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Krazan & ASSOCIATES, INC.

GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

April 11, 2019

KA Project No. 062-19005

Abbey Road Group Land Development Services Company, LLC
PO Box 1224
Puyallup, Washington 98371

Attn: Mr. Gil Hulsmann

Email: Gil.Hulsmann@AbbeyRoadGroup.com
Tel: (253) 435-3699 (ext. 101)

Reference: **Geotechnical Engineering Investigation**
East Town Crossing
Parcel Nos. 0420264053, 0420264054, 0420351066
SE Corner of E. Shaw Road and E. Pioneer Way
Puyallup, Washington 98371

Dear Mr. Hulsmann,

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.

Theresa R. Nunan

Theresa R. Nunan
Project Engineer

TRN:MR

City of Puyallup
Development & Permitting Services
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic

City of Puyallup
Building
REVIEWED FOR COMPLIANCE
BSnowden
08/29/2024
7:25:17 AM

Full-Sized legible color report is required to be provided by the Permittee on site for all Inspections

GEOTECHNICAL ENGINEERING INVESTIGATION
EAST TOWN CROSSING
PARCEL NOS. 0420264053, 0420264054, 0420351066
SE CORNER OF E. SHAW ROAD & E. PIONEER WAY
PUYALLUP, WASHINGTON

PROJECT NO. 062-19005
APRIL 11, 2019

Prepared for:

ABBEY ROAD GROUP LAND DEVELOPMENT SERVICES COMPANY, LLC
ATTN: MR. GIL HULSMANN
PO BOX 1224
PUYALLUP, WA 98371

Prepared by:

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SE CORNER OF EAST SHAW ROAD AND EAST PIONEER WAY
PUYALLUP, WASHINGTON

INTRODUCTION

This report presents the results of our Geotechnical Engineering Investigation for the proposed East Town Crossing project located near the southeast corner of East Shaw Road and East Pioneer Way in Puyallup, 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, drainage and landscaping, erosion control, foundations, concrete floor slabs and exterior flatwork, lateral earth pressures, and pavement.

A Site Plan showing the approximate exploratory boring and monitoring well 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, exploratory boring logs, and the laboratory testing results. 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 January 25, 2019 (Proposal Number G19001WAT) and included the following:

- Exploration of the subsurface soil and groundwater conditions by conducting approximately three (3) geotechnical borings and installing two (2) groundwater level monitoring wells using a subcontracted drill rig;
- Provide a site plan showing the geotechnical boring and monitoring well locations;

- Provide comprehensive boring and monitoring well logs, including soil stratification and classification, and groundwater levels where applicable;
- Recommended foundation type for the proposed structures;
- Allowable foundation bearing pressure, anticipated settlements (both total and differential), coefficient of horizontal friction for footing design, and frost penetration depth;
- Recommendations for seismic design considerations including site coefficient and ground acceleration based on the 2015 IBC;
- Recommendations for structural fill materials, placement, and compaction;
- Recommendations for suitability of on-site soils as structural fill;
- Recommendations for temporary excavations;
- Recommendations for site drainage and erosion control;
- Recommendations for flexible and rigid pavements, as well as permeable pavement.

PROPOSED CONSTRUCTION

Based on the Overall Site Plan prepared by Abbey Road Group Land Development Services, dated December 12, 2018, we understand that the proposed development will include construction of six residential structures (designated Buildings A through E) and a club house/office building. Site drainage systems will include a subsurface stormwater system located in the southern portion of the property, and a rain garden along the northern and eastern edges of the site. We have not been provided with details regarding construction of the subsurface stormwater system. The planned development will also include utility installation, and paved parking areas and driveways. For the purpose of our analyses, we have assumed that the residential buildings and club house will be 1- to 2-story structures with a slab-on-grade floor system. We have also assumed only minor grading up to 1 foot of cut or fill will be required to establish planned elevations for the site.

SITE LOCATION AND DESCRIPTION

The site consists of three undeveloped parcels encompassing approximately 7 acres of land located south and east of the intersection of Shaw Road with East Pioneer Way. The site is bordered to the north by East Pioneer Way, to the south by commercial property, to the east by undeveloped land and a creek, and to the west by undeveloped land and abandoned residences. The site is roughly rectangular in shape and relatively level at approximately Elevation 72 to 74 feet. A dirt road runs north-south through the center of the site, and also extends from the center of the site westward towards Shaw Road. An existing storm pond is located in the southeast corner of the site, with the bottom at Elevation 69 feet. A wetland that has been field verified by others is located within the western central edge of the site. A creek runs along the eastern boundary of the site.

Most of the property is covered with seasonal vegetation, brambles, and a few trees located within the central portion of the site. Some trash and an abandoned trailer are located in the north central portion of the site. The southern portion of the site is currently being used by the adjacent business for container storage.

We understand that past construction activities for the undeveloped parcel to the west of the site that borders Shaw Road and East Pioneer Way consisted of the placement of fill material to raise the existing grades, based on the Geotechnical Evaluation and Additional Recommendations report prepared by Krazan & Associates, dated March 13, 2007. Those fill activities did not extend into this site.

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 and 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 Washington Division of Geology and Earth Resources, Geologic Map of the South Half of the Tacoma Quadrangle, Washington (Open File Report 87-3) indicates that the property is located in an area that is predominantly underlain by recent alluvium deposited by the Puyallup River. The recent alluvium consists of interbedded silt, sandy silt, silty sand, sand, gravel, local areas of peat and clay. The finer material represents overbank material and local lacustrine deposits, and the coarser materials most likely represent deposits in abandoned channels of the Puyallup River.

FIELD INVESTIGATION

A field investigation consisting of three (3) exploratory soil borings and installation of two (2) monitoring wells was completed to evaluate the subsurface soil and groundwater conditions at the project location. The soil borings were completed on March 11, 2019 by a Krazan subcontractor utilizing a hollow stem auger drill rig. The soil borings were advanced to depths ranging from 21.5 to 38.5 feet below the existing ground surface (bgs). A geotechnical engineer from Krazan and Associates was present during the explorations, examined the soils and geologic conditions encountered, obtained samples of the different soil types, and maintained logs of the explorations.

Representative samples of the subsurface soils encountered in the borings were collected and sealed in plastic bags. These samples were transported to our laboratory for further examination and testing. The soils encountered in the exploratory borings were continuously examined and visually classified in accordance with the Unified Soil Classification System (USCS).

SOIL PROFILE AND SUBSURFACE CONDITIONS

The geotechnical subsurface exploration for this project consisted of soil borings and monitoring wells advanced to depths of approximately 21.5 to 38.5 feet bgs. The locations of the soil borings and monitoring wells are shown on the Site Plan in Figure 2.

Beneath 5 to 8 inches of surficial topsoil, the borings encountered alluvial soils to their explored depths. The topsoil was underlain by 4.5 to 7 feet of brown silty sand (SM) and poorly graded sand (SP) with relative densities in the loose to medium dense range. The sand soils were underlain by a 3-foot thick stratum of interbedded sandy silt (ML) that exhibited medium stiff to stiff consistencies and silty sand (SM) soils with relative densities in the loose to medium dense range.

Boring B-1 encountered a layer of silty clay and clayey silt beneath the sandy silt and silty sands from 7.5 to 11.0 feet bgs. The silty clay (CL) and clayey silt (ML) exhibited a very soft consistency with a Standard Penetration Test (SPT) resistance (N-value) of 1/12 inches and a moisture content of 51 percent.

The clayey silt in boring B-1 and the silty sand/sandy silt stratum in borings B-2 and B-3 were underlain by silty sand, sand, and gravel soils with varying silt contents to the termination depths of 21.5, 38.5, and 21.5 feet bgs, respectively. These granular soils exhibited relative densities in the loose to very dense range with N-values ranging from 8 to 60/8" blows per foot.

Gradation and Atterberg Limits tests were conducted on representative samples of the soils for classification purposes and for determination of engineering properties. The gradation and Atterberg Limits results are graphically depicted in Appendix A. For additional information about the soils encountered, please refer to the boring logs in Appendix A.

Monitoring Wells: Two monitoring wells, designated W-1 and W-2, were installed at the site on March 11, 2019 using a subcontracted driller and track mounted drill rig. Monitoring well W-1 was installed within borehole B-1. The boreholes for monitoring wells W-1 and W-2 were advanced to a depth of 21.5 feet and 20 feet below the existing ground surface, respectively, using 4¼-inch diameter hollow stem augers. A 10-foot long section of slotted PVC pipe attached to a 10-foot section of solid PVC pipe was inserted into the borehole, and the annular space between the pipe and the augers was backfilled with filter sand to a depth of 8 feet bgs followed by bentonite chips to the ground surface. A metal well cap was then installed over the pipe and cemented in-place to protect the well from unauthorized access. The installation log for monitoring wells W-1 and W-2 are included in Appendix A.

GROUNDWATER

Groundwater was encountered during the drilling operations at a depth of about 7 to 8 feet below the existing ground surface. It should be recognized that groundwater elevations may fluctuate with time. The groundwater level will be dependent upon seasonal precipitation, irrigation, land use, climatic conditions, as well as other factors. Therefore, water 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 Services (NRCS) map for Pierce County Area, Washington, classifies the site area as Briscot loam. The NRCS classifies the Briscot loam as Hydrologic Soil Group B/D with low potential for erosion in a disturbed state.

It has been our experience that soil erosion 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, i.e., 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.

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 borings on this site extended to a maximum depth of 38.5 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 U.S. Geological Survey (USGS) Earthquake Hazards Program Website and 2012/2015 IBC to obtain values for S_S, S_{MS}, S_{DS}, S_1, S_{M1}, S_{D1}, F_a, and F_v. The USGS website includes the most updated published data on seismic conditions. The seismic design parameters for this site are as follows:

Seismic Design Parameters
(Reference: 2015 IBC Section 1613.3.2, ASCE, and USGS)

Seismic Item	Value
Site Coefficient F_a	1.003
S_s	1.243 g
S_{MS}	1.247 g
S_{DS}	0.831 g
Site Coefficient F_v	1.524
S_1	0.476 g
S_{M1}	0.726 g
S_{D1}	0.484 g

Additional seismic considerations include liquefaction potential and amplification of ground motions by loose/soft soil deposits. The liquefaction potential is highest for loose sand with a high groundwater table. Soil liquefaction is a state where soil particles lose contact with each other and become suspended in a viscous fluid. This suspension of the soil grains results in a complete loss of strength as the effective stress drops to zero. Liquefaction normally occurs under saturated conditions in soils such as sand in which the strength is purely frictional. However, liquefaction has occurred in soils other than clean sand. Liquefaction usually occurs under vibratory conditions such as those induced by seismic events.

We have reviewed "Liquefaction Susceptibility Map of Pierce County, Washington" by Stephen P. Palmer et al., (WA DNR, 2004). The map indicates that the site area is located in a zone of high liquefaction susceptibility. At the request of our client, we have conducted a site-specific liquefaction analysis for this project.

To evaluate the liquefaction potential of the site, we analyzed the following factors:

1) Soil type
2) Groundwater depth
3) Relative soil density
4) Initial confining pressure
5) Maximum anticipated intensity and duration of ground shaking

Liquefaction Analysis: The commercially available liquefaction analysis software, LiquefyPro from CivilTech, was used to evaluate the liquefaction potential and the possible liquefaction induced settlement for the site soil and groundwater conditions based on our explorations. The analysis was performed using the information from the soil test boring and laboratory gradation analyses. Maximum

Considered Earthquake (MCE) was selected in accordance with the 2015 International Building Code (IBC) Chapter 16 and the U.S. Geological Survey (USGS) Earthquake Hazards Program website. For this analysis, a maximum earthquake magnitude of 7.11 and peak horizontal ground surface acceleration of 0.5g were used. Our analysis assumed a groundwater depth of 7.0 feet during the earthquake.

The maximum liquefaction induced settlement for this type of seismic event is estimated to be on the order of about 2 inches. The differential settlements are estimated to be on the order of about 1-inch.

CONCLUSIONS AND RECOMMENDATIONS

General

It is our opinion that the planned improvements at this site are feasible, provided that the geotechnical engineering recommendations presented in this report are included in the project design. Based on our explorations, it is our opinion that conventional spread foundations supported on medium dense/stiff or firmer native soil, or on structural fill extending to the medium dense/stiff or firmer native soil would be appropriate for the new buildings.

We recommend that organic topsoil, undocumented fill, and loose/soft soils be stripped to expose the underlying medium dense/stiff or firmer native soil. Footings should extend through any organic or loose soil and be founded on the underlying medium dense or firmer native soil, or structural fill extending to the competent native soils.

Exploration boring B-1 was drilled in the northern portion of the site, in the area of the planned rain garden between Pioneer Way and the Club House and Residential Building E. Boring B-1 encountered a layer of very soft silty clay between 7.5 and 11 feet below the existing ground surface. These materials are not considered suitable to support foundations and will need to be removed where they are encountered. Test pits should be conducted prior to the construction phase to determine the aerial extent (i.e. lateral extent and depth) of this very soft clay layer. If the additional test pit exploration reveals that the soft clay layer extends into the footprint of the Clubhouse or Residential Building E, or any of the other structures, additional foundation recommendations will be necessary to address the effect of the very soft clays. If the very soft clay is encountered in building areas, a deep foundation system may be required for support of the structure(s).

Borings B-2 and B-3 (drilled within the eastern and southern portions of the site) and monitoring well W-2 (installed within the central portion of the site) encountered medium dense/stiff native soils at depths of approximately 5 and 7 feet bgs, respectively; however, deeper layers of loose/soft soils may be encountered in unexplored areas of the site.

The soils encountered on this site are considered moisture-sensitive and will be easily disturbed and difficult to compact when wet. We recommend that construction take place during the drier summer months, if possible. If construction is to take place during wet weather, additional expenses and delays should be expected due to the wet conditions. Additional expenses could include the need for placing a blanket of rock spalls to protect exposed subgrades and construction traffic areas.

Site Preparation

General site clearing should include removal of any undocumented fill, organics, asphaltic concrete, abandoned utilities, structures including foundations, basement walls and floors, rubble, and rubbish. After stripping operations and removal of any loose and/or debris-laden fill, the exposed subgrade should be visually inspected and/or proof rolled to identify any soft/loose areas. Additional recommendations for preparation of specific areas are provided in the **Foundations**, **Pavement Design** and **Exterior Flatwork** subsections of this report.

The soils that will be encountered during site development are considered extremely moisture-sensitive and may disturb easily in wet conditions. The prepared subgrade should be protected from construction traffic and surface water should be diverted around prepared subgrade. We recommend that the site be developed only during extended periods of dry weather.

During wet weather conditions, subgrade stability problems and grading difficulties may develop due to excess moisture, disturbance of sensitive soils and/or the presence of perched groundwater. Construction during the extended periods of wet weather could result in the need to remove wet disturbed soils if they cannot be suitably compacted due to elevated moisture contents. The onsite soils have significant silt content in the explored areas and are moisture sensitive, and can be easily disturbed when wet. 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. General project site winterization should consist of the placement of aggregate base and the protection of exposed soils during the construction phase. It should be understood that even if Best Management Practices (BMP's) for wintertime soil protection are implemented and followed there is a significant chance that moisture disturbed soil mitigation work will still be required.

Any buried structures encountered during construction should be properly removed and backfilled. Excavations, depressions, or soft and pliant areas extending below the planned finish subgrade levels should be excavated to expose firm undisturbed soil, and backfilled with structural fill. In general, any septic tanks, underground storage tanks, debris pits, cesspools, or similar structures should be completely removed. Concrete footings should be removed to an equivalent 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.

We understand that backfilling of the wetland in the central western edge of the site that has been field identified by others will be permitted for construction of the paved parking area and subsurface storm system. We also understand that proposed Residential Building C will be constructed within the area currently occupied by an existing storm pond. Our field explorations were not specifically conducted within either of these areas. Any organic, silt or clay soils, or accumulations of sediment, encountered within the wetland area or the existing storm pond should be removed down to firm undisturbed soil, and backfilled with structural fill to the planned finish grades.

A representative of our firm should be present during all site clearing and 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 onsite soils have variable cohesion strengths, therefore the safe angles to which these materials may be cut for temporary excavations is limited, as the soils may be prone to caving and slope failures in temporary excavations. Temporary excavations in the loose to medium dense native soils should be sloped no steeper than 2H:1V (horizontal to vertical) 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 reasoning 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, pavement, 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.

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 are generally considered suitable for re-use 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 use 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). All structural fill material should be submitted for approval to the geotechnical engineer at least 48 hours prior to delivery to the site.

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.

Foundations

Our exploratory borings encountered loose to medium dense granular soils underlain by a 3-foot thick stratum of interbedded sandy silt and silty sand, followed by loose to very dense granular alluvial soils to the explored depths. Boring B-1, drilled at the proposed rain garden area in the northern end of the site, encountered a 3.5-foot thick layer of very soft silty clay at a depth of 7.5 feet bgs.

The very soft clay encountered in Boring B-1 between 7.5 and 11 feet below the existing ground surface is not considered suitable to support foundations and will need to be removed where it is encountered.

Further exploration of this area with test pits should be conducted during the planning phase to determine the aerial extent (i.e. lateral extent and depth) of this very soft clay layer. If the additional test pit exploration reveals that the soft clay layer extends into the footprint of the Clubhouse or Residential Building E, or any of the other structures, additional foundation recommendations will be necessary to address the effect of the very soft clays. If the very soft clay is encountered in building areas, a deep foundation system may be required for support of the structure(s).

Borings B-2 and B-3 and monitoring well W-2, drilled within the eastern, southern, and central portions of the site, encountered medium dense/stiff native soils at depths of approximately 5 and 7 feet bgs; however, deeper layers of loose/soft soils may be encountered in unexplored areas of the site.

Pending the findings of further explorations in the northern portion of the site, the proposed structures may be supported on a shallow foundation system. Where loose/soft soils are encountered at the planned footing elevations, the subgrade should be over-excavated to expose suitable bearing soil. The foundation excavations should be evaluated by Krazan & Associates prior to structural fill placement to verify that the foundations will bear on suitable material.

Building foundations should extend at least 18 inches below the lowest adjacent finished ground surface for frost protection and bearing capacity considerations. Footing widths should be based on the anticipated loads and allowable soil bearing pressure, and should conform to current International Building Code (IBC) guidelines. Water should not be allowed to accumulate in foundation excavations. All loose or disturbed soil should be removed from the foundation excavation prior to placing concrete.

For foundations constructed as outlined above, we recommend an allowable design bearing capacity of 2,000 pounds per square foot (psf) may be used for foundation design for this project. A representative of Krazan and Associates should evaluate the foundation bearing soil prior to footing form construction.

Resistance to lateral footing displacement can be computed using an allowable friction factor of 0.35 acting between the bases of foundations and the supporting subgrade. Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 150 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. A 1/3 increase in the above values may be used for short duration wind and seismic loads.

For foundations constructed as recommended, the total static settlement is not expected to exceed 1-inch. Differential settlement, along a 20-foot exterior wall footing, or between adjoining column footings 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 become flooded or saturated. It should be noted that the estimated settlement provided herewith is a static settlement and does not include liquefaction induced settlement. Static settlement is induced by the applied dead load from the structures.

Up to 2 inches of total settlement and 1 inch of differential settlement could occur during and/or following a seismic event. The foundation elements, i.e. spread and wall footings, could be structurally tied together to create a stiffer structure. It should be noted that this measure would not mitigate the anticipated seismic settlement; however, it may reduce the damage associated with the anticipated seismic settlement, particularly the effects of differential settlement on a structure.

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.

Lateral Earth Pressures and Retaining Walls

We understand that a below grade stormwater vault is planned for this project. We have developed criteria for the design of retaining or below grade walls for the stormwater vault. Our design parameters are based on retention of the native soils. The parameters are also based on level, well-drained wall backfill conditions. Walls may be designed as "restrained" retaining walls based on "at-rest" earth pressures, plus any surcharge on top of the walls as described below, if the walls are braced to restrain movement and/or movement is not acceptable. Unrestrained walls may be designed based on "active" earth pressure, if the walls are not part of the buildings and some movement of the retaining walls is acceptable. Acceptable lateral movement equal to at least 0.2 percent of the wall height would warrant the use of "active" earth pressure values for design. We recommend that walls supporting horizontal backfill and not subjected to hydrostatic forces be designed using a triangular earth pressure distribution equivalent to that exerted by a fluid with a density of 38 pcf for yielding (active condition) walls, and 60 pcf for non-yielding (at-rest condition) walls.

The stated lateral earth pressures do not include the effects of hydrostatic pressure generated by water accumulation behind the retaining walls or loads imposed by construction equipment, foundations, back slopes or roadways (surcharge loads). Groundwater was encountered in each of the borings at 7 to 8 feet below the ground surface. Portions of the vault that will extend below the groundwater level will need to be designed to resist hydrostatic pressures and buoyant forces. Equivalent fluid densities for buoyant soil pressure under yielding conditions would be 20 pcf and 30 pcf for nonyielding conditions. The allowable buoyant passive pressure would be 100 pcf with a factor of safety of 2.0.

Floor Slabs and Exterior Flatwork

Before the placement of concrete floors or pavements on the site, or before any floor supporting fill is placed, the loose soils and undocumented fill must be removed to expose medium dense or firmer undisturbed native soil. The subgrade should then be proof-rolled to confirm that the subgrade contains no soft or deflecting areas. Areas of yielding soils should be excavated and backfilled with structural fill.

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 = 200 pounds per cubic inch (pci) for slabs supported on medium dense or firmer native soils or on structural fill extending to medium dense or firmer native soil.

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 angular 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 our 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

The soil borings were checked for the presence of groundwater during exploratory operations. Groundwater was encountered in all of our borings at approximately 7 to 8 feet bgs. 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

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 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

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.

All utility trench backfill should consist of suitable on-site material or imported granular material. 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.

Pavement Design

Based on our explorations, the near surface soils at the site are interpreted as loose to medium dense silty sand and sand soils to depths of approximately 4.5 to 7.0 feet bgs. Due to the loose nature of the anticipated pavement subgrade soils, we recommend that subgrade modification techniques be considered. Subgrade modification typically includes the over-excavation of unsuitable materials, the placement of a geotextile fabric at the bottom of the over-excavated area, and then the placement of structural fill, with the structural fill consisting of clean crushed rock, rock spalls, or Controlled Density Fill (CDF). We recommend the use of a high-strength geotextile separation fabric, such as Mirafi 600X or equivalent, for the geotextile. 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 over-excavation of the loose soil to at least 12 inches below the planned pavement subgrade elevation. The exposed grade after the over-excavation should be compacted to at least 95 percent of the maximum dry density as determined by ASTM Test Method D1557. We recommend that a high-strength geotextile separation fabric, such as Mirafi 600X or equivalent, then be placed over the compacted soil. After the fabric is placed, the area should be filled to the planned slab subgrade elevation with structural fill. The structural fill should be compacted to at least 95 percent of the maximum dry density as determined by ASTM Test Method D1557. In-place density tests should be performed to verify proper moisture content and adequate compaction.

In areas where the pavement subgrade soil consists of firm and unyielding native soils, a proof roll of the pavement subgrade soil may be performed in lieu of the compaction and in-place density tests. 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 this material becomes wet.

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 (delivery and fire trucks). Pavement design life of 20 years was assumed for our analysis. Recommendations for an asphaltic concrete flexible pavement section and Portland Cement Concrete (PCC) rigid pavement section are provided in Tables 1 and 2 below.

Table 1: ASPHALTIC CONCRETE (FLEXIBLE) PAVEMENT

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

Table 2: PORTLAND CEMENT CONCRETE (RIGID) PAVEMENT
4000 psi with FIBER MESH

Min. PCC Depth	Aggregate Base	Compacted Subgrade**
6.0 in.	4.0 in.	12.0 in.

** *A proof roll may be performed in lieu of in-place density tests*

The asphaltic concrete depth listed in Table 1 for the flexible pavement section should be a surface course type asphalt, such as Washington Department of Transportation (WSDOT) ½-inch Hot Mix Asphalt (HMA). The pavement specification in Appendix C provides additional recommendations, including aggregate base material.

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. We should also be present during the construction of stormwater management system to evaluate the soils. 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.

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 teams' 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.

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.

04/11/19

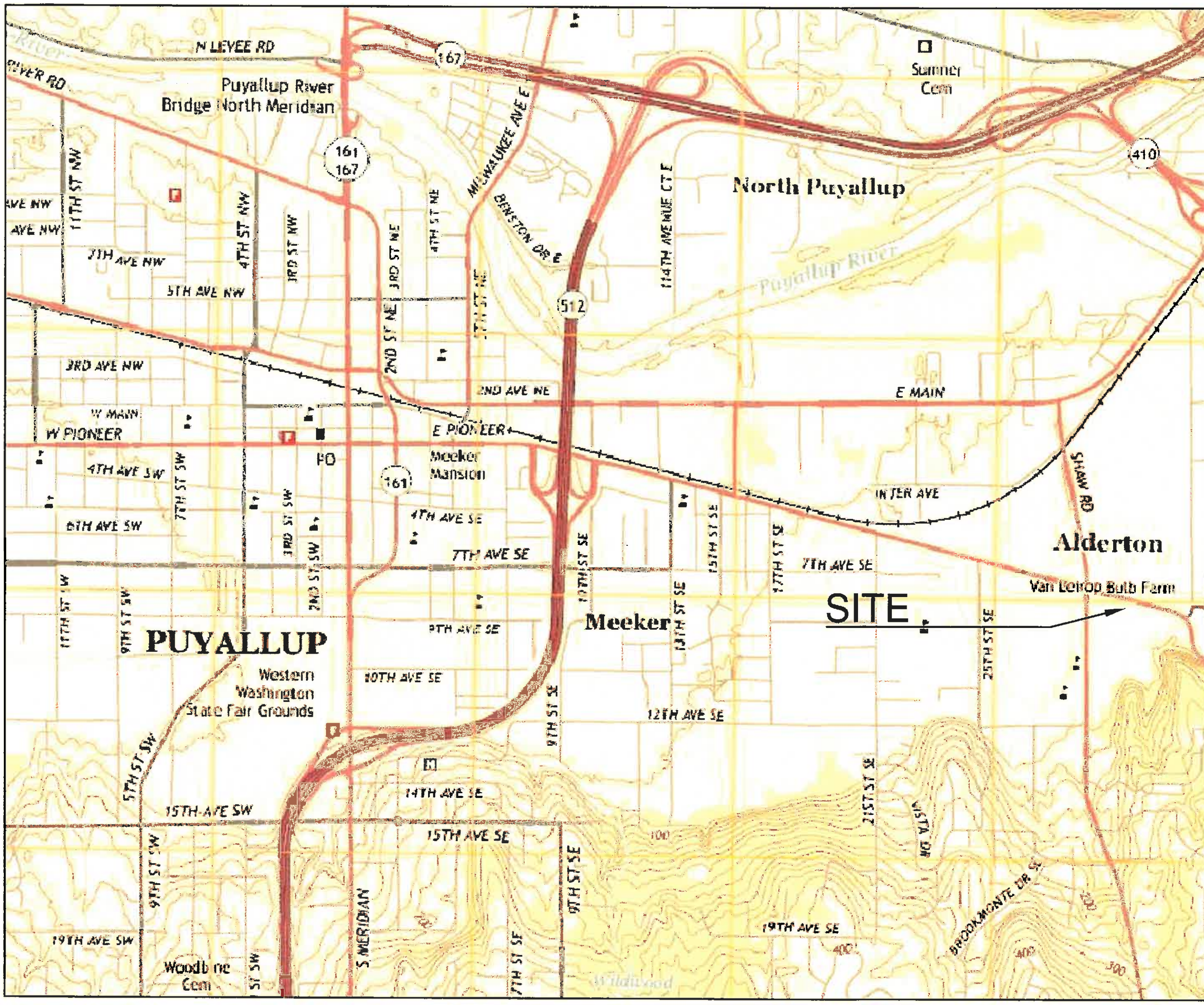
MICHAEL D. RUNDQUIST
STATE OF WASHINGTON
41415
REGISTERED
PROFESSIONAL ENGINEER

Theresa R. Nunan

Michael D. Rundquist, P.E.
Senior Project Manager

Theresa R. Nunan
Project Engineer

TRN:MDR



City of Puyallup
Development & Permitting Services
ISSUED PERMIT

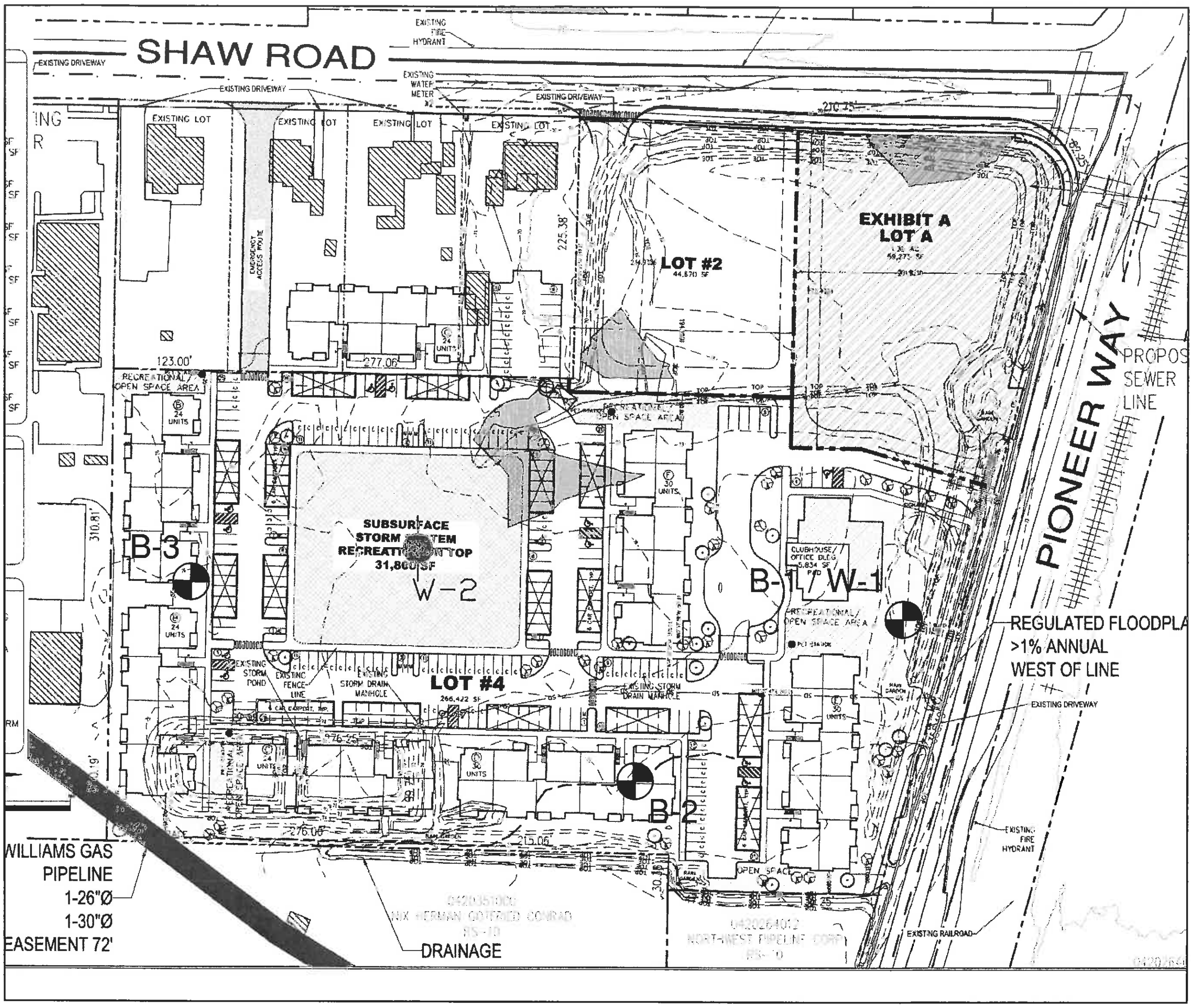
Building	Planning
Engineering	Public Works
Fire	Traffic

Reference: USGS topographic map website, Puyallup, WA, dated 2017.

N

Vicinity Map

East Town Crossing	Figure 1
Shaw Rd & E Pioneer Way, Puyallup, WA	
Project Number: 062-19007	Drawn By: T. Nunan Date: April 2019
Krazan & ASSOCIATES, INC.	Not to Scale



LEGEND

- B-1 Number and Approximate Location of Borings
- W-1 Approximate Location of Monitoring Well

City of Puyallup
Development & Permitting Services
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic

Reference: Plan Sheet titled "Overall Site Plan", prepared by Abbey Road Group dated December 7, 2018.

Site Plan

East Town Crossing

Shaw Rd & E Pioneer Way, Puyallup, WA

Project Number: 062-19007

Krazan & ASSOCIATES, INC.

Figure 2

Drawn By: T. Nunan

Date: April 2019

Not to Scale

APPENDIX A

FIELD INVESTIGATION AND LABORATORY TESTING

Field Investigation

The field investigation consisted of a surface reconnaissance and a subsurface exploration program. Exploratory borings and monitoring wells were drilled and sampled for subsurface exploration at this site. The soil explorations reached depths of approximately 38.5 feet below the existing ground surface. The approximate exploratory boring locations are shown on the Site Plan (Figure 2). The logs of the soil explorations and monitoring wells are presented in this appendix. The depths shown on the attached logs are from the existing ground surface at the time of our exploration.

The drilled borings were advanced using a subcontracted 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 exploration and are described in general accordance with the Unified Soil Classification System (USCS). All samples were returned to our laboratory for evaluation.

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 surface and subsurface materials encountered.

Krazan & ASSOCIATES, INC.

Project: East Town Crossing	Project Number: 062-19007	Client: Abbey Road Group	Boring No.	B-1
Address, City, State: SE Corner Shaw Road & E. Pioneer Way, Puyallup, WA			Drilling Company: Geologic Drill Partners	
Project Manager: Theresa Nunan	Date — Started: 3.11.2019		Equipment: Track Bobcat	
Field Engineer: Theresa Nunan	Date — Completed: 3.11.2019		Drilling Method: Hollow Stem Augers	
Notes: Monitoring Well W-1 installed in borehole.	Date — Backfilled: 3.11.2019		Hammer Type: 140-lb. Manual	
Ground Surface Elevation: 72 +/- feet MSL	Groundwater Depth: 8 feet	Groundwater Elev.:	Total Depth of Boring: 21.5 ft.	

Elev. (feet)	Depth (feet)	Sample Type	Sample ID	Blow Counts	N-Value (blows/ft)	Graphic Log	Classification	Lab Results
		SPT	1-1	1 6 9	15		Brown Silty SAND (SM), trace gravel and very thin roots, with occassional 6 to 8-inch thick stiff sandy clay layers, medium dense, moist	
							Brownsih Grey Poorly Graded SAND (SP), fine grained, medium dense, moist	
	5	SPT	1-2A 1-2B	4 5 5	10		Alternating 4 to 12-inch thick layers of brown Sandy SILT (ML) and Silty SAND (SM), medium stiff/loose, moist to wet	% Si/Cl = 78.5 % MC = 35.4
		SPT	1-3A 1-3B	1 1/12"	1/12"		Dark Brownish Grey Silty CLAY (CL) with marsh grass, seams of peat and thin roots, very soft, wet	LL = 35 PI = 1 % F. Sa = 19.8 % Si/Cl = 79.1 % MC = 51.2
	10	SPT	1-4	1 2 6	8		- - - Becomes Clayey SILT (ML), with fine sand and thin roots, very soft	
							Dark Grey/Black Silty SAND (SM), fine to medium grained, loose, wet	
	15	SPT	1-5	5 4 4	8		- - - Same	
	20	SPT	1-6	4 12 12	24		- - - Becomes Poorly Graded SAND (SP-SM) with Silt, fine to medium grained, medium dense, wet	
							End of Boring at 21.5 Feet	
	25							

Krazan & ASSOCIATES, INC.

Project: East Town Crossing	**Project Number:** 062-19007	**Client:** Abbey Road Group	**Boring No.** **B-2**
Address, City, State: SE Corner Shaw Road & E. Pioneer Way, Puyallup, WA			**Drilling Company:** Geologic Drill Partners
Project Manager: Theresa Nunan	**Date** — **Started:** 3.11.2019		**Equipment:** Track Bobcat
Field Engineer: Theresa Nunan	**Date** — **Completed:** 3.11.2019		**Drilling Method:** Hollow Stem Augers
Notes:	**Date** — **Backfilled:** 3.11.2019		**Hammer Type:** 140-lb. Manual
Ground Surface Elevation: 73 +/- feet MSL	**Groundwater Depth:** 8 feet	**Groundwater Elev.:**	**Total Depth of Boring:** 38.5 ft.

Elev. (feet)	Depth (feet)	Sample Type	Sample ID	Blow Counts	N-Value (blows/ft)	Graphic Log	Classification	Lab Results
							5 inches Grass and Topsoil	
		SPT	2-1	2 2 5	7		Brown Silty SAND (SM), fine grained, with occassional sandy clay seams, loose, moist	
	5	SPT	2-2	3 4 2	6		- - - Same	% Si/Cl = 42.9 % MC = 29.3
	▼ (8)	SPT	2-3	4 8 11	19		Brownish Grey Sandy SILT (ML), fine grained, with occassional 1 to 2-inch thick seams dark grey fine sand, moist to wet, stiff	% Si/Cl = 88.2 % MC = 37.0
	10	SPT	2-4	5 8 8	16		Dark Grey/Black Silty SAND (SM), fine to medium grained, medium dense, wet	% Si/Cl = 14.5 % MC = 25.0
	15	SPT	2-5	28 12 12	24		- - - Becomes Sand (SP-SM) with Silt, fine to medium grained, medium dense	% Grav = 0 % Sa = 90.8 % Si/Cl = 8.9 % MC = 22.6
							- - - At 18 feet, drilling choppy due to lots of gravel	
	20	SPT	2-6	18 40 20/8"	60/8"		Dark Grey/Black Poorly Graded GRAVEL (GP-GM) with sand and silt, very dense, wet	
	25							

Krazan & ASSOCIATES, INC.

Project: East Town Crossing	Project Number: 062-19007	Client: Abbey Road Group	Boring No.	B-2
Address, City, State: SE Corner Shaw Road & E. Pioneer Way, Puyallup, WA			Drilling Company: Geologic Drill Partners	
Project Manager: Theresa Nunan	Date — Started: 3.11.2019		Equipment: Track Bobcat	
Field Engineer: Theresa Nunan	Date — Completed: 3.11.2019		Drilling Method: Hollow Stem Augers	
Notes:	Date — Backfilled: 3.11.2019		Hammer Type: 140-lb. Manual	
Ground Surface Elevation: 73 +/- feet MSL	Groundwater Depth: 8 feet	Groundwater Elev.:	Total Depth of Boring: 38.5 ft.	

Elev. (feet)	Depth (feet)	Sample Type	Sample ID	Blow Counts	N-Value (blows/ft)	Graphic Log	Classification	Lab Results
	25	SPT	2-7	10 9 14	23		Dark Grey SAND (SP-SM) with Silt, trace gravel, fine to coarse grained, with occassional 3 to 4-inch thick seams gravel (GP-GM) with silt, medium dense, wet	
	30	SPT	2-8	4 4 15	19		- - - Same	% Grav = 9.0 % Sa = 82.5 % Si/Cl = 8.5 % MC = 18.8
	35	SPT	2-9	6 5 10	15		At 33 feet, alternating 4 to 12-inch thick layers of Dark Grey/Black SAND (SP-SM) with gravel and silt **AND** Dark Grey/Black GRAVEL (GP-GM) with sand and silt, medium dense, wet	% Si/Cl = 5.6 % MC = 18.9
		SPT	2-10	37 20 17	37		- - - Becomes dense	% Grav = 44.8 % Sa = 47.4 % Si/Cl = 7.8 % MC = 9.4
	40						**End of Boring at 38.5 Feet**	
	45							
	50							

City of Puyallup
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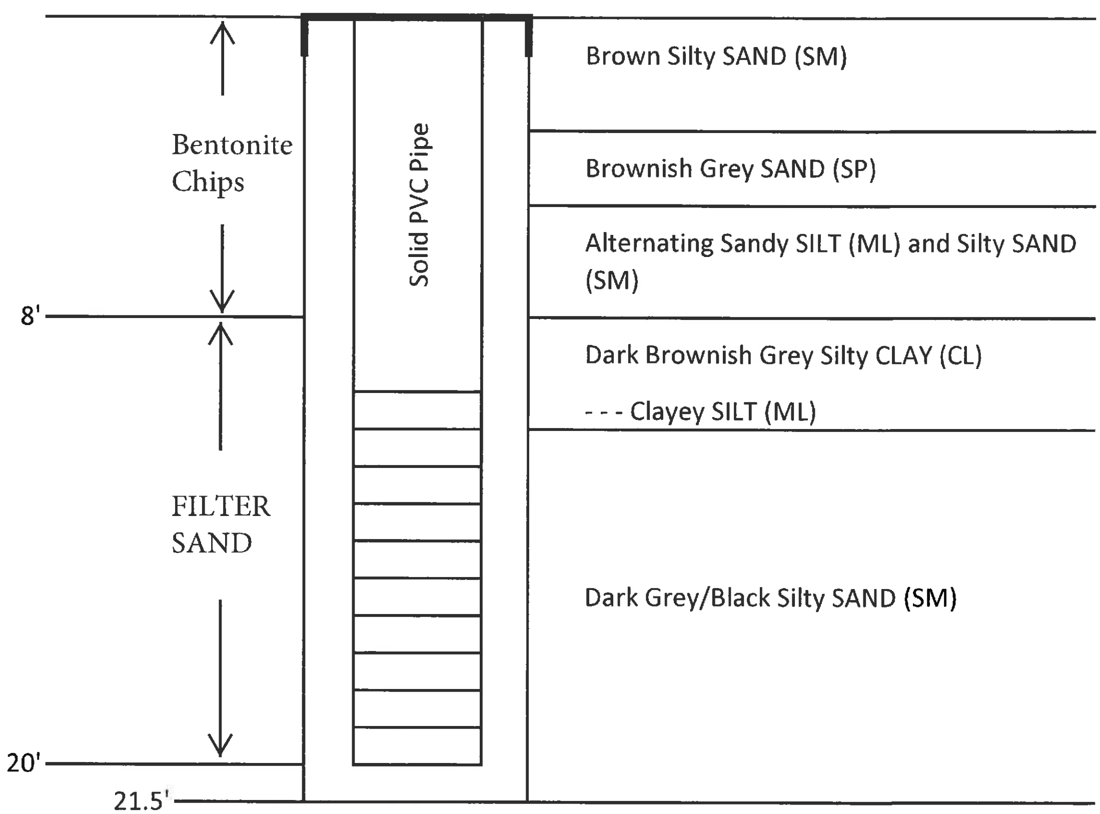
Fire | Traffic

Krazan & ASSOCIATES, INC.

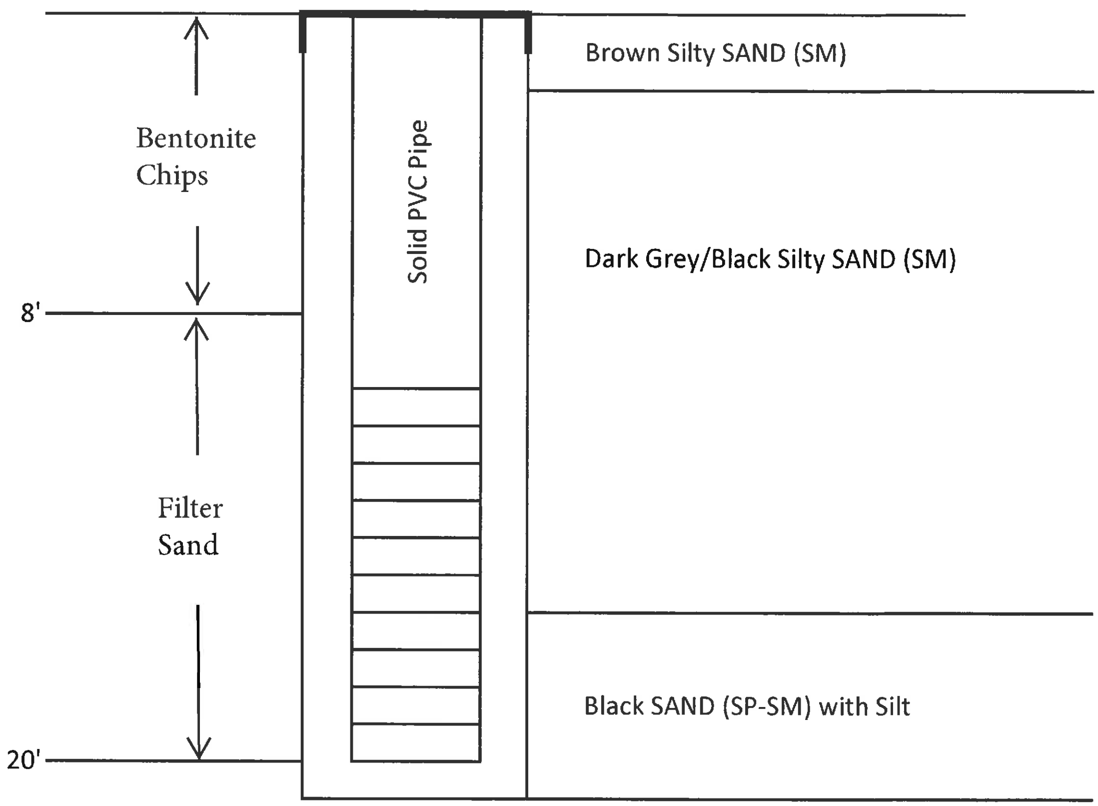
Project: East Town Crossing	Project Number: 062-19007	Client: Abbey Road Group	Boring No. B-3
Address, City, State: SE Corner Shaw Road & E. Pioneer Way, Puyallup, WA			Drilling Company: Geologic Drill Partners
Project Manager: Theresa Nunan	Date — Started: 3.11.2019		Equipment: Track Bobcat
Field Engineer: Theresa Nunan	Date — Completed: 3.11.2019		Drilling Method: Hollow Stem Augers
Notes:	Date — Backfilled: 3.11.2019		Hammer Type: 140-lb. Manual
Ground Surface Elevation: 74 +/- feet MSL	Groundwater Depth: 7 feet		Total Depth of Boring: 21.5 ft.

Elev. (feet)	Depth (feet)	Sample Type	Sample ID	Blow Counts	N-Value (blows/ft)	Graphic Log	Classification	Lab Results
							Brown Silty SAND (SM), trace gravel and very thin roots, with occassional 2 to 3-inch thick stiff sandy clay layers, loose, moist	
		SPT	3-1	2 4 5	9			
							Brownish Grey Sandy SILT (ML), fine grained, with occassional 0.5 to 2-inch thick seams dark grey fine sand, stiff, moist to wet, stiff	
	5	SPT	3-2	4 6 6	12			
	▼ (7)							
		SPT	3-3	5 5 5	10		Dark Grey/Black Silty SAND (SM), fine to medium grained, medium dense, wet	
	10	SPT	3-4	3 5 7	12			
							- - - Becomes Sand (SP-SM) with Silt, fine to medium grained, medium dense, wet	
	15	SPT	3-5	6 10 7	17			
							Dark Grey/Black Silty SAND (SM), fine to medium grained, with a 4-inch thick seam of peat at 20 feet, medium dense, wet	
	20	SPT	3-6	4 6 8	14			
							End of Boring at 21.5 Feet	
	25							

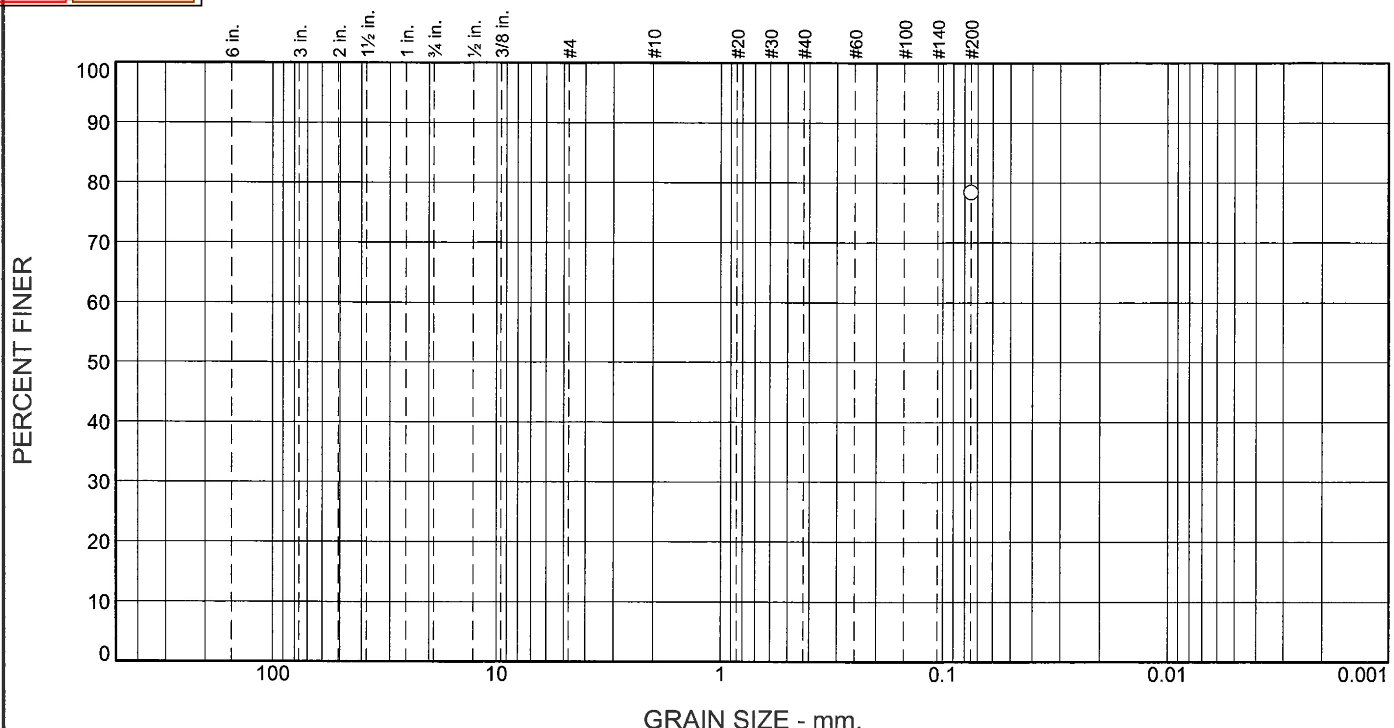
Monitoring Well
MW-1



Monitoring Well
MW-2



Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
						78.5

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#200	78.5		

* (no specification provided)

Material Description

Brown Sandy SILT

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= ML **AASHTO (M 145)=**

Coefficients

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

Remarks

Sample ID:19L131
Sample Date:3-11-19
Moisture Content = 35.4 %

Date Received: 3-15-19 **Date Tested:** 3-22-19

Tested By: M.Thomas

Checked By: M.Thomas

Title: Materials Laboratory Manager

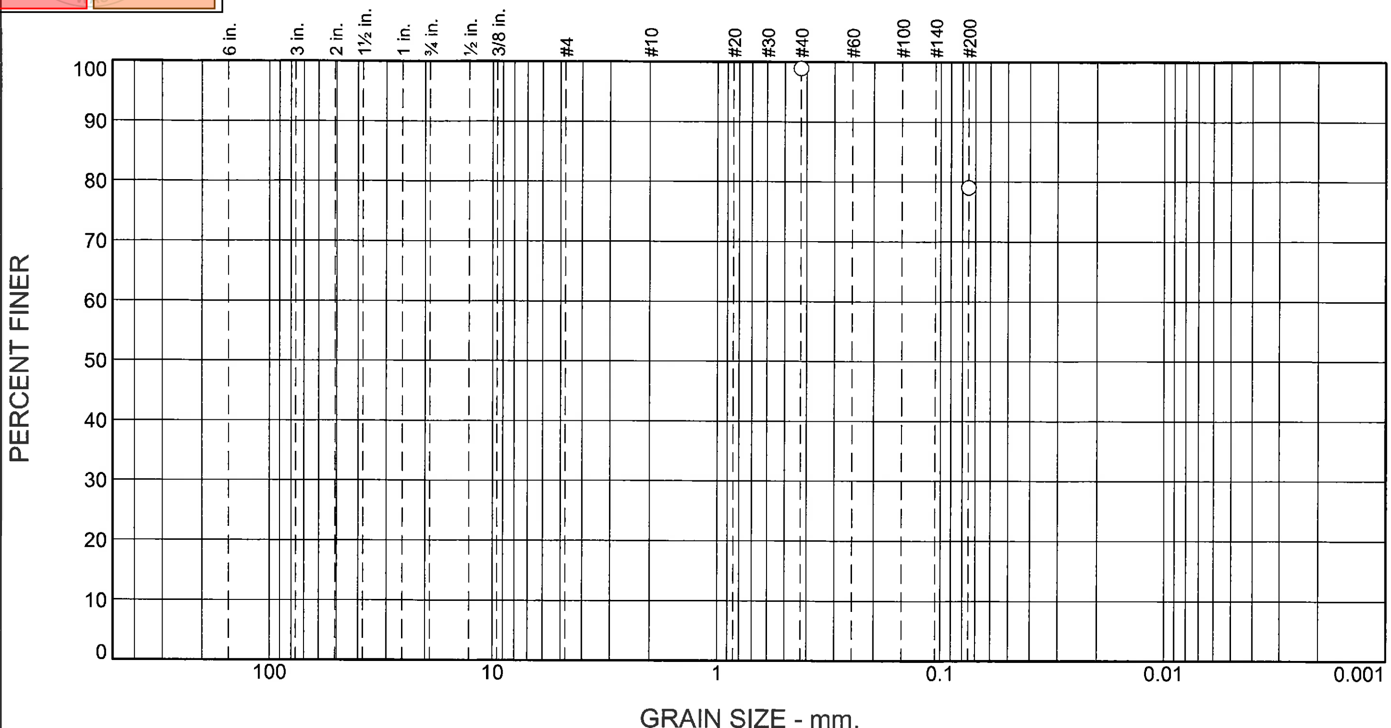
Location: B-1 Sample 1-2B
Sample Number: 19L131 **Depth:** 5'-6.5' **Date Sampled:** 3-11-19

Krazan

Client: Abbey Road Group Land Development Services Company.LLC.
Project: East Town Crossing

Project No: 062-19007 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
					19.8	79.1

Test Results (C-136 & C-117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#40	98.9		
#200	79.1		

* (no specification provided)

Material Description

Grey Clayey SILT with fine sand

Atterberg Limits (ASTM D 4318)

PL= 33.5 LL= 34.9 PI= 1.4

Classification

USCS (D 2487)= ML AASHTO (M 145)=

Coefficients

D_{90}= 0.1948 D_{85}= 0.1258 D_{60}=
D_{50}= D_{30}= D_{15}=
D_{10}= C_u= C_c=

Remarks

Sample ID:19L120
Sample Date:3-11-19
Moisture Content = 51.2 %

Date Received: 3-15-19 **Date Tested:** 3-15-19

Tested By: M.Thomas

Checked By: M.Thomas

Title: Materials Laboratory Manager

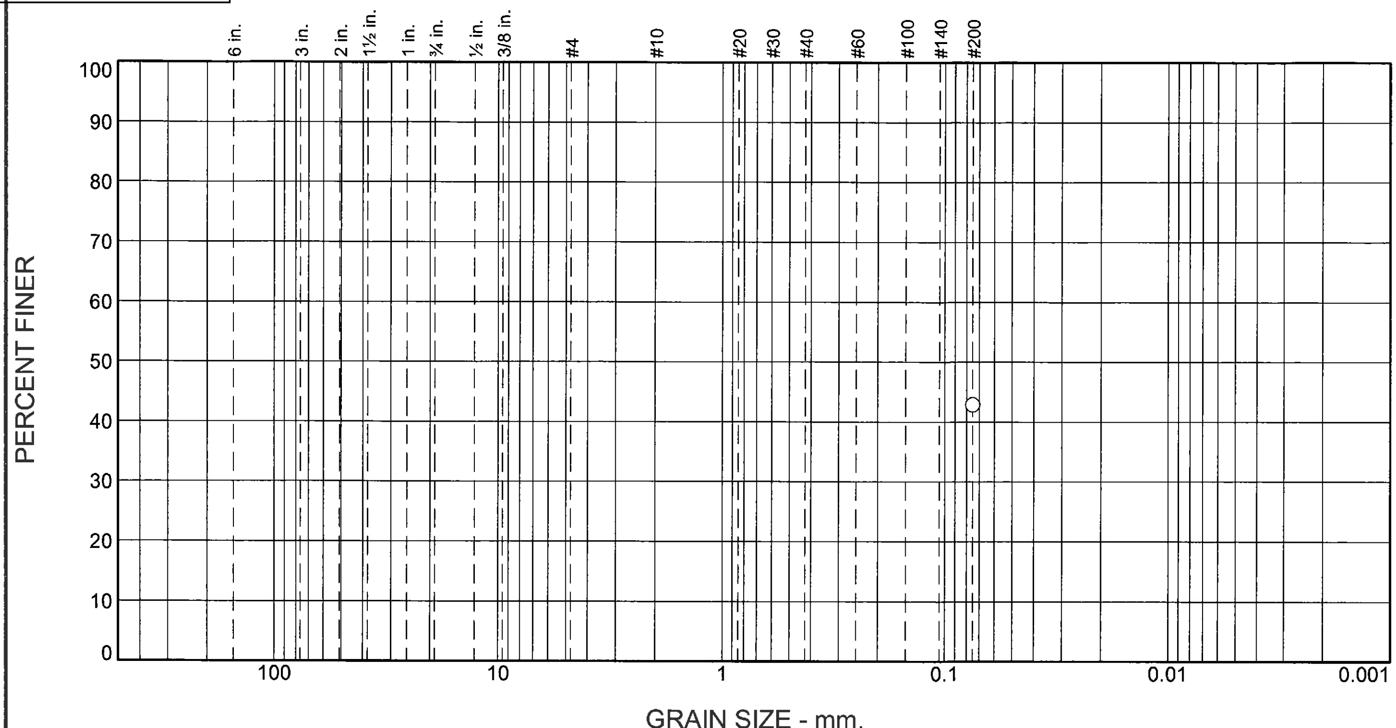
Location: B-1 Sample 1-3B
Sample Number: 19L120 **Depth:** 7.5'-9' **Date Sampled:** 3-11-19

Krazan

Client: Abbey Road Group Land Development Services Company.LLC.
Project: East Town Crossing

Project No: 062-19007 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
						42.9

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#200	42.9		

* (no specification provided)

Material Description

Brown silty sand.

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)=

Coefficients

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

Remarks

Sample ID:19L132
Sample Date:3-11-19
Moisture Content = 29.3 %

Date Received: 3-15-19 **Date Tested:** 3-22-19

Tested By: M.Thomas

Checked By: M.Thomas

Title: Materials Laboratory Manager

Location: B-2 Sample 2-2
Sample Number: 19L132 **Depth:** 5'-6.5'

Date Sampled: 3-11-19

Krazan

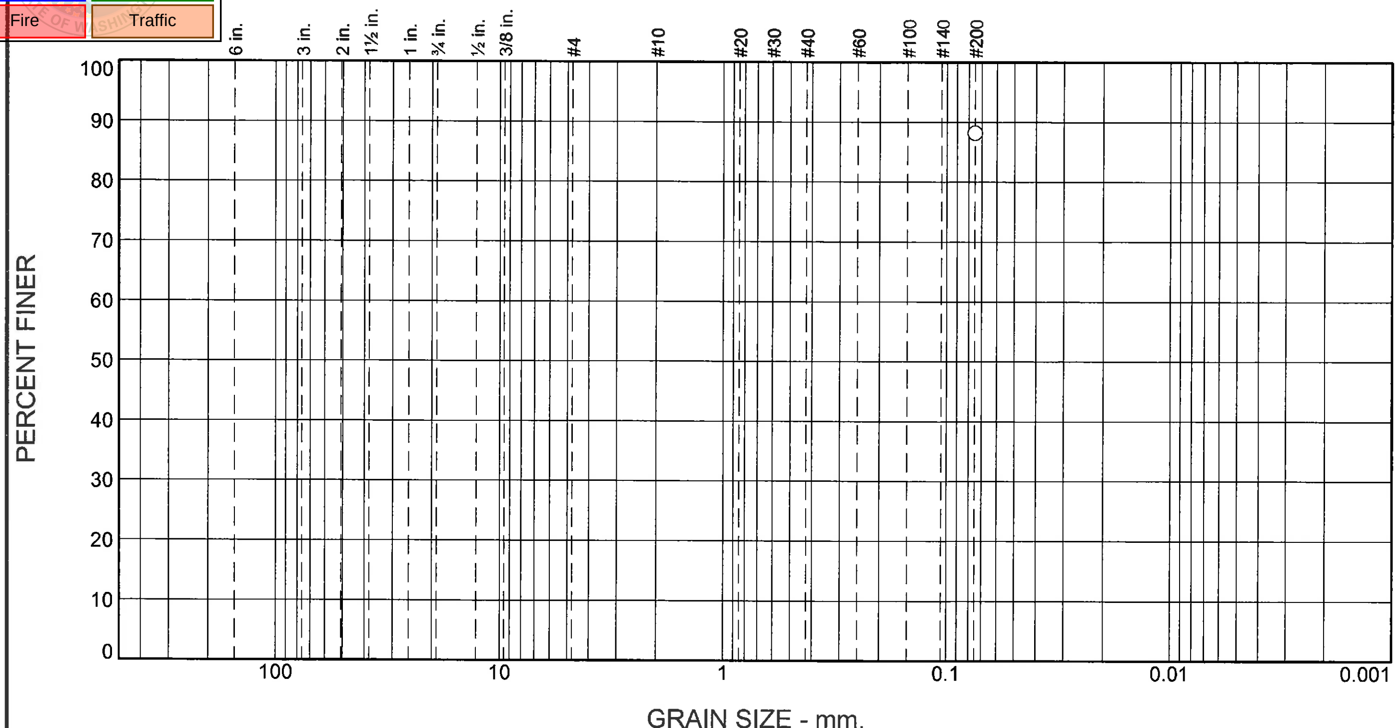
Client: Abbey Road Group Land Development Services Company.LLC.
Project: East Town Crossing

Project No: 062-19007 **Figure**

City of Puyallup
Development & Permitting Services
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
						88.2

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#200	88.2		

* (no specification provided)

Material Description

Brown sandy silt.

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= ML **AASHTO (M 145)=**

Coefficients

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

Remarks

Sample ID:19L133
Sample Date:3-11-19
Moisture Content = 37.0%

Date Received: 3-15-19 **Date Tested:** 3-22-19

Tested By: M.Thomas

Checked By: M.Thomas

Title: Materials Laboratory Manager

Location: B-2 Sample 2-3 **Date Sampled:** 3-11-19
Sample Number: 19L133 **Depth:** 7.5'-9'

Krazan

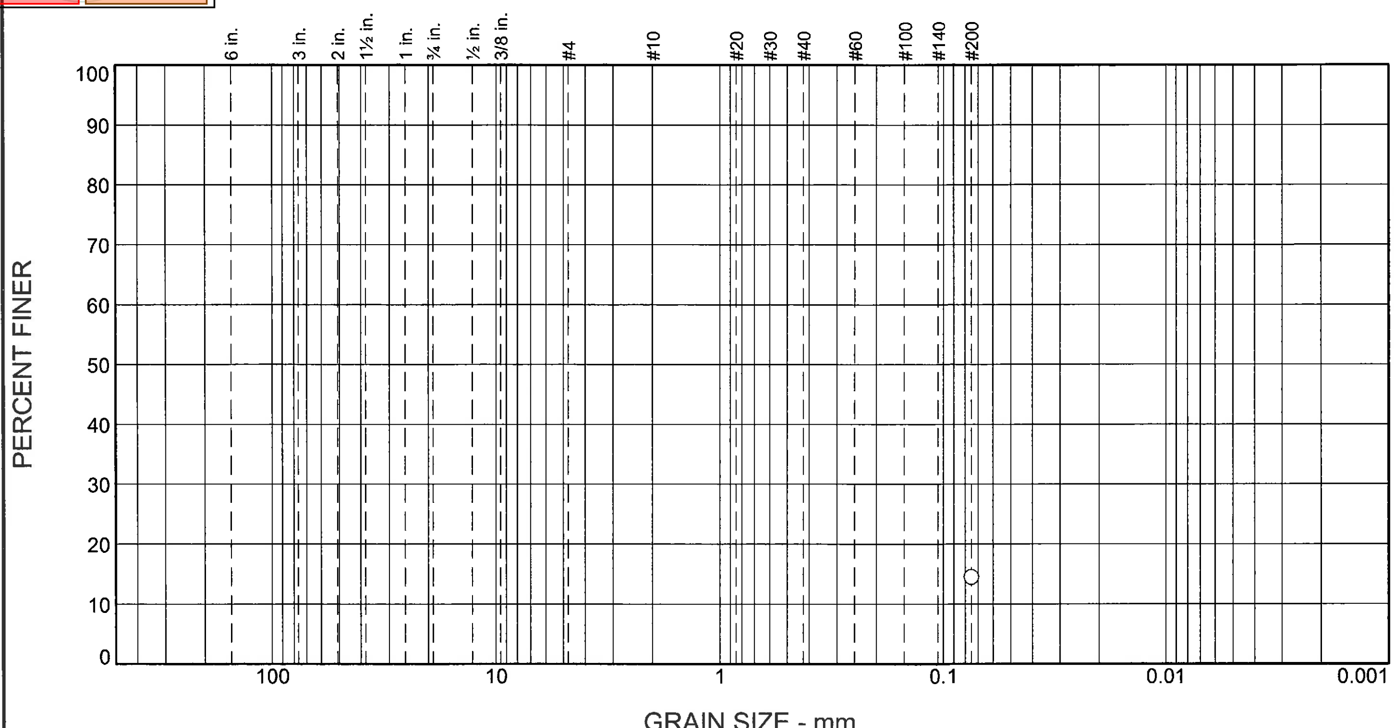
Client: Abbey Road Group Land Development Services Company.LLC.
Project: East Town Crossing

Project No: 062-19007 **Figure**

City of Puyallup
Development & Permitting Services
ISSUED PERMIT

Building	Planning
Engineering	Public Works
Fire	Traffic

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
						14.5

Test Results (C-136 & C-117)			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#200	14.5		

* (no specification provided)

Material Description

Dark Grey/Black silty sand.

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SM AASHTO (M 145)=

Coefficients

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

Remarks

Sample ID:19L134
sample Date:3-11-19
Moisture Content = 25.0 %

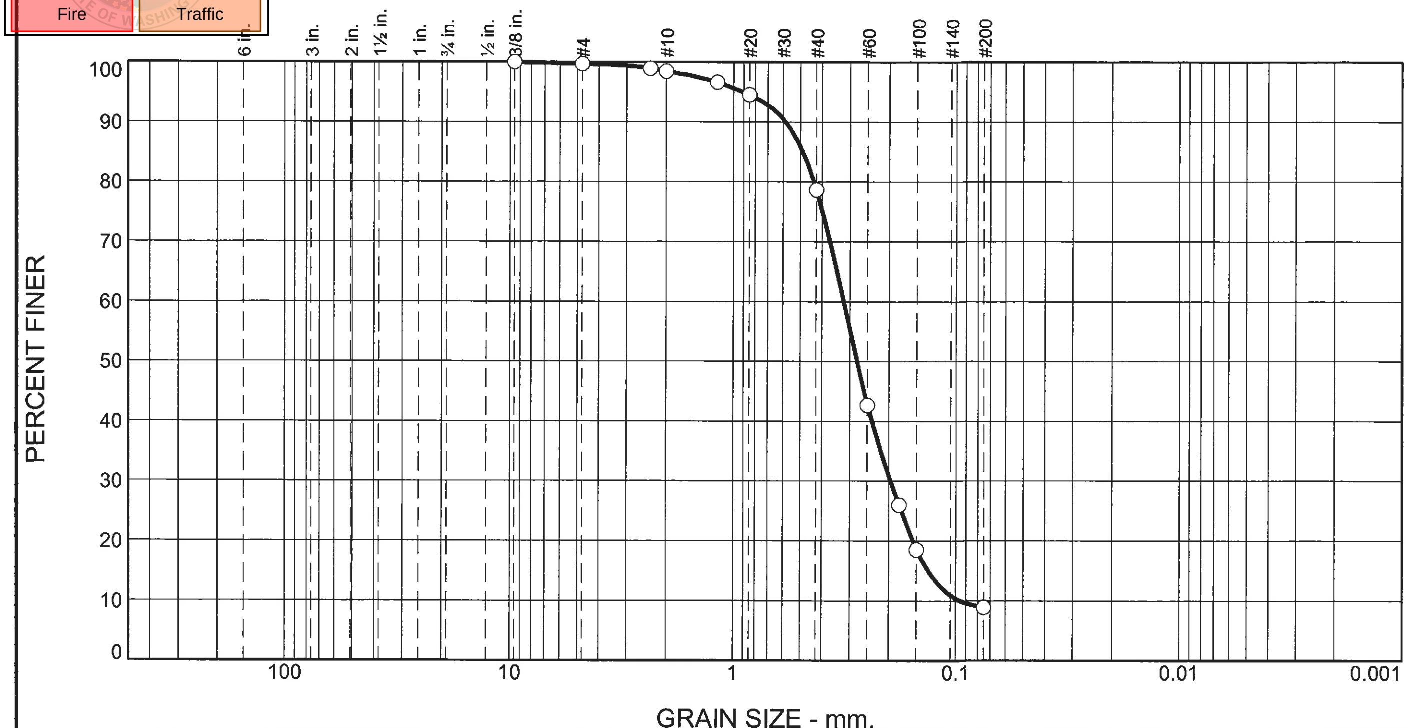
Date Received: 3-15-19 **Date Tested:** 3-22-19
Tested By: M.Thomas
Checked By: M.Thomas
Title: Materials Laboratory Manager

Location: B-2 Sample 2-4
Sample Number: 19L134 **Depth:** 10'-11.5' **Date Sampled:** 3-11-19

Krazan

Client: Abbey Road Group Land Development Services Company.LLC.
Project: East Town Crossing
Project No: 062-19007 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
0.0	0.0	0.3	1.2	19.8	69.8	8.9

Test Results (C-136 & C-117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
.375	100.0		
#4	99.7		
#8	98.9		
#10	98.5		
#16	96.6		
#20	94.5		
#40	78.7		
#60	42.7		
#80	26.0		
#100	18.5		
#200	8.9		

* (no specification provided)

Material Description

Dark Grey/Black sand with silt

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-3

Coefficients

D_{90}= 0.5827 D_{85}= 0.4892 D_{60}= 0.3205
D_{50}= 0.2792 D_{30}= 0.1966 D_{15}= 0.1334
D_{10}= 0.0956 C_u= 3.35 C_c= 1.26

Remarks

Sample ID:19L121
Sample Date:3-11-19
Moisture Content = 22.6 %

Date Received: 3-15-19 **Date Tested:** 3-22-19

Tested By: M.Thomas

Checked By: M.Thomas

Title: Materials laboratory Manager

Location: B-2 Sample 2-5
Sample Number: 19L121 **Depth:** 15'-16.5'

Date Sampled: 3-11-19

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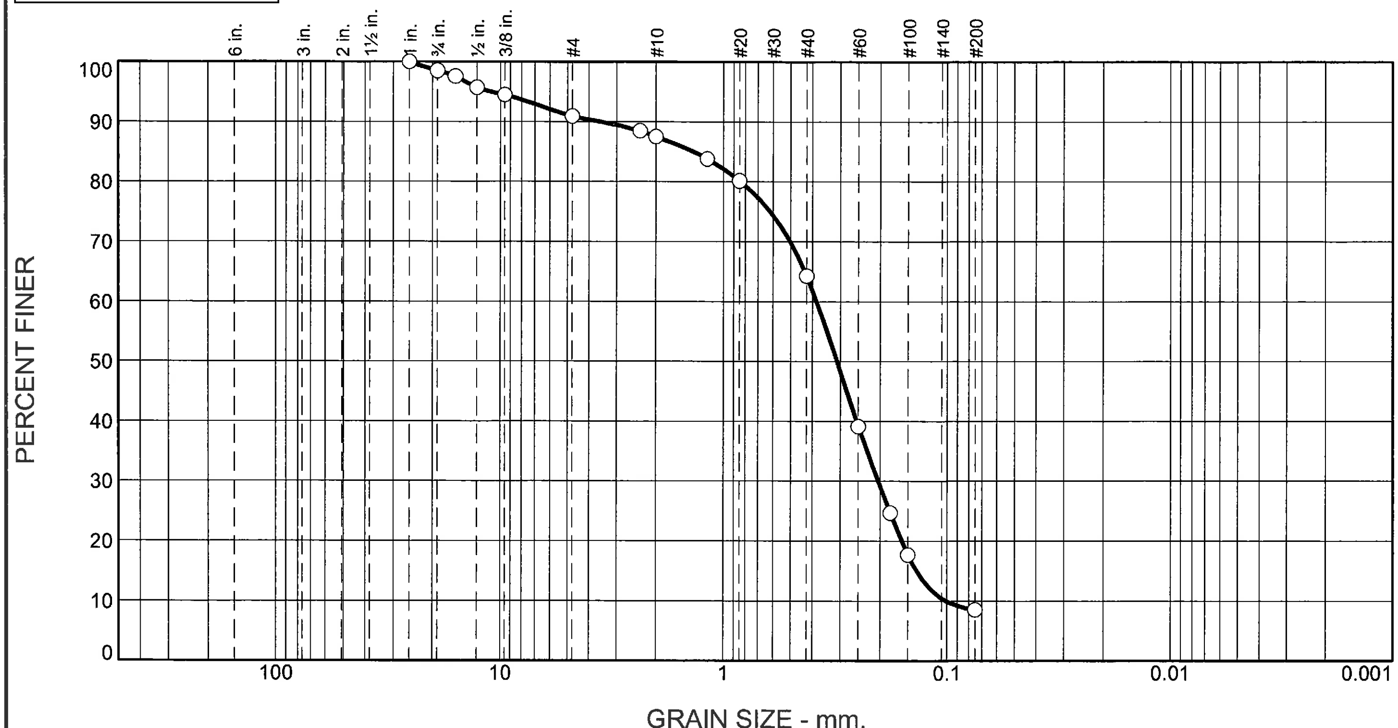
Client: Abbey Road Group Land Development Services Company.LLC.
Project: East Town Crossing

Project No: 062-19007 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
0.0	1.4	7.6	3.5	23.3	55.7	8.5

Test Results (C-136 & C-117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1	100.0		
.75	98.6		
.625	97.6		
.5	95.7		
.375	94.5		
#4	91.0		
#8	88.5		
#10	87.5		
#16	83.8		
#20	80.2		
#40	64.2		
#60	39.1		
#80	24.7		
#100	17.7		
#200	8.5		

* (no specification provided)

Material Description

Dark Grey/Black sand with silt.

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-3

Coefficients

D_{90}= 3.5671 D_{85}= 1.3567 D_{60}= 0.3839
D_{50}= 0.3115 D_{30}= 0.2039 D_{15}= 0.1371
D_{10}= 0.1011 C_u= 3.80 C_c= 1.07

Remarks

Sample ID:19L122
Sample Date:3-11-19
Moisture Content = 18.8 %

Date Received: 3-15-19 **Date Tested:** 3-22-19

Tested By: M.Thomas

Checked By: M.Thomas

Title: Materials Laboratory Manager

Location: B-2 Sample 2-8
Sample Number: 19L122 **Depth:** 30'-31.5'
Date Sampled: 3-11-19

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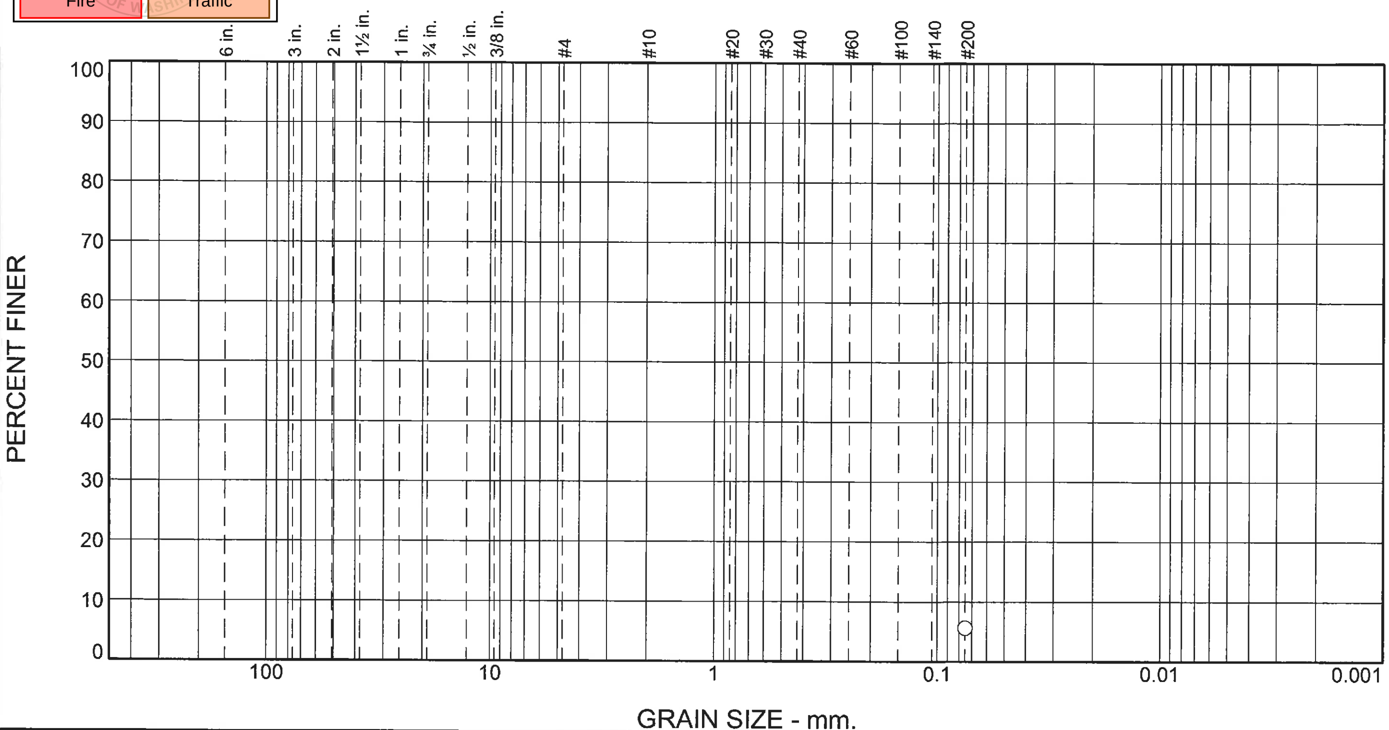
Client: Abbey Road Group Land Development Services Company.LLC.
Project: East Town Crossing

Project No: 062-19007 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines
	Coarse	Fine	Coarse	Medium	Fine	
						5.6

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
#200	5.6		

* (no specification provided)

Material Description

Dark Grey/Black sand with silt.

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= SP-SM AASHTO (M 145)=

Coefficients

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

Remarks

Sample ID:19L135
Sample Date:3-11-19
Moisture Content = 18.9 %

Date Received: 3-15-19 **Date Tested:** 3-11-19

Tested By: M.Thomas

Checked By: M.Thomas

Title: Materials Laboratory Manager

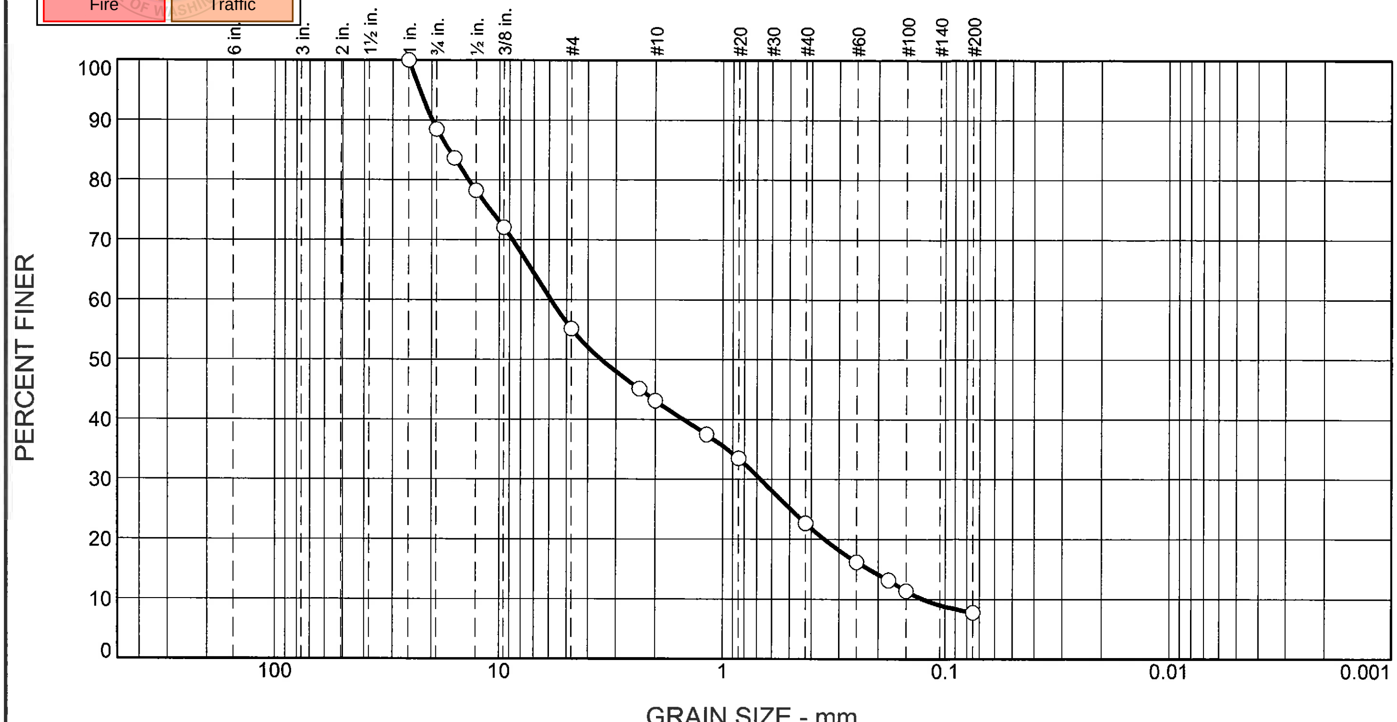
Location: B-2 Sample 2-9
Sample Number: 19L135 **Depth:** 35'-36.5' **Date Sampled:** 3-11-19

Krazan

Client: Abbey Road Group Land Development Services Company.LLC.
Project: East Town Crossing

Project No: 062-19007 **Figure**

Particle Size Distribution Report



% +3"	% Gravel Coarse	% Gravel Fine	% Sand Coarse	% Sand Medium	% Sand Fine	% Fines
0.0	11.5	33.3	12.0	20.5	14.9	7.8

Test Results (C-136 & C-117)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
1	100.0		
.75	88.5		
.625	83.7		
.5	78.3		
.375	72.1		
#4	55.2		
#8	45.1		
#10	43.2		
#16	37.5		
#20	33.5		
#40	22.7		
#60	16.2		
#80	13.2		
#100	11.4		
#200	7.8		

* (no specification provided)

Material Description

Dark Grey/Black sand with silt and gravel.

Atterberg Limits (ASTM D 4318)

PL= NP **LL=** NV **PI=** NP

Classification

USCS (D 2487)= SP-SM **AASHTO (M 145)=** A-1-a

Coefficients

D_{90}= 19.9452 D_{85}= 16.7747 D_{60}= 5.8717
D_{50}= 3.4968 D_{30}= 0.6741 D_{15}= 0.2194
D_{10}= 0.1253 C_u= 46.85 C_c= 0.62

Remarks

Sample ID:19L123
Sample Date:3-11-19
Moisture Content = 9.4 %

Date Received: 3-11-19 **Date Tested:** 3-11-19
Tested By: M.Thomas
Checked By: M.Thomas
Title: Materials Laboratory Manager

Location: B-2 Sample 2-10
Sample Number: 19L123 **Depth:** 37'-38.5' **Date Sampled:** 3-11-19

Krazan

Client: Abbey Road Group Land Development Services Company.LLC.
Project: East Town Crossing
Project No: 062-19007 **Figure**

APPENDIX B

EARTHWORK SPECIFICATIONS

GENERAL

When 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 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 or the Engineers.

TECHNICAL REQUIREMENTS: All compacted materials shall be densified to a density of 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

General site clearing should include removal of any organics, asphaltic concrete, abandoned utilities, structures including foundations, basement walls and floors, rubble, and rubbish. After stripping operations and removal of any loose and/or debris-laden fill, the exposed subgrade should be visually inspected and/or proof rolled to identify any soft/loose areas.

SUBGRADE PREPARATION: Subgrade should be prepared as described in our site preparation section of this report.

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 reasonably incidental to the completion of the pavement shown on the plans and as herein specified, except work specifically notes as "Work Not Included."

3. **PREPARATION OF THE SUBGRADE** – Subgrade should be prepared as described in our site preparation and pavement design sections of this report.

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 a 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 compaction equipment, as well as the process of 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.