Stormwater Management Report

March 4, 2022

Olympic Place Apartments
Rough Grading

Prepared for:

Trevor Gaskin
Coast Development
328 N Olympic Ave
Arlington, WA 98223

Prepared by:

ERIC J SCOTT
STATE OF WASHINGTON
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3/4/2022

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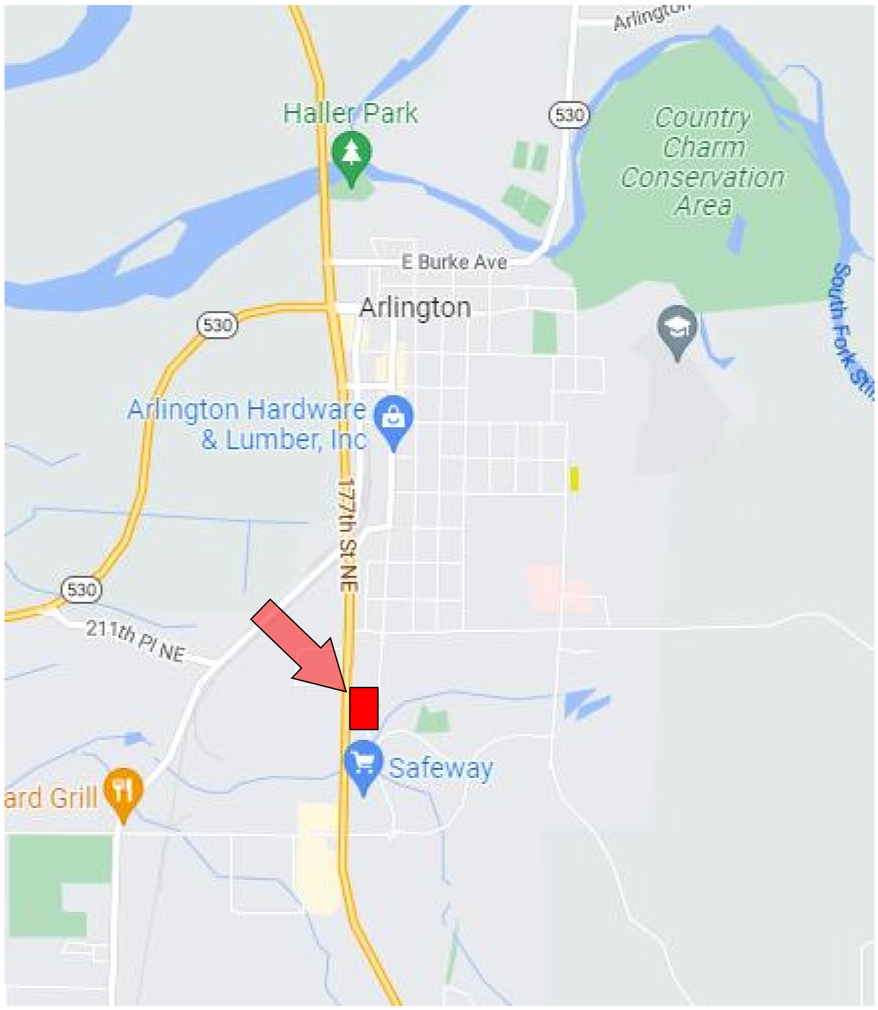
Project Overview

Site Location

The project is located along Olympic Place, north of Safeway in Arlington, Washington (Parcel #00893800002800).



Code Compliance

The project will comply with:

- [WSDOT] STANDARD SPECIFICATIONS for ROAD, BRIDGE and MUNICIPAL CONSTRUCTION, WSDOT, 2018 Edition with amendments
- [ADCS] Arlington Design and Construction Standards, dated July 2008
- [AMC] Arlington Municipal Code
- [SWMMWW] 2019 Stormwater Management Manual for Western Washington

Executive Summary

The proposed project will include clearing and grading the site in preparation for future development of an apartment complex. Permitting and this report only reflect clearing and grading of the site at this time.

Existing Conditions

The property is currently undeveloped and contains grasses and invasive vegetation. A berm/levee is at the southern and western property lines to prevent flooding of the site when Portage Creek overtops its banks. Olympic Place and an apartment complex is to the east, a lumber yard it to the north, Portage Creek is to the south, and SR-9 is to the west.

Soils

Geologic information for the project site was obtained from the Geologic map of the Arlington East 7.5-minute quadrangle, Snohomish County, Washington (Minard, 1985) published by the U.S. Geological Survey. This map indicates that the project site is underlain by Vashon Drift Recessional Outwash consisting of the Marysville Sand Member (map unit Qvrm). The Marysville Sand Member consists of mostly well-drained, outwash sand with minor amounts of gravel. The Arlington Gravel Member (map unit Gavra) of the Recessional Outwash is mapped near the northern portion of the subject property. Deposits of the Arlington Gravel consist of mostly well- drained and stratified sand and gravel deposits. Sediments of both soil types were deposited as valley fill by meltwater flowing south from the stagnating and receding Vashon Glacier during the Pleistocene Epoch.

On-site explorations indicate that the encountered subsurface soil conditions are generally in accordance with the Marysville Sand Member soil unit. For the purposes of this Geotechnical report, we have referred to the native soil as 'Marysville Sand'.

Geotechnical report is included in Appendix B for reference.

Proposed Conditions

The proposed project will simply clear and grade the site. No hardscape or structures will be included in this permit at this time.

Pervious/Impervious Areas

For use in determining stormwater mitigation fees the following areas represent the true pervious/impervious area for the entire site.

Existing Pervious/Impervious Areas	Area (SF)	Area (AC)
Total Impervious Surface	0	0
Total Pervious Surface	71,874	1.65
TOTAL SITE AREA	71,874	1.65
Mitigated Pervious/Impervious Area	Area (SF)	Area (AC)
Total Impervious Surface	0	0
Total Pervious Surface	71,874	1.65
TOTAL SITE AREA	71,874	1.65

Minimum Stormwater Management Requirements

Overview of Minimum Requirements

Per Flowchart Figure I-2.4.1, Minimum requirement 1-5 shall apply to the project.

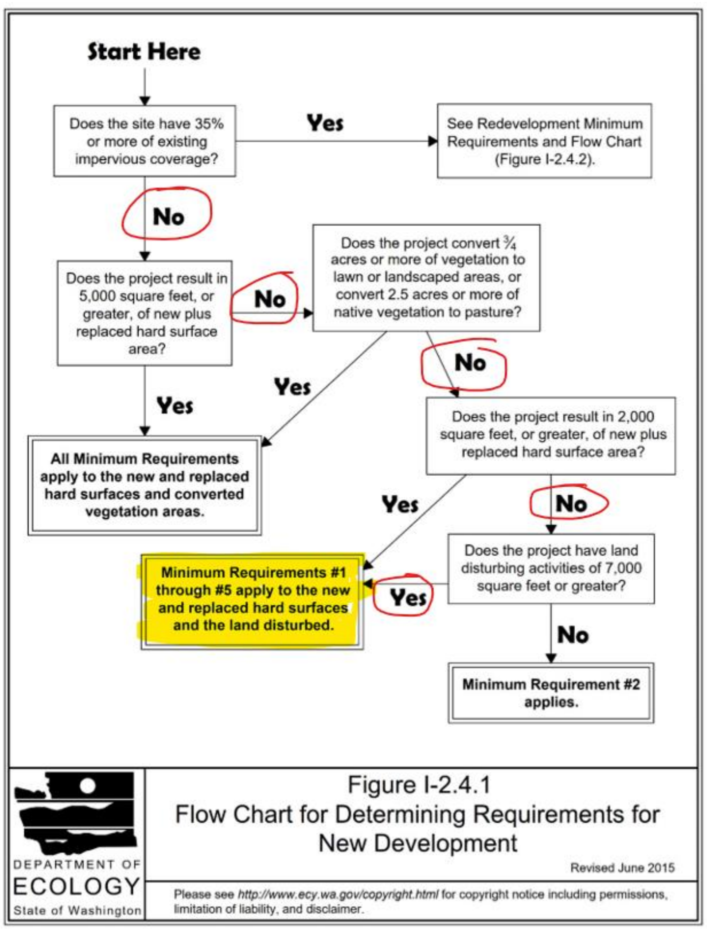


Figure I-2.4.1
Flow Chart for Determining Requirements for New Development

1-Preparation of Stormwater Site Plans

Stormwater site plans were prepared in accordance with Volume I, Chapter 3 of the SWMMWW.

2-Construction Stormwater Pollution Prevention Plan (SWPPP)

A SWPPP narrative has been prepared and is included in Appendix A and on the plan set. The erosion potential for the site is very low to non-existent. The onsite soils are highly infiltratable so no runoff during construction is anticipated.

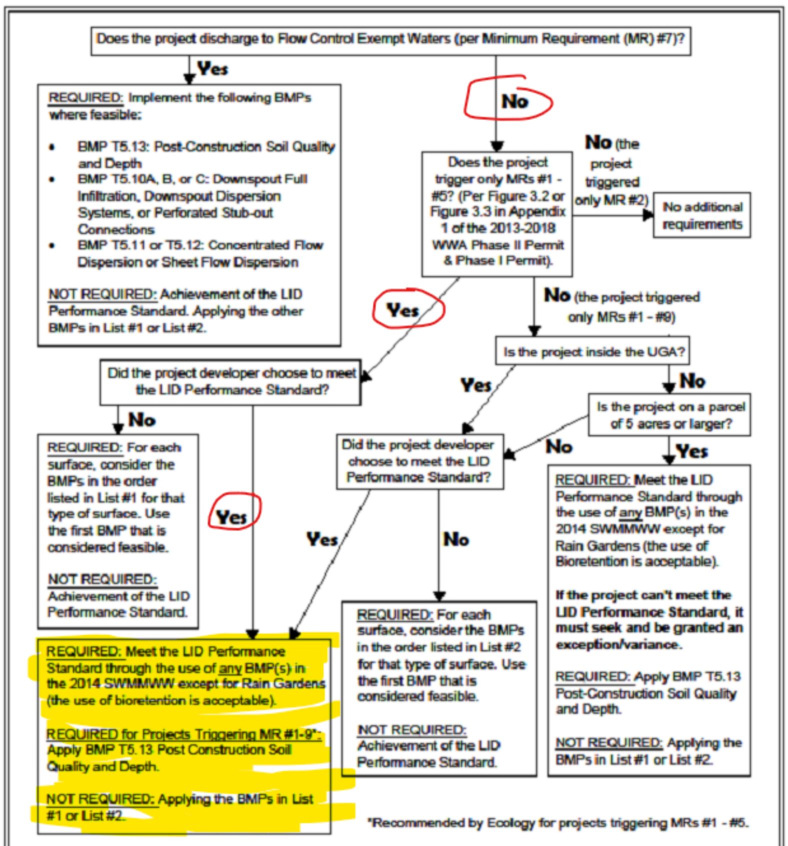
3-Source Control of Pollution

The project will not pose any source of pollution for the site other than concrete for the building foundations. The site is not considered a high use site, however oil/water separators are proposed for the parking areas. The SWPPP provided will address the source control of pollution during the construction phase.

4-Preservation of Natural Drainage Systems and Outfalls

Existing regional drainage infiltrates into the soils. Proposed drainage system will also infiltrate, therefore, preservation of natural drainage systems and outfall is being met.

5-Onsite Stormwater Management



DEPARTMENT OF ECOLOGY State of Washington

Figure I-2.5.1
Flow Chart for Determining LID MR #5 Requirements

Revised June 2015

All drainage systems are designed to infiltrate 100% of the stormwater therefore meeting and exceeding the LID stormwater requirements including other minimum requirements. Detailed drainage calculations are provided in the appendices.

SSC-4 of the SWMMWW requires that infiltration facilities that are utilized for treatment purposes must document that the water quality design storm volume (indicated by WWHM or MGS Flood, or runoff from a 6-month, 24-hour rain event) can infiltrate through the infiltration basin surface within 48 hours. The infiltration facilities will be designed to infiltrate 100% of the stormwater within depth of the storage layer. The water quality storm, which is less than all storms contained within the model, will also be contained within the storage layer of the infiltration facilities. SSC-4 is therefore met.

Upstream Analysis

No stormwater from offsite areas are anticipated to flow onto the project site.

Downstream Analysis

The proposed storm drain mitigation for the project site will infiltrate 100% of the stormwater. Therefore, no impacts to the downstream system are anticipated.

In the event that onsite drainage systems are overwhelmed by excessive rainfall, the overflow will outfall over the berm to the south and east and then flow into Portage Creek.

BMP T5.13: Post-Construction Soil Quality and Depth

BMP T5.13 is not applicable as no landscape area is included in this project. The site is 100% impervious.

6-Runoff Treatment

Not required

7-Flow Control

Not required

8-Wetland Protection

Not required

9-Operation and Maintenance

Not required

Appendix A

Construction Stormwater Pollution Prevent Plan (SWPPP)

SWPPP ELEMENTS

1 – PRESERVE VEGETATION/MARK CLEARING LIMITS

The land disturbance activities for development requires the consideration to be given to minimize the removal of existing trees, disturbance and compaction of native soils, except as needed for building purposes. The duff layer, native soil and vegetation shall be retained in an undisturbed state to the minimum degree practicable.

Best Management Practices (BMPs) to be used:

- BMP C103: High Visibility Fence
- BMP C233: Silt Fence

2-ESTABLISH CONSTRUCTION ACCESS

A stabilized construction entrance has been constructed at other areas of the overall plat development. This lot is not adjacent to public roads.

Best Management Practices (BMPs) to be used:

- BMP C105: Stabilized Construction Entrance

3-CONTROL FLOW RATES

Flow rates will be controlled by using SWPPP Element #4, sediment controls.

4-INSTALL SEDIMENT CONTROLS

Due to the permeability of the site soils, surface flows from the site are expected to be negligible and therefore no sediment controls are needed. If the contractor notices that dirty storm water is leaving the site, then the contractor shall place silt fencing down slope from the disturbed areas as shown on the SWPPP.

Best Management Practices (BMPs) to be used:

- BMP C233: Silt Fence
- BMP C240: Sediment Trap

5-STABILIZED SOILS

If required, all exposed soil and any soil stockpile will be stabilized. No soils shall remain exposed and unworked for more than 2 days between October 1 and April 30. Any land disturbed areas outside of the proposed structure and paving will be permanently seeded. The site will be stabilized with gravel surfacing.

Best Management Practices (BMPs) to be used:

- BMP C140: Dust Control

6-PROTECT SLOPES

There are no cut or fill slopes with this project.

Best Management Practices (BMPs) to be used:

- None required

7-PROTECT PERMANENT DRAIN INLETS

Existing and proposed storm drain inlets will be protected during construction.

Best Management Practices (BMPs) to be used:

- BMP C220: Storm Drain Inlet Protection

8-STABILIZE CHANNELS AND OUTLETS

There are no existing channels and the proposed construction does not create new channels.

Best Management Practices (BMPs) to be used:

- None Required

9-CONTROL POLLUTANTS

Any and all chemicals, liquid projects, petroleum projects, and other materials that have the potential to pose a threat to human or the environment will be covered, contained and protected from vandalism. All such products will either be locked in a trailer or locked in a leak proof container. Any on-site fueling will have secondary containment to prevent possibility of spills. Any heavy equipment/vehicles will only be on-site temporarily. Any spills will be cleaned immediately. Fertilizers and pesticides will be applied per the manufacturers label requirements for application rate and procedures. No pH modifying sources such as cement kiln dust, fly ash, concrete washing treatment, curing waters, etc. are anticipated; if however they are, we will contain and/or remove the polluted substance from the site per manufacturer's recommendations.

Best Management Practices (BMPs) to be used:

- None required

10-CONTROL DEWATERING

For the proposed building, dewatering is not expected to be required; thus, dewatering control will not be required for this project.

Best Management Practices (BMPs) to be used:

- None Required

11-MAINTAIN BEST MANAGEMENT PRACTICES

BMPs will be inspected and maintained after storms and during construction.

12-MANAGE THE PROJECT

This SWPPP will be implemented at all times and will be modified whenever there is a significant change to the site conditions. The Erosion control BMPs will be implemented in the following sequence:

1. Mark the clearing limits.
2. Establish staging areas for storage and handling polluted materials and BMPs.
3. Install sediment control BMPs.
4. Hand grade and install stabilization measure for disturbed areas
5. Maintain BMPs until final site stabilization, at which time they may be removed.

13-PROTECT ON-SITE STORMWATER BMPS

On-site storm water BMPs, existing and proposed, will be protected at all times from siltation and compaction during construction. The approved plans have both construction sequencing and appropriate SWPPP BMPs to minimize the risk to storm water BMPs.

Best Management Practices (BMPs) to be used:

- None Required

Appendix B

Geotechnical Report

Geotechnical Engineering Report

Proposed Apartment Building
North and West of Olympic Place NE and Jensen Farm Lane
Arlington, WA 98223

Prepared For:

Coast Construction Group
Attn: Mr. Trevor Gaskin
328 North Olympic Avenue
Arlington, WA 98223

1,888251.5276
Bellingham Arlington | Oak Harbor
geotest-mc.com

November 5, 2021 [redacted]
Project No. 21-0921

Coast Construction Group
328 North Olympic Avenue
Arlington, WA 98223

Attention : Mr. Trevor Gaskin, President

Regarding: **Geotechnical Engineering Report**
Proposed Apartment Building
North and West of Olympic Place NE and Jensen Farm Lane
Arlington, WA 98223
(Parcel No. 00893800002800)

Dear Trevor,

As requested, GeoTest Services, Inc. [GeoTest] is pleased **to** submit the following report summarizing the results of our Geotechnical engineering evaluation for the proposed apartment building at the above referenced address in Arlington, 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 September 24, 2021 and authorized by Coast Construction Group.

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 .

GERRY D. BAUTISTA
STATE OF WASHINGTON
51531
REGISTERED
PROFESSIONAL ENGINEER
11/5/2021

Gerry D. Bautista, Jr., P.E.
Project Geotechnical Engineer

Edwardo Garcia, P.E.
Geotechnical Department Manager

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. Out scope of services includes the following tasks:

- Explore soil and groundwater conditions underlying the site by excavating four test pits with a client-provided tracked excavator.
- Perform one Pilot Infiltration Test (PIT) in accordance with the Stormwater Management Manual for Western Washington (SMMWW). The SMMWW is the stormwater manual currently adopted by the City of Arlington.
- Perform laboratory testing on representative samples to classify and evaluate the engineering characteristics of the soils encountered and to assess on-site infiltration capably.
- 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, pavement structures, geotechnical consultation, and construction monitoring.
- Assess Geologically Hazardous Areas (if present) per Arlington Municipal Code (AMC).

PROJECT DESCRIPTION

The vacant subject property is approximately 1.6 acres in size and is located on the western side of Olympic Place NE, approximately 150 feet north of the intersection with Jensen Farm Lane. The property appears to be reasonably flat with only minor elevation differentials across the site.

GeoTest understands that a new apartment building will be constructed on the subject property. Although preliminary drawings are not available for the proposed structure, we expect that the proposed facility will be three stories, wood-framed, and utilize shallow conventional foundations and slab-on-grade floors. Asphalt parking and drive lanes will also serve the new structure.

GeoTest generally anticipates that information regarding infiltration feasibility will be needed for the property. No preliminary information regarding the number, type, or configuration of the proposed facility or facilities was available as of the writing of this proposal.

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

As discussed previously, the vacant subject property (Parcel No. 00893800002800) is approximately 1.6 acres in size and is located on the western side of Olympic Place NE, approximately 150 feet north of the intersection with Jensen Farm Lane. The property is located just south of a lumber facility (Chinook Lumber) and west of a residential neighborhood. Jensen Creek borders the subject property to the east. The site has been historically cleared of trees and currently contains a grass field. The property appears to be reasonably flat with only minor elevation differentials across the site. GeoTest understands that there are existing utility easements that run east/west through the northern-central portion of the subject property.

Image 1: Existing surface conditions at the subject property, facing south. (Images 1 and 2 taken on October 5, 2021.)

Subsurface Soil Conditions

Subsurface conditions were explored by advancing five test pits (TP-1 through TP-4 and PIT-1) on October 5, 2021. The explorations were each advanced to an approximate depth of 8 to 10 feet below ground surface (BGS) using a track-mounted excavator. Approximate locations of these explorations have been plotted on *the Site and Exploration Plan* (Figure 2).

The test pits encountered similar subsurface conditions. In general, explorations consisted of approximately 1 to 1.5 feet of loose, dark black to brown, damp, very silty sand with abundant organics (topsoil) at the surface. Underlying the topsoil was medium-dense, sand to gravelly sand (Marysville Sand). The Marysville Sand was encountered to the maximum explored depth of the test pits. In TP-2, a layer of very sandy gravel was encountered from approximately 5.5 to 8 feet BGS, then Marysville Sand was again encountered underlying the gravel to the maximum explored depth of the test pit.

More detailed logs of the subsurface conditions encountered within our explorations are presented in the enclosed *Test Pit Logs* attached to the end of this report.

Image 2: Exploration of TP-2 showing subsurface conditions.

General Geologic Conditions

Geologic information for the project site was obtained from the *Geologic map of the Arlington East 7.5-minute quadrangle, Snohomish County, Washington* (Minard, 1985) published by the U.S. Geological Survey. This map indicates that the project site is underlain by Vashon Drift Recessional Outwash consisting of the Marysville Sand Member (map unit Qvrm). The Marysville Sand Member consists of mostly well-drained, outwash sand with minor amounts of gravel. The Arlington Gravel Member (map unit Gavra) of the Recessional Outwash is mapped near the northern portion of the subject property. Deposits of the Arlington Gravel consist of mostly well-drained and stratified sand and gravel deposits. Sediments of both soil types were deposited as valley fill by meltwater flowing south from the stagnating and receding Vashon Glacier during the Pleistocene Epoch.

Our on-site explorations indicate that the encountered subsurface soil conditions are generally in accordance with the Marysville Sand Member soil unit. For the purposes of this Geotechnical report, we have referred to the native soil as 'Marysville Sand'.

Groundwater

No groundwater seepage was encountered in the test pits at the time of our investigation on October 5, 2021. 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 fluctuate depending on local subsurface conditions, precipitation, and changes in on-site and off-site use.

GEOLOGIC HAZARDS

As the subject property is located within the City of Arlington, GeoTest reviewed Chapter 20.93.600 (Geologically Hazardous Areas) of the AMC. Since the subject property is flat with little discernible elevation change, it is GeoTest's opinion that the subject property does not contain hazards pertaining to erosion or steep slopes (i.e., not an Erosion Hazard or Steep Slope Hazard). However, the subject property contains a slope that is classified as a Landslide Hazard, and the subject property is mapped as having a low to moderate susceptibility to liquefaction. This landslide hazard is addressed in the next section.

Landslide Hazards

Based on Chapter 20.93.600(b)(2) of the AMC, Landslide Hazard Areas shall include areas subject to severe risk or landslide based on a combination of geologic, topographic, and hydrologic factors.

[redacted]

A steep slope approximately 10 feet in height and over 33 percent inclination is situated on the northern margin of the subject property. Since the subject property is generally underlain by Marysville Sand/Arlington Gravel and not rock, this slope would be classified as a Landslide Hazard.

Chapter 20.93.630(b)(2) of the AMC discusses minimum buffers from the edge of all landslide hazard areas. This section states that, unless an alteration is approved by the City of Arlington, "a minimum buffer of 50 feet shall be provided from the edges of all landslide hazards regardless of slope". We did not observe noticeable signs of recent movement of this slope during our visits to the site. Although the northern slope is slightly over 10 feet, it is GeoTest's opinion that the risk of surficial movement on this slope is low. Thus, GeoTest recommends that conventional boundary setbacks be used for the proposed building. If the proposed building will be situated in close proximity to the northern slope, the northern foundation wall can be designed as a combination foundation and retaining wall if necessary.

GeoTest understands that the Client has obtained conditional approval from the City of Arlington to reduce the top-of-slope buffer for the southern slope adjacent to the creek to a minimum of 25 feet. The southern slope overlooking the existing creek is not classified as a steep slope or a Landslide Hazard per the AMC. It is GeoTest's opinion that any proposed development be set back a minimum of 25 feet from the top of the creek slope.

It is also GeoTest's opinion that the proposed development would not adversely affect the overall stability of the existing northern or southern slopes if the recommendations in this report are followed.

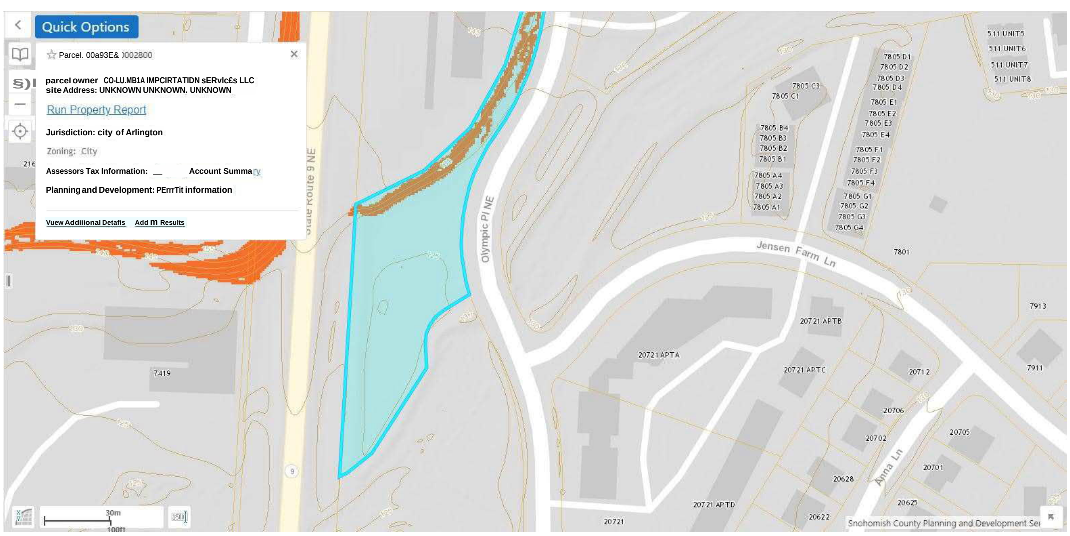


Image 3: Screenshot from Snohomish County PDS Map Portal showing the location of the steep slope in relation to the subject property. Slopes over 33 percent inclination shown in red.

Seismic and Liquefaction Hazards

Based on a review of information obtained from the Washington State Department of Natural Resources *Geologic Information Portal,* the subject site is classified as having a low to moderate liquefaction susceptibility. However, this map only provides an estimate of the likelihood that the soil will liquefy as a result of an earthquake and is meant as a general guide to delineate areas prone to liquefaction.

Liquefaction is defined as a significant rise in porewater pressure within a soil mass caused by earthquake-induced cyclic shaking. The shear strength of liquefiable soils is reduced during large and/or long duration earthquakes as the soil consistency approaches that of semi-solid slurry. Liquefaction can result in significant and widespread structural damage if not properly mitigated. Deposits of loose, granular soil below the groundwater table are most susceptible to liquefaction. Damage caused by foundation rotation, lateral spreading, and other ground movements can result from soil liquefaction.

Based on our subsurface explorations, the site is underlain by native, medium dense, sandy soils with varying amounts of gravel. No groundwater seepage was encountered in the explorations. Groundwater seepage, if encountered, would be within medium-dense to dense, native soils. Due to these factors, it is GeoTest's opinion that the potential for liquefaction underlying the subject property is low. Thus, it is also our opinion that no additional mitigations are required for the proposed development.

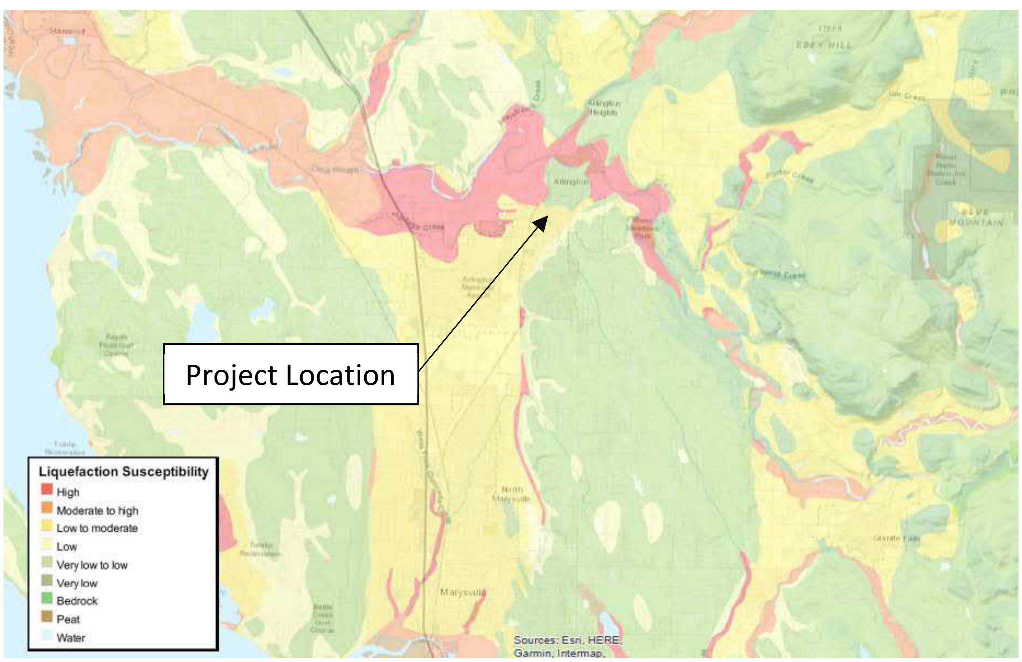


Image 4: Map showing liquefaction hazard susceptibility. Yellow depicts "low to moderate" susceptibility in the vicinity of subject property. Data source: Washington Geologic Information Portal.

CONCLUSIONS AND RECOMMENDATIONS

Based on the evaluation of the data collected during this investigation, it is GeoTest's 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.

The subsurface explorations that were performed for this study generally encountered native, non-organic, medium-dense, Marysville Sand within approximately 1 to 1.5 feet of existing grade. We recommend that the loose, near-surface topsoil be removed from the building footprints down to the native Marysville Sand. Once stripping is completed, the subgrade should then be compacted to a firm and unyielding condition. GeoTest personnel should be on site to observe the excavation and confirm that adequate native subgrade has been exposed. The proposed buildings 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 firm and unyielding soils. Further recommendations regarding the placement and compaction of structural fill can be found in *the Fill and Compaction* section of this report.

Based on the native soils encountered in the test pits, it appears that the subject site is suitable for stormwater infiltration. The native Marysville Sand encountered in our explorations was medium dense and composed of sand with varying amounts of gravel. GeoTest performed a Pilot Infiltration Test (PIT) to obtain a calculated design infiltration rate per the SMMWW. This is presented in *the Storm water Infiltration Potential* section of this report.

Site Preparation and Earthwork

The portions of the site proposed for foundations, floor slabs, pavements, and sidewalks should be prepared by removing existing topsoil, loose fill (if present), 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 comparative effort.

Reuse of On-Site Soil

The on-site, non-organic, Marysville Sand is suitable for reuse as structural fill when placed at or near optimum moisture contents, as determined by ASTM D1557, and if allowed for in the project plans and specifications. The near-surface soils contain elevated silt contents and are expected to be difficult to use during periods of wet weather.

The Contractor and Owner should be prepared to manage over-optimum moisture content soils. Moisture content of the site 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/replaced with drier structural fill.

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

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 medium-dense Marysville Sand 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

Foundation support for the proposed developments can be established via continuous or isolated spread footings founded on firm and unyielding native soils (Marysville Sand), or on properly compacted structural fill placed directly over firm and unyielding native soil. GeoTest expects that at least 1 to 1.5 feet of excavation will be required to remove organic topsoil and loose fill soils (if present) and reveal competent bearing soils. 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 areas. If footings or structural fill will be placed atop the native, near-surface weathered glacial soils, 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 by the Geotechnical Engineer or their representative, 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 remedially compacted, firm, and unyielding Marysville Sand, or on compacted structural fill placed directly above these 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.

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

Floor slabs for the proposed buildings can be supported on firm and unyielding, properly prepared native subgrade or on properly placed and compacted structural fill placed over firm and unyielding native soil. The native subgrade should be proof rolled as recommended in *the Site Preparation and Earthwork* section of this report.

GeoTest recommends that 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. If water vapor migration through concrete slabs is a concern, 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.

A Subgrade Modulus (k) of 200 pounds per cubic inch (pa) is recommended for use in design of concrete slab elements placed on firm and unyielding native soil or on properly placed structural fill over remedially compacted existing site soils. These values assume site preparations prior to slab installation follow the minimum soil preparation measures recommended above.

Exterior concrete slabs-on-grade, such as for parking and sidewalks, may be supported directly on properly prepared native soils or existing fill soils, however, long-term performance will be enhanced if exterior slabs are placed on a layer of clean, durable, well-draining granular material as recommended herein.

Foundation and Site Drainage

Positive surface gradients should be provided adjacent to new foundation areas 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. If applicable, a comprehensive review should occur to confirm that non-permitted discharges or stormwater flows do not impact Jensen Creek. Pavement and sidewalk areas, if present, should be sloped and drainage gradients should be maintained to carry surface water away from foundation areas 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 foundations as shown in *the Typical Footing 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 concrete 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.

Please understand that the above recommendations are intended to assist the design engineer and/or architect in development of foundation and site drainage parameters and are based on our experience with similar projects in the area. The final foundation and site drainage plan that will be incorporated into the project plans is to be determined by the design team.

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 0.001to 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 300 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 concrete 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 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 any 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 the Marysville Sand 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 1.5:1. 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: IV or flatter. Permanent cuts or fills used in 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 Marysville Sand.

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 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 and *Typical Utility Trench Section* (Figure 4).

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 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. We expect that trenches that are excavated within close proximity to the existing stream along the north and east perimeters of the subject property may have a greater probability of encountering instability, depending on the observed groundwater conditions. Thus, we recommend that trenches be set back as far from the existing stream as is practical.

Pavement Subgrade Preparation

Selection of a pavement section is typically a choice relative to its higher initial cost and lower long-term maintenance, or lower initial cost with more frequent maintenance. For this reason, we recommend that the Owner participate in the selection of proposed pavement improvements planned for the site. Site grading plans should include provisions for sloping of the subgrade soils in proposed pavement areas, so that passive drainage of the pavement section(s) can proceed uninterrupted during the life of the project. The proposed pavement areas should be prepared as indicated in *the Site Preparation and Earthwork* section of this report.

We anticipate that asphaltic concrete will be used for pavements at this site. Based on the expected use of the facilities and subsurface conditions encountered in our explorations, a standard "light duty" pavement section consisting of 2.5 inches of hot-mix asphalt (HMA) over 8 inches of crushed surfacing base course (CSBC) is appropriate. CSBC should meet the criteria of Washington State Department of Transportation (WSDOT) Standard Specification 9-03.9[3].

Areas that will be accessed by more heavily loaded vehicles, semi and garbage trucks, etc. will require a thicker asphalt section and should be designed using a paving section consisting of 4 inches of Class %-inch HMA asphalt surfacing above 8 inches of CSBC meeting criteria set forth in WSDOT Standard Specification 9-03.9[3].

GeoTest is available to further consult, review, and or/modify our pavement section recommendations based on further discussion and/or analysis with the project team/Owner. The above pavement sections should be considered initial recommendations and may be accepted and/or modified by the site civil engineer based on the actual finished site grading elevations and/or the Owner's preferences.

Stormwater Infiltration Potential

Per the SMMWW, medium dense, predominately granular sand (Marysville Sand) is suitable for infiltration. GeoTest performed one PIT test with the bottom entirely in Marysville Sand. GeoTest also observed the excavation of numerous exploration pits to confirm the presence of Marysville Sand at depth across the project site. Based on our findings, it is GeoTest's opinion that the Marysville Sand soils are suitable for the conventional infiltration of stormwater. The results of our infiltration test are presented below.

Pilot Infiltration Test Results

GeoTest performed one small-scale PIT test on October 5, 2021, per the SMMWW in order to determine the initial saturated hydraulic conductivity rate (Ksat initial) in inches per hour. The base of the PIT was excavated to the dimensions of approximately 6.5 feet long by 5.5 feet wide, with a depth of 2.75 feet BGS. The bottom of the PIT extended into the native, poorly graded Marysville Sand. Please note that elevation and survey data was not available to us at the time of this report. Approximate ground elevations were obtained from the Snohomish County PDS Map Portal website.

Infiltration testing was conducted by discharging water into the flat-bottom excavation for a 6-hour "soaking period". The purpose of the 6-hour pre-soak was to allow the soils in the immediate vicinity of the test area to exhibit saturated conditions. Water was discharged into the excavation at a metered rate while keeping the water level within the testing area approximately fixed. The cumulative volume and instantaneous flow rates were recorded approximately every 15 to 30 minutes. Water for the infiltration testing was obtained from a municipal hydrant.

Following the 6-hour pre-soak and steady-state period, the water was shut off and the rate of infiltration (the drop of the standing water) in inches per hour was recorded until fully drained. At the conclusion of the testing, the bottom of the PIT was excavated an additional 5 feet to identify possible restrictive layers. GeoTest did not observe noticeable indications of hydraulically restrictive layers between the bottom of the PIT test and the extent of the overexcavation.

Design Infiltration Rates

The initial, uncorrected hydraulic conductivity (Ksat initial) was calculated for the PIT using the infiltration rate recorded during the falling-head test. This is measured as change in depth per recorded time interval. The Ksat initial value is shown below in Table 1. GeoTest then determined the corrected, long-term infiltration rate (Ksat design) by applying the following correction factors in accordance with the SMMWW:

- Site variability and number of locations tests, CFC= 0.50
- Test method (small-scale test), CFt = 0.50
- Degree of influent control to prevent siltation and bio-buildup, CFm = 0.90

Table 1 provides a summary of the calculated infiltration rate determined at the PIT location:

Table 1
Calculated Infiltration Rate

PIT ID	Ksat Initial (in/hr)	Reduction Factor *	Ksat Design (in/hr)
PIT-1	56.8	0.225	12.8

* Total Reduction Factor = (0.50)(0.50)(0.90) = 0.225

Based on our PIT result and analysis of the subsurface soils, the infiltration rates within the native, poorly graded Marysville Sand at the location tested was calculated to be **12.8 in/hr.** This rate is representative of an excavation that extends at least 5 vertical feet into Marysville Sand. It should be noted that this rate is only valid for a facility that is in the vicinity of PIT-1. GeoTest does not anticipate that additional reductions or corrections for the mounding of groundwater will be required for a facility in this location.

Storm water Treatment

The on-site stormwater facilities may require some form of pollutant pretreatment with an amended soil prior to on-site infiltration or off-site 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 three soil samples collected from the explorations performed for this project. 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	6.0	Marysville Sand	3.6	0.87%	6.4
PIT-1	0.5	Topsoil	26.5	10.26%	5.4
PIT-1	3.0	Marysville Sand (Weathered)	10.7	2.76%	5.9

Suitability for on-site pollutant treatment is determined in accordance with SSC-6 of the SMMWW. 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, soils within the upper 3 feet (Topsoil and weathered Marysville Sand) are suitable for stormwater treatment. The unweathered Marysville Sand found at depth would not be suitable for stormwater treatment.

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. This would result in slower infiltration rates due to the higher silt content. 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 Services, Inc. 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 Services, Inc. has prepared this report for the exclusive use of Coast Construction Group and their design consultants for specific application to the design of the proposed apartment building to be located north of the intersection of Olympic Place NE and Jensen Farm Lane in Arlington, 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 geological information for the site. If variations in subsurface conditions are encountered during construction that differ from those contained within this report, GeoTest should be allowed to review the recommendations contained in this report 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; this responsibility is specifically disclaimed.

Attachments:	Figure 1	Vicinity Map
	Figure 2	Site and Exploration Plan
	Figure 3	Typical Footing and Wall Drain Section
	Figure 4	Typical Utility Trench Section
	Figure 5	Soil Classification System and Key
	Figures 6 – 10	Test Pit Logs
	Figure 11	Grain Size Test Data
	Attached	Northwest Agricultural Consultants Results
	Attached	Report Limitations and Guidelines for its Use

REFERENCES

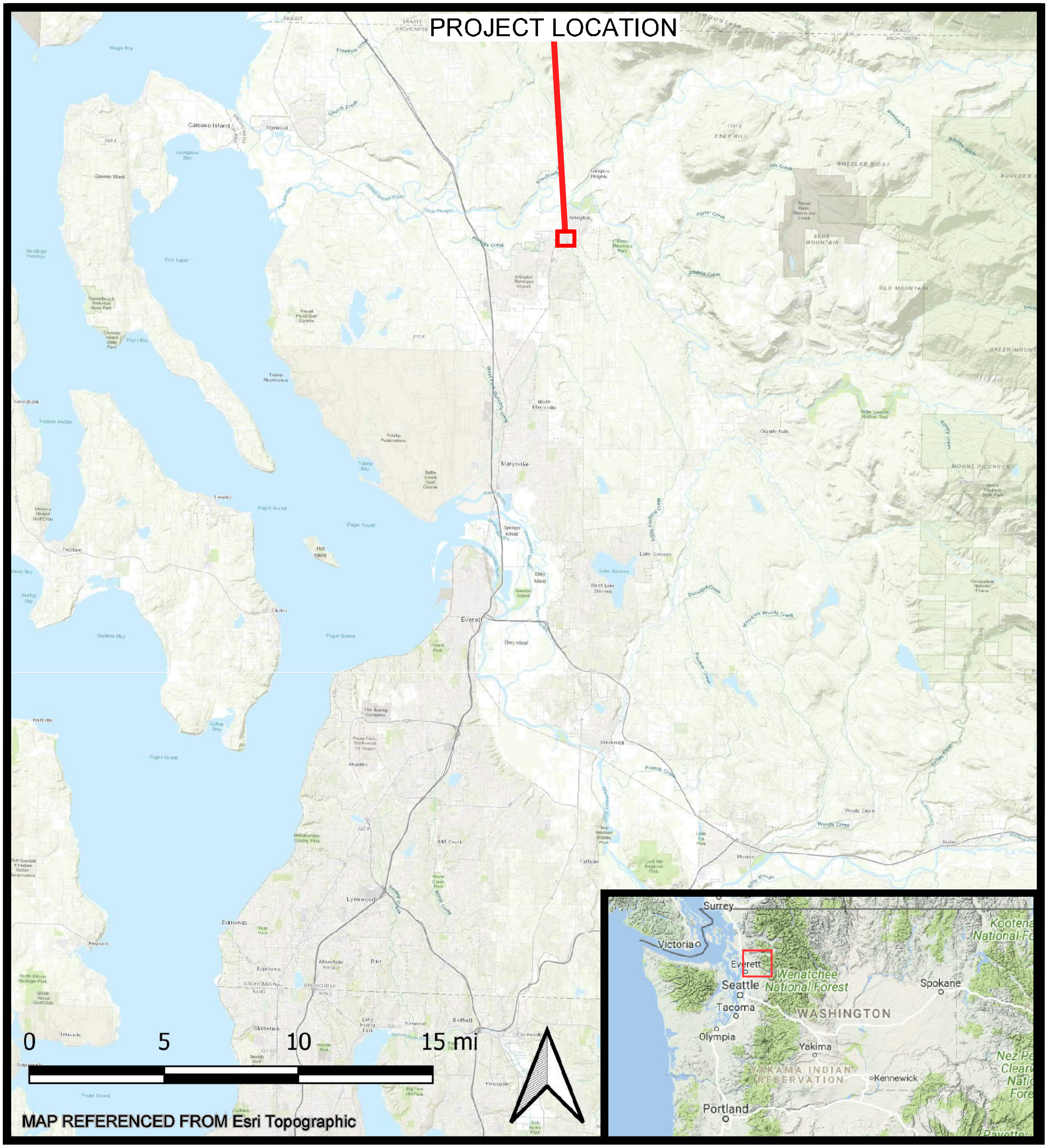
Arlington Municipal Code, *Chapter* 20.93.600 *(Geologically Hazardous Areas).* Retrieved in October 2021 from https://library.municode.com/wa/arlington/codes/code of ordinances

Gariepy, D., Graul, C., Heye, A., Howie, D., Labib, F., & Song, K. (n.d.), *2019 Stormwater Management Manual for Western Washington* (2019 SMMWW) (pp, 1-1108) (United States, Washington State Department of Ecology).

Minard, J.P., 1985. *Geologic map of the Arlington East 7.5-minute quadrangle, Snohomish County, Washington [mop].* Scale 1:24,000. US Geological Survey MF-1739.

PDS Map Portal. Snohomish County Planning and Development Services - Online Web Services. Retrieved in October 2021 from https://snohomishcountywa.gov/3752/PDS-Map-portal

Washington Interactive Geologic Mop. Washington State Department of Natural Resources - Online Web Services. Retrieved in October 2021 from https://www.dnr.wa.gov/geologyportal



GEOTEST

Date: 11-1-21	By: SEM	Scale: As Shown	Project
			21-0921

VICINITY MAP

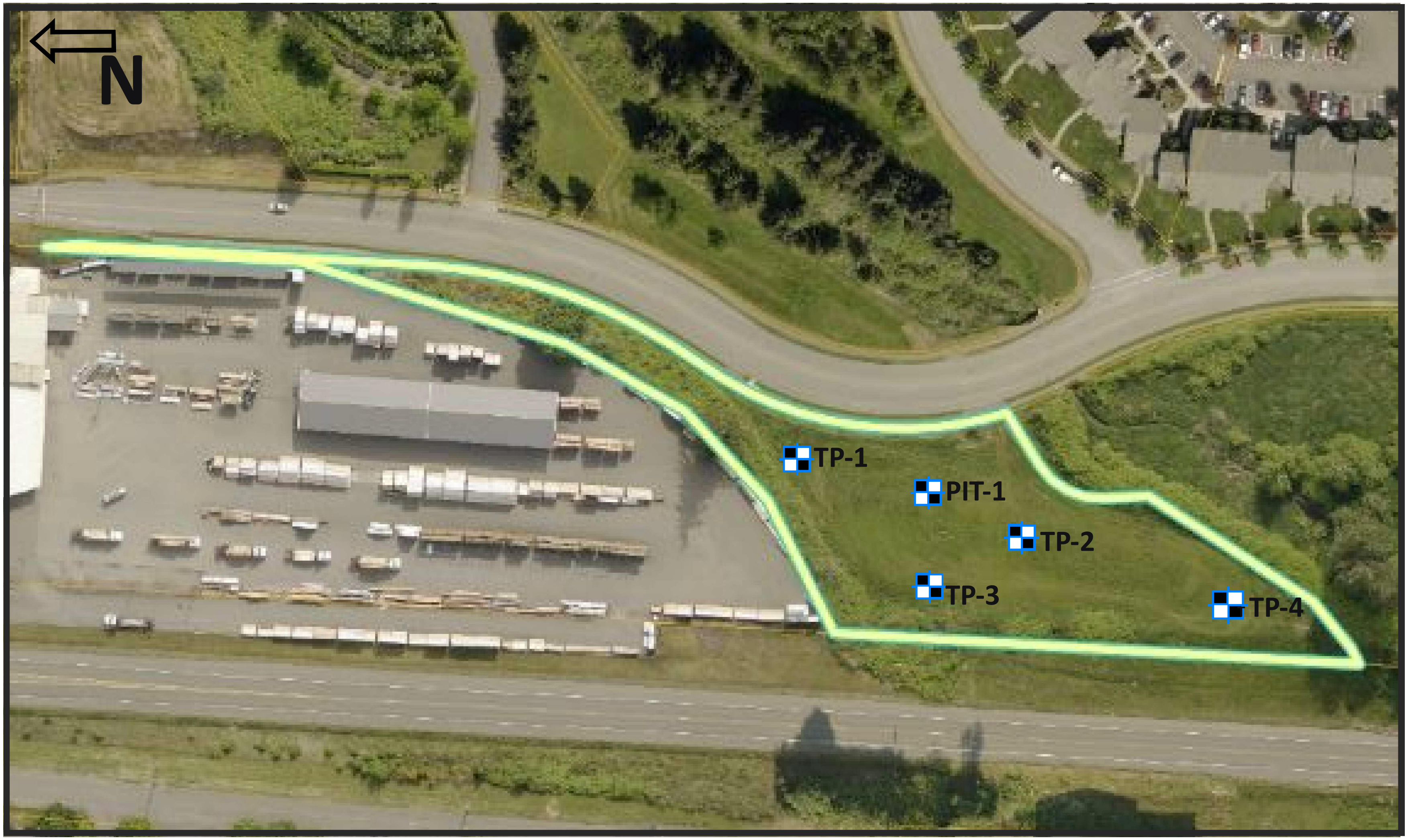
PROPOSED APARTMENT BUILDING

NORTH AND WEST OF OLYMPIC PL. NE AND JENSEN FARM LN.

ARLINGTON, WA 98223

Figure

1



AERIAL IMAGERY FROM SNOHOMISH COUNTY PDS MAP PORTAL

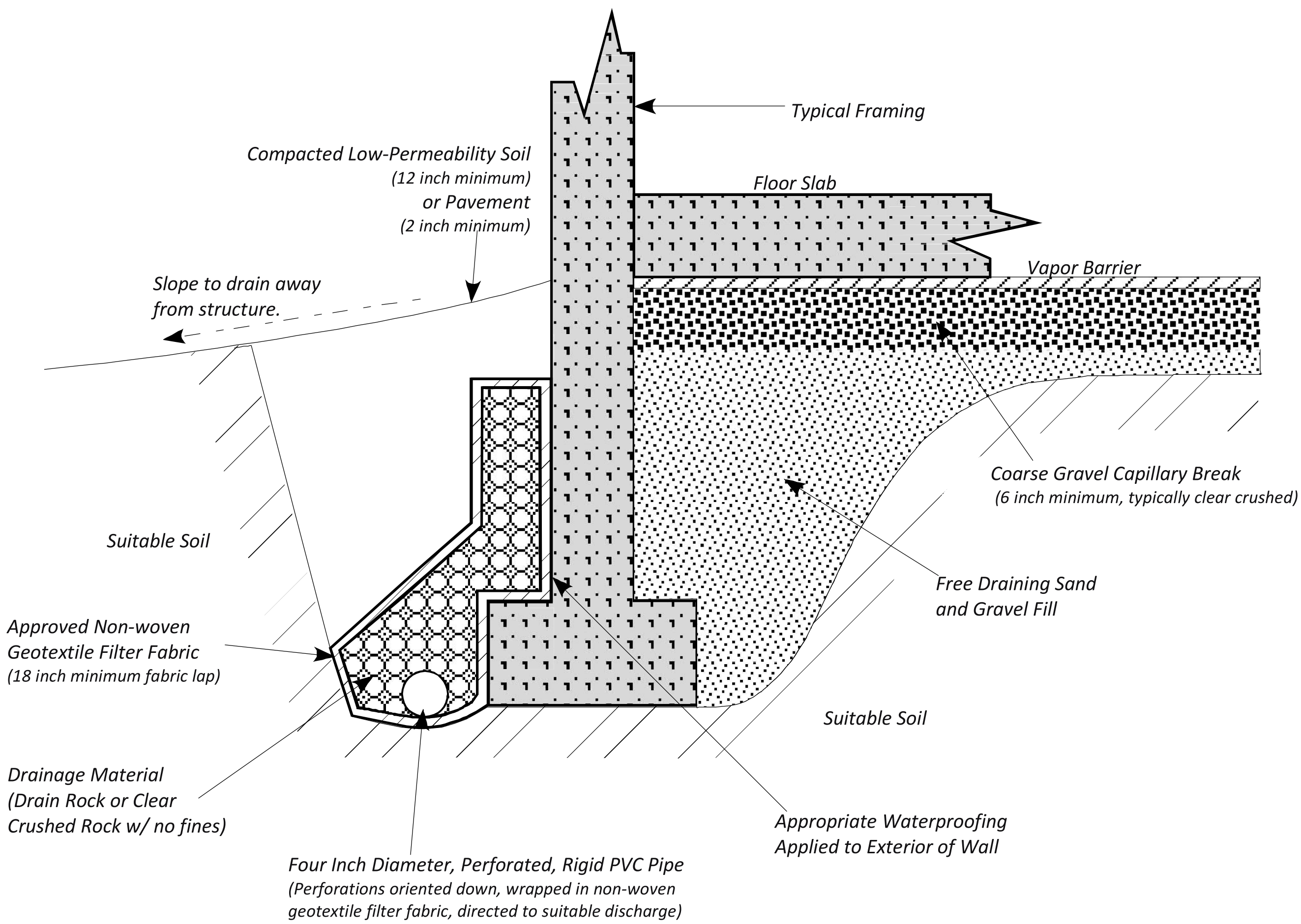
Legend

- TP-# Approximate Test Pit Location
- PIT-# Approximate Pilot Infiltration Test Location

GEOTEST

Date: 11-1-21	By: SEM	Scale: As shown	Project 21-0921
SITE AND EXPLORATION PLAN PROPOSED APARTMENT BUILDING NORTH AND WEST OF OLYMPIC PL. N AND JENSEN FARM LN. ARLINGTON, WA 98223			Figure 2

SHALLOW FOOTINGS WITH INTERIOR SLAB-ON-GRADE



Notes:

This figure is not intended to be representative of a design. This figure is intended to present concepts that can be incorporated into afunctional foundation drain designed by a Civil Engineer. In all cases, refer to the Civil plan sheet for drain details and elevations.

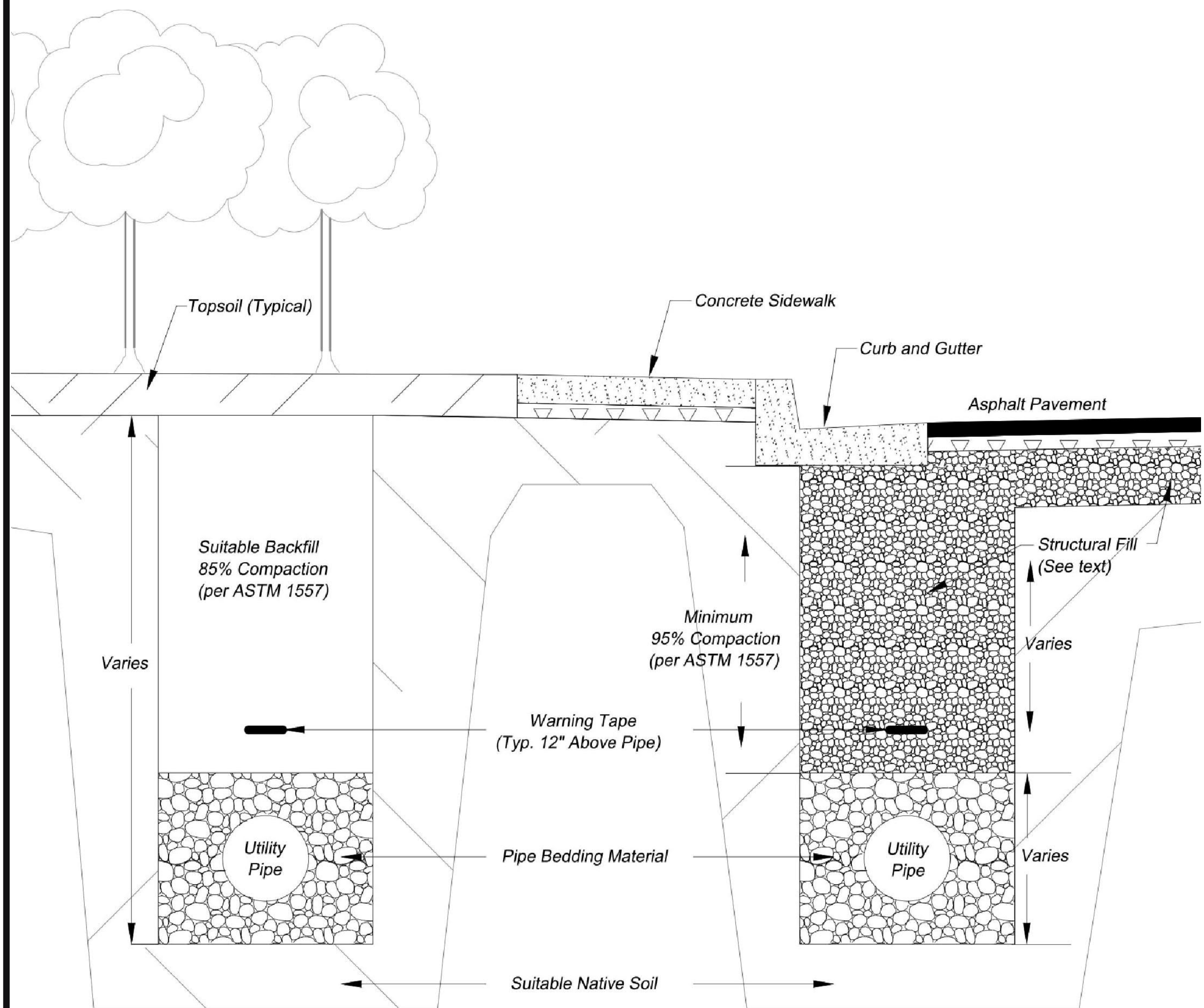
Footings should be properly buried for frost protection in accordance with International Building Code or local Municipal building codes (typically 18 inches below exterior finished grades).

The footing drain will need to be modified from this typical drawing to fit the dimensions of the planned footing and slab configuration.

GEOTEST	Date: 11-1-21	By: GDB	Scale: None	Project 21-0921
	TYPICAL FOOTING & WALL DRAIN SECTION **PROPOSED APARTMENT BUILDING** **NORTH AND WEST OF OLYMPIC PL. NE AND JENSEN FARM LN.** **ARLINGTON, WA 98223**			Figure 3

LANDSCAPING AREAS

LOAD BEARING AREAS



Date: 11-1-21	By: SEM	Scale: None	Project 21-0921

TYPICAL UTILITY TRENCH SECTION

PROPOSED APARTMENT BUILDING

NORTH AND WEST OF OLYMPIC PL. NE AND JENSEN FARM LN.

ARLINGTON, WA 98223

Figure 4

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

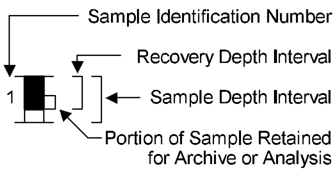
OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

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 Apartment Building
Olympic Pl./Jensen Farm Ln.
Arlington, WA

Soil Classification System and Key

Figure
5

TEST PIT LOG

Test Pit No. TP-1

PROJECT: Proposed Apartment Building **PROJECT NO.:** 21-0921
LOCATION: North and West of Olympic Pl. NE and Jensen Farm Lane **DATE:** 10-5-21
EXPLORATION METHOD: Tracked Excavator **ELEVATION:** 128'
CONTRACTOR/DRILLER: Coast Construction **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
128 / 0				SP	Loose, dark brown, moist, silty SAND with rootlets and organics (Topsoil)
	1	d			
126 / 2	2	d	W = 14.0 GS	SP	Medium dense, orange-brown, moist,slightly silty gravelly SAND, weathered, trace silt (Weathered Marysille Sand)
				SP	
				SP	Medium dense, gray-weathered tan, moist, gravelly SAND, trace silt, poorly-graded (Marysville Sand) Becomes light tan color and finer grained at 8.0' BGS
3	3	d			
124 / 4					
122 / 6	4	d	GT		
120 / 8	5	d			
118 / 10	6	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 10.0 ft below site grades on 10-5-21

Notes:

Figure: 6

TEST PIT LOG

Test Pit No. TP-2

GEOTEST

PROJECT: Proposed Apartment Building — **PROJECT NO.:** 21-0921
LOCATION: North and West of Olympic Pl. NE and Jensen Farm Lane — **DATE:** 10-5-21
EXPLORATION METHOD: Tracked Excavator — **ELEVATION:** 126'
CONTRACTOR/DRILLER: Coast Construction — **LOGGED BY:** JR
DEPTH TO WATER TABLE: N/A **PERCHED WATER:** N/A **CAVING** 6.0'

ELEVATION/ DEPTH	SOIL SAMPLE AND TEST DATA: SAMPLE & TEST DATA			USCS SYMBOL	SOIL PROFILE DESCRIPTION
126 / 0				SP	Loose, black, moist, silty SAND, organics, rootlets, (Topsoil)
	7	d			
1					
	8	d		SP	Medium dense, weathered tan, moist, very gravelly SAND, trace silt (Weathered Marysville Sand)
124 / 2				SP	Medium dense, gray-tan, moist, gravelly SAND, trace silt, poorly graded (Marysville Sand)
3	9	d	W = 3.3 GS	SP	
122 / 4					
5					
120 / 6	10	d	W = 2.9 GS	GW GW	Medium deanse, gray- tan, moist, very sandy GRAVEL, trace silt, well-graded (Marysville Sand) Moderate caving @ 6.0' BSG
7					
118 / 8	11	d		SP	Medium dense, gray-tan, moist, SAND, trace gravel, poorly graded (Marysville Sand)
9					
116 / 10	12	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 10-5-21

Figure: 7

Notes:

TEST PIT LOG

Test Pit No. TP-3

PROJECT: Proposed Apartment Building **PROJECT NO.:** 21-0921
LOCATION: North and West of Olympic Pl. NE and Jensen Farm Lane **DATE:** 10-5-21
EXPLORATION METHOD: Tracked Excavator **ELEVATION:** 125'
CONTRACTOR/DRILLER: Coast Construction **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
125 / 0					
	13	d		SP	Loose, dark brown, moist, slightly gravelly, silty SAND, organics, rootlets (Topsoil)
124 / 1					
	14	d		SP	Medium dense, weathered tan, moist, gravelly SAND, trace silt and cobbles (Weathered Marysville Sand)
123 / 2				SP	Medium dense, tan-gray, moist, gravelly SAND with trace cobbles, poorly graded (Marysville Sand)
122 / 3	15	d			
121 / 4					
120 / 5					
119 / 6	16	d			
118 / 7					
117 / 8	17	d	W = 7.1 GS	SP / SP	Medium dense, tan-gray, moist, SAND, trace gravel, poorly graded (Marysville Sand)
116 / 9					
115 / 10	18	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-3 was terminated at 10.0 ft below site grades on 10-5-21

Figure: 8

Notes:

TEST PIT LOG

Test Pit No. TP-4

PROJECT: Proposed Apartment Building — **PROJECT NO.:** 21-0921
LOCATION: North and West of Olympic Pl. NE and Jensen Farm Lane — **DATE:** 10-5-21
EXPLORATION METHOD: Tracked Excavator — **ELEVATION:** 125'
CONTRACTOR/DRILLER: Coast Construction — **LOGGED BY:** JR
DEPTH TO WATER TABLE: N/A **PERCHED WATER:** N/A **CAVING** N/A

ELEVATION/ DEPTH	SAMPLE & TEST DATA		USCS SYMBOL	SOIL PROFILE DESCRIPTION
125 / 0	19	d	SP	Loose, black, moist, silty SAND with trace gravel, rootlets, organics (Topsoil)
123 / 2	20	d	SP	Medium dense, weathered tan, gravelly SAND with trace silt and cobbles, poorly graded (Weathered Marysville Sand)
	21	d	SP	Medium dense, tan-gray, moist gravelly SAND with trace cobbles, poorly graded (Marysville Sand) Finer grained @ 8.0' BGS
121 / 4				
119 / 6	22	d		
117 / 8	23	d		Medium dense, tan-gray, moist, SAND, trace gravel, poorly graded (Marysville Sand)
115 / 10	24	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-4 was terminated at 10.0 ft below site grades on 10-5-21

Figure: 9

Notes:

TEST PIT LOG

Test Pit No. PIT-1

PROJECT: Proposed Apartment Building — **PROJECT NO.:** 21-0921
LOCATION: North and West of Olympic Pl. NE and Jensen Farm Lane — **DATE:** 10-5-21
EXPLORATION METHOD: Tracked Excavator — **ELEVATION:** 126'
CONTRACTOR/DRILLER: Coast Construction — **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
126 / 0				SP	Loose, black, moist, silty SAND with organics and rootlets (Topsoil)
	25	d	GT		
124 / 2				SP	Medium dense, weathered tan, moist, very gravelly SAND, trace silt, poorly graded (Marysville Sand) PIT test performed at 2.75' BGS
3	26	d	GT		
122 / 4					
5					
120 / 6	27	d	W = 7.2 GS	SP	
7					Medium dense, weathered tan, moist SAND, trace silt, poorly graded (Marysville Sand)
118 / 8	28	D			

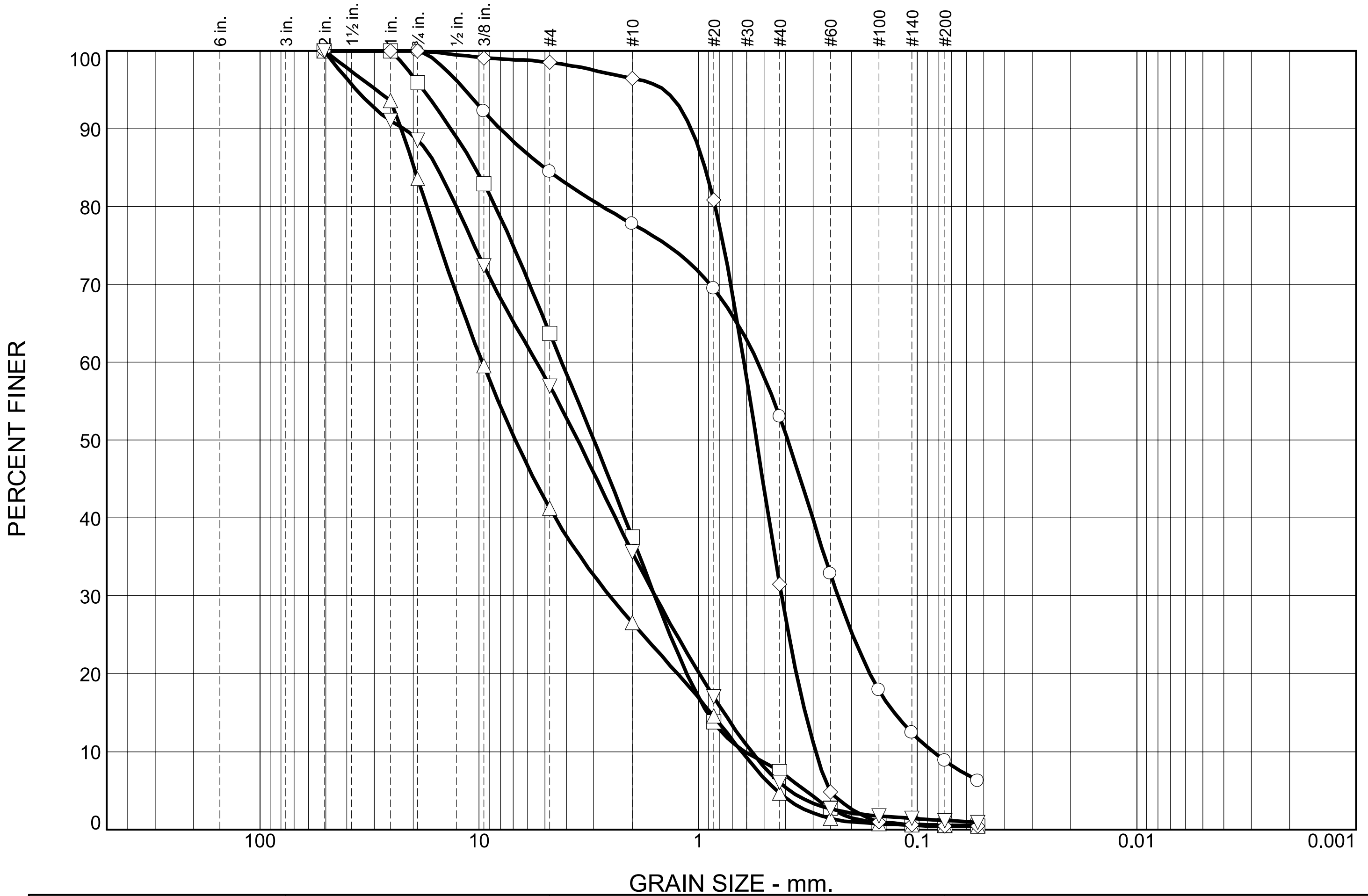
Reference Notes:
1. Stratigraphic contacts are based on field interpretations and are approximate.
2. Reference to the text of this report is necessary for a proper understanding of subsurface conditions.
3. Refer to "Soil Classification System and Key' figure for an explanation of the graphics/symbols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

Test Pit PIT-1 was terminated at 8.0 ft below site grades on 10-5-21

Notes:

Figure: 10

Grain Size Test Data



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	16	6	25	44	9	
□	0	4	32	26	31	6	1	
△	0	16	43	14	22	4	1	
◇	0	0	1	3	65	31	0	
▽	0	11	32	21	30	5	1	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	TP-1	2	1.5	Slightly silty, Gravelly SAND	SP
□	TP-2	9	3.0	Very gravelly SAND, trace silt, poorly graded	SP
△	TP-2	10	6.0	Very sandy GRAVEL, trace silt, well-graded	GW
◇	TP-3	17	8.0	SAND, trace gravel, poorly graded	SP
▽	PIT-1	27	5.5	Very gravelly SAND, trace silt, poorly graded	SP

GEOTEST
1.888.251.5276
Bellingham | Arlington | Oak Harbor
www.geotest-inc.com

Client: Coast Constrution Group

Project: Proposed Apartment Building

Project No.: 21-0921 **Figure** 11

Tested By: JAC **Checked By:** TAC/GDB

Northwest Agricultural Consultants

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PAP-Accredited

NAPT

GeoTest Services Inc.
741 Marine Drive
Bellingham, WA 98225

Report: 57071-1-1
Date: October 8, 2021
Project No: 21-0921
Project Name: Arlington Car Wash

Sample ID	pH	Organic Matter	Cation Exchange Capacity
TP-1 @ 6.0’	6.4	0.87%	3.6 meq/100g
Pit-1 @ 0.5’	5.4	10.26%	26.5 meq/100g
Pit-1 @ 3.0’	5.9	2.76%	10.7 meq/100g
Method	**SM 4500-H^+ B**	**ASTM D2974**	**EPA 9081**

REPORT LIMITATIONS AND GUIDELINES FOR ITS USE[1]

Subsurface issues may cause construction delays, cost overruns, claims, and disputes. While you cannot eliminate all such risks, you can manage them. The following information is provided to help:

Geotechnical Services are Performed for Specific Purposes, Persons, and Projects

At GeoTest our geotechnical engineers and geologists structure their services to meet specific needs of our clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of an owner, a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineer who prepared it. And no one – not even you – should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report is Based on a Unique Set of Project-Specific Factors

GeoTest's geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the clients goals, objectives, and risk management preferences; the general nature of the structure involved its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless GeoTest, who conducted the study specifically states otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

1Information in this document is based upon material developed by ASFE, Professional Firms Practicing in the Geosciences(asfe.org)

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed, for example, from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed construction,
- alterations in drainage designs; or
- composition of the design team; the passage of time; man-made alterations and construction whether on or adjacent to the site; or by natural alterations and events, such as floods, earthquakes or groundwater fluctuations; or project ownership.

Always inform GeoTest's geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. Do not rely on the findings and conclusions of this report, whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact GeoTest before applying the report to determine if it is still relevant. A minor amount of additional testing or analysis will help determine if the report remains applicable.

Most Geotechnical and Geologic Findings are Professional Opinions

Our site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoTest's engineers and geologists review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ – sometimes significantly – from those indicated in your report. Retaining GeoTest who developed this report to provide construction observation is the most effective method of managing the risks associated with anticipated or unanticipated conditions.

1Information in this document is based upon material developed by ASFE, Professional Firms Practicing in the Geosciences(asfe.org)

A Report's Recommendations are Not Final

Do not over-rely on the construction recommendations included in this report. Those recommendations are not final, because geotechnical engineers or geologists develop them principally from judgment and opinion. GeoTest's geotechnical engineers or geologists can finalize their recommendations only by observing actual subsurface conditions revealed during construction. GeoTest cannot assume responsibility or liability for the report's recommendations if our firm does not perform the construction observation.

A Geotechnical Engineering or Geologic Report may be Subject to Misinterpretation

Misinterpretation of this report by other design team members can result in costly problems. Lower that risk by having GeoTest confer with appropriate members of the design team after submitting the report. Also, we suggest retaining GeoTest to review pertinent elements of the design teams plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having GeoTest participate in pre-bid and preconstruction conferences, and by providing construction observation.

Do not Redraw the Exploration Logs

Our geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors of omissions, the logs included in this report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable; but recognizes that separating logs from the report can elevate risk.

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In that letter, consider advising the contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoTest and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

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In addition, it is recommended that a contingency for unanticipated conditions be included in your project budget and schedule.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering or geology is far less exact than other engineering disciplines. This lack of understanding can create unrealistic expectations that can lead to disappointments, claims, and disputes. To help reduce risk, GeoTest includes an explanatory limitations section in our reports. Read these provisions closely. Ask questions and we encourage our clients or their representative to contact our office if you are unclear as to how these provisions apply to your project.

Environmental Concerns Are Not Covered in this Geotechnical or Geologic Report

The equipment, techniques, and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated containments, etc. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk management guidance. Do not rely on environmental report prepared for some one else.

Obtain Professional Assistance to Deal with Biological Pollutants

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts biological pollutants from growing on indoor surfaces. Biological pollutants includes but is not limited to molds, fungi, spores, bacteria and viruses. To be effective, all such strategies should be devised for the express purpose of prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional biological pollutant prevention consultant. Because just a small amount of water or moisture can lead to the development of severe biological infestations, a number of prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of this study, the geotechnical engineer or geologist in charge of this project is not a biological pollutant prevention consultant; none of the services preformed in connection with this geotechnical engineering or geological study were designed or conducted for the purpose of preventing biological infestations.

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