auger explorations. The approximate locations of our explorations are shown on the Schematic Site Plan in Figure 2. A geologist from Nelson Geotechnical Associates, Inc. (NGA) was present during the explorations, examined the soils and geologic conditions encountered, and maintained logs of the explorations. The soils were visually classified in general accordance with the Unified Soil Classification System, presented in Figure 4. The logs of our explorations are presented as Figures 5 and 6. The following paragraph contains a brief description of the subsurface conditions encountered in the explorations. For a detailed description of the subsurface conditions, the test pit and hand auger logs should be reviewed.

In all of our explorations we encountered 2.0 to 5.0 feet of dark brown to orange-brown, silty, fine to coarse sand with various amounts of roots, organics, gravel, cobbles, and iron-oxide weathering which we interpreted as topsoil and/or undocumented fill soils. Underlying the undocumented fill soils, we generally encountered fine to coarse sand with gravel, roots, and varying amounts of silt, which we interpreted as native Pre-Olympia non-glacial deposits. All of our explorations were completed within these deposits at depths in the range of 5.1 to 8.0 feet below the existing ground surface.

Hydrogeologic Conditions

We did not encounter groundwater seepage in explorations completed within the site. If seepage were to be encountered on the site, we would interpret this water to be perched groundwater. Perched water occurs when surface water infiltrates through less dense, more permeable soils and accumulates on top of underlying, less permeable soils. Perched water does not represent a regional groundwater "table" within the upper soil horizons. Perched water tends to vary spatially and is dependent upon the amount of precipitation. We would expect the amount of perched water to decrease during drier times of the year and increase during wetter periods.

SENSITIVE AREA EVALUATION

Seismic Hazard

We reviewed the 2018 International Building Code (IBC) and the ASCE 7-16 for seismic site classification for this project. Since competent glacial soils were encountered at depth within the subject site, the site conditions best fit the IBC description for Site Class D.

Table 1 below provides seismic design parameters for the site that are in conformance with the 2018 IBC, which specifies a design earthquake having a two percent probability of occurrence in 50 years (return interval of 2,475 years), and the 2014 USGS seismic hazard maps.

Table 1 – ASCE 7-16 Seismic Design Parameters

Site Class	Spectral Acceleration at 0.2 sec. (g) S_s	Spectral Acceleration at 1.0 sec. (g) S_1	Site Coefficients		Design Spectral Response Parameters	
			F_a	F_v	S_{DS}	S_{D1}
D	1.63	0.64	Null	Null	1.15	0.88

The spectral response accelerations were obtained from ASCE Hazard Tool website (2024 data) for the project address.

Hazards associated with seismic activity include liquefaction potential and amplification of ground motion. Liquefaction is caused by a rise in pore pressures in a loose, fine sand deposit beneath the groundwater table. It is our opinion that the medium dense or better Pre-Olympia non-glacial deposits interpreted to underlie the site have a low potential for liquefaction or amplification of ground motion.

Erosion Hazard

The criteria used for determination of the erosion hazard for affected areas include soil type, slope gradient, vegetation cover, and groundwater conditions. The erosion sensitivity is related to vegetative cover and the specific surface soil types, which are related to the underlying geologic soil units. The Natural Resources Conservation Service (NRCS) lists the site as Kitsap silt loam, 2 to 8 percent slopes. The erosion hazard is listed as slight. Based on our observations and the material encountered, we would interpret this site as having a low to moderate erosion hazard where the surficial soils are exposed. It is our opinion that the erosion hazard for site soils should be low in areas where the site is not disturbed.

Landslide Hazard/Slope Stability

The criteria used for evaluation of landslide hazards include soil type, slope gradient, and groundwater conditions. The ground surface within the property is generally gently to moderately sloping down from the east to west and south to north. A steep north-facing slope is located within the very northeastern portion of the property that descends from the subject property north through the neighboring northern property at inclinations of 24 to 27 degrees (44.5 to 51.0 percent), as shown in Cross-Section A-A' in Figure 3. The slope nearest the development area has a vertical relief of approximately 35 feet. We did not observe evidence of significant slope instability within or within the immediate vicinity of the property during our investigation, such as deep-seated landsliding. We also did not observe groundwater seepage or signs of erosion or sloughing on the site slopes at the time of our visit. The City of Mercer Island has mapped the site as a landslide area and the slope near the northern property line as a protected slope area.

The core of the slope is inferred to consist primarily of medium dense or better native Pre-Olympia non-glacial deposits. Relatively shallow sloughing failures as well as surficial erosion are natural processes and should be expected on the steeper site slopes during extreme weather conditions. It is our opinion that while there is potential for erosion, soil creep, and shallow failures within the loose surficial soils on the steep slope, there is not a significant potential for deep-seated slope failures under current site conditions. Proper site grading and drainage as well as adequate foundation placement as recommended in this report should help maintain current stability conditions.

CONCLUSIONS AND RECOMMENDATIONS

General

It is our opinion that the proposed residential additions within this property are feasible from a geotechnical standpoint. It is also our opinion that the soils that underlie the site and form the core of the site slopes within the northern portion of the property should be stable with respect to deep-seated earth movements, due to their inherent strength and slope geometry. However, shallow failures could occur on the slopes in the loose surficial soil, especially during adverse weather or a significant seismic event. Proper foundation construction and placement, erosion and drainage control measures as recommended in this report should reduce the impact of such events on the proposed development. Our explorations indicated that the site was underlain by surficial undocumented fill soils with medium dense or better Pre-Olympia non-glacial deposits at depth within the proposed development area. These competent native soils should provide adequate support for foundation and slab loads. We recommend that the structure be designed utilizing conventional shallow foundations. Footings should extend through any loose surficial soil and be keyed into the underlying competent native soils. These soils should be encountered roughly 2.0 to 5.0 feet below the existing ground surface within the proposed development area with some potential localized areas of deeper loose soils closer to top of the northern slope. Additionally, during our explorations near the northeastern portion of the existing residence, we encountered medium dense or better native soils at the base of the existing footing. We also performed an exploration along the southern portion of the existing residence which encountered relatively shallow native soils at a depth of 2.5 feet. It is our opinion that the existing foundation is situated on competent native bearing soils. This is further discussed in our **Foundations** subsection of this report.

All grading operations and drainage improvements planned as part of this development should be planned and completed in a matter that enhances the stability of the site slopes, not reduces it. Excavation spoils associated with the building addition excavations should not be stockpiled near the slope or be allowed to encroach on the slopes. Also, runoff generated within the site should be collected and routed into a permanent discharge system and not be allowed to flow over the site slopes. Future vegetation management on the slopes should be the subject of a specific evaluation and a plan approved by the City of Mercer Island. The site slopes should be monitored on an ongoing basis, especially during the wet season, for any signs of instability, and corrective actions promptly taken should any signs of instability be observed. Lawn clipping and any other household trash or debris should never be allowed to reach the site slopes.

The soils encountered on this site are considered moisture-sensitive and will disturb easily when wet. To lessen the potential impacts of construction on the steep slope and to reduce cost overruns and delays, we recommend that construction take place during the drier summer months. If construction takes place during the rainy months, additional expenses and delays should be expected. Additional expenses could include the need for placing erosion control and temporary drainage measures to protect the slopes, the need for placing a blanket of rock spalls on exposed subgrades and construction traffic areas prior to placing structural fill, and the need for importing all-weather material for structural fill.

Under no circumstances should water be allowed to flow over or concentrate on the site slopes, both during construction, and after construction has been completed. We recommend that stormwater runoff from the new roof and yard drains be collected and tightlined to an approved discharge point. The slopes should be protected from erosion. We recommend that all disturbed areas be replanted with vegetation to re-establish vegetation cover as soon as possible. Specific recommendations for erosion control are presented in the **Erosion Control and Slope Protection Measures** subsection of this report.

Erosion Control and Slope Protection Measures

The erosion hazard for the on-site soils is interpreted to be low to moderate, but the actual hazard will be dependent on how the site is graded and how water is allowed to concentrate. Best Management Practices (BMPs) should be used to control erosion. Areas disturbed during construction should be protected from erosion. Erosion control measures may include diverting surface water away from the stripped or disturbed areas. Silt fences and/or straw bales should be erected to prevent muddy water from leaving the site or flowing over the site slopes. Stockpiles should be covered with plastic sheeting during wet weather and stockpiled material should be placed on or near sloping portions of the site. Disturbed areas should be planted as soon as practical, and the vegetation should be maintained until it is established. The erosion potential for areas not stripped of vegetation should be low.

Protection of slopes, protected slope areas, and buffer areas should be performed as required by City of Mercer Island code. Specifically, we recommend that the site slopes not be disturbed or modified through placement of any fill or removal of the existing vegetation. No material of any kind should be placed on the slope, within 20 feet of the top of slope, or be allowed to reach the slopes, such as excavation spoils, lawn clippings, and other yard waste, trash, or soil stockpiles. Trees should not be cut down or removed from the site slopes unless a mitigation plan is developed, such as the replacement of vegetation for erosion protection. Replacement of vegetation should be performed in accordance with City of Mercer Island code. Any proposed development within the vicinity of the site slope areas, other than light decks or patios, should be the subject of a specific geotechnical evaluation. Under no circumstances should water be allowed to concentrate on the slopes.

Structure Setback

Uncertainties related to building along steep slopes are typically addressed by the use of building setbacks. The purpose of the setback is to establish a "buffer zone" between the structure and the top/toe of the slope so that ample room is allowed for normal slope recession during a reasonable life span of the structure. In a general sense, the greater the setback distance, the lower the risk of slope failures impacting the structure. From a geological standpoint, the setback dimension is based on the slope's physical characteristics, such as slope height, surface angle, material composition, and hydrology. Other factors such as historical slope activity, rate of regression, and the type and desired life span of the development are important considerations as well.

As discussed above, although there is a potential for the steep slope below the proposed addition location to experience minor localized failures, we believe it is stable with respect to deep-seated instability. The existing residence is setback approximately 30 feet from the top of the northern steep slope. Due to the topography of the slope, the proposed location of the addition on the northwestern portion of the existing residence is planned to have a setback of at least 40 feet which is greater than the existing structure setback. Due to the core of the steep slope consisting of primarily medium dense or better glacial soils, the lack of groundwater seepage, and the height and angle of the overall slopes, it is our opinion that the existing 30-foot setback should be sufficient for the life of the structure. We recommend this setback area not be disturbed or modified through placement of any fill or removal of the existing vegetation. No material of any kind should be placed on the slope, within 30 feet of the top of slope, or be allowed to reach the slopes, such as excavation spoils, lawn clippings, and other yard waste, trash, or soil stockpiles. This setback should provide suitable protection of the structure in the case of shallow failures and erosion from the eastern steep slope.

Site Preparation and Grading

After erosion control measures are implemented, site preparation should consist of removing any hard surfaces and stripping any loose soils and undocumented fill to expose medium dense or better native soils in new foundation and slab-on-grade areas. These soils should generally be encountered between 2.0 to 5.0 feet below the existing ground surface. The stripped materials should be removed from the site. If the ground surface, after site stripping, should appear to be loose, it should be compacted to a non-yielding condition. Areas observed to pump or weave during compaction should be over-excavated and replaced with properly compacted structural fill or rock spalls. If loose soils are encountered in any slab areas, the loose soils should be removed and replaced with rock spalls or granular structural fill. If significant surface water flow is encountered during construction, this flow should be diverted around areas to be developed, and the exposed subgrades should be maintained in a semi-dry condition.

This site is underlain by moisture-sensitive soils. Due to these conditions, special site stripping and grading techniques might be necessary, especially if grading is attempted in wet weather. These could include promptly covering exposed subgrades with a layer of crushed rock for protection. If wet conditions are encountered or construction is attempted in wet weather, the subgrade should not be compacted as this could cause further subgrade disturbance. In wet conditions, it may be necessary to cover the exposed subgrade with a layer of crushed rock as soon as it is exposed to protect the moisture sensitive soils from disturbance by machine or foot traffic during construction. The prepared subgrade should be protected from construction traffic and surface water should be diverted around prepared subgrade. Shallow groundwater, if encountered, should be intercepted with cut-off drains and routed around the planned grading area, or the groundwater should be controlled with sump-pumps or dewatering systems. Failure to follow these recommendations could cause erosion, as well as result in inadequate subgrades.

Temporary and Permanent Slopes

Final grading plans were not available at the time this report was prepared. However, temporary excavations may be required to construct the planned addition. Temporary excavation stability is a function of many factors, including the type and consistency of soils, depth of the cut, surcharge loads adjacent to the excavation, length of time a cut remains open, and the presence of surface water or groundwater. It is exceedingly difficult under these variable conditions to estimate a stable, temporary, cut slope angle. Therefore, it should be the responsibility of the contractor to maintain safe slope configurations since they are continuously at the job site, able to observe the soil and groundwater conditions encountered and able to monitor the nature and condition of the cut slopes.

The following information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Nelson Geotechnical Associates, Inc. assumes responsibility for job site safety. Job site safety is the sole responsibility of the project contractor.

For planning purposes, we recommend that temporary cuts in the on-site soils be no steeper than 1.5 Horizontal to 1 Vertical (1.5H:1V). If significant groundwater seepage or surface water flow were encountered, we would expect that flatter inclinations would be necessary. We recommend that cut slopes be protected from erosion. Measures taken may include covering cut slopes with plastic sheeting and diverting surface runoff away from the top of cut slopes. Excavated material should not be stockpiled any closer than 10 feet from the top of the cuts. We do not recommend vertical slopes for cuts deeper than four feet if worker access is necessary. We recommend that cut slope heights and inclinations conform to WISHA/OSHA standards. If the above inclinations cannot be met due to property line constraints and/or worker access issues, we recommend that shoring be considered for the planned cuts.

We are available to provide specific recommendations for temporary shoring once grading plans have been finalized.

Permanent cut and fill slopes should be no steeper than 2H:1V. However, flatter inclinations may be required in areas where loose soils are encountered. Permanent slopes should be planted, and the vegetative cover should be maintained until it is established. We should review plans and visit the site to evaluate excavations for this project.

Foundation Support

Shallow Foundation Support: Conventional shallow spread foundations should be placed on undisturbed medium dense or better native soils or structural fill extending to these soils. Medium dense or better soils should be encountered roughly 2.0 to 5.0 feet below the ground surface based on our explorations in the proposed development areas; however, localized deeper areas of loose soil may be encountered closer to the top of the northern slope. Where undocumented fill or less dense soils are encountered at footing bearing elevation, the subgrade should be over-excavated to expose suitable bearing soil.

The residence addition foundations should be supported on the competent native glacial soils and should extend at least 18 inches below the lowest adjacent finished ground surface for frost protection and bearing capacity considerations. Foundations should be designed in accordance with the 2018 IBC. Footing widths should be based on the anticipated loads and allowable soil bearing pressure. Water should not be allowed to accumulate in footing trenches. All loose or disturbed soil should be removed from the foundation excavation prior to placing concrete.

For foundations constructed as outlined above, we recommend an allowable design bearing pressure of not more than 2,000 pounds per square foot (psf) be used for the footing design for footings founded on the medium dense or better native soils. The foundation bearing soil should be evaluated by a representative of NGA. We should be consulted if higher bearing pressures are needed. Current IBC guidelines should be used when considering increased allowable bearing pressure for short-term transitory wind or seismic loads. Potential foundation settlement using the recommended allowable bearing pressure is estimated to be less than one inch total and ½-inch differential between adjacent footings or across a distance of about 20 feet, based on our experience with similar projects.

Lateral loads may be resisted by friction on the base of the footing and passive resistance against the subsurface portions of the foundation. A coefficient of friction of 0.35 may be used to calculate the base friction and should be applied to the vertical dead load only. Passive resistance may be calculated as a triangular equivalent fluid pressure distribution. An equivalent fluid density of 200 pounds per cubic foot (pcf) should be used for passive resistance design for a level ground surface adjacent to the footing. This level surface should extend a distance equal to at least three times the footing depth. These recommended values incorporate safety factors of 1.5 and 2.0 applied to the estimated ultimate values for frictional and passive resistance, respectively. To achieve this value of passive resistance, the foundations should be poured "neat" against the native medium dense soils or compacted fill should be used as backfill against the front of the footing. We recommend that the upper one-foot of soil be neglected when calculating the passive resistance.

We also explored the soils in the immediate vicinity of the existing residence. Our explorations indicated the residence is situated on competent native soils at relatively shallow depths. We understand the eastern portion of the existing residence is proposed to have an additional story added. We recommend a structural engineer licensed in the State of Washington investigate the existing foundations to confirm they can handle the additional load. Total loads on existing foundations should not exceed our parameters stated above.

Structural Fill

General: Fill placed beneath foundations, slabs, pavements, or other settlement-sensitive structures should be placed as structural fill. Structural fill, by definition, is placed in accordance with prescribed methods and standards, and is monitored by an experienced geotechnical professional or soils technician. Field monitoring procedures would include the performance of a representative number of in-place density tests to document the attainment of the desired degree of relative compaction. The area to receive the fill should be suitably prepared as described in the **Site Preparation and Grading** subsection prior to beginning fill placement.

Materials: Structural fill should consist of a good quality, granular soil, free of organics and other deleterious material, and be well graded to a maximum size of about three inches. All-weather structural fill should contain no more than five-percent fines (soil finer than U.S. No. 200 sieve, based on that fraction passing the U.S. 3/4-inch sieve). Some of the on-site soils could be used as structural fill, but that will highly depend on the moisture content of the material at the time of construction. We should be retained to evaluate proposed structural fill material prior to placement.

Fill Placement: Following subgrade preparation, placement of structural fill may proceed. All filling should be accomplished in uniform lifts up to eight inches thick. Each lift should be spread evenly and be thoroughly compacted prior to placement of subsequent lifts. All structural fill should be compacted to a minimum of 95 percent of its maximum dry density. Maximum dry density, in this report, refers to that density as determined by the ASTM D-1557 Compaction Test procedure. The moisture content of the soils to be compacted should be within about two percent of optimum so that a readily compactable condition exists. It may be necessary to over-excavate and remove wet soils in cases where drying to a compactable condition is not feasible. All compaction should be accomplished by equipment of a type and size sufficient to attain the desired degree of compaction.

Slab-on-Grade

Slabs-on-grade should be supported on subgrade soils prepared as described in the **Site Preparation and Grading** subsection of this report. We recommend that all floor slabs be underlain by at least six inches of free-draining gravel with less than three percent by weight of the material passing Sieve #200 for use as a capillary break. A suitable vapor barrier, such as heavy plastic sheeting (6-mil minimum), should be placed over the capillary break material. An additional 2-inch-thick moist sand layer may be used to cover the vapor barrier. This sand layer is optional and is intended to protect the vapor barrier membrane during construction and assist in curing the concrete.

Utilities

We recommend that underground utilities be bedded with a minimum six inches of pea gravel prior to backfilling the trench with on-site or imported material. Trenches within settlement sensitive areas should be compacted to 95% of the modified proctor as described in the **Structural Fill** subsection of this report. Trench backfill should be compacted to a minimum of 95% of the modified proctor maximum dry density within the roadway. Trenches located in non-structural areas should be compacted to a minimum 90% of the maximum dry density. Trench backfill compaction should be tested.

Site Drainage

Surface Drainage: The finished ground surface should be graded such that runoff is directed away from the residence and the slopes. Water should not be allowed to collect in any areas where footings, slabs, or pavements are to be constructed. Final site grades should allow for drainage away from the structures. We suggest that the finished ground be sloped at a minimum gradient of three percent, for a distance of at least 10 feet away from the structures.

Subsurface Drainage: If groundwater is encountered during construction, we recommend that the contractor slope the bottom of the excavation and collect the water into ditches and small sump pits where the water can be pumped from the excavation and routed to a suitable discharge point. Water should not be allowed to flow over the steep slope. Perched groundwater conditions are anticipated on this site and footing drains are recommended for this project. Footing drains should be installed at least one foot below planned finished floor elevation. The drains should consist of a minimum four-inch-diameter, rigid, slotted or perforated, PVC pipe surrounded by free-draining material covered with filter fabric. We recommend that the free-draining material consist of an 18-inch-wide zone of clean (less than three-percent fines), granular material. Washed rock is an acceptable drain material. The free-draining material should extend behind any subsurface walls to one foot below the finished ground surface.

The top foot of soil should consist of low permeability soil placed over plastic sheeting or building paper to minimize the migration of surface water or silt into the footing drain. Footing drains should discharge into tightlines leading to an approved collection and discharge point with convenient cleanouts to prolong the useful life of the drains. Roof drains should not be connected to wall or footing drains. We also recommend that all residence downspouts and yard drains be investigated to understand where they are directed. At a minimum, we recommend that all residence downspouts and yard drains be tight lined and directed to discharge to an approved discharge location located within the roadway.

CONSTRUCTION MONITORING

We recommend that we be retained to provide construction monitoring services to evaluate conditions encountered in the field with respect to anticipated conditions, to provide recommendations for design changes should the conditions differ from anticipated, and to evaluate whether construction activities comply with contract plans and specifications.

CLOSURE

Based on our understanding of the proposed plans, and provided that the recommendations in our in this report are strictly followed during construction, the areas disturbed by construction should remain stable meeting the criteria stated in **Mercer Island City Code 19.07.160.B.2.a-d.** In addition, the development has been designed so that the risk to the lot and adjacent properties is eliminated or mitigated such that the site is determined to be safe, meeting the requirements stated in **Mercer Island City Code 19.07.160.B.3.b.**

USE OF THIS REPORT

NGA has prepared this report for **Chiara Maggiore, Jeffrey Rudd,** and associated agents, for use in the planning and design of the proposed improvements on this site only. The scope of our work does not include services related to construction safety precautions and 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. There are possible variations in subsurface conditions between the explorations and also with time. Our report, conclusions, and interpretations should not be construed as a warranty of subsurface conditions. A contingency for unanticipated conditions should be included in the budget and schedule. We recommend that we be retained to review the project plans after they have been developed to determine that recommendations in the report were incorporated into project plans.

All people who own or occupy homes on or near hillsides should realize that landslide movements are always a possibility. The landowner should periodically inspect the slope, especially after a winter storm. If distress is evident, a geotechnical engineer should be contacted for advice on remedial/preventative measures. The probability that landsliding will occur is substantially reduced by the proper maintenance of drainage control measures at the site (the runoff from the roofs should be led to an approved discharge point). Therefore, the homeowner should take responsibility for performing such maintenance. Consequently, we recommend that a copy of our report be provided to any future homeowners of the property if the home is sold.

We recommend that NGA be retained to review final plans prior to construction. We also recommend that NGA be retained to provide monitoring and consultation services during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed differ from those anticipated, and to evaluate whether or not earthwork and foundation installation activities comply with contract plans and specifications. We should be contacted a minimum of one week prior to construction activities and could attend pre-construction meetings if requested.

Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering practices in effect in this area at the time this report was prepared. No other warranty, expressed or implied, is made. Our observations, findings, and opinions are a means to identify and reduce the inherent risks to the owner.

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We appreciate the opportunity to provide service to you on this project. If you have any questions or require further information, please call.

Sincerely,

NELSON GEOTECHNICAL ASSOCIATES, INC.

Daniel J. O'Dell
Project Geologist

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REGISTERED
PROFESSIONAL ENGINEER
3.27.2024

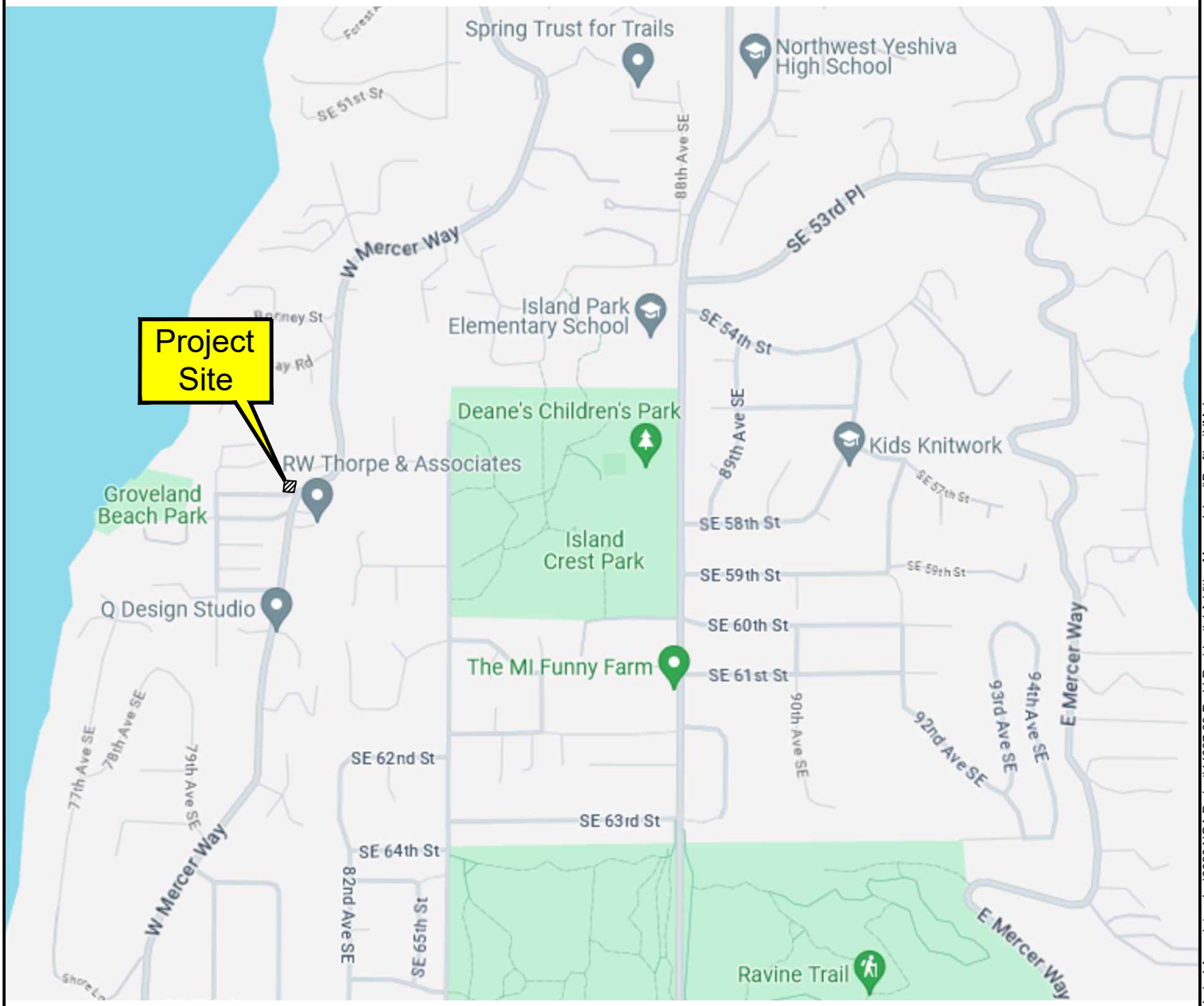
Khaled M. Shawish, PE
Principal

DJO:FKS:KMS:dy

Six Figures Attached

VICINITY MAP

Not to Scale



Mercer Island, WA

Project Number	Rudd Residential Addition Vicinity Map	NELSON GEOTECHNICAL ASSOCIATES, INC	No.	Date	Revision	By	CK
1482723			1	2/5/24	Original	ABT	DJO
Figure 1		

Woodinville Office
17311-135th Ave. NE, A-500
Woodinville, WA 98072
(425) 486-1669 / Fax: 481-2510

Wenatchee Office
105 Palouse St.
Wenatchee, WA 98801
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www.nelsongeotech.com

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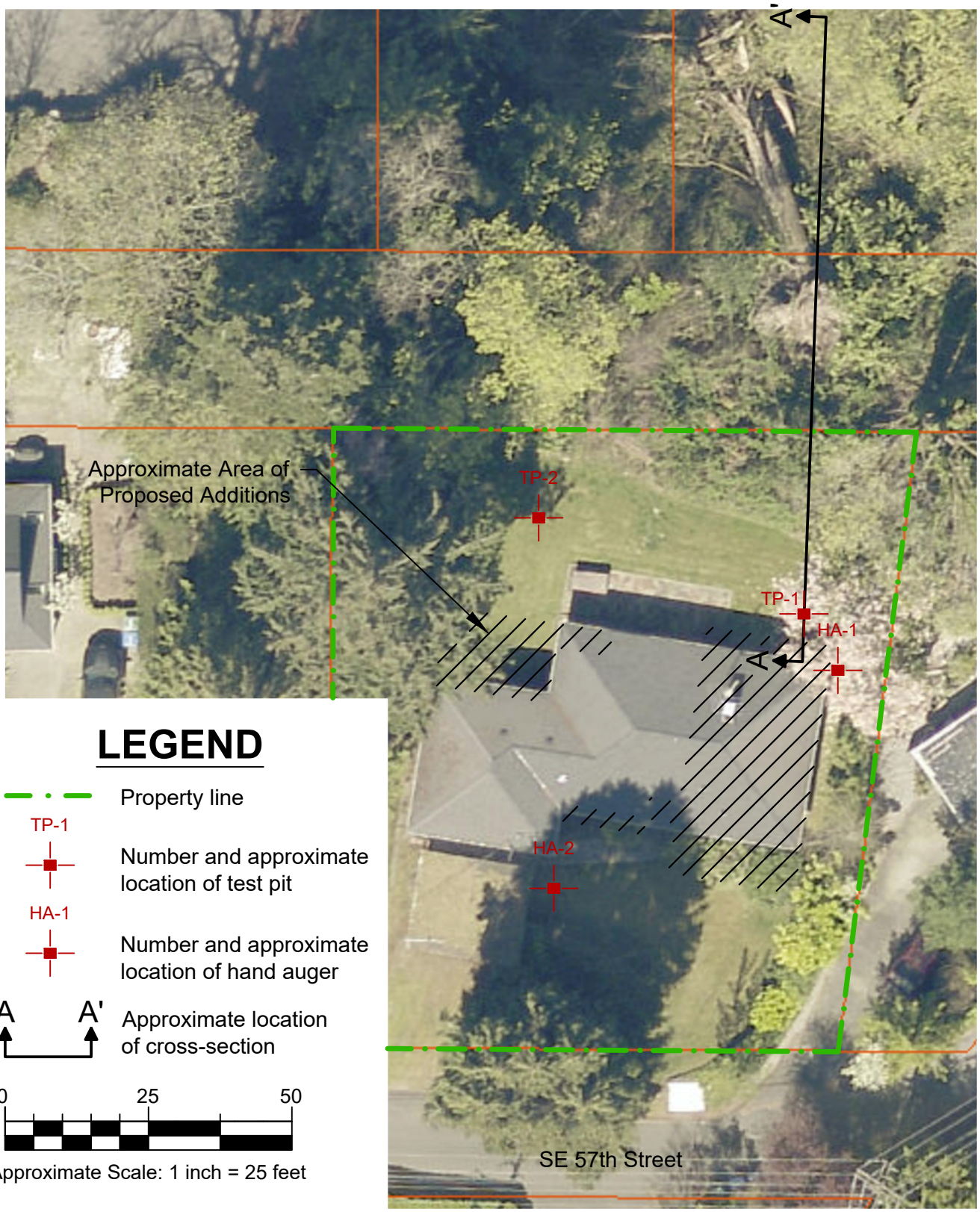
Site Plan



LEGEND

- Property line
- TP-1 — Number and approximate location of test pit
- HA-1 — Number and approximate location of hand auger
- A A' — Approximate location of cross-section

0 25 50

Approximate Scale: 1 inch = 25 feet

Reference: Site Plan based on field measurements, observations, and aerial parcel map review.

Project Number	Rudd Residence Addition Site Plan
1482723	
Figure 2	

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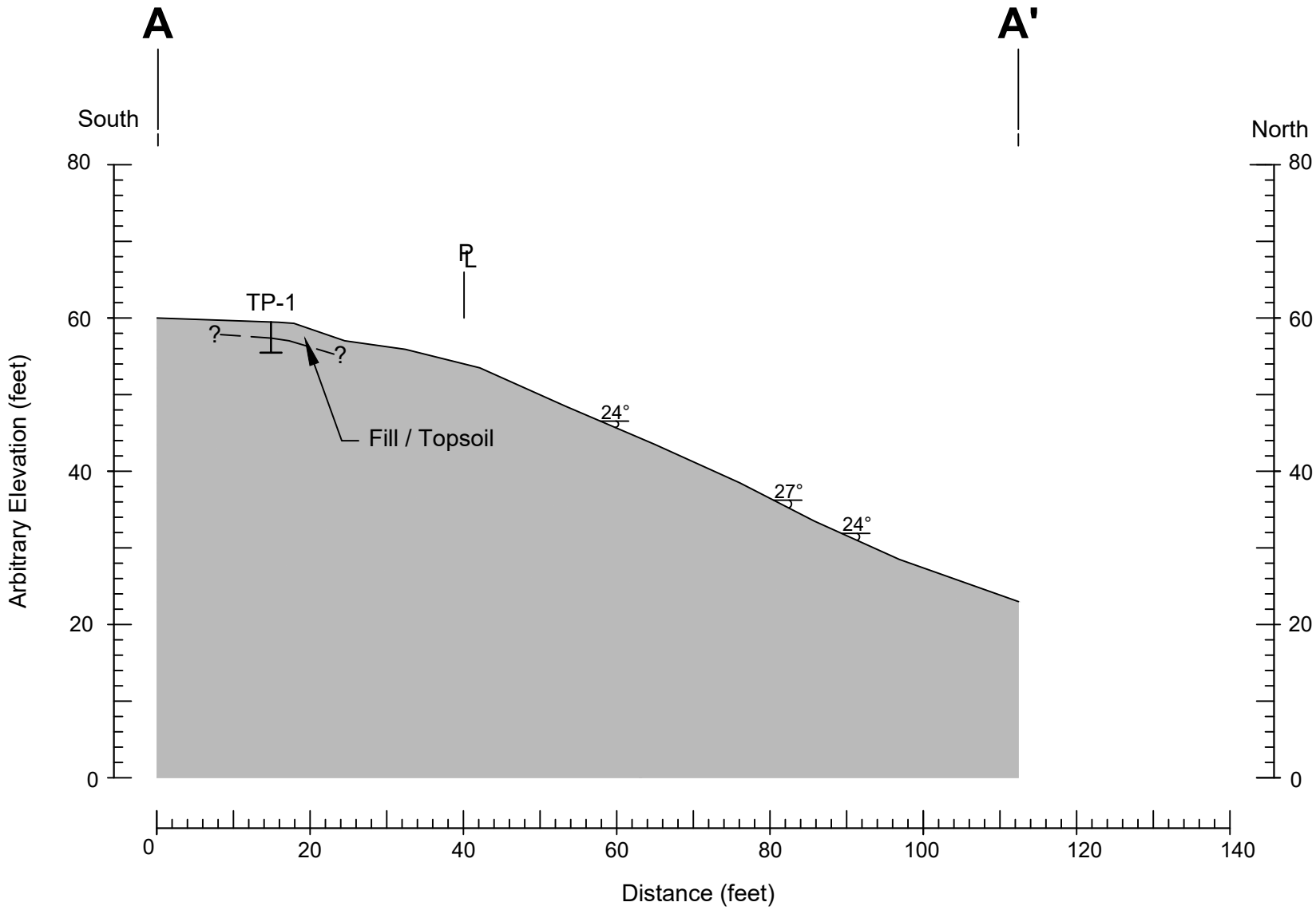

Exploration

Test Pit Designation → TP-1

Groundwater Level During Exploration →

Geologic Contact (approximate) → ? — — ?

NOTES:
1) Stratigraphic conditions are interpolated between the explorations. Actual conditions may vary.
2) Elevations are arbitrary.

Reference: Cross Section is based on field measurements using a hand-held clinometer and 100-ft tape measure.

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Rudd Residence Addition
Cross-Section A-A'

Project Number 1482723

Figure 3

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UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE - GRAINED SOILS MORE THAN 50 % RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50 % OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50 % OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE - GRAINED SOILS MORE THAN 50 % PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50 %	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 % OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1) Field classification is based on visual examination of soil in general accordance with ASTM D 2488-93.

2) Soil classification using laboratory tests is based on ASTM D 2488-93.

3) Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry - Absence of moisture, dusty, dry to the touch

Moist - Damp, but no visible water.

Wet - Visible free water or saturated, usually soil is obtained from below water table

Project Number 1482723	Rudd Residence Additon Soil Classification Chart	NELSON GEOTECHNICAL ASSOCIATES, INC
Figure 4		

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LOG OF EXPLORATION

DEPTH (FEET)	USCS	SOIL DESCRIPTION
TEST PIT ONE		
0.0 – 1.5		GRASS UNDERLAIN BY DARK BROWN, SILTY FINE TO MEDIUM SAND WITH ROOTS, ORGANICS, IRON-OXIDE WEATHERING, AND GRAVEL (LOOSE, MOIST) **(UNDOCUMENTED FILL/TOPSOIL)**
1.5 – 5.0		GRAY-BROWN TO ORANGE-BROWN, SILTY FINE TO COARSE SAND WITH GRAVEL AND ROOTS (LOOSE TO MEDIUM DENSE, MOIST TO WET) **(UNDOCUMENTED FILL)**
5.0 – 6.5	SM-SW	GRAY, FINE TO COARSE SAND WITH SILT, GRAVEL, ROOTS, AND SILT CLASTS (MEDIUM DENSE, MOIST)
		SAMPLES WERE NOT COLLECTED GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 6.5 FEET ON 02/05/2024
TEST PIT TWO		
0.0 – 0.5		GRASS UNDERLAIN BY DARK BROWN, SILTY FINE TO MEDIUM SAND WITH ROOTS, ORGANICS, AND GRAVEL (LOOSE, MOIST) **(UNDOCUMENTED FILL/TOPSOIL)**
0.5 – 3.5		ORANGE-BROWN TO LIGHT BROWN, SILTY FINE TO COARSE SAND WITH ROOTS AND GRAVEL (LOOSE TO MEDIUM DENSE, MOIST) **(UNDOCUMENTED FILL)**
4.5 – 8.0	SM-SW	LIGHT BROWN TO GRAY-BROWN, FINE TO COARSE SAND WITH SILT, GRAVEL, TRACE COBBLES, AND IRON-OXIDE STAINING (MEDIUM DENSE, MOIST)
		SAMPLES WERE COLLECTED AT 6.5 FEET AND 8.0 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED TEST PIT CAVING WAS NOT ENCOUNTERED TEST PIT WAS COMPLETED AT 8.0 FEET ON 02/05/2024
HAND AUGER ONE		
0.0 – 1.0		MOSS AND BARE DIRT UNDERLAIN BY DARK BROWN, SILTY FINE TO MEDIUM SAND WITH ROOTS, ORGANICS, IRON-OXIDE WEATHERING, AND GRAVEL (LOOSE, MOIST) **(UNDOCUMENTED FILL/TOPSOIL)**
1.0 – 2.0		LIGHT BROWN TO ORANGE-BROWN, SILTY FINE TO MEDIUM SAND WITH ROOTS, GRAVEL, AND TRACE COBBLES (LOOSE, MOIST) **(UNDOCUMENTED FILL)**
2.0 – 4.0	SM-SW	LIGHT BROWN TO GRAY-BROWN, FINE TO COARSE SAND WITH SILT, TRACE ROOTS AND GRAVEL (MEDIUM DENSE, MOIST TO WET)
4.0 – 6.0	SM	GRAY, SILTY FINE SAND WITH IRON-OXIDE STAINING (MEDIUM DENSE TO DENSE, MOIST)
		SAMPLES WERE NOT COLLECTED GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED HAND AUGER CAVING WAS NOT ENCOUNTERED HAND AUGER WAS COMPLETED AT 6.0 FEET ON 02/05/2024

LOG OF EXPLORATION

DEPTH (FEET)	USCS	SOIL DESCRIPTION
HAND AUGER TWO		
0 – 2.0		GRASS UNDERLAIN BY DARK BROWN TO LIGHT BROWN, SILTY FINE TO MEDIUM SAND WITH ROOTS, GRAVEL, CHARCOAL, AND TRACE ORGANICS (LOOSE, MOIST) **(UNDOCUMENTED FILL/TOPSOIL)**
2.0 – 2.5		DARK BROWN, SILTY FINE TO MEDIUM SAND WITH GRAVEL, AND TRACE COBBLES (LOOSE, MOIST TO WET) **(UNDOCUMENTED FILL)**
2.5 – 4.5	SM-SW	LIGHT BROWN TO GRAY-BROWN, SILTY FINE TO MEDIUM SAND WITH GRAVEL, TRACE ROOTS, AND WELL-CEMENTED CLASTS OF SILTY FINE TO MEDIUM SAND WITH GRAVEL (MEDIUM DENSE TO DENSE, MOIST)
4.5 – 5.0	SM-SW	GRAY-BROWN TO ORANGE-BROWN, SILTY FINE TO COARSE SAND WITH TRACE ROOTS, IRON-OXIDE WEATHERING, AND GRAVEL (MEDIUM DENSE, MOIST)
5.0 – 5.1	SM	GRAY TO BLUE-GRAY, SILTY FINE SAND WITH IRON-OXIDE STAINING (MEDIUM DENSE TO DENSE, MOIST)
		SAMPLE WAS COLLECTED AT 3.5 FEET GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED HAND AUGER CAVING WAS NOT ENCOUNTERED HAND AUGER WAS COMPLETED AT 5.1 FEET ON 02/05/2024