Geotechnical Engineering Report

Proposed Short Plat
17907 36th Avenue West
Lynnwood, WA 98037

Prepared For:

Randy and Kathrine Moore
17907 36th Avenue West
Lynnwood, WA 98037

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March 16, 2022
Project No. 22-0266

Randy and Kathrine Moore
17907 36th Avenue West
Lynnwood, WA 98037

Regarding: **Geotechnical Engineering Report**
Proposed Short Plat
17907 36th Avenue West
Lynnwood, WA 98037
(Parcel No. 27041000401700)

Dear Randy and Kathrine,

As requested, GeoTest Services, Inc. [GeoTest] is pleased to submit the following report summarizing the results of our geotechnical engineering evaluation for the proposed short plat to be constructed at 17907 36th Avenue West in Lynnwood, WA (see *Vicinity Map*, Figure 1). This report has been prepared in general accordance with the terms and conditions established in our services agreement dated January 11, 2022 and authorized by yourself.

GeoTest appreciates the opportunity to provide geotechnical services on this project and look forward to assisting you during the construction phase. Should you have any further questions regarding the information contained within the report, or if we may be of service in other regards, please contact the undersigned.

Respectfully,
GeoTest Services, Inc.

EDWARDO A. GARCIA
STATE OF WASHINGTON
40319
REGISTERED
PROFESSIONAL ENGINEER
03-16-22

Jacob Rector, G.I.T.	Tristan A. Coragiulo, G.I.T.	Edwardo Garcia, P.E.
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Enclosure: Geotechnical Engineering Report

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PURPOSE AND SCOPE OF SERVICES

The purpose of this evaluation is to establish general subsurface conditions beneath the site from which conclusions and recommendations pertaining to the project design can be formulated. Our scope of services includes the following tasks:

- Explore soil and groundwater conditions underlying the site by advancing two Wildcat Dynamic Cone Penetration tests (DCPs) between 8 and 10 feet below the ground surface (BGS), and excavate two exploratory test pits (TPs) to depths of approximately 10 feet with a track-mounted excavator subcontracted by GeoTest.

- Perform laboratory testing on representative samples to classify and evaluate the engineering characteristics of the soils encountered and to assess on-site infiltration capability.

- Provide a written report containing a description of subsurface conditions and exploration logs. The findings and recommendations in this report pertain to site preparation and earthwork, fill and compaction, seismic design, foundation recommendations, concrete slab-on-grade construction, foundation and site drainage, infiltration feasibility, utilities, temporary and permanent slopes, geotechnical consultation, and construction monitoring.

- Assess Geologically Hazardous Areas (if present) per Lynnwood Municipal Code (LMC).

PROJECT DESCRIPTION

The trapezoidal-shaped, approximately 0.84-acre subject property is located on the southern side of 179th Street Southwest and the east side of 36th Avenue West within the city of Lynnwood, WA. A one-story single-family residence originally constructed in 1960 is situated in the central portion of the subject property. The northern half of the parcel consists of south facing, moderately steep slopes, in which the existing residence was constructed with a daylighting basement. The gated property is served by a paved driveway from 36th Avenue W that hugs the southern property line. Mapped wetland areas are located just north and south of the main driveway. The recently constructed off-property residence west of the proposed short plat is elevated in grade with a rocked retaining wall exposed near the subject property's driveway.

Based on the preliminary site plan and discussions with Mr. Andrew S. Lofstedt of ASPI, LLC as well as the Client, GeoTest understands that the property will be converted into three lots oriented latitudinally, with the existing residence remaining. We anticipate that the proposed structures will be wood-framed, utilizing a daylighting basement and slab-on-grade floors.

GeoTest expects that the infiltration of stormwater will be needed as part of lot development. The underlying native soils are in an area that is assumed to have low permeability soils. GeoTest generally anticipates the use of Low Impact Development stormwater approaches coupled with shallow infiltration facilities to manage stormwater on the property. Preliminary information regarding these stormwater concepts were not developed at the time that this report was written.

SITE CONDITIONS

This section includes a description of the general surface and subsurface conditions observed at the project site during the time of our field investigation. Interpretations of site conditions are based on the results and review of available information, site reconnaissance, subsurface explorations, laboratory testing, and previous experience in the project vicinity.

Surface Conditions

The west portion of the property complex consists of an asphalt driveway, a small shed and forested area along the west property line. The existing residential structure is in the central part of the proposed development area. The east section of the site consists of a maintained lawn and landscaped areas along the eastern and southern fence lines.

From the northern fence line of the subject property (approximate elevation 490 feet), the property generally slopes to the south at an average inclination of 22 percent. Residential parcels border the subject parcel on the east and west sides.

Subsurface Soil Conditions

Subsurface conditions were explored by advancing two exploratory test pits (TP-1 and TP-2) and two Wildcat Dynamic Cone Penetration tests (DCP-1 and DCP-2) on February 14, 2022. The test pit explorations were advanced to an approximate depth of 9.5 to 10 feet BGS using a track-mounted excavator. DCP tests were advanced to depths between 8 and 10 feet BGS where refusal conditions were met. Approximate locations of these explorations have been plotted on the *Site and Exploration Plan* (Figure 2).

DCP tests were conducted to evaluate the relative density and/or consistency of the site soils. The DCP analysis consisted of driving an approximately 1-inch diameter steel rod into the ground utilizing a 35-pound drop hammer. By measuring the number of blows it takes to drive the rod every four inches (10 cm), the general density of granular soils and the stiffness of cohesive soils can be determined. The number of blows for each increment can be correlated to standard N values typically obtained from Standard Penetration Testing (SPT) performed using a mechanized soil drill rig.

The subsurface for TP-1 consisted of 0.5 feet of topsoil overlying native, medium dense to dense, silty, gravelly sand. The silty, gravelly, sand deposits are interpreted to be Till. This soil transitioned from medium dense to dense, tan, silty sand (weathered Till) into dense to very dense and grey (unweathered Till) at approximately 2.5 BGS. Probable fill soils were seen in TP-2 for the upper approximately 7 feet of the exploration. A 2-inch diameter PVC pipe was also encountered within this exploration at a approximate depth of 2 feet, as well as a 9-inch lens of relict topsoil at 3 feet BGS. The very dense, unweathered Till was observed in both test pits to maximum explored depths.

More detailed logs of the subsurface conditions encountered within our exploration is presented in the Test Pit Logs attached to the end of this report.

Images 1 and 2. Subsurface soil conditions within test pits TP-1 (left) and TP-2 (right).

General Geologic Conditions

Geologic information for the project site was obtained from the *Geologic map of the Edmonds East and part of the Edmonds West quadrangles, Washington* (Minard, 1985) published by the U.S. Geological Survey. The map indicates that the project site is underlain by Till (Qvt) of the Vashon Drift. Till is generally composed of a non-sorted mixture of clay, silt, sand, pebbles, cobbles, and boulders, all in variable amounts. This layer is typically very dense and well consolidated due to the compaction of overriding ice during deposition. Deposition occurred over irregular topographic surfaces and as a result the thickness of the unit can vary between 10 to 40 feet.

Our on-site explorations indicate that the encountered subsurface soil conditions are generally consistent with published geological information.

Groundwater

Groundwater was not encountered in the test pit explorations on February 14, 2022. However, perched groundwater seepage atop the very dense, low permeability till soil could be encountered depending on the time of year.

Perched groundwater conditions occur above the regional groundwater table in the unsaturated zone and typically occur when loose, more permeable soil is underlain by denser, less permeable soil. The vertical movement of water through loose soils is restricted once a dense or less permeable soil (i.e. Till) is encountered. Perched groundwater conditions typically develop in the wet season (November through April) or after extended periods of rainfall.

The groundwater conditions reported on the exploration logs are for the specific locations and dates indicated, and therefore may not be indicative of other locations and/or times. Groundwater levels are variable and groundwater conditions will fluctuate depending on local subsurface conditions, precipitation, and changes in on-site and off-site use.

Web Soil Survey

According to the United States Department of Agriculture (USDA) Natural Resource Conservation Service website, soils within the vicinity of the subject property are classified as Alderwood-Urban, land complex, 2 to 8 percent slopes.

Table 1 summarizes the soil properties obtained from the USDA Web Soil Survey website. Values of K range from 0.02 to 0.69; the higher the value, the more susceptible the soil is to sheet and rill erosion by water. Soils classified as “s” have such limitations as shallowness of rooting zones, stones, low moisture-holding capacity, low fertility difficult to correct, and salinity or sodium (USDA, 1961).

According to the USDA Web Soil Survey, the soils mapped within the upper portion of the property possess a K value of 0.05, which constitutes a **low** erosion potential.

Table 1: USDA Web Soil Survey Classifications

Map Unit Symbol	Soil Type 5
Map Unit Name	Alderwood-Urban, land complex, 2 to 8 percent slopes
Soil Description	Gravelly to very gravelly, ashy, sandy loam
Landform	Till Plains
Parent Material	Basal till
Land Capability Classification	4s
Erosion K Factor, Whole Soil	0.05

GEOLOGIC HAZARDS

The Lynnwood Municipal Code 17.10.100 defines Geologically Hazardous Areas as “areas that are naturally susceptible to geologic events such as landslides, seismic activity and severe erosion.”

Our geotechnical investigation included an assessment of potential geologic hazards that include landslide, erosion, flood, liquefaction, and seismic hazards. For this report, we reviewed the information in the Lynnwood Municipal Code 17.10.100 and the Snohomish County PDS Map Portal website. Based on this information and our observations of the subject property, it does not appear that landslide, erosion, flood, or liquefaction hazards are present on or in the immediate vicinity of the subject property.

Seismic and Liquefaction Hazard Areas

Section 17.10.100 of the LMC also defines seismic hazard areas as "lands that are underlain by soft or loose saturated soils that are subject to liquefaction settlement or spreading during earthquake induced ground shaking."

The online interactive *Washington Geologic Information Portal* published by the Washington State Department of Natural Resources (DNR) indicates that the subject property is not located near a mapped fault. In addition, the project site contains underlying, glacially consolidated Till soils which are dense to very dense and generally have low to very low susceptibility to seismic liquefaction. The DNR also indicates that the subject site has a very low potential for seismic liquefaction.

Based on these conditions, it is GeoTest's opinion that the proposed development area should not be considered a seismic hazard area per LMC. Thus, no mitigation for such a hazard is required for this project.

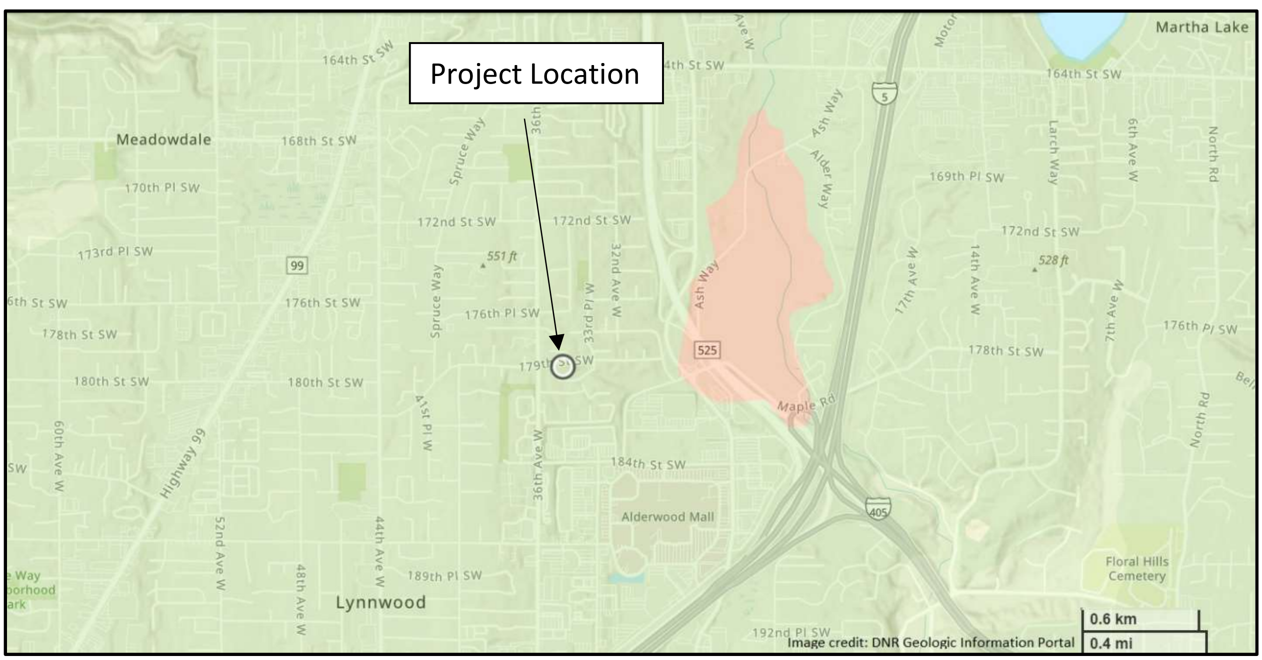


Image 3. Screenshot of DNR Geologic Information Portal. Green layers represent very low liquefaction susceptibility.

Landslide Hazard Areas

Section 17.10.100 of the Lynnwood Municipal Code (LMC) defines landslide hazardous areas as “areas with slopes steeper than 40 percent. Areas with slopes between 15 to 40 percent that are underlain by soils largely consisting of silt and clay. Areas with slopes steeper than 15 percent with zones of emergent water such as ground water seepage or springs. Areas of landslide deposits regardless of slope.”

Slope gradients observed on site were measured to be approximately 22 percent based on topographic map data. In addition, the underlying Till soils consist predominantly of silty sands with varying gravel content. Although Till soils are glacially consolidated soils that can have varying proportions of grain sizes, the project site does not meet the LMC criteria to be defined as a landslide hazardous area. Thus no mitigation for a landslide hazard area is required for this project.

Although the property is not considered a landslide hazard area per LMC criteria, the proposed building will still be constructed on a slope. Because two of the three lots will be constructed on the subject slopes with multi-level housing and parking on 179th Street SW, it is our assumption that engineered retaining walls will be required for this project. As such, GeoTest recommends that conventional construction practices be utilized. Further, strict adherence to applicable OSHA, State, and/or County safety standards during construction should be implemented. Appropriate open hole cut depths, temporary cut slopes and/or temporary shoring approaches during construction should be included as part of the submittal to the reviewing agency.

Because of sloping site conditions, all roof water and foundation drain discharge must be collected and routed to an appropriate disposal area. Concentrated sources of water should not be allowed to discharge on to the slope.

Erosion Hazard Areas

The LMC defines potential erosion hazards as “areas are lands underlain by soils identified by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) as having “severe” or “very severe” erosion hazards.”

As previously discussed, the subject property has a “low” erosion potential. Based on the LMC criteria, it is GeoTest’s opinion that the subject property does not contain an Erosion Hazard Area.

However, GeoTest still recommends that the following mitigations and housekeeping items be implemented to prevent excessive erosion from occurring during erosion:

- All clearing and grading activities for future residence construction will need to incorporate Best Management Practices (BMPs) for erosion control in compliance with current City of Lynnwood codes and standards.

- GeoTest recommends that appropriate silt fencing be incorporated into the construction plan for erosion control.
- GeoTest recommends that onsite BMPs be implemented during construction. Areas of native vegetation left in place, could also be enhanced by adding additional native plant species and/or other vegetation enhancements.
- Removal of vegetation and trees without proper mitigation may increase the risk of failure for the surficial soils during periods of wet weather. Planting additional brush and vegetation within the subject site and areas disturbed by excavation activities will help maintain near surface slope stability by providing a stable root base within the near surface soils.
- Yard waste should not be dumped onto the top or face of existing or developed site slopes. Yard waste can retain water and cause slope instability.
- Proper drainage controls have a significant effect on erosion. All surface water and any collected drainage water should not be allowed to be concentrated and discharged down the face of an existing steep slope. All collected stormwater should be directed to an appropriate collection system away from the slope, as designated on the project plans.
- All areas disturbed by construction practices should be vegetated or otherwise protected to limit the potential for erosion (as soon as practical) during and after construction. Areas requiring immediate protection from the effects of erosion should be covered with either plastic, mulch, or erosion control netting/blankets. Areas requiring permanent stabilization should be seeded with an approved grass seed mixture, hydroseeded with an approved seed-mulch-fertilizer mixture or landscaped with a suitable planting design.

In addition to the preceding recommendations, typical erosion control measures during construction will be required. These measures can include a rock-surfaced construction entrance or downslope silt fencing, depending on the City of Lynnwood regulations. No other mitigations are required to address erosion hazards on the property.

CONCLUSIONS AND RECOMMENDATIONS

Based on the evaluation of the data collected during this investigation, it is our opinion that the subsurface conditions at the site are suitable for the proposed development, provided the recommendations contained herein are incorporated into the project design.

Subsurface explorations exposed in this study generally encountered approximately 0.5 feet of topsoil overlying native Till and, in localized areas, possible loose fill soils. GeoTest recommends that loose fill soils be removed from the building footprint down to expose the native Till. GeoTest generally anticipates that between 2 to 7 feet of stripping will be needed in order to remove loose fill soils and to expose the native weathered soils. The proposed structure can then be constructed with conventional continuous or individual spread foundations bearing directly on firm and unyielding native soil, or on compacted structural fill placed atop these soils. Further recommendations regarding the placement and compaction of structural fill can be found in the *Fill and Compaction* section of this report.

The native Till soils encountered in our explorations are glacially consolidated and contain a high percentage of fines. GeoTest anticipates that perched groundwater seepage may be encountered atop the low permeability, unweathered Till soils depending on the time of year or after an extended period of heavy precipitation. Therefore, it appears that the native Till soils are not suitable for the conventional infiltration of stormwater. GeoTest recommends that approaches other than infiltration be considered to address stormwater management on this project.

Site Preparation and Earthwork

The portions of the site proposed for foundations and floor slabs should be prepared by removing existing loose fill, deleterious material, and significant accumulations of organics. Prior to placement of any foundation elements or structural fill, the exposed subgrade under all areas to be occupied by soil-supported floor slabs, spread, or continuous foundations should be recompacted to a firm and unyielding condition. Verification of compaction should be performed by qualified geotechnical personnel. The purpose of this effort is to identify loose or soft soil deposits so that, if feasible, the soil distributed during site work can be recompacted.

Proof rolling should be carefully observed by qualified geotechnical personnel. Areas exhibiting significant deflection, pumping, or over-saturation that cannot be readily compacted should be overexcavated to firm soil. Overexcavated areas should be backfilled with compacted granular material placed in accordance with subsequent recommendations for structural fill. During periods of wet weather, proof rolling could damage the exposed subgrade. Under these conditions, qualified geotechnical personnel should observe subgrade conditions to determine if proof rolling is feasible.

Fill and Compaction

Structural fill used to obtain final elevations for footings and soil-supported floor slabs must be properly placed and compacted. In most cases, suitable, non-organic, predominantly granular soil may be used for fill material provided the material is properly moisture conditioned prior to placement and compaction, and the specified degree of compaction is obtained. Material containing topsoil, wood, trash, organic material, or construction debris is not suitable for reuse as structural fill and should be properly disposed off-site or placed in nonstructural areas.

Soils containing more than approximately five percent fines are considered moisture sensitive and are difficult to compact to a firm and unyielding condition when over the optimum moisture content by more than approximately two percent. The optimum moisture content is that which allows the greatest dry density to be achieved at a given level of compactive effort.

Reuse of On-Site Soil

The near-surface, non-organic, existing fill soils (sand and gravel) and underlying native soils can be suitable for reuse as structural fill when placed at or near optimum moisture content as determined by ASTM D1557 and if allowed for in the plans and specifications. Weathered and unweathered Till soils contain high percentages of fines and should be considered moisture sensitive. Reuse of these soils may be considerably more difficult to use at or near perched groundwater elevations (if present) and during the wet weather season (typically October through May).
If using on-site materials, the Contractor and Owner should be prepared to manage over optimum moisture content soils. The moisture content of the soils may be difficult to control during periods of wet weather.

Imported Structural Fill

GeoTest recommends that imported structural fill consist of clean, well-graded sandy gravel, gravelly sand, or other approved naturally occurring granular material (pit run) with at least 30 percent retained on the No. 4 sieve, or a well-graded crushed rock. Structural fill for dry weather construction may contain up to 10 percent fines (that portion passing the U.S. No. 200 sieve) based on the portion passing the U.S. No. 4 sieve. The use of an imported fill having more than 10 percent fines may be feasible, but the use of these soils should generally be reviewed by the design team prior to the start of construction.

Imported structural fill with less than five percent fines should be used during wet weather conditions. Due to wet site conditions, soil moisture contents could be high enough that it may be difficult to compact even clean imported select granular fill to a firm and unyielding condition. Soils with an over-optimum moisture content should be scarified and dried back to a suitable moisture content during periods of dry weather or removed and replaced with drier structural fill.

Keying and Benching

Where fill is to be placed on slopes steeper than 5H:1V, the base of new structural fill should be tied to firm and unyielding native soils by appropriate keying and benching.

The purpose of a keyway is to embed the toe of new structural fill into existing slopes. Keyways for hillside fills should be at least 5 feet wide, 2 feet deep, and cut into the native soil. Level benches can then be cut following the contours of the slope. Benches in native soils are typically cut a few feet wider than the equipment being used to cut them.

Backfill and Compaction

Structural fill should be placed in horizontal lifts. The structural fill must measure 8 to 10 inches in loose thickness and be thoroughly compacted. All structural fill placed under load bearing areas should be compacted to at least 95 percent of the maximum dry density, as determined using test method ASTM

D1557. The top of the compacted structural fill should extend outside all foundations and other structural improvements a minimum distance equal to the thickness of the fill. We recommend that compaction be tested after placement of each lift in the fill pad.

Wet Weather Earthwork

The fine grained, native soils observed on site are particularly susceptible to degradation during wet weather. As a result, it may be difficult to control the moisture content of site soils during the wet season. If construction takes place during wet weather, GeoTest recommends that structural fill consist of imported, clean, well-graded sand or sand and gravel as described above. If fill is to be placed or earthwork is to be performed in wet conditions, the contractor may reduce soil disturbance by:

- Limiting the size of areas that are stripped of topsoil and left exposed
- Accomplishing earthwork in small sections
- Limiting construction traffic over unprotected soil
- Sloping excavated surfaces to promote runoff
- Limiting the size and type of construction equipment used
- Providing gravel 'working mats' over areas of prepared subgrade
- Removing wet surficial soil prior to commencing fill placement each day
- Sealing the exposed ground surface by rolling with a smooth drum compactor or rubber-tired roller at the end of each working day
- Providing up-gradient perimeter ditches or low earthen berms and using temporary sumps to collect runoff and prevent water from ponding and damaging exposed subgrades

Seismic Design Considerations

The Pacific Northwest is seismically active, and the site could be subject to movement from a moderate or major earthquake. Consequently, moderate levels of seismic shaking should be accounted for during the design life of the project, and the proposed structure should be designed to resist earthquake loading using appropriate design methodology.

For structures designed using the seismic design provisions of the 2018 International Building Code, the very dense Till underlying the site is classified as Site Class D, according to ASCE 7-16. The structural engineer should select the appropriate design response spectrum based on Site Class D soil and the geographical location of the proposed construction.

Foundation Support

Continuous or isolated spread footings founded on firm and unyielding, weathered or unweathered Till soils or on properly compacted structural fill placed directly over undisturbed native soil can provide foundation support for the proposed improvements. GeoTest recommends that qualified geotechnical personnel confirm that suitable bearing conditions have been reached prior to placement of structural fill or foundation formwork.

To provide proper support, GeoTest recommends that existing topsoil, existing fill (if present), and/or loose upper portions of the native soil be removed from beneath the building foundation area. Our explorations conducted on site indicate that as much as 7 feet of loose material exist near TP-2. The final location of the proposed structures has not, however, been established at the time of this report. Dense, unweathered soils are unlikely to require much preparation. However, if footings or structural fill will be placed atop the native, near-surface weathered Till, the surface should be compacted to a firm and unyielding condition with a smooth-drum roller, hoe-pack, or a similar piece of construction equipment. Once suitable bearing conditions have been confirmed, then foundations can bear directly on native soils or on properly compacted structural fill as described in the *Fill and Compaction* section of this report.

Continuous and isolated spread footings should be founded 18 inches, minimum, below the lowest adjacent final grade for freeze/thaw protection. The footings should be sized in accordance with the structural engineer's prescribed design criteria and seismic considerations.

Allowable Bearing Capacity

Assuming the above foundation support criteria are satisfied, continuous or isolated spread footings founded directly on native, firm and unyielding, Till soils or on compacted structural fill placed directly over undisturbed native soils may be proportioned using a net allowable soil bearing pressure of 2,500 pounds per square foot (psf).

The 'net allowable bearing pressure' refers to the pressure that can be imposed on the soil at foundation level. This pressure includes all dead loads, live loads, the weight of the footing, and any backfill placed above the footing. The net allowable bearing pressure may be increased by one-third for transient wind or seismic loads.

Foundation Settlement

Settlement of shallow foundations depends on foundation size and bearing pressure, as well as the strength and compressibility characteristics of the underlying soil. If construction is accomplished as recommended and at the maximum allowable soil bearing pressure, GeoTest estimates the total settlement of building foundations to be less than one inch. Differential settlement between two adjacent load-bearing components supported on competent soil is estimated to be less than one half the total settlement.

Floor Support

Conventional slab-on-grade floor construction is feasible for the planned site improvements. Our explorations did not encounter organic soils, such as relict topsoil, between the near-surface fill soils and the underlying native weathered Till. Thus, floor slabs can be supported on firm and unyielding, properly prepared existing fill subgrade, native subgrade, or on properly placed and compacted structural placed over properly prepared native soil. The existing fill soils or native subgrade should be proof rolled as recommended in the *Site Preparation and Earthwork* section of this report.

GeoTest recommends that interior concrete slab-on-grade floors be underlain with at least 6 inches of clean, compacted, free-draining gravel. The gravel should contain less than 3 percent passing the U.S. Standard No. 200 sieve (based on a wet sieve analysis of that portion passing the U.S. Standard No. 4 sieve). The purpose of this gravel layer is to provide uniform support for the slab, provide a capillary break, and act as a drainage layer. To help reduce the potential for water vapor migration through floor slabs, a continuous 10-mil minimum thick polyethylene sheet with tape-sealed joints should be installed below the slab to serve as an impermeable vapor barrier. The vapor barrier should be installed and sealed in accordance with the manufacturer's instructions.

Foundation and Site Drainage

Positive surface gradients should be provided adjacent to the proposed building to direct surface water away from the building and toward suitable drainage facilities. Roof drainage should not be introduced into the perimeter footing drains but should be separately discharged directly to the stormwater collection system or similar municipality-approved outlet. Pavement and sidewalk areas, if present, should be sloped and drainage gradients should be maintained to carry surface water away from the building towards an approved stormwater collection system. Surface water should not be allowed to pond and soak into the ground surface near buildings or paved areas during or after construction. Construction excavations should be sloped to drain to sumps where water from seepage, rainfall, and runoff can be collected and pumped to a suitable discharge facility.

To reduce the potential for groundwater and surface water to seep into interior spaces, GeoTest recommends that an exterior footing drain system be constructed around the perimeter of new building foundations as shown in the *Conceptual Footing and Wall Drain Section* (Figure 3) of this report. The drain should consist of a perforated pipe measuring 4 inches in diameter at minimum, surrounded by at least 12 inches of filtering media. The pipe should be sloped to carry water to an approved collection system.

The filtering media may consist of open-graded drain rock wrapped in a nonwoven geotextile fabric such as Mirafi 140N (or equivalent) or wrapped with a graded sand and gravel filter. For foundations supporting retaining walls, drainage backfill should be carried up the back of the wall and be at least 12 inches wide. The drainage backfill should extend from the foundation drain to within approximately 1 foot of the finished grade and consist of open-graded drain rock containing less than 3 percent fines by weight passing the U.S. Standard No. 200 sieve (based on a wet sieve analysis of that portion passing the U.S. Standard No. 4 sieve). The invert of the footing drainpipe should be placed at approximately the same elevation as the bottom of the footing or 12 inches below the adjacent floor slab grade, whichever is deeper, so that water will be contained. This process prevents water from seeping through walls or floor slabs. The drain system should include cleanouts to allow for periodic maintenance and inspection.

GeoTest expects that perched groundwater seepage will be encountered atop the low permeability, Till soils depending on the time of year. Depending on the final building elevations, an underslab drainage system may be required for the proposed building, particularly if it will include a full basement. We can provide further recommendations for underslab drainage upon request.

Depending on final site grades, it may be prudent to construct an interceptor drain, such as a French drain, to collect upslope water and divert it away from the proposed development. As preliminary grading plans had not been prepared at the time that this report was written, we can provide additional recommendations and consultation regarding site drainage improvements upon request.

Resistance to Lateral Loads

The lateral earth pressures that develop against retaining walls will depend on the method of backfill placement, degree of compaction, slope of backfill, type of backfill material, provisions for drainage, magnitude and location of any adjacent surcharge loads, and the degree to which the wall can yield laterally during or after placement of backfill. If the wall is allowed to rotate or yield so the top of the wall moves an amount equal to or greater than about 0.001 to 0.002 times its height (a yielding wall), the soil pressure exerted comprises the active soil pressure. When a wall is restrained against lateral movement or tilting (a nonyielding wall), the soil pressure exerted comprises the at rest soil pressure. Wall restraint may develop if a rigid structural network is constructed prior to backfilling or if the wall is inherently stiff.

GeoTest recommends that yielding walls under drained conditions be designed for an equivalent fluid density of 35 pounds per cubic foot (pcf), for structural fill in active soil conditions. Nonyielding walls under drained conditions should be designed for an equivalent fluid density of 55 pcf, for structural fill in at-rest conditions. Design of walls should include appropriate lateral pressures caused by surcharge loads located within a horizontal distance equal to or less than the height of the wall. For uniform surcharge pressures, a uniformly distributed lateral pressure equal to 35 percent and 50 percent of the vertical surcharge pressure should be added to the lateral soil pressures for yielding and nonyielding walls, respectively.

For structures designed using the seismic design provisions of the International Building Code, GeoTest recommends that retaining walls include a seismic surcharge in addition to the equivalent fluid densities presented above. We recommend that a seismic surcharge of approximately 8H (where H is the height of the wall) be used for design purposes. This surcharge assumes that the wall is allowed to rotate or yield. If the wall is restrained, GeoTest should be contacted so that we can provide a revised seismic surcharge pressure.

Passive earth pressures developed against the sides of building foundations, in conjunction with friction developed between the base of the footings and the supporting subgrade, will resist lateral loads transmitted from the structure to its foundation. For design purposes, the passive resistance of well-compacted fill placed against the sides of foundations is equivalent to a fluid with a density of 350 pcf. The recommended value includes a safety factor of about 1.5 and is based on the assumption that the ground surface adjacent to the structure is level in the direction of movement for a distance equal to or greater than twice the embedment depth. The recommended value also assumes drained conditions that will prevent the buildup of hydrostatic pressure in the compacted fill. Retaining walls should include a drain system constructed in general accordance with the recommendations presented in the *Foundation and Site Drainage* section of this report. In design computations, the upper 12 inches of passive resistance should be neglected if the soil is not covered by floor slabs or pavement. If future plans call for the removal of the soil providing resistance, the passive resistance should not be considered.

An allowable coefficient of base friction of 0.35, applied to vertical dead loads only, may be used between the underlying imported granular structural fill and the base of the footing. If foundations will bear directly on the native soil, an allowable coefficient of 0.30 should be used.

If passive and frictional resistance are considered together, one half the recommended passive soil resistance value should be used since larger strains are required to mobilize the passive soil resistance as compared to frictional resistance. A safety factor of about 1.5 is included in the base friction design value. GeoTest does not recommend increasing the coefficient of friction to resist seismic or wind loads.

Temporary and Permanent Slopes

The contractor is responsible for construction slope configurations and maintaining safe working conditions, including temporary excavation stability. All applicable local, state, and federal safety codes should be followed. All open cuts should be monitored during and after excavation for evidence of instability. If instability is detected, the contractor should flatten the side slopes or install temporary shoring.

Temporary excavations in excess of 4 feet should be shored or sloped in accordance with Safety Standards for Construction Work Part N, WAC 296-155-66403.

Temporary unsupported excavations in very dense Till, encountered at the project site are classified as a Type B soil according to WAC 296-155-66401 and may be sloped as steep as 1H :1V (Horizontal: Vertical). All soils encountered are classified as Type C soil in the presence of groundwater seepage and may be sloped as steep as 1.5H:1V. Flatter slopes or temporary shoring may be required in areas where groundwater flow is present and unstable conditions develop.

Temporary slopes and excavations should be protected as soon as possible using appropriate methods to prevent erosion from occurring during periods of wet weather.

GeoTest recommends that permanent cut or fill slopes be designed for inclinations of 2H: 1V or flatter. Permanent cuts or fills used in detention ponds, retention ponds, or earth slopes intended to hold water should be 3H: 1V or flatter. All permanent slopes should be vegetated or otherwise protected to limit the potential for erosion as soon as practical after construction.

Utilities

Utility trenches must be properly backfilled and compacted to reduce cracking or localized loss of foundation, slab, or pavement support. Excavations for new shallow underground utilities are expected to be placed within native soil (Till).

Trench backfill in improved areas (beneath structures, pavements, sidewalks, etc.) should consist of structural fill as defined in the *Fill and Compaction* section of this report. Outside of improved areas, trench backfill may consist of reused native material provided the backfill can be compacted to the project specifications. Trench backfill should be placed and compacted in general accordance with the recommendations presented in the *Fill and Compaction* section of this report.

The native Till is generally very dense and is not expected to drain efficiently. Utility trench backfill is likely to be more permeable than the native soils. As such, upgradient utility trenches have the potential to route subsurface sources of water towards new construction. GeoTest recommends that low permeability trench dams and water stops be considered should utility trenches be installed upgradient of any planned structures. Prior to implementing these mitigations, a review of the trench depths and gradients should be performed to determine if these mitigations should be included in the final design.

Surcharge loads on trench support systems due to construction equipment, stockpiled material, and vehicle traffic should be included in the design of any anticipated shoring system. The contractor should implement measures to prevent surface water runoff from entering trenches and excavations. In addition, vibration as a result of construction activity and traffic may cause caving of the trench walls.

The contractor is responsible for trench configurations. All applicable local, state, and federal safety codes should be followed. All open cuts should be monitored by the contractor during excavation for any evidence of instability. If instability is detected, the contractor should flatten the side slopes or install temporary shoring. If groundwater or groundwater seepage is present, and the trench is not properly dewatered, the soil within the trench zone may be prone to caving, channeling, and running. Trench widths may be substantially wider than under dewatered conditions.

Stormwater Infiltration Potential

The native Till soil encountered across the subject property has an elevated level of fines, often in excess of 20 percent of more, and is also glacially consolidated. In combination with the relative density, Till will restrict the conventional infiltration of stormwater and, in our opinion, supports the presence of a “restriction layer” as defined by the 2012 Washington State Department of Ecology *Stormwater*

Management Manual for Western Washington (SMMWW) (amended December 2014). Additionally, GeoTest expects the presence of perched groundwater seepage atop low permeability, unweathered Till soils depending on the time of the year and after an extended period of heavy precipitation.

Volume 3 of the 2012 *SMMWW* describes Till as a "low permeability" zone and further defines Till, or "hardpan", as having very poor infiltration capacity. Furthermore, Volume 5 of the 2012 *SMMWW* describes that compacted Till is typically used as a pond liner and is preferred because of its general resilience and ease of maintenance.

Based on this information, it is GeoTest's opinion that the underlying, near surface, glacially consolidated Till soils are not suitable for the conventional infiltration of stormwater. GeoTest recommends that approaches other than infiltration be considered to address stormwater management on this project.

Stormwater Treatment

The stormwater facilities on-site may require some form of pollutant pretreatment with an amended soil prior to on-site infiltration or offsite discharge. The reuse of on-site topsoil is often the most sustainable and cost-effective method for pollutant treatment purposes. Cation exchange capacities, organic contents, and pH of site subsurface soils were also tested to determine possible pollutant treatment suitability.

Cation exchange capacity, organic content, and pH tests were performed by Northwest Agricultural Consultants on one soil sample collected from the explorations shown in Table 2. A summary of the laboratory test results is presented in Table 2 below.

Table 2
Cation Exchange Capacity, Organic Content, and pH Laboratory Test Results

Test Pit ID	Sample Depth (ft)	Geologic Unit	Cation Exchange Capacity (meq/100 grams)	Organic Content	pH
TP-1	2.0	Weathered Till	6.5	2.17%	5.7
TP-1	3.5	Till	4.0	1.06%	5.8
TP-2	4.0	Probable Fill	12.4	4.26%	5.6

Suitability for on-site pollutant treatment is determined in accordance with SSC-6 of the 2012 Washington State Department of Ecology *Stormwater Management Manual for Western Washington* (amended December 2014). Soils with an organic content of greater than or equal to 1 percent and a cation exchange capacity of greater than or equal to 5 meq/100 grams are characterized as suitable for stormwater treatment. Based on the results shown in Table 2, native weathered soils are suitable for stormwater treatment. However, low rates of infiltration should be anticipated in these soils due to their high silt contents and density.

On-site soils can be amended by mixing higher silt content soils or adding mulch (or other admixtures) to elevate the cation exchange capacity and organic contents. On-site amended soil requires additional testing to confirm compliance with ecological regulations. GeoTest is available to perform additional laboratory testing as part of an expanded scope of services if the soil is to be amended. Alternatively, the owner may elect to import amended soils with the desired properties for planned treatment facilities.

Geotechnical Consultation and Construction Monitoring

GeoTest recommends that we be involved in the project design review process. The purpose of the review is to verify that the recommendations presented in this report are understood and incorporated in the design and specifications.

We also recommend that geotechnical construction monitoring services be provided. These services should include observation by GeoTest personnel during structural fill placement, compaction activities, and subgrade preparation operations to confirm that design subgrade conditions are obtained beneath the areas of improvement.

Periodic field density testing should be performed to verify that the appropriate degree of compaction is obtained. The purpose of these services is to observe compliance with the design concepts, specifications, and recommendations of this report. In the event that subsurface conditions differ from those anticipated before the start of construction, GeoTest would be pleased to provide revised recommendations appropriate to the conditions revealed during construction.

GeoTest is available to provide a full range of materials testing and special inspection during construction as required by the local building department and the International Building Code. This may include specific construction inspections on materials such as reinforced concrete, reinforced masonry, wood framing, and structural steel. These services are supported by our fully accredited materials testing laboratories.

USE OF THIS REPORT

GeoTest has prepared this report for the exclusive use of Randy and Kathrine Moore and their design consultants for specific application to the design of the proposed short plat located at 17907 36th Avenue West in Lynnwood, WA. Use of this report by others is at the user's sole risk. This report is not applicable to other site locations. Our services are conducted in accordance with accepted practices of the geotechnical engineering profession; no other warranty, express or implied, is made as to the professional advice included in this report.

Our site explorations indicate subsurface conditions at the dates and locations indicated. It is not warranted that these conditions are representative of conditions at other locations and times. The analyses, conclusions, and recommendations contained in this report are based on site conditions to the limited depth and time of our explorations, a geological reconnaissance of the area, and a review of previously published USGS geological information for the site. If variations in subsurface conditions are encountered during construction that differs from those contained within this report, GeoTest should be allowed to review the recommendations and, if necessary, make revisions. If there is a substantial lapse of time between submission of this report and the start of construction, or if conditions change due to construction operations at or adjacent to the project site, we recommend that we review this report to determine the applicability of the conclusions and recommendations contained herein.

The earthwork contractor is responsible to perform all work in conformance with all applicable WISHA/OSHA regulations. GeoTest Services, Inc. is not responsible for job site safety on this project, and this responsibility is specifically disclaimed.

Attachments:	Figure 1	Vicinity Map
	Figure 2	Site and Exploration Plan
	Figure 3	Conceptual Footing and Wall Drain Section
	Figure 4	Soil Classification System and Key
	Figures 5 – 6	Test Pit Logs
	Figures 7	Grain Size Test Data
	Attached	DCP Logs
	Attached	Northwest Agricultural Consultants Results
	Attached	Report Limitations and Guidelines for its Use

REFERENCES

Bakeman, S., Dan, G., Howie, D., Killelea, J., Labib, F., & Ed, O. (n.d.). *2012 Stormwater Management Manual for Western Washington, as Amended in December 2014 (The 2014 SMMWW)* (pp. 1-1042) (United States, Washington State Department of Ecology).

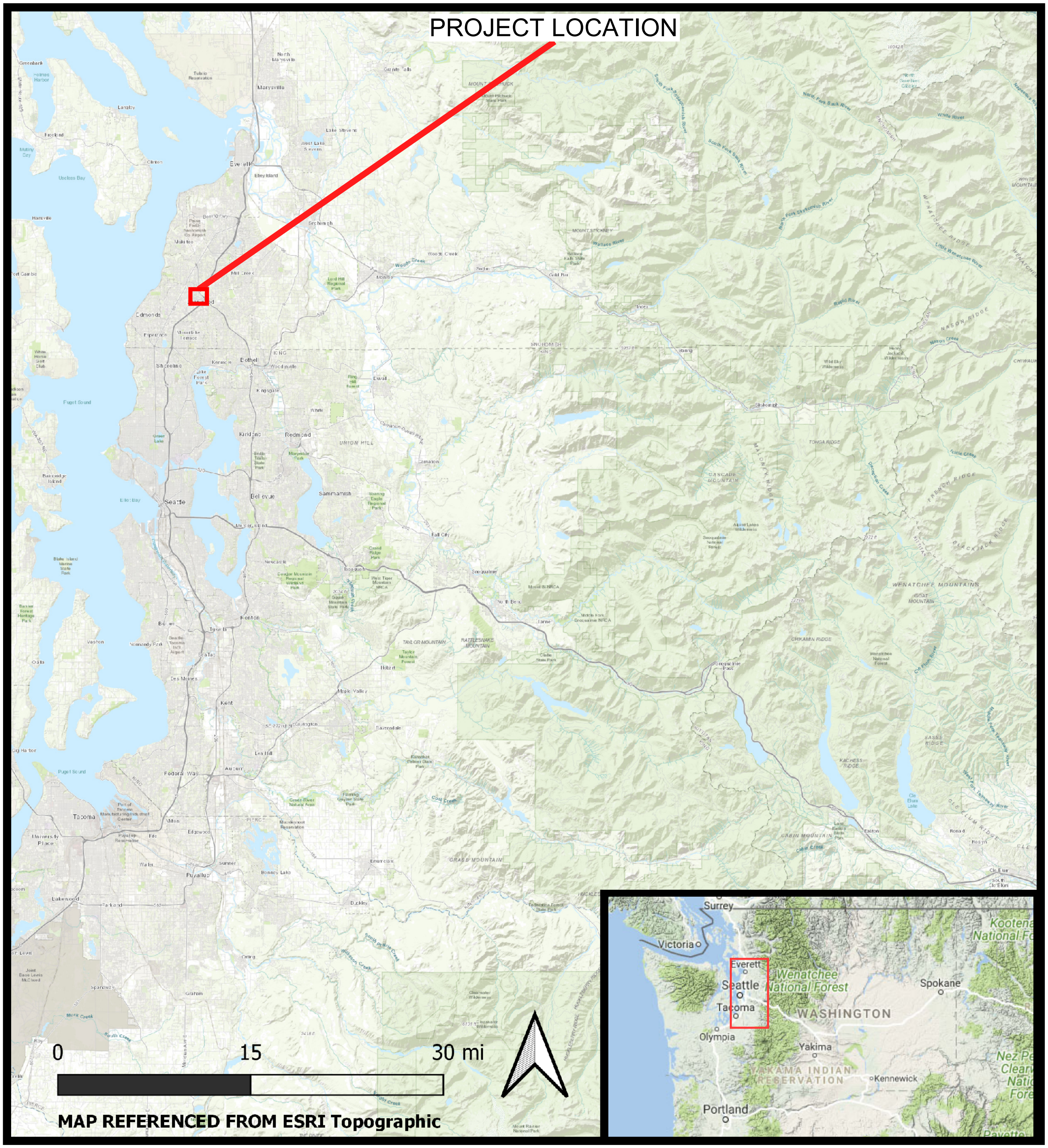
Land Capability Classification (Agriculture Handbook No. 210). Soil Conservation Service, U.S. Department of Agriculture, 1961.

Lynnwood Municipal Code, City of Lynnwood (Washington). Retrieved in March 2022, from *https://www.codepublishing.com/WA/Lynnwood/#!/Lynnwood17/Lynnwood1710.html#17.10.100*

Minard, J.P., 1983. *Geologic Map of the Edmonds East and part of the Edmonds West Quadrangles, Washington* [Map]. Scale 1:24,000. United States Geological Survey MF-1541.

Snohomish County PDS Map Portal, Snohomish County (Washington). Retrieved in March 2022, from https://snohomishcountywa.gov/3752/PDS-Map-Portal

Washington Interactive Geologic Map. Washington State Department of Natural Resources - Online Web Services. Retrieved in March 2022.



GEOTEST

Date: 2-14-2022 | By: JR | Scale: As Shown

VICINITY MAP
PROPOSED SHORT PLAT
17907 36TH AVENUE WEST
LYNNWOOD, WA 98037

Project
22-0266

Figure
1

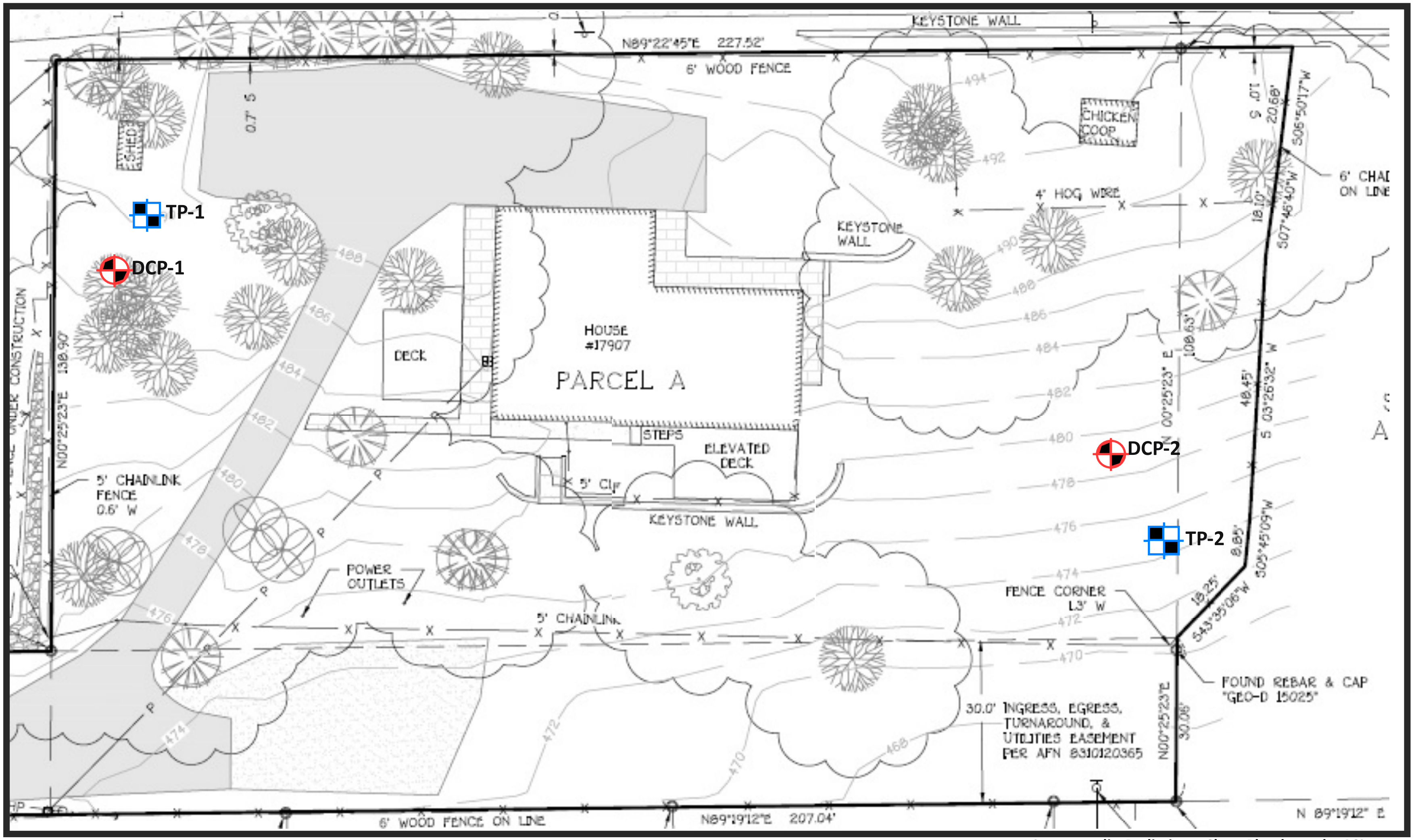


Image credit: Preliminary Short Plat drawn by ASL

= Approximate test pit location

= Approximate DCP Location

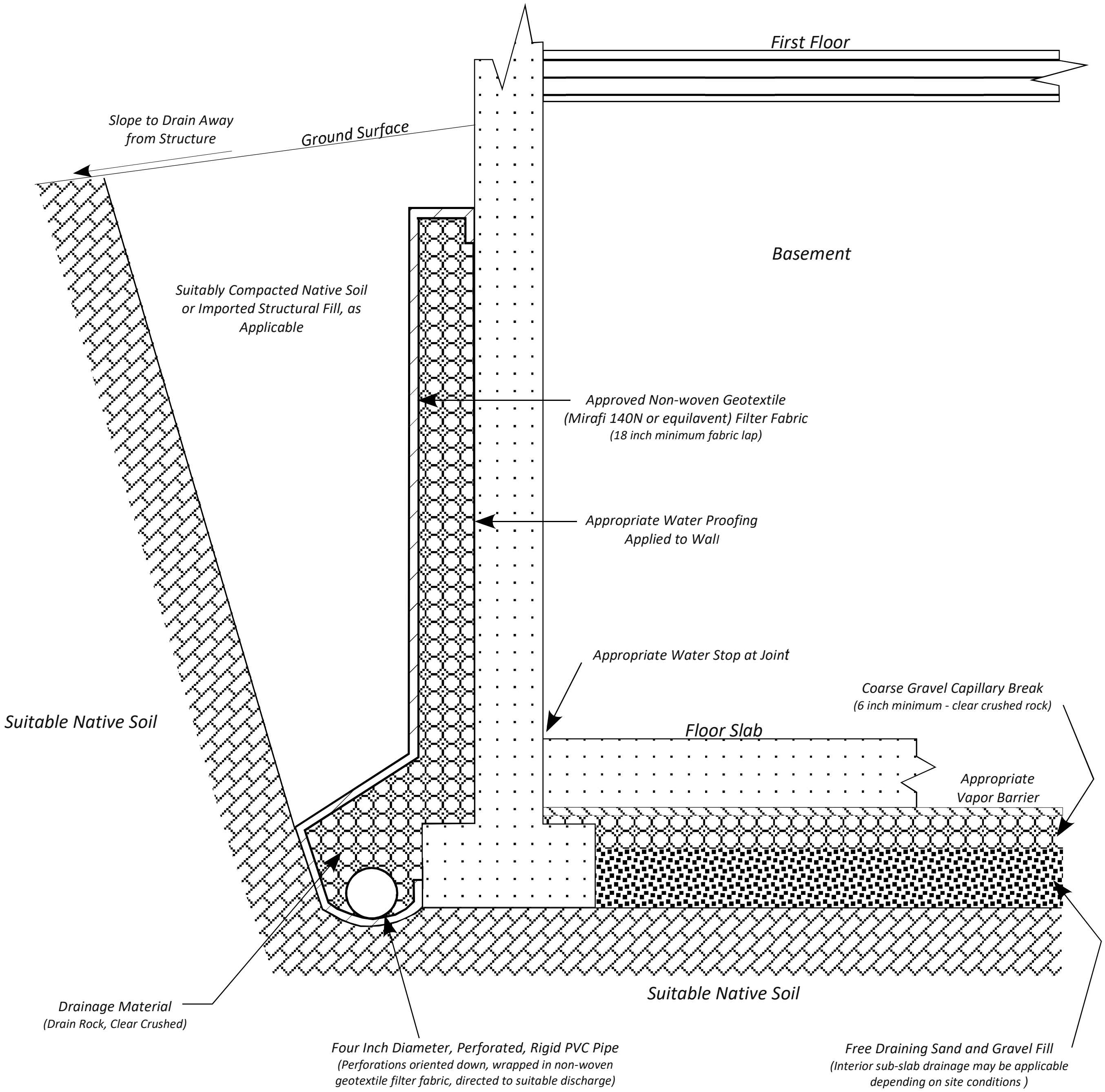
GEOTEST

Date: 2-14-2022	By: JR	Scale: As Shown	Project 22-0266

SITE AND EXPLORATION PLAN
PROPOSED SHORT PLAT
17907 36TH AVENUE WEST
LYNNWOOD, WA 98037

Figure 2

CONCEPTUAL BASEMENT WITH INTERIOR SLAB-ON-GRADE



Notes:
Footings should be properly buried for frost protection in accordance with International Building Code or local building codes (Typically 18 inches below exterior finished grades).

Date: 2-24-22	By: JR	Scale: As Shown	Project 22-0266
CONCEPTUAL FOOTING & WALL DRAIN SECTION PROPOSED SHORT PLAT 17907 36TH AVE WEST LYNNWOOD, WA 98037			Figure 3

GEOTEST

Soil Classification System

MAJOR DIVISIONS			GRAPHIC SYMBOL	USCS LETTER SYMBOL	TYPICAL DESCRIPTIONS[(1)(2)]
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
				GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GM	Silty gravel; gravel/sand/silt mixture(s)
				GC	Clayey gravel; gravel/sand/clay mixture(s)
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
				SP	Poorly graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)			ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity
				CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay
				OL	Organic silt; organic, silty clay of low plasticity
	SILT AND CLAY (Liquid limit greater than 50)			MH	Inorganic silt; micaceous or diatomaceous fine sand
				CH	Inorganic clay of high plasticity; fat clay
				OH	Organic clay of medium to high plasticity; organic silt
	HIGHLY ORGANIC SOIL			PT	Peat; humus; swamp soil with high organic content

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

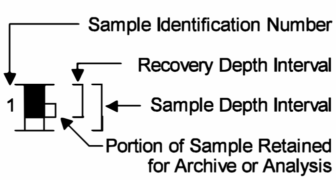
Notes: 1. Soil descriptions are based on the general approach presented in the *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, as outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the *Standard Test Method for Classification of Soils for Engineering Purposes*, as outlined in ASTM D 2487.

2. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

Primary Constituent:	> 50%	- "GRAVEL," "SAND," "SILT," "CLAY," etc.
Secondary Constituents:	> 30% and ≤ 50%	- "very gravelly," "very sandy," "very silty," etc.
	> 12% and ≤ 30%	- "gravelly," "sandy," "silty," etc.
Additional Constituents:	> 5% and ≤ 12%	- "slightly gravelly," "slightly sandy," "slightly silty," etc.
	≤ 5%	- "trace gravel," "trace sand," "trace silt," etc., or not noted.

Drilling and Sampling Key

SAMPLE NUMBER & INTERVAL



SAMPLER TYPE

Code	Description
a	3.25-inch O.D., 2.42-inch I.D. Split Spoon
b	2.00-inch O.D., 1.50-inch I.D. Split Spoon
c	Shelby Tube
d	Grab Sample
e	Other - See text if applicable
1	300-lb Hammer, 30-inch Drop
2	140-lb Hammer, 30-inch Drop
3	Pushed
4	Other - See text if applicable

Groundwater

▽ ATD Approximate water elevation at time of drilling (ATD) or on date noted. Groundwater levels can fluctuate due to precipitation, seasonal conditions, and other factors.

Field and Lab Test Data

Code	Description
PP = 1.0	Pocket Penetrometer, tsf
TV = 0.5	Torvane, tsf
PID = 100	Photoionization Detector VOC screening, ppm
W = 10	Moisture Content, %
D = 120	Dry Density, pcf
-200 = 60	Material smaller than No. 200 sieve, %
GS	Grain Size - See separate figure for data
AL	Atterberg Limits - See separate figure for data
GT	Other Geotechnical Testing
CA	Chemical Analysis

GEOTEST

Proposed Short Plat
17907 36th Ave West
Lynnwood, WA 98037

Soil Classification System and Key

Figure 4

TEST PIT LOG

Test Pit No. TP-1

PROJECT: Proposed Short Plat **PROJECT NO.:** 22-0266
LOCATION: 17907 36th Avenue West, Lynnwood, WA 98037 **DATE:** 2-14-2022
EXPLORATION METHOD: Excavator **ELEVATION:** 490'
CONTRACTOR/DRILLER: PacNW Excavation **LOGGED BY:** JR
DEPTH TO WATER TABLE: N/A **PERCHED WATER:** N/A **CAVING** N\A

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE & TEST DATA			USCS SYMBOL	SOIL PROFILE DESCRIPTION
490 — 0				SM	Loose, dark brown, wet, silty SAND with organics and rootlets (Topsoil)
1	1	d		SM	Medium dense, tan, damp, slightly silty, gravelly SAND with cobbles (Weathered Till)
488 — 2	2	d	GT	SM	Dense, grey, damp, silty, gravelly SAND fine-grained (Till)
3	3	d	GT		
486 — 4					
5	4	d	W = 9.4 GS		
484 — 6					
7	5	d			Finer grained and increased silt content at 7'
482 — 8					
9	6	d	W = 14.3 GS		
	7	d			

Reference Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key' figure for an explanation of the graphics/symbols used.

Test Pit TP-1 was terminated at 9.75 ft below site grades on 2-14-2022

Notes:

Figure: 5

TEST PIT LOG

Test Pit No. TP-2

PROJECT: Proposed Short Plat **PROJECT NO.:** 22-0266
LOCATION: 17907 36th Avenue West, Lynnwood, WA 98037 **DATE:** 2-14-2022
EXPLORATION METHOD: Excavator **ELEVATION:** 475'
CONTRACTOR/DRILLER: PacNW Excavation **LOGGED BY:** JR
DEPTH TO WATER TABLE: N/A **PERCHED WATER:** N/A **CAVING** N\A

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE & TEST DATA			USCS SYMBOL	SOIL PROFILE DESCRIPTION
475 / 0					Sod
	8	d		SM	Very loose to loose, grey and brown, wet, silty SAND with trace gravel, mottled (Probable Fill)
473 / 2					
3	9	d	W = 12.1 GS		0.75' thick lense of relict topsoil at 3'
471 / 4	10	d	GT		
469 / 6	11	d	W = 9.3 GS		
7				SM	Dense, grey, damp, silty, gravelly, SAND fine-grained (Till)
467 / 8	12	d			
465 / 10	13	d			

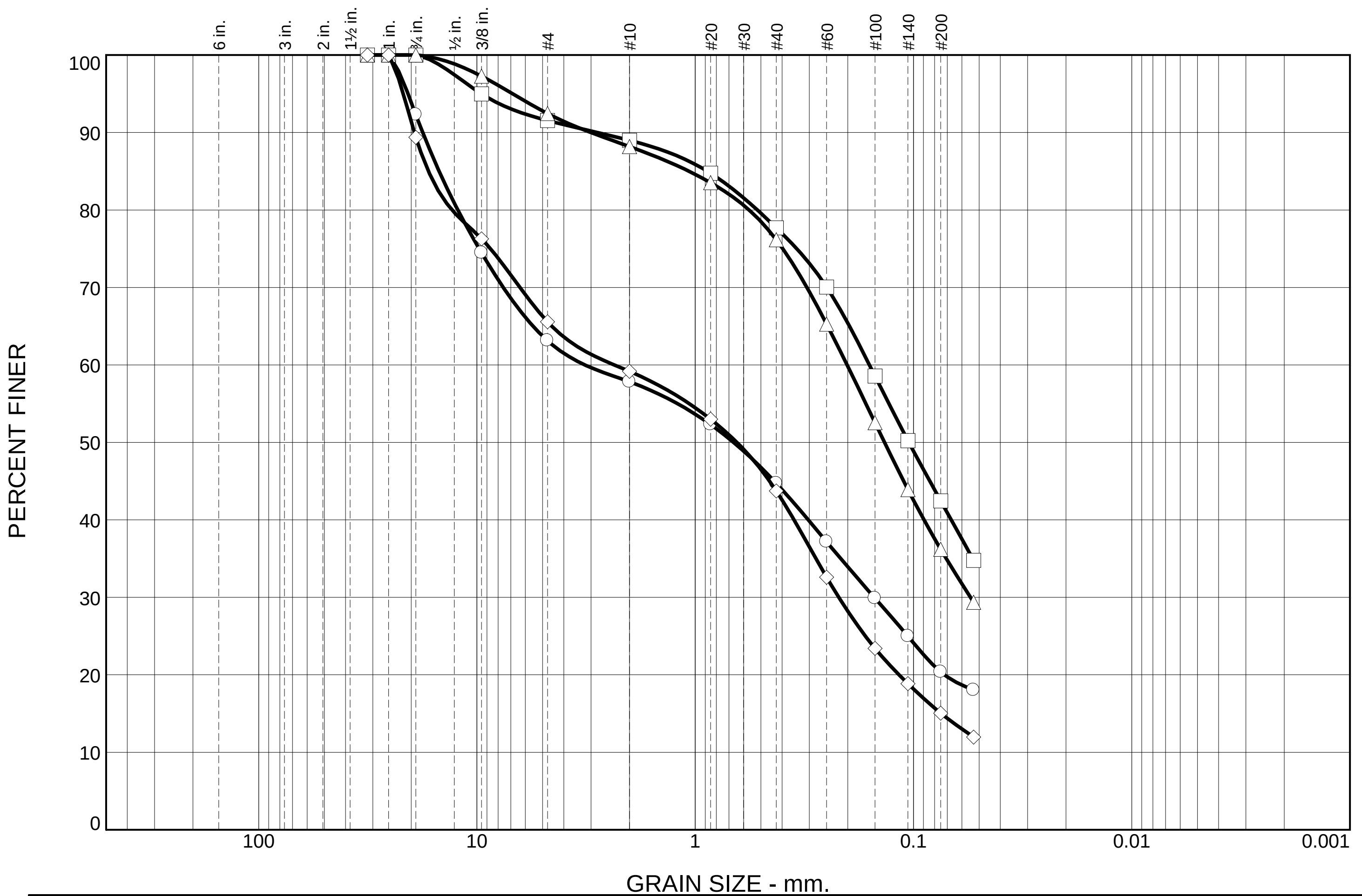
Reference Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key' figure for an explanation of the graphics/symbols used.

Test Pit TP-2 was terminated at 10.0 ft below site grades on 2-14-2022

Figure: 6

Notes:

Grain Size Test Data



Symbol	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	8	29	5	13	25	20	
□	0	0	8	3	11	36	42	
△	0	0	8	4	12	40	36	
◇	0	11	23	7	15	29	15	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-1	4	5	Silty, very gravelly SAND	SM
□	TP-1	6	8.5	Slightly gravelly, very silty SAND	SM
△	TP-2	9	2.75	Slightly gravelly, very silty SAND	SM
◇	TP-2	11	6	Silty, very gravelly SAND	SM

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Client: Moore, Randy

Project: Proposed Short Plat

Project No.: 22-0266

Figure 7

Tested By: IZ

WILDCAT DYNAMIC CONE LOG

GeoTest Services, Inc.
741 Marine Drive
Bellingham, WA 98225

PROJECT NUMBER: 22-0266
DATE STARTED: 02-14-2022
DATE COMPLETED: 02-14-2022

HOLE #: DCP-1
CREW: JR
PROJECT: Lynnwood Short Plat
ADDRESS: 17907 36th Avenue West
LOCATION: Lynnwood, WA 98037

SURFACE ELEVATION: 490'
WATER ON COMPLETION: Not Determined
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY SAND & SILT	CLAY
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
- 1 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 2 ft	12	53.3		15	MEDIUM DENSE	STIFF
-	15	66.6		19	MEDIUM DENSE	VERY STIFF
-	14	62.2		17	MEDIUM DENSE	VERY STIFF
- 3 ft	12	53.3		15	MEDIUM DENSE	STIFF
- 1 m	35	155.4		-	DENSE	HARD
-	36	139.0		-	DENSE	HARD
- 4 ft	9	34.7		9	LOOSE	STIFF
-	12	46.3		13	MEDIUM DENSE	STIFF
-	41	158.3		-	DENSE	HARD
- 5 ft	58	223.9		-	VERY DENSE	HARD
-	34	131.2		-	DENSE	HARD
-	18	69.5		19	MEDIUM DENSE	VERY STIFF
- 6 ft	22	84.9		24	MEDIUM DENSE	VERY STIFF
-	26	100.4		-	MEDIUM DENSE	VERY STIFF
- 2 m	41	158.3		-	DENSE	HARD
- 7 ft	71	242.8		-	VERY DENSE	HARD
-	66	225.7		-	VERY DENSE	HARD
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

GeoTest Services, Inc.
741 Marine Drive
Bellingham, WA 98225

PROJECT NUMBER: 22-0266
DATE STARTED: 02-14-2022
DATE COMPLETED: 02-14-2022

HOLE #: DCP-2
CREW: JR
PROJECT: Lynnwood Short Plat
ADDRESS: 17907 36th Avenue West
LOCATION: Lynnwood, WA 98037

SURFACE ELEVATION: 475'
WATER ON COMPLETION: Not Determined
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY SAND & SILT	CLAY
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 1 ft	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 2 ft	2	8.9	••	2	VERY LOOSE	SOFT
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	8	35.5	••••••••••	10	LOOSE	STIFF
- 3 ft	8	35.5	••••••••••	10	LOOSE	STIFF
- 1 m	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
- 4 ft	7	27.0	•••••••	7	LOOSE	MEDIUM STIFF
-	12	46.3	•••••••••••••	13	MEDIUM DENSE	STIFF
-	12	46.3	•••••••••••••	13	MEDIUM DENSE	STIFF
- 5 ft	15	57.9	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
-	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
- 6 ft	6	23.2	••••••	6	LOOSE	MEDIUM STIFF
-	3	11.6	•••	3	VERY LOOSE	SOFT
- 2 m	1	3.9	•	1	VERY LOOSE	VERY SOFT
- 7 ft	0	0.0		0	VERY LOOSE	VERY SOFT
-	3	10.3	••	2	VERY LOOSE	SOFT
-	14	47.9	•••••••••••••	13	MEDIUM DENSE	STIFF
- 8 ft	14	47.9	•••••••••••••	13	MEDIUM DENSE	STIFF
-	14	47.9	•••••••••••••	13	MEDIUM DENSE	STIFF
-	14	47.9	•••••••••••••	13	MEDIUM DENSE	STIFF
- 9 ft	11	37.6	••••••••••	10	LOOSE	STIFF
-	11	37.6	••••••••••	10	LOOSE	STIFF
-	37	126.5	••••••••••••••••••••••••••••••••••••	-	DENSE	HARD
- 3 m 10 ft	56	191.5	•••	-	VERY DENSE	HARD
-	58	177.5	•••	-	DENSE	HARD
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

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PAP-Accredited
NAPT

GeoTest Services Inc.
741 Marine Drive
Bellingham, WA 98225

Report: 58019-1-1
Date: February 19, 2022
Project No: 22-0266
Project Name: Lynnwood Short Plat

Sample ID	pH	Organic Matter	Cation Exchange Capacity
TP-1 @ 2.0’	5.7	2.17%	6.5 meq/100g
TP-1 @ 3.5’	5.8	1.06%	4.0 meq/100g
TP-2 @ 4.0’	5.6	4.26%	12.4 meq/100g
Method	**SM 4500-H^+ B**	**ASTM D2974**	**EPA 9081**