GEOTECHNICAL ENGINEERING INVESTIGATION
HILDER PEARSON ELEMENTARY SCHOOL (HPES) PORTABLE BUILDING INSTALLATION
15650 CENTRAL VALLEY ROAD NW
POULSBO, WASHINGTON

Project No. 102-20013
MAY 12, 2020

Prepared for:

ART ANDERSON
ATTN: MR. BRAD GINN, P.E.
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GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

May 12, 2020

KA Project No. 102-20013

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Reference: Geotechnical Engineering Investigation
HPES Portable Building Installation
15650 Central Valley Road NW
Poulsbo, Washington

Dear Mr. Ginn,

In accordance with your request, we have completed a Geotechnical Engineering Investigation for the referenced site. The results of our investigation are presented in the attached report.

If you have any questions, or if we can be of further assistance, please do not hesitate to contact our office.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

Vijay Chaudhary, P.E.
Project Engineer

CB:VC

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POULSBO, WASHINGTON

INTRODUCTION

This report presents the results of our Geotechnical Engineering Investigation for the HPES new portable classroom installation project located at 15650 Central Valley Road in Poulsbo, Washington as shown on the Vicinity Map in Figure 1. Discussions regarding site conditions are presented in this report, together with conclusions and recommendations pertaining to site preparation, excavations, structural fill, utility trench backfill, foundations, slope stability, pavement design, drainage, and erosion control.

A site plan showing the approximate exploratory test pit locations is presented following the text of this report in Figure 2. Appendix A includes USCS Soil Classification information, as well as a description of the field investigation, laboratory testing, and the exploratory test pit logs. Appendix B contains a guide to aid in the development of earthwork specifications. Pavement design guidelines are presented in Appendix C. The recommendations in the main text of the report have precedence over the more general specifications in the appendices.

PURPOSE AND SCOPE

This investigation was conducted to evaluate the subsurface soil and groundwater conditions at the site, to develop geotechnical engineering recommendations for use in design of specific construction elements and to provide criteria for site preparation and earthwork construction.

Our scope of services was performed in general accordance with our proposal for this project, dated March 20, 2020 (Krazan Proposal Number G20033.1WAP) and included the following:

- An exploration of the subsurface soil and groundwater conditions by conducting two (2) geotechnical borings using a subcontracted drill rig;
- Provide a site plan showing the geotechnical boring locations;
- Provide comprehensive boring logs including soil stratification and classification, and groundwater levels where applicable;

- Recommended foundation type for the proposed structure;
- Allowable foundation bearing pressure, anticipated settlements (both total and differential), coefficient of horizontal friction, passive soil pressure and frost penetration depth for foundation design;
- Recommendations for seismic design considerations including site coefficient and ground acceleration based on the 2012/2015 IBC;
- Recommendations for structural fill materials, placement, and compaction;
- Recommendations regarding the suitability of on-site soils as structural fill;
- Recommendations for temporary excavations;
- Provide slope stability analysis;
- Recommendations for site drainage and erosion control; and
- Recommendations for the pavement design.

Environmental services, such as chemical analysis of soil and groundwater for possible environmental contaminants, were not included in our scope of services for this project.

PROPOSED CONSTRUCTION

Based on our review of the project plans prepared by the Blazer Industries, Inc., dated, it is our understanding that the proposed development will include construction of a portable classroom building, which will roughly cover an area of 1,700 square feet. The plan states that the foundation has been designed with an assumed allowable soil bearing pressure of 1,500 pounds per square foot (psf). We have assumed column loads of 30,000 pounds and wall loads of 1,000 to 2,000 plf for the soil bearing capacity and settlement analyses. The development may also include construction of utilities, paved and landscape areas.

SITE CONDITIONS

The site is located directly east of Central Valley Road NW, in a sparsely populated residential area. The site can be accessed from Central Valley Road NW. The site is currently developed with the elementary school in the center of the site with a forested area along the eastern edge of the property. The site covers approximately 10.12 acres. The site is situated along the top of an eastern facing slope along the eastern edge of the site. The eastern slope has vertical relief of approximately 40 feet and is inclined at approximately 30 degrees. However, the rest of the site is relatively flat. The slope is vegetated primarily with mature trees and underbrush. We did not observe signs of shallow soil movement or soil creep, such as minor sloughing and curved tree trunks, along the slope.

The site is bordered by State Highway 308 to the north, residential properties to the east and south, and Central Valley Road NW to the west.

GEOLOGIC SETTING

The site lies within the central Puget Lowland. The lowland is part of a regional north-south trending trough that extends from southwestern British Columbia to near Eugene, Oregon. North of Olympia, Washington, this lowland is glacially carved, with a depositional and erosional history including at least four separate glacial advances/retreats. The Puget Lowland is bounded to the west by the Olympic Mountains and to the east by the Cascade Range. The lowland is filled with glacial and nonglacial sediments.

The Geologic Map of the Seabeck and Poulsbo 7.5-minute Quadrangles, Kitsap and Jefferson Counties, Washington (WA DNR, October 2013) indicates that the site vicinity is underlain by Vashon lodgment till (Qgt). The lodgment till is described as diamicton of clay, silt, sand, pebbles, cobbles, and isolated boulders; brown to gray; lightly weathered or unweathered; compact, commonly resembling concrete; unsorted; unstratified. Our explorations generally encountered undocumented fill overlying the native glacial soils.

FIELD INVESTIGATION

Two (2) exploratory soil borings were completed to evaluate the subsurface soil and groundwater conditions at the site. The soil boring was completed on March 28, 2020 with a subcontracted drill rig. The soil borings extended to a maximum depth of approximately 28.5 feet below the existing ground surface (BGS). A senior geologist from Krazan and Associates was present during the explorations, examined the soil and geologic conditions encountered, obtained samples of the different soil types, and maintained logs of the explorations. The approximate locations of the exploratory borings are shown on the Site Plan in Figure 2.

Representative samples of the subsurface soils encountered in the geotechnical exploration were collected and sealed in plastic bags. The soils encountered in the exploration were visually classified in general accordance with the Unified Soil Classification System (USCS). A more detailed description of the field investigation is presented in Appendix A.

SOIL PROFILE AND SUBSURFACE CONDITIONS

B-1 was advanced at the proposed modular building area, and B-2 was advanced in the play area located near the top of the eastern slope. The approximate location of the soil borings are shown on the Site Plan (Figure 1). This section of the report is intended to provide a general description the subsurface conditions. Detailed descriptions of the soils encountered in each of the borings are presented in the boring pit logs in Appendix A.

Asphaltic Concrete: B-1 encountered roughly 6-inches of asphaltic concrete.

Organic Topsoil: Soil boring B-2 encountered roughly 6-inches of organic topsoil.

Undocumented Fill: Below the asphaltic concrete and organic topsoil, our borings encountered undocumented fill consisting of moist, loose, brown to gray silty sand with gravel to the depths of roughly 7.5 feet and 10.0 feet BGS. Organics and debris were also noted in B-1 at roughly 5.0 feet BGS.

Native Glacial Soils: Underlying the undocumented fill, the borings generally encountered medium dense to very dense, moist, gray to brown silty sand with gravel and silty gravel with sand extending to the maximum depth explored at 21.0 feet and 28.5 feet BGS. A 10-foot layer (15 to 25 feet BGS) of very stiff to hard, wet, gray to brown sandy silt was encountered in B-2. We interpreted the silty sand with gravel, silty gravel with sand, and sandy silt to be native glacial soils.

Groundwater Observations: Groundwater seepage was encountered in soil boring B-2 at approximately 15 feet BGS and was interpreted to be perched groundwater. Perched groundwater occurs when surface water infiltrates through less dense, more permeable soils and accumulates on top of a relatively low-permeability soil layer. Perched water tends to vary spatially and is dependent upon the amount of rainfall, and does not represent a regional groundwater "table" within the upper soil horizons. We would expect the amount of perched water to decrease during drier times of the year and increase during wetter periods.

It should be recognized that groundwater elevations may fluctuate with time. The groundwater level will be dependent upon seasonal precipitation, irrigation, land use, and climatic conditions, as well as other factors. Therefore, groundwater levels at the time of the field investigation may be different from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

GEOLOGIC HAZARDS

Erosion Concern/Hazard

The Natural Resources Conservation Service (NRCS) map for Kitsap County indicates that the soils in the site area are classified as Alderwood gravelly sandy loam. The NRCS classifies Alderwood gravelly sandy loam as Hydrologic Soil Group B. In general, these soils are listed to have low to moderate erosion hazard in a disturbed state on a level surface. However, these soils can be considered to have high erosion hazard on steep slopes.

It has been our experience that soil erosion potential can be minimized through landscaping and surface water runoff control. Typically, erosion of exposed soils will be most noticeable during periods of rainfall and may be controlled by the use of normal temporary erosion control measures, such as silt

fences, hay bales, mulching, control ditches or diversion trenching, and contour furrowing. Erosion control measures should be in place before the onset of wet weather.

Landslide Hazard

During our site visit we did not observe signs of recent slide scarps, tension cracks, or slumps within the site that would indicate current deep-seated instability on the steep slopes within or near the property. Signs of shallow soil movement and soil creep, such as curved tree trunks, were not observed on the eastern slope of the property. However it should be noted that soil creep is the gradual, imperceptible downslope movement of surficial soils under the effect of gravity, and is typical on steep slopes.

A review of the Washington State Department of Ecology Coastal Zone Atlas, and current geologic hazard mapping presented on the Kitsap County GIS and Parcel Viewer websites were performed in conjunction with this study.

The subject property is located in an area mapped as stable slopes (S). Stable slopes are described as slopes generally less than fifteen percent except in areas of low groundwater concentration or competent bedrock.

The Kitsap County Parcel Viewer shows isolated moderate landslide hazard areas mapped in the eastern portion of the property. The eastern slope has vertical relief of approximately 40 feet and is inclined at approximately 30 degrees. The medium dense to very dense, native glacial soils that are interpreted to underlie the property and form the core of the site slopes are considered to have good strength. Accordingly, it is our opinion that the steep slope within the site is relatively stable with respect to deep seated landsliding under current conditions. In our opinion, there is some potential for shallow sloughing and sliding in the surficial loose topsoil and weathered soils on the steep slope.

The control of surface water and near-surface groundwater is very important for the long-term stability of the steep slope at this site. Maintenance of vegetation cover and the installation and maintenance of drainage systems to direct water away from the steep slope should reduce the potential of slope movement.

Seismic Hazard

The 2015 International Building Code (IBC), Section 1613.3.2, refers to Chapter 20 of ASCE-7 for Site Class Definitions. It is our opinion that the overall soil profile corresponds to Site Class D as defined by Table 20.3-1 "Site Class Definitions," according to the 2010 ASCE-7 Standard. Site Class D applies to a "Stiff Soil" profile. The seismic site class is based on a soil profile extending to a depth of 100 feet. The soil boring on this site extended to a maximum depth of 28.5 feet and this seismic site class designation is based on the assumption that similar soil conditions continue below the depth explored.

We referred to the Applied Technology Council (ATC) website and the 2015 IBC to obtain values for S_S, S_{MS}, S_{DS}, S_1, S_{M1}, S_{D1}, F_a, and F_v. The ATC website utilizes the most updated published data on seismic conditions from the United States Geological Survey. The seismic design parameters for this site are presented in the following table:

Table 1: Seismic Design Parameters
(Reference: 2015 IBC Section 1613.3.2, ASCE 7-10, and ATC)

Seismic Item	Value
Site Coefficient F_a	1.000
S_s	1.334
S_{MS}	1.334
S_{DS}	0.889
Site Coefficient F_v	1.500
S_1	0.533
S_{M1}	0.799
S_{D1}	0.533

Additional seismic considerations include liquefaction potential and amplification of ground motions by soft soil deposits. The liquefaction potential is highest for loose sand with a high groundwater table. The native soils primarily consisting of medium dense to very dense silty sand with gravel, silty gravel with sand and very stiff to hard sandy silt interpreted to underlie the site are considered to have a low potential for liquefaction and amplification of ground motion.

The Liquefaction Susceptibility Map of Kitsap County, Washington, by Stephen Palmer, et al. (WADNR, September 2004) has mapped the site area to have a very low liquefaction susceptibility.

CONCLUSIONS AND RECOMMENDATIONS

General

It is our opinion from a geotechnical standpoint that the site is compatible with the proposed development, provided that our geotechnical recommendations are incorporated into project plans and are implemented during construction.

Slope Conditions: We did not observe signs of recent rotational-type deep-seated slope failures. Relatively shallow failures as well as surficial erosion are natural processes and should be expected to

occur on these slopes. It is our opinion that there is potential for erosion, soil creep, and shallow failures within the loose surficial soils on the steeper portions of the slope.

The control of surface water and near-surface groundwater is very important for maintaining the long-term stability of the steep slope. It would be prudent for the property owners to identify all drainage system components and outflows for regular monitoring of the drainage system. We strongly recommend that drainage systems be maintained throughout the life of the property. Maintenance of the drainage system is very important for maintaining the stability of the steep slope, and thus it should be inspected on a regular basis.

The vegetation on the slope should be maintained. Although the site slopes are considered to be relatively stable under current conditions, vegetation is considered to play an integral part in slope stabilization and erosion control. Erosion and sediment control measures should be implemented if any soils are exposed on the slope and these measures should be in general accordance with best management practices and with local regulations. The slope should not be stripped of vegetation.

The proposed building location is roughly 146 feet west of the top of the eastern slope. We interpret the slope to be stable with respect to deep-seated failures under current conditions. There is an existing play area near the eastern slope and we understand that there is no development currently planned in that area. In our opinion the proposed development should not impact the existing slope condition or vice-versa.

Landslide movements are always a possibility for properties located on or near hillsides. It may be prudent for the property owner to retain a qualified geotechnical professional to periodically inspect the slope, especially after a winter storm or when any stress is evident. The probability that landsliding will occur is substantially reduced by the proper maintenance of drainage control measures at the site. Therefore, the property owner should take responsibility for performing such maintenance.

Soil Conditions: Our soil exploration encountered roughly 6 inches of asphaltic concrete / organic topsoil underlain by approximately 7.5 to 10.0 feet of undocumented fill. The undocumented fill was underlain by medium dense to very dense, and very stiff to hard native glacial soils at the site. The native glacial soils typically have a relatively high capacity for foundation support and form relatively stable slopes.

Foundations: Based on our explorations, conventional spread foundations bearing on the medium dense or firmer native soils or on structural fill extending to the medium dense or firmer native soils should provide adequate support for the planned structures. Detailed geotechnical engineering recommendations for foundation design are presented in this report.

Stormwater Drainage: Proper site grading and drainage should help maintain current stability conditions. A comprehensive drainage plan will be an important part of a successful development

project at this site. Surface water runoff should not be allowed to flow over the steep slope along the eastern portion of the property during or after construction.

On-site Soils: The on-site soils free of organics and debris may be suitable for use as structural fill material, provided the moisture content is near optimum and the soil could be suitably compacted to specifications. This will depend on the moisture content of the soils at the time of construction. Krazan and Associates should be retained to determine if the on-site soils can be used as structural fill material at the time of construction.

Site Preparation

We understand that the proposed development is limited to the planned portable building area. However, we have provided general guidelines for site preparation, if needed. In general site clearing should include removal of any vegetation and associated root systems; wood; abandoned utilities; structures including foundations, rubble; and rubbish. Further site preparation recommendations are provided in the **Foundations, Pavement,** and **Floor Slab and Exterior Flatwork** sections of this report.

The asphaltic concrete should be removed from the building pad area. The building pad then should be proof-rolled with a loaded tandem-axle dump truck or probed, and be visually inspected to identify any loose/soft areas. Any loose soils or undocumented fill should be excavated to expose firm native soils. The resulting excavations should be filled with structural fill as described in the **Structural Fill** section of this report.

During wet weather conditions, which typically occur from October through May, subgrade stability problems and grading difficulties may develop due to excess moisture, disturbance of moisture sensitive soils and/or the presence of perched groundwater. Earthwork construction during extended periods of wet weather could create the need to remove wet disturbed soils if they cannot be suitably compacted due to elevated moisture contents. The on-site soils encountered in our borings are considered to be moisture sensitive. If over-excavation is necessary, it should be confirmed through continuous monitoring and testing by a qualified geotechnical engineer or geologist. Soils that have become unstable may require drying to near their optimal moisture content before compaction is feasible. Selective drying may be accomplished by scarifying or windrowing surficial material during extended periods of dry, warm weather (typically during the summer months). If the soils cannot be dried back to a workable moisture condition, remedial measures may be required. Preparation of the site for wet weather conditions may consist of the placement of a layer of aggregate base for the protection of exposed soils during construction.

It should be understood that even if Best Management Practices (BMP's) for soil protection are implemented for the wet season, there is a significant chance that additional soil mitigation work will be needed.

Any buried structures encountered during construction should be completely removed and backfilled with structural fill. Excavations, depressions, or soft and pliant areas extending below the planned subgrade elevations should be excavated to expose medium dense or firmer soil, and be backfilled with structural fill. In general, any septic tanks, underground storage tanks, debris pits, cesspools, or similar structures and deleterious materials should be completely removed. Any concrete footings encountered in the planned foundation area should be removed to depth of at least 3 feet below proposed footing elevations or as recommended by the geotechnical engineer. The resulting excavations should be backfilled with structural fill.

A representative of our firm should be available on request during all grading operations to observe, test and evaluate earthwork construction. This testing and observation is an integral part of our service, as acceptance of earthwork construction is dependent upon compaction and stability of the material. The geotechnical engineer may reject any material that does not meet compaction and stability requirements. Further recommendations, contained in this report, are predicated upon the assumption that earthwork construction will conform to the recommendations set forth in this section and in the Structural Fill section below.

Temporary Excavations

The on-site soils have variable cohesion strengths, therefore the safe angles to which these materials may be cut for temporary excavations is variable, as the soils may be prone to caving and slope failures in temporary excavations deeper than 4 feet. Temporary excavations in the competent native soils should be sloped no steeper than 1H:1V (horizontal to vertical) where room permits. If undocumented fill is exposed during the excavation, then the excavation should be sloped no steeper than 2H:1V where room permits.

All temporary cuts should be in accordance with Washington Administrative Code (WAC) Part N, Excavation, Trenching, and Shoring. The temporary slope cuts should be visually inspected daily by a qualified person during construction work activities and the results of the inspections should be included in daily reports. The contractor is responsible for maintaining the stability of the temporary cut slopes and minimizing slope erosion during construction. The temporary cut slopes should be covered with plastic sheeting to help minimize erosion during wet weather and the slopes should be closely monitored until the permanent retaining systems are complete. Materials should not be stored and equipment operated within 10 feet of the top of any temporary cut slope.

A Krazan & Associates geologist or geotechnical engineer should observe, at least periodically, the temporary cut slopes during the excavation work. The reason for this is that all soil conditions may not be fully delineated by the limited sampling of the site from the geotechnical explorations. In the case of temporary slope cuts, the existing soil conditions may not be fully revealed until the excavation work exposes the soil. Typically, as excavation work progresses, the maximum inclination of the temporary slope will need to be evaluated by the geotechnical engineer so that supplemental recommendations can

be made. Soil and groundwater conditions can be highly variable. Scheduling for soil work will need to be adjustable, to deal with unanticipated conditions, so that the project can proceed smoothly and required deadlines can be met. If any variations or undesirable conditions are encountered during construction, Krazan & Associates should be notified so that supplemental recommendations can be made.

Structural Fill

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

Best Management Practices (BMP's) should be followed when considering the suitability of the existing materials for use as structural fill. The on-site soils may be suitable for reuse as structural fill, provided the soil is free of organic material and debris, and it is within ± 2 percent of the optimum moisture content. If the native soils are stockpiled for later use as structural fill, the stockpiles should be covered to protect the soil from wet weather conditions. We recommend that a representative of Krazan & Associates be on site during the excavation work to determine which soils are suitable for placement as structural fill.

Imported, all weather structural fill material should consist of well-graded gravel or a sand and gravel mixture with a maximum grain size of 3 inches and less than 5 percent fines (material passing the U.S. Standard No. 200 Sieve). Structural fill also can consist crushed rock, rock spalls and controlled density fill (CDF). All structural fill material should be submitted for approval to the geotechnical engineer at least 48 hours prior to delivery to the site.

Granular fill soils should be placed in horizontal lifts not exceeding 8 inches in thickness prior to compaction, moisture-conditioned as necessary, (moisture content of soil shall not vary by more than ±2 percent of optimum moisture) and the material should be compacted to at least 95 percent of the maximum dry density based on ASTM D1557 Test Method. In-place density tests should be performed on all structural fill to document proper moisture content and adequate compaction. Additional lifts should not be placed if the previous lift did not meet the compaction requirements or if soil conditions are not considered stable.

Fill placed on slopes should be placed as structural fill. Sloping areas to receive fill should be benched for added stability. The benches should be horizontal with a minimum width of four feet.

Foundations

General: The proposed structure may be supported on a conventional spread foundation system bearing on the medium dense or firmer native soils or on structural fill including granular soils, rock spalls or Control Density Fill (CDF) extending to the medium dense or firmer native soils. *Based on our soil explorations, we interpreted the medium dense or firmer native load bearing soils in the planned building area to be approximately 7.5 feet below the existing grade.* We recommend that we evaluate the foundation subgrade soils during construction to determine the consistency throughout the building pad.

We have assumed column loads of 30,000 pounds and wall loads of 1,000 to 2,000 plf for the soil bearing capacity and settlement analyses. *We should be contacted to re-evaluate the potential settlement and the allowable bearing pressure, if the design loads vary significantly from these assumed values.*

Shallow Foundations: Conventional shallow spread footings supported on medium dense of firmer native soils, or on structural fill extending to the medium dense or firmer native soils, may be designed using an allowable soil bearing pressure of **2,000 pounds per square foot (psf)** for dead plus live loads. This value may be increased by 1/3 for short duration loads such as wind or seismic loading. A representative of Krazan and Associates should evaluate the foundation bearing soil and observe structural fill placement.

Footings should have a minimum embedment depth of 18 inches below pad subgrade (soil grade) or adjacent exterior grade, whichever is lower. Footing widths should be based on the anticipated loads and allowable soil bearing pressure. Footings should have a minimum width of at least 12 inches regardless of load. Water should not be allowed to accumulate in footing trenches. All undocumented fill and loose or disturbed soils should be removed from the foundation excavations prior to placing concrete. Water should not be allowed to collect in the foundation excavations.

Structural Fill in Footing Areas: If structural fill consisting of granular soils and rock spalls are used, then the foundation excavations would need to be widened on both sides of the footing a distance equal to one-half of the depth of the over-excavation below the bottom of the footing. Structural fill consisting granular soils should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. To reduce the volume of extra excavation needed for the footing trenches and to simplify structural fill placement, it may be practical to place Control Density Fill (CDF) to fill the deeper footing trenches to the planned footing subgrade elevations. If CDF is used, the trench may be excavated only slightly wider (6 inches wider on each side) than the footing.

Potential Foundation Settlement: For foundations constructed as recommended, the total settlement is not expected to exceed 1-inch. Differential settlement should be less than ½-inch. Most settlement is expected to occur during construction, as the loads are applied. However, additional post-construction

settlement may occur if the foundation soils are flooded or saturated. It should be noted that the risk of liquefaction is considered low, given the composition and density of the native, on-site soils.

Lateral Resistance: Resistance to lateral displacement can be computed using an allowable friction factor of 0.35 acting between the bases of foundations and the supporting subgrade soil. Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 250 pounds per cubic foot (pcf) acting against the appropriate vertical footing faces (neglecting the upper 12 inches). The allowable friction factor and allowable equivalent fluid passive pressure values include a factor of safety of 1.5. The frictional and passive resistance of the soil may be combined without reduction in determining the total lateral resistance. These values are based on footings founded on competent native soils or on structural fill extending to the competent native soils

Foundation Drainage: Seasonal rainfall, water run-off, and the normal practice of watering trees and landscaping areas around the proposed structures, should not be permitted to flood and/or saturate foundation subgrade soils. To prevent the buildup of water within the footing areas, continuous footing drains (with cleanouts) should be provided at the bases of the footings. The footing drains should consist of a minimum 4-inch diameter rigid perforated PVC pipe, sloped to drain, with perforations placed near the bottom and enveloped in all directions by washed rock and wrapped with filter fabric to limit the migration of silt and clay into the drain.

Slope Stability Analysis

The site plan shows the building to be roughly 146 feet from the top of the eastern steep slope. Krazan and Associates performed a slope stability analysis on a representative cross section (A) through this portion of the property as shown on Figure 2. The cross sections used in the analyses were obtained from the topographic map provided by Art Anderson & Associates, and measurements taken during our site visit.

The analyses were performed using the commercially available computer program GeoStudio. Soil strength parameters used in the analyses were estimated values based on exploratory boring at the site as part of our field investigation.

The pseudostatic method was used for the slope stability analysis to estimate the factor of safety (FS) under seismic conditions. The seismic coefficient used in a pseudostatic analysis is typically taken to be 1/2 of the peak ground acceleration (PGA) that the site is estimated to experience during the design earthquake. For this project site the PGA was 0.55, Kh was 0.28 g, based on the information from the USGS for the event with a 2 percent probability of being exceeded in 50 years.

The results of slope stability analyses are expressed as a FS against displacement failure. The FS is the ratio of resisting forces to driving forces. A FS of 1.0 is equilibrium; a FS of less than 1.0 indicates failure. Typically, a FS of 1.5 for static conditions and 1.1 for seismic (pseudostatic) conditions is

considered adequate in standard local practice. A FS between 1.0 and 1.5 under static conditions (or less than 1.1 under seismic conditions) is not adequate due to the uncertainties in the modeling process. A lower FS for seismic conditions is considered adequate as the probability of occurrence of the seismic conditions analyzed is relatively low.

The results of the slope stability analyses are presented in the following tables. A graphical presentation of the results of the static and seismic slope stability analyses are presented in the attached Figures 3 and 4, respectively.

Slope Stability Results (Static Condition)

	Calculated Factor of Safety	Factor of Safety Required
A-A Global Stability	2.24	1.5

Slope Stability Results (Seismic Condition)

	Calculated Factor of Safety	Factor of Safety Required
A-A Global Stability	1.15	1.1

Structure Setbacks

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

We understand that the proposed building will be roughly 146 feet from the top of the eastern steep slope. A playground currently occupies area near the eastern steep slope and we understand that there is no development currently planned in that area. However, in the future, if structures or impervious areas including pavement and sidewalks are planned near the slope, then we recommend a setback of at least 25 feet be maintained between these structures and the top of the steep slope. For structures on shallow spread foundation placed closer than 25 feet from the top of the steep slope we recommend the down slope footing lines be deepened to maintain an effective setback of 25 feet between the bottom of the footing and the face of the slope. This effective setback is shown on the Schematic Effective Setback detail in Figure 3. We should be retained to evaluate the foundation subgrade and setback distances prior to placing foundation forms.

Protection of the setback and steep slope areas should be performed as required by Kitsap County or the City of Poulsbo, as applicable. Specifically, we recommend that an undisturbed buffer area, at least 15 feet in width, be established west of the top of the steep slope along the eastern portion of the site. This buffer should not to be disturbed or modified through placement of any fill or removal of the existing vegetation. No material of any kind should be placed on the buffer or slope or be allowed to reach the slope, such as excavation spoils, lawn clippings and other yard waste, trash, and soil stockpiles. Replacement of vegetation in the undisturbed buffer area should be performed in accordance with Kitsap County or the City of Poulsbo code. Any proposed development within the setback area should be the subject of a specific geotechnical evaluation. Under no circumstances should water be allowed to concentrate on the steep slopes. Any sloping areas disturbed during construction should be planted with vegetation as soon as practical to reduce the potential for erosion.

Floor Slabs and Exterior Flatwork

We understand that proposed development is limited to the design and installation of the portable classroom building. However, if floor slabs and exterior flatwork is planned, then recommendation as stated in this section should be followed.

Before the placement of concrete floors or sidewalks on the site, or before any floor supporting fill is placed, the organic topsoil should be removed. Our explorations encountered roughly 7.5 feet to 10.0 feet of undocumented fill overlying the competent native glacial soils. If undocumented fill is encountered at the planned subgrade elevations, then we recommended that the undocumented fill soils should be excavated to *at least 1 foot* below the planned slab subgrade and then backfilled with structural fill. Deeper excavation may be required, if soft/loose and yielding soil conditions are exposed during over-excavation. We should evaluate the subgrade soil conditions, and observe the over-excavation and structural fill placement during construction.

Any additional fill used to increase the elevation of the floor slab should meet the requirements of structural fill. Fill soils should be placed in horizontal lifts not exceeding 8 inches loose thickness, moisture-conditioned as necessary, (moisture content of soil shall not vary by more than ±2 percent of optimum moisture) and the material should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557.

Floor slabs may be designed using a modulus of subgrade reaction value of k = 150 pounds per cubic inch (pci) for slabs supported on medium dense or firmer native soils or on at least 1 foot of structural fill as recommended in the above paragraph.

In areas where it is desired to reduce floor dampness, such as areas covered with moisture sensitive floor coverings, we recommend that concrete slab-on-grade floors be underlain by a water vapor retarder system. According to ASTM guidelines, the water vapor retarder should consist of a vapor retarder sheeting underlain by a minimum of 4-inches of compacted clean (less than 5 percent passing

the U.S. Standard No. 200 Sieve), open-graded coarse rock of ¾-inch maximum size. The vapor retarder sheeting should be protected from puncture damage.

It is recommended that the utility trenches within the building pads be compacted, as specified in this report, to minimize the transmission of moisture through the utility trench backfill. Special attention to the drainage and irrigation adjacent to the buildings is recommended. Grading should establish drainage away from the structures and this drainage pattern should be maintained. Water should not be allowed to collect adjacent to the structures. Excessive irrigation within landscaped areas adjacent to the structure should not be allowed to occur. In addition, ventilation of the structure may be prudent to reduce the accumulation of interior moisture.

Erosion and Sediment Control

Erosion and sediment control (ESC) is used to minimize the transportation of sediment to wetlands, streams, lakes, drainage systems, and adjacent properties. Erosion and sediment control measures should be implemented and these measures should be in general accordance with local regulations. As a minimum, the following basic recommendations should be incorporated into the design of the erosion and sediment control features of the site:

1) Phase the soil, foundation, utility and other work, requiring excavation or the disturbance of the site soils, to take place during the dry season (generally May through September). However, provided precautions are taken using Best Management Practices (BMP's), grading activities can be undertaken during the wet season (generally October through April), but it should also be known that this may increase the overall cost of the project.

2) All site work should be completed and stabilized as quickly as possible.

3) Additional perimeter erosion and sediment control features may be required to reduce the possibility of sediment entering the surface water. This may include additional silt fences, silt fences with a higher Apparent Opening Size (AOS), construction of a berm, or other filtration systems.

4) Any runoff generated by dewatering discharge should be treated through construction of a sediment trap if there is sufficient space. If space is limited, other filtration methods will need to be incorporated.

Groundwater Influence on Structures and Earthwork Construction

Groundwater seepage was encountered at approximately 15.0 feet in boring B-2 and was interpreted to be perched groundwater. Perched groundwater occurs when surface water infiltrates through less dense,

more permeable soils and accumulates on top of a relatively low-permeability soil layer. Perched water tends to vary spatially and is dependent upon the amount of rainfall, and does not represent a regional groundwater "table" within the upper soil horizons. We would expect the amount of perched water to decrease during drier times of the year and increase during wetter periods.

It should be recognized that groundwater elevations may fluctuate with time. The groundwater level will be dependent upon seasonal precipitation, irrigation, land use, and climatic conditions, as well as other factors. Therefore, groundwater levels at the time of the field investigation may be different from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

If groundwater is encountered during construction, we should observe the conditions to determine if dewatering will be needed. Design of temporary dewatering systems to remove groundwater should be the responsibility of the contractor. If earthwork is performed during or soon after periods of precipitation, the subgrade soils may become saturated. These soils may "pump," and the materials may not respond to densification techniques. Typical remedial measures include: disking and aerating the soil during dry weather; mixing the soil with drier materials; removing and replacing the soil with an approved fill material. A qualified geotechnical engineering firm should be consulted prior to implementing remedial measures to observe the unstable subgrade conditions and provide appropriate recommendations.

Drainage and Landscaping

The ground surface should slope away from building pads and pavement areas, toward appropriate drop inlets or other surface drainage devices. It is recommended that adjacent exterior grades be sloped a minimum of 2 percent for a minimum distance of 5 feet away from structures. Roof drains should be tightlined away from foundations. Roof drains should not be connected to the footing drains.

Pavement areas, if planned, should be inclined at a minimum of 1 percent and drainage gradients should be maintained to carry all surface water to collection facilities, and suitable outlets. These grades should be maintained for the life of the project.

Specific recommendations for and design of storm water disposal systems or septic disposal systems are beyond the scope of our services and should be prepared by other consultants that are familiar with design and discharge requirements.

Utility Trench Backfill

We recommend that utility trench backfill be placed in general accordance with typical recommendations for structural fill placement. A firm and unyielding subgrade should allow for the proper placement of subsurface utilities. This could include the placement of geotextile and quarry rock in the bottom of utility trenches prior to placement of pipe bedding, utilities and trench backfill.

Utility trenches should be excavated according to accepted engineering practices following OSHA (Occupational Safety and Health Administration) standards, by a contractor experienced in such work. The responsibility for the safety of open trenches should be borne by the contractor. Traffic and vibration adjacent to trench walls should be minimized; cyclic wetting and drying of excavation side slopes should be avoided. Depending upon the location and depth of some utility trenches, groundwater flow into open excavations could be experienced, especially during or shortly following periods of precipitation.

All utility trench backfill should consist of structural fill. Utility trench backfill placed in or adjacent to buildings and exterior slabs should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. The upper 5 feet of utility trench backfill placed in pavement areas should be compacted to at least 95 percent of the maximum dry density based on ASTM Test Method D1557. Below 5 feet, utility trench backfill in pavement areas should be compacted to at least 90 percent of the maximum dry density based on ASTM Test Method D1557. Pipe bedding should be in accordance with the pipe manufacturer's recommendations.

The contractor is responsible for removing all water-sensitive soils from the trenches regardless of the backfill location and compaction requirements. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

We should be retained to evaluate proposed structural fill materials prior to construction to provide recommendations regarding how to place and evaluate fill performance. Pipe bedding should be in accordance with the pipe manufacturer's recommendations.

Pavement Design

We understand that proposed development is limited to the design and installation of the portable classroom building. However, if pavement is planned, then recommendation as stated in this section should be followed.

Our explorations encountered roughly 7.5 feet to 10.0 feet of undocumented fill overlying the competent native glacial soils. If soft/loose or undocumented fill soils are encountered in the pavement subgrade, we recommend that subgrade modification techniques be considered. Subgrade modification typically includes the overexcavation of unsuitable materials, the placement of a high-strength geotextile fabric at the bottom of the over-excavated area, and then the placement of structural fill. Subgrade modification such as this is intended to disperse surcharge loads and therefore aid in pavement performance.

Where loose soils are encountered in the pavement subgrade, we recommend overexcavation of the soft/loose or undocumented fill soils to at least 12 inches below the planned pavement subgrade elevation. We recommend that a high-strength geotextile separation fabric, such as Mirafi 600X or equivalent then be placed over the exposed grade. After the fabric is placed, the area should be filled to

the planned pavement subgrade elevation with structural fill. It should be noted that subgrade soils that have relatively high silt contents may be highly sensitive to moisture conditions. The subgrade strength and performance characteristics of a silty subgrade material may be dramatically reduced if it becomes wet.

Deeper excavation may be required, if soft/loose and yielding soil conditions are exposed during over-excavation. We should evaluate the subgrade soil conditions, and observe the over-excavation and structural fill placement during construction.

Traffic loads were not provided, however, based on our knowledge of the proposed project, we expect the traffic to range from light duty (passenger automobiles) to heavy duty (school buses / firetrucks). The following tables show the minimum recommended pavement sections for both light duty and heavy duty traffic loads.

ASPHALTIC CONCRETE (FLEXIBLE) PAVEMENT
LIGHT DUTY (PARKING AREA)

Asphaltic Concrete	Aggregate Base*	Compacted Subgrade* **
2.0 in.	6.0 in.	12.0 in.

** 95% compaction based on ASTM Test Method D1557*
*** A proof roll may be performed in lieu of in place density tests*

ASPHALTIC CONCRETE (FLEXIBLE) PAVEMENT
HEAVY DUTY (HEAVY TRUCK AREA)

Asphaltic Concrete	Aggregate Base*	Compacted Subgrade* **
3.0 in.	6.0 in.	12.0 in.

** 95% compaction based on ASTM Test Method D1557*
*** A proof roll may be performed in lieu of in place density tests*

PORTLAND CEMENT CONCRETE (RIGID) PAVEMENT
4000 psi with FIBER MESH

Min. PCC Depth	Aggregate Base*	Compacted Subgrade* **
6.0 in.	6.0 in.	12.0 in.

** 95% compaction based on ASTM Test Method D1557*
*** A proof roll may be performed in lieu of in place density tests*

The asphaltic concrete depth in the flexible pavement tables should be a surface course type asphalt, such as Washington Department of Transportation (WSDOT) ½ inch HMA. The pavement specification in Appendix C provides additional recommendations including aggregate base material. The rigid pavement design is based on a Portland Cement Concrete (PCC) mix that has a 28-day compressive strength of 4,000 pounds per square inch (psi). The design is also based on a concrete flexural strength or modulus of rupture of 550 psi.

Testing and Inspection

A representative of Krazan & Associates, Inc. should be present at the site during the earthwork activities to confirm that actual subsurface conditions are consistent with the exploratory fieldwork. This activity is an integral part of our services as acceptance of earthwork construction is dependent upon compaction testing and stability of the material. This representative can also verify that the intent of these recommendations is incorporated into the project design and construction. Krazan & Associates, Inc. will not be responsible for grades or staking, since this is the responsibility of the Prime Contractor. Furthermore, Krazan & Associates is not responsible for the contractor's procedures, methods, scheduling or management of the work site.

LIMITATIONS

Geotechnical engineering is one of the newest divisions of Civil Engineering. This branch of Civil Engineering is constantly improving as new technologies and understanding of earth sciences improves. Although your site was analyzed using the most appropriate current techniques and methods, undoubtedly there will be substantial future improvements in this branch of engineering. In addition to improvements in the field of geotechnical engineering, physical changes in the site either due to excavation or fill placement, new agency regulations or possible changes in the proposed structure after the time of completion of the soils report may require the soils report to be professionally reviewed. In light of this, the owner should be aware that there is a practical limit to the usefulness of this report without critical review. Although the time limit for this review is strictly arbitrary, it is suggested that two years be considered a reasonable time for the usefulness of this report.

This report has been prepared for the exclusive use of the Art Anderson and their assigns. Foundation and earthwork construction is characterized by the presence of a calculated risk that soil and groundwater conditions have been fully revealed by the original foundation investigation. This risk is derived from the practical necessity of basing interpretations and design conclusions on limited sampling of the earth. Our report, design conclusions and interpretations should not be construed as a warranty of the subsurface conditions. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. The recommendations made in this report are based on the assumption that soil conditions do not vary significantly from those disclosed during our field investigation. The findings and conclusions of this report can be affected by the passage of time, such as seasonal weather conditions, manmade influences, such as construction on or adjacent to the site,

natural events such as earthquakes, slope instability, flooding, or groundwater fluctuations. If any variations or undesirable conditions are encountered during construction, the geotechnical engineer should be notified so that supplemental recommendations can be made.

The conclusions of this report are based on the information provided regarding the proposed construction. If the proposed construction is relocated or redesigned, the conclusions in this report may not be valid. The geotechnical engineer should be notified of any changes so that the recommendations can be reviewed and reevaluated.

Misinterpretations of this report by other design team members can result in project delays and cost overruns. These risks can be reduced by having Krazan & Associates, Inc. involved with the design team's meetings and discussions after submitting the report. Krazan & Associates, Inc. should also be retained for reviewing pertinent elements of the design team's plans and specifications. Contractors can also misinterpret this report. To reduce this, risk Krazan & Associates. Inc. should participate in pre-bid and preconstruction meetings, and provide construction observations during the site work.

This report is a geotechnical engineering investigation with the purpose of evaluating the soil conditions in terms of foundation design. The scope of our services did not include any environmental site assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater or atmosphere, or the presence of wetlands. Any statements or absence of statements, in this report or on any soils log regarding odors, unusual or suspicious items, or conditions observed are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous and/or toxic assessments.

The geotechnical information presented herein is based upon professional interpretation utilizing standard engineering practices and a degree of conservatism deemed proper for this project. It is not warranted that such information and interpretation cannot be superseded by future geotechnical developments. We emphasize that this report is valid for this project as outlined above, and should not be used for any other site. Our report is prepared for the exclusive use of our client. No other party may rely on the product of our services unless we agree in advance to such reliance in writing.

Properties on Hillsides: During our visit, we did not observe indications of current deep seated land sliding within the property. However, signs of shallow soil movement, such as curved tree trunks, were observed in areas of the site. Shallow soil movement is typically caused by the movement of loose/soft surficial soils in a wet conditions. Relatively shallow failures as well as surficial erosion are natural processes and should be expected to occur within sloping ground.

Although indications of erosion and current significant land sliding were not observed on the property during our site visit, it is our opinion that there is always some potential for soil movement on sloping ground. Property owner's with structures on or near hillsides should realize that landslide movements are always a possibility. It may be prudent for the property owner to retain a qualified geotechnical

professional to periodically inspect the slope, especially after a winter storm or when any stress is evident. The probability that landsliding will occur is substantially reduced by the proper implementation and maintenance of drainage control measures at the site. Therefore, the property owner should take responsibility for performing such maintenance.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (253) 939-2500.

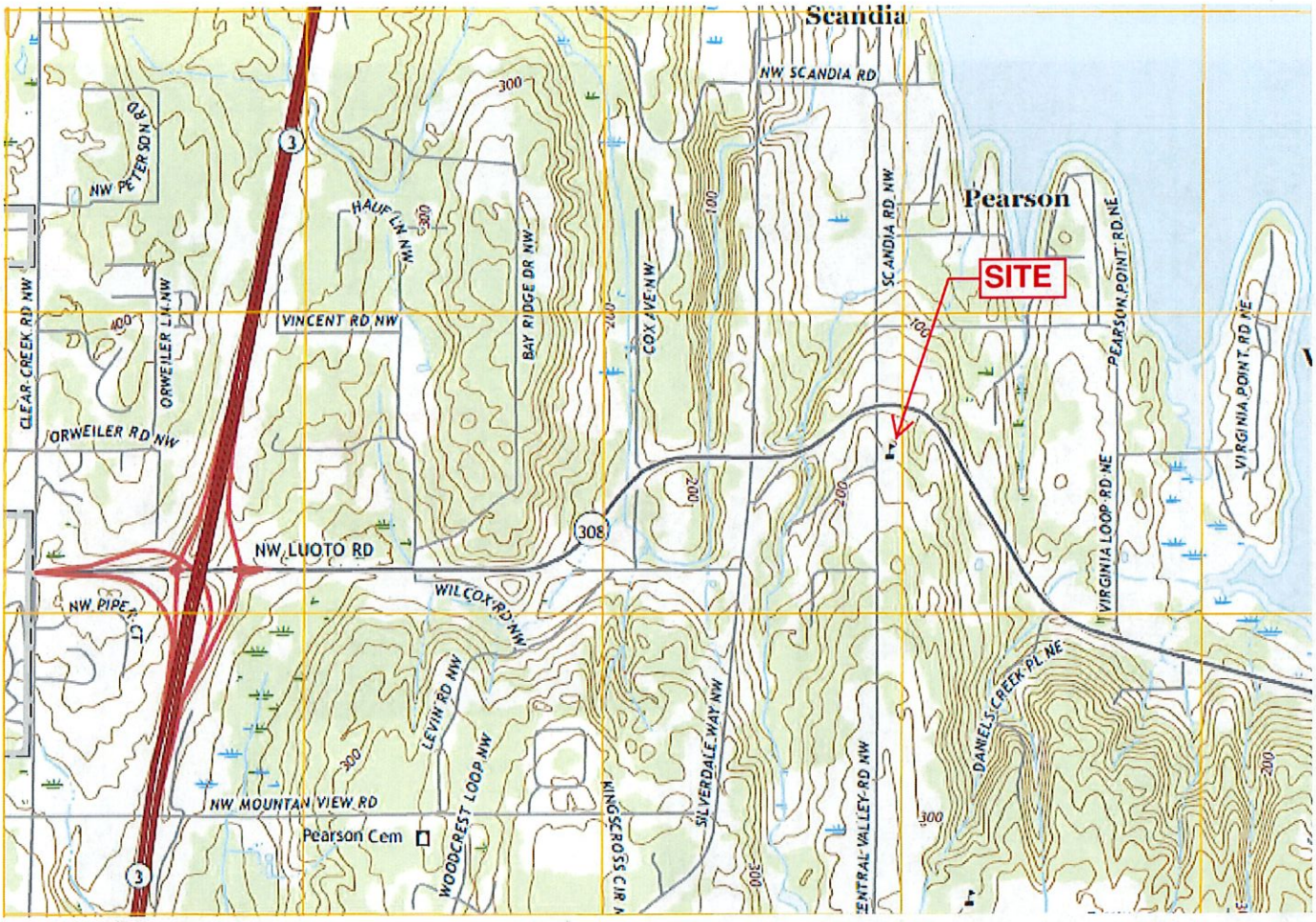
Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

5/12/20

Vijay Chaudhary, P.E.
Project Engineer

CB:VC

Vicinity Map



S topographic map titled "Poulsbo Quadrangle,
5-Minute Series", dated 2020.

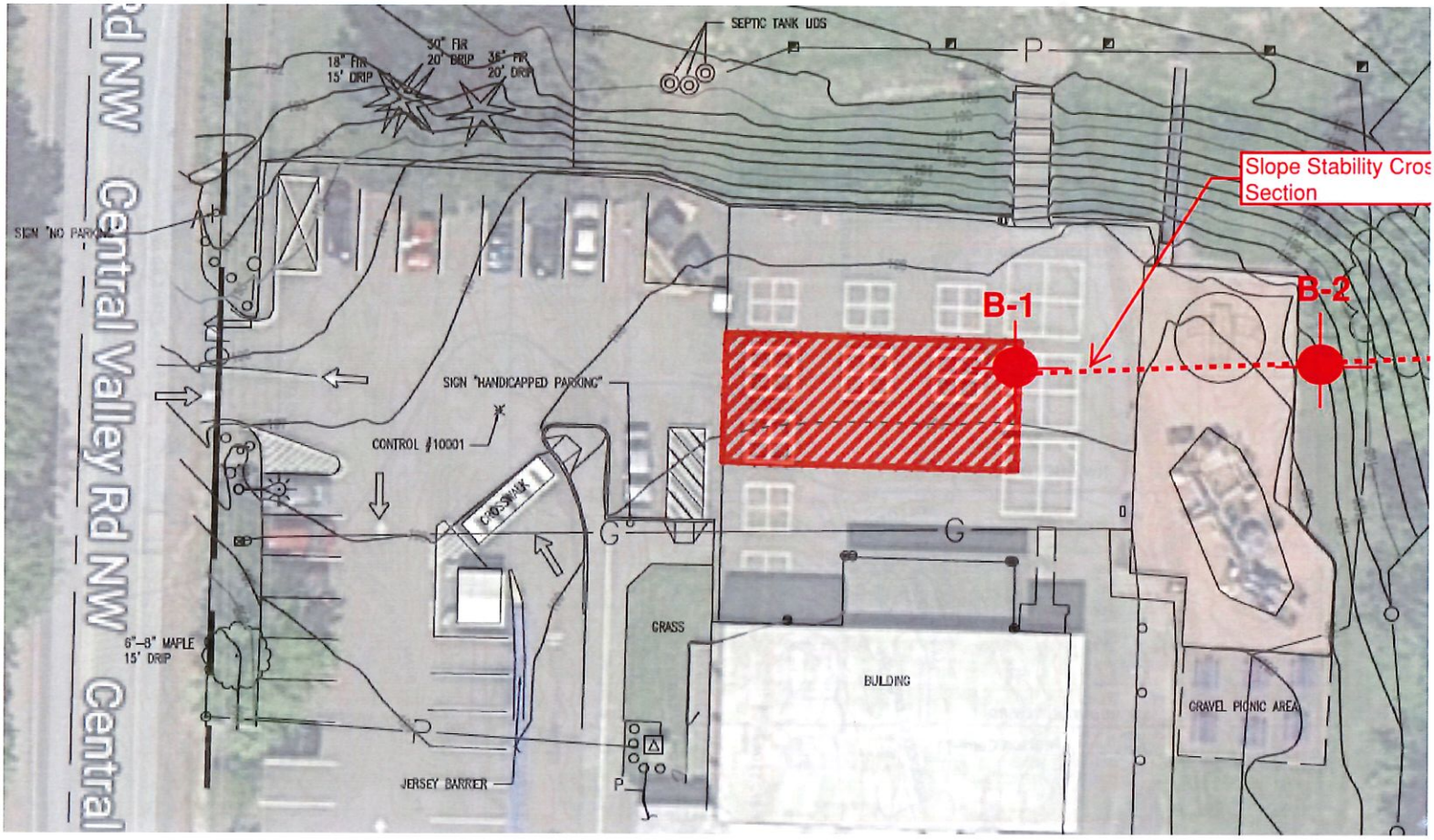
Krazan

HPES Portable Building Installation

Date: May 2020	Project Number: 102-20013	
Drawn By: VC	Figure: 1	Not to scale

Permit Number: 20-02306

Site Plan



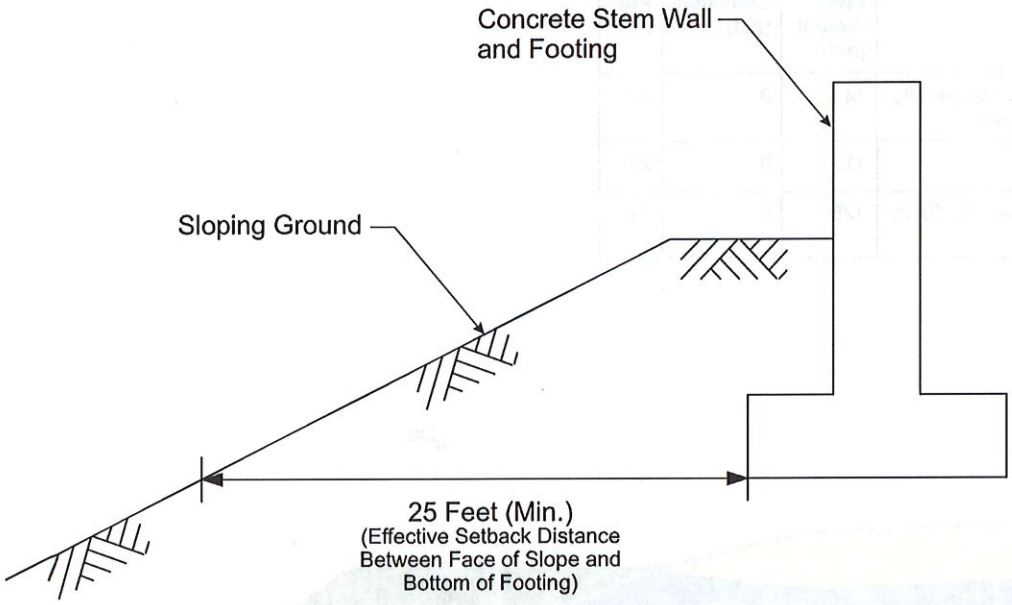
Reference: Conceptual layout provided by Art Anderson.

Number and Approximate Location of Soil Borings

Krazan		
HPES Portable Building Installation		
Date: May 2020	Project Number: 102-20013	
Drawn By: VC/CB	Figure: 2	Not to scale

Foundation Effective Setback Detail

(Not to Scale)



Krazan & ASSOCIATES, INC.

HPES Portable Building Installation

Date: May 2020	Project Number: 102-20013	
Drawn By: VC	Figure 3	Not to scale

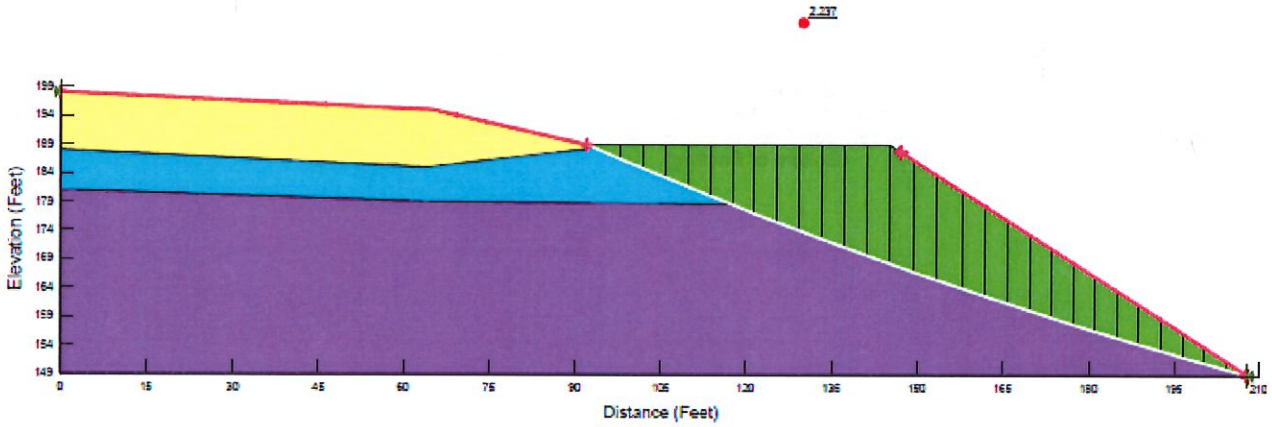
Permit Number: 20-02306

Slope Stability (Static Condition)

Legend:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Dense to Very Dense Silty Sand with Gravel	140	0	38
	Fill Material	115	0	28
	Medium Dense Silty Sand with Gravel	125	0	34

Static F of S: 2.237



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HPES Portable Building Installation

Date: May 2020	Project Number: 102-20013	
Drawn By: CB	Figure: 4	Not to scale

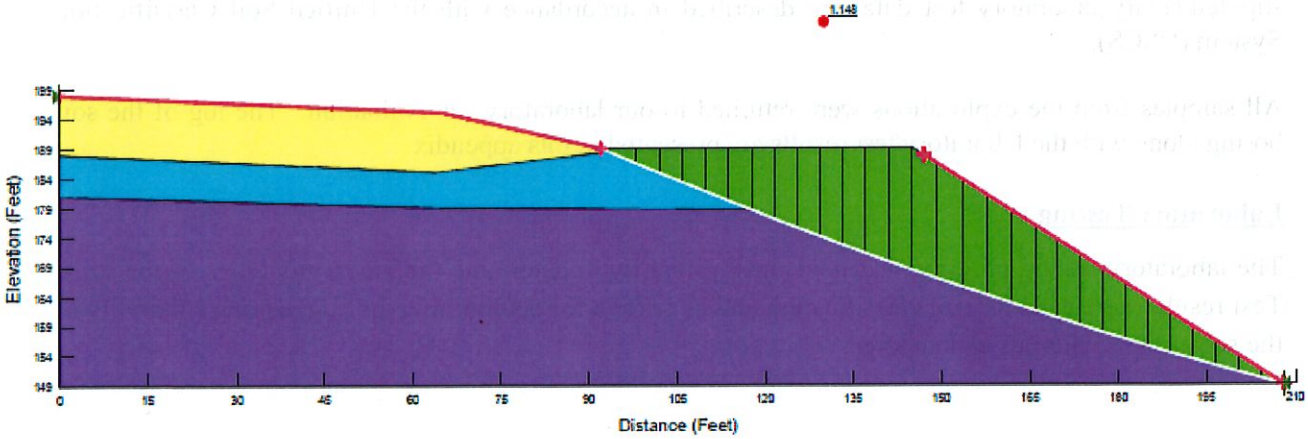
Permit Number: 20-02306

Slope Stability (Seismic Condition)

Legend:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)
	Dense to Very Dense Silty Sand with Gravel	140	0	38
	Fill Material	115	0	28
	Medium Dense Silty Sand with Gravel	125	0	34

Seismic F of S: 1.148



Krazan

HPES Portable Building Installation

Date: May 2020	Project Number: 102-20013	
Drawn By: CB	Figure: 5	Not to scale

APPENDIX A

FIELD INVESTIGATION AND LABORATORY TESTING

Field Investigation

Two (2) exploratory soil borings were completed to evaluate the subsurface soil and groundwater conditions at the site. The soil borings were completed on March 28, 2020 with a subcontracted drill rig. The maximum exploration depth was approximately 28.5 feet BGS. The approximate exploratory boring locations are shown on the Site Plan (Figure 2). The depth shown on the attached soil boring logs are from the existing ground surface at the time of our exploration.

The borings were advanced using a track-mounted, auger drilling rig. Soil samples were obtained by using the Standard Penetration Test (SPT) as described in ASTM Test Method D1586. The Standard Penetration Test and sampling method consists of driving a standard 2-inch outside-diameter, split barrel sampler into the subsoil with a 140-pound hammer free falling a vertical distance of 30 inches. The summation of hammer-blows required to drive the sampler the final 12-inches of an 18-inch sample interval is defined as the Standard Penetration Resistance, or N-value. The blow count is presented graphically on the boring logs in this appendix. The resistance, or "N" value, provides a measure of the relative density of granular soils or of the relative consistency of cohesive soils.

The soils encountered were logged in the field during the subsurface exploration and, with supplementary laboratory test data, are described in accordance with the Unified Soil Classification System (USCS).

All samples from the explorations were returned to our laboratory for evaluation. The log of the soil boring along with the laboratory test results are presented in this appendix.

Laboratory Testing

The laboratory testing program was developed primarily to determine the index properties of the soils. Test results were used for soil classification and as criteria for determining the engineering suitability of the subsurface materials encountered.

Soil Classification

USCS Soil Classification				
Major Division			Group Description	
Coarse-Grained Soils < 50% passes #200 sieve	Gravel and Gravelly Soils < 50% coarse fraction passes #4 sieve	Gravel (with little or no fines)	GW	Well-Graded Gravel
			GP	Poorly Graded Gravel
		Gravel (with > 12% fines)	GM	Silty Gravel
			GC	Clayey Gravel
	Sand and Sandy Soils > 50% coarse fraction passes #4 sieve	Sand (with little or no fines)	SW	Well-Graded Sand
			SP	Poorly Graded Sand
		Sand (with > 12% fines)	SM	Silty Sand
			SC	Clayey Sand
Fine-Grained Soils > 50% passes #200 sieve	Silt and Clay Liquid Limit < 50		ML	Silt
			CL	Lean Clay
			OL	Organic Silt and Clay (Low Plasticity)
	Silt and Clay Liquid Limit > 50		MH	Inorganic Silt
			CH	Inorganic Clay
			OH	Organic Clay and Silt (Med. to High Plasticity)
Highly Organic Soils			PT	Peat

Relative Density with Respect to SPT N-Value			
Coarse-Grained Soils		Fine-Grained Soils	
Density	N-Value (Blows/Ft)	Density	N-Value (Blows/Ft)
Very Loose	0 - 4	Very Soft	0 - 1
Loose	5 -10	Soft	2 - 4
Medium Dense	11 - 30	Medium Stiff	5 - 8
Dense	31 - 50	Stiff	9 - 15
Very Dense	> 50	Very Stiff	16 - 30
		Hard	> 30

Krazan & ASSOCIATES, INC.

HPES Portable Building Installation

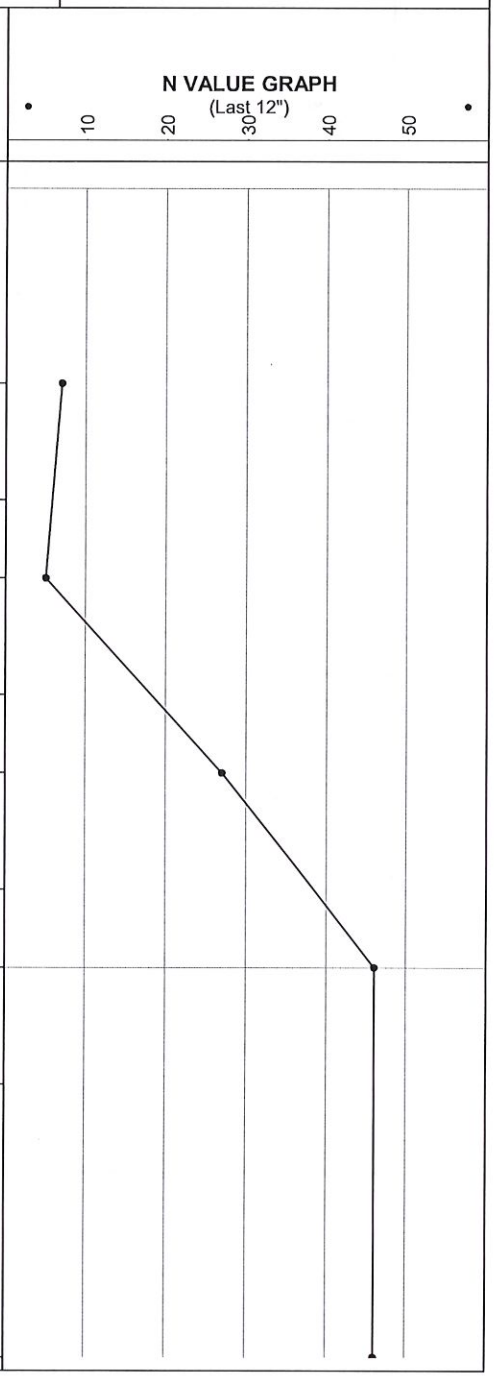
Date: May 2020	References: USCS	
Drawn By: VC		Project Number: 102-20013

Krazan & Associates, Inc.

LOG OF BORING No. B1

Date Drilled: 3/28/20	Project: HPES New Portable Installation	Notes:
Location: Poulsbo, WA	Ground Elevation: N/A	Logged By: CB
Hammer Type: Manual ☑ Automatic ☐ Other ☐		
Water Level: N/A	Drilling Method: HSA	

Depth (ft)	MATERIAL DESCRIPTION	Sample No. /Type	1st 6"	2nd 6"	3rd 6"	N Value
0	Ground Surface Asphalt					
1	Brown-gray silty sand with trace gravel (loose, moist) (undocumented fill)					
3		S-1	3	3	4	7
4	-Organics and debris noted at 5.0 feet					
6		S-2	4	3	2	5
8	Gray-brown silty sand with gravel (medium dense to dense, moist)	S-3	6	12	15	27
10	-Soil becomes more gravelly and dense at 10.0 feet	S-4	17	19	27	46
15						



LEGEND

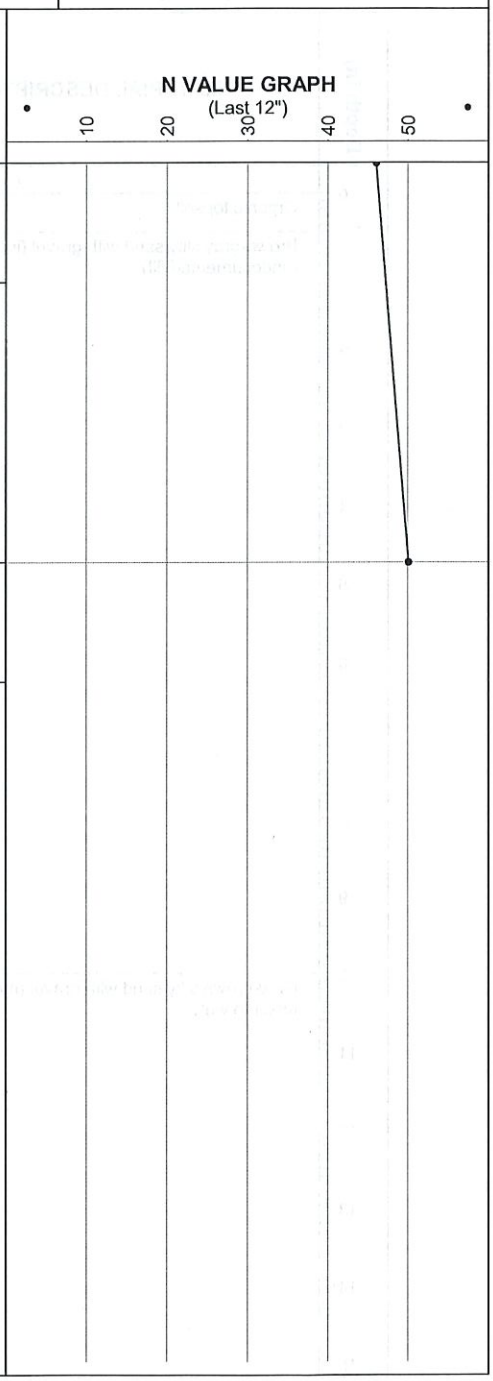
SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings-	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	D C - Driving Casing	

Krazan & Associates, Inc.

LOG OF BORING No. B1

Date Drilled: 3/28/20	Project: HPES New Portable Installation	Notes:
Location: Poulsbo, WA	Ground Elevation: N/A	Logged By: CB
Hammer Type: Manual ☑ Automatic ☐ Other ☐		
Water Level: N/A	Drilling Method: HSA	

Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample No. /Type	1st 6"	2nd 6"	3rd 6"	N Value
16	Gray-brown silty sand with gravel (medium dense to dense, moist)		S-5	14	24	22	46
17							
18							
19							
20	Gray-brown silty gravel with sand (very dense, moist)		S-6	16	50/6"	-	50+
21							
22	End of Exploratory Boring						
23							
24							
25							
26							
27							
28							
29							
30							



LEGEND

SAMPLER TYPE

- SS - Split Spoon
- ST - Shelby Tube
- AWG - Rock Core, 1-1/8"
- NQ - Rock Core, 1-7/8"
- CU - Cuttings-
- CT - Continuous Tube

DRILLING METHOD

- HSA - Hollow Stem Auger
- CFA - Continuous Flight Augers
- D C - Driving Casing
- RW - Rotary Wash
- RC - Rock Core

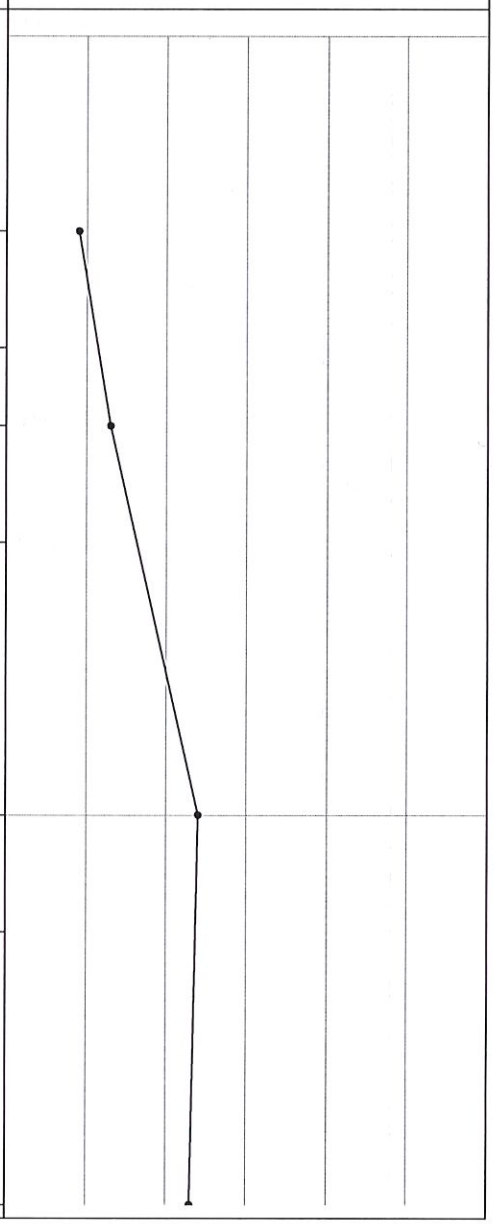
Krazan & Associates, Inc.

LOG OF BORING No. B2

Date Drilled: 3/28/20	Project: HPES New Portable Installation	Notes:
Location: Poulsbo, WA	Ground Elevation: N/A	Logged By: CB
Hammer Type: Manual ☑ Automatic ☐ Other ☐		
Water Level: 15.0 feet	Drilling Method: HSA	

Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample No. /Type	1st 6"	2nd 6"	3rd 6"	N Value
0	Ground Surface						
	Organic topsoil						
	Brown-gray silty sand with gravel (loose, moist) (undocumented fill)						
3			S-1/SS	3	4	5	9
6			S-2/SS	3	4	9	9
10	Gray-brown silty sand with gravel (medium dense, moist to wet)						
11			S-3/SS	13	13	11	24

N VALUE GRAPH (Last 12")



LEGEND

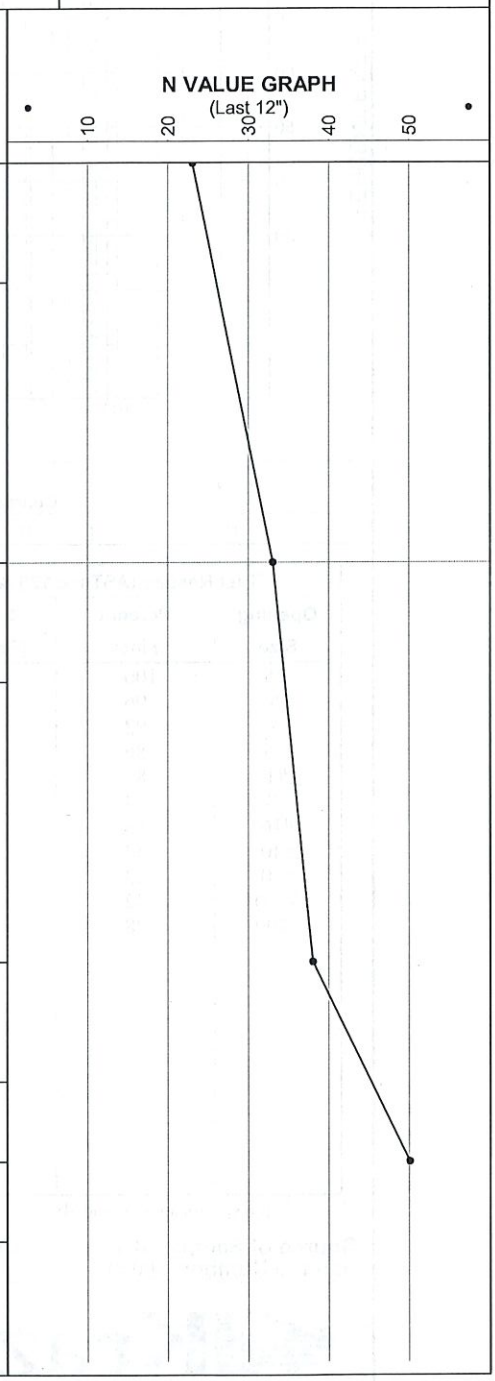
SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings-	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	D C - Driving Casing	

Krazan & Associates, Inc.

LOG OF BORING No. B2

Date Drilled: 3/28/20	Project: HPES New Portable Installation	Notes:
Location: Poulsbo, WA	Ground Elevation: N/A	Logged By: CB
Hammer Type: Manual ☑ Automatic ☐ Other ☐		
Water Level: 15.0 feet	Drilling Method: HSA	

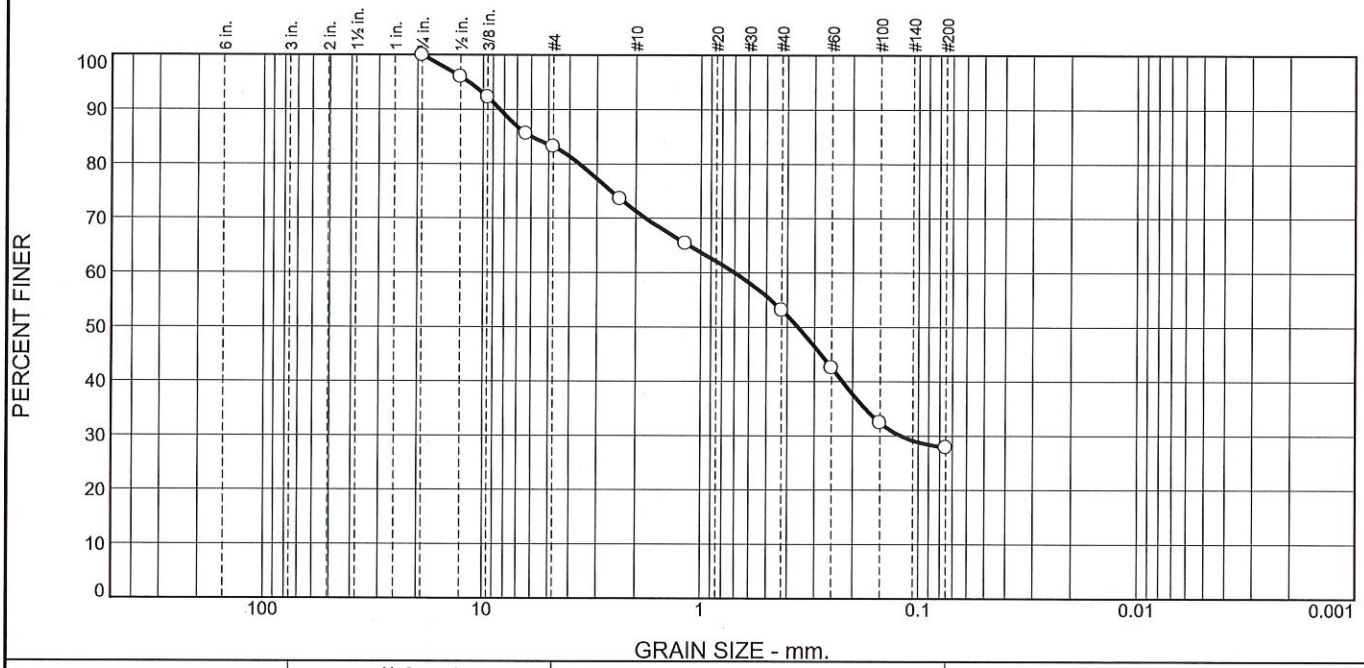
Depth (ft)	MATERIAL DESCRIPTION	Graphic Log	Sample No. /Type	1st 6"	2nd 6"	3rd 6"	N Value
	Gray-brown sandy silt (very stiff to hard, wet)						
16			S-4/SS	6	10	13	23
17							
18							
19							
20	-Soil becomes hard at 20.0 feet						
21			S-5/SS	12	14	19	33
22							
23							
24							
25	Gray silty sand with gravel (very dense, moist)						
26			S-6/SS	13	19	19	38
27							
28			S-7/SS	19	50/5"	-	50+
	End of Exploratory Boring						
29							
30							



LEGEND

SAMPLER TYPE		DRILLING METHOD	
SS - Split Spoon	NQ - Rock Core, 1-7/8"	HSA - Hollow Stem Auger	RW - Rotary Wash
ST - Shelby Tube	CU - Cuttings-	CFA - Continuous Flight Augers	RC - Rock Core
AWG - Rock Core, 1-1/8"	CT - Continuous Tube	D C - Driving Casing	

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	17	12	18	25	28	

Test Results (ASTm c 136 & ASTM C 117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.75	100		
.5	96		
.375	92		
.25	86		
#4	83		
#8	74		
#16	65		
#40	53		
#60	43		
#100	32		
#200	28		

* (no specification provided)

Material Description

Silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 8.3791 D_{85}= 6.0237 D_{60}= 0.7025
D_{50}= 0.3580 D_{30}= 0.1208 D_{15}=
D_{10}= C_u= C_c=

Remarks

Source: B-1, S-4 @ 11.5'
Sampled By: Chloe Bartlet

Date Received: 4/6/20 **Date Tested:** 4/8/20
Tested By: Aaron Clyde
Checked By: Aaron Clyde
Title: Laboratory Manager

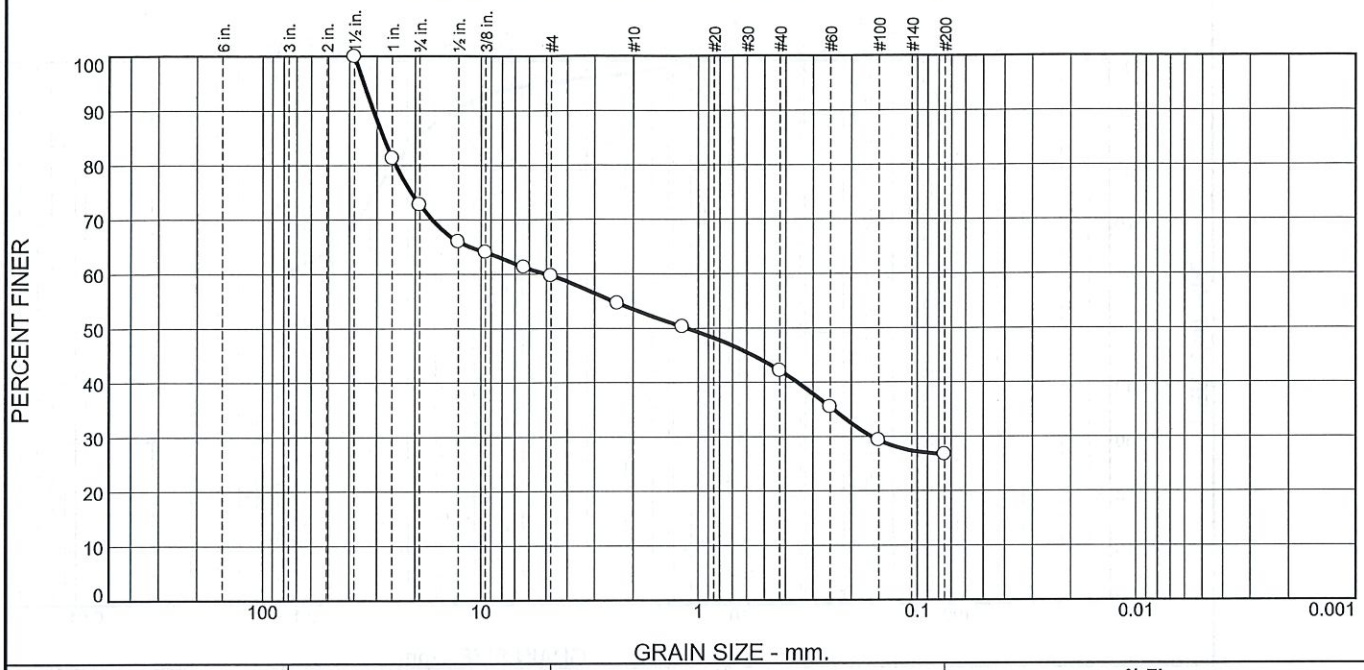
Source of Sample: B-1 **Depth:** 11.5' **Date Sampled:** 3/28/20
Sample Number: S0090

Krazan

Client: Art Anderson
Project: Hilder Pearson School New Portable Installation
Project No: 10220013 **Figure**

Checked By: _____

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	27	13	7	11	15	27	

Test Results (ASTM C 136 & ASTM C 117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1.5	100		
1	81		
.75	73		
.5	66		
.375	64		
.25	61		
#4	60		
#8	55		
#16	50		
#40	42		
#60	35		
#100	29		
#200	27		

* (no specification provided)

Material Description

Silty gravel with sand

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= GM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 31.1345 D_{85}= 27.8743 D_{60}= 5.0279
D_{50}= 1.1306 D_{30}= 0.1619 D_{15}=
D_{10}= C_u= C_c=

Remarks

Source: Native B-1, S-6, @ 21-5'
Sampled By: Chloe Bartlet

Date Received: 4/6/20 **Date Tested:** 4/6/20
Tested By: Aaron Clyde
Checked By: Aaron Clyde
Title: Laboratory Manager

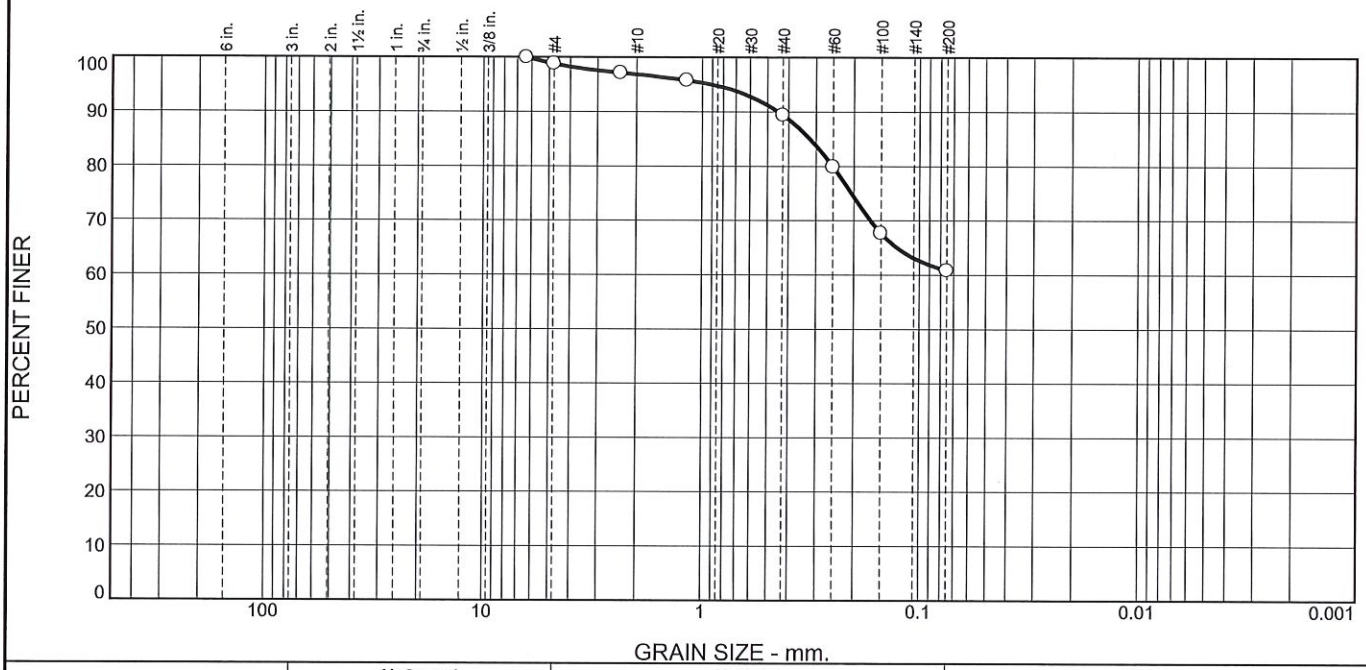
Source of Sample: B-1 **Depth:** 21.5' **Date Sampled:** 3/28/20
Sample Number: S0091

Krazan

Client: Art Anderson
Project: Hilder Pearson School New Portable Installation
Project No: 10220013 **Figure**

Checked By: _____

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	1	2	8	28	61	

TEST RESULTS

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1/4	100		
#4	99		
#8	97		
#16	96		
#40	89		
#60	80		
#100	68		
#200	61		

* (no specification provided)

Material Description

Sandy silt

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= ML AASHTO (M 145)= A-4(0)

Coefficients

D_{90}= 0.4473 D_{85}= 0.3202 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Source: Native, B-2, S-5 @ 21.5'
Sampled by: Chloe Bartlett

Date Received: 4/6/20 **Date Tested:** 4/8/20
Tested By: Aaron Clyde
Checked By: Elizabeth Basler
Title: Staff Engineer

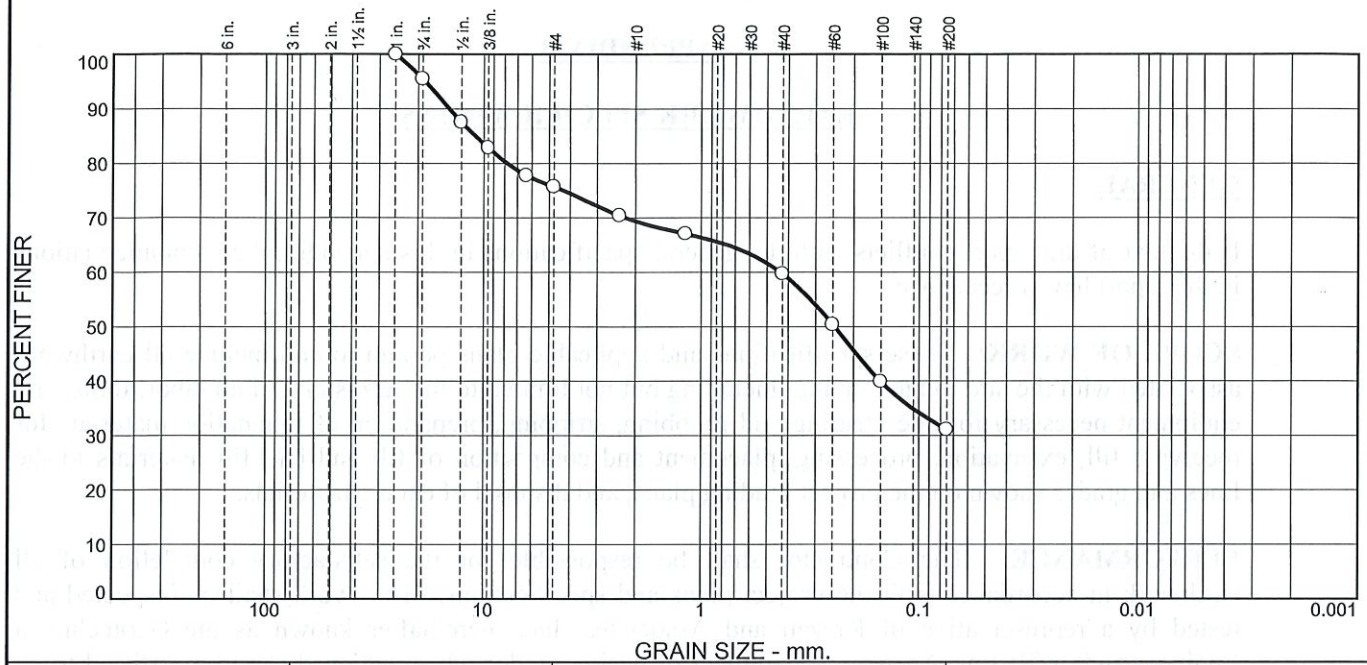
Source of Sample: B-2 **Depth:** 21.5' **Date Sampled:** 3/28/20
Sample Number: S0092

Krazan

Client: Art Anderson
Project: Hilder Pearson School New Portable Installation
Project No: 10220013 **Figure**

Checked By: _____

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	5	19	7	9	29	31	

Test Results (ASTM C 136 & ASTM C 117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1	100		
.75	95		
.5	88		
.375	83		
.25	78		
#4	76		
#8	70		
#16	67		
#40	60		
#60	50		
#100	40		
#200	31		

* (no specification provided)

Material Description

Silty sand with gravel

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 14.4420 D_{85}= 10.9722 D_{60}= 0.4364
D_{50}= 0.2459 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Source: Native B-2, S-7 @ 29-0'
Sampled By: Chloe Bartlet

Date Received: 4/6/20 **Date Tested:** 4/8/20
Tested By: Aaron Clyde
Checked By: Aaron Clyde
Title: Laboratory Manager

Source of Sample: B-2 **Depth:** 29.0' **Date Sampled:** 3/28/20
Sample Number: S0093

Krazan

Client: Art Anderson
Project: Hilder Pearson School New Portable Installation
Project No: 10220013 **Figure**

Checked By: _____

APPENDIX B

EARTHWORK SPECIFICATIONS

GENERAL

If the text of the report conflicts with the general specifications in this appendix, the recommendations in the report have precedence.

SCOPE OF WORK: These specifications and applicable plans pertain to and include all earthwork associated with the site rough grading, including but not limited to the furnishing of all labor, tools, and equipment necessary for site clearing and grubbing, stripping, preparation of foundation materials for receiving fill, excavation, processing, placement and compaction of fill and backfill materials to the lines and grades shown on the project grading plans, and disposal of excess materials.

PERFORMANCE: The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications. This work shall be inspected and tested by a representative of Krazan and Associates, Inc., hereinafter known as the Geotechnical Engineer and/or Testing Agency. Attainment of design grades when achieved shall be certified to by the project Civil Engineer. Both the Geotechnical Engineer and Civil Engineer are the Owner's representatives. If the contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory as determined by both the Geotechnical Engineer and Civil Engineer. No deviation from these specifications shall be made except upon written approval of the Geotechnical Engineer, Civil Engineer or project Architect.

No earthwork shall be performed without the physical presence or approval of the Geotechnical Engineer. The Contractor shall notify the Geotechnical Engineer at least 2 working days prior to the commencement of any aspect of the site earthwork.

The Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the Owner and the Engineers harmless from any and all liability, real or alleged, in connection with the performance of work on this project, except for liability arising from the sole negligence of the Owner of the Engineers.

TECHNICAL REQUIREMENTS: All compacted materials shall be densified to a density not less than 95 percent of maximum dry density as determined by ASTM Test Method D1557 as specified in the technical portion of the Geotechnical Engineering Report. The results of these tests and compliance with these specifications shall be the basis upon which satisfactory completion of work will be judged by the Geotechnical Engineer.

SOIL AND FOUNDATION CONDITIONS: The Contractor is presumed to have visited the site and to have familiarized himself with existing site conditions and the contents of the data presented in the soil report.

The Contractor shall make his own interpretation of the data contained in said report, and the Contractor shall not be relieved of liability under the contractor for any loss sustained as a result of any variance between conditions indicated by or deduced from said report and the actual conditions encountered during the progress of the work.

DUST CONTROL: The work includes dust control as required for the alleviation or prevention of any dust nuisance on or about the site or the borrow area, or off-site if caused by the Contractor's operation either during the performance of the earthwork or resulting from the conditions in which the Contractor leaves the site. The Contractor shall assume all liability, including Court costs of codefendants, for all claims related to dust or windblown materials attributable to his work.

SITE PREPARATION

Site preparation shall consist of site clearing and grabbing and preparations of foundation materials for receiving fill.

CLEARING AND GRUBBING: The Contractor shall accept the site in this present condition and shall demolish and/or remove from the area of designated project, earthwork all structures, both surface and subsurface, trees, brush, roots, debris, organic matter, and all other matter determined by the Geotechnical Engineer to be deleterious. Such materials shall become the property of the Contractor and shall be removed from the site.

Tree root systems in proposed building areas should be removed to a minimum depth of 3 feet and to such an extent which would permit removal of all roots larger than 1 inch. Tree root removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill or tree root excavation should not be permitted until all exposed surfaces have been inspected and the Geotechnical Engineer is present for the proper control of backfill placement and compaction. Burning in areas, which are to receive fill materials, shall not be permitted.

SUBGRADE PREPARATION: Surfaces to receive Structural fill shall be prepared as outlined above, excavated/scarified to a depth of 12 inches, moisture-conditioned as necessary, and compacted to 95 percent compaction.

Loose and/or areas of disturbed soils shall be moisture conditioned and compacted to 95 percent compaction. All ruts, hummocks, or other uneven surface features shall be removed by surface grading prior to placement of any fill material. All areas which are to receive fill materials shall be approved by the Geotechnical Engineer prior to the placement of any of the fill material.

EXCAVATION: All excavation shall be accomplished to the tolerance normally defined by the Civil Engineer as shown on the project grading plans. All over excavation below the grades specified shall be backfilled at the Contractor's expense and shall be compacted in accordance with the applicable technical requirements.

FILL AND BACKFILL MATERIAL: No material shall be moved or compacted without the presence of the Geotechnical Engineer. Material from the required site excavation may be utilized for construction site fills provided prior approval is given by the Geotechnical Engineer. All materials utilized for constructing site fills shall be free from vegetable or other deleterious matter as determined by the Geotechnical Engineer.

PLACEMENT, SPREADING AND COMPACTION: The placement and spreading of approved fill materials and the processing and compaction of approved fill and native materials shall be the responsibility of the Contractor. However, compaction of fill materials by flooding, ponding, or jetting shall not be permitted unless specifically approved by local code, as well as the Geotechnical Engineer.

Both cut and fill shall be surface compacted to the satisfaction of the Geotechnical Engineer prior to final acceptance.

SEASONAL LIMITS: No fill material shall be placed, spread, or rolled while it is frozen or thawing or during unfavorable wet weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until the Geotechnical Engineer indicates that the moisture content and density of previously placed fill are as specified.

APPENDIX C

PAVEMENT SPECIFICATIONS

1. DEFINITIONS – The term "pavement" shall include asphalt concrete surfacing, untreated aggregate base, and aggregate subbase. The term "subgrade" is that portion of the area on which surfacing, base, or subbase is to be placed.

2. SCOPE OF WORK – This portion of the work shall include all labor, materials, tools and equipment necessary for and reasonable incidental to the completion of the pavement shown on the plans and as herein specified, except work specifically noted as "Work Not Included."

3. PREPARATION OF THE SUBGRADE – The Contractor shall prepare the surface of the various subgrades receiving subsequent pavement courses to the lines, grades, and dimensions given on the plans and as per the pavement design section of this report. The upper 12 inches of the soil subgrade beneath the pavement section shall be compacted to a minimum compaction of 95% of maximum dry density as determined by test method ASTM D1557. The finished subgrades shall be tested and approved by the Geotechnical Engineer prior to the placement of additional pavement of additional pavement courses.

4. AGGREGATE BASE – The aggregate base shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate base should conform to WSDOT Standard Specification for Crushed Surfacing Base Course or Top Course (Item 9-03.9(3)). The base material shall be compacted to a minimum compaction of 95% as determined by ASTM D1557. Each layer of subbase shall be tested and approved by the Geotechnical Engineer prior to the placement of successive layers.

5. ASPHALTIC CONCRETE SURFACING – Asphaltic concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at central mixing plant and spread and compacted on a prepared base in conformity with the lines, grades, and dimensions shown on the plans. The drying, proportioning, and mixing of the materials shall conform to WSDOT Specifications.

The prime coat, spreading and compacting equipment, and spreading and compacting the mixture shall conform to WSDOT Specifications, with the exception that no surface course shall be placed when the atmospheric temperature is below 50 degrees F. The surfacing shall be rolled with combination steel-wheel and pneumatic rollers, as described in WSDOT Specifications. The surface course shall be placed with an approved self-propelled mechanical spreading and finishing machine.

6. TACK COAT – The tack (mixing type asphaltic emulsion) shall conform to and be applied in accordance with the requirements of WSDOT Specifications.