Attachment H

Limited Geotechnical Engineering Report

Proposed Residences
530 38th Street
Bellingham, WA 98225

Prepared For:
Slusher Luxury Homes
512 40th Street
Bellingham, WA 98229

Attn: Mr. Trent Slusher

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March 1, 2023
Project No. 23-0024

Slusher Luxury Homes
512 40th Street
Bellingham, WA 98229

Attn: **Trent Slusher, Principal**

Regarding: **Limited Geotechnical Engineering Report**
Proposed Residences
530 38th Street
Bellingham, WA 98225
(Parcel No. 370306487445)

Dear Mr. Slusher,

As requested, GeoTest Services, Inc. (GeoTest) is pleased to submit the following report summarizing the results of our limited geotechnical engineering evaluation for the property located at 530 38th Street in Bellingham, Washington (see *Vicinity Map*, Figure 1). This report has been prepared in general accordance with the terms and conditions established in our services agreement (Proposal No. 23-118G) dated January 11, 2023.

GeoTest appreciates the opportunity to provide geotechnical services on this project and look forward to assisting you in further phases of the development and on any future projects. Should you have any 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.

State of Washington
Engineering Geologist
19110664
Licensed Geologist
3.1.2023.
HARRISON G. SIMONS

Wyatt Carstens
Geotechnical Technician

Harrison Simons, L.E.G.
Geotechnical Project Manager

Enclosure: Limited Geotechnical Engineering Report

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PURPOSE AND SCOPE OF SERVICES

The purpose of this investigation is to establish general surface and subsurface conditions beneath the site from which conclusions and recommendations pertaining to project design can be formulated. Our study includes a review of the potential geologic hazards that are present on, or adjacent to, the property. In addition, we have evaluated the feasibility of stormwater infiltration at the project site. Our scope of services includes the following tasks:

- Perform surface reconnaissance of the parcel and sloping terrain within its vicinity.
- Explore soil and groundwater conditions underlying the subject area by advancing 5 test pit explorations with a subcontracted tracked excavator.
- Perform laboratory testing on representative samples to classify and determine the engineering characteristics of the soils encountered.
- Provide a written report containing a description of surface and subsurface conditions, exploration logs, with findings and recommendations pertaining to the feasibility of on-site stormwater infiltration based on the 2019 Stormwater Management Manual for Western Washington.
- Discussion of geologic hazards and recommended mitigations, as needed, in compliance with Bellingham Municipal Code (BMC).

PROJECT DESCRIPTION

The subject area consists of a rectangularly-shaped, roughly 0.72-acre parcel located within a mid-slope setting to the west of 38th Street in Bellingham, Washington. The parcel currently contains a single-family residence and associated driveway within its central portion.

We understand that the existing residence and driveway will be demolished and that the existing parcel will be divided into two new lots of roughly 0.31 and 0.41 acres in size. Based on an architectural plan set provided by our client, site improvement is expected to include the construction of a new, roughly 2,000 square foot single-family residence and associated utilities within the northern lot. Further, an approximately 2,400 square foot single-family residence and associated utilities will be constructed within the southern lot. The residences would be accessed by driveways that will extend west from 38th Street. Although structural plans were not available for our review at the time this report was written, we anticipate that the structures will utilize conventional concrete foundations, wood framing and slab on grade style floor construction. Thus, structural loading conditions are expected to be light in scale.

Following a review of *City of Bellingham CityIQ* mapping, the site appears to contain slopes in its northern portion which exceed 30 to 40 percent slope inclinations. Therefore, these areas may be considered potential geologic hazard areas per Bellingham Municipal Code.

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 investigations. 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. A GeoTest Geotechnical Technician performed field work on January 27, 2023.

Surface Conditions

The subject property is located within a gently, to moderately sloping, mid-slope setting on the west side of 38th Street in the southeastern portion of Bellingham, Washington. The site is bordered by sparsely spaced single-family residences in all directions. An existing single-family residence is located at the central portion of the site. The southern half of the site is generally a vegetated with landscaped grasses, while the northern half generally contains overgrown black berry and other low-lying bushes. Adolescent to mature deciduous trees were observed to be scattered across the entire parcel. Mature trees were observed to be vertically oriented.

Image 1 (left) and Image 2 (right) – General surface conditions of the subject property. Image 1 is TP-2 in-progress facing southwest. Image 2 showing the slope area at the northern edge. Perspective is from the northeast corner facing southwest. Photos taken January 27th, 2023.

Overall, the parcel contains gentle topography which slopes down towards the northwest and extends from roughly 356 feet above sea level (ASL) within its southeastern corner to roughly 330 feet ASL within its northwestern corner. This change in elevation results in roughly 26 feet of vertical relief across its lateral extent. Within the southeastern portion of the site, relatively

gradual slopes of less than 30 percent gradient extend down towards the north and west from the elevation of 38th Street. Within the northwestern most portion of the site, slope gradients do increase over roughly 10 to 13 feet of relief. However, these slopes only briefly exceed 40 percent slope inclinations over roughly 8 feet of total vertical relief, with the remaining relief associated with lesser slope inclinations. Mildly sloping terrain, and minor evidence of past site grading, with approximately 4 feet of vertical relief was observed west of the existing structure.

Vegetation across the parcel generally consisted of grasses, low-lying brush, and adolescent to mature deciduous trees. The trees observed within the parcel exhibited vertical growth positions. No springs or groundwater seepage were observed at the project site. GeoTest did not observe evidence of insipient slope instability, or significant ongoing erosion at the time of our site visit.

Subsurface Soil Conditions

Subsurface conditions were investigated by advancing five test pit explorations (TP-1 through TP-5) with a subcontracted excavator and operator under the direction of a GeoTest Geotechnical Technician on January 27, 2023. The explorations were advanced to depths ranging from 8.5 to 9.5 feet below ground surface (BGS). Soil classification followed the guidelines of the American Society for Testing and Materials (ASTM) D2487 and D2488. Approximate locations of the test pit explorations have been plotted on the *Site and Exploration Plan* (Figure 2). A *Soil Classification System and Key* is presented as Figure 4. Detailed test pit logs of the subsurface conditions encountered at exploration locations are attached as Appendix A. Laboratory testing data is attached as Appendix B.

Image 3 (left) and Image 4 (right) – General subsurface conditions observed at the subject property. Image 3 shows subsurface conditions in TP-4. Note previously placed fill soils and debris atop native soils at depth in TP-5. Photos taken January 27th, 2023.

Our subsurface explorations displayed somewhat variable subsurface conditions across the site. Within TP-3, TP-4, and TP-5, GeoTest observed uncontrolled fill materials which extended from the surface to depths of between 1.0 and 3.5 feet BGS. These materials were variable but were generally described as loose to medium dense, brown to tan, damp, silty sand that contained various amounts of organic and anthropogenic debris. Within TP-1 and TP-2, between 0.5 and 0.75 feet of loose, dark brown, damp, silty sand that contained organics, and was interpreted as topsoil, was observed to extend to depth from the surface.

Below the uncontrolled fill and topsoil materials, explorations contacted native materials which were widely variable in terms of gradation across the project site. In general, these materials were described as loose to dense or soft to very stiff, tan to gray, slightly silty sands, very silty sand, sandy silt and stiff clay. These materials were interpreted as weathered, trending to unweathered undifferentiated glacial drift deposits. In general, the native undifferentiated glacial drift deposits generally contained less silt and clay within explorations TP-1 and TP-2 when compared to TP-3 through TP-5. Overall, the native materials were observed to increase in density / consistency with depth in all exploration locations. Perched groundwater seepage was encountered within explorations TP-1, TP-2 and TP-4 between 3.3 and 7.0 feet BGS.

All explorations were terminated at the referenced depths due to exploration cave-in or once planned depths were attained.

General Geologic Conditions

According to the *Geologic Map of the Bellingham 1:100,000 Quadrangle, Washington* (Lapen, 2000) general geologic conditions at the project site are mapped as undifferentiated glacial deposits (unit Qgd). According to Lapen, this unit may include any and all glacial deposits mapped within the project vicinity, such as glacial outwash, marine deltaic outwash, glacial till, marine outwash, glaciomarine drift and/or emergence (beach) deposits.

According to the same map, the Chuckanut Formation is located approximately 0.5 miles to the west of the project site. Lapen describes this unit (Ec_{cp}) as the Padden Member of the Chuckanut Formation. The Chuckanut Formation contains six members which consist of arkosic sandstone, siltstone, conglomerate, and coal which were deposited during the Eocene and possibly Late Paleocene to Early Oligocene. Specifically, Lapen describes the Padden Member as moderately to well sorted sandstone and conglomerate alternating with mud stone and minor coal. The sandstone ranges from fine to coarse grained, with pebbly to conglomeratic sandstone layers common. Planar cross-bedding, flat-bedding, trough cross-bedding and ripple lamination are common bedding features. Color is light olive-gray to pale yellowish brown. Thickness is possibly more than 3,000 meters.

Our field observations appear to support the mapped undifferentiated glacial drift deposits. It should be noted that the published soil types are representative of regional conditions and some variation between on-site soils and mapped geologic units should generally be anticipated.

Based on our review of the Washington State Department of Natural Resources (DNR) *Geologic Information Portal,* there are no active tectonic faults or landslides mapped within the vicinity of the project site.

Groundwater

Slow perched groundwater seepage was observed within explorations TP-1, TP-2, and TP-4 at depths of 3.3, 4.6, and 7.0 feet BGS respectively. Moreover, near surface, weathered undifferentiated glacial deposits were commonly observed to be mottled within the various exploration locations (Appendix A).

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 or bedrock. The vertical movement of water through loose soil is restricted once a dense or less permeable soil or bedrock is encountered. Perched groundwater conditions typically develop in the wet season (October through April) or after extended periods of rainfall. The occurrence of perched water within the subsurface is often discontinuous.

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 (NRCS) *Web Soil Survey* website, soils within the subject area are classified as Squalicum gravelly loam, 5 to 15 percent slopes at the northern half and Squalicum-Urban land complex, 5 to 20 percent slopes at the southern half. Table 1, below, summarizes the soil properties that were obtained from the USDA *Web Soil Survey* website.

The Squalicum gravelly loam soils consist of gravelly, ashy loam derived from a parent material of volcanic ash, loess, and slope alluvium over glacial drift. The Squalicum-Urban land complex consists of gravelly ashy loam derived from a parent material of volcanic ash, loess, and slope alluvium over glacial drift. These soils are generally moderately well drained and are rated as having a **moderate** erosion susceptibility with an erosion K factor of 0.24. 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.

Native soils at the project site appeared to be generally consistent with the *Web Soil Survey* description. Further discussion is provided in the *Erosion Hazard Areas* section of this report.

Table 1 USDA Web Soil Survey Soil Classifications		
Map Unit Symbol	156	159
Map Unit Name	Squalicum gravelly loam, 5 to 15 percent slopes	Squalicum-Urban land complex, 5 to 20 percent slopes
Soil Description	Gravelly ashy loam	Gravelly ashy loam
Landform	Hillslopes	Hillslopes
Parent Material	Volcanic ash, loess, and slope alluvium over glacial drift	Volcanic ash, loess, and slope alluvium over glacial drift
Land Capability Classification	3e	3e
Erosion K Factor, Whole Soil	0.24	0.24

Bare Earth Imagery Review

GeoTest reviewed bare earth imagery acquired in 2013 of the subject property, and the associated landforms. Based on our review, the site itself displays relatively planar, gently to moderately steep topography with only one limited area which exceed 40 percent inclinations within its northwestern mostportion. Frequent evidence of past grading in the form of roadways, terraces, and cuts, can be seen in the site vicinity. However, no evidence of instability, such as tension cracks, head scarps, or significant downslope accumulations of materials were noted on or adjacent to the project site. (*Bare Earth Site Plan*, Figure 3). Outside of the general topographic profile of the slopes, no signs of large scale "global" instability on subject property were observed in our bare earth imagery review.

Please note that not all signs of slope instability can be observed in the bare earth imagery review due to imagery resolution and scale. In addition, any signs of instability on the site slopes that have occurred within the last 10 years, if present, have occurred after original imagery acquisition. Bare earth imagery was obtained through the DNR *LIDAR Portal* website.

GEOLOGICALLY HAZARDOUS AREAS

According to BMC section 16.55.410, *geologically hazardous areas include areas susceptible to erosion, landslide, rock fall, subsidence, earthquake, or other geological events that pose a threat to the health and safety of citizens when incompatible development is sited in areas of significant hazard*. In this section we present a review of the site and proposed development in accordance with the City of Bellingham Critical Areas Ordinance 16.55.410-16.55.460, specifically as relating to geologic hazards.

Erosion Hazard Areas - BMC 16.55.420A

Bellingham Municipal Code (BMC) 16.55.420A defines Erosion Hazard Areas as, *areas prone to soil erosion. Specifically, these areas include any area where the soil type is predominantly (greater that 50 percent) comprised of sand, clay, silt, and/or organic matter and the slope is greater than 30 percent.*

The soils underlying the project site are composed of greater than 50 percent sand and silt. Additionally, limited areas of the site exceed 30 percent grades within the northwestern most portion of the project site (See Figure 3 – *Bare Earth Imagery*). **Therefore, this portion of project site is considered to contain Erosion Hazard Areas per Bellingham Municipal Code.** Residential construction is required to meet the standards outlined in 16.55.440A. Thus, the development will require an erosion and sediment control, drainage, and mitigation plan prepared in compliance with BMC 15.42. In our opinion, the erosion potential at the project site can be managed with appropriate construction practices.

Long term slope erosion must be mitigated through proper drainage and civil design. Stormwater volumes generated from proposed impermeable surfaces should be collected and directed to a municipally acceptable location. The following recommendations are intended to prevent excessive erosion from occurring at the site during and following construction:

- All clearing and grading activities for future residence construction will need to incorporate Best Management Practices (BMP's) for erosion control in compliance with current Bellingham Municipal Codes and standards.

- We recommend that appropriate silt fencing be incorporated into the construction plan for erosion control.

- We recommend that on-site BMP's be implemented during construction. Areas of native vegetation should be left in place or may 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 native vegetation within the sloped portion of the subject site and in areas disturbed by excavation activities will help maintain near surface slope stability by providing a stable root base within the near surface soils.

- 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 the sloped portions of the subject area. All collected stormwater should be directed to an engineered collection system.

- All areas disturbed by the 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 stabilizations should be seeded with an approved grass seed mixture, hydroseeded with an approved seed-mulch-fertilizer mixture or landscaped with a suitable planting design.

It should also be noted that the proposed development will be subject to the City of Bellingham Stormwater Mitigation Minimum Requirements that are set forth in BMC section 15.42.060F. Depending on the final surface area that will be disturbed as a result of site development, various requirements (#1 through #9) may be required by the City of Bellingham, prior to project permitting.

Landslide Hazard Areas - BMC 16.55.420B

BMC 16.55.420B broadly defines Landslide Hazard Areas as, *[areas] prone to landslides and/or subsidence that could include slow to rapid movement of soil, fill materials, rock and other geologic strata resulting in risk of injury or damage to the public and environment. Landslides could result from any combination of soil, slope, topography, underlying geologic structure, hydrology, freeze-thaw, earthquake, and other geologic influences. Specific geologic hazards include slopes with an incline that is equal or greater than 40 percent grade (22 degrees) with a vertical elevation change of at least 10 feet. Slope shall be calculated by identifying slopes that have at least 10 feet of vertical elevation change within a horizontal distance of 25 feet or less.*

Based on our review of digital elevation models, topographic drawings, and our on-site observations, **the project site does not contain Landslide Hazard Areas as defined by Bellingham Municipal Code** (See Figure 3 – *Bare Earth Imagery*).

Large scale global instability, consisting of deep-seated rotational failures, can extend down into the subsurface to substantial depths. These failures typically leave geomorphic evidence of their existence on the slope. Typical indicators can consist of recessional and sometimes nested head scarps, tension cracks, sag pongs, seepage zones, hummocky ground surface and slump blocks. Visual indications of large-scale global slope instability, such as those referenced above, were not observed at the subject property. In addition, Chuckanut Formation bedrock is known to exist in the shallow subsurface in the vicinity of the proposed development which would reduce the potential for deep-seated failures.

It is our opinion that there is a relatively **low risk** of relatively shallow, “skin-slides” occurring and impacting the proposed residence location tover the life of the structure. Similarly, it is also our professional opinion that there is a generally **low risk** of large-scale rotational, or translational

landslides occurring and impacting the planned development site under static conditions over the life the proposed improvements.

Please keep in mind that the Pacific Northwest is seismically active, and it is difficult to predict how the slopes at the property may behave during a large earthquake.

Seismic Hazard Areas - BMC 16.55.420C

Bellingham Municipal Code defines Seismic Hazard Areas as, *areas subject to severe risk of damage as a result of earthquake induced ground shaking, slope failure, settlement, soil liquefaction, lateral spreading, or surface faulting. Specific areas of very high response to seismic shaking include areas depicted as "fill" and "alluvial deposits" within Whatcom County's Map Folio of Geologic Hazards, 1995.*

The subject site is mapped as a "very low to low" liquefaction susceptibility area (Palmer et al., 2004). However, this map only provides an estimate of the likelihood that soil will liquefy as a result of an earthquake and is meant as a general guide to indicate areas potentially susceptible to liquefaction. The shallow depth to commonly fine grained soils and lack of regional near surface groundwater table at the subject property support the mapped susceptibility rating. Therefore, the subject **site is not considered a seismic hazard area per BMC**.

However, the proposed development is located within the Seismic Design Category D_1, which states that site slopes may be unstable during a seismic event. As such, we recommend that the design team utilize seismic design standards per the International Building Code (IBC) such that the planned structure, including nonstructural components that are permanently attached to building's supports, be designed to resist the effects of earthquake motions. However, GeoTest does not expect that further mitigations will be required to address this potential hazard.

Please keep in mind that the Pacific Northwest is seismically active. Large Cascadia subduction zone earthquakes with possible magnitudes of 8 or 9 could produce ground shaking events with the potential to significantly impact the subject property regardless of the subsurface. Cascadia subduction zone earthquakes have occurred 6 times in the last 3,500 years with the most recent taking place in 1700, approximately 320 years ago. They have been determined to have an average reoccurrence interval of approximately 300 to 700 years. (Atwater and Haley, 1997).

Mine Hazard Areas - BMC 16.55.420D

The BMC defines Mine Hazard Areas as *those areas underlain by or affected by mine workings such as adits, gangways, tunnels, drifts, or airshafts, and those areas of probable sink holes, gas releases, or subsidence due to mine workings.*

Based on Bellingham Geologic Hazards Map (1991), the project site is **not** located within the near vicinity of any mine areas, and therefore does not meet the criteria of a Mine Hazard Area as defined by BMC 16.55.420D. As such, no mitigations for this specific hazard are required.

CONCLUSIONS AND RECOMMENDATIONS

Based on the evaluation of data collected during this investigation, and assuming conventional best management practices are implemented during construction, it is our opinion that the subsurface conditions at the site are suitable for the proposed development.

Medium dense native soils are present at shallow depths in the vicinity of the development area and can provide adequate support for the proposed structures and roadways. In our opinion, the residences, will be sited within a suitable portion of the project site from a mitigation sequencing standpoint.

A portion of this report constitutes a stormwater infiltration feasibility evaluation. Based on the conditions encountered within our subsurface explorations, the project site does not appear to be suitable for the conventional infiltration of stormwater. With adequate engineering and/or proper stormwater design based on the current *Stormwater Management Manual for Western Washington* (SMMWW), GeoTest does not anticipate that the proposed improvements will negatively impact the subject property or adjacent parcels.

The project site is known to contain potential erosion hazards as described by Bellingham Municipal Code. Assuming that the recommendations presented in this report are implemented into the plan for development, it is our opinion that these hazards will be adequately mitigated in conformance with BMC 16.55.450(A).

Mitigation of Geologic Hazards

Based upon an evaluation of the data collected during this investigation, it is our opinion that the construction of the proposed single-family residence on the subject property, as discussed, is feasible and will be adequately mitigated with respect to the following requirements per BMC 16.55.450(A). We understand that site generated stormwater will be addressed via engineered design which will collect site generated stormwater and direct it to the municipal stormwater system in 38th Street. As such, it is our opinion that the proposed development:

- Will not increase the threat of the geological hazard to adjacent properties beyond predevelopment conditions.
- Will not adversely impact other critical areas.
- Is designed so that the hazard to the project is eliminated or mitigated to a level equal to or less than predevelopment conditions; and
- We anticipate the site to be safe as designed under static conditions and normal use.

Furthermore, per BMC 16.55.460(A.2) it is our opinion that the proposed development:

- Will not increase surface water discharge or sedimentation to adjacent properties beyond predevelopment conditions.
- Will not decrease slope stability on adjacent properties; and
- Such alterations will not adversely impact other geologically hazardous areas.

In consideration of 16.55.460 (4 and 5), GeoTest does not anticipate that removal of the vegetation or the placement of the planned building footings will have a negative impact on the slopes. However, in order to prevent excessive erosion from occurring, we recommend that development plans retain as much native vegetation as possible and revegetate site slopes as feasible.

We recommend that the design team utilize seismic design standards per the IBC such that the planned structure, including nonstructural components that are permanently attached to the building's supports, be designed to resist the effects of earthquake motions.

It should be noted that no amount of engineering can completely mitigate or prevent slope instability. Mitigation is intended to make the risk posed by the slope that is present on site less and it should not be interpreted that mitigation is representative of eliminating any and all risk that might be present on the site. It is assumed that the property owner is aware of the slope that is present on the site and that she/he has been adequately informed and is accepting of the risks associated with sloped property development.

Stormwater Infiltration Potential

The near surface native materials and uncontrolled fills materials underlying the subject site commonly contained between 30 and 60 percent fines by mass. These materials were variable in terms of thickness and gradation. In addition, in the locations where relatively granular native materials were encountered within the shallow subsurface, perched groundwater and mottling was also observed. The presence of the highly variable, and often fine-grained native materials, and/or near surface perched groundwater, in our opinion, supports the presence of a "restrictive layer", as defined by the 2019 Stormwater Management Manual for Western Washington. Maintaining a minimum separation from the base of traditional stormwater infiltration systems to these restrictive layers does not appear feasible. Thus, it is our opinion that the site is not suitable for conventional stormwater infiltration.

Stormwater Considerations

With adequate engineering and/or proper stormwater design based on the current Stormwater Manual, GeoTest does not anticipate that the proposed improvements will negatively impact the steep slopes any more than the existing site conditions do.

The stormwater collection system should be considered a routine maintenance item and should be regularly checked for proper working order. Typically, the stormwater system is checked at least twice a year and after any major storm event.

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 proposed building. 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 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 building 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 laboratory.

USE OF THIS REPORT

GeoTest Services, Inc. has prepared this report for the exclusive use of Slusher Luxury Homes and their design consultants for specific application to the design of the proposed residence at 530 38th Street in Bellingham, Washington. 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 and conclusions 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 future construction that differ from those contained within this report, GeoTest should be allowed to review our 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 contained herein.

The future prospective earthwork contractor is responsible for performing 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	Bare Earth Imagery
Figure 4	Soil Classification System and Key
Appendix A	Test Pit Logs
Appendix B	Laboratory Test Results
Attachment	Report Limitations and Guidelines for Its Use (4 Pages)

REFERENCES

American Society for Testing and Materials (ASTM). *Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).* ASTM D2487 – 17e1.

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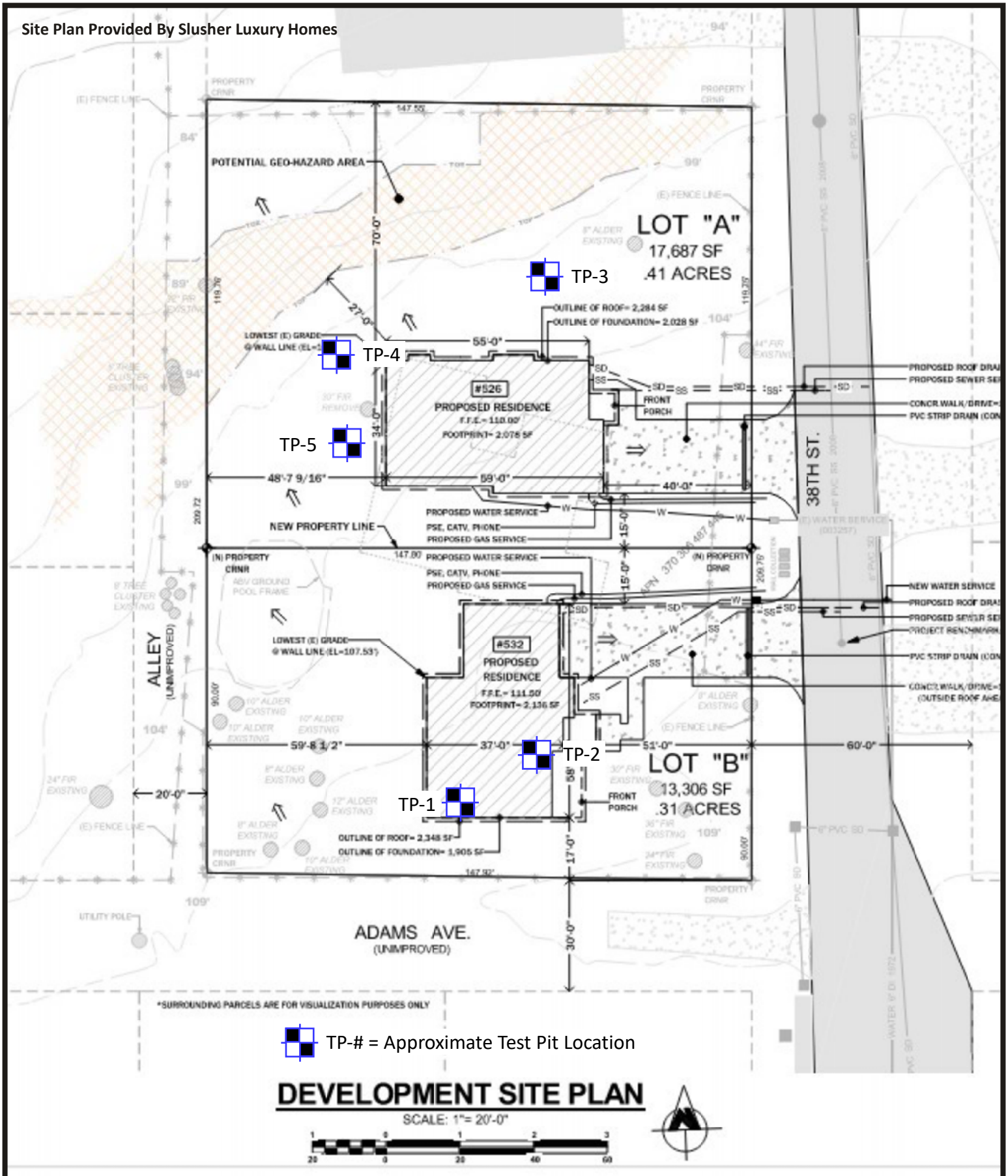
Date: 2-27-23	By: WC	Scale: As Shown	Project 23-0024

VICINITY MAP
38TH STREET RESIDENCES
530 38TH STREET
BELLINGHAM, WA

Figure 1

Site Plan Provided By Slusher Luxury Homes



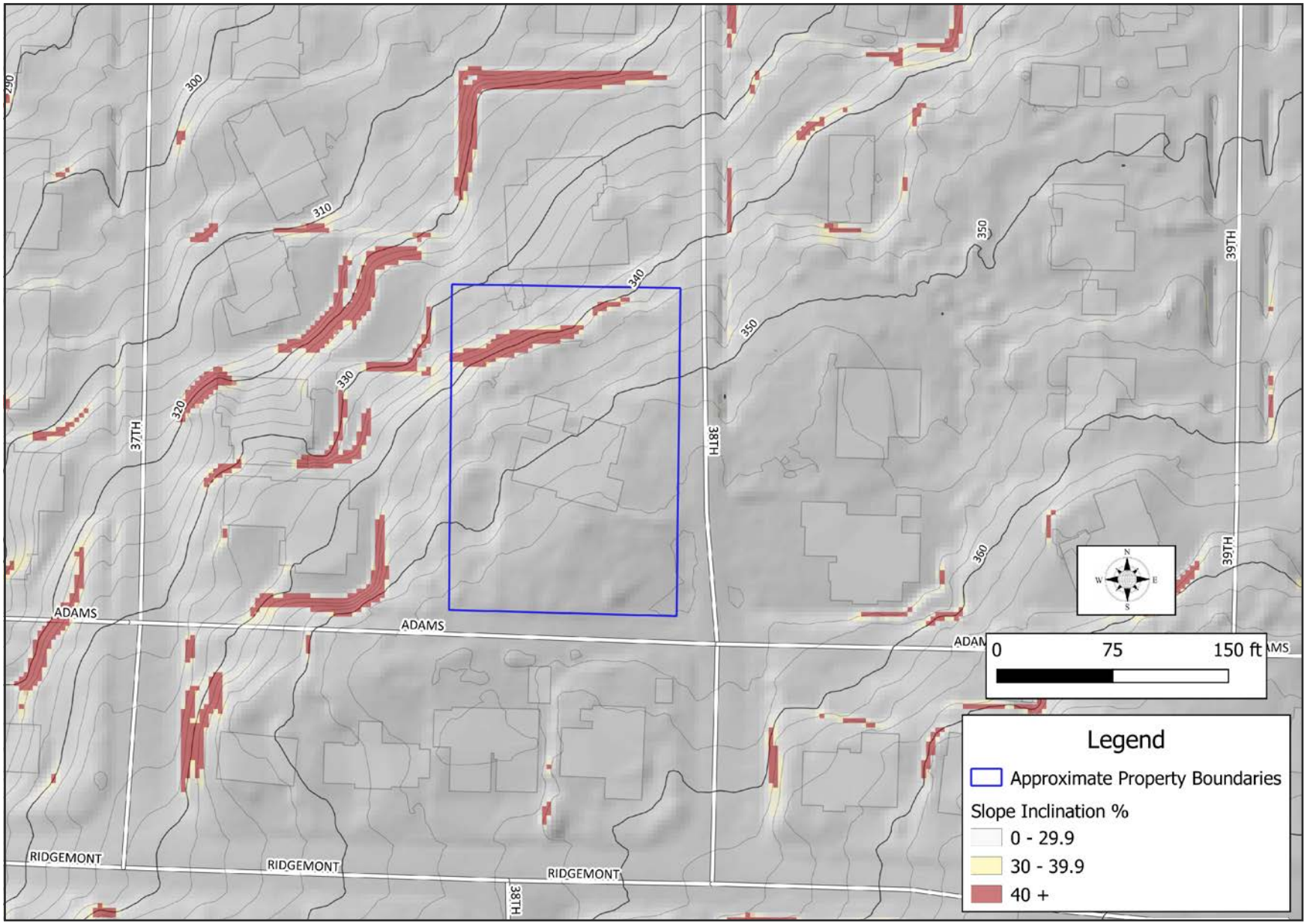
DEVELOPMENT SITE PLAN

SCALE: 1"= 20'-0"

Date: 2-27-23	By: WC	Scale: As Shown	Project 23-0024

SITE AND EXPLORATION PLAN
38TH STREET RESIDENCES
530 38TH STREET
BELLINGHAM, WA

Figure 2



DATA SOURCE(S):			
PARCELS : PUBLIC GIS DATA ELEVATION, SLOPE, AND HILLSHADE: DERIVED FROM BELLINGHAM_2013 LIDAR SURVEY	Date: 2-27-23	By: HS	Scale: As Shown

GEOTEST

BARE EARTH IMAGE PLAN

38TH STREET RESIDENCES

530 38TH STREET

BELLINGHAM, WASHINGTON

Project **23-0024**

Figure **3**

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

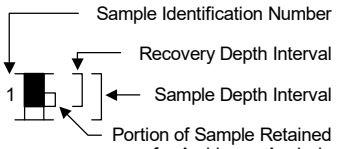
Notes: 1. Soil descriptions are based on the general approach presented in the *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, as outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the *Standard Test 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 Residences
530 38th St
Bellingham, WA

Soil Classification System and Key

Figure 4

Appendix A:

Exploration Logs

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TP-1

SAMPLE DATA				SOIL PROFILE			NOTES/GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): ~355 Excavated By: Fountain Construction / WC	
0	1	d	W = 30		SM	Loose, dark brown, damp, silty SAND with organics (Topsoil)	
					SM	Loose to medium dense, burnt orange to brown, damp, gravelly, silty SAND (Weathered Undifferentiated Glacial Deposits) - Density estimated with #4 rebar	
	2	d	W = 14 GS				
2					SP	Medium dense, light brown to burnt orange, damp, SAND with trace silt and gravel (Weathered Undifferentiated Glacial Deposits)	
	3	d	W = 10 GS			- Density estimated with #4 rebar	
			PP=0.5 TSF		ML	Soft, gray to tan, wet, sandy SILT with ocassional mottling (Weathered Undifferentiated Glacial Deposits)	Slight groundwater seepage encountered at 3.3 ft.
					SM	Medium dense, gray to brown, moist, silty SAND with trace gravel (Undifferentiated Glacial Deposits)	
4						- Density estimated with #4 rebar	
	4	d	W = 17 GS			Increase in coarse-grained sand and moisture observed at 5 feet BGS	
6							
	5	d				Transitions to wet, decrease in silt observed at 7.2 feet BGS	Moderate groundwater seepage encountered at 7.2 ft.
8							
	Test Pit Completed 01/27/23 Total Depth of Test Pit = 8.5 ft.					Test pit terminated at 8.5 due to caving and groundwater	
10							
12							

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 explanation of graphics and symbols.

GEOTEST

Proposed Residences
530 38th St
Bellingham, WA

Log of Test Pit

Figure
A-1

TP-2

SAMPLE DATA			SOIL PROFILE			NOTES/GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): ~355 Excavated By: Fountain Construction / WC	
0	6	d	W = 33		SM	Loose, dark brown, damp, silty SAND with organics (Topsoil)	
	7	d	W = 23		SM	Loose to medium dense, burnt orange, damp, very silty SAND with trace gravel (Weathered Undifferentiated Glacial Deposits) - Density estimated with #4 rebar	
2	8	d	W = 14 GS		SP	Medium dense, brown to burnt orange, damp, slightly gravelly SAND (Weathered Undifferentiated Glacial Deposits) - Density estimated with #4 rebar	
4	9	d	W = 22 GS		SM	Medium dense, tan to gray, damp, very silty, slightly gravelly SAND with trace mottling (Weathered Undifferentiated Glacial Deposits) - Density estimated with #4 rebar	Slight groundwater seepage encountered at 4.6 ft.
6	10	d	W = 21 GS		SM	Medium dense, brown, moist, very silty SAND with trace gravel (Undifferentiated Glacial Deposits) Transitions to gray, trace gravel observed at 6 feet BGS Variable silt content observed in unit	
8	11	d				Increase in silt content observed at 8.5 feet BGS Transitions to dense at 9 feet BGS	
	12	d					
10	Test Pit Completed 01/27/23 Total Depth of Test Pit = 9.8 ft.					Test pit terminated at planned depth	
12							

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 explanation of graphics and symbols.

GEOTEST

Proposed Residences
530 38th St
Bellingham, WA

Log of Test Pit

Figure
A-2

TP-3

SAMPLE DATA			SOIL PROFILE			NOTES/GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): ~350 Excavated By: Fountain Construction / WC	
0	13	d			SM	Medium dense, gray to black, damp, gravelly, silty SAND (Uncontrolled Fill)	Groundwater not encountered.
					SM	Decommissioned water line observed at 0.8 feet BGS Medium dense to dense, light brown, damp to moist, very silty SAND with trace gravel (Weathered Undifferentiated Glacial Deposits) - Density estimated with #4 rebar	
2	14	d					
	15	d	W = 28 GS PP=0.5 TSF		ML	Soft, burnt orange, moist, very sandy, slightly gravelly SILT (Weathered Undifferentiated Glacial Deposits)	
4	16	d			SM	Medium dense, tan to gray, moist, very silty SAND with trace gravel and mottling (Weathered Undifferentiated Glacial Deposits) - Density estimated with #4 rebar	
6	17	d	W = 15 GS PP=2-4TSF		ML	Stiff to very stiff, dark gray to blue, damp to moist, very sandy, slightly gravelly SILT, blocky texture (Undifferentiated Glacial Deposits)	
8	18	d					
	19	d			CL	Stiff, dark gray to blue, moist, CLAY with trace sand and gravel, moderate plasticity observed (Undifferentiated Glacial Deposits)	
10						Test pit terminated at planned depth	
	Test Pit Completed 01/27/23 Total Depth of Test Pit = 9.8 ft.						
12							

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 explanation of graphics and symbols.

GEOTEST

Proposed Residences
530 38th St
Bellingham, WA

Log of Test Pit

Figure
A-3

TP-4

SAMPLE DATA			SOIL PROFILE			NOTES/GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): ~350 Excavated By: Fountain Construction / WC	
0					DB	Loose to dense, dark brown, damp, silty SAND with organics, concrete ruble, and anthropogenic debris (Uncontrolled Fill) - Density estimated with #4 rebar	
	20	d					
2						Decommissioned utilities observed at 2 feet BGS	
					SM	Medium dense, tan to gray, damp, very silty SAND with trace gravel and mottling (Weathered Undifferentiated Glacial Deposits) - Density estimated with #4 rebar	
	21	d	W = 18 GS				
4							
			PP= 0.5 TSF		ML	Soft to medium stiff, burnt orange, moist to wet, SILT with trace sand and gravel (Weathered Undifferentiated Glacial Deposits)	
6	22	d					
					ML	Stiff to very stiff, tan to gray, damp to moist, very sandy, slightly gravelly SILT, blocky texture (Undifferentiated Glacial Deposits)	Slight groundwater seepage encountered at 7.0 ft.
	23	d	W = 20 GS				
8						Transitions to gray, increase in silt content observed at 8 feet BGS	
	24	d				Transitions to very stiff to hard, light gray, very blocky texture observed at 8.5 feet BGS	
						Test pit terminated at planned depth	
10	Test Pit Completed 01/27/23 Total Depth of Test Pit = 9.5 ft.						
12							

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 explanation of graphics and symbols.

GEOTEST

Proposed Residences
530 38th St
Bellingham, WA

Log of Test Pit

Figure
A-4

TP-5

SAMPLE DATA			SOIL PROFILE			NOTES/GROUNDWATER
Depth (ft)	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: Tracked Excavator Ground Elevation (ft): ~350 Excavated By: Fountain Construction / WC	
0					DB	Medium dense to dense, brown to burnt orange, damp, silty SAND with metal, bricks, and concrete debris (Uncontrolled Fill) - Density estimated with #4 rebar	Groundwater not encountered.
2							
4	25	d	W = 16 GS		SM	Dense, tan to gray, damp, very silty SAND with trace gravel and mottling (Undifferentiated Glacial Deposits) - Density estimated with #4 rebar	
6						Slight blocky texture, decrease in mottling at 6 feet BGS	
	26	d					
8						Transitions to very dense and blocky at 8 feet BGS	
	27	d					
						Test pit terminated at planned depth	
10	Test Pit Completed 01/27/23 Total Depth of Test Pit = 9.5 ft.						
12							

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 explanation of graphics and symbols.

GEOTEST

Proposed Residences
530 38th St
Bellingham, WA

Log of Test Pit

Figure
A-5

Appendix B:

Laboratory Test Results

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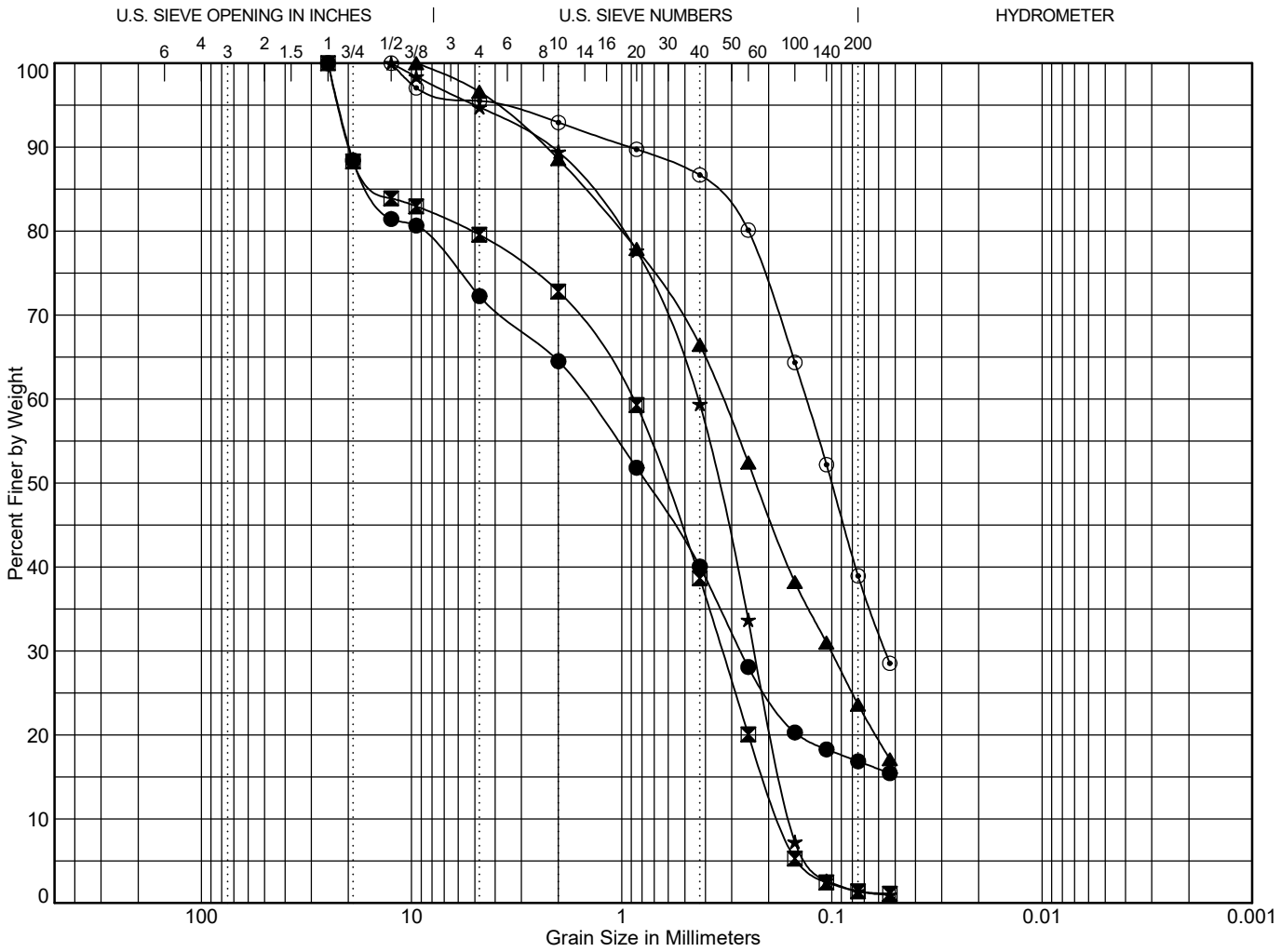


Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point		Depth	Classification	LL	PL	PI	C_c	C_u
●	TP-1	1.2	Gravelly, silty SAND (SM)					
⊠	TP-1	2.3	Gravelly SAND (SP)				0.70	5.04
▲	TP-1	4.6	Silty SAND with trace gravel (SM)					
★	TP-2	2.6	Slightly gravelly SAND (SP)				0.79	2.75
⊙	TP-2	4.5	Very silty, slightly gravelly SAND (SM)					

Point		Depth	D_{90}	D_{60}	D_{50}	D_{30}	D_{10}	%Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	TP-1	1.2	19.726	1.476	0.763	0.272		11.6	16.2	7.8	24.4	23.2	16.9
⊠	TP-1	2.3	19.773	0.89	0.622	0.332	0.177	11.7	8.7	6.8	34.1	37.3	1.4
▲	TP-1	4.6	2.335	0.333	0.229	0.101		0.0	3.4	8.0	22.1	42.8	23.6
★	TP-2	2.6	2.191	0.435	0.35	0.233	0.158	0.0	5.2	5.3	30.0	58.0	1.4
⊙	TP-2	4.5	0.913	0.132	0.1	0.056		0.0	4.5	2.6	6.2	47.7	38.9

$C_c = D_{30}^2/(D_{60} * D_{10})$
$C_u = D_{60}/D_{10}$

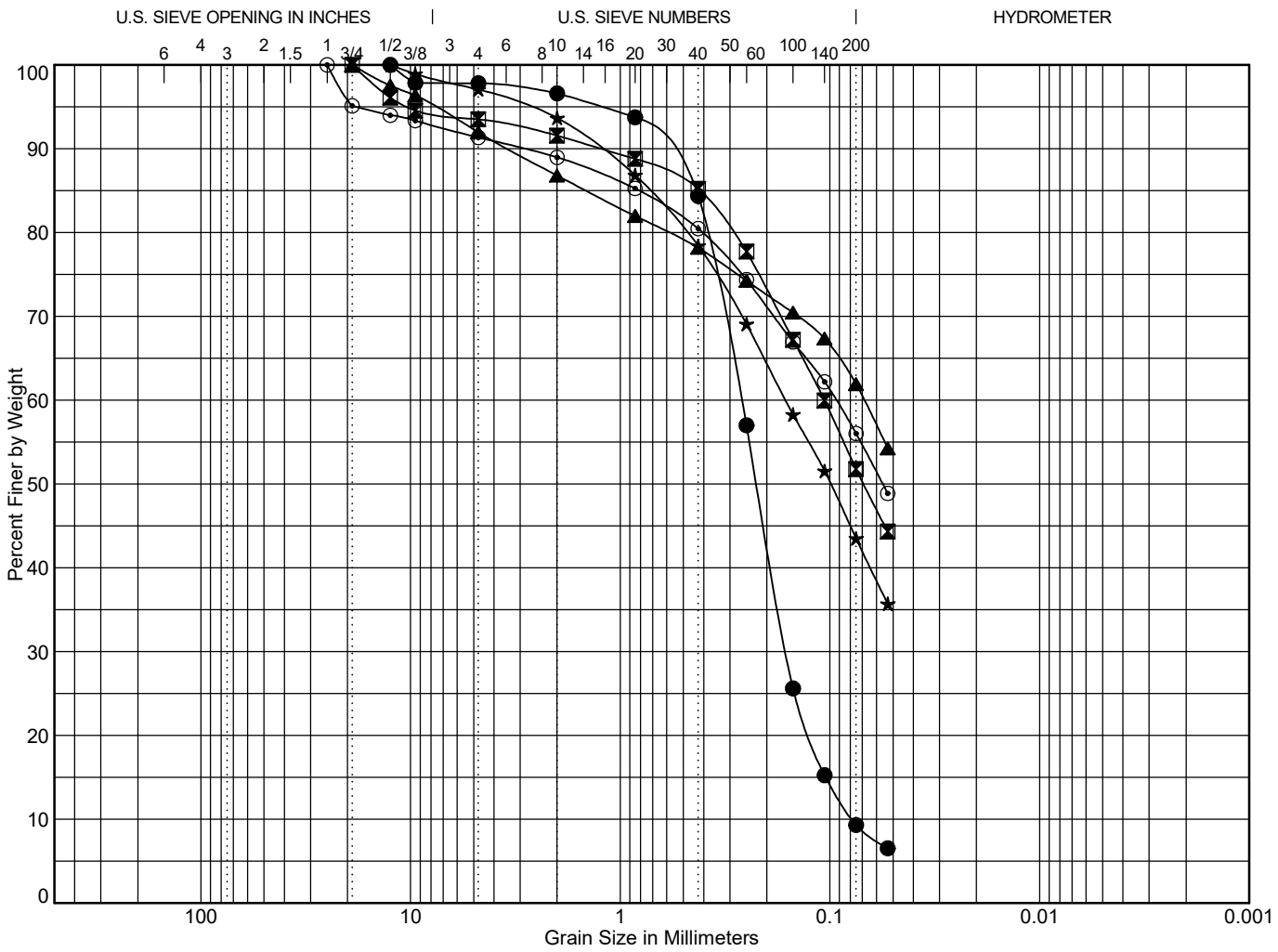
To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW

GEOTEST

Proposed Residences
530 38th St
Bellingham, WA

Grain Size Test Data

Figure
B-1



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point		Depth	Classification	LL	PL	PI	C_c	C_u
●	TP-2	5.8	Slightly silty SAND with trace gravel (SP-SM)				1.25	3.39
⊠	TP-3	2.7	Very sandy, slightly gravelly SILT (ML)					
▲	TP-3	6.0	Very sandy, slightly gravelly SILT (ML)					
★	TP-4	3.5	Very silty SAND with trace gravel (SM)					
⊙	TP-4	6.8	Very sandy, slightly gravelly SILT (ML)					

Point		Depth	D_{90}	D_{60}	D_{50}	D_{30}	D_{10}	%Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
●	TP-2	5.8	0.645	0.265	0.223	0.161	0.078	0.0	2.2	1.2	12.2	75.1	9.3
⊠	TP-3	2.7	1.236	0.106	0.069			0.0	6.5	2.0	6.3	33.4	51.8
▲	TP-3	6.0	3.427	0.069				0.0	8.1	5.1	8.6	16.3	61.9
★	TP-4	3.5	1.263	0.163	0.099			0.0	2.9	3.4	15.2	34.9	43.5
⊙	TP-4	6.8	2.912	0.094	0.056			4.9	3.8	2.4	8.5	24.4	56.0

$C_c = D_{30}^2/(D_{60} * D_{10})$

$C_u = D_{60}/D_{10}$

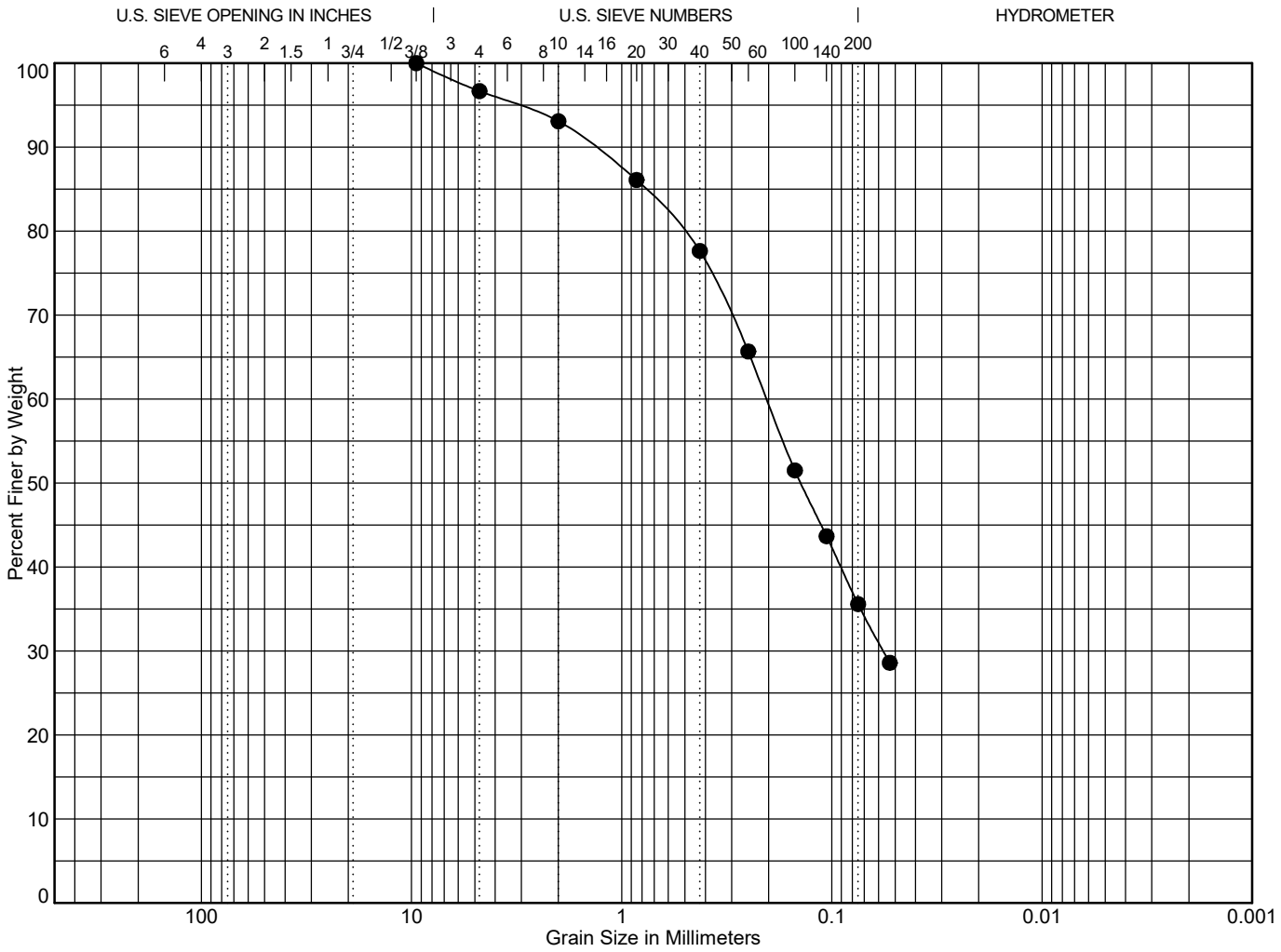
To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW

GEOTEST

Proposed Residences
530 38th St
Bellingham, WA

Grain Size Test Data

Figure
B-2



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point	Depth	Classification	LL	PL	PI	C_c	C_u
● TP-5	4.0	Very silty SAND with trace gravel (SM)					

Point	Depth	D_{90}	D_{60}	D_{50}	D_{30}	D_{10}	%Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
● TP-5	4.0	1.372	0.204	0.14	0.057		0.0	3.3	3.6	15.4	42.1	35.6

$C_c = D_{30}^2/(D_{60} * D_{10})$

$C_u = D_{60}/D_{10}$

To be well graded: $1 < C_c < 3$ and $C_u > 4$ for GW or $C_u > 6$ for SW

GEOTEST

Proposed Residences
530 38th St
Bellingham, WA

Grain Size Test Data

Figure
B-3

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.

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

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.

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