

La Center Middle School

La Center, Washington

October 3, 2018

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GEOTECHNICAL SITE INVESTIGATION LA CENTER MIDDLE SCHOOL LA CENTER, WASHINGTON

Prepared For: Mr. Dave Holmes, Superintendent

La Center School District 725 NE Highland Avenue La Center, Washington

Site Location: Southwest of the intersection of NE Lockwood

Creek Road and NE 23rd Avenue

Parcel Nos: Northern portion of 209064000,

209120000, 209118000, and 209119000

La Center, Washington

Prepared By: Columbia West Engineering, Inc.

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GEOTECHNICAL SITE INVESTIGATION LA CENTER MIDDLE SCHOOL LA CENTER, WASHINGTON

1.0 INTRODUCTION

Columbia West Engineering, Inc. (Columbia West) was retained by La Center School District to conduct a geotechnical site investigation for the proposed La Center Middle School project located in La Center, Washington. The purpose of the investigation was to observe and assess subsurface soil conditions at specific locations and provide geotechnical engineering analyses, planning, and design recommendations for proposed development. This report supplements Columbia West's previously published report 18084, La Center Middle School Geotechnical Feasibility Assessment dated May 17, 2018. The specific scope of services was outlined in a proposal contract dated June 19, 2018. This report summarizes the investigation and provides field assessment documentation and laboratory analytical test reports. This report is subject to the limitations expressed in Section 6.0, Conclusion and Limitations, and Appendix F.

1.1 **General Site Information**

As indicated on Figures 1 and 2, the subject site is located southwest of the intersection of NE Lockwood Creek Road and NE 23rd Avenue in La Center, Washington. The site is comprised of tax parcels 209120000, 209118000, 209119000, and the northern portion of 209064000 totaling approximately 24.5 acres. The regulatory jurisdictional agency is the City of La Center, Washington. The approximate latitude and longitude are N 45° 51' 26" and W 122° 38' 58", and the legal description are portions of the SE ¼ and NE ¼ of Section 02, T4N, R1E, Willamette Meridian.

La Center Municipal Code Sections 18.300.090 (4) and (5) define geologic hazard requirements for parcels proposed for development in areas subject to La Center jurisdiction. Four potential geologic hazards are identified: (4a) erosion hazard, (4b) landslide hazard areas, (4c) seismic hazard areas, and (5) slopes greater than 25 percent. Columbia West reviewed whether these geologic hazards are present at the subject property proposed for development. The geologic hazard review was based upon physical and visual reconnaissance, subsurface exploration, laboratory analysis of collected soil samples, and review of maps and other published technical literature. The results of the geologic hazard review for the potential geologic hazards indicated that only (4c) seismic hazard areas exist at the site. Erosion hazard, landslide hazard and slopes greater than 25 percent are not mapped or observed at the site. Seismic hazard issues pertaining to site development are discussed in Section 5.10, Seismic Design Considerations, Section 5.11, Soil Liquefaction and Dynamic Settlement, and Section 5.12, Settlement Mitigation and Soil Improvements.



1.2 **Proposed Development**

Based upon correspondence with the La Center School District (LCSD) and review of a preliminary site plan, Columbia West understands that a middle school building and associated infrastructure are proposed. Figure 2A indicates the proposed site layout. In addition, proposed development is likely to include essential utilities for structures, stormwater management facilities, as well as asphalt concrete paving to provide vehicle and bus access to the school. Columbia West has not reviewed preliminary grading plans but understands that cut and fill areas may be proposed. This report is based upon proposed development as described and may not be applicable if modified.

2.0 REGIONAL GEOLOGY AND SOIL CONDITIONS

The subject site lies within the Willamette Valley/Puget Sound Lowland, a wide physiographic depression flanked by the mountainous Coast Range on the west and the Cascade Range on the east. Inclined or uplifted structural zones within the Willamette Valley/Puget Sound Lowland constitute highland areas and depressed structural zones form sediment-filled basins. The site is located in the northern portion of the Portland/Vancouver Basin, an open, somewhat elliptical, northwest-trending syncline approximately 60 miles wide.

According to the Geologic Map of the Ridgefield Quadrangle, Clark and Cowlitz Counties, Washington (Russell C. Evarts, USGS Geological Survey Scientific Investigation Map 2844, 2004), near-surface soils are expected to consist of Pleistocene-aged, unconsolidated, rhythmically bedded, periglacial clay, silt, and fine- to medium-textured sand deposits derived from catastrophic outburst floods of Glacial Lake Missoula (Qfs). The fine-textured flood deposits are underlain by Pleistocene to Pliocene, unconsolidated to cemented, deeply weathered, pebble to boulder sedimentary conglomerate (QTc).

The Web Soil Survey (United States Department of Agriculture, Natural Resource Conservation Service [USDA NRCS], 2018 Website) identifies surface soils primarily as Gee silt loam and Odne silt loam. Gee and Odne series soils are generally fine-textured clays and silts with very low permeability, moderate to high water capacity, and low shear strength. Gee and Odne soils are generally moisture sensitive, somewhat compressible, and described as having moderate shrink-swell potential. The erosion hazard is slight primarily based upon slope grade.

3.0 REGIONAL SEISMOLOGY

Recent research and subsurface mapping investigations within the Pacific Northwest appear to suggest the historic potential risk for a large earthquake event with strong localized ground movement may be underestimated. Past earthquakes in the Pacific Northwest appear to have caused landslides and ground subsidence, in addition to severe flooding near coastal areas. Earthquakes may also induce soil liquefaction, which occurs when elevated horizontal ground acceleration and velocity cause soil particles to interact as a fluid as opposed to a solid. Liquefaction of soil can result in lateral spreading and temporary loss of bearing capacity and shear strength.



There are at least four major known fault zones in the vicinity of the site that may be capable of generating potentially destructive horizontal accelerations. These fault zones are described briefly in the following text.

Portland Hills Fault Zone

The Portland Hills Fault Zone consists of several northwest-trending faults located along the northeastern margin of the Tualatin Mountains, also known as the Portland Hills, and the southwest margin of the Portland Basin. The fault zone is approximately 25 to 30 miles in length and is located approximately 17 miles southwest of the site. According to Seismic Design Mapping, State of Oregon (Geomatrix Consultants, 1995), there is no definitive consensus among geologists as to the zone fault type. Several alternate interpretations have been suggested.

According to the USGS Earthquake Hazards Program, the fault was originally mapped as a down-to-the-northeast normal fault but has also been mapped as part of a regional-scale zone of right-lateral, oblique slip faults, and as a steep escarpment caused by asymmetrical folding above a south-west dipping, blind thrust fault. The Portland Hills fault offsets Miocene Columbia River Basalts, and Miocene to Pliocene sedimentary rocks of the Troutdale Formation. No fault scarps on surficial Quaternary deposits have been described along the fault trace, and the fault is mapped as buried by the Pleistocene-aged Missoula flood deposits.

However, evidence suggests that fault movement has impacted shallow Holocene deposits and deeper Pleistocene sediments. Seismologists recorded a M3.2 earthquake thought to be associated with the fault zone near Kelly Point Park in November 2012, a M3.9 earthquake thought to be associated with the fault zone near Kelly Point Park in April 2003, and a M3.5 earthquake possibly associated with the fault zone occurred approximately 1.3 miles east of the fault in 1991. Therefore, the Portland Hills Fault Zone is generally thought to be potentially active and capable of producing possible damaging earthquakes.

Gales Creek-Newberg-Mt. Angel Fault Zone

Located approximately 32 miles southwest of the site, the northwest-striking, approximately 50-mile long Gales Creek-Newberg-Mt. Angel Structural Zone forms the northwestern boundary between the Oregon Coast Range and the Willamette Valley, and consists of a series of discontinuous northwest-trending faults. The southern end of the fault zone forms the southwest margin of the Tualatin basin. Possible late-Quaternary geomorphic surface deformation may exist along the structural zone (Geomatrix Consultants, 1995).

According to the USGS Earthquake Hazards Program, the Mount Angel fault is mapped as a high-angle, reverse-oblique fault, which offsets Miocene rocks of the Columbia River Basalts, and Miocene and Pliocene sedimentary rocks. The fault appears to have controlled emplacement of the Frenchman Spring Member of the Wanapum Basalts, and thus must have a history that predates the Miocene age of these rocks. No unequivocal



evidence of deformation of Quaternary deposits has been described, but a thick sequence of sediments deposited by the Missoula floods covers much of the southern part of the fault trace.

Although no definitive evidence of impacts to Holocene sediments have clearly been identified, the Mount Angel fault appears to have been the location of minor earthquake swarms in 1990 near Woodburn, Oregon, and a M5.6 earthquake in March 1993 near Scotts Mills, approximately four miles south of the mapped extent of the Mt. Angel fault. It is unclear if the earthquake occurred along the fault zone or a parallel structure. Therefore, the Gales Creek-Newberg-Mt. Angel Structural Zone is considered potentially active.

Lacamas Lake-Sandy River Fault Zone

The northwest-trending Lacamas Lake Fault and northeast-trending Sandy River Fault intersect north of Camas, Washington approximately 21 miles southeast of the site, and form part of the northeastern margin of the Portland basin. According to Geology and Groundwater Conditions of Clark County Washington (USGS Water Supply Paper 1600, Mundorff, 1964) and the Geologic Map of the Lake Oswego Quadrangle (Oregon DOGAMI Series GMS-59, 1989), the Lacamas Lake fault zone consists of shear contact between the Troutdale Formation and underlying Oligocene andesite-basalt bedrock. Secondary shear contact associated with the fault zone may have produced a series of prominent northwest-southeast geomorphic lineaments in proximity to the site.

According to the USGS Earthquake Hazards Program the fault has been mapped as a normal fault with down-to-the-southwest displacement and has also been described as a steeply northeast or southwest-dipping, oblique, right-lateral, slip-fault. The trace of the Lacamas Lake fault is marked by the very linear lower reach of Lacamas Creek. No fault scarps on Quaternary surficial deposits have been described. The Lacamas Lake fault offsets Pliocene-aged sedimentary conglomerates generally identified as the Troutdale formation, and Pliocene- to Pleistocene-aged basalts generally identified as the Boring Lava formation.

Recent seismic reflection data across the probable trace of the fault under the Columbia River yielded no unequivocal evidence of displacement underlying the Missoula flood deposits, however, recorded mild seismic activity during the recent past indicates this area may be potentially seismogenic.

Cascadia Subduction Zone

The Cascadia Subduction Zone has recently been recognized as a potential source of strong earthquake activity in the Portland/Vancouver Basin. This phenomenon is the result of the earth's large tectonic plate movement. Geologic evidence indicates that volcanic ocean floor activity along the Juan de Fuca ridge in the Pacific Ocean causes the Juan de Fuca Plate to perpetually move east and subduct under the North American Continental Plate. The subduction zone results in historic volcanic and potential earthquake activity in



proximity to the plate interface, believed to lie approximately 20 to 50 miles west of the general location of the Oregon and Washington coast (Geomatrix Consultants, 1995).

GEOTECHNICAL AND GEOLOGIC FIELD INVESTIGATION

A geotechnical field investigation consisting of visual reconnaissance, five test pits (TP-11 through TP-15), four infiltration tests (IT-1 through IT-4), two soil borings (SB-3 and SB-4), and three CPT soundings (CPT-1 through CPT-3) was conducted at the subject site on August 8, 22, and 31, 2018. Test pit explorations TP-1 through TP-10 and soil borings SB-1 and SB-2 were conducted on April 19 and 20, 2018 as part of Columbia West's original geotechnical field investigation (18084, La Center Middle School Geotechnical Feasibility Assessment, May 17, 2018). Soil borings were conducted with a trailer-mounted solid-stem drill rig. CPT soundings were conducted with a track-mounted cone penetrometer rig. Test pits were conducted with a track-mounted excavator. Subsurface soil profiles were logged in accordance with Unified Soil Classification System (USCS) Disturbed soil samples were collected from relevant soil horizons and submitted for laboratory analysis. Analytical laboratory test results are presented in Appendix A. Exploration locations are indicated on Figure 2. Subsurface exploration logs are presented in Appendix B. Soil descriptions and classification information are provided in Appendix C. A photo log is presented in Appendix D.

Surface Investigation and Site Description

The approximate 24.5-acre subject site consists of four parcels located southwest of the intersection of NE Lockwood Road and NE 23rd Avenue. The subject site is currently undeveloped and primarily vegetated with grass and mature trees lining the south site boundary. Evidence of remnant structure debris and surface disturbance was observed on the southern portion of the site. Field reconnaissance and review of site topographic mapping indicate site grades are relatively flat, ranging from 0 to 5 percent. Visual reconnaissance conducted during site visits indicate the site has been subjected to grading activity. Site elevations in the proposed development area range from 146 feet amsl at the northeast site corner to 128 feet amsl at the southwest site corner.

4.2 **Subsurface Exploration and Investigation**

Soil borings were advanced to a maximum depth of 55.3 feet below ground surface (bgs). Test pits were advanced to a maximum depth of 15 feet bgs. Exploration locations were selected to observe subsurface soil characteristics in proximity to proposed development areas and are indicated on Figure 2.

4.2.1 Soil Type Description

The field investigation indicated the presence of approximately 12 to 18 inches of till zone with sod and topsoil in the observed locations. Underlying the topsoil layer, subsurface soils resembling native USDA Gee and Odne soil series descriptions were encountered. Subsurface lithology was reasonably consistent at all explored locations and may generally be described by soil types identified in the following text.



Disturbed Clay Fill

Disturbed CLAY FILL soils were encountered in test pits TP-9 and TP-10 in the southern parcel to a depth of 4 and 5 feet, respectively. Remnant structure debris was also encountered. Disturbed soil depth may be greater or lesser in areas not explored on the southern parcel, due to previous use and structure demolition.

Soil Type 1 – Lean CLAY / Sandy Lean CLAY / Lean CLAY with Sand

Soil Type 1 was observed to primarily consist of orange-brown, moist to wet, soft to medium stiff lean CLAY, lean CLAY with sand, and sandy lean CLAY. Soil Type 1 was observed below the topsoil layer in soil borings SB-1 through SB-4, TP-1 through TP-8, TP-11 through TP-15, as well as below the disturbed clay fill in test pits TP-9 and TP-10. Soil Type 1 extended to depths between 4.5 and 10 feet in test pits TP-1 through TP-15 and soil borings SB-1 through SB-4 where it was underlain by Soil Type 2.

Analytical laboratory testing conducted upon representative soil samples obtained from test pits TP-1 and TP-15 and soil borings SB-1, SB-2, and SB-3 indicated 66.9 to 88.9 percent by weight passing the No. 200 sieve and in situ moistures ranging from 19.2 to 41.8 percent. Atterberg Limits analysis indicated liquid limits ranging from 30 to 46 percent and plasticity indices ranging from 8 to 22 percent. The laboratory tested samples of Soil Type 1 are classified CL according to USCS specifications and A-7-6(19), A-7-6(14), and A-6(9) according to AASHTO specifications.

Soil Type 2 - SILT / SILT with Sand / Silty SAND / Clayey SAND / Silty CLAY with Sand

Soil Type 2 was observed to primarily consist of brown to blue-grey, moist to wet, soft to hard SILT, SILT with sand, and silty CLAY with sand, and loose to medium dense silty SAND and clayey SAND. Soil Type 2 was observed below Soil Type 1 in test pits TP-1 through TP-15, and soil borings SB-1 through SB-4. Soil Type 2 extended to a maximum depth of 33.4 feet in soil borings SB-1 through SB-4 where it was underlain by Soil Type 3.

Analytical laboratory testing conducted upon representative soil samples obtained from test pits TP-1, TP-4, and TP-5 and soil borings SB-1 and SB-2 indicated 32.4 to 92.7 percent by weight passing the No. 200 sieve and in situ moistures ranging from approximately 24.9 to 42.2 percent. Atterberg Limits analysis indicated liquid limits ranging from 26 to 33 percent and plasticity indices ranging from 3 to 12 percent. Several laboratory tested samples of Soil Type 2 exhibited nonplastic soil behavior. The laboratory tested samples of Soil Type 2 are classified SM, ML, CL-ML, and SC according to USCS specifications and A-4(2), A-4(3), A-4(4), A-4(5), A-4(0), A-4(8), and A-2-6(0) according to AASHTO specifications.

Soil Type 3 – Weathered Conglomerate

Semi-consolidated to unconsolidated conglomerate was encountered beneath Soil Type 2 at depths of 32 to 33.4 feet bgs in soil borings SB-1 through SB-4. Soil Type 3 was explored to a maximum depth of 55.3 feet bgs where exploration was terminated due to practical refusal of the drill rig. Soil Type 3 was visually observed to consist of orangebrown to varicolored, moist, very dense clayey gravel with sand and silt. Gravels, where



present, were observed to be rounded to sub-rounded volcanic and sedimentary parent material. Analytical laboratory testing was not conducted upon soil samples obtained by SPT split-spoon samplers due to small quantities of recovery.

4.2.2 Groundwater

Groundwater seeps were encountered in test pit explorations TP-1 through TP-10 at depths ranging from 1 to 4 feet on April 18, 2018. Piezometers were installed in borings SB-1 and SB-2 to depths of 28 and 28.5 feet, respectively. Piezometers consist of 2-inch PVC pipe with 10 feet of screen at the bottom of the piezometer. Initial readings indicated groundwater as shallow as 3 feet below the piezometer lid elevation. Figure 2B presents piezometer locations and groundwater monitoring observations. Piezometers should be decommissioned in accordance with Washington Department of Ecology regulations prior to site improvements construction.

Groundwater levels are often subject to seasonal variance and may rise during extended periods of increased precipitation. Perched groundwater may also be present in localized areas. Seeps and springs may become evident during site grading, primarily along slopes or in areas cut below existing grade. Structures, roads, and drainage design should be planned accordingly.

Ponding water was observed at the ground surface throughout the site during the subsurface investigation conducted on April 18, 2018 and surficial drainage appeared to be poor. Runoff and groundwater from higher elevations to the north and northeast of the site likely impact the shallow water table on the property. A drainage ditch follows NE 23rd Avenue on its north side along the south boundary of the study area and carries runoff to the south and west. The drainage ditch contained ponded water at the time of the investigation on April 18, 2018, indicating inadequate gradient or blockage downstream.

5.0 DESIGN RECOMMENDATIONS

The geotechnical site investigation suggests the proposed development is generally compatible with surface and subsurface soils, provided the recommendations presented in this report are utilized and incorporated into the design and construction processes. The primary geotechnical concerns with the subject site are shallow groundwater and dynamic settlement. Design recommendations are presented in the following text sections.

5.1 Site Preparation and Grading

Vegetation, organic material, unsuitable fill, and deleterious material that may be encountered should be cleared from areas identified for structures and site grading. Vegetation, other organic material, and debris should be removed from the site. Stripped topsoil should also be removed or used only as landscape fill in nonstructural areas with slopes less than 25 percent. The stripping depth for sod and highly organic topsoil is anticipated to vary between 12 and 18 inches. The required stripping depth may increase in areas of existing fill, heavy organics, or previously existing structures. Actual stripping depths should be determined based upon visual observations made during construction



when soil conditions are exposed. The post-construction maximum depth of landscape fill placed or spread at any location onsite should not exceed one foot.

Previously disturbed soil, debris, or unconsolidated fill encountered during grading or construction activities should be removed completely and thoroughly from structural areas. Demolition work prior to site improvements construction may generate unsuitable fill and disturbed soils in areas of old foundations, basement walls, utilities, and debris. These materials should also be thoroughly removed from structural areas and backfilled with engineered structural fill.

Test pits excavated during site exploration were backfilled loosely with onsite soils. These test pits should be located and properly backfilled with structural fill during site improvements construction. Trees, stumps, and associated roots should also be removed from structural areas, individually and carefully. Resulting cavities and excavation areas should be backfilled with engineered structural fill.

Site grading activities should be performed in accordance with requirements specified in the 2015 International Building Code (IBC), Chapter 18 and Appendix J, with exceptions noted in the text herein. Site preparation, soil stripping, and grading activities should be observed and documented by Columbia West.

5.2 **Engineered Structural Fill**

Areas proposed for fill placement should be appropriately prepared as described in the preceding text. Surface soils should then be scarified and compacted prior to additional fill placement. Engineered structural fill should be placed in loose lifts not exceeding 12 inches in depth and compacted using standard conventional compaction equipment. The soil moisture content should be within two percentage points of optimum conditions. A field density at least equal to 95 percent of the maximum dry density, obtained from the standard Proctor moisture-density relationship test (ASTM D698), is recommended for structural fill placement. For engineered structural fill placed on sloped grades, the area should be benched to provide a horizontal surface for compaction.

Compaction of engineered structural fill should be verified by nuclear gauge field compaction testing performed in accordance with ASTM D6938. Field compaction testing should be performed for each vertical foot of engineered fill placed. Engineered fill placement should be observed by Columbia West.

Engineered structural fill placement activities should be performed during dry summer months if possible. Clean fine-textured native soils may be suitable for use as structural fill if adequately dried or moisture-conditioned to achieve recommended compaction specifications. Native soils may require addition of moisture during periods of dry weather. Compacted fill soils should be covered shortly after placement.

Because they are moisture-sensitive, fine-textured soils are often difficult to excavate and compact during wet weather conditions. If adequate compaction is not achievable with clean native soils, import structural fill consisting of granular fill meeting WSDOT specifications for *Gravel Borrow 9-03.14(1)* is recommended.



Representative samples of proposed engineered structural fill should be submitted for laboratory analysis and approval by Columbia West prior to placement. analyses should include particle-size gradation and standard Proctor moisture-density analysis.

5.3 **Cut and Fill Slopes**

Fill placed on existing grades steeper than 5H:1V should be horizontally benched at least 10 feet into the slope. Fill slopes greater than six feet in height should be vertically keyed into existing subsurface soil. A typical fill slope cross-section is shown in Figure 3. Drainage implementations, including subdrains or perforated drain pipe trenches, may also be necessary in proximity to cut and fill slopes if seeps or springs are encountered. Drainage design may be performed on a case-by-case basis. Extent, depth, and location of drainage may be determined in the field by Columbia West during construction when soil conditions are exposed. Failure to provide adequate drainage may result in soil sloughing, settlement, or erosion.

Final cut or fill slopes at the site should not exceed 2H:1V or 20 feet in height without individual slope stability analysis. The values above assume a minimum horizontal setback for loads of 10 feet from top of cut or fill slope face or overall slope height divided by three (H/3), whichever is greater. A minimum slope setback detail for structures is presented in Figure 4.

Concentrated drainage or water flow over the face of slopes should be prohibited, and adequate protection against erosion is required. Fill slopes should be constructed by placing fill material in maximum 12-inch level lifts, compacting as described in Section 5.2, Engineered Structural Fill and horizontally benching where appropriate. Fill slopes should be overbuilt, compacted, and trimmed at least two feet horizontally to provide adequate compaction of the outer slope face. Proper cut and fill slope construction is critical to overall project stability and should be observed and documented by Columbia West.

Foundations 5.4

Building foundations are anticipated to consist of shallow continuous perimeter or column spread footings. Footings should be designed by a licensed structural engineer and conform to the recommendations below. Typical building loads are not expected to exceed approximately 4 to 6 kips per foot for perimeter footings or 130 kips per column. If actual loading exceeds anticipated loading, additional analysis should be conducted for the specific load conditions and proposed footing dimensions.

The existing ground surface should be prepared as described in Section 5.1, Site Preparation and Grading, and Section 5.2, Engineered Structural Fill. Foundations should bear upon firm native soil or engineered structural fill.

To evaluate bearing capacity for proposed structures, serviceability and reliability of shear resistance for subsurface soils was considered. Allowable bearing capacity is typically a function of footing dimension and subsurface soil properties, including settlement and shear resistance. Based upon in situ field testing and laboratory analysis, the estimated



allowable bearing capacity for well-drained foundations prepared as described above is 2,000 psf. Bearing capacity may be increased by one-third for transient lateral forces such as seismic or wind. The estimated coefficient of friction between in situ compacted native soil or engineered structural fill and in-place poured concrete is 0.45. Lateral forces may also be resisted by an assumed passive soil equivalent fluid pressure of 250 psf/f against embedded footings. The upper six inches of soil should be neglected in passive pressure calculations.

Footings should extend to a depth at least 18 inches below lowest adjacent grade to provide adequate bearing capacity and protection against frost heave. constructed during wet weather conditions will require over-excavation of saturated subgrade soils and granular structural backfill prior to concrete placement. excavation recommendations should be provided by Columbia West during foundation excavation and construction. Excavations adjacent to foundations should not extend within a 1.5H:1V angle projected down from the outside bottom footing edge without additional geotechnical analysis.

Foundations should not be permitted to bear upon existing fill or disturbed soil. Because soil is often heterogeneous and anisotropic, Columbia West should observe foundation excavations prior to placing forms or reinforcing bar to verify subgrade support conditions are as anticipated in this report.

5.4.1 Luminaire, Signal, and Sign Foundations

Foundations for luminaire, signal, and sign poles should be designed in accordance with the International Building Code (IBC) Chapter 18 by a licensed structural engineer. Based upon review of IBC literature, and SPT blow count observations made during the field exploration, the allowable lateral bearing pressure for foundations installed in competent native soils or engineered structural fill is 100 psf/ft up to a maximum of 1,000 psf. Columbia West should be contacted to review foundation designs and evaluate compatibility with geotechnical design assumptions.

5.5 Slabs on Grade

Proposed structures may have slab-on-grade floors. Slabs should be supported on firm, competent, in situ soil or engineered structural fill. Disturbed soils and unsuitable fills in proposed slab locations should be removed and replaced with structural fill. The modulus of subgrade reaction is estimated to be 100 psi/inch.

Preparation and compaction beneath slabs should be performed in accordance with the recommendations presented in Section 5.1, Site Preparation and Grading and Section 5.2, Engineered Structural Fill. Slabs should be underlain by at least 6 inches of 1 1/4"-0 crushed aggregate meeting WSDOT 9-03.9(3). Geotextile filter fabric conforming to WSDOT 2010 Standard Specification M 41-10, 9-33.2(1), Geotextile Properties, Table 3: Geotextile for Separation or Soil Stabilization may be used below the crushed aggregate to increase subgrade support. If desired, a moisture barrier may be constructed beneath the slabs. Slabs should be appropriately waterproofed in accordance with the desired type of



finished flooring. Slab thickness and reinforcement should be designed by an experienced structural engineer in accordance with anticipated loads.

5.6 **Static Settlement**

Based upon the anticipated structural loading and allowable soil bearing pressure described above, Columbia West analyzed estimated static settlement for the proposed structure. Settlement analysis was conducted using Schmertmann's (1970, 1978) method to calculate vertical foundation displacement using CPT results.

Total long-term static footing displacement for shallow foundations constructed as described in this report is not anticipated to exceed approximately 1 inch. Differential settlement between comparably loaded footing elements is not expected to exceed approximately ½ inch over a span of 50 feet. The resulting vertical displacement after loading may be due to elastic distortion, dissipation of excess pore pressure, or soil creep.

The values above assume fill placement of no more than 4 feet across the proposed building footprint. Shallow foundations bearing upon engineered structural fill greater than 4 feet in thickness may be subject to additional settlement associated with large-area surcharge loading. Columbia West should be contacted to assess potential areal fill settlements once final grading plans and associated cut and fill plans are available.

5.7 **Excavation**

Soil borings SB-1 through SB-4 were advanced with mud-rotary and trailer-mounted solidstem drill rigs to a maximum depth of 55.3 feet bgs due to practical refusal of the drill rig on competent conglomerate. Due to documented depths of bedrock in the explored locations, blasting or specialized rock-excavation techniques are not anticipated. As indicated previously in Section 4.2.2, Groundwater, seeps were encountered as shallow as one foot bgs. Documented groundwater depths on May 1, 2018 in piezometers P-1 and P-2 were observed at 4.2 and 3.5 feet bgs, respectively. Recommendations as described in Section 5.8, Dewatering should be considered in locations where subsurface construction activities intersect the water table

Based upon laboratory analysis and field testing, near-surface soils may be Washington State Industrial Safety and Health Administration (WISHA) Type C. For temporary opencut excavations deeper than four feet, but less than 20 feet in soils of these types, the maximum allowable slope is 1.5H:1V. WISHA soil type should be confirmed during field construction activities by the contractor. Soil is often anisotropic and heterogeneous, and it is possible that WISHA soil types determined in the field may differ from those described

Site-specific shoring design may be required if open-cut excavations are infeasible or if excavations are proposed adjacent to existing infrastructure. Typical methods for stabilizing excavations consist of soldier piles and timber lagging, sheet pile walls, tiebacks and shotcrete, or pre-fabricated hydraulic shoring. Because lateral earth pressure distributions acting on below-grade structures are dependent upon the type of shoring



system used, Columbia West should be contacted to conduct additional analysis when shoring type, excavation depths, and locations are known.

The contractor should be held responsible for site safety, sloping, and shoring. Columbia West is not responsible for contractor activities and in no case should excavation be conducted in excess of all applicable local, state, and federal laws.

5.8 Dewatering

Groundwater elevation and hydrostatic pressure should be carefully considered during design of utilities, retaining walls, or other structures that require below-grade excavation. described previously, shallow seasonal groundwater may be encountered in areas proposed for development. Utility trenches in shallow groundwater areas or excavations and cuts that remain open for even short periods of time may undermine or collapse due to groundwater effects. Placement of layers of riprap or quarry spalls in localized areas on shallow excavation side slopes may be required to limit instability. Over-excavation and stabilization of pipe trenches or other excavations with imported crushed aggregate or gabion rock may also be necessary to provide adequate subgrade support.

Significant pumping and dewatering may be required to temporarily reduce the groundwater elevation to allow construction of proposed below-grade structures, installation of utilities, or placement of structural fills. Dewatering via a sump within excavation zones may be insufficient to control groundwater and provide excavation side slope stability. Dewatering may be more feasibly conducted by installing a system of temporary well points and pumps around proposed excavation areas or utility trenches. Depending on proposed utility depths, a sitespecific dewatering plan may be necessary. Well pumps should remain functioning at all times during the excavation and construction period. Suitable back-up pumps and power supplies should be available to prevent unanticipated shut-down of dewatering equipment. Failure to operate pumps full-time may result in flooding of the excavation zones, resulting in damage to forms, slopes, or equipment.

Columbia West recommends that the contractor be required to prepare and present a detailed dewatering plan. The contractor should consult with a dewatering professional, as necessary, to provide an adequate dewatering plan for site conditions. If additional subsurface information not provided in the site-specific geotechnical report is necessary to complete the dewatering plan, the contractor shall be responsible for securing all the required information necessary for the design of the system. The contractor should be required to acknowledge the existence of challenging surface and subsurface soil conditions including, but not limited to, shallow groundwater, low-strength soils, potential running sands, and potential collapsing trench conditions.

The dewatering plan should be submitted and reviewed by the owner prior to commencement of construction activities requiring dewatering. The dewatering plan should include, at a minimum, well construction details, pumping rates, radius of influence of pumping wells, effluent flow rates, water disposal locations, outfall scour considerations, and all applicable environmental considerations.



Lateral Earth Pressure 5.9

If retaining walls are proposed, lateral earth pressures should be carefully considered in the design process. Hydrostatic pressure and additional surcharge loading should also be considered. Retained material may include engineered structural backfill or undisturbed native soil. Structural wall backfill should consist of imported granular material meeting Section 9-03.12(2) of WSDOT Standard Specifications. Backfill should be prepared and compacted to at least 95 percent of maximum dry density as determined by the modified Proctor test (ASTM D1557). Recommended parameters for lateral earth pressures for retained soils and engineered structural backfill consisting of imported granular fill meeting WSDOT specifications for *Gravel Backfill for Walls 9-03.12(2)* are presented in Table 1.

The design parameters presented in Table 1 are valid for static loading cases only and are based upon in situ soils or compacted granular fill. The recommended earth pressures do not include surcharge loads, dynamic loading, hydrostatic pressure, or seismic design.

If seismic design is required for unrestrained walls, seismic forces may be calculated by superimposing a uniform lateral force of 10H² pounds per lineal foot of wall, where H is the total wall height in feet. If seismic design is required for restrained walls, seismic forces may be calculated by superimposing a uniform lateral force of 25H² pounds per lineal foot of wall. The resultant force should be applied at 0.6H from the base of the wall. If sloped backfill conditions are proposed for the site, Columbia West should be contacted for additional analysis and associated recommendations.

Detained Cail	•	nt Fluid Pr Level Back	Wet	Drained Internal	
Retained Soil	At-rest	Active	Passive	Density	Angle of Friction
Undisturbed native Lean CLAY / Lean CLAY with Sand / Sandy Lean CLAY (Soil Type 1)	58 pcf	40 pcf	305 pcf	110 pcf	28°
Approved Structural Backfill Material	EQ not	22 nof	560 not	125 not	38°
WSDOT 9-03.12(2) compacted aggregate backfill	52 pcf	32 pcf	568 pcf	135 pcf	30

Table 1. Lateral Earth Pressure Parameters for Level Backfill

A continuous one-foot-thick zone of free-draining, washed, open-graded 1-inch by 2-inch drain rock and a 4-inch perforated gravity drain pipe is assumed behind retaining walls. Geotextile filter fabric should be placed between the drain rock and backfill soil. Specifications for drainpipe design are presented in Section 5.14, Drainage. If walls cannot be gravity drained, saturated base conditions and/or applicable hydrostatic pressures should be assumed.

Final retaining wall design should be reviewed and approved by Columbia West. Retaining wall subgrade and backfill activities should also be observed and tested for compliance with recommended specifications by Columbia West during construction.



^{*} The upper 6 inches of soil should be neglected in passive pressure calculations. If exterior grade from top or toe of retaining wall is sloped, Columbia West should be contacted to provide location-specific lateral earth pressures.

5.10 Seismic Design Considerations

According to the United States Geologic Survey (USGS) 2012 Seismic Design Maps Summary Report, the anticipated peak ground and maximum considered earthquake spectral response accelerations resulting from seismic activity for the subject site are summarized in Table 2.

Table 2. Approximate Probabilistic Ground Motion Values for 'firm rock' sites based on subject property longitude and latitude

	2% Probability of Exceedance in 50 yrs
Peak Ground Acceleration	0.39 g
0.2 sec Spectral Acceleration	0.89 g
1.0 sec Spectral Acceleration	0.40 g

The listed probabilistic ground motion values are based upon "firm rock" sites with an assumed shear wave velocity of 2,500 ft/s in the upper 100 feet of soil profile. These values should be adjusted for site class effects by applying site coefficients Fa and Fv as defined in 2015 IBC Tables 1613.3.3(1) and (2); the PGA should be adjusted by applying the site coefficient FPGA as defined by ASCE 7, Chapter 11, Table 11.8-1. The site coefficients are intended to more accurately characterize estimated peak ground and respective earthquake spectral response accelerations by considering site-specific soil characteristics and index properties.

The Site Class Map of Clark County, Washington (Washington State Department of Natural Resources, 2004), indicates site soils may be represented by Site Class C as defined in 2015 IBC Section 1613.3.5. However, subsurface exploration, in situ soil testing, and review of local well logs and geologic maps indicates that site soils exhibit characteristics of Site Class D. This site class designation indicates that some amplification of seismic energy may occur during a seismic event because of subsurface conditions.

Localized peak ground accelerations exceeding the adjusted values may occur in some areas in direct proximity to an earthquake's origin. This may be a result of amplification of seismic energy due to depth to competent bedrock, compression and shear wave velocity of bedrock, presence and thickness of loose, unconsolidated alluvial deposits, soil plasticity, grain size, and other factors.

Identification of specific seismic response spectra is beyond the scope of this investigation. If site structures are designed in accordance with recommendations specified in the 2015 IBC, the potential for peak ground accelerations in excess of the adjusted and amplified values should be understood.

Soil Liquefaction and Dynamic Settlement

According to the Liquefaction Susceptibility Map of Clark County Washington (Washington State Department of Natural Resources, 2004), the site is mapped as very low



susceptibility for liquefaction. However, approximately one-half south and southwest of the subject site toward the East Fork Lewis River, hazard mapping indicates the area has moderate to high susceptibility to liquefaction.

Procedures for evaluation of liquefaction resistance of soils have been developed based upon empirical data from liquefaction case studies and have become standard of practice in the United States. These empirical procedures are based upon correlation with SPT data or CPT data. CPT data obtained in the field are used in a series of empirical equations developed using previous data from liquefaction case studies. The procedure uses the CPT data to calculate two variables: the cyclic stress ratio (CSR), or the demand imposed on the soil layer due to an expected seismic event; and the cyclic resistance ratio (CRR), or the capacity of the soil to resist liquefaction. The ability of a soil to resist liquefaction can be calculated as the ratio of CRR to CSR and represented as a factor of safety. In general, a factor of safety greater than 1.3 is considered an acceptable risk.

Soils most susceptible to liquefaction are generally saturated, cohesionless, loose to medium-dense sands within 50 feet of the ground surface. Recent research has also indicated that low plasticity silts and clays may also be subject to sand-like liquefaction behavior if the plasticity index determined by the Atterberg Limits analysis is less than 8. Potentially liquefiable soils located above the existing, historic, or expected groundwater levels do not generally pose a liquefaction hazard. It is important to note that changes in perched groundwater elevation may occur due to project development or other factors not observed at the time of investigation.

The liquefaction potential for soils underlying the site was analyzed using the CLiq program and the Robertson NCEER method of analysis. Liquefaction analysis was conducted to explored depths of 31.3 to 34.4 feet bgs on the soil profiles obtained from explorations CPT-1 through CPT-3. Using a peak horizontal ground acceleration of 0.39g, an earthquake moment magnitude of 7.82 (based upon deaggregation of seismic hazards for the site using the National Seismic Hazards Mapping Project, USGS 2008), and a design groundwater depth of 3 feet below existing grade, the factor of safety was less than 1.3 for several soil layers, indicating high potential for liquefaction during a seismic event.

Anticipated Vertical Settlement Exploration Liquefaction Evaluation Method with Depth Weighting Factor **Applied** CPT-1 Robertson (NCEER 1998, 2009) 2.2 inches CPT-2 Robertson (NCEER 1998, 2009) 2.2 inches CPT-3 Robertson (NCEER 1998, 2009) 4.9 inches

Table 3. Estimated Total Settlement Induced by Liquefaction

Based upon the empirical procedures and input data described above, the total estimated settlement due to liquefaction at the analyzed location is presented in Table 3. The analysis output of CLiq is presented in Appendix E. Note that dynamic settlement induced by liquefaction occurs via different mechanisms than the estimated static settlement described in Section 5.6, Static Settlement. Differential liquefaction settlement between comparably loaded footings over a span of 50 feet is not expected to exceed approximately half of the highest total settlement estimate shown in Table 3.

According to Cetin et al, a depth weighting factor may be applied to the analysis of The depth weighting factor captures the effects of void ratio dynamic settlement. redistribution in shallower sublayers, reduced shear stresses and number of shear cycles transmitted to deeper soils due to the liquefaction of shallower soils, and arching of non-liquefiable soil layers.

5.12 Settlement Mitigation and Soil Improvements

As described below, potential earthquake-induced liquefaction settlements may be reduced by soil improvements. One or a combination of these soil improvement or mitigation methods may be desired to increase soil shear strength and reduce the amount of potential settlement. As previously mentioned, if structural fills are placed in excess of four feet in thickness, shallow foundations may be subject to additional static settlement associated with large-area surcharge loading. Columbia West should be contacted to assess potential areal fill settlements once final grading plans and associated cut and fill plans are available.

In-situ soil densification may be considered to reduce potential liquefaction settlement. A variety of soil improvement methods are available. Some improvement methods, such as dynamic compaction, may not be feasible due to observed subsurface conditions. However, other improvement methods such as compaction grouting, rammed-aggregate piers, or stone columns may be possible. The compaction grouting process consists of injecting pressurized grout into the loose or weak soil layer in a closely-spaced grid pattern. Stone columns and rammed-aggregate piers are similarly constructed in a grid pattern and may be installed by vibratory or other methods. Both methods increase relative density by densifying the soil between the grout or stone column locations, thereby reducing potential for liquefaction. Stone columns may also provide drainage pathways to allow pore pressures in potentially liquefiable layers to dissipate more quickly. Other mitigation techniques may include driven grout piles or standard steel or concrete piles. Proposed soil improvement programs should be developed by a specialized contractor working in cooperation with licensed geotechnical and structural engineers.

Soil improvements may reduce the potential liquefaction-induced movements to an acceptable level of risk. After an appropriate mitigation plan is selected, additional in-situ testing prior to construction may be conducted to determine the level of improvement achieved and reevaluate the liquefaction potential. Selection of an appropriate mitigation plan may depend upon site planning, architectural, and structural engineering factors in



addition to geotechnical concerns. All parties involved should work closely together to develop a suitable improvement plan with a clear understanding of the risks.

5.13 Infiltration Testing Results

To investigate the feasibility of subsurface disposal of stormwater, Columbia West conducted in situ infiltration testing at four locations within the project area on August 31, 2018. Results of in situ infiltration testing are presented in Table 4. The soil classifications presented in Table 4 are based upon visual assessment. The measured infiltration rates are presented as a coefficient of permeability (k) and have been reported without application of a factor of safety.

As indicated in Table 4, tests were conducted in test pits TP-11 through TP-14 at the indicated depths. Tested native soils are visually classified as lean CLAY.

Test Number	Location	Approximate Test Depth (feet bgs)	Groundwater Depth (8-31-18)	Soil Type (Visual Classification)	Passing No. 200 Sieve (%)	Infiltration Rate (*Coefficient of Permeability, k)
IT-1	TP-11	2.0	Not encountered to 2 feet bgs	CL, Lean CLAY	=	0.20
IT-2	TP-12	2.0	Not encountered to 2 feet bgs	CL, Lean CLAY	-	0.05
IT-3	TP-13	2.0	Not encountered to 2 feet bgs	CL, Lean CLAY	-	0.01
IT-4	TP-14	2.0	Not encountered to 14 feet bgs	CL, Lean CLAY	-	0.02

Table 4. Infiltration Test Data

Single-ring, falling head infiltration testing was performed by inserting three-inch diameter pipes into the soil at the noted depths. The tests were conducted by filling the pipes with water and measuring time relative to changes in hydraulic head at regular intervals. Using Darcy's Law for saturated flow in homogeneous media, the coefficient of permeability (k) was then calculated.

Due to the presence of fine-textured, low permeability soils at the site, subsurface disposal of concentrated stormwater is likely infeasible and is not recommended without further study.

5.14 Drainage

At a minimum, site drainage should include surface water collection and conveyance to properly designed stormwater management structures and facilities. Drainage design in general should conform to City of La Center regulations. Finished site grading should be conducted with positive drainage away from structures. Depressions or shallow areas that may retain ponding water should be avoided. Roof drains, low-point drains, and perimeter foundation drains are recommended for structures. Drains should consist of separate systems and gravity flow with a minimum two-percent slope away from foundations into the stormwater system or approved discharge location.



^{*}Infiltration rate as defined by soil's approximate vertical coefficient of permeability (k).

Perimeter foundation drains should consist of 3-inch perforated PVC pipe surrounded by a minimum of 1 ft³ of clean, washed drain rock per linear foot of pipe and wrapped with geotextile filter fabric. Open-graded drain rock with a maximum particle size of 3 inches and less than 2 percent passing the No. 200 sieve is recommended. Geotextile filter fabric should consist of Mirafi 140N or approved equivalent, with AOS between No. 70 and No. 100 sieve. The water permittivity should be greater than 1.5/sec. Figure 5 presents a typical foundation drain. Perimeter drains may limit increased hydrostatic pressure beneath footings and assist in reducing potential perched moisture areas.

Subdrains should also be considered if portions of the site are cut below surrounding grades. Shallow groundwater, springs, or seeps should be conveyed via drainage channel or perforated pipe into the stormwater management system or an approved discharge. Recommendations for design and installation of perforated drainage pipe may be performed on a case-by-case basis by the geotechnical engineer during construction. Failure to provide adequate surface and sub-surface drainage may result in soil slumping or unanticipated settlement of structures exceeding tolerable limits. A typical perforated drain pipe trench detail is presented in Figure 6.

Site improvements construction in some areas may occur at or near the shallow seasonal groundwater table, particularly if work is conducted during wet-weather conditions. Dewatering may be necessary and a drainage mat may be required to achieve sufficient elevation for fill placement. A typical drainage mat is shown on Figure 7. Columbia West should determine drainage mat location, extent, and thickness when subsurface conditions are exposed. Drainage mats may need to be constructed in conjunction with subdrains to convey captured water to an approved discharge location. If slabs are proposed at cut or existing grade elevations, underdrains may be needed to provide adequate drainage.

Foundation drains and subdrains should be closely monitored after construction to assess their effectiveness. If additional surface or shallow subsurface seeps become evident, the drainage provisions may require modification or additional drains. Columbia West should be consulted to provide appropriate recommendations.

5.15 Bituminous Asphalt and Portland Cement Concrete

Review of site layout plans and correspondence with the design team indicates that proposed development includes asphalt paved access drives and parking lots for passenger cars and school busses. Columbia West conducted engineering analysis for flexible pavement design using the 1993 AASHTO Guide for Design of Pavement Structures in general accordance with Washington State Department of Transportation (WSDOT) structural design policy. Design Equivalent Single Axle Loads (ESALS) over a 20-year period are primarily based upon bus count information provided by PBS Engineering and Environmental, Inc. and commonly published Load Equivalency Factors Construction traffic was not included in the analysis. Minimum structural thickness recommendations and associated specifications for proposed flexible pavement structures are provided in Table 5.



Pavement Section Layer	Minimum La	ayer Thickness	Specifications
ravement Section Layer	Passenger Car Parking and Access Drives*	Heavy Vehicle Parking and Access Drives**	Specifications
Asphalt concrete surface HMA Class ½" PG 70-22	3 inches	4 inches	91 percent of maximum Rice density (ASTM D2041)
Base course (WSDOT 9-03.9(3) 1¼"-0 crushed aggregate	6 inches	12 inches	Compacted to 95 percent of maximum modified Proctor density (ASTM D1557)
Scarified and compacted existing subgrade material	12 inches	12 inches	Compacted to 95 percent of maximum standard Proctor density (ASTM D1557)

Table 5. Flexible Pavement Section Recommendations

For dry weather construction, pavement surface sections should bear upon competent subgrade consisting of scarified and compacted native soil or engineered structural fill. Wet weather pavement construction is discussed in Section 5.16, Wet Weather Construction Methods and Techniques. Subgrade conditions should be evaluated and tested by Columbia West prior to placement of crushed aggregate base. Subgrade evaluation should include nuclear gauge density testing and wheel proof-roll observations conducted with a 12-cubic yard, double-axle dump truck or equivalent. Nuclear gauge density testing should be conducted at 150-foot intervals or as determined by the onsite geotechnical engineer. Subgrade soil should be compacted to at least 95 percent of the modified Proctor dry density, as determined by ASTM D1557. Areas of observed deflection or rutting during proof-roll evaluation should be excavated to a firm surface and replaced with compacted crushed aggregate.

Crushed aggregate base should be compacted and tested in accordance with the specifications outlined above. Asphalt concrete pavement should be compacted to at least 91 percent of maximum Rice density. Nuclear gauge density testing should be conducted to verify adherence to recommended specifications. Testing frequency should be in accordance with Washington Department of Transportation and City of La Center specifications.

Portland cement concrete curbs and sidewalks should be installed in accordance with City of La Center specifications. Curb and sidewalk aggregate base should be observed and proof-rolled by Columbia West. Soft areas that deflect or rut should be stabilized prior to pouring concrete. Concrete should be tested during installation in accordance with ASTM C171, C138, C231, C143, C1064, and C31. This includes casting of cylinder specimen at a frequency of four cylinders per 100 cubic yards of poured concrete. Recommended field concrete testing includes slump, air entrainment, temperature, and unit weight.

5.16 Wet Weather Construction Methods and Techniques

Wet weather construction often results in significant shear strength reduction and soft areas that may rut or deflect. Installation of granular working layers may be necessary to



^{*} Design recommendations assume that passenger car parking and access drives are not subject to bus or other heavy traffic.

^{**} General recommendations based up on maximum traffic loading of up to 34 heavy vehicles or busses per day. If actual truck traffic substantially exceeds 34 trucks per day, reduced pavement serviceability and design life should be expected.

provide a firm support base and sustain construction equipment. Granular layers should consist of all-weather gravel, 2x4-inch gabion, or other similar material (six-inch maximum size with less than five percent passing the No. 200 sieve).

Construction equipment traffic across exposed soil should be minimized. Equipment traffic induces dynamic loading, which may result in weak areas and significant reduction in shear strength for wet soils. Wet weather construction may also result in generation of significant excess quantities of soft wet soil. This material should be removed from the site or stockpiled in a designated area.

Construction during wet weather conditions may require increased base thickness. Over-excavation of subgrade soils or subgrade amendment with lime and/or cement may be necessary to provide a firm base upon which to place crushed aggregate. Geotextile filter fabric is also recommended. If soil amendment with lime or cement is considered, Columbia West should be contacted to provide appropriate recommendations based upon observed field conditions and desired performance criteria.

Crushed aggregate base should be installed in a single lift with trucks end-dumping from an advancing pad of granular fill. During extended wet periods, stripping activities may also need to be conducted from an advancing pad of granular fill. Once installed, the crushed aggregate base should be compacted with several passes from a static drum roller. A vibratory compactor is not recommended because it may further disturb the subgrade. Subdrains may also be necessary to provide subgrade drainage and maintain structural integrity.

Crushed aggregate base should be compacted to at least 95 percent of maximum dry density according to the modified Proctor density test (ASTM D1557). Compaction should be verified by nuclear gauge density testing. Observation of a proof-roll with a loaded dump truck is also recommended as an indication of the compacted aggregate's performance.

It should be understood that wet weather construction is risky and costly. Columbia West should observe and document wet weather construction activities. Proper construction methods and techniques are critical to overall project integrity.

5.17 Erosion Control Measures

Based upon field observations and laboratory testing, the erosion hazard for site soils in flat to shallow-gradient portions of the property is likely to be low. The potential for erosion generally increases in sloped areas. Therefore, disturbance to vegetation in sloped areas should be minimized during construction activities. Soil is also prone to erosion if unprotected and unvegetated during periods of increased precipitation. Erosion can be minimized by performing construction activities during dry summer months.

Site-specific erosion control measures should be implemented to address the maintenance of exposed areas. This may include silt fence, biofilter bags, straw wattles, or other suitable methods. During construction activities, exposed areas should be well-compacted and protected from erosion with visqueen, surface tackifier, or other means, as



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Geotechnical Site Investigation La Center Middle School, La Center, Washington

appropriate. Temporary slopes or exposed areas may be covered with straw, crushed aggregate, or riprap in localized areas to minimize erosion. Erosion and water runoff during wet weather conditions may be controlled by application of strategically placed channels and small detention depressions with overflow pipes.

After grading, exposed surfaces should be vegetated as soon as possible with erosion-resistant native vegetation. Jute mesh or straw may be applied to enhance vegetation. Once established, vegetation should be properly maintained. Disturbance to existing native vegetation and surrounding organic soil should also be minimized during construction activities.

5.18 Soil Shrink/Swell Potential

Based upon laboratory analysis, near-surface soils may contain as much as 88.9 percent by weight passing the No. 200 sieve and exhibit a plasticity index ranging from 0 to 22 percent. This indicates the potential for soil shrinking or swelling and underscores the importance of proper moisture conditioning during fill placement. Medium to high plasticity soils should be placed and compacted at a moisture content approximately two percent above optimum as determined by laboratory analysis.

5.19 Utility Installation

Utility installation may require subsurface excavation and trenching. Excavation, trenching and shoring should conform to federal (Occupational Safety and Health Administration) (OSHA) (29 CFR, Part 1926) and WISHA (WAC, Chapter 296-155) regulations. Site soils may slough when cut vertically and sudden precipitation events or perched groundwater may result in accumulation of water within excavation zones and trenches.

Utilities should be installed in general accordance with manufacturer's recommendations. Utility trench backfill should consist of WSDOT 9-03.19 Bank Run Gravel for Trench Backfill or WSDOT 9-03.14(2) Select Borrow with a maximum particle size of 2 ½-inches. Trench backfill material within 18 inches of the top of utility pipes should be hand compacted (i.e., no heavy compaction equipment). The remaining backfill should be compacted to at least 95 percent of maximum dry density as determined by the standard Proctor moisture-density test (ASTM D698). Clean, free-draining, fine bedding sand is recommended for use in the pipe zone. With exception of the pipe zone, backfill should be placed in loose lifts not exceeding 12 inches in thickness.

Compaction of utility trench backfill material should be verified by nuclear gauge field compaction testing performed in accordance with ASTM D6938. It is recommended that field compaction testing be performed at 200-foot intervals along the utility trench centerline at the surface and midpoint depth of the trench. Compaction frequency and specifications may be modified for non-structural areas in accordance with recommendations of the site geotechnical engineer.

6.0 CONCLUSION AND LIMITATIONS

This geotechnical site investigation report was prepared in accordance with accepted standard conventional principles and practices of geotechnical engineering. This



investigation pertains only to material tested and observed as of the date of this report and is based upon proposed site development as described in the text herein. This report is a professional opinion containing recommendations established bv interpretations of subsurface soils based upon conditions observed during site exploration. Soil conditions may differ between tested locations or over time. Slight variations may produce impacts to the performance of structural facilities if not adequately addressed. This underscores the importance of diligent QA/QC construction observation and testing to verify soil conditions are as anticipated in this report.

Therefore, this report contains several recommendations for field observation and testing by Columbia West personnel during construction activities. Columbia West cannot accept responsibility for deviations from recommendations described in this report. performance of structural facilities is often related to the degree of construction observation by qualified personnel. These services should be performed to the full extent recommended.

This report is not an environmental assessment and should not be construed as a representative warranty of site subsurface conditions. The discovery of adverse environmental conditions, or subsurface soils that deviate significantly from those described in this report, should immediately prompt further investigation. statements are in lieu of all other statements expressed or implied.

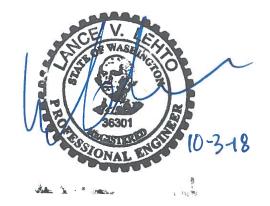
This report was prepared solely for the client and is not to be reproduced without prior authorization from Columbia West. Final engineering plans and specifications for the project should be reviewed and approved by Columbia West as they relate to geotechnical and grading issues prior to final design approval. Columbia West is not responsible for independent conclusions or recommendations made by other parties based upon information presented in this report. Unless a particular service was expressly included in the scope, it was not performed and there should be no assumptions based upon services not provided. Additional report limitations and important information about this document are presented in Appendix F. This information should be carefully read and understood by the client and other parties reviewing this document.

Sincerely,

COLUMBIA WEST ENGINEERING, Inc.

Lance V. Lehto, PE, GE

President





REFERENCES

Annual Book of ASTM Standards, Soil and Rock (I), v04.08, American Society for Testing and Materials, 1999.

ASCE 7, Minimum Design Loads for Buildings and Other Structures, American Society of Civil Engineers, 2011.

Beeson, M.H., Tolan, T.L., Madin, I.P., Geologic Map of the Lake Oswego Quadrangle, Clackamas, Multnomah, and Washington Counties, Oregon; Oregon Department of Geology and Mineral Industries; Geological Map Series GMS-59, 1989.

Clark County Maps Online (http://gis.clark.wa.gov/ccgis/mol/property.htm)

Evarts, Russell C., Geological Map of the Ridgefield Quadrangle, Clark and Cowlitz Counties, Washington, Scientific Investigations Map 2844, US Geological Survey, 2004.

Geomatrix Consultants, Seismic Design Mapping, State of Oregon, January 1995.

International Building Code: 2015 International Building Code, 2015 edition, International Code Council, 2015.

Palmer, Stephen P., Magsino, Sammantha L., Poelstra, James L., and Niggemann, Rebecca A., Site Class Map of Clark County, Washington: Washington State Department of Natural Resources, September 2004.

Palmer. Stephen P., et al, Liquefaction Susceptibility Map of Clark County, Washington, Washington State Department of Natural Resources, Division of Geology and Earth Resources, September 2004.

Safety and Health Regulations for Construction, 29 CFR Part 1926, Occupational Safety and Health Administration (OSHA), revised July 1, 2001.

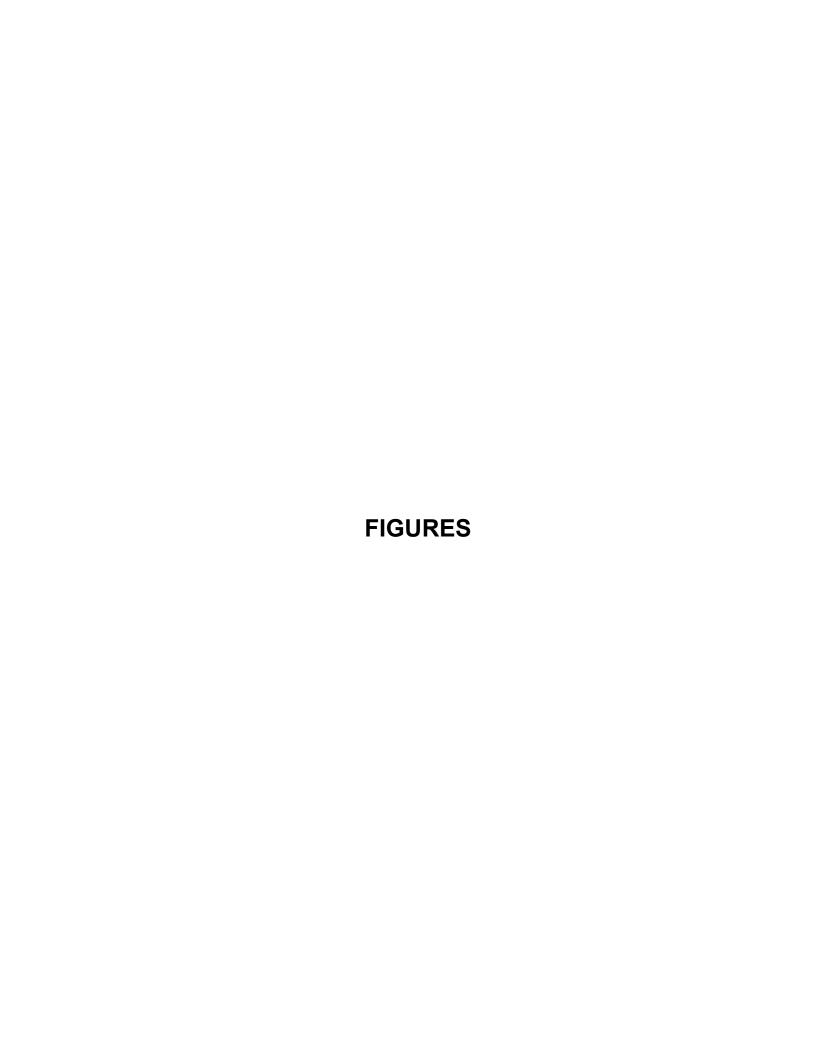
Safety Standards for Construction Work, Part N, Excavation, Trenching and Shoring, Washington Administrative Code, Chapter 296-155, Division of Industrial Safety and Health, Washington Department of Labor and Industries, February, 1993.

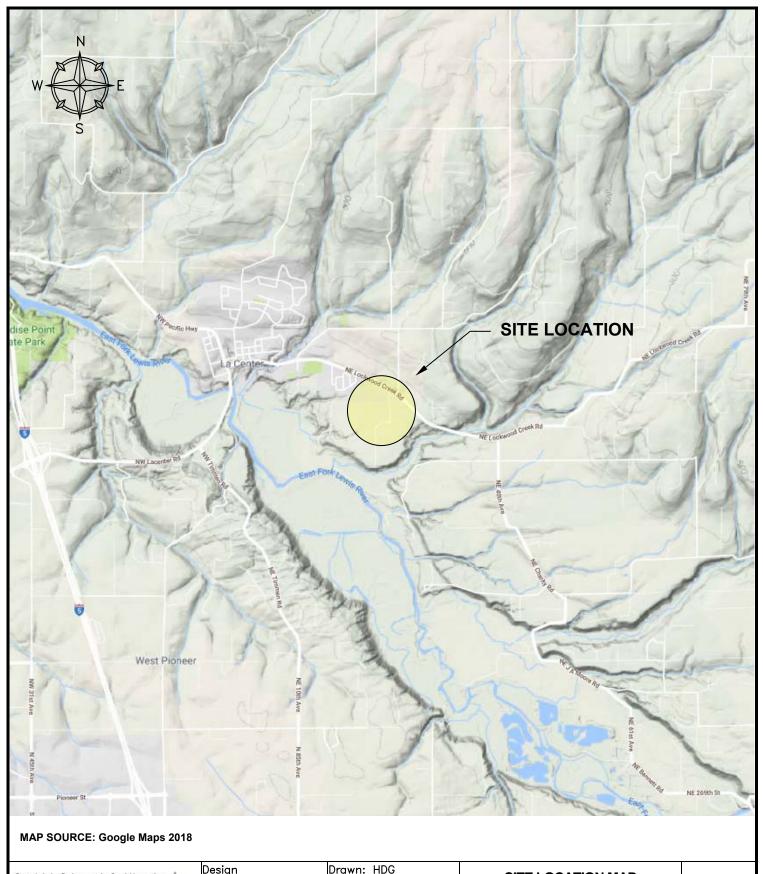
United States Geologic Survey (USGS), 2012 Seismic Design Maps, Web Application, Accessed April 2018

Wong, Ivan, et al, Earthquake Scenario and Probabilistic Earthquake Ground Shaking Maps for the Portland, Oregon, Metropolitan Area, IMS-16, Oregon Department of Geology and Mineral Industries, 2000.

Web Soil Survey, Natural Resources Conservation Service, United States Department of Agriculture 2018 website (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.).







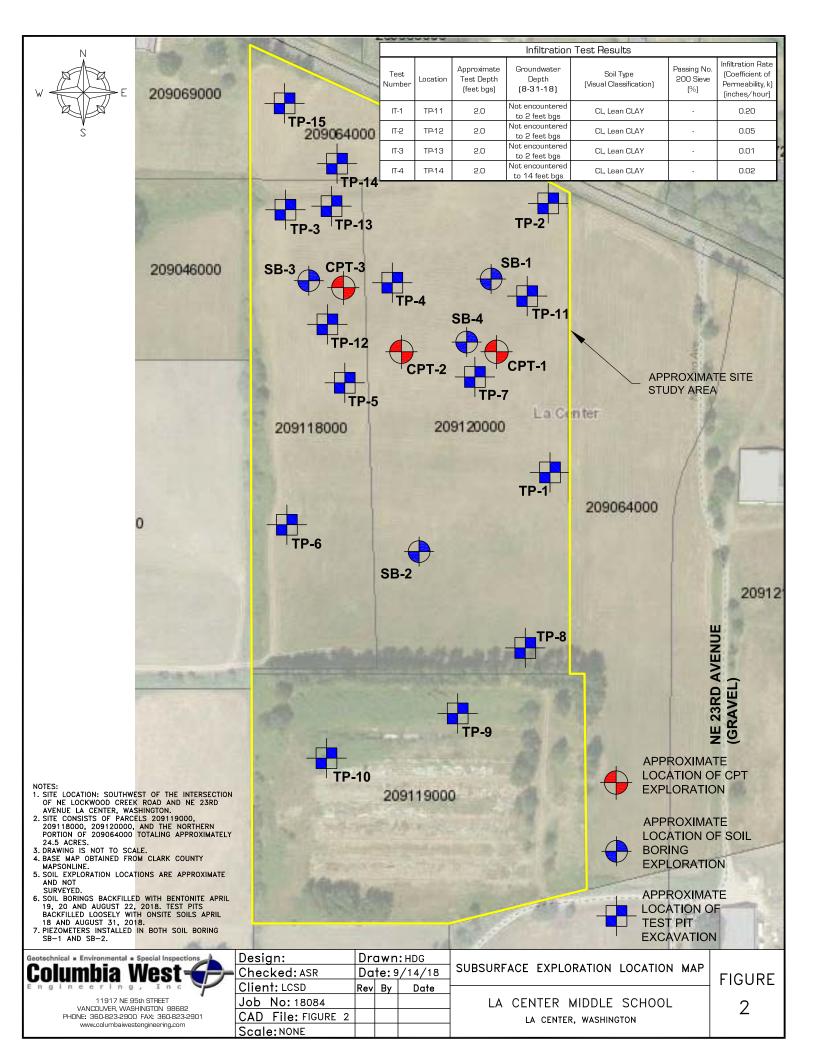


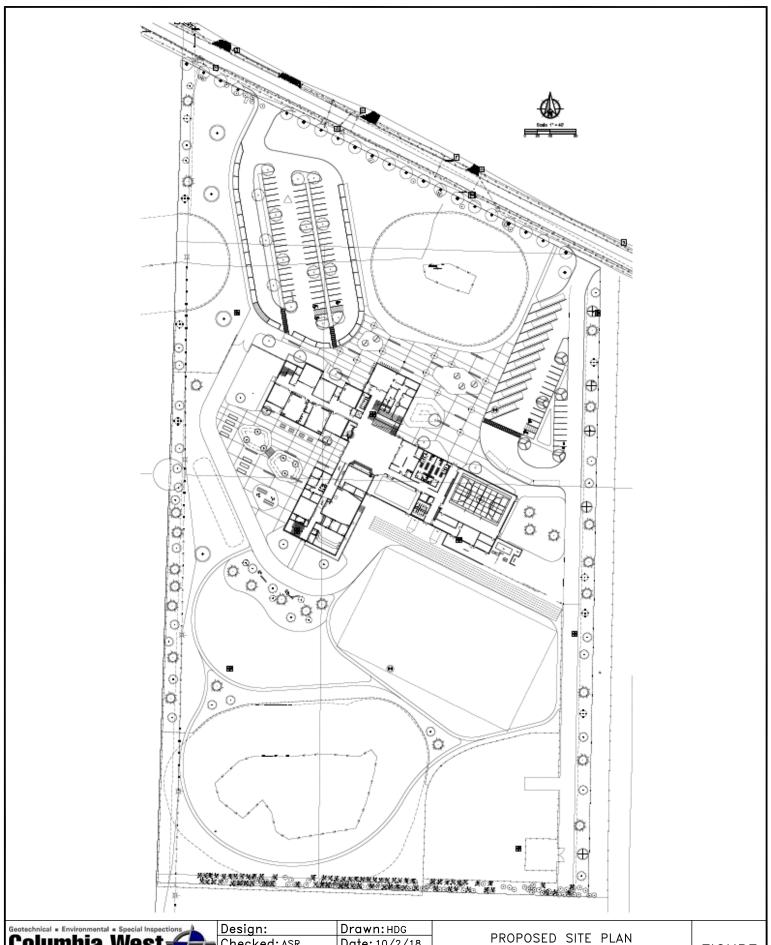
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SITE LOCATION MAP

LA CENTER MIDDLE SCHOOL LA CENTER, WASHINGTON

FIGURE 1





Geotechnical = Environmental = Special Inspection
Columbia West 11917 NE 95th STREET VANCOUVER, WASHINGTON 98682 PHONE: 360-823-2900 FAX: 360-823-2901 www.columbaiwestengineering.com

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LA CENTER MIDDLE SCHOOL LA CENTER, WASHINGTON

FIGURE 2A



La Center Middle School La Center School District La Center, Washington CWE W.O. #: 18084

- 2" PVC Piezometers installed on 4/19 and 4/20 2018.
- All elevations approximate based upon Clark County GIS topographic info.
- Lid Elevation = Ground Surface for depth measurements.
- * Initial water level measurement taken during construction of wells. This value is not plotted on the chart below.

SB-1

Piezometer Depth (ft) = 28.5 Apx. Lid Elevation (ft) = 138 SB-2

Piezometer Depth (ft) = 28 Apx. Lid Elevation (ft) = 134

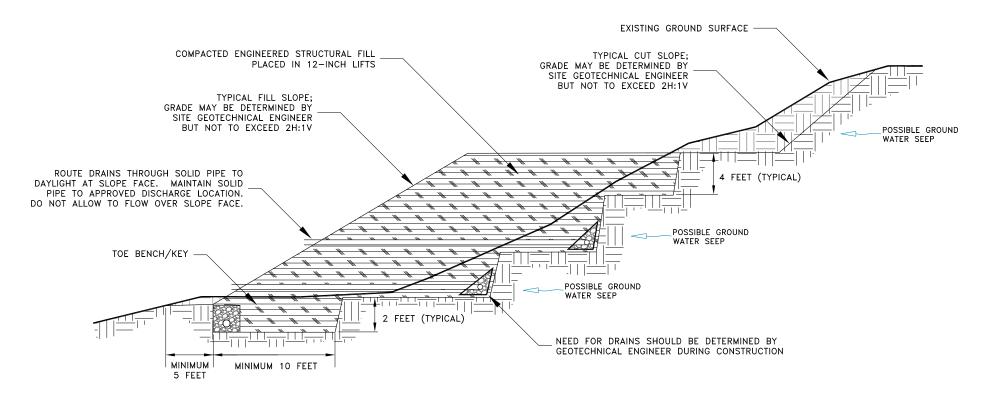
	G	roundwater Lev	el	Groundwater Level			
Date	depth (bgs)		feet (amsl)	depth (bgs)		feet (amsl)	
4/20/2018	3.0	INITIAL*	135.0	3.0	INITIAL*	131.0	
5/1/2018	4.2		133.8	3.5		130.5	
5/16/2018	6.0		132.0	4.9		129.1	
6/12/2018	8.4		129.6	7.8		126.2	
8/22/2018	13.0		125.0	11.2		122.8	

FIGURE 2B





TYPICAL CUT AND FILL SLOPE CROSS-SECTION



TYPICAL DRAIN SECTION DETAIL

DRAIN SPECIFICATIONS

GEOTEXTILE FABRIC SHALL CONSIST OF MIRAFI 140N OR APPROVED EQUIVALENT WITH AOS BETWEEN No. 70 AND No. 100 SIEVE.

WASHED DRAIN ROCK SHALL BE OPEN-GRADED ANGULAR DRAIN ROCK WITH LESS THAN 2 PERCENT PASSING THE No. 200 SIEVE AND A MAXIMUM PARTICLE SIZE OF 3 INCHES.

GEOTEXTILE FABRIC WASHED DRAIN ROCK MINIMUM 2 FEET MINIMUM 2 FEET

FIGURE

3

NOTES:

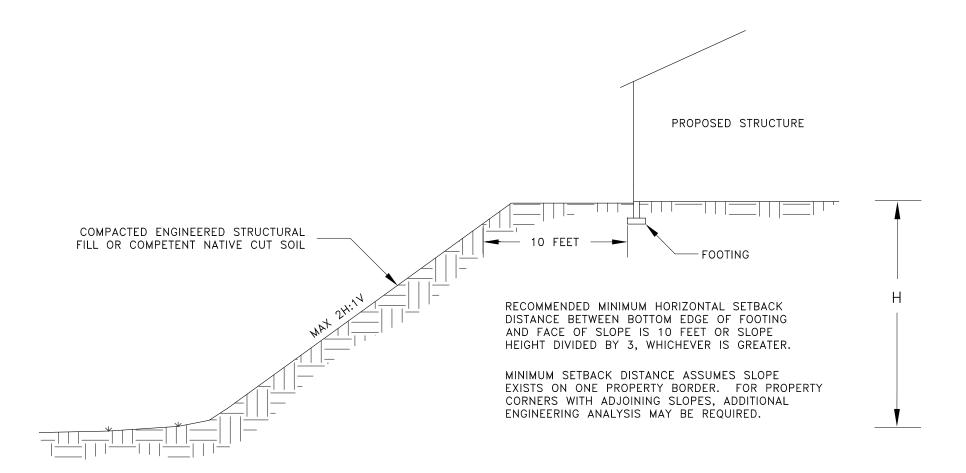
- 1. DRAWING IS NOT TO SCALE.
- 2. SLOPES AND PROFILES SHOWN ARE APPROXIMATE.
- 3. DRAWING REPRESENTS TYPICAL FILL AND CUT SLOPE SECTION, AND MAY NOT BE SITE-SPECIFIC.

Colu	Environmental * Special Inspections mbia West
	11917 NE 95th STREET

11917 NE 95th STREET
VANCOUVER, WASHINGTON 98682
PHONE: 360-823-2900 FAX: 360-823-2901
www.columbalwestengineering.com

Design:	Dro	awn	: HDG	TYPICAL CUT AND FILL				
Checked: ASR	Da	te:1	0/2/18	SLOPE CROSS-SECTION				
Client: LCSD	Rev	Ву	Date					
Job No: 18084				LA CENTER MIDDLE SCHOOL				
CAD File: FIGURE 3				LA CENTER MIDDLE SCHOOL LA CENTER, WASHINGTON				
Scale: NONE				LA CENTER, WASHINGTON				

MINIMUM FOUNDATION SLOPE SETBACK DETAIL



NOTES:

- 1. DRAWING IS NOT TO SCALE.
- SLOPES AND PROFILES SHOWN ARE APPROXIMATE.
 DRAWING REPRESENTS TYPICAL FOUNDATION
- 3. DRAWING REPRESENTS TYPICAL FOUNDATION SETBACK DETAIL, AND MAY NOT BE SITE—SPECIFIC.

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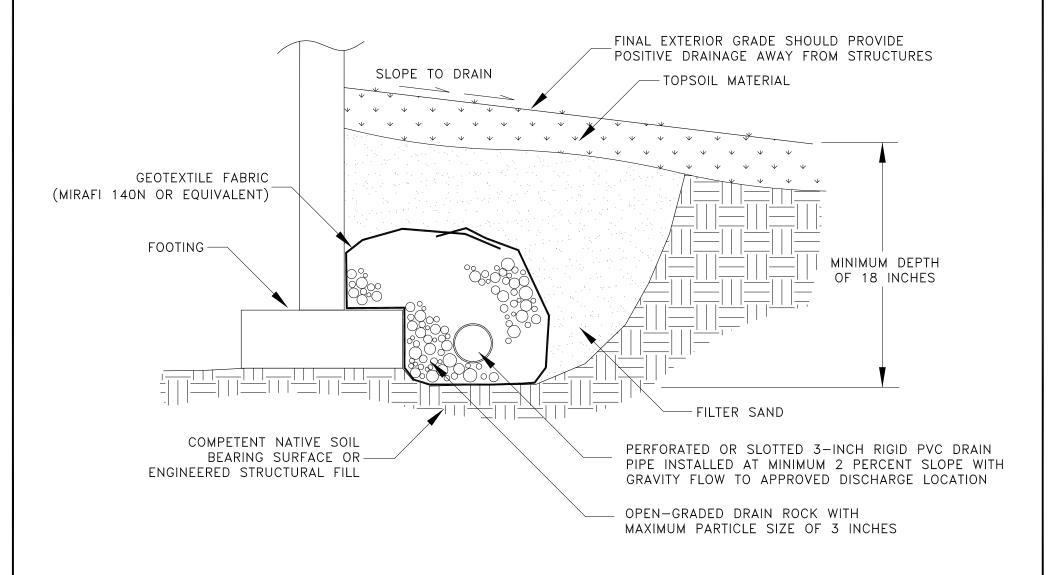
	Design:	Dr	awn	: HDG	
_	Checked: ASR		Date: 10/2/18		
	Client: LCSD	Rev	Ву	Date	
	Job No: 18084				
	CAD File: FIGURE 4				ו
	Scale: NONE				

TYPICAL MINIMUM SLOPE SETBACK DETAIL

LA CENTER MIDDLE SCHOOL LA CENTER, WASHINGTON

FIGURE 4

TYPICAL PERIMETER FOOTING DRAIN DETAIL



NOTES:

1. DRAWING IS NOT TO SCALE.

2. DRAWING REPRESENTS TYPICAL FOOTING DRAIN DETAIL AND MAY NOT BE SITE-SPECIFIC.

Geote	chni	cal =	En		=	enta		Spi	ecial	Ins	pect	tions	
U	DI	ul	ĬΪ	Įį.	lŀ	a	V	V	e	S	ľ		7
En	g	i n	e	e	ri	n	g		I	n	C	7	
					40		.E.O		CTD			•	

11917 NE 95th STREET					
VANCOUVER, WASHINGTON 98682					
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www.columbaiwestengineering.com					

	Design:		Drawn: HDG			
<u> </u>	Checked: ASR	Date: 10/2/18				
	Client: LCSD	Rev	Ву	Date		
	Job No:18084					
	CAD File: FIGURE 5					
	Scale: NONE					

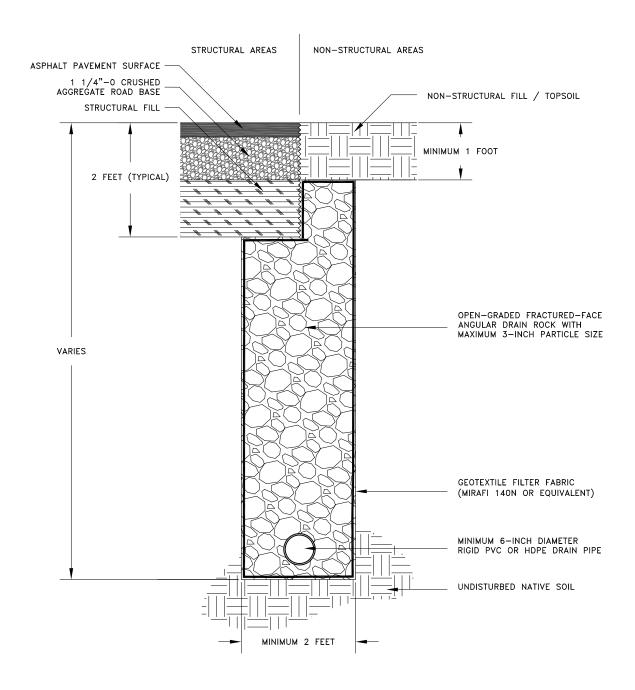
TYPICA	L PERIM	METER
FOOTING	DRAIN	DETAIL

LA CENTER MIDDLE SCHOOL
LA CENTER, WASHINGTON

FIGURE

5

TYPICAL PERFORATED DRAIN PIPE TRENCH DETAIL



NOTE: LOCATION, INVERT ELEVATION, DEPTH OF TRENCH, AND EXTENT OF PERFORATED PIPE REQUIRED MAY BE MODIFIED BY THE GEOTECHNICAL ENGINEER DURING CONSTRUCTION BASED UPON FIELD OBSERVATION AND SITE—SPECIFIC SOIL CONDITIONS.

	Geotechnical = Environmental = Special Inspections	ı
	Columbia West 	(
	Engineering, Inc	(
	11917 NE 95th STREET VANCOUVER, WASHINGTON 98682	Γ,
	PHONE: 360-823-2900 FAX: 360-823-2901	(
ı	www.columbaiwestengineering.com	Г

Design:	Dro	awn	:HDG	
Checked: ASR	Da	te: 1	0/2/18	
Client:LCSD	Rev	Ву	Date	H
Job No: 18084				
CAD File: FIGURE 6				
Scale: NONE				

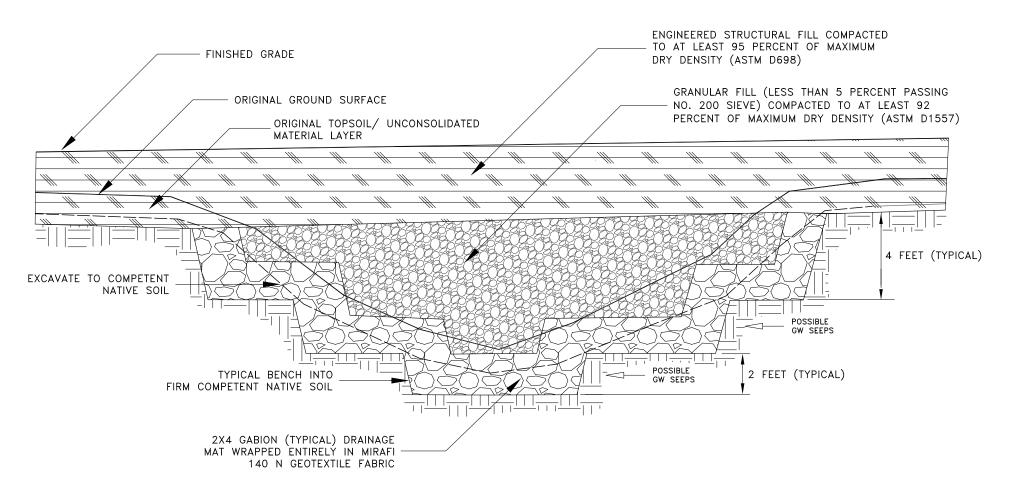
TYF	PICAL	PERFORA	TED
DRAIN	PIPE	TRENCH	DETAIL

FIGURE

LA CENTER MIDDLE SCHOOL LA CENTER, WASHINGTON

6

TYPICAL DRAINAGE MAT CROSS-SECTION



NOTES:

- 1. DRAWING IS NOT TO SCALE.
- 2. SLOPES AND PROFILES SHOWN ARE APPROXIMATE.
- 3. DRAWING REPRESENTS TYPICAL DRAINAGE MAT SECTION AND MAY NOT BE SITE-SPECIFIC.
- 4. DEPTH, LOCATION, EXTENT, AND THICKNESS OF GABION MAT AND GRANULAR FILL LAYER SHOULD BE DETERMINED IN THE FIELD BY COLUMBIA WEST.
- 5. DRAIN PIPE MAY BE NEEDED AT LOWEST GRADIENT POINT OF DRAINAGE MAT TO CONTROL AND DIRECT FLOW.



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	Design:	Dr	<u>awn</u>	: HDG	
-	Checked: ASR	Da	te:1	0/2/18	
	Client: LCSD	Rev	Ву	Date	_
	Job No: 18084				
	CAD File: FIGURE 7				
	Scale: NONE				

TYPICAL DRAINAGE MAT SECTION	FIGURE
LA CENTER MIDDLE SCHOOL LA CENTER, WASHINGTON	7

APPENDIX A LABORATORY TEST RESULTS



		i Ait	HOLL-O	IZE ANA		·							
PROJECT	NC 111 C 1 1		CLIENT	II 1 G			PRO	DJECT NO			LAB ID		
	r Middle School			ve Holmes, Sur					084			518-346)
La Center	r, Washington			ter School Dist			REF	OA /			FIELD ID	TD1 1	
				E Highland Ave			DAT	U4/2 E SAMPL	27/18		SAMPLE	TP1.1	
			La Cen	ter, Washington	1 98629		DAT		ED 8/18		SAMPLEL	ASR	
MATERIAL I	DATA							04/1	0/10			ASK	
MATERIAL SAMP			MATERIAL SO	NIDCE			LUSC	S SOIL T	VDE				
Lean CLA				t TP-01				CL, Le		lav			
			depth =					,		J			
SPECIFICATIONS	S			2 1001			AAS	SHTO SOIL	TYPE				
none							A	A-7-6 (1	19)				
I ABORATO	DRY TEST DATA												
LABORATORY E							TES	T PROCE	DURE				
	"Mary Ann" Sifter	637						ASTM		13			
ADDITIONAL							+	EVE DAT					
	initial dry mass (g) =	113.49								% (gravel =	0.0%	
as-receiv	ved moisture content =	38.3%	coefficier	nt of curvature, C _C	= n/a					%	sand =	11.1%	
	liquid limit =	44	coefficien	t of uniformity, C_U	= n/a				%	silt an	d clay =	88.9%	
	plastic limit =	25	€	effective size, D ₍₁₀₎	= n/a								
	plasticity index =	19		D ₍₃₀₎								PASSIN	
	fineness modulus =	n/a		D ₍₆₀₎	= n/a			SIEVE S	SIZE		EVE	SPE	
								US	mm	act.	interp.	max	min
		CDAIN S	ZE DISTRIBU	TION					150.0 100.0		100% 100%		
		GRAIN SI						3.00"	75.0		100%		
-4	3" 2½" 1½" 1½" 3/4" 3/8" 3/8"	1/4"	#10 #20 #30 #40	#50 #60 #100 #140 #170 #200				2.50"	63.0		100%		
100% 💁	00 000 000 0	TO 0	t	++ ++++++		100%		2.00"	50.0		100%		
-			200	-00 oa				1.75"	45.0		100%		
90%				7000		90%	교	1.50" 1.25"	37.5 31.5		100% 100%		
-							GRAVEL	1.25	25.0		100%		
80%						80%	5	7/8"	22.4		100%		
								3/4"	19.0		100%		
70%						70%		5/8"	16.0		100%		
								1/2" 3/8"	12.5 9.50		100% 100%		
60%						60%		3/0 1/4"	6.30		100%		
ing								#4	4.75	100%	10070		
bassin 50%						50%		#8	2.36		99%		
žd %								#10	2.00	98%			
40%						40%			1.18	070/	97%		
40%						4070			0.850	97%	96%		
30%						30%			0.425	96%	7070		
30%						3070	SAND		0.300		95%		
2007						200/	S		0.250	95%			
20%						20%			0.180	0.407	94%		
									0.150 0.106	94%	91%		
10%						10%			0.090		90%		
						-		#200	0.075	89%			
0% 100.0	00 10.0	0	1.00	0.10		+ 0%).01	DAT	E TESTEI	D		TESTED	ВҮ	
100.0	10.0		ticle size (mm)	0.10	U			04/2	20/18			RTT	
		μαι						1		1	,		_
		→ sieve s	zes	sieve data				4		1		X	
							1						

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			AI	ILKDI	ING LI		KEPU	X I			
	enter Middle enter, Washi		ol		ve Holmes, Ster School D	-	lent	PROJECT NO. 18084 REPORT DATE	LAB ID S18-346 FIELD ID		
	,	<i>U</i>			Highland A			04/27/18	TP1.1		
					ter, Washing			DATE SAMPLED 04/18/18	SAMPLED BY ASR		
MATERI	AL DATA										
MATERIAL	SAMPLED CLAY			MATERIAL SO Test Pit				USCS SOIL TYPE			
Lean	CLAI			depth =			CL, Lean Clay				
			_	асри	2 ICCt						
	ATORY TEST	T DAT	Α					TEST PROCEDURE			
		chine.	Hand Rolled					ASTM D4318			
	ERG LIMITS	,,	LIQUID LIMIT DETERMIN	ATION							
				0	2	€	4		JID LIMIT		
lic	quid limit =	44	wet soil + pan weight, g	= 29.19	28.93	30.42	32.07	100%			
	stic limit =	25	dry soil + pan weight, g		26.53	27.43	28.46	80%			
plastic	ity index =	19	pan weight, g		20.94	20.85	20.62	% 70% of 60%			
			N (blows) moisture, %		28 42.9 %	20 45.4 %	16 46.1 %	50%			
SHRINKA	\CF		PLASTIC LIMIT DETERMI		42.9 70	45.4 70	40.1 /0	40% E 30%			
JIININK	IOL		TEASTIC EIWIT DETERWI	1	2	6	4	20%			
shrink	age limit =	n/a	wet soil + pan weight, g		28.18			10%			
	age ratio =	n/a	dry soil + pan weight, g	= 26.53	26.72				25 100		
			pan weight, g		20.86			number	of blows, "N"		
			moisture, %	= 25.1 %	24.9 %			ADDITIONAL DATA			
			DI ACTI		-			ADDITIONAL DATA			
			PLASTI	CITY CHAR	.J			0/ grave	1 - 0.00/		
80	-						2000	% grave % sand			
							por	% silt and clay			
70	1				+-/		·	% siit and day			
	-					ا" ممر	J" Line	% clay			
60	, -					,,,,,,		moisture conten			
	-				مممر ا			moisture conten	1 - 36.370		
پ 50	,				2000						
gex	-				,	/	"A" Line				
Ë 40	-				CH or 0	OH					
plasticity index	-			20/00							
olasi	-		/ / / .	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,							
a 30	-		1								
			CL or OL								
20	20		9								
			L. P. C.		MH or O	н					
10		, 									
		CL	-ML ML or (OL				0.475.7507	Treates at		
0			 		 -			DATE TESTED 04/24/18	TESTED BY JJC		
	0 10	:	20 30 40		60 70	80	90 100	U4/24/18	JJC		
				liquid limit				family	C		

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La Center Middle School		CLIENT			PRO.	JECT NO.		LAB ID		
			Holmes, Superinter	ndent		18084			518-347	7
La Center, Washington		La Center S	School District		REPO	ORT DATE		FIELD ID		
		725 NE Hi	ghland Avenue			04/27/13			TP1.2	
		La Center,	Washington 98629)	DATE	E SAMPLED		SAMPLE		
						04/18/1	8		ASR	
IATERIAL DATA		MATERIAL SOURC			Luco	S SOIL TYPE				
MATERIAL SAMPLED SILT		Test Pit TP				1L, Silt				
2121		depth = 6 f				12, 2111				
PECIFICATIONS		1 1				HTO SOIL TYPE				
none					A	-4(0)				
ABORATORY TEST DATA					ı					
ABORATORY EQUIPMENT						PROCEDURE				
Rainhart "Mary Ann" Sifter	637				_	STM D69	013			
ADDITIONAL DATA	100.14				SIE	VE DATA	0/. a	ravel =	0.00/	
initial dry mass (g) = as-received moisture content =		opefficient of	ourvoturo C -	m/a			U	ravel = sand =	0.0%	
as-received moisture content =			curvature, C _C = iniformity, C _U =	n/a n/a		0/	% silt and			
plastic limit =			iriiomity, C _U = ive size, D ₍₁₀₎ =	n/a n/a		70	ont and	ciay –	92.170	
plasticity index =		Circot	D ₍₃₀₎ =	n/a			l p	PERCENT	Γ PASSIN	G
fineness modulus =			D ₍₆₀₎ =	n/a		SIEVE SIZE	SIE		SPE	
						US mm	act.	interp.	max	m
						6.00" 150.0		100%		
	GRAIN S	SIZE DISTRIBUTIO	N			4.00" 100.0		100%		
22%" 173" 174" 175" 258	#4 #4	# #10 # #20 # #30 ##50	#80 #100 #170 #200			3.00" 75.0 2.50" 63.0		100% 100%		
100% 0-00-000-0-0) ,, 0,0,,,	·γ - ο - ο - ο - ο - ο - ο -	~~~	100%		2.00" 50.0		100%		
			900			1.75" 45.0		100%		
90%			179	90%	닖	1.50" 37.5		100%		
E]	GRAVEL	1.25" 31.5 1.00" 25.0		100% 100%		
80%				80%	S.	7/8" 22.4		100%		
~~ ~~]		3/4" 19.0		100%		
								4000/		
70%				70%		5/8" 16.0		100%		
- II				70%		1/2" 12.5		100%		
70%						1/2" 12.5 3/8" 9.50		100% 100%		
70%				70%		1/2" 12.5 3/8" 9.50 1/4" 6.30	100%	100%		
70%				60%		1/2" 12.5 3/8" 9.50 1/4" 6.30	100%	100% 100%		
70%						1/2" 12.5 3/8" 9.50 1/4" 6.30 #4 4.75 #8 2.36 #10 2.00	100%	100% 100% 100%		
70%				60%		1/2" 12.5 3/8" 9.50 1/4" 6.30 #4 4.75 #8 2.36 #10 2.00 #16 1.18	100%	100% 100% 100%		
70%				60%		1/2" 12.5 3/8" 9.50 1/4" 6.30 #4 4.75 #8 2.36 #10 2.00 #16 1.18 #20 0.850		100% 100% 100% 100%		
70%				60% 50% 40%	0	1/2" 12.5 3/8" 9.50 1/4" 6.30 #4 4.75 #8 2.36 #10 2.00 #16 1.18	100%	100% 100% 100%		
70% 60% 50% 60% 60%				60%	SAND	1/2" 12.5 3/8" 9.50 1/4" 6.30 #4 4.75 #8 2.36 #10 2.00 #16 1.18 #20 0.850 #30 0.600 #40 0.425 #50 0.300	100% 100% 99%	100% 100% 100% 100%		
70% 60% 60% 40% 40% 30%				60% 50% 40% 30%	SAND	1/2" 12.5 3/8" 9.50 1/4" 6.30 #4 4.75 #8 2.36 #10 2.00 #16 1.18 #20 0.850 #30 0.600 #40 0.425 #50 0.300 #60 0.250	100% 100%	100% 100% 100% 100% 100% 100% 99%		
70%				60% 50% 40%	SAND	1/2" 12.5 3/8" 9.50 1/4" 6.30 #4 4.75 #8 2.36 #10 2.00 #16 1.18 #20 0.850 #30 0.600 #40 0.425 #50 0.300 #60 0.250 #80 0.180	100% 100% 99% 99%	100% 100% 100% 100% 100%		
70%				60% 50% 40% 30% 20%	SAND	1/2" 12.5 3/8" 9.50 1/4" 6.30 #4 4.75 #8 2.36 #10 2.00 #16 1.18 #20 0.850 #30 0.600 #40 0.425 #50 0.300 #60 0.250	100% 100% 99%	100% 100% 100% 100% 100% 100% 99%		
70% 60% 50% 40% 40% 30%				60% 50% 40% 30%	SAND	1/2" 12.5 3/8" 9.50 1/4" 6.30 #4 4.75 #8 2.36 #10 2.00 #16 1.18 #20 0.850 #30 0.600 #40 0.425 #50 0.300 #60 0.250 #80 0.180 #100 0.150	100% 100% 99% 99%	100% 100% 100% 100% 100% 100% 99% 99%		
70%				60% 50% 40% 30% 20%		1/2" 12.5 3/8" 9.50 1/4" 6.30 #4 4.75 #8 2.36 #10 2.00 #16 1.18 #20 0.850 #30 0.600 #40 0.425 #50 0.300 #60 0.250 #80 0.180 #140 0.106 #170 0.090 #200 0.075	100% 100% 99% 99% 99%	100% 100% 100% 100% 100% 100% 99% 99% 96% 94%		
70%)0	1.00	0.10	60% 50% 40% 30% 20%		1/2" 12.5 3/8" 9.50 1/4" 6.30 #4 4.75 #8 2.36 #10 2.00 #16 1.18 #20 0.850 #30 0.600 #40 0.425 #80 0.180 #100 0.150 #140 0.106 #170 0.090 #200 0.075	100% 100% 99% 99% 99%	100% 100% 100% 100% 100% 100% 99% 99% 96%		
70% 60% 50% 40% 40% 10% 0%		1.00 article size (mm)	0.10	60% 50% 40% 30% 20% 10%		1/2" 12.5 3/8" 9.50 1/4" 6.30 #4 4.75 #8 2.36 #10 2.00 #16 1.18 #20 0.850 #30 0.600 #40 0.425 #50 0.300 #60 0.250 #80 0.180 #140 0.106 #170 0.090 #200 0.075	100% 100% 99% 99% 99%	100% 100% 100% 100% 100% 100% 99% 99% 96% 94%	BY RTT	
70%		article size (mm)	O.10	60% 50% 40% 30% 20% 10%		1/2" 12.5 3/8" 9.50 1/4" 6.30 #4 4.75 #8 2.36 #10 2.00 #16 1.18 #20 0.850 #30 0.600 #40 0.425 #50 0.300 #60 0.250 #80 0.180 #100 0.150 #110 0.075 ETESTED 04/20/13	100% 100% 99% 99% 99%	100% 100% 100% 100% 100% 100% 99% 99% 96% 94% TESTED I		

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PROJEC La		ter M	iddle	School					(CLIEN M		ave	Hol	mes,	Suj	perir	ntende	nt		PRO	OJECT N	10. 8084		LAB ID	S18-34	8
La	Cent	er, W	ashin	gton						La	ı Ce	nter	Sch	ool i	Dist	rict				REI	PORT DA	ATE		FIELD ID		
										72	5 N	E H	lighl	and	Ave	nue						/27/18	3		TP1.3	
													, Wa							DA	TE SAMF			SAMPLE		
													,		0						04.	/18/18	3		ASR	
MATE			Ά								DIAL	00110	0.5							Luc	20.001	T) (D.E.				
MATERI		MPLED ith Sa	ınd						N			SOUR Pit T	CE P-01								CS SOIL	TYPE Silt wi	th Sar	nd		
SIL	/1 VVI	1111 50	ina										feet							'	.v1L, L)11t W1	iii bai	ıa		
SPECIF	ICATIO	NS								uc	Pin		ICCI							AAS	SHTO SO	OIL TYPE				
non																					A-4(5					
LARC	RAT	ORY	TFST	DATA																						
LABORA				DITTI																TES	ST PROC	CEDURE				
Rai	nhar	t "Ma	ary Aı	nn" Sif	ter 6	37															ASTN	1 D69	13			
		L DAT	_																	SI	EVE DA	ιTΑ				
		ini	tial dry	mass (g	g) =	124.	30																	gravel =	0.0%	
as	s-rece	eived r	noistur	e conter	nt =	42.2	2%			coe	fficie	ent of	f curv	ature/	, C _C	=	n/a	ı					%	sand =	16.3%	
				iquid lim			30			coe	fficie		unifo	-			n/a	ì				%	silt an	d clay =	83.7%	
				astic lim			23					effe	ctive				n/a						1			
		.		city inde			7								D ₍₃₀₎		n/a				OLEV (E	0.75		PERCEN		
		TIF	ieness	modulu	s =	1	n/a								D ₍₆₀₎	,=	n/a	ì			SIEVE	ı	act.	EVE interp.	max	ECS min
																			US mm 6.00" 150.0				act.	100%	пах	111111
						GR	AIN	SIZE	E DI	STF	RIBU	JTIC	N								4.00"	100.0		100%		
		=		la La la d	1									8 8 9	28						3.00"	75.0		100%		
				3/4"				#8	#	#5	# #	# #	9 8	# #:	#2				4000/		2.50"	63.0		100%		
11	JU% (ω00			••			0-		\circ	→	ф.,	0				-	100%		2.00" 1.75"	50.0 45.0		100% 100%		
	000/																		000/	١.	1.50"	37.5		100%		
'	90% -													٩	Q I				90%	GRAVEL	1.25"	31.5		100%		
	000/	-													þ			1	000/	3RA	1.00"	25.0		100%		
'	80% -																		80%	ľ	7/8" 3/4"	22.4 19.0		100%		
	= 00/	-																-	=00 /		5/8"	16.0		100% 100%		
	70% -									Ш								1	70%		1/2"	12.5		100%		
		-																-	/		3/8"	9.50		100%		
б	60% -	Elli								Ш								-	60%		1/4"	6.30	1000/	100%		
passin		-																-			#4	4.75 2.36	100%	100%		
pas	50% -	Filli																-	50%		#10	2.00	100%	10070		
%																		-			#16	1.18		100%		
•	40% -	H								Ш								-	40%		#20	0.850	100%			
]			#30	0.600	99%	99%		
	30% -	-																-	30%	SAND	#40 #50	0.425 0.300	77 70	99%		
		EIIII																		s/s	#60	0.250	98%	-		
	20% -					+++					++	++				+		+	20%		#80	0.180		97%		
																		1			#100 #140	0.150	96%	000/		
	10% -					+++						++						+	10%		#140 #170	0.106 0.090		90% 87%		
																		1			#200	0.075	84%	-,,,		
	0% - 100	0.00			10.00				1.0	00 1				0.1	0			0.0	0% 1	DA	TE TEST	ED		TESTED	BY	
	100				.0.00		n	artic			mm'	١		J. I	J			0.0	•		04	/20/18	3		RTT	
							۲	J. 110		(,	,										1	1	7		_
						•	sie	ve sizes			-		sieve da	ata							9	-	1 6		X	



					REPUR		T		
PROJECT La Center Middle School		CLIENT Mr Dave	e Holmes, S	uperintend	lent	PROJECT NO. 18084	LAB ID S18-348		
La Center, Washington			r School Di	-	.0110	REPORT DATE	FIELD ID		
La Center, Washington			Highland A			04/27/18	TP1.3		
			r, Washingt			DATE SAMPLED	SAMPLED BY		
		La Cente	i, wasiiiigi	.011 90029		04/18/18	ASR		
MATERIAL DATA									
MATERIAL SAMPLED SILT with Sand		MATERIAL SOU Test Pit	RCE TD_01			USCS SOIL TYPE ML, Silt with San	d		
SIL1 with Sand		depth = 9			ML, Silt with Sand				
4 D O D 4 T O D V T C O T D 4 T 4		чери ,	7 1001			L			
LABORATORY TEST DATA LABORATORY EQUIPMENT						TEST PROCEDURE			
Liquid Limit Machine, Ha	and Rolled					ASTM D4318			
_	IQUID LIMIT DETERMINAT	ION				LIO	UD I IMIT		
		0	2	8	4	100% F	IID LIMIT		
liquid limit = 30	wet soil + pan weight, g =	34.64	32.30	30.82	31.28	90%			
plastic limit = 23	dry soil + pan weight, g =	31.52	29.71	28.42	28.77	80%			
plasticity index = 7	pan weight, g =	20.76	20.94	20.63	20.85	% 70% = 60% = 60%			
	N (blows) =	32	27	22	17	50% true			
CUDINIVACE	moisture, % =	29.0 %	29.5 %	30.8 %	31.7 %	30% Book 100 and 100 a			
SHRINKAGE	PLASTIC LIMIT DETERMINA	ATION	9	6	4	20%			
shrinkage limit = n/a	wet soil + pan weight, g =	28.02	29.09	•		10%			
shrinkage ratio = n/a	dry soil + pan weight, g =	26.66	27.52			0% F	25 100		
	pan weight, g =	20.72	20.85			number (of blows, "N"		
	moisture, % =	22.9 %	23.5 %						
70	PLASITION	TY CHART	CH or O	,,,,,,,	"A" Line	% grave % sand % silt and clay % silt % clay moisture content	1 = 16.3% v = 83.7% t = n/a v = n/a		
20 20 CL-M	30 40	50 60	MH or OH	80	90 100	DATE TESTED 04/25/18	TESTED BY RTT		

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DD0 ISOT		TOLL-SIZI					10		LABIS		
PROJECT La Center Middle School		CLIENT Mr. Dave H	olmes, Superin	itendent	PR	OJECT N			LAB ID	10 24	2
La Center, Washington			chool District	nenuem	DE	I PORT DA	8084		FIELD ID	18-34	9
La Center, washington					KE		/27/18			TP4.1	
		_	hland Avenue		DΛ	TE SAME			SAMPLED		
		La Center, \	Washington 980	529	DA.		/18/18		SAIVII LLL	ASR	
MATERIAL DATA						UT	/10/10			ASIC	
MATERIAL DATA MATERIAL SAMPLED		MATERIAL SOURCE			ш	CS SOIL	TVDE				
SILT		Test Pit TP-	.04			ML, S					
SILI		depth = 4.5				IVIL, D	1111				
SPECIFICATIONS		depin – 4.3	icci		ΔΔ	SHTO SO	OIL TYPE				
none						A-4(0					
							,				
LABORATORY TEST DATA											
LABORATORY EQUIPMENT						ST PROC					
Rainhart "Mary Ann" Sifter	637					ASTN	1 D69	13			
ADDITIONAL DATA					SI	EVE DA	ATA				
initial dry mass (g)									gravel =	0.0%	
as-received moisture content		coefficient of cu		n/a					sand =	9.8%	
liquid limit		coefficient of un		n/a			%	silt and	d clay =	90.2%	
plastic limit		effectiv	ve size, D ₍₁₀₎ =	n/a				1 -			
plasticity index			D ₍₃₀₎ =	n/a		015175	. 0.75		PERCENT		
fineness modulus	= n/a		$D_{(60)} =$	n/a		SIEVE	T.		EVE		ECS
						US (00"	mm	act.	interp.	max	min
	GRAIN SIZE	DISTRIBUTION	ı			6.00" 4.00"	150.0 100.0		100% 100%		
						3.00"	75.0		100%		
2.7%" 2.7%" 17%" 17%" 17%" 17%" 17%" 17%" 17%" 1	3/8" 1/4" #4 #10	#16 #20 #30 #40 #50	#80 #100 #140 #200			2.50"	63.0		100%		
100% 0 00 000 000 0		~~ -0-0-0-0	+ + + + + + + + + + + + + + + + + + +	100	%	2.00"	50.0		100%		
			- ~ a			1.75"	45.0		100%		
90%				90%		1.50" 1.25"	37.5 31.5		100% 100%		
					GRAVEL	1.00"	25.0		100%		
80%				80%	, j	7/8"	22.4		100%		
						3/4"	19.0		100%		
70%				709		5/8"	16.0		100%		
						1/2"	12.5		100%		
60%				60%		3/8" 1/4"	9.50 6.30		100% 100%		
6						#4	4.75	100%	10070		
50%				50%		#8	2.36		100%		
8 50 %					'	#10	2.00	100%			
%				100		#16	1.18		100%		
40%				40%)	#20	0.850	100%	000/		
						#30 #40	0.600 0.425	99%	99%		
30%				30%	SAND	#50	0.425	17/0	99%		
						#60	0.250	99%			
20%				20%		#80	0.180		98%		
						#100	0.150	97%			
10%				109		#140	0.106		94% 92%		
						#170 #200	0.090 0.075	90%	7 ∠70		
0%				0%	DA	TE TEST		7070	TESTED E	BY	
100.00 10	.00	1.00	0.10	0.01			/20/18			RTT	
	partic	le size (mm)				0 1				1111	
	sieve sizes	—• sie	ve data			4	1-	16		X	
	3,010 0,200	- 36				0					
							IA WEST				

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PROJECT	CLIENT			DJECT NO.		LAB ID		
La Center Middle School	Mr. Dave Holmes, Superintenden	ıt	PKC	180	84		S18-35	0
La Center, Washington	La Center School District		RFP	ORT DATE	U T	FIELD ID		
La Centei, washington			INLI	04/27	//18	TILLEDID	TP5.1	
	725 NE Highland Avenue		DΔT	E SAMPLED		SAMPLE		
	La Center, Washington 98629		DAT	04/18		SAWII ELI	ASR	
MATERIAL DATA				07/10	710		ASIC	
MATERIAL SAMPLED	MATERIAL SOURCE		USC	S SOIL TYP	F			
Silty SAND	Test Pit TP-05			SM, Silty				
,	depth = 14 feet			, ,				
SPECIFICATIONS	To Proceedings		AAS	HTO SOIL T	YPE			
none			A	A-4(0)				
_ABORATORY TEST DATA								
ABORATORY EQUIPMENT			TES	T PROCEDU	JRE			
Rainhart "Mary Ann" Sifter 637			A	ASTM D	6913			
ADDITIONAL DATA			1	VE DATA				
initial dry mass (g) = 172.53					%	gravel =	0.0%	
as-received moisture content = 35.4%	coefficient of curvature, $C_C = n/a$					% sand =		
liquid limit = -	coefficient of uniformity, $C_U = n/a$					nd clay =		
plastic limit = -	effective size, $D_{(10)} = n/a$,		
plasticity index = NP	$D_{(30)} = n/a$					PERCEN [®]	T PASSIN	١G
fineness modulus = n/a	$D_{(60)} = 0.094$	mm		SIEVE SIZ	ZE :	SIEVE		ECS
	(/			US m	nm act.	interp.	max	min
				6.00" 15	0.0	100%	l.	
GRAIN SI	ZE DISTRIBUTION			4.00" 10	0.00	100%		
275." 275." 17. 17. 17. 17. 17. 17. 17. 17. 17. 17.	# # # # # # # # # # # # # # # # # # #				5.0	100%		
100% Q-QQ-QQQ-QQQ-Q-Q-Q-Q-Q-Q-Q-Q-Q-Q-Q-Q-Q	* * * * * * * * * * * * * * * * * * * *	- 100%			3.0	100%		
100%		100%			0.0 5.0	100% 100%		
-		1			7.5	100%		
90% +	├── 	90%	GRAVEL		1.5	100%		
]	\S		5.0	100%		
80% + + + + + + + + + + + + + + + + + + +	 	80%	ဗ	7/8" 2	2.4	100%		
		1		3/4" 1	9.0	100%		
70%	├── ┊ ┼┼┼┼┼┼	70%			6.0	100%		
]			2.5	100%		
60%	$ \cdot \cdot$	60%			.50	100% 100%		
6 0		1 00 %			.30 .75 100%			
		500/			.36	100%		
50%		50%			.00 100%			
%		}			.18	100%		
40% + + + + + + + + + + + + + + + + + + +		40%		#20 0.	850 100%	6		
		1		#30 0.	600	100%		
30%		30%	Ω	#40 0.	425 100%	6		
<u></u>		1	SAND		300	99%		
20%		20%	,		250 99%			
~		- 20,0			180 150 85%	90%		
100/		400/			150 85% 106	67%		
10%		10%			090	58%		
]			075 48%			
100.00 10.00	1.00 0.10	0% 0.01	DAT	E TESTED		TESTED	ВҮ	
		0.01		04/20	/18		RTT	
part	ticle size (mm)					_		
• sieve siz	zes ——— sieve data			40	_1		X	
				0				
				OLLIMBIA W		.===		

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La Center Middle School La Center, Washington La Center, Washington La Center School District 725 NE Highland Avenue La Center, Washington 98629 ASR MATERIAL DATA MATERIAL SAMPLED Lean CLAY with Sand MATERIAL SOURCE Test Pit TP-15, depth = 2 feet native subgrade soils MASHTO SOIL TYPE A-6(9) ABORATORY TEST DATA ABORATORY EQUIPMENT Rainhart "Mary Ann" Sifter 637 ADDITIONAL DATA initial dry mass (g) = 222.55 as-received moisture content = 19.2% coefficient of curvature, $C_c = n/a$ n/a		ICLL-SIZE ANAL I SIS					
La Center, Washington	PROJECT La Center Middle School	CLIENT Mr. Dava Holmes, Superintendent		PROJECT NO.	0.4	LAB ID	0
T25 NE Highland Avenue La Center, Washington 98629 MATERIAL DATA		_					8
Table SAMPLED BY OS/31/18 SAMPLED BY OS/31/18	La Center, Washington						
ASERIAL DATA MATERIAL SOURCE Test Pit TP-15, depth = 2 feet native subgrade soils MATERIAL SOURCE Test Pit TP-15, depth = 2 feet native subgrade soils MATERIAL SOURCE Test Pit TP-15, depth = 2 feet native subgrade soils AASITO SOIL TYPE A-6(9) AASITO MOPILIA ABDORATORY TEST DATA ABDO		725 NE Highland Avenue					l
MATERIAL DATA MATERIAL SOURCE Test PIT TP-15, depth = 2 feet native subgrade soils		La Center, Washington 98629					
MATERIAL SUMPET Lean CLAY with Sand				08/31	/18	ASR	
Test Pit TP-15, depth = 2 feet native subgrade soils	MATERIAL DATA						
PECFFCATIONS AASHTO SOIL TYPE				USCS SOIL TYP	E		
## ABORATORY TEST DATA ## ABORATORY EQUIPMENT ## ASTIM D6913	Lean CLAY with Sand	_		CL, Lear	i Clay with	h Sand	
ABORATORY TEST DATA ABORATORY SOURMENT Rainhart "Mary Ann" Sifter 637 DODITIONAL DATA initial dry mass (g) = 222.55 as-received moisture content = 19.2% coefficient of curvature, C _C = n/a liquid limit = 35 coefficient of uniformity, C _u = n/a plastic limit = 23 effective size, D _{frop} = n/a plasticity index = 12 D _{frop} = n/a D _{frop} = n/a D _{frop} = n/a SIEVE SIZE		native subgrade soils					
## ABORATORY TEST DATA ## ABORATORY EQUIPMENT Rainhart "Mary Ann" Sirber 637 ## ADDITIONAL DATA ## ADDITIONAL DATA ## Initial dry mass (g) = 222.55 as-received moisture content = 19.2% coefficient of curvature, C _C = n/a plastic limit = 23 effective size, D ₁₀₀ = n/a plasticity index = 12 plasticity inde					YPE		
### Rainhart "Mary Ann" Sifter 637 ***********************************	none			A-6(9)			
Rainhart "Mary Ann" Sifter 637 ADDITIONAL DATA ADDITIONAL DATA Initial dry mass (g) = 222.55 as-received moisture content = 19.2% coefficient of curvature, C _C = n/a plastic imit = 23 effective size, D ₁₀₀ = n/a plasticity index = 12 p	ABORATORY TEST DATA			•			
ADDITIONAL DATA initial dry mass (g) = 222.55 as-received moisture content = 19.2% coefficient of curvature, C _C = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 3.5 coefficient of curvature, C _C = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 2.3 effective size, D ₁₀₀ = n/a plastic limit = 3.5 coefficient of curvature, C _C = n/a plastic limit = 2.3 effective size, D ₁₀₀ =	LABORATORY EQUIPMENT						
Size				ASTM D	6913		
as-received moisture content = 19.2% coefficient of curvature, C _C = n/a	ADDITIONAL DATA			SIEVE DATA			
Silt and clay = 79.7% Silt	initial dry mass (g) = 222.55				_		
plasticity index = 12	as-received moisture content = 19.2%						
Plasticity index = 12	liquid limit = 35	coefficient of uniformity, $C_U = n/a$			% silt and	l clay = 79.7%	
Percent Passing	plastic limit = 23	effective size, $D_{(10)} = n/a$					
US mm act. interp. max m max m m max m m m m m m m m m	plasticity index = 12				P	PERCENT PASSIN	NG
Comparison C	fineness modulus = n/a	$D_{(60)} = n/a$		SIEVE SIZ	ZE SIE	EVE SP	ECS
## A00				US m	nm act.	interp. max	mir
100% 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0							
100% 100%	GRAIN SIZE	E DISTRIBUTION					
100% 90% 80% 70% 40% 90% 100.00 10.0		140 200 200 141 200 200 200					
90% 1.75" 45.0 100% 1.50" 37.5 100% 1.50"	100% 0 00 000 000 0 0 0 0	* * * * * * * * * * * * * * * * * * * *	100%				
90% 80% 80% 80% 80% 70% 70% 70% 70% 70% 60% 40% 40% 40% 40% 40% 40% 40% 40% 40% 4			10070				
80% 80% 80% 80% 80% 80% 80% 80% 80% 80%		Toolog	-	4.50" 0			
70%	90%		90%	<mark>불</mark> 1.25" 3			
70%]	≨ 1.00" 2	5.0	100%	
70% 60% 60% 60% 1/2" 12.5 100% 1/2" 12.5 100% 1/2" 6.30 100% 1/2"	80%		+ 80%	1/0 2			
1/2" 12.5 100% 3/8" 9.50 100% 1/4" 4.75 100% 3/8" 9.50 100% 1/4" 4.75 100% 3/8" 9.50 100% 1/4" 4.75 100% 3/8" 9.50 100% 1/4" 4.75 100% 3/8" 9.50 100% 1/4" 4.75 100% 4/4" 4			1				
Buss 50%	70% + + + + + + + + + + + + + + + + + + +		70%				
50%]				
## 4 4.75 100% ## 2.36 99% ## 2.36 90% ## 2.36 90% ## 2.36 90% ## 2.36 90% ## 2.36 90% ## 2.36 90% ## 2.36 90% ## 2.36 90% ## 2.36 90% ## 2.36 90% ## 2.36 90% ##	60%		60%				
#8 2.36 99% #10 2.00 99% #16 1.18 98% #20 0.850 97% #30 0.600 96% #30 0.250 93% #80 0.180 91% #100 0.150 90% #100 0.150 90% #1100 0.150 90% #1100 0.150 90% #1100 0.150 90% #1100 0.150 90% #1100 0.150 90% #1100 0.150 90% #1100 0.150 90% #1100 0.150 90% #1100 0.150 90% #1100 0.150 90% #1100 0.1	6		1			10070	
#16 1.18 98% #20 0.850 97% #30 0.600 96% #40 0.425 95% #50 0.300 94% #60 0.250 93% #80 0.180 91% #100 0.150 90% #100 0.150 90% #100 0.150 90% #100 0.075 80% DATE TESTED BY #20 0.9714/18 KMS	<u>8</u> 50%		50%			99%	
40%	ed 30% [[[[]]]]		30%	#10 2	.00 99%		
30% 20% 30% 20% 30% 20% 30% 30% 30% 30% 30% 30% 30% 30% 30% 3				#16 1	.18	98%	
30% 20% 20% 20% 20% 20% 20% 20% 20% 20% 2	40%		+ 40%				
20% #50 0.300 94% #60 0.250 93% #80 0.180 91% #100 0.150 90% #140 0.106 85% #200 0.075 80% DATE TESTED BY COMPANY TESTED BY KMS			1			96%	
20% #80 0.180 91% #100 0.150 90% #100 0.00 10.00 1.00 0.10 0.01 DATE TESTED WATER TESTED TESTED BY COMPANY TESTED	30% [30%	9 #40 0.		0.40/	
20% #80 0.180 91% #100 0.150 90% #100 0.00 10.00 1.00 0.10 0.01 DATE TESTED WATER TESTED TESTED BY COMPANY TESTED			1	#50 0.		94%	
10% #100 0.150 90% #140 0.106 85% #170 0.090 82% #200 0.075 80% DATE TESTED BY O9/14/18 KMS	20%		20%	#00 U.		91%	
10% #140 0.106 85% #170 0.090 82% #200 0.075 80% DATE TESTED BY COMPANY OF THE SIZE (mm) particle size (mm) #140 0.106 85% #170 0.090 82% #200 0.075 80% DATE TESTED BY COMPANY OF TESTED BY KMS			1			3170	
#170 0.090 82% #200 0.075 80% DATE TESTED BY O9/14/18 TESTED BY O9/14/18 KMS	10%		10%			85%	
0% 100.00 1.00 0.10 0.01 DATE TESTED BY 09/14/18 KMS	10 /0		1076				
100.00 10.00 1.00 0.10 0.01 0.01 0.01 0			1	#200 0.	075 80%		
particle size (mm) 09/14/18 KMS		100 010		DATE TESTED		TESTED BY	
				09/14	/18	KMS	
• sieve sizes —— sieve data	partic	10 0120 (IIIII)				2	
	sieve sizes			A		1	

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PROJECT						141110	KEPUI	PROJECT NO.	LAB ID
	enter Middle	e Scho	ool	CLIENT Mr. Day	ve Holmes, S	Superinten	dent	18084	S18-888
	enter, Wash				ter School D	-		REPORT DATE	FIELD ID
	,				Highland A			09/27/18	TP15.1
					ter, Washing			DATE SAMPLED	SAMPLED BY
				La Cen	.ci, washing	,ton 70027		08/31/18	ASR
	AL DATA								
MATERIAL	SAMPLED CLAY with	Sand		MATERIAL SO	URCE TP-15, dep	th - 2 foot		USCS SOIL TYPE CL, Lean Clay w	rith Sand
Lean	CLAT WILL	i Sanu			ubgrade soil			CL, Lean Clay w	illi Saliu
				nauve s	uograde son	.8			
	ATORY TES		A					T	
	RY EQUIPMENT		Hand Rolled					TEST PROCEDURE ASTM D4318	
		ciiiie,		TION				ASTW1 D4516	
ATTERBI	ERG LIMITS		LIQUID LIMIT DETERMINA	ATION ①	2	6	4	LIQ	UID LIMIT
lic	quid limit =	35	wet soil + pan weight, g =		31.55	31.69	\top	100% -	
	astic limit =	23	dry soil + pan weight, g =		28.76	28.75		90% =	
	city index =	12	pan weight, g		20.76	20.75		% 70% 	
, ,,,,,,	,	-	N (blows) =		24	18			
			moisture, % =		34.9 %	36.8 %		908 moisture 50% 40% moisture	
SHRINKA	AGE		PLASTIC LIMIT DETERMIN	NATION				E 30%	0
				0	2	6	4	20%	
shrink	age limit =	n/a	wet soil + pan weight, g =	= 28.28	27.83			10%	
shrinka	age ratio =	n/a	dry soil + pan weight, g =	= 26.91	26.50			10	25 100
			pan weight, g =		20.64			number	of blows, "N"
			moisture, % =	= 22.6 %	22.7 %				
					_			ADDITIONAL DATA	
			PLASTIC	ITY CHAR	ı				1 000
80) <u>T</u>							% grave	
								% san	
70) 丰						,	% silt and cla	•
	-					ا" ممر	J" Line	% si	
00	, -					and a		% cla	y = n/a
60) 				200	,		moisture conter	nt = 19.2%
					ممر				
≍ ⁵⁰)			\prec	1000				
plasticity index	-			/	CH or (он 📗	"A" Line		
<u>.</u> 40	, ‡								
ic.	-			,					
olas			/ ·	´					
a 30	, <u>† </u>		1						
	[I pare						
20) 		CL or OL	4-					
			l joint l		MH or O	н			
10	, ‡		× 9		-				
	/-	i CI	-+ML or C	DL					
•				_				DATE TESTED	TESTED BY
0	0 10		20 30 40	50	60 70	80	90 100	09/19/18	KMS
				iquid limit				1 1	
								Jan (

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La Center Middle School La Center, Washington La Center School District T25 NE Highland Avenue La Center, Washington 98629 ATERIAL DATA ATERIAL SAMPLED Sandy Lean CLAY PECIFICATIONS none ABORATORY TEST DATA ARIGNATORY EQUIPMENT Rainhart "Mary Ann" Sifter 637 Mr. Dave Holmes, Superintendent La Center, Superintendent La Center School District REPORT DATE REPORT DATE FIELD ID 05/01/18 SB1.1 DATE SAMPLED 05/01/18 SB1.1 DATE SAMPLED 04/19/18 SMPLED BY ASR ASR ASR ASR ASR ASR ASR ASR		CLL-SIZE ANAL I SIS I			T	
La Center, Washington La Center School District 725 NE Highland Avenue La Center, Washington 98629 ATERIAL DATA ATERIAL DATA ATERIAL SAMPLED Soil Boring SB-01 depth = 2.5 feet ASRMED Soil Boring SB-01 depth = 2.5 feet ASRMED Soil Boring SB-01 depth = 2.5 feet ASRMED Soil Soil Boring SB-01 depth = 2.5 feet ASRMED Soil Soil Boring SB-01 depth = 2.5 feet ASRMED Soil Soil Free A-7-6(14) ASSIND DOIL	PROJECT La Center Middle School	CLIENT Mr. Dave Holmes, Superintendent	F		LAB ID	010 256
Part			ļ.			
Ta Center, Washington 98629	La Center, Washington		F			
ATERIAL DATA ATERIAL DATA ATERIAL SAMPLED Sandy Lean CLAY MATERIAL SOURCE Soil Boring SB-01 depth = 2.5 feet A7-6(14) ASSI BORATORY TEST DATA SIEVE DA		_	Į.			
ATERNAL DATA MATERNAL SOURCE Soil Borring SB-01 depth = 2.5 feet		La Center, Washington 98629				
MASTERNA SQUIRCE Soil Borring SB-01 depth = 2.5 feet Soil Borring SB-01 depth = 2.5 feet MASTORY TEST DATA ### APPRILATIONS INCIDENT TEST DATA ### APPRILAT				04/19/18	3	ASK
Soil Boring SB-01 depth = 2.5 feet						
Companies Co			L		C1.	
ASPROADOR Tree A-7-6(14) ASPROADOR A-7-6(14)	Sandy Lean CLAY			CL, Sandy I	Lean Clay	
### AP-7-6(14) ### AP-7-6(1		depth = 2.5 feet				
## ABORATORY TEST DATA ## BEORATORY EQUIPMENT Rainhart "Mary Ann" Sifter 637 ## ASTM D6913 ## ASTM D6913 ## SIEVE DATA ## Silve			A			
## SIEVE DISTRIBUTION GRAIN SIZE DISTRIBUTION 100%	none			A-7-0(14)		
Rainhart "Mary Ann" Sifter 637	LABORATORY TEST DATA		<u> </u>			
Application	LABORATORY EQUIPMENT		T			
Similar Simi	·			ASTM D69	13	
as-received moisture content = 37.7% coefficient of curvature, C _C = n/a liquid limit = 46 coefficient of uniformity, C _D = n/a plastic limit = 24 effective size, D ₍₁₀₎ = n/a plasticity index = 22 D ₍₂₀₎ = n/a D ₍₂₀₎ = n/a SIEVE SIZE SIZE SIZE SIZE SIZE SIZE SIZE SIZ	ADDITIONAL DATA			SIEVE DATA		
liquid limit	· · · · · · · · · · · · · · · · · · ·				•	
Plastic limit = 24 effective size, D ₍₁₀₎ = n/a plasticity index = 22 D ₍₃₀₎ = n/a D ₍₈₀₎ = n/a	as-received moisture content = 37.7%					
Plasticity index		· · · · · · · · · · · · · · · · · · ·		%	silt and clay =	66.9%
SIEVE SIZE SIEVE SPECS	•				1	
US mm act. interp. max min						
100% 100%	fineness modulus = n/a	$D_{(60)} = n/a$			1 .	
4.00					·	max min
100%	OD AIN OZE	DISTRIBUTION				
2.50° 63.0 100% 100% 90% 80% 70% 60% 40% 100 0.150 0.95% 100 0.150 0						
100% 90% 80% 70% 60% 40% 90% 100% 1,5° 37.5 100% 1,0° 37.5 100% 1,10° 25.0 100% 1,12° 21.5 100% 34" 19.0 100% 1,12° 12.5 100% 36" 95.0 100% 1,12° 12.5 100% 36" 95.0 100% 1,12° 12.5 100% 36" 160 100% 1,12° 12.5 100% 36" 95.0 100% 1,12° 12.5 100% 36" 95.0 100% 1,12° 12.5 100% 36" 95.0 100% 1,12° 12.5 100% 36" 95.0 100% 1,12° 12.5 100% 36" 95.0 100% 1,12° 12.5 100% 36" 95.0 100% 1,12° 12.5 100% 36" 95.0 100% 1,12° 12.5 100% 36" 95.0 100% 1,12° 12.5 100% 36" 95.0 100% 1,12° 12.5 100% 36" 95.0 100% 1,12° 12.5 100% 36" 95.0 100% 1,12° 12.5 100% 36" 95.0 100% 1,12° 12.5 100% 36" 160 0 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12.5 100% 36" 100% 1,12° 12	4"	#16 #20 #30 #40 #50 #100 #1140 #200				
90% 80% 80% 80% 80% 80% 80% 80% 80% 80% 8			100%			
80% 80% 70% 70% 60% 60% 60% 40% 40% 30% 40% 100.00 10				1.75" 45.0	100%	
70%	90%		90%	1.50" 37.5		
70%				1.25" 31.5		
70%	80%		80%	25.0		
70%			0070			
1/2" 12.5 100% 3/8" 9.50 100% 1/4" 6.30 1/4" 1/4" 6.30 1/4" 1/4" 6.30 1/4"	700/		700/			
50% 40% 40% 40% 30% 20% 100.00 10.00	70%	8	70%			
#4 4.75 100% #8 2.36 100% #10 2.00 100% #16 1.18 99% #20 0.850 99% #30 0.600 98% #30 0.600 98% #40 0.425 97% #50 0.300 96% #60 0.250 95% #80 0.180 91% #100 0.150 89% #100 0.150 8				3/8" 9.50	100%	
#8 2.36 100% #10 2.00 100% #16 1.18 99% #20 0.850 99% #30 0.600 98% #30 0.600 98% #30 0.250 95% #80 0.180 91% #100 0.150 89% #100 0.150 89% #170 0.090 73% #200 0.075 67% DATE TESTED TESTED BY RTT #RTT			60%			
40% 30% 20% 10% 100.00 10.00 1.00 0.10 0.10 40% #20 0.850 99% #30 0.600 98% #30 0.600 98% #60 0.250 95% #80 0.180 91% #100 0.150 89% #1100 0.150 89%	Sin [
40% 30% 20% 10% 100.00 10.00 1.00 0.10 0.10 40% #20 0.850 99% #30 0.600 98% #30 0.600 98% #60 0.250 95% #80 0.180 91% #100 0.150 89% #1100 0.150 89%	8 50% + + + + + + + + + + + + + + + + + + +		50%			
40% 30% 20% 10% 100.00 10.00 1.00 0.10 0.10 40% #20 0.850 99% #30 0.600 98% #30 0.600 98% #60 0.250 95% #80 0.180 91% #100 0.150 89% #1100 0.150 89%	1%					
30% 20% 30% 20% 30% 20% 30% 30% 30% 30% 30% 30% 30% 30% 30% 3			40%			
20%						
20% #50 0.300 96% #60 0.250 95% #80 0.180 91% #100 0.150 89% #140 0.106 78% #170 0.090 73% #200 0.075 67% DATE TESTED BY RTT	30% + + + + + + + + + + + + + + + + + + +		30%	2 #40 0.425		
20% #80 0.180 91% #100 0.150 89% #140 0.106 78% #170 0.090 73% #200 0.075 67% DATE TESTED O4/26/18 RTT				#50 0.300		
10% #100 0.150 89% #140 0.106 78% #170 0.090 73% #200 0.075 67% DATE TESTED WAY 100.00 Particle size (mm)	20%			#00 0.230		
10% #140 0.106 78% #170 0.090 73% #200 0.075 67% DATE TESTED BY TESTED BY RTT 10% #170 0.090 73% #200 0.075 67% DATE TESTED BY RTT						
#170 0.090 73% #200 0.075 67% DATE TESTED BY 04/26/18 RTT	10%		10%			
0% 100.00 1.00 0.10 0.01 DATE TESTED W TESTED BY 04/26/18 RTT	1070		10/0			
100.00 10.00 1.00 0.10 0.01 DATE TESTED 1 125 TESTED 1 12				#200 0.075	67%	
particle size (mm) 04/26/18 RTT		1.00 0.10 0				
			-	04/26/18	3	RTT
◆ sieve sizes	partici	(mm)	Γ			
	→ sieve sizes			Jan		



				/ \ .							\ 	
PROJEC	ct Center Mid	dla Caha	o1		(CLIENT Mr. Dov	a Halm	. C.		dont	PROJECT NO.	LAB ID
						Mr. Dav		_		ueni	18084	S18-356
La	Center, Wa	shington				La Cente					REPORT DATE	FIELD ID
						725 NE					05/01/18 DATE SAMPLED	SB1.1
						La Cente	er, Wash	ningtor	98629		04/19/18	ASR
MATE	RIAL DATA										0 11 02 7 2 0	
	IAL SAMPLED				N	MATERIAL SOL	JRCE				USCS SOIL TYPE	
	dy Lean CI	LAY				Soil Bor	ing SB-	01			CL, Sandy Lea	an Clay
						depth = 1						
۸RO	RATORY TE	EST DAT	٨									
	ATORY EQUIPME		<u> </u>								TEST PROCEDURE	
	uid Limit N		Hand Ro	lled							ASTM D4318	
	RBERG LIMITS			MIT DETERMI	NATIO	ON						
						0	9		6	4		IQUID LIMIT
	liquid limit =	= 46	wet soil	+ pan weight,	q =	30.87	29.81	1	31.23	29.27	100%	
ı	plastic limit =			+ pan weight,		27.80	27.05		27.87	26.53	80%	
	· sticity index =			pan weight,		20.75	20.94		20.62	20.86	% 70%	
				N (blows		35	29		23	18		
				moisture, 9	% =	43.6 %	45.2 9	%	46.3 %	48.3 %	moisture 50% - 40%	9 0 0 0
SHRIN	IKAGE		PLASTIC	LIMIT DETERI	MINA	TION					E 30%	
						0	2		6	4	20%	
	inkage limit =			+ pan weight,		27.42	27.47	7			0%	
shri	nkage ratio =	= n/a	dry soil	+ pan weight,	g =	26.16	26.20)			10	25 100
				pan weight,	g =	20.83	20.88				num	ber of blows, "N"
				moisture, 9	% =	23.6 %	23.9 9	%				
											ADDITIONAL DATA	
				PLAST	ICIT	Y CHART	Γ					
	80		· T	T			·	1			% gr	avel = 0.0%
	F							/		, por	% s	and = 33.1%
	70										% silt and	clay = 66.9%
	/0 <u></u>								الممر	U" Line	%	silt = n/a
	[,	O Line	%	clay = n/a
	60					+-	/	1000			moisture con	tent = 37.7%
	-							-				
	50						,,,,,					
plasticity index	ļ.					("A" Line		
ä	40			/		1 ,,,,,	CF	or OH				
icit	40					1-						
ast	-				ممر	´						
ם	30 -		ļ	<u> </u>	<i>,</i>							
	[, or or		1/						
	20			CL or OL	0	X_{-}						
			مممد					<u></u>				
	ŀ		and a second				МН	or OH				
	10	/ /	4									
		CL	-ML	ML o	r OL						DATE	1-ra
	0	1	ļ								DATE TESTED	TESTED BY
		10	20 3	0 40			0 1	70	80	90 100	04/30/18	RTT
					liqu	uid limit					1	16
											_	

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	ICLE-SIZE ANAL I SIS I	<u>`</u>					
PROJECT La Center Middle School	Mr. Dave Holmes, Superintendent		PRO.	JECT NO.	l'	AB ID	0.57
	_			18084		S18-3	357
La Center, Washington	La Center School District		REP(ORT DATE		FIELD ID	_
	725 NE Highland Avenue		_	05/01/18		SB1	.4
	La Center, Washington 98629		DATE	E SAMPLED		SAMPLED BY	
				04/19/18	8	AS	R
MATERIAL DATA							
MATERIAL SAMPLED	MATERIAL SOURCE			S SOIL TYPE	. ~ .		
SILT with Sand	Soil Boring SB-01		N	IL, Silt wi	th Sand		
	depth = 9.5 feet						
SPECIFICATIONS				HTO SOIL TYPE			
none			A	- 4(2)			
ABORATORY TEST DATA							
ABORATORY EQUIPMENT				T PROCEDURE			
Rainhart "Mary Ann" Sifter 637			Α	STM D69	13		_
ADDITIONAL DATA			SIE	VE DATA			
initial dry mass (g) = 138.12					_	avel = 0.0	
as-received moisture content = 36.5%	coefficient of curvature, $C_C = n/a$				% s	and = 17.7	%
liquid limit = 27	coefficient of uniformity, $C_U = n/a$			%	silt and	clay = 82.3	%
plastic limit = 24	effective size, $D_{(10)} = n/a$						
plasticity index = 3	$D_{(30)} = n/a$				PE	ERCENT PAS	SING
fineness modulus = n/a	$D_{(60)} = n/a$			SIEVE SIZE	SIE	VE 9	SPECS
				US mm	act.	interp. max	(min
				6.00" 150.0		100%	·
GRAIN SIZI	E DISTRIBUTION			4.00" 100.0		100%	
727.7.1.7.7.7.7.1.7.7.7.7.7.7.7.7.7.7.7.	#16 #20 #30 #40 #100 #114 #200			3.00" 75.0		100%	
	# # # # ## ## ###	1000/		2.50" 63.0		100%	
100% 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		100%		2.00" 50.0		100%	
				1.75" 45.0 1.50" 37.5		100% 100%	
90% +		90%	I	1.25" 31.5		100%	
			I≹	1.00" 25.0		100%	
80% +		80%	ច	7/8" 22.4		100%	
				3/4" 19.0		100%	
70%		70%		5/8" 16.0		100%	
70%		70%		1/2" 12.5		100%	
				3/8" 9.50		100%	
3 60% + + + + + + + + + + + + + + + + + + +		- 60%		1/4" 6.30		100%	
ing ing				#4 4.75	100%		
50%		50%		#8 2.36		100%	
d %				#10 2.00	100%		
		400/		#16 1.18		100%	
40%		40%		#20 0.850	100%		
				#30 0.600	10551	100%	
30%		30%	9	#40 0.425	100%	4000/	
<u> </u>			SAND	#50 0.300	000/	100%	
20%		20%		#60 0.250	99%	000/	
				#80 0.180 #100 0.150	000/	98%	
				#100 0.150 #140 0.106	98%	90%	
10%		- 10%		#170 0.106 #170 0.090		90% 86%	
				#200 0.075	82%	JU /0	
0% 111111111111111111111111111111111111		0%	DATE	E TESTED		TESTED BY	
100.00 10.00		01		04/26/18		RT	Т
partic	ele size (mm)			0 1/20/10		IV1	•
. along along	piquo data			1	10	7	
• sieve sizes	sieve data			0			_
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OJECT La Center Midd La Center, Wasł		ol		e Holmes, er School D	Superintenc District	lent	PROJECT NO. 18084 REPORT DATE	LAB ID S18-357 FIELD ID
				Highland A			05/01/18	SB1.4
			La Cent	er, Washing	gton 98629		DATE SAMPLED 04/19/18	SAMPLED BY ASR
ATERIAL DATA								
TERIAL SAMPLED SILT with Sand			MATERIAL SOI Soil Bor	JRCE ring SB-01			USCS SOIL TYPE ML, Silt with Sa	nd
			depth =	-			, 2	
BORATORY TES		Α						
BORATORY EQUIPMEN Liquid Limit Ma		Hand Rolled					TEST PROCEDURE ASTM D4318	
TTERBERG LIMITS		LIQUID LIMIT DETERMINA	ATION				110	UID LIMIT
			0	9	6	•	100% F	
liquid limit =	27	wet soil + pan weight, g		33.34	32.87	34.96	90%	
plastic limit = plasticity index =	24 3	dry soil + pan weight, g : pan weight, g :		30.74 20.94	30.28 20.63	31.94 20.85	80% 	
rasticity index =	3	pan weignt, g : N (blows) :		20.94	20.63	19		
		moisture, %		26.5 %	26.8 %	27.2 %	60% to 50% to 50	
RINKAGE		PLASTIC LIMIT DETERMI					40% t 30%	9-0-0
			0	0	6	4	20%	
hrinkage limit =	n/a	wet soil + pan weight, g		28.10			10%	
hrinkage ratio =	n/a	dry soil + pan weight, g	= 26.09	26.70			10	25](
-								
Ŭ		pan weight, g	= 20.72	20.85			number	of blows, "N"
		pan weight, g : moisture, % :	= 20.72	20.85 23.9 %				of blows, "N"
		moisture, %	= 20.72	23.9 %			ADDITIONAL DATA	
80 -		moisture, %	= 20.72 = 24.0 %	23.9 %				el = 0.0%
80		moisture, %	= 20.72 = 24.0 %	23.9 %			ADDITIONAL DATA % grave	el = 0.0% d = 17.7%
		moisture, %	= 20.72 = 24.0 %	23.9 %		I'l line	ADDITIONAL DATA % grave % san	el = 0.0% d = 17.7% y = 82.3%
80		moisture, %	= 20.72 = 24.0 %	23.9 %	, or "U	J" Line	ADDITIONAL DATA % grave % san % silt and cla	el = 0.0% d = 17.7% y = 82.3% lt = n/a
80 -		moisture, %	= 20.72 = 24.0 %	23.9 %	parameter "U	J" Line	ADDITIONAL DATA % grave % san % silt and cla % si	el = 0.0% d = 17.7% y = 82.3% lt = n/a y = n/a
70		moisture, %	= 20.72 = 24.0 %	23.9 %	parameter "U	J" Line	% grave % san % silt and cla % si % cla	el = 0.0% d = 17.7% y = 82.3% lt = n/a y = n/a
70		moisture, %	= 20.72 = 24.0 %	23.9 %			% grave % san % silt and cla % si % cla	el = 0.0% d = 17.7% y = 82.3% lt = n/a y = n/a
70		moisture, %	= 20.72 = 24.0 %	23.9 %		J" Line	% grave % san % silt and cla % si % cla	el = 0.0% d = 17.7% y = 82.3% lt = n/a y = n/a
70		moisture, %	= 20.72 = 24.0 %	23.9 %			% grave % san % silt and cla % si % cla	el = 0.0% d = 17.7% y = 82.3% lt = n/a y = n/a
70		moisture, %	= 20.72 = 24.0 %	23.9 %			% grave % san % silt and cla % si % cla	el = 0.0% d = 17.7% y = 82.3% lt = n/a y = n/a
80 70 70 70 70 70 70 70 70 70 70 70 70 70		moisture, %	= 20.72 = 24.0 %	23.9 %			% grave % san % silt and cla % si % cla	el = 0.0% d = 17.7% y = 82.3% lt = n/a y = n/a
70		moisture, %	= 20.72 = 24.0 %	23.9 %			% grave % san % silt and cla % si % cla	el = 0.0% d = 17.7% y = 82.3% lt = n/a y = n/a
80 70 80 80 80 80 80 80 80 80 80 80 80 80 80		PLASTIC	= 20.72 = 24.0 %	23.9 %			% grave % san % silt and cla % si % cla	el = 0.0% d = 17.7% y = 82.3% lt = n/a y = n/a
80 70 60 60 60 60 60 60 60 60 60 60 60 60 60		moisture, %	= 20.72 = 24.0 %	23.9 %	ОН		% grave % san % silt and cla % si % cla	el = 0.0% d = 17.7% y = 82.3% lt = n/a y = n/a
80 70 60 60 60 60 60 60 60 60 60 60 60 60 60	CL	PLASTIC	= 20.72 = 24.0 %	23.9 % T CH or	ОН		ADDITIONAL DATA % grave % san % silt and cla % si % cla moisture conter DATE TESTED	el = 0.0% d = 17.7% y = 82.3% lt = n/a y = n/a nt = 36.5%
80 70 60 50 50 50 50 50 50 50 50 50 50 50 50 50		PLASTIC PLASTIC PLASTIC ML or C	= 20.72 = 24.0 %	23.9 % T CH or	ОН		% grave % san % silt and cla % si % cla moisture conter	el = 0.0% d = 17.7% y = 82.3% lt = n/a y = n/a nt = 36.5%

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	CLE-SIZE ANALYSIS R				
PROJECT La Center Middle School	CLIENT Mr. Davis Halmas Symposintandant	P	ROJECT NO.	LAB ID	040 0 50
	Mr. Dave Holmes, Superintendent	_	18084		S18-358
La Center, Washington	La Center School District	R	EPORT DATE 05/01/18	FIELD ID	SB1.7
	725 NE Highland Avenue		ATE SAMPLED	SAMPLE	
	La Center, Washington 98629		04/19/18		ASR
MATERIAL DATA				•	
ATERIAL SAMPLED Silty CLAY with Sand	MATERIAL SOURCE	U	SCS SOIL TYPE	ty Clay with	Cond
Sity CLAT with Sand	Soil Boring SB-01 depth = 19.5 feet		CL-IVIL, SII	ty Clay with	Sanu
PECIFICATIONS	deptii = 19.5 feet	A	ASHTO SOIL TYPE		
none			A-4(2)		
ABORATORY TEST DATA					
ABORATORY EQUIPMENT		T	EST PROCEDURE	1.2	
Rainhart "Mary Ann" Sifter 637			ASTM D69	13	
ADDITIONAL DATA initial dry mass (g) = 151.73			SIEVE DATA	% gravel =	0.0%
as-received moisture content = 29.6%	coefficient of curvature, $C_C = n/a$			% sand =	
liquid limit = 26	coefficient of uniformity, $C_{IJ} = n/a$		%	silt and clay =	
plastic limit = 21	effective size, $D_{(10)} = n/a$,	
plasticity index = 5	$D_{(30)} = n/a$			PERCEN	T PASSING
fineness modulus = n/a	$D_{(60)} = n/a$		SIEVE SIZE	SIEVE	SPECS
			US mm	act. interp.	max m
CD AIN CIZE	DISTRIBUTION		6.00" 150.0 4.00" 100.0	100% 100%	
	DISTRIBUTION		3.00" 75.0	100%	
42 72 73 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	#16 #20 #30 #40 #60 #60 #100 #1170 #200		2.50" 63.0	100%	
100% 9-99-009-0-9-9-9	- 	100%	2.00" 50.0	100%	
			1.75" 45.0	100%	
90% + + + + + + + + + + + + + + + + + + +		90%	1.50" 37.5 1.25" 31.5	100% 100%	
		90% 190%	1.00" 25.0	100%	
80%		80%	1/8 22.4	100%	
			3/4" 19.0	100%	
70%		70%	5/8" 16.0 1/2" 12.5	100% 100%	
			3/8" 9.50	100%	
ත ^{60%}		60%	1/4" 6.30	100%	
			#4 4.75	100%	
50%		50%	#8 2.36 #10 2.00	100% 100%	
<u>-</u>			#16 1.18	100%	
40% + + + + + + + + + + + + + + + + + + +		40%	#20 0.850	100%	
			#30 0.600	99%	
30%		30%	#40 0.425	99%	
		30% CN 45	#50 0.300 #60 0.250	99% 99%	
20%		20%	#80 0.180	96%	
-			#100 0.150	95%	
10%		10%	#140 0.106	84%	
			#170 0.090 #200 0.075	79% 73%	
0% 100 00	100 010	0% D	ATE TESTED	TESTED	BY
100.00 10.00	1.00 0.10 0.0	1	04/26/18		RTT
partic	le size (mm)			•	
• sieve sizes			for	1 C	X

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PROJEC	٦٢					CLIENT				KLFOR	PROJECT NO.	LAB ID
	Center Middl	e Scho	ol			Mr. Day	e Holme	es, Sup	erinten	dent	18084	S18-358
La (Center, Wash	ington				La Cent		_			REPORT DATE	FIELD ID
		Ü				725 NE	Highlan	d Aver	nue		05/01/18	SB1.7
						La Cent)	DATE SAMPLED 04/19/18	SAMPLED BY ASR
MATE	RIAL DATA										04/19/18	ASK
	AL SAMPLED				I	MATERIAL SO	URCE				USCS SOIL TYPE	
Silt	y CLAY with	Sand				Soil Bo	ring SB-	01			CL-ML, Silty	Clay with Sand
						depth =	19.5 fee	t				
LABO	RATORY TES	T DAT	A									
	ATORY EQUIPMENT										TEST PROCEDURE	
	uid Limit Ma	chine,									ASTM D4318	
ATTER	RBERG LIMITS		LIQUID LI	MIT DETER	MINAT						L	IQUID LIMIT
	P 1 P 2	2.5			г	0	9		6	9	100% E	
	liquid limit =	26		+ pan weigl		34.51	31.65		35.78	32.11	90%	
	plastic limit = sticity index =	21 5	ary soil	+ pan weigl	· · · · · ·	31.80 20.94	29.43 20.64		32.68 20.90	29.61	80% - 80% -	
pias	onony muex =	5		pan weigl	nt, g = [ows) = [33	20.62	+	24	15		
				moisture		25.0 %	25.3 9	/ ₆	26.3 %	28.3 %	moisture 50% - 40%	
SHRIN	IKAGE		PLASTIC	LIMIT DETE			20.0 /		/0		40% E 30%	
						0	2		6	4	20%	90 0
shri	nkage limit =	n/a	wet soil	+ pan weigl	ht, g =	28.63	28.90)			10%	
shrii	nkage ratio =	n/a	dry soil	+ pan weigl	ht, g =	27.27	27.48	3			10	25 100
				pan weigl	ht, g =	20.84	20.87	7			num	ber of blows, "N"
				moisture	e, % =	21.2 %	21.5 9	%				
											ADDITIONAL DATA	
				PLAS	STICI	TY CHAR	Т					
	80 T			ĺ						200	_	avel = 0.0%
	-											and = 26.9%
	70						ļ,		<u> </u>	<u> </u>	% silt and	•
	-								,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	U" Line		silt = n/a
	60							200	•			clay = n/a
	60 +							,,,,,			moisture con	tent = 29.6%
	-											
×	50					\nearrow	, or or					
ind	-					بمبر ا	CH	or OH		"A" Line		
Ę	40 +											
plasticity index					مر	1	/					
plė	30 +		ļ.,	/								
	-			programme .	01							
	20			CL or (\uparrow	-					
	10		o o o o o o o o o o o o o o o o o o o				MH	or OH				
		ر CL	-ML O	ML	or OL						DATE TECTED	LEGIED DV
	0	i	ļ			<u> </u>	ļ	70	<u> </u>	00 100	DATE TESTED 04/30/18	TESTED BY RTT
	0 10		20 3	0 40		50 (uid limit	50 7	70	80	90 100		•
					ııq	uru mmit					Jan	C

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La Center Middle School La Center, Washington La Center School District 725 NE Highland Avenue La Center, Washington 98629 ATERIAL DATA ATERIAL SAMPLED Lean CLAY with Sand MATERIAL SOURCE Soil Boring SB-02 depth = 7.5 feet AASHTO SOIL TYPE A-4(5) AASHTO SOIL TYPE A-4(5) ABORATORY EST DATA ABORATORY EST DATA ABORATORY EST DATA ABORATORY EQUIPMENT Rainhart "Mary Ann" Sifter 637 ADDITIONAL DATA initial dry mass (g) = 133.16 as-received moisture content = 41.8% plastic limit = 30 plastic limit = 30 plastic limit = 22 plasticity index = 8 fineness modulus = n/a Mr. Dave Holmes, Superintendent La Center School District 725 NE Highland Avenue Description 1884 S18-359 REPORT DATE O5/01/18 SB2.3 ASIM D65/01/18 SB2.3 ASIM D67/01/18 SIEVE DATA SIEVE DATA SIEVE DATA % silt and clay = 77.4% because of the percent passing percent passing percent passing percent passing sieve specs SIEVE SIEVE SIEVE SPECS		ARTICLE-SIZE ANALTSK	J 11 L 1						
La Center, Washington	PROJECT La Contar Middle School	CLIENT Mr. Dava Halmas, Superintandan	·+	PR		2.4	LAB ID	710.25	^
Table Tab		_	ıı	55		54			9
Tate Same	La Center, Washington			REF		(1.0	FIELD ID		
ATERIAL DATA MATERIAL SOURCE Soil Boring SB-02 depth = 7.5 feet MATERIAL SOURCE Soil Boring SB-02 depth = 7.5 feet MATERIAL SOURCE Soil Boring SB-02 depth = 7.5 feet MATERIAL SOURCE Soil Boring SB-02 depth = 7.5 feet MATERIAL SOURCE Soil Boring SB-02 depth = 7.5 feet MATERIAL SOURCE Soil Boring SB-02 depth = 7.5 feet MATERIAL SOURCE Soil Boring SB-02 depth = 7.5 feet MATERIAL SOURCE Soil Boring SB-02 depth = 7.5 feet MATERIAL SOURCE SOIL TYPE SATION SOIL TYPE SATI		_		_			0.4		
MTERIAL DATA MATERIAL SOURCE Soil Boring SB-02 depth = 7.5 feet		La Center, Washington 98629		DA			SAMPLE		
MATERIAL SOURCE Lean CLAY with Sand Soil Boring SB-02 depth = 7.5 feet					04/19	/18		ASR	
CL_ Lean Clay with Sand Soil Boring SB-02 CL_ Lean Clay with Sand depth = 7.5 feet A4(5)	MATERIAL DATA								
depth = 7.5 feet				USO	CS SOIL TYP	E			
ASCRATORY TEST DATA ABGRATORY TEST DATA ABGRATORY EQUIPMENT Rainhart "Mary Ann" Sifter 637 ADDITIONAL DATA Initial dry mass (g) = 133.16 as-received moisture content = 41.8% coefficient of curvature, C _C = n/a plasticity index = 8 D ₍₂₀₀₎ = n/a D ₍₂₀₀₎ =	Lean CLAY with Sand			1 '	CL, Lear	Clay v	vith Sand	ļ.	
ABORATORY TEST DATA #BORATORY FLIST DATA		depth = 7.5 feet							
ABORATORY TEST DATA Rainhart "Mary Ann" Sifter 637 ADDITIONAL DATA initial dry mass (g) = 133.16						YPE			
Resinhart "Marry Ann" Sifter 637 ADDITIONAL DATA Initial dry mass (g) = 133.16 as-received moisture content = 41.8% coefficient of curvature, C _C = n/a % sand = 22.6% % sand = 22.6% % sand = 22.6% % sand = 22.6% % silt and clay = 77.4% silt and clay = 77.4% final dry mass (g) = 133.16 as-received moisture content = 41.8% coefficient of uniformity, C _U = n/a plastic limit = 30 coefficient of uniformity, C _U = n/a plastic limit = 22 effective size, D ₁₀₀ = n/a plastic limit = 22 plastic limit = 22 plastic limit = 22 plastic limit = 30 D ₁₀₀ = n/a plastic limit = 30 plastic limi	none				A-4(5)				
ASTM D6913 SIEVE DATA	_ABORATORY TEST DATA								
ADDITIONAL DATA initial dry mass (g) = 133.16 as-received moisture content = 41.8% coefficient of curvature, C _C = n/a plastic limit = 30 coefficient of uniformity, C _U = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 30 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = n/a plastic limit = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic limit = 22 affective size, D ₁₀₀ = n/a plastic size size size size size size size size	LABORATORY EQUIPMENT								
Size 133.16 Size 133.16 Coefficient of curvature, \$C_{\mathbb{C}} = n/a n/a N/a Size 133.16 Size	·			1	ASTM D	6913			
as-received moisture content = 41.8% coefficient of curvature, C _C = n/a plastic limit = 30 coefficient of uniformity, C _U = n/a plasticity index = 8 plasticity index = 100% plas	ADDITIONAL DATA			SII	EVE DATA				
Silt and clay = 77.4% Silt and clay = 77.4% Plastic limit = 22 effective size, D ₍₁₀₀₎ = n/a D ₍₈₀₀₎ = n/a D ₍₈₀₀₎ = n/a D ₍₈₀₀₎ = n/a Silve size Silve Specs Specs	initial dry mass (g) = 133.1						•		
Plastic limit = 22 effective size, D ₍₁₀₎ = n/a D ₍₃₀₎	as-received moisture content = 41.8								
PERCENT PASSING SIEVE S		the state of the s				% silt a	and clay =	77.4%	
SIEVE SIZE SIEVE SPECS US mm act interp. max act interp.									
US mm act interp max m									
Comparisor 100%	fineness modulus = n	$D_{(60)} = n/a$			SIEVE SIZ				
## ADW 100%								max	mir
100%									
100% 2.50° 63.0 2.50° 63.0 2.50° 63.0	GRA	AIN SIZE DISTRIBUTION							
100% 90% 80% 80% 70% 70% 70% 60% 40% 30% 40% 30% 40% 30% 20% 40% 30% 100% 100% 100% 100% 100% 100% 100	7, 1, 2, 3, 3, 1, 1, 1, 2, 3, 3, 1, 1, 1, 2, 3, 1, 1, 1, 2, 3, 1, 1, 1, 2, 3, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	£8 110 110 110 110 110 110 110 11							
90%		** * * * * * * * * * * * * * * * * * *	100%						
90% 80% 70% 70% 60% 60% 40% 30% 40% 30% 100.00 100.00 10.00		1 3 4 4 4 4 A	1						
70% 34" 19.0 100% 100% 58" 16.0 100% 12" 12.5 100% 38" 9.50 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 100% 14" 6.30 100% 100% 14" 6.30 100% 100% 14" 6.30 100% 100% 14" 6.30 100% 100%	000/		1	١.					
70% 34" 19.0 100% 100% 58" 16.0 100% 12" 12.5 100% 38" 9.50 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 100% 14" 6.30 100% 100% 14" 6.30 100% 100% 14" 6.30 100% 100% 14" 6.30 100% 100%	90%		90%	NEI N	1.25" 3	1.5	100%		
70% 34" 19.0 100% 100% 58" 16.0 100% 12" 12.5 100% 38" 9.50 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 14" 6.30 100% 100% 14" 6.30 100% 100% 14" 6.30 100% 100% 14" 6.30 100% 100% 14" 6.30 100% 100%			1	Ϋ́	1.00" 2	5.0	100%		
70% 60% 60% 60% 60% 1/2" 12.5 100% 3/8" 9.50 1100% 1/4" 6.30 100% 1/4" 6.30 100% 1/4" 6.30 99% #4 4.75 100% 3/8" 9.50 100% 1/4" 6.30 99% #4 4.75 100% 3/8" 9.50 100% 1/4" 6.30 99% #4 4.75 100% 1/4" 6.30 99% #4 4.75 100% 1/4" 6.30 99% #4 4.75 100% 1/4" 6.30 99% #4 0.425 98% 99% #30 0.600 98% #30 0.600 98% #4 0.425 98% 99% #30 0.600 98% #4 0.425 98% 99% #30 0.600 99% #4 0.425 98% 99% #30 0.600 99% #4 0.425 98% 99% #30 0.600 98% #4 0.425 98% 99% #30 0.600 98% #4 0.425 98% 99% #4 0.425 98% 99% #4 0.425 98% 99% #4 0.425 98% 99% #4 0.425 98% 99% #4 0.425 98% 99% #4 0.425 98% 99% 99% 99% 99% 99% 99% 99% 99% 99%	80%		80%	١٥					
DUSS 50% 60% 60% 60% 1/2" 12.5 100% 3/8" 9.50 100% 1/4" 6.30 100% 1/4" 4.475 100% 1/4" 6.30 99% 1/4" 6.30 99% 1/4" 6.118 99% 1/4" 6.118 99% 1/4" 6.118 99% 1/4" 6.118 99% 1/4" 6.118 99% 1/4" 6.10 0.50 97% 1/4" 6.00 0.50 97%			1						
Buss 50%	70%								
50%			1						
\$\frac{\pmathcal{2}}{30\%}\$ \$\frac{\pmathcal{2}}{40\%}\$ \$\	60%		60%						
#8 2.36 99% #10 2.00 99% #16 1.18 99% #20 0.850 99% #30 0.600 98% #30 0.300 97% #50 0.300 97% #60 0.250 97% #80 0.180 95% #100 0.150 94% #100 0.150 94% #100 0.150 94%	Bu		1						
#16 1.18 99% #20 0.850 99% #30 0.600 98% #30 0.600 98% #40 0.425 98% #50 0.300 97% #60 0.250 97% #80 0.180 95% #100 0.150 94% #1100 0.150 94% #1100 0.000 86% #200 0.075 77% DATE TESTED BY O4/26/18 RTT	8 50%		50%						
40% 30% 20% 10% 10% 100.00 10.	8d ~~		3070		#10 2	00 99%	6		
30% 20% 30% 20% 30% 20% 30% 30% 30% 30% 30% 30% 30% 30% 30% 3	F1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		1		#16 1	18	99%		
30% 20% 20% 20% 20% 20% 20% 20% 20% 20% 2	40%		40%						
#50 0.300 97% #60 0.250 97% #80 0.180 95% #100 0.150 94% #140 0.106 86% #170 0.090 82% #200 0.075 77% DATE TESTED BY Od/26/18 RTT									
20% #80 0.180 95% #80 0.180 95% #100 0.150 94% #140 0.106 86% #170 0.090 82% #200 0.075 77% DATE TESTED BY O4/26/18 RTT	30% [30%	9					
20% #80 0.180 95% #80 0.180 95% #100 0.150 94% #140 0.106 86% #170 0.090 82% #200 0.075 77% DATE TESTED BY O4/26/18 RTT			-	SAI					
10%	20%		20%						
10% #140 0.106 86% #170 0.090 82% #200 0.075 77% DATE TESTED BY O4/26/18 RTT			1						
#170 0.090 82% #200 0.075 77% DATE TESTED BY 04/26/18 RTT	10%		100/						
0% 100.00 1.00 0.10 0.01 DATE TESTED BY 04/26/18 RTT	1070		1076						
100.00 10.00 1.00 0.10 0.01 DATE TESTED 1 100 100 100 100 100 100 100 100 100			1		#200 <u></u> 0.	075 <u>7</u> 7%	%		
particle size (mm) 04/26/18 RTT		1 00 0 10		DAT	TE TESTED		TESTED	BY	
	10.00		0.01		04/26	/18		RTT	
• sieve sizes —— sieve data		particle Size (IIIII)					^		
	•	sieve sizes —————————— sieve data			fo			1	
				L					

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	ALIERBI	ERG L		REPUR	K I	
PROJECT La Center Middle School La Center, Washington	La Cen 725 NE	ve Holmes, ter School D Highland A ter, Washing	District Avenue	lent	PROJECT NO. 18084 REPORT DATE 05/01/18 DATE SAMPLED 04/19/18	S18-359 FIELD ID SB2.3 SAMPLED BY ASR
MATERIAL DATA	I					
MATERIAL SAMPLED Lean CLAY with Sand		ource oring SB-02 7.5 feet			USCS SOIL TYPE CL, Lean Clay w	ith Sand
LABORATORY TEST DATA LABORATORY EQUIPMENT Liquid Limit Machine, Hand R	olled				TEST PROCEDURE ASTM D4318	
	LIMIT DETERMINATION					
•	bil + pan weight, g = 33.20 bil + pan weight, g = 30.39 pan weight, g = 20.88 N (blows) = 35	32.68 29.95 20.84 30	29.24 27.26 20.76 24	32.55 29.75 20.71 17	100% 90% 80% 70%	JID LIMIT
SHRINKAGE PLASTI	moisture, % = 29.6 % C LIMIT DETERMINATION	30.0 %	30.5 %	31.0 %	00% 1 00% 1	9-90
=	$\begin{array}{c} \text{oil} + \text{pan weight, g} = & 28.15 \\ \text{oil} + \text{pan weight, g} = & 26.80 \\ \text{pan weight, g} = & 20.72 \\ \text{moisture, \%} = & 22.2 \% \end{array}$	28.51 27.14 20.85 21.8 %			0% 10 number	25 100 of blows, "N"
70 60 50 50 50 50 50 50 50 50 50 50 50 50 50	CL or OL	CH or	ОН	J" Line "A" Line	% grave % sand % silt and clay % sil % clay moisture conten	d = 22.6% y = 77.4% t = n/a y = n/a
10 CL-ML 0 10 20	ML or OL 30 40 50 Iiquid limit	60 70	80	90 100	DATE TESTED 04/30/18	TESTED BY RTT

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	CLL-SIZE ANAL I SIS KE		Lunin
PROJECT La Center Middle School	CLIENT Mr. Dave Holmes, Superintendent	PROJECT NO.	LAB ID
	Mr. Dave Holmes, Superintendent	18084	S18-360
La Center, Washington	La Center School District	REPORT DATE	FIELD ID
	725 NE Highland Avenue	05/01/18	SB2.8
	La Center, Washington 98629	DATE SAMPLED	SAMPLED BY
	·	04/20/18	ASR
MATERIAL DATA			
MATERIAL SAMPLED	MATERIAL SOURCE	USCS SOIL TYPE	
Clayey SAND	Soil Boring SB-02	SC, Clayey Sand	
	depth = 30 feet		
SPECIFICATIONS		AASHTO SOIL TYPE	
none		A-2-6(0)	
LABORATORY TEST DATA		•	
LABORATORY EQUIPMENT		TEST PROCEDURE	
Rainhart "Mary Ann" Sifter 637		ASTM D6913	
ADDITIONAL DATA		SIEVE DATA	
initial dry mass (g) = 148.33		%	gravel = 0.0%
as-received moisture content = 24.9%	coefficient of curvature, $C_C = n/a$	%	% sand = 67.6%
liquid limit = 27	coefficient of uniformity, $C_U = n/a$	% silt an	nd clay = 32.4%
plastic limit = 15	effective size, $D_{(10)} = n/a$		
plasticity index = 12	$D_{(30)} = n/a$		PERCENT PASSING
fineness modulus = n/a	$D_{(60)} = 0.272 \text{ mm}$	SIEVE SIZE S	IEVE SPECS
		US mm act.	interp. max min
		6.00" 150.0	100%
GRAIN SIZE	DISTRIBUTION	4.00" 100.0	100%
## # 4 # 108	#16 #30 #40 #40 #100 #1140 #200	3.00" 75.0	100%
100% Q-QQ-QQQ-QQQ-QQQ-Q-Q-Q-Q-Q-Q-Q-Q-Q-Q-Q	** ** ** ** ** ** ** ** ** ** ** ** **	2.50" 63.0 2.00" 50.0	100% 100%
	-o-la	1.75" 45.0	100%
		1 50" 37 5	100%
90%	900	6. 1.00" 25.0	100%
		¥ 1.00" 25.0	100%
80%	809	1/0 22.4	100%
		3/4" 19.0	100%
70%	70	6 5/8" 16.0	100%
		1/2" 12.5	100%
60%	60°	3/8" 9.50 1/4" 6.30	100% 100%
6		#4 4.75 100%	
\$ 50%	500	#0 0.26	98%
bass 50%		#10 2.00 98%	
		#16 1.18	96%
40%	40°	#20 0.850 95%	
		#30 0.600	92%
30%	300	40 0.425 88%	
		% #50 0.300 #60 0.250 55%	66%
20%	200	/ #00 0.230 3376	45%
		% #80 0.180 #100 0.150 40%	4 370
100/		W440 0.400	36%
10%	100	#170 0.090	34%
		#200 0.075 32%	
0%	1.00 0.10 0.01		TESTED BY
		04/26/18	RTT
particle	e size (mm)		_
sieve sizes		And C	
1.010 0.100			
		COLLIMBIA WEST ENGIN	



La Center M	Iiddle Scho	ool	CLIENT Mr. Day	e Holmes,	Superintend	dent	PROJECT NO. 18084	LAB ID S18-360
La Center, V	Washington	1		er School D	_		REPORT DATE	FIELD ID
•	C			Highland A			05/01/18	SB2.8
				-	gton 98629		DATE SAMPLED	SAMPLED BY
ATERIAL DA							04/20/18	ASR
ATERIAL DA			MATERIAL SO	IRCE			USCS SOIL TYPE	
Clayey SAN				ring SB-02			SC, Clayey Sand	l
			depth =	30 feet				
ABORATORY		A						
BORATORY EQUII Liquid Limi		Hand Rolled					TEST PROCEDURE ASTM D4318	
TTERBERG LIM		LIQUID LIMIT DETERMIN	IATION					UID LIMIT
			0	9	6	4	100% F	OID LIMIT
liquid lim		wet soil + pan weight, g		30.81	35.41		90%	
plastic lim		dry soil + pan weight, g		28.72	32.21		80%	
plasticity inde	ex = 12	pan weight, g		20.85	20.70		% 70% - oʻ 60% -	
		N (blows)		25 26.6 %	27.8 %		50%	
IDINIKACE		moisture, %		20.0 %	27.8 %		60% t	
RINKAGE		PLASTIC LIMIT DETERM	IINATION	0	6	4	20%	**
shrinkage lim	it = n/a	wet soil + pan weight, g		27.05			10%	
hrinkage rati		dry soil + pan weight, g	`	26.22			0% + 10	25]
		pan weight, g	g = 20.74	20.59			number	of blows, "N"
		pan weight, g moisture, %		20.59 14.7 %			ADDITIONAL DATA	r of blows, "N"
80 —	1	moisture, %		14.7 %				
80		moisture, %	5 = 15.0 %	14.7 %			ADDITIONAL DATA % grave % san	el = 0.0% d = 67.6%
		moisture, %	5 = 15.0 %	14.7 %			ADDITIONAL DATA % grave	el = 0.0% d = 67.6%
80 70		moisture, %	5 = 15.0 %	14.7 %	"rece"	J" Line	ADDITIONAL DATA % grave % san % silt and cla % s	el = 0.0% d = 67.6% ny = 32.4% elt = n/a
70		moisture, %	5 = 15.0 %	14.7 %	John Town	J" Line	ADDITIONAL DATA % grav. % san % silt and cla	el = 0.0% d = 67.6% ny = 32.4% elt = n/a
		moisture, %	5 = 15.0 %	14.7 %	"L	J" Line	ADDITIONAL DATA % grave % san % silt and cla % s	el = 0.0% d = 67.6% dy = 32.4% filt = n/a dy = n/a
70		moisture, %	5 = 15.0 %	14.7 %	Jana Para III	J" Line	ADDITIONAL DATA % grave % san % silt and cla % s % cla	el = 0.0% d = 67.6% by = 32.4% filt = n/a by = n/a
70		moisture, %	5 = 15.0 %	14.7 %	,,,,,,		ADDITIONAL DATA % grave % san % silt and cla % s % cla	el = 0.0% d = 67.6% by = 32.4% filt = n/a by = n/a
70		moisture, %	5 = 15.0 %	14.7 %		J" Line	ADDITIONAL DATA % grave % san % silt and cla % s % cla	el = 0.0% d = 67.6% by = 32.4% filt = n/a by = n/a
70		moisture, %	5 = 15.0 %	14.7 % T			ADDITIONAL DATA % grave % san % silt and cla % s % cla	el = 0.0% d = 67.6% by = 32.4% filt = n/a by = n/a
70		moisture, %	5 = 15.0 %	14.7 % T			ADDITIONAL DATA % grave % san % silt and cla % s % cla	el = 0.0% d = 67.6% by = 32.4% filt = n/a by = n/a
70		moisture, %	5 = 15.0 %	14.7 % T			ADDITIONAL DATA % grave % san % silt and cla % s % cla	el = 0.0% d = 67.6% ny = 32.4% filt = n/a ny = n/a
70		moisture, %	5 = 15.0 %	14.7 % T			ADDITIONAL DATA % grave % san % silt and cla % s % cla	el = 0.0% d = 67.6% ny = 32.4% filt = n/a ny = n/a
70		PLASTI	5 = 15.0 %	14.7 % T			ADDITIONAL DATA % grave % san % silt and cla % s % cla	el = 0.0% d = 67.6% ny = 32.4% filt = n/a ny = n/a
70		moisture, %	5 = 15.0 %	14.7 %	ОН		ADDITIONAL DATA % grave % san % silt and cla % s % cla	el = 0.0% d = 67.6% by = 32.4% filt = n/a by = n/a
70 60 50 50 50 50 50 50 50 50 50 50 50 50 50		PLASTI	5 = 15.0 %	14.7 % T	ОН		ADDITIONAL DATA % grave % san % silt and cla % s % cla	el = 0.0% d = 67.6% by = 32.4% filt = n/a by = n/a
70	į C	PLASTI	CITY CHAR	14.7 %	ОН		% grave % san % silt and cla % s % cla moisture content	el = 0.0% d = 67.6% ny = 32.4% filt = n/a ny = n/a nt = 24.9%
70 60 50 10 10 10 10 10 10 10 10 10 10 10 10 10		PLASTI PLASTI PLASTI ML or	CITY CHAR	T CH or C	ОН	"A" Line	ADDITIONAL DATA % grave % san % silt and cla % s % cla moisture content DATE TESTED	el = 0.0% d = 67.6% by = 32.4% filt = n/a by = n/a nt = 24.9%
70 60 50 50 50 50 50 50 50 50 50 50 50 50 50		PLASTI PLASTI CL or OL	CITY CHAR	14.7 %	ОН		ADDITIONAL DATA % grave % san % silt and cla % s % cla moisture content DATE TESTED 04/30/18	el = 0.0% d = 67.6% ny = 32.4% silt = n/a ny = n/a nt = 24.9%

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	. ,		ZL ANAL	. 0.0							
PROJECT La Center Middle School		CLIENT Mr. Dov	a Halmas Supari	ntandant	PR	OJECT N	o. 8084		LAB ID	10.000	`
			Mr. Dave Holmes, Superintendent							18-889	1
La Center, Washington			er School District		RE	PORT DA			FIELD ID	ana a	
			Highland Avenue		<u> </u>		/26/18			SB3.3	
		La Cente	er, Washington 98	629	DA	TE SAMP			SAMPLED		
						08/	/22/18			HDG	
MATERIAL DATA											
MATERIAL SAMPLED		MATERIAL SOU				CS SOIL		L C	ı		
SILT with Sand			ing SB-03		-	ML, S	iit Wit	h Sand	Į.		
		depth = '	7.5 feet								
SPECIFICATIONS						SHTO SC A-4(3)					
none					•	A-4(3)	,				
LABORATORY TEST DATA					·						
ABORATORY EQUIPMENT						ST PROC					
Rainhart "Mary Ann" Sifter 637	7					ASTM	1 D69	13			
ADDITIONAL DATA					SI	EVE DA	TA				
, (3,	171.45							_	ravel =	0.0%	
	37.0%		of curvature, $C_C =$	n/a					sand =		
liquid limit =	30		of uniformity, $C_U =$	n/a			%	silt and	clay =	79.3%	
plastic limit =	25	effe	ective size, D ₍₁₀₎ =	n/a							
plasticity index =	5		$D_{(30)} =$	n/a					ERCENT		
fineness modulus =	n/a		$D_{(60)} =$	n/a		SIEVE	SIZE	SIE		SPE	
						US	mm	act.	interp.	max	min
	00 4141 0175	DIOTOIDUT	1011			6.00"	150.0		100%		
(GRAIN SIZE	DISTRIBUT	ION			4.00" 3.00"	100.0 75.0		100% 100%		
7. 17. 17. 17. 17. 17. 17. 17. 17. 17. 1	#4 #4 #10	#16 #20 #30 #40	#50 #60 #100 #170 #200			2.50"	63.0		100%		
100% 0-00-000-000-0-0-0	9	- 0-0-0-0-	<u> </u>		0%	2.00"	50.0		100%		
			ا ا ا ا ا			1.75"	45.0		100%		
90%				90	% _	1.50"	37.5		100%		
			ધ્		% % % % % % % % % % % % % % % % % % %	1.25"	31.5		100%		
					, K	1.00"	25.0		100%		
80%				80	%	7/8"	22.4		100%		
			1			3/4" 5/8"	19.0 16.0		100% 100%		
70%				70	%	1/2"	12.5		100%		
						3/8"	9.50		100%		
_ 60% + + + + + + + + + + + + + + + + + + +					%	1/4"	6.30		100%		
ing						#4	4.75	100%			
50% +				50	%	#8	2.36		100%		
d %						#10	2.00	100%			
40%				40	0/	#16	1.18		100%		
70/0				40	70	#20	0.850	100%	1000/		
						#30 #40	0.600 0.425	00%	100%		
30%				30	% SAND	#40 #50	0.425	99%	99%		
<u> </u>					SA	#60	0.250	99%	JJ /0		
20%					%	#80	0.180	-0,0	97%		
						#100	0.150	96%			
10%				10	%	#140	0.106		88%		
						#170	0.090		84%		
0%				0%		#200	0.075	79%			
100.00 10.00		1.00	0.10	0.01	, DA	TE TEST			TESTED E		
	particle	e size (mm)				09	/19/18			KMS	
	P •						1	, ,	7		
	sieve sizes		- sieve data			/	fam				
· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·						V WEST				

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a Center, Washington		l la ('ente					
			er School D			REPORT DATE 09/26/18	FIELD ID SB3.3
			Highland A			DATE SAMPLED	SAMPLED BY
		La Cente	er, Washing	gton 98629		08/22/18	HDG
TERIAL DATA							
ERIAL SAMPLED JILT with Sand		MATERIAL SOL Soil Bor	URCE ring SB-03			USCS SOIL TYPE ML, Silt with Sa	nd
121 Will Suite		depth = '	-			, 5110 (1111 50	
BORATORY TEST DATA	4					•	
ORATORY EQUIPMENT Liquid Limit Machine,	Hand Rolled					TEST PROCEDURE ASTM D4318	
TERBERG LIMITS	LIQUID LIMIT DETERMINAT	TION					
		0	0	6	4		UID LIMIT
liquid limit = 30	wet soil + pan weight, g =	36.84	34.36	34.13		100%	
plastic limit = 25	dry soil + pan weight, g =	33.18	31.21	30.99		80%	
lasticity index = 5	pan weight, g =		20.76	20.80		% 70% u i 60% 	
	N (blows) = moisture, % =		30.1 %	30.8 %		50%	
RINKAGE	PLASTIC LIMIT DETERMINA		30.1 %	30.6 %		60% t	
AINRAGE	PLASTIC LIMIT DETERMINA	1	2	6	4	20%	
hrinkage limit = n/a	wet soil + pan weight, g =		28.28			10%	
nrinkage ratio = n/a	dry soil + pan weight, g =		26.76			10	25]
	pan weight, g =	20.84	20.64			number	r of blows, "N"
	moisture, % =	25.5 %	24.8 %				
80	PLASTICI	ITY CHART	T			ADDITIONAL DATA % grave	
					, or or	% san	
70					,,,,	% silt and cla	
				ا" ممر	J" Line	% s	
60				2000		% cla	
-			امر	•		moisture conter	nt = 37.0%
			proces				
50		Λ.	,,,,,,		"A" Line		
plasticity index		المممر	CH or	ОН	A LINE		
A 40 + + + + + + + + + + + + + + + + + +							
asti		^^					
ā ₃₀ ‡							
	Land Control						
20	CL or OL	4	 				
10	process of the same of the sam		MH or O	Н			
	-ML or OL	-				DATE TESTED	TESTED BY
	++		++-			09/24/18	RTT
0 10 2	20 30 40	50 6	60 70	80	90 100	09/24/18	KII

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	TICLE-SIZE ANAL I SIS						
PROJECT La Center Middle School	CLIENT Mr. Dava Halmas Superintendent		PROJI	ECT NO. 18084	LA	B ID	
	Mr. Dave Holmes, Superintendent	=				S18-89	JU
La Center, Washington	La Center School District		REPO	RT DATE		ELD ID	
	725 NE Highland Avenue		D.1	09/26/18		SB3.4	
	La Center, Washington 98629		DATE	SAMPLED		MPLED BY	
				08/22/18	3	HDG	f
MATERIAL DATA							
MATERIAL SAMPLED	MATERIAL SOURCE		USCS	SOIL TYPE	1 1.1 (C 1	
Lean CLAY with Sand	Soil Boring SB-03			L, Lean C	iay with a	Sana	
	depth = 10.5 feet						
SPECIFICATIONS				TO SOIL TYPE			
none			A-	-4(8)			
ABORATORY TEST DATA			•				
ABORATORY EQUIPMENT				PROCEDURE			
Rainhart "Mary Ann" Sifter 637		A.	STM D69	13			
ADDITIONAL DATA			SIEV	E DATA			
initial dry mass (g) = 88.83					% gra		
as-received moisture content = 39.8%	coefficient of curvature, $C_C = n/a$					ind = 15.3%	
liquid limit = 33	coefficient of uniformity, $C_U = n/a$			%	silt and cl	lay = 84.7%)
plastic limit = 23	effective size, $D_{(10)} = n/a$						
plasticity index = 10	$D_{(30)} = \qquad \qquad n/a$					RCENT PASSI	
fineness modulus = n/a	$D_{(60)} = n/a$			SIEVE SIZE	SIEVE	-	PECS
				US mm		terp. max	min
05 AIN	OUTE DISTRIBUTION			5.00" 150.0		00%	
GRAIN	SIZE DISTRIBUTION			4.00" 100.0 3.00" 75.0		00%	
7.7. 17. 1	## #10 #10 #10 #10 #110 #110 #110			2.50" 63.0		00%	
100% 0, 00 000 000 0 0 10 0 0 1		<u>+</u> 100%		2.00" 50.0		00%	
		-		1.75" 45.0	1	00%	
90%		90%	′ بـا	1.50" 37.5	1	00%	
		1	12	1.25" 31.5		00%	
80%		80%	GR/	1.00" 25.0		00%	
		1 00%		7/8" 22.4 3/4" 19.0		00%	
		1		5/8" 16.0		00%	
70%		70%		1/2" 12.5		00%	
		1		3/8" 9.50	1	00%	
60%		60%		1/4" 6.30	1	00%	
sing		1		#4 4.75	100%		
50%		50%		#8 2.36		00%	
ж.		1		#10 2.00 #16 1.18	100%	00%	
40% + + + + + + + + + + + + + + + + + + +		40%		#20 0.850	100%	100%	
		1		#30 0.600		00%	
30%		30%		#40 0.425	99%		
		3070	SAND	#50 0.300	Ç	99%	
2004		2004		#60 0.250	99%		
20%		20%		#80 0.180		97%	
		1		#100 0.150 #140 0.106	97%	Ω10/.	
10%		10%		#140 0.106 #170 0.090		91% 88%	
		1		#200 0.075	85%		
0% [1.00 0.10	 0%	_	TESTED		STED BY	
100.00 10.00		0.01		09/19/18	3	KMS	
į,	particle size (mm)						
+ sie	eve sizes —• sieve data			An	1 C	~	
				0			
				LIMBIA WEST			

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PROJECT La Center Middle School	CLIENT	e Holmes, S		lent	PROJECT NO. 18084	LAB ID S18-890	
La Center, Washington	La Cente	er School D Highland A	istrict	 -	REPORT DATE 09/26/18	FIELD ID SB3.4	
		er, Washing		DATE SAMPLED 08/22/18	SAMPLED BY HDG		
IATERIAL DATA							
MATERIAL SAMPLED Lean CLAY with Sand	Soil Bor depth = 1	ing SB-03		USCS SOIL TYPE CL, Lean Clay with Sand			
	ucpin –	10.5 1001			<u> </u>		
ABORATORY TEST DATA ABORATORY EQUIPMENT					TEST PROCEDURE		
Liquid Limit Machine, Hand Rolled					ASTM D4318		
ATTERBERG LIMITS LIQUID LIMIT DETERMINA	TION						
	0	2	6	4		JID LIMIT	
liquid limit = 33 wet soil + pan weight, g =	30.17	31.58	33.39	32.41	100%		
plastic limit = 23 dry soil + pan weight, g =		28.89	30.14	29.45	80%		
plasticity index = 10 pan weight, g =		20.73	20.59	20.91	% 70% +		
N (blows) =		26	21	17	2. 50%		
moisture, % =		33.0 %	34.0 %	34.7 %	— som 30% — ⊕ 60% — ⊕ 60% — ⊕	-00	
SHRINKAGE PLASTIC LIMIT DETERMIN					E 30%		
abainteen limit	0	27.50	6	•	10%		
shrinkage limit = n/a wet soil + pan weight, g = shrinkage ratio = n/a dry soil + pan weight, g =		27.58 26.33			0%	25 100	
pan weight, g =	-	20.86			10	of blows, "N"	
moisture, % =		22.9 %				o. 2.0o,	
70 60 50 50 50 50 50 50 50 50 50 50 50 50 50	ITY CHART	CH or C	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	J" Line	% grave % sand % silt and clay % sil % clay moisture conten	d = 15.3% / = 84.7% t = n/a / = n/a	
20 CL or OL 10 CL ML ML or O 0 10 20 30 40	50 60	MH or O	80	90 100	DATE TESTED 09/24/18	TESTED BY RTT	

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	CLL-SIZE ANAL I SIS			1		
PROJECT La Center Middle School	Mr. Dave Holmes, Superintendent		PROJECT NO.		AB ID	
	La Center School District		1808 REPORT DATE		S18-891 ELD ID	
La Center, Washington						
	725 NE Highland Avenue		09/26 DATE SAMPLED		SB4.4	
	La Center, Washington 98629				AMPLED BY	
			08/22	/18	HDG	
MATERIAL DATA			1			
MATERIAL SAMPLED	MATERIAL SOURCE		USCS SOIL TYP	E		
SILT	Soil Boring SB-04		ML, Silt			
	depth = 10 feet					
SPECIFICATIONS none			AASHTO SOIL T A-4(4)	YPE		
none			A-4(4)			
ABORATORY TEST DATA			•			
LABORATORY EQUIPMENT			TEST PROCEDU			
Rainhart "Mary Ann" Sifter 637			ASTM D	6913		
ADDITIONAL DATA			SIEVE DATA			
initial dry mass (g) = 158.17				% gra	vel = 0.0%	
as-received moisture content = 41.7%	coefficient of curvature, $C_C = n/a$,, ,,	and = 9.6%	
liquid limit = 30	coefficient of uniformity, $C_U = n/a$			% silt and c	clay = 90.4%	
plastic limit = 26	effective size, $D_{(10)} = n/a$					
plasticity index = 4	$D_{(30)} = n/a$				RCENT PASSING	
fineness modulus = n/a	$D_{(60)} = n/a$		SIEVE SIZ			
					nterp. max mir	
00 AIN 0175	PIOTRIBUTION				100%	
GRAIN SIZE	DISTRIBUTION				100% 100%	
7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.	# # # # # # # # # # # # # # # # # # #				100%	
100% 0-00-000-0-0-0-0-0-0-0-	-0+0+4-4-4-4+++++++++++++++++++++++++++	100%			100%	
	7400]	1.75" 4	5.0	100%	
90%		90%	1.50" 3	7.5	100%	
		1	12		100%	
80%		80%	1.00" 2		100%	
80%		80%	110 2		100%	
		-			100% 100%	
70%		70%			100%	
		1			100%	
_ 60%			1/4" 6		100%	
ing		-	#4 4	.75 100%		
50%		50%			100%	
nd %		1		.00 100%		
40%		40%			99%	
40%		40%		850 99%	000/	
		1	440 0	600 425 99%	99%	
30%		30%	1 =		98%	
		-	5 #60 0.	250 98%		
20%		20%			97%	
		-		150 97%		
10%		10%	#140 0.	106	94%	
		1			92%	
0%				075 90%	-0.TED D):	
100.00 10.00	1.00 0.10	0.01	DATE TESTED		ESTED BY	
partic	le size (mm)		09/19	/18	KMS	
•			1	1		
sieve sizes	sieve data		1			
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									<u> </u>	
PROJEC	ct Center Mid	dla Caha	o.1		CLIENT Mr. Dor	ıa Halmaa	Cumoninton	dont	PROJECT NO.	LAB ID
							Superintend	ieiii	18084	S18-891
La	Center, Wa	snington				er School			REPORT DATE	FIELD ID
						Highland .			09/26/18 DATE SAMPLED	SB4.4 SAMPLED BY
					La Cent	er, Washin	gton 98629		08/22/18	HDG
MATE	RIAL DATA								00,22,10	112.0
MATER	IAL SAMPLED	-			MATERIAL SO	URCE			USCS SOIL TYPE	
SIL	Т					ring SB-04	•		ML, Silt	
					depth =	10 feet				
ABO	RATORY TE	EST DAT	A							
	ATORY EQUIPME								TEST PROCEDURE	
	uid Limit M								ASTM D4318	
ATTE	RBERG LIMITS	8	LIQUID LII	MIT DETERMINA		•		•	LIC	QUID LIMIT
	Paradal Parada	20			0	22.22	8	9	100% E	
	liquid limit =			+ pan weight, g =		33.33	33.92	32.24	90%	
	plastic limit =		ary soil -	+ pan weight, g =		30.47	30.82	29.47	80%	
pias	sticity index =	= 4		pan weight, g =		20.89	20.82	20.76	% 70% + 60% +	
				N (blows) = moisture, % =	L	25 29.9 %	31.0 %	15 31.8 %	— 50% — 50% — 60%	
OLIDIA	WAOE		DI ACTICI	•		29.9 %	31.0 %	31.6 %	— 50 40% E 30% E 6—	
SHKIN	IKAGE		PLASTIC	LIMIT DETERMIN	IATION	0	6	4	20%	
chri	inkage limit =	= n/a	wot soil	+ pan weight, g =		27.21	U		10%	
	nkage mm = nkage ratio =			+ pan weight, g = + pan weight, g =		25.86		+	0% 10	25 100
0	ago .ao	11/12	u., co	pan weight, g =		20.59				er of blows, "N"
				moisture, % =		25.6 %				· · · · · · · · · · · · · · · · · · ·
									ADDITIONAL DATA	
				PLASTIC	ITY CHAR	Т				
	80		· · · · · · · · · · · · · · · · · · ·	······································	T T	<u> </u>			% grav	vel = 0.0%
	-							2000	% sa	nd = 9.6%
									% silt and cl	ay = 90.4%
	70						,,,,,			silt = n/a
							ا" مرام	J" Line		ay = n/a
	60		-						moisture conte	•
	ļ								moisture conte	71.7/0
	50									
ěx	50							"A" Line		
plasticity index	-				أممر	CH o	OH	, LIIIC		
city	40 -						/-			
ısti	ŀ				,,,,]					
g	30		ļj							
	-			, and a						
	20			2000	\mathcal{X}					
	20 +		200	CL or OL						
	[2000			MH or	OH			
	10 -	/	 	/+						
		CL	-ML	ML or O	L					
	0		1			 			DATE TESTED	TESTED BY
		10	20 30	0 40	50	60 70	80	90 100	09/24/18	RTT
				li	quid limit				1 1	Coto
									you	

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	ICLL-SIZE ANAL I SIS			T
PROJECT La Center Middle School	Mr. Dave Holmes, Superintendent		PROJECT NO.	LAB ID
	_		18084	S18-892
La Center, Washington	La Center School District		REPORT DATE	FIELD ID
	725 NE Highland Avenue		09/26/18	
	La Center, Washington 98629		DATE SAMPLED	SAMPLED BY
			08/22/18	HDG
MATERIAL DATA				
MATERIAL SAMPLED	MATERIAL SOURCE		USCS SOIL TYPE	l. C 1
SILT with Sand	Soil Boring SB-04		ML, Silt with	n Sand
	depth = 20 feet			
SPECIFICATIONS			AASHTO SOIL TYPE	
none			A-4(2)	
LABORATORY TEST DATA			•	
LABORATORY EQUIPMENT			TEST PROCEDURE	
Rainhart "Mary Ann" Sifter 637			ASTM D691	13
ADDITIONAL DATA			SIEVE DATA	
initial dry mass (g) = 199.95				% gravel = 0.3%
as-received moisture content = 28.4%	coefficient of curvature, $C_C = n/a$			% sand = $16.1%$
liquid limit = 26	coefficient of uniformity, $C_U = n/a$		% :	silt and clay = 83.6%
plastic limit = 22	effective size, $D_{(10)} = n/a$			
plasticity index = 4	$D_{(30)} = n/a$			PERCENT PASSING
fineness modulus = n/a	$D_{(60)} = n/a$		SIEVE SIZE	SIEVE SPECS
			US mm	act. interp. max min
	- DIOTRIBUTION		6.00" 150.0	100%
GRAIN SIZE	E DISTRIBUTION		4.00" 100.0 3.00" 75.0	100% 100%
7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.	# # # # 16 # # # # # # 100 # # # # # # # # # # # # # # # # # # #		2.50" 63.0	100%
100% Q_QQ @QQ @QQ Q_Q_Q_Q		<u>-</u> 100%	2.00" 50.0	100%
	١]	1.75" 45.0	100%
90%		90%	1.50" 37.5	100%
		1	1.50" 37.5 1.25" 31.5 1.00" 25.0	100%
80%		80%	1.00" 25.0	100%
80%		80%	7/8" 22.4 3/4" 19.0	100% 100%
		-	5/8" 16.0	100%
70%		70%	1/2" 12.5	100%
		1	3/8" 9.50	100%
_ 60% + + + + + + + + + + + + + + + + + + +		60%	1/4" 6.30	100%
Sing I		1	#4 4.75	100%
50%		50%	#8 2.36	100%
d %]	#10 2.00	100%
40%		40%	#16 1.18	100%
			#20 0.850 #30 0.600	100% 99%
		-	#40 0.405	99%
30%		30%	#40 0.425 #50 0.300 #60 0.250	99%
]	#60 0.250	99%
20%		20%	#80 0.180	97%
		1	#100 0.150	97%
10%		10%	#140 0.106	90%
]	#170 0.090	87%
0%		¹ 0%	#200 0.075	84%
100.00 10.00	1.00 0.10	0.01	DATE TESTED	TESTED BY
partic	le size (mm)		09/19/18	KMS
·			1	10
sieve sizes			you	
				ENGINEERING INC authorized signat

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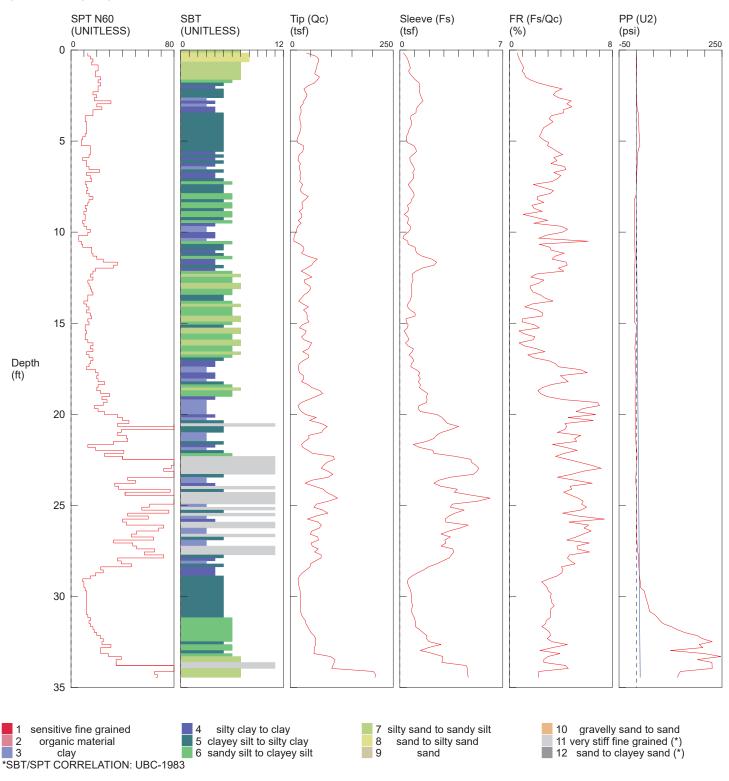
				/\\		-I\\\ C			<u> </u>	
PROJEC	ct Center Mid	ddla Caba	1		CLIENT Do	ua Halmaa	Cumominton	dont	PROJECT NO.	LAB ID
							Superintend	ient	18084	S18-892
La	Center, Wa	ashington				ter School l			REPORT DATE	FIELD ID
						Highland .			09/26/18 DATE SAMPLED	SB4.7
					La Cent	ter, Washin	gton 98629		08/22/18	HDG
MATE	RIAL DATA	Α			ı					
	IAL SAMPLED				MATERIAL SO	URCE			USCS SOIL TYPE	
SIL	T with Sar	nd			Soil Bo	ring SB-04			ML, Silt with S	and
					depth =	20 feet				
_ABO	RATORY T	TEST DAT	A							
ABORA	ATORY EQUIPM	MENT							TEST PROCEDURE	
Liq	uid Limit l	Machine,	Hand Rol	lled					ASTM D4318	
ATTE	RBERG LIMIT	rs	LIQUID LII	MIT DETERMINA			_	_	LI	QUID LIMIT
					0	9	•	4	100% F	
	liquid limit			+ pan weight, g =		33.92	32.29	33.47	90%	
	plastic limit		dry soil -	+ pan weight, g =		31.27	29.87	30.73	80%	
plas	sticity index	= 4		pan weight, g =		20.74	20.47	20.83	% 70% 	
				N (blows) =		27	23	19	3 50%	
				moisture, % =		25.2 %	25.7 %	27.7 %	00% to 00	
SHRIN	IKAGE		PLASTIC I	LIMIT DETERMIN			_		E 30% = 0	000
					0	2	•	4	10%	
	inkage limit			+ pan weight, g =		28.46			0%	
SIIII	nkage ratio	= n/a	ary son -	+ pan weight, g =		27.06		_	10	25 100 er of blows, "N"
				pan weight, g = moisture, % =		20.60			Humi	er or blows, N
				moisture, 70 -	- 21.5 /0	21.7 /0			ADDITIONAL DATA	
				PI ASTIC	ITY CHAR	т			-	
	80 —			,	•	•			% gra	vel = 0.3%
	ou F								=	ind = 16.1%
	-								% silt and c	
	70 -					 		.		•
	F						ا" ممر	J" Line		silt = n/a
	60						poor			lay = n/a
	00 <u>F</u>						•		moisture cont	ent = 28.4%
	ŀ					2000				
×	50				\prec	Jorean -				
nde	<u> </u>				(CH or	ОН	"A" Line		
<u>:</u>	40			/_						
ž. Č.	ļ				<i>/</i>					
plasticity index	20			/ /	´					
_	30			2000						
	ļ			proces .						
	20		1	CL or OL						
	ţ		1			MH or	ЭН			
	10	/	,			-				
		101	-ML	ML or O	.					
			<u> </u>	IVIL OF C	_				DATE TESTED	TESTED BY
	0 1	10	20 30		50	60 70	80	90 100	09/24/18	RTT
	U	10	20 30		quid limit	00 10	00	<i>3</i> 0 100		•
				!!	quiu illilit				famil	Cont

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APPENDIX B SUBSURFACE EXPLORATION LOGS

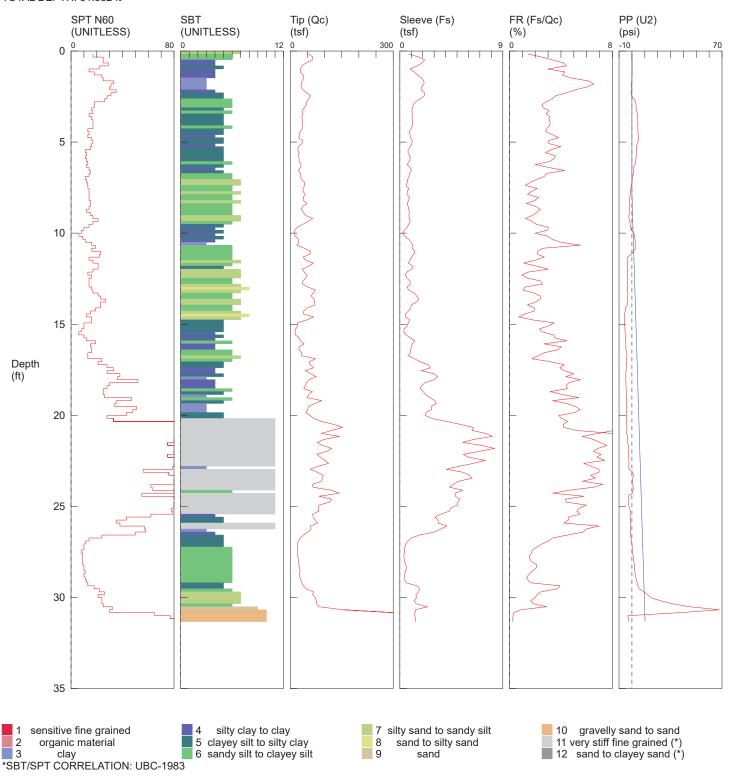
Columbia West / CPT-1 / 2313 NE Lockwood Creek Rd La Center

OPERATOR: OGE DMM CONE ID: DDG1452 HOLE NUMBER: CPT-1 TEST DATE: 8/8/2018 8:50:57 AM TOTAL DEPTH: 34.449 ft



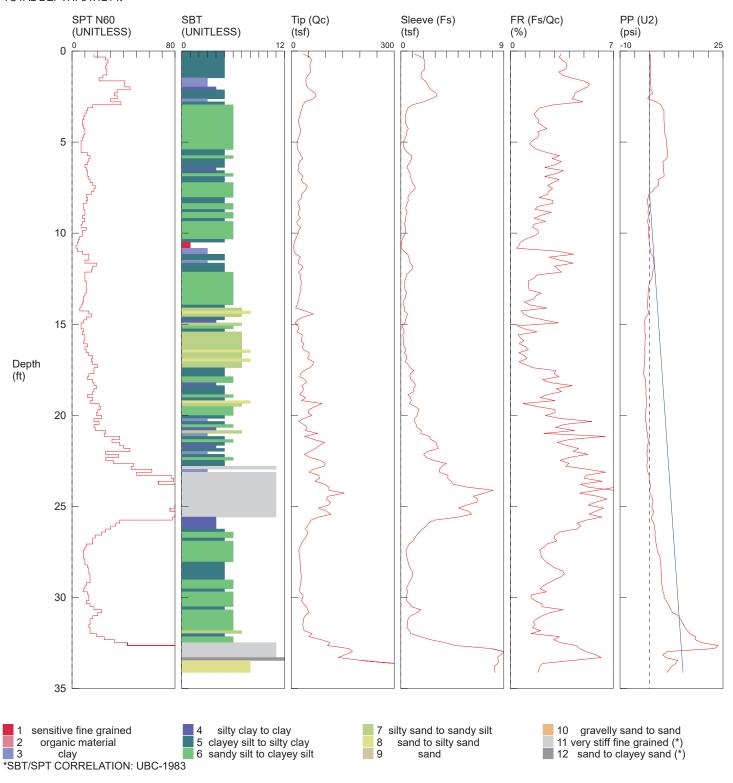
Columbia West / CPT-2 / 2313 NE Lockwood Creek Rd La Center

OPERATOR: OGE DMM CONE ID: DDG1452 HOLE NUMBER: CPT-2 TEST DATE: 8/8/2018 10:39:31 AM TOTAL DEPTH: 31.332 ft



Columbia West / CPT-3 / 2313 NE Lockwood Creek Rd La Center

OPERATOR: OGE DMM CONE ID: DDG1452 HOLE NUMBER: CPT-3 TEST DATE: 8/8/2018 11:15:11 AM TOTAL DEPTH: 34.121 ft



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SOIL BORING LOG

La		er Mido	dle Scl	hool			La Center School Dis	trict		ECT NO. 1808		BORING NO. SB-1			
		er, Wa	shingt	on			DRILLING CONTRACTOR Western States	DRILL RIG CME-55	ENGI	NEER/GEO ASR		PAGE NO	o. 1 of 2		
		ure 2					DRILLING METHOD Mud-Rotary	SAMPLING METHOD		T DATE 4/19/20)18	START TIME 0800			
REMA							APPROX. SURFACE ELEVATION 138 ft amsl	GROUNDWATER DEPTH 3 feet bgs		н DATE 4/19/2()18	FINISH TIME 1400			
Depth (ft)	Elevation (ft amsl)	Field ID + Sample Type	(u	PT N-value ncorrected) 0 25 50 75	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRI	soil (by	boratory properties y symbol) 50 75	Moisture Content (%)	Passing ♣ No. 200 Sieve (%)	Liquid Limit	O Plasticity Index		
0.	-						Approximately 18 inches ZONE.	of grass and topsoil TILL							
4-	- 136 - - - - - - 132	SPT SB1.1	11	*	CL		Orange-brown sandy lea medium stiff, moderate p blocky texture. [Soil Type	plasticity. Gray mottles,	0	X0 +	37.7	66.9	46	22	
12-	- - -128 -	SPT SB1.3 SPT SB1.4	3 •		ML		Medium brown SILT with soft to medium stiff, low p content (fine texture). [So	plasticity. Variable sand	0	K +	36.5	82.3	27	3	
16-	- 124 - - - - 120 -	SPT SB1.5	3 •						0	(+	29.6	73.1	26	5	
24 -	- 116 	SPT SB1.8	24		CL-ML		Blue-gray SILTY CLAY wedium stiff to stiff, low to Varying amounts of fine	to moderate plasticity.							

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SOIL BORING LOG

PROJECT NAME La Center Middle School	La Center School Dist	rict	PROJECT N	NO. 3084	BORING NO. SB-1			
PROJECT LOCATION La Center, Washington	DRILLING CONTRACTOR Western States	DRILL RIG CME-55		GEOLOGIST SR	PAGE NO. 2 of 2			
BORING LOCATION See Figure 2	DRILLING METHOD SAMPLING METHOD SPT)/2018	START TIME 0800			
REMARKS None	APPROX. SURFACE ELEVATION 138 ft amsl	GROUNDWATER DEPTH 3 feet bgs	FINISH DAT	E 9/2018	FINISH TIME 1400			
(#) Had a line (ample ample am	LITHOLOGIC DESCRIP	PTION AND REMARKS	laborato soil prope (by syml	Moistur (lod	Passing No. 200 Sleve (%) Limit Co Plasticity Index			
30 108 SPI 12 SB1.9 32 -		o moderate plasticity. sand. [Soil Type 2] MERATE - ired CONGLOMERATE, I sub-angular to I gravels in sand, silt,						
SPI SB1.11 50 FOR 5"	Soil boring terminated at refusal. Groundwater encounterer Piezometer installed to 28 from 18 to 28 feet BGS.	d at 3.0 feet.						
50 - 88								
52								
56 -								
58 + 80								

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PROJECT NAME La Center Middle School	La Center School Dis	trict	PROJECT NO. 1808	34	BORING	NO. SB-2	
PROJECT LOCATION La Center, Washington	DRILLING CONTRACTOR Western States	DRILL RIG CME-55	ENGINEER/GEO ASF		PAGE NO	o. 1 of 2	
BORING LOCATION See Figure 2	DRILLING METHOD Mud-Rotary	SAMPLING METHOD SPT	START DATE 4/19/20	018	START T	_{IME} 1445	
REMARKS None	APPROX. SURFACE ELEVATION 134 ft amsl	GROUNDWATER DEPTH 3 feet bgs	FINISH DATE 4/20/20	018	FINISH T	1300	
(uncorrected) Sept N-value (uncorrected) Type Sept N-value (uncorrected) Type Graphic Log Gra	LITHOLOGIC DESCRII	PTION AND REMARKS	laboratory soil properties (by symbol) 25 50 75		Passing No. 200 Sieve (%)	LiquidLimit	O Plasticity Index
0	Approximately 18 inches ZONE.	of grass and topsoil TILL					
2 - 132 V CL CL SP1 A - 128 SB2.1 5 SB2.2 5 SB	Orange-brown LEAN CL wet, medium dense, low Gray mottles, blocky text	to moderate plasticity.					
8- SB2.3 10-124 SHELBY	Medium brown SILT with soft to medium stiff, low pontent (fine texture). [So	plasticity. Variable sand	O •× +	41.8	77.4	30	8
SPI 4 SB2.4 CL-ML SB2.5 11 SB2.5	Blue-gray SILTY CLAY v medium stiff to stiff, low t Varying amounts of fine s	o moderate plasticity.	_				
18 — 116 20 — SPI							
SB2.6 25 SB2.6 25 SB2.6 24 -							
26 108 SB2.7 16							
28 - SC	Blue-gray clayey SAND, dense, moderate plastici sand. [Soil Type 2]						

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									SOIL BOININ								
	ente	er Mid	dle Sch	100	I				CLIENT La Center School Di				1808		BORING	SB-2	
PROJEC La Co			shingto	on					DRILLING CONTRACTOR Western States	DRILL RIG CME-55	EN		ASF	COGIST	PAGE N	o. 2 of 2	
BORING See I									DRILLING METHOD Mud-Rotary	SAMPLING METHOD SPT	STA	4/	ATE 19/2	018	START	TIME 1445	
REMARK None									APPROX. SURFACE ELEVATION 134 ft amsl	GROUNDWATER DEPTH 3 feet bgs	FIN	ISH D 4/2	ATE 20/2	018	FINISH	1300	
Depth (ft)	(ft amsl)	Field ID + Sample Type	(ur	PT Noncorr	ecte	d)	USCS Soil Type	Graphic Log	LITHOLOGIC DESCF	RIPTION AND REMARKS	sc (il pro by sy	ratory pertie: rmbol) 0 75		Passing No. 200 Sieve (%)	Liquid	O Plasticity Index
30 . 1	104	SPT	25								0			24.9	32.4	27	12
32 -		SB2.8							WEATHERED CONGL	OMERATE -					02.1		12
34 - 1	100	SPT SB2.9	REFUSAL 50		\ •	•			Orange-brown to varice partially to fully cement sub-rounded pebbles a and clay matrix. Moist,	olored CONGLOMERATE, ed sub-angular to nd gravels in sand, silt,							
36-	96		FOR 5"						plasticity. [Soil Type 3]								
40 -																	
42 - 9	92																
44 - 46 - 8		SPT SB2.10	REFUSAL 50 FOR 5"		•	•			1								
48-			T GIK 3														
50 + 8	34								1								
52-																	
54 + 8	30	SPT	REFUSAL					%			_						
56 - 58 - 7	76	SB2.11	FOR 3"						Soil boring terminated a refusal. Groundwater encounte Piezometer installed to interval from 18.5 to 28	28.5 feet. Screened							
60																	

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				I					
PROJECT NAME La Center Middle School	CLIENT La Center Sch			PROJECT 18084	1		BORING SB-3		
PROJECT LOCATION La Center, Washington	Dan Fischer E		DRILL RIG Trailer-mount	ENGINEE HDG	:R		PAGE NO		
BORING LOCATION See Figure 2	DRILLING METHOD Solid-stem		SAMPLING METHOD SPT	START D. 08/22			START T 0815		
REMARKS None	APPROX. SURFACE EI	LEVATION	GROUNDWATER DEPTH Not observed	FINISH D. 08/22			FINISH T 1035		
(t) transport (t	AASHTO Soil Type Graphic Log	LITHOL	OGIC DESCRIPTION AND REMARKS		Wet Density (PCF)	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index
0	 W	1 .	ly 6 to 8 inches of topsoil and g						
1-132 2- SPI SB3.1 11	A-4(3)	medium stiff mottles, bloc Brown to tan soft to mediu content (fine	In sandy lean CLAY, moist to voto stiff, moderate plasticity. Graky texture. [Soil Type 1] SILT with sand, wet to saturation stiff, low plasticity. Variable texture). [Soil Type 2]	ed, sand		37.0	79.3	30	5
SHELBY SB3.4 SPI SB3.5 3 CL	A-4(8)		e-gray lean CLAY with sand, monant in here. [Soil Type 2]	noist		39.8	84.7	33	10
SPI SB3.6 10									
20 - SPI SB3.7 16									
24									

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COIL BOTTING		
La Center Middle School CLIENT La Center School District	PROJECT NO. BORING NO. 18084 SB-3	0.
PROJECT LOCATION La Center, Washington DRILLING CONTRACTOR Dan Fischer Excavating Traile	er-mount ENGINEER PAGE NO. HDG 2 of 2	
See Figure 2 Solid-stem SPT	START DATE	
1.2.17.11.10	bwater depth finish date finish tim bbserved 08/22/18 1035	IE
Field ID SPT N-value (uncorrected) Soil Type Soil Type Graphic Log LITHOLOGIC DE	Wet Density (%) Passing No. 200 Sieve (%)	Liquid Limit Plasticity Index
30 SPI SB3.8 18 A-4 Brown to blue-gray I to wet, soft to hard. 32 WEATHERED CON Orange-brown to va CONGLOMERATE, sub-angular to sub-r	lean CLAY with sand, moist [Soil Type 2] IGLOMERATE - ricolored partially to fully cemented rounded pebbles and gravels y matrix. Moist, very hard, [Soil Type 3] ed at 32.9 ft bgs.	

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											I			I		
	ECT NA	ame er Mido	dle Sc	hoc	ol		La Cer	nter Sch	nool District		PROJEC 1808			BORING SB-4	NO.	
		cation ter, Wa	ehina	ton			Dan Fi		or Excavating	DRILL RIG Trailer-mount	ENGINE			PAGE NO		
BORI	NG LOC	CATION	Silling	1011			DRILLING N	METHOD	.xoavating	SAMPLING METHOD	START D	ATE		START T	IME	
Se		ure 2					Solid-s		EVATION.	SPT GROUNDWATER DEPTH	08/22 FINISH D			1055 FINISH T		
No							136 ft a		LEVATION	Not observed	08/22			1310		
Depth (ft)	Elevation (ft amsl)	Field ID + Sample Type	(u	ncorre	-value ected) 5 50 75	USCS Soil Type	AASHTO Soil Type	Graphic Log	LITHOLO	OGIC DESCRIPTION AND REMA	ARKS	Wet Density (PCF)	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index
0 .	136							 }!! _* <u>\!</u>		y 6 to 8 inches of topsoil a	-					
6-	- 132 - 132 - 128	SPT SB4.2	13 8	•		CL	A-7		medium dens mottles, block	rn sandy lean CLAY, mois se, moderate plasticity. Gr ky texture. [Soil Type 1]	ay					
	- 124 -		5			ML	A-4(4)		stiff, low plas texture). [Soi		nt (fine		41.7	90.4	30	4
18 -	-120	SPI SB4.5	12	•		SC	A-4		Blue-gray cla dense, mode sand. [Soil Ty	yey SAND, moist to wet, r rate plasticity. Medium-tex ype 2]	medium ktured					
22 -	- 116 - - - - 112	SB4.6	17			ML	A-4(2)		Blue-gray SII hard. [Soil Ty	_T with sand, moist to wet /pe 2]	, stiff to		28.4	83.6	26	4
26 - 26 - 28 - 30	- 108 -	SPI SB4.7	29													

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La		er Mid	dle Sc	hool		1		nool District		PROJEC 1808	4		BORING SB-4		
		er, Wa	shingt	ton		DRILLING C		or E xcavating	DRILL RIG Trailer-mount	ENGINE			PAGE NO		
See	Fig	ure 2				DRILLING N	tem		SAMPLING METHOD SPT	START 0	2/18		START T 1055		
REMA Noi						136 ft a		LEVATION	GROUNDWATER DEPTH Not observed	FINISH 0 08/22			1310		
Depth (ft)	Elevation (ft amsl)	Field ID + Sample Type	(un	PT N-value ncorrected)	USCS Soil Type	AASHTO Soil Type	Graphic Log	LITHOL	OGIC DESCRIPTION AND REMA	ARKS	Wet Density (PCF)	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index
30 .	-	SPT SB4.8	23	+		A-4		Blue-gray SII hard. [Soil Ty	_T with sand, moist to wet /pe 2]	, stiff to					
32 -	- 104 -	SPT	REFUSAL			-	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		D CONGLOMERATE -						
34 -		SB4.9	50 FOR 4"	•	_	_	3/07	CONGLOME sub-angular in sand, silt,	RATE, partially to fully cel to sub-rounded pebbles ar and clay matrix. Moist, ver	nd gravels					
36-	- 100 -							Soil boring te	erminated at 33.4 ft bgs. not observed.						
38 -	.														
40 -	-96 -														
42-	-														
44 -	- -92 -														
46 -	-														
48 -	- -88														
50 -	.														
52 -	- 84 -														
54 -	-														
56 -	- 80														
58 -	-														
60	76														

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	T NAME enter Middl T LOCATION	e School				CLIENT La Center School Distr CONTRACTOR	ict EQUIPMENT	18084		NEED	TEST PIT	NO.
	enter, Wasl	nington				L&S Contractors	CAT 307E	ASR	313 I /EINGI	NEEK	4/18/1	18
	imate test pit Figure 2	LOCATION				APPROX. SURFACE ELEVATION 138 ft amsl	GROUNDWATER DEPTH Seeps at 1 feet bgs	START 1 0815			FINISH T 0850	IME
Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	phic og	LITHOLOGIC DESCRI	PTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
V					 	Approximately 18 inche TILL ZONE.	s of grass and topsoil					
- - -	TP-1.1	Gee silt loam	A-7-6(19)	CL		Orange-brown lean CLA sand, moist to wet, med plasticity. Gray mottles, Type 1]	ium dense, moderate	38.3	88.9	44	19	
- 5 - -	TP1.2		A-4(0)	ML		Medium brown SILT to saturated, soft to mediu non-plastic. Variable sa texture). [Soil Type 2]		39.1	92.7	NP	NP	
- - 10 -	TP1.3		A-4(5)					42.2	83.7	30	7	
-						Bottom of test pit at 14	feet bgs.					
- 15 -						Groundwater seeps end Heavy flow.						

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	nter Middl	le School				La Center School Dist		18084	1		TEST PIT	NO.
	r LOCATION nter, Was	hinaton				CONTRACTOR L&S Contractors	EQUIPMENT CAT 307E	GEOLOG ASR	SIST/ENGI	NEER	DATE 4/18/1	8
APPROXI	IMATE TEST PITI igure 2					APPROX. SURFACE ELEVATION 142 ft amsl	GROUNDWATER DEPTH Seeps at 3 feet bgs	START 1 0855			FINISH T 0915	
Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRI	PTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0					Mr	Approximately 18 inche TILL ZONE.	s of grass and topsoil					
. 5		Gee silt loam	A-7	CL		Orange-brown lean CL/sand, moist to wet, med plasticity. Gray mottles, Type 1]	lium dense, moderate					
10			A-4	ML		Medium brown SILT to saturated, soft to mediu non-plastic. Variable sa texture). [Soil Type 2]						
15						Bottom of test pit at 15 Groundwater seeps end Moderate flow.						

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PROJEC ⁻						CLIENT		PROJEC			TEST PIT	NO.
	enter Middl	e School				La Center School Distr		1808			TP-3	
	TLOCATION enter, Wasl	nington				CONTRACTOR L&S Contractors	EQUIPMENT CAT 307E	ASR	GIST/ENGI	NEER	DATE 4/18/1	18
	imate test pit Figure 2	LOCATION			I	APPROX. SURFACE ELEVATION 136 ft amsl	GROUNDWATER DEPTH Seeps at 3 feet bgs	9920			FINISH T 0950	IME
Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRI	PTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
-						Approximately 18 inche TILL ZONE.	s of grass and topsoil					
- -		Odne silt loam	A-7	CL		Orange-brown lean CLA sand, moist to wet, med plasticity. Gray mottles, Type 1]	ium dense, moderate					
- 5												
-			A-4	ML		Medium brown SILT to saturated, soft to mediu non-plastic. Variable sa texture). [Soil Type 2]						
- 10												
- 15						Bottom of test pit at 14. Groundwater seeps end Moderate flow.						

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	nter Midd	le School				La Center School Dist		18084	4		TEST PIT	NO.
	LOCATION nter, Was	hinaton				CONTRACTOR L&S Contractors	EQUIPMENT CAT 307E	GEOLOG ASR	GIST/ENGI	NEER	DATE 4/18/1	18
APPROXI	MATE TEST PI igure 2		ı		ı	APPROX. SURFACE ELEVATION 137 ft amsl	GROUNDWATER DEPTH Seeps at 3 feet bgs	START 1 1000			FINISH T 1050	
Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphi Log	LITHOLOGIC DESCR	IPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
0						Approximately 18 inche TILL ZONE.	s of grass and topsoil					
▼		Gee silt loam	A-7	CL		Orange-brown lean CL/ sand, moist to wet, med plasticity. Gray mottles, Type 1]	dium dense, moderate					
5	TP4.1		A-4(0)	ML		Medium brown SILT to saturated, soft to mediu non-plastic. Variable sa texture). [Soil Type 2]		39.8	90.2	NP	NP	
10												
15						Bottom of test pit at 14 Groundwater seeps end Heavy flow.	feet bgs. countered at 3 feet bgs.					

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	nter Middl	e School				CLIENT La Center School Distr		PROJECT 18084	1		TEST PIT	NO.
	r LOCATION nter, Wasl	hington				CONTRACTOR L&S Contractors	EQUIPMENT CAT 307E	ASR	SIST/ENGI	NEER	DATE 4/18/1	18
APPROXI	MATE TEST PIT					APPROX. SURFACE ELEVATION 135 ft amsl	GROUNDWATER DEPTH Seeps at 3 feet bgs	START 1 1100		I	FINISH T	
Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRI	PTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
- O					Mr	Approximately 18 inche TILL ZONE.	s of grass and topsoil					
- - - 5		Odne silt loam	A-7	CL		Orange-brown lean CLA sand, moist to wet, med plasticity. Gray mottles, Type 1]	ium dense, moderate					
- 5			A-4	ML		Medium brown SILT to						
-						saturated, soft to mediu non-plastic. Variable sa texture). [Soil Type 2]	nd and clay content (fine					
- 10												
- - 15	TP5.1		A-4(0)	ML-CL		Blue-gray silty SAND, w to non-plastic, variable s Type 2]		35.4	48.2	NP	NP	
-						Bottom of test pit at 15 i Groundwater seeps end Moderate flow.						

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PROJEC	enter Middle TLOCATION					L	CLIENT La Center School Distr CONTRACTOR	EQUIPMENT			NEER	TEST PIT	
	nter, Wasł						L&S Contractors APPROX. SURFACE ELEVATION	CAT 307E GROUNDWATER DEPTH	ASR			4/18/1 FINISH T	
	IMATE TEST PIT	LOCATION					132 ft amsl	Seeps at 2 feet bgs	1200			1240	IME
Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphi Log	ic	LITHOLOGIC DESCRI	PTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
-							Approximately 18 inches TILL ZONE.	s of grass and topsoil					
		Odne silt loam	A-7	CL			Orange-brown lean CLA sand, moist to wet, med plasticity. Gray mottles, Type 1]	ium dense, moderate					
- 5													
- - - 10			A-4	ML			Medium brown SILT to saturated, soft to mediu non-plastic. Variable satexture). [Soil Type 2]						
- - 15 -							Bottom of test pit at 14 t Groundwater seeps end Moderate flow.						

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	enter Middl	e School				CLIENT La Center School Distr		PROJECT 18084	4		TEST PIT	NO.	
	T LOCATION enter, Wasl	hington				CONTRACTOR L&S Contractors	EQUIPMENT CAT 307E	ASR	GIST/ENGI	NEER	DATE 4/18/1	18/18	
	imate test pit Figure 2	LOCATION				APPROX. SURFACE ELEVATION GROUNDWATER DEPTH 136 ft amsl Seeps at 1 feet bgs		START TIME 1245			FINISH T 1315	IME	
Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRI	PTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing	
▼					Mr	Approximately 18 inche TILL ZONE.	s of grass and topsoil						
-		Odne silt loam	A-7	CL		Orange-brown lean CLA sand, moist to wet, med plasticity. Gray mottles, Type 1]	lium dense, moderate						
- 5						Interbedded sand and s	ilt lenses.						
- 10			A-4	ML		Medium brown SILT to saturated, soft to mediu non-plastic. Variable sa texture). [Soil Type 2]							
- - 15 -						Bottom of test pit at 13 Groundwater seeps end Heavy flow.							

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PROJEC [*]	TNAME					CLIENT		PROJEC	T NO		TEST PIT	· NO
La Center Middle School			La Center School Distr	rict	18084			TP-8				
	TLOCATION enter, Wasl	hington				CONTRACTOR L&S Contractors	EQUIPMENT CAT 307E	GEOLOG ASR	GIST/ENGI	NEER	4/18/18	
	APPROXIMATE TEST PIT LOCATION See Figure 2			ı	APPROX. SURFACE ELEVATION 134 ft amsl	GROUNDWATER DEPTH START TIME Seeps at 2 feet bgs 1320			FINISH TIME 1345			
Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRI	PTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
- O						Approximately 18 inche TILL ZONE.	s of grass and topsoil		_			
		Gee silt loam	A-7	CL		Orange-brown lean CLA sand, moist to wet, med plasticity. Gray mottles, Type 1]	lium dense, moderate					
- 5												
-			A-4	ML		Medium brown SILT to saturated, soft to mediu non-plastic. Variable sa texture). [Soil Type 2]						
- 10 - -												
- - 15 -						Bottom of test pit at 14 Groundwater seeps end Moderate flow.						

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PROJECT NAME La Center Middle School PROJECT LOCATION			CLIENT La Center School Distr	rict	PROJECT 18084	1		TEST PIT	NO.			
	r LOCATION nter, Was	hinaton				CONTRACTOR L&S Contractors	EQUIPMENT CAT 307E	GEOLOG	SIST/ENGI	NEER	DATE 4/18/1	18
APPROXI	MATE TEST PIT					APPROX. SURFACE ELEVATION 132 ft amsl	GROUNDWATER DEPTH Seeps at 4 feet bgs	START TIME 1350			FINISH TIME 1415	
Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRI	PTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
- -				CL		Minor topsoil, disturbed previous grading.	clay FILL, evidence of					
- - ▼ - 5		Gee silt loam	A-7	CL		Orange-brown lean CLA sand, moist to wet, med plasticity. Gray mottles, Type 1]	lium dense, moderate					
- - 10			A-4	ML		Medium brown SILT to saturated, soft to mediu non-plastic. Variable sa texture). [Soil Type 2]						
- - 15 -						Bottom of test pit at 14 Groundwater seeps end Moderate flow.						

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PROJECT La Ce	TNAME enter Middl	e School				CLIENT La Center School Dis	strict	PROJEC 18084			TEST PIT	
	TLOCATION enter, Was	hinaton				CONTRACTOR L&S Contractors	EQUIPMENT CAT 307E	GEOLOG ASR	SIST/ENGI	NEER	DATE 4/18/1	8
APPROX	imate test pit					APPROX. SURFACE ELEVATION 132 ft amsl		START T 1420			FINISH T 1500	
Depth (feet)	Sample Field ID	SCS Soil Survey Description		USCS Soil Type	Graph Log	ic LITHOLOGIC DESC	RIPTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
- 5 		Odne silt loam	A-7	CL		Orange-brown lean Cl sand, moist to wet, me plasticity. Gray mottles Type 1] Medium brown SILT to saturated, soft to med	AY to lean CLAY with edium dense, moderate s, blocky texture. [Soil of SILT with sand, wet to jum stiff, low plasticity to and and clay content (fine		N			
- - - 15						Bottom of test pit at 14 Groundwater seeps en Moderate flow.	4 feet bgs. ncountered at 4 feet bgs.					

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						120111						
	enter Middl	e School				CLIENT La Center School Disti		PROJECT 18084	4		TEST PIT TP-1 1	NO.
	т LOCATION enter, Wasl	hington				CONTRACTOR L&S Contractors	EQUIPMENT CAT 307E	ASR	GIST/ENGI	NEER	8/31/	18
	imate test pit Figure 2	LOCATION			_	APPROX. SURFACE ELEVATION 136 ft amsl	GROUNDWATER DEPTH Not encountered	START 1)		FINISH T 0830	IME
Depth (feet)	Sample Field ID	SCS Soil Survey Description		USCS Soil Type	Graphic Log	LITHOLOGIC DESCRI	PTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
						Approximately 18 inches TILL ZONE.	s of grass and topsoil					
-		Gee silt loam	A-7	CL		Orange-brown lean CLA moderate plasticity. Gra texture. [Soil Type 1]	AY, moist, medium stiff, y mottles, blocky					IT-1 Depth = 2.0 ft k = 0.2 in/hr
_						Bottom of test pit at 2.0 Groundwater not encou	feet. ntered.					
- 5												
-												
-												
- 10 -												
-												
- - 15												
-												

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PROJEC ⁻	TNAME					CLIENT		PROJEC	T NO		TEST PIT	T NO
La Ce	enter Middl	e School				La Center School Dist	rict	18084	4		TP-12	
	TLOCATION enter, Wasl	hington				CONTRACTOR L&S Contractors	EQUIPMENT CAT 307E	GEOLOG	GIST/ENGI	NEER	DATE 8/31/	18
APPROX	imate test pit Figure 2					APPROX. SURFACE ELEVATION GROUNDWATER DEPTH STAR: 133 ft amsl Not encountered 083			;		FINISH T 0840	IME
Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRI	PTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
- -						Approximately 18 inche TILL ZONE.	s of grass and topsoil					
_		Gee silt loam	A-7	CL		Orange-brown lean CL/ moderate plasticity. Gra texture. [Soil Type 1]	AY, moist, medium stiff, ay mottles, blocky					IT-2 Depth = 2.0 ft k = 0.05 in/hr
_					*****	Bottom of test pit at 2.0 Groundwater not encou	feet. ntered.					
- 5												
_												
-												
- 10 -												
-												
- 15 -												

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										T	
	e School					rict	1808 ⁴	1 NO. 1			
CT LOCATION					CONTRACTOR	EQUIPMENT	GEOLOG	SIST/ENGI	NEER	DATE	
	LOCATION					Not encountered					
Sample	SCS	AASHTO	USCS	0 1:		I			. <u>i</u> e iei		Infiltration
Field ID	Soil Survey Description	Soil Type	Soil Type	Log			Moist Con.	Pass No. 200 (%	Liqu	Plasti Inde	Testing
					Approximately 18 inche TILL ZONE.	s of grass and topsoil					
	Odne silt loam	A-7	CL		Orange-brown lean CLA moderate plasticity. Gratexture. [Soil Type 1]	AY, moist, medium stiff, ay mottles, blocky					IT-3 Depth = 2.0 ft k = 0.01 in/hr
					Bottom of test pit at 2.0 Groundwater not encou	feet. ntered.					
	Sample Field ID	enter Middle School CT LOCATION enter, Washington XIMATE TEST PIT LOCATION Figure 2 Sample Field ID Odne silt loam	enter Middle School ET LOCATION enter, Washington XIMATE TEST PIT LOCATION Figure 2 Sample Field ID Odne silt loam Odne silt loam	enter Middle School CT LOCATION enter, Washington XIMATE TEST PIT LOCATION Figure 2 Sample Field ID Odne silt loam Odne silt loam Odne silt loam	enter Middle School CTLOCATION enter, Washington XIMATE TEST PIT LOCATION Figure 2 Sample Field ID SCS Soil Survey Description Odne silt loam A-7 CL Odne silt CD Odne silt CD	enter Middle School ET LOCATION enter, Washington XIMATE TEST PIT LOCATION Figure 2 Sample Field ID Soll Survey Description Odne silt loam A-7 CL Odne silt loam A-7 CL Bottom of test pit at 2.0 Groundwater not encou	enter Middle School ctricocation enter, Washington Simple Field ID Sample Field ID AASHTO Description AASHTO LSC Soil Survey Type AASHTO Location Soil Type AASHTO Location Soil Type Contractors L&S Contractors L&S Contractors L&S Contractors CAT 307E APPROX SURFACE ELEVATION ROUNDWATER DEPTH Not encountered AASHTO Location Soil Type Carphic Las Contractors CAT 307E APPROX SURFACE ELEVATION ROUNDWATER DEPTH Not encountered APPROX SURFACE ELEVATION ARCHIOLOGIC DESCRIPTION AND REMARKS LITHOLOGIC DESCRIPTION AND REMARKS TILL ZONE. Approximately 18 inches of grass and topsoil TILL ZONE. Orange-brown lean CLAY, moist, medium stiff, moderate plasticity. Gray mottles, blocky texture. [Soil Type 1] Bottom of test pit at 2.0 feet. Groundwater not encountered.	ENTER MIDIGIDE SCHOOL Enter, Washington CONTRACTOR ENTERST PIT LOCATION Fligure 2 Sample Field JD Description Odne silt loam A-7 CL Ioam Odne silt Coam Ioam Odne silt Coam Ioam Ioam Ioam Ioam Ioam Ioam Ioam I	enter Middle School CTLOCATION enter, Washington CAT 307E CAT 3	enter Middle School La Center School District TIOCATION enter, Washington APPROX SURFACE BEVANTON Sample Boscription Soll Survey APPROX SURFACE BEVANTON Boscription APPROX SURFACE BEVANTON APPROX SURFACE BEVANTON APPROX SURFACE BEVANTON APPROX SURFACE BEVANTON Not encountered ASR ASART IME ORAGO Orange-brown lean CLAY, moist, medium stiff, moderate plasticity, Gray mottles, blocky texture. [Soil Type 1] Bottom of test pit at 2.0 feet. Groundwater not encountered.	enter Middle School La Center School District TOCATION CONTRACTOR Enter, Washington CAT 307E ASR ASR Soli Survey Soli Survey Soli Survey Description Description ASSISTITUTE CATION Figure 2 Sample Bild Soli Survey Description Description ASSISTITUTE Type Type Approximately 18 inches of grass and topsoil TILL ZONE. APPROximately 18 inches of grass and topsoil TILL ZONE. Orange-brown lean CLAY, moist, medium stiff, moderate plasticity. Gray mottles, blocky texture. [Soil Type 1] Bottom of test pit at 2.0 feet. Groundwater not encountered.

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La Ce	PROJECT NAME La Center Middle School PROJECT LOCATION					CLIENT La Center School Dist		PROJECT 18084	4		TEST PI	
	·LOCATION nter, Wasl	hington				CONTRACTOR L&S Contractors	EQUIPMENT CAT 307E	GEOLOG	GIST/ENGI	NEER	8/31/	18
APPROXI	MATE TEST PIT					APPROX. SURFACE ELEVATION 135 ft amsl	GROUNDWATER DEPTH Not encountered	START 1 0914			FINISH 1	IME
Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRI	PTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
- O					Mic	Approximately 18 inche TILL ZONE.	s of grass and topsoil					
5		Gee silt loam	A-7	CL		Orange-brown lean CL/ moderate plasticity. Gra texture. [Soil Type 1]	AY, moist, medium stiff, ay mottles, blocky					IT-4 Depth = 2.0 ft k = 0.02 in/hr
- 10 - -			A-4	ML		Brownish grey SILT with stiff, low plasticity to not silt/clay content. [Soil Ty	n-plastic, variable					
- - 15 -						Bottom of test pit at 14 Groundwater not encou						

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PROJEC						CLIENT		PROJEC			TEST PIT	
	enter Middl	e School				La Center School Dist		18084			TP-15	5
	enter, Was	hington				CONTRACTOR L&S Contractors	CAT 307E	ASR	SIST/ENGI	NEER	8/31/	18
	imate test pit Figure 2	LOCATION	ΓΙΟΝ			APPROX. SURFACE ELEVATION 138 ft amsl GROUNDWATER DEPTH Not encountered		START TIME 0930			1000	
Depth (feet)	Sample Field ID	SCS Soil Survey Description	AASHTO Soil Type	USCS Soil Type	Graphic Log	LITHOLOGIC DESCRI	PTION AND REMARKS	Moisture Content (%)	Passing No. 200 Sieve (%)	Liquid Limit	Plasticity Index	Infiltration Testing
-						Approximately 18 inche TILL ZONE.	s of grass and topsoil					
- 5	TP15.1	Gee silt loam	A-6(9)	CL		Orange-brown lean CL/sand, moist to wet, med plasticity. Gray mottles, Type 1]	lium dense, moderate	19.2	79.7	35	12	
- - 10 -			A-4	ML		wet, soft to medium stiff	nish grey SILT with sand, f, low plasticity to nd and clay content (fine					
- - 15 -						Bottom of test pit at 15 Groundwater not encou						

APPENDIX C SOIL CLASSIFICATION INFORMATION

SOIL DESCRIPTION AND CLASSIFICATION GUIDELINES

Particle-Size Classification

	AST	M/USCS	AASHTO				
COMPONENT	size range	sieve size range	size range	sieve size range			
Cobbles	> 75 mm	greater than 3 inches	> 75 mm	greater than 3 inches			
Gravel	75 mm – 4.75 mm	3 inches to No. 4 sieve	75 mm – 2.00 mm	3 inches to No. 10 sieve			
Coarse	75 mm – 19.0 mm	3 inches to 3/4-inch sieve	-	-			
Fine	19.0 mm – 4.75 mm	3/4-inch to No. 4 sieve	-	-			
Sand	4.75 mm – 0.075 mm	No. 4 to No. 200 sieve	2.00 mm – 0.075 mm	No. 10 to No. 200 sieve			
Coarse	4.75 mm – 2.00 mm	No. 4 to No. 10 sieve	2.00 mm – 0.425 mm	No. 10 to No. 40 sieve			
Medium	2.00 mm – 0.425 mm	No. 10 to No. 40 sieve	-	-			
Fine	0.425 mm – 0.075 mm	No. 40 to No. 200 sieve	0.425 mm – 0.075 mm	No. 40 to No. 200 sieve			
Fines (Silt and Clay)	< 0.075 mm	Passing No. 200 sieve	< 0.075 mm	Passing No. 200 sieve			

Consistency for Cohesive Soil

CONSISTENCY	SPT N-VALUE (BLOWS PER FOOT)	POCKET PENETROMETER (UNCONFINED COMPRESSIVE STRENGTH, tsf)
Very Soft	2	less than 0.25
Soft	2 to 4	0.25 to 0.50
Medium Stiff	4 to 8	0.50 to 1.0
Stiff	8 to 15	1.0 to 2.0
Very Stiff	15 to 30	2.0 to 4.0
Hard	30 to 60	greater than 4.0
Very Hard	greater than 60	-

Relative Density for Granular Soil

RELATIVE DENSITY	SPT N-VALUE (BLOWS PER FOOT)
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	more than 50

Moisture Designations

TERM	FIELD IDENTIFICATION
Dry	No moisture. Dusty or dry.
Damp	Some moisture. Cohesive soils are usually below plastic limit and are moldable.
Moist	Grains appear darkened, but no visible water is present. Cohesive soils will clump. Sand will bulk. Soils are often at or near plastic limit.
Wet	Visible water on larger grains. Sand and silt exhibit dilatancy. Cohesive soil can be readily remolded. Soil leaves wetness on the hand when squeezed. Soil is much wetter than optimum moisture content and is above plastic limit.

AASHTO SOIL CLASSIFICATION SYSTEM

TABLE 1. Classification of Soils and Soil-Aggregate Mixtures

General Classification	(35 Per	Granular Materi		Silt-Clay Materials (More than 35 Percent Passing 0.075)					
Group Classification	A-1	A-3	A-2	A-4	A-5	A-6	A-7		
Sieve analysis, percent passing:									
2.00 mm (No. 10)	-	-	-						
0.425 mm (No. 40)	50 max	51 min	-	-	-	-	-		
0.075 mm (No. 200)	25 max	10 max	35 max	36 min	36 min	36 min	36 min		
Characteristics of fraction passing 0.425 mm (No. 40)									
Liquid limit				40 max	41 min	40 max	41 min		
Plasticity index	6 max	N.P.		10 max	10 max	11 min	11 min		
General rating as subgrade		Excellent to good		Fair to poor					

Note: The placing of A-3 before A-2 is necessary in the "left to right elimination process" and does not indicate superiority of A-3 over A-2.

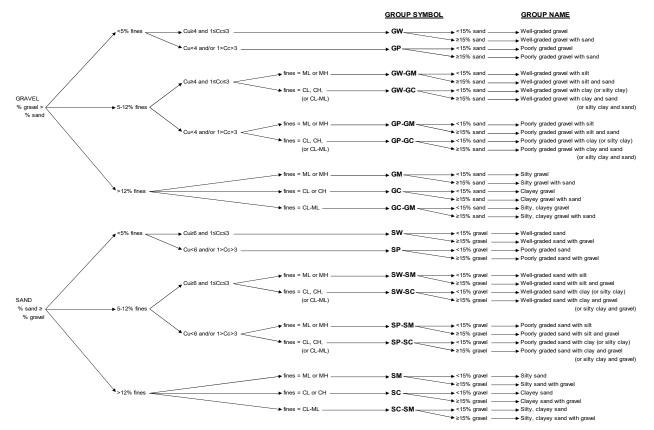
TABLE 2. Classification of Soils and Soil-Aggregate Mixtures

	Granular Materials						Silt-Clay Materials					
General Classification		(35 Percent or Less Passing 0.075 mm)							(More than 35 Percent Passing 0.075 mm)			
	<u>A-1</u>			A-2							A-7	
											A-7-5,	
Group Classification	A-1-a	A-1-b	A-3	A-2-4	A-2-5	A-2-6	A-2-7	A-4	A-5	A-6	A-7-6	
Sieve analysis, percent passing:												
2.00 mm (No. 10)	50 max	-	-	-	-	-	-	-	-	-	-	
0.425 mm (No. 40)	30 max	50 max	51 min	-	-	-	-	-	-	-	-	
0.075 mm (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min	
Characteristics of fraction passing 0.425 mm (No.	<u>40)</u>											
Liquid limit				40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min	
Plasticity index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11min	
Usual types of significant constituent materials	ual types of significant constituent materials Stone fragments, gravel and sand		Fine									
-			sand	Silty or clayey gravel and sand				Silty soils Clayey		ey soils		
General ratings as subgrade	Excellent to Good						Fair to poor					

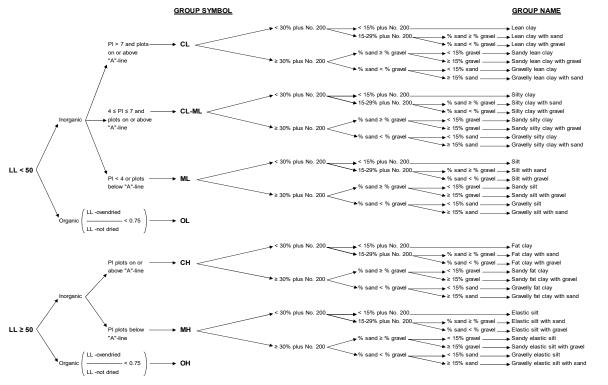
Note: Plasticity index of A-7-5 subgroup is equal to or less than LL minus 30. Plasticity index of A-7-6 subgroup is greater than LL minus 30 (see Figure 2).

AASHTO = American Association of State Highway and Transportation Officials

USCS SOIL CLASSIFICATION SYSTEM



Flow Chart for Classifying Coarse-Grained Soils (More Than 50% Retained on No. 200 Sieve)



Flow Chart for Classifying Fine-Grained Soil (50% or More Passes No. 200 Sieve)

APPENDIX D PHOTO LOG



LA CENTER MIDDLE SCHOOL LA CENTER, WASHINGTON PHOTO LOG



Site Overview, Facing South



Typical Observed Sod and Topsoil Depth





LA CENTER MIDDLE SCHOOL LA CENTER, WASHINGTON PHOTO LOG



Test Pit Profile, Test Pit TP-5





LA CENTER MIDDLE SCHOOL LA CENTER, WASHINGTON PHOTO LOG



Subsurface Exploration Activity, Soil Boring SB-1



APPENDIX E LIQUEFACTION EVALUATION



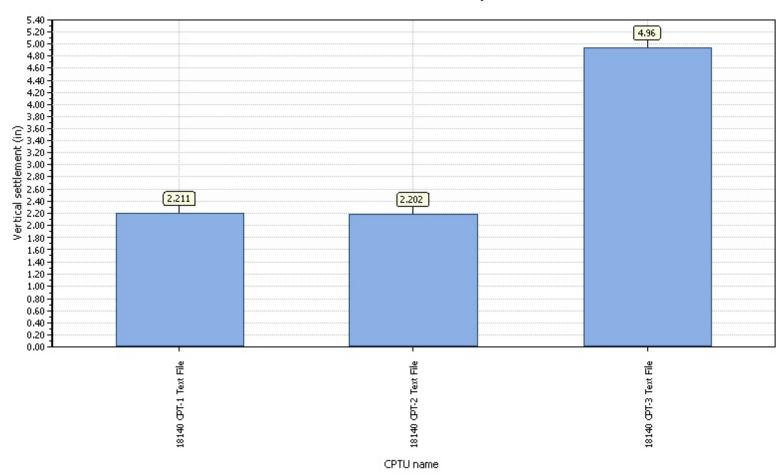
Columbia West Engineering, Inc.

11917 NE 95th Avenue Vancouver, WA 98682

http://www.columbiawestengineering.com

Project title : LCMS Location : La Center

Overall vertical settlements report





Columbia West Engineering, Inc.

11917 NE 95th Avenue Vancouver, WA 98682

http://www.columbiawestengineering.com

LIQUEFACTION ANALYSIS REPORT

Project title: LCMS Location: La Center

CPT file: 18140 CPT-1 Text File Input parameters and analysis data

Analysis method: Fines correction method: Points to test:

Earthquake magnitude M_w: Peak ground acceleration:

Robertson (2009) Robertson (2009) Based on Ic value

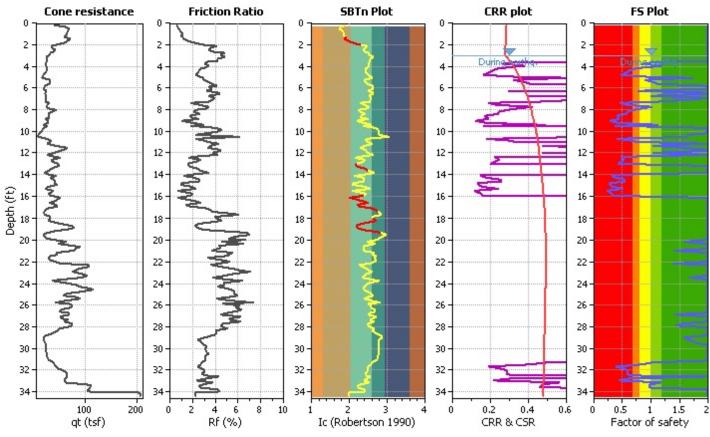
7.50 ft G.W.T. (in-situ): G.W.T. (earthq.): Average results interval: Ic cut-off value: Unit weight calculation:

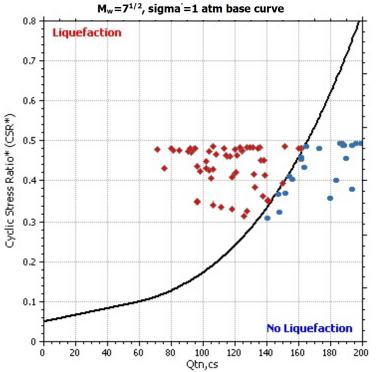
3.00 ft 1 2.60 Based on SBT Use fill: Nο Fill height: Fill weight: Trans. detect. applied:

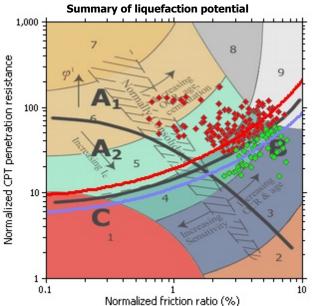
N/A N/A Yes K_{σ} applied: No

Clay like behavior applied: All soils Limit depth applied: No N/A

Limit depth: Method based MSF method:



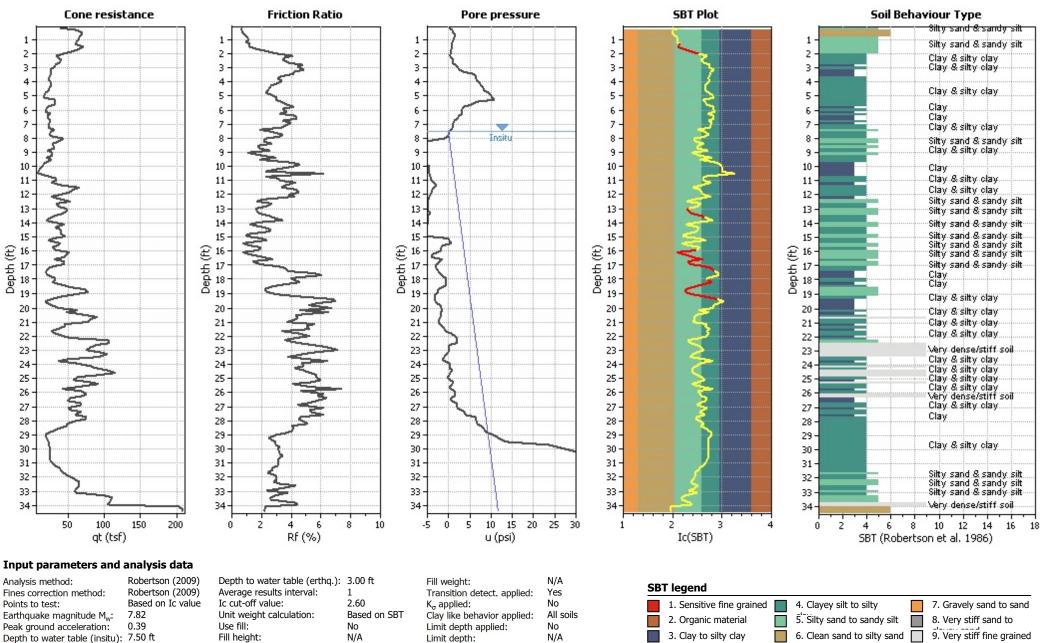




Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground

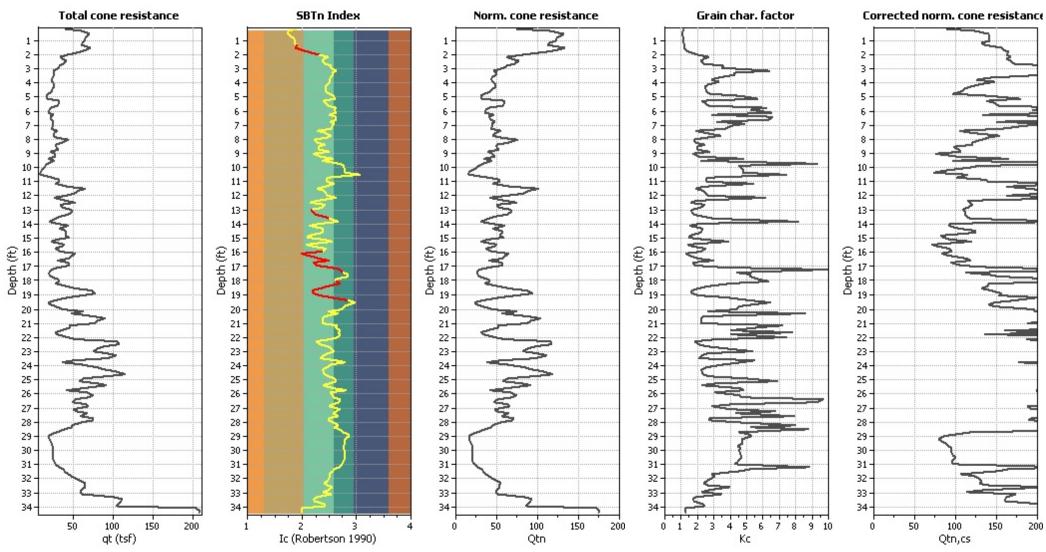
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plo



CPT basic interpretation plots (normaliz Norm, friction ratio SBTn Plot Norm. Soil Behaviour Type Norm, cone resistance Nom. pore pressure ratio Sand & silty sand Silty sand & sandy silt. 2 2 3 -3 Clay & silty clay 4 Silty sand & sandy silt 5 Silty sand & sandy silt 6 6 6 Clay & silty clay Silty sand & sandy silt 8 8 Silty sand & sandy silt 9 9 9 Silty sand & sandy silt Clay & silty clay 10 10 -10 10 Cláv 11 11 11 11 -11 Silty sand & sandy silt 12 12 12 12 12 Silty sand & sandy silt. 13 13 13 13 13 Clav & silty clay 14 14 14 14 14 Silty sand & sandy silt 15 15 15 15 15 Clay & silty clay 16 Depth (F) (£) 16 -(£) 16 · (f) 16 to 17 to 18 to 19 £ 16 Sand & silty sand £ 17 Silty sand & sandy silt 18 G Silty sand & sandy silt. 19 19 19 19 19 Clay 20 20 20 20 20 Clay 21 21 21 21 21 Clay & silty clay 22 22 22 22 Clay & silty clay 22 Very dense/stiff soil 23 23 23 23 23 Silty sand & sandy silt 24 24 24 24-24 Very dense/stiff soil 25 25 25 25 25 Cláv 26 Clay. 26 26 26 26 Cláv 27 27 27 27 27 Clay 28 28 28 28 28 Clay & silty clay 29 29 29 Clay 29 29 30 30 30 30 30 -Clay & silty clay 31 31 31 31 31-32 32 32 32 -32 Silty sand & sandy silt Silty sand & sandy silt 33 33 33 33 -33 Very dense/stiff soil 34 34 34 34 34 50 150 200 10 0 0.2 0.4 0.6 0.8 100 0 8 -0.2 4 6 8 10 12 14 16 18 Fr (%) Qtn Ic (Robertson 1990) SBTn (Robertson 1990) Input parameters and analysis data Robertson (2009) Depth to water table (erthq.): 3.00 ft N/A Analysis method: Fill weight: SBTn legend Robertson (2009) Average results interval: Yes Fines correction method: Transition detect. applied: Based on Ic value Ic cut-off value: 2.60 Points to test: K_{σ} applied: No 4. Clayey silt to silty 7. Gravely sand to sand 1. Sensitive fine grained Unit weight calculation: Earthquake magnitude M...: 7.82 Based on SBT Clay like behavior applied: All soils 5. Silty sand to sandy silt 2. Organic material 8. Very stiff sand to 0.39 Use fill: Peak ground acceleration: No Limit depth applied: No 9. Very stiff fine grained 3. Clay to silty clay 6. Clean sand to silty sand Depth to water table (insitu): 7.50 ft Fill height: N/A N/A Limit depth:

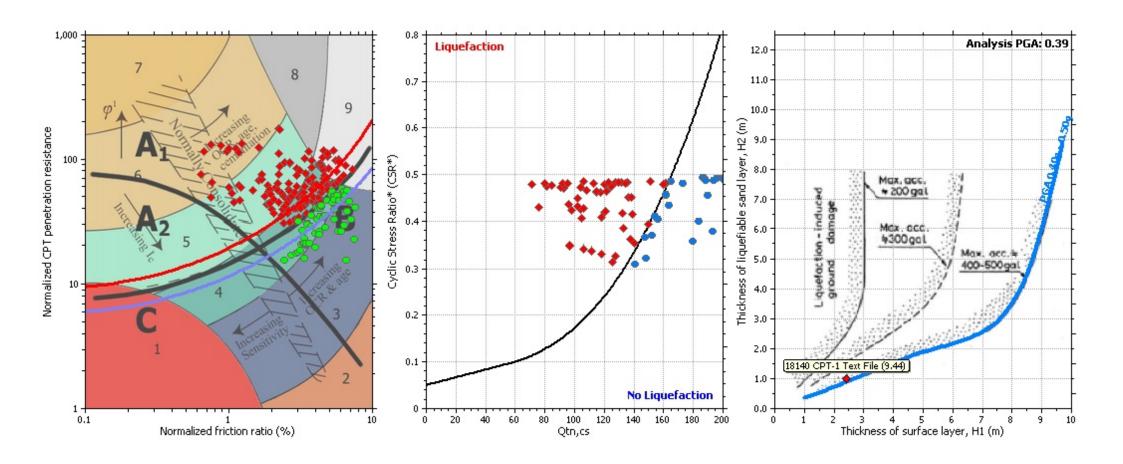
Liquefaction analysis overall plots (intermediate resu



Input parameters and analysis data

Analysis method: Robertson (2009) Depth to water table (erthq.): 3.00 ft Fill weight: N/A Fines correction method: Robertson (2009) Average results interval: Transition detect. applied: Yes Based on Ic value Ic cut-off value: 2.60 No Points to test: K_{σ} applied: 7.82 Unit weight calculation: Based on SBT Clay like behavior applied: All soils Earthquake magnitude M_w: Peak ground acceleration: 0.39 Limit depth applied: No Depth to water table (insitu): 7.50 ft Fill height: N/A Limit depth: N/A

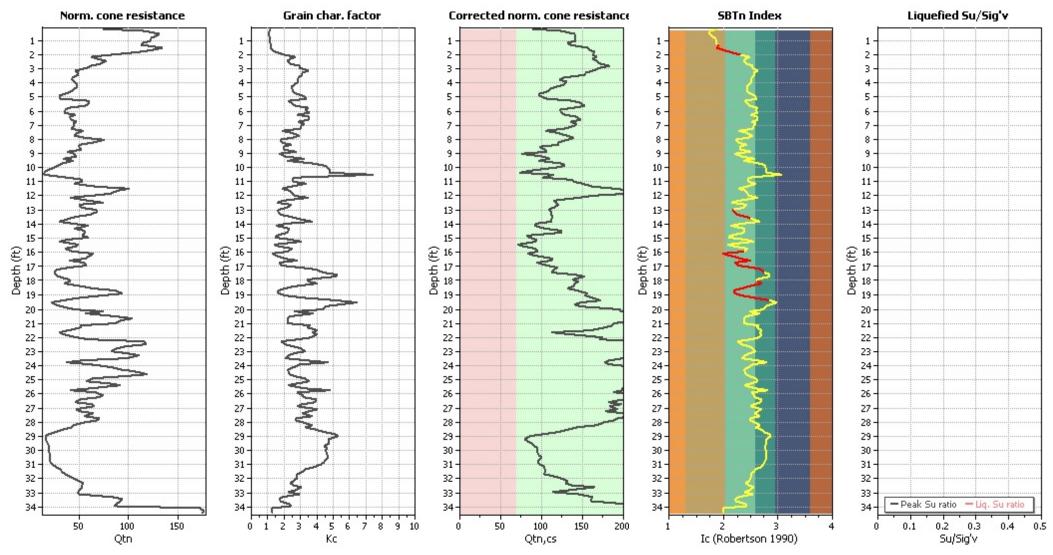
Liquefaction analysis summary plo



Input parameters and analysis data

Analysis method: Robertson (2009) Depth to water table (erthq.): 3.00 ft Fill weight: N/A Fines correction method: Robertson (2009) Average results interval: Transition detect. applied: Yes Based on Ic value Ic cut-off value: 2.60 No Points to test: K_{σ} applied: 7.82 Unit weight calculation: Based on SBT Clay like behavior applied: All soils Earthquake magnitude M_w: Peak ground acceleration: 0.39 Use fill: Limit depth applied: No Depth to water table (insitu): 7.50 ft Fill height: N/A Limit depth: N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

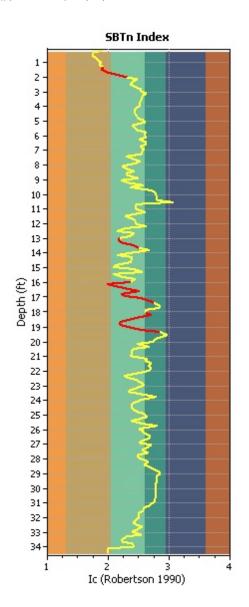
Analysis method: Robertson (2009) Depth to water table (erthq.): 3.00 ft Fill weight: N/A Fines correction method: Robertson (2009) Average results interval: Transition detect. applied: Yes Based on Ic value Ic cut-off value: 2.60 No Points to test: K_{σ} applied: Unit weight calculation: Based on SBT Clay like behavior applied: Earthquake magnitude M_w: 7.82 All soils Peak ground acceleration: 0.39 Use fill: Limit depth applied: No Depth to water table (insitu): 7.50 ft Fill height: N/A Limit depth: N/A

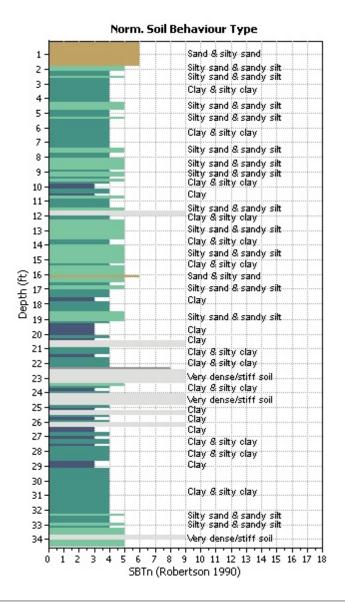
TRANSITION LAYER DETECTION ALGORITHM REPORT Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between 1.80 < I_c < 3.0) and a rate of change of I_c . Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.





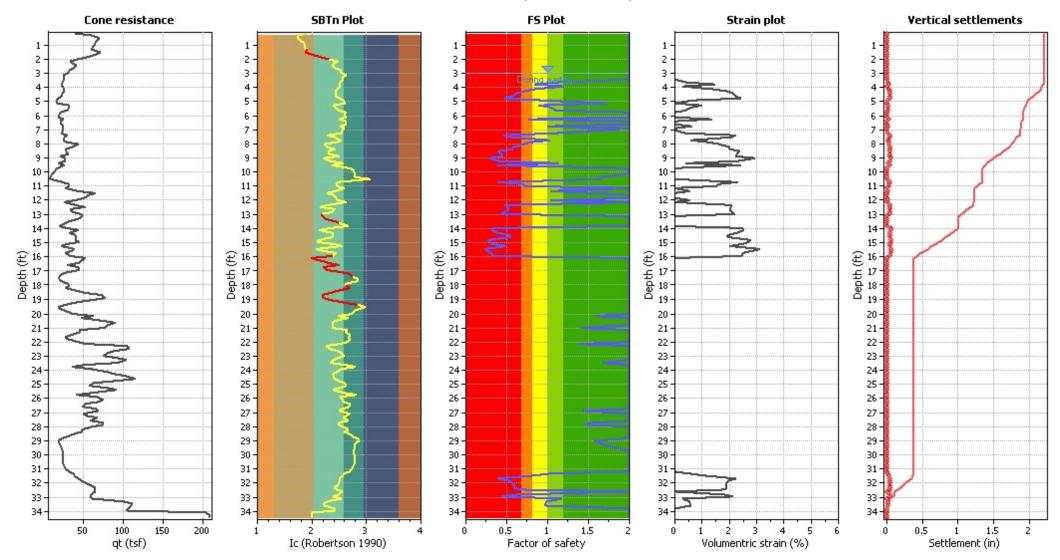
Transition layer algorithm properties

 $\begin{array}{ll} I_c \text{ minimum check value:} & 1.70 \\ I_c \text{ maximum check value:} & 3.00 \\ I_c \text{ change ratio value:} & 0.0250 \\ \text{Minimum number of points in layer:} & 4 \end{array}$

General statistics

Total points in CPT file: 210
Total points excluded: 29
Exclusion percentage: 13.81%
Number of layers detected: 6

Estimation of post-earthquake settlements



Abbreviations

qt: Total cone resistance (cone resistance qc corrected for pore water effects)

I_c: Soil Behaviour Type Index

FS: Calculated Factor of Safety against liquefaction

Volumentric strain: Post-liquefaction volumentric strain



Columbia West Engineering, Inc.

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LIQUEFACTION ANALYSIS REPORT

Project title: LCMS Location: La Center

CPT file: 18140 CPT-2 Text File Input parameters and analysis data

Robertson (2009) Analysis method: Fines correction method: Robertson (2009) Points to test: Based on Ic value Earthquake magnitude M_w:

Peak ground acceleration:

7.82

0.39

G.W.T. (in-situ): G.W.T. (earthq.): Average results interval: Ic cut-off value: Unit weight calculation:

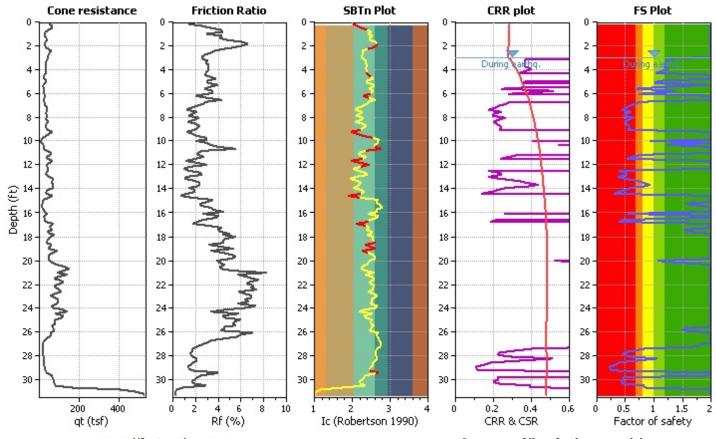
3.00 ft 1 2.60 Based on SBT

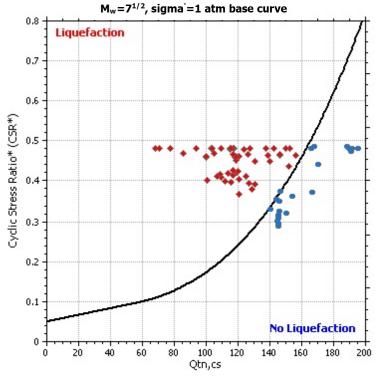
7.50 ft

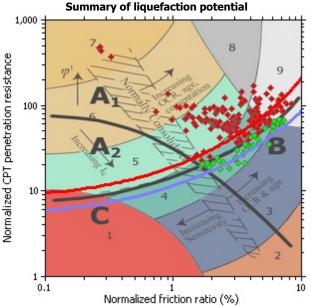
Use fill: Nο Fill height: Fill weight: Trans. detect. applied: K_{σ} applied:

N/A N/A Yes No

Clay like behavior applied: All soils Limit depth applied: No Limit depth: N/A Method based MSF method:



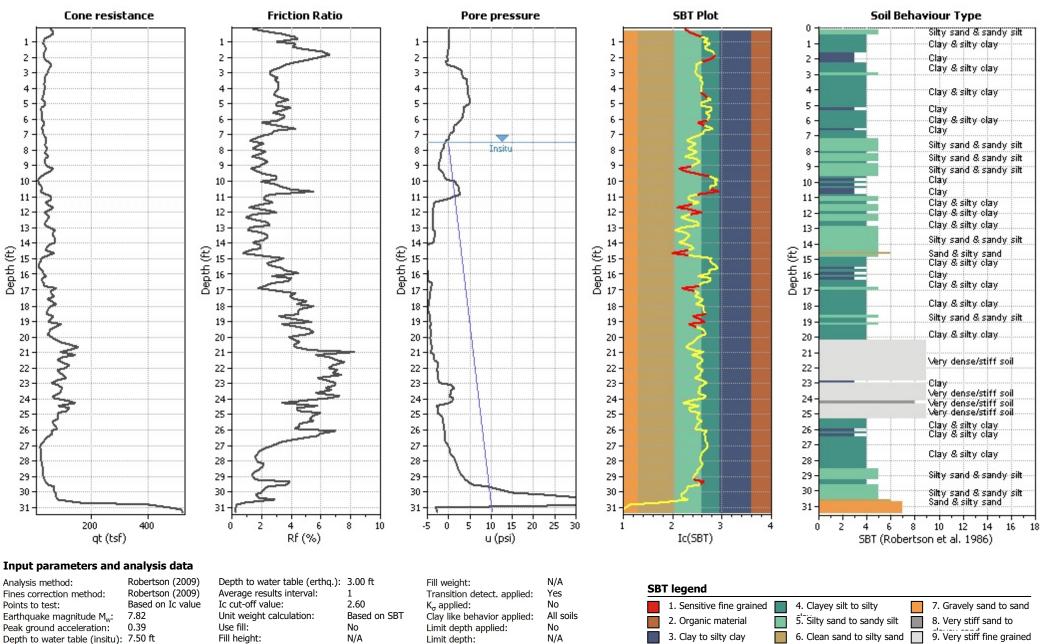




Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground

Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

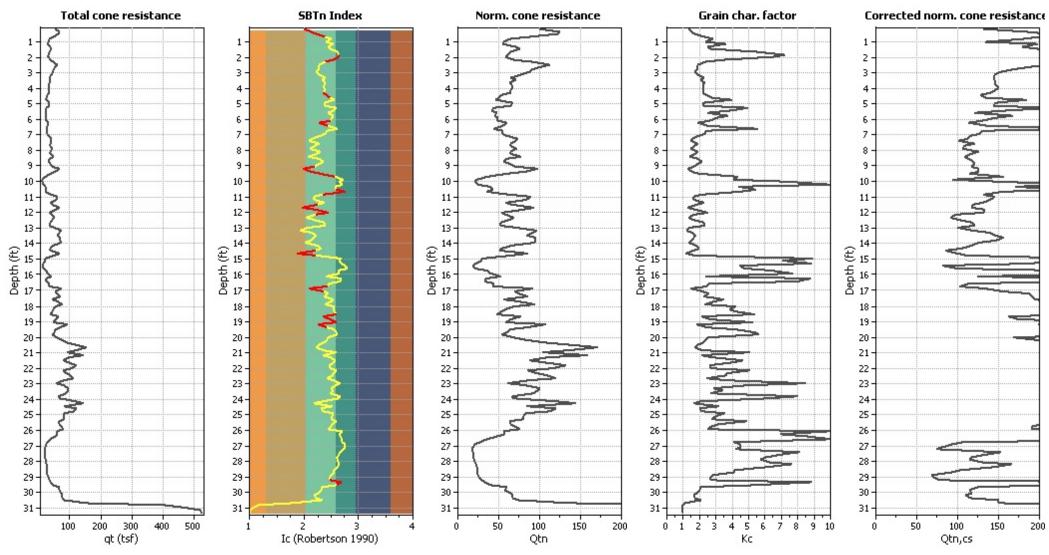
CPT basic interpretation plo



CPT basic interpretation plots (normaliz SBTn Plot Norm, cone resistance Norm, friction ratio Nom. pore pressure ratio Norm. Soil Behaviour Type Sand & silty sand Clay & siltý clay Clay & silty clay 2 Clay. 3 3 3 3 Silty sand & sandy silt Cláy & silty clay 5 5 5 5 Clay & silty clay Clay & silty clay 6 6 6 Silty sand & sandy silt 8 8 8 9 9 -9 Sand & silty sand 10 10 10 10 -10 Clay & silty clay 11 11 11 11 -11 Sand & silty sand 12 12 12 12 12 Sand & silty sand 13 13 13 13 13 -Sand & silty sand 14 14 Sand & silty sand Depth (f) Depth (f) 14 (£) 15-€ 15. € 15 Sand & siltý sand Clay & siltý clay Depth Depthi Clay & silty clay Clay & silty clay Clay & silty clay 18 18 18 18 18 Clay & silty clay Clay & silty clay 19 19 19 19 -19 Clay & silty clay 20 20 20 -20 20 Very dense/stiff soil 21 21 21 21 -21 22 22 22 22 -22 Very dense/stiff soil 23 23 23 23 23 24 24 24 24. 24 Very dense/stiff soil Very dense/stiff soil 25 25 25 25 25 -Clay & silty clay 26 26 26 26 26 27 27 27 27 27 -Cláy & silty clay 28 28 28 28 28 -29 29 29 29 29 Silty sand & sandy silt 30 30 30 30 30 -Silty sand & sandy silt Sand & silty sand 31 31 -31 31 50 100 150 200 10 -0.2 0 0.2 0.4 0.6 0.8 8 6 8 10 12 14 16 18 Fr (%) Qtn Ic (Robertson 1990) SBTn (Robertson 1990) Input parameters and analysis data Robertson (2009) Depth to water table (erthq.): 3.00 ft N/A Analysis method: Fill weight: SBTn legend Average results interval: Robertson (2009) Yes Fines correction method: Transition detect. applied: Based on Ic value Ic cut-off value: 2.60 Points to test: K_{σ} applied: No 4. Clayey silt to silty 7. Gravely sand to sand 1. Sensitive fine grained Unit weight calculation: Earthquake magnitude M.,; 7.82 Based on SBT Clay like behavior applied: All soils 5. Silty sand to sandy silt 2. Organic material 8. Very stiff sand to 0.39 Use fill: Peak ground acceleration: No Limit depth applied: No 9. Very stiff fine grained 3. Clay to silty clay 6. Clean sand to silty sand Depth to water table (insitu): 7.50 ft Fill height: N/A N/A

Limit depth:

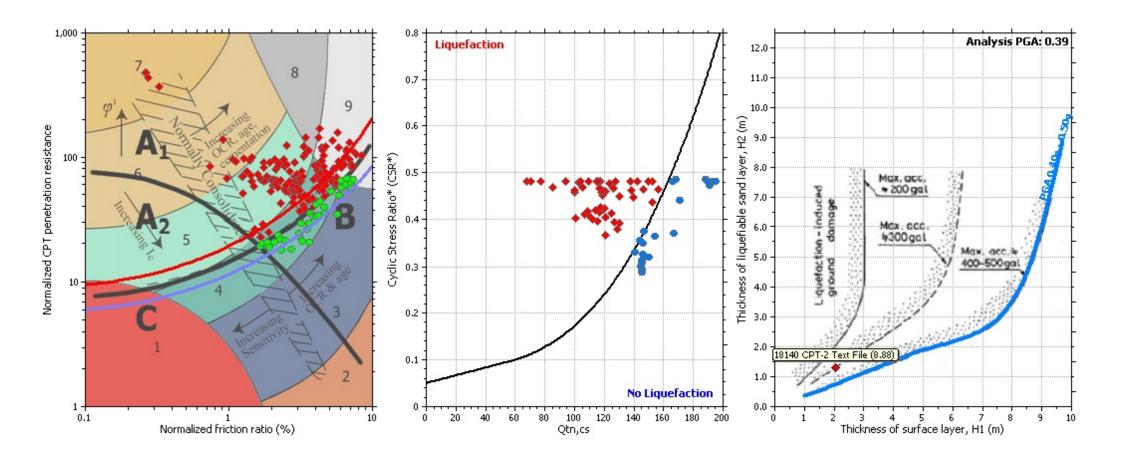
Liquefaction analysis overall plots (intermediate resu



Input parameters and analysis data

Analysis method: Robertson (2009) Depth to water table (erthq.): 3.00 ft Fill weight: N/A Fines correction method: Robertson (2009) Average results interval: Transition detect. applied: Yes Based on Ic value Ic cut-off value: 2.60 No Points to test: K_{σ} applied: 7.82 Unit weight calculation: Based on SBT Clay like behavior applied: All soils Earthquake magnitude M_w: Peak ground acceleration: 0.39 Limit depth applied: No Depth to water table (insitu): 7.50 ft Fill height: N/A Limit depth: N/A

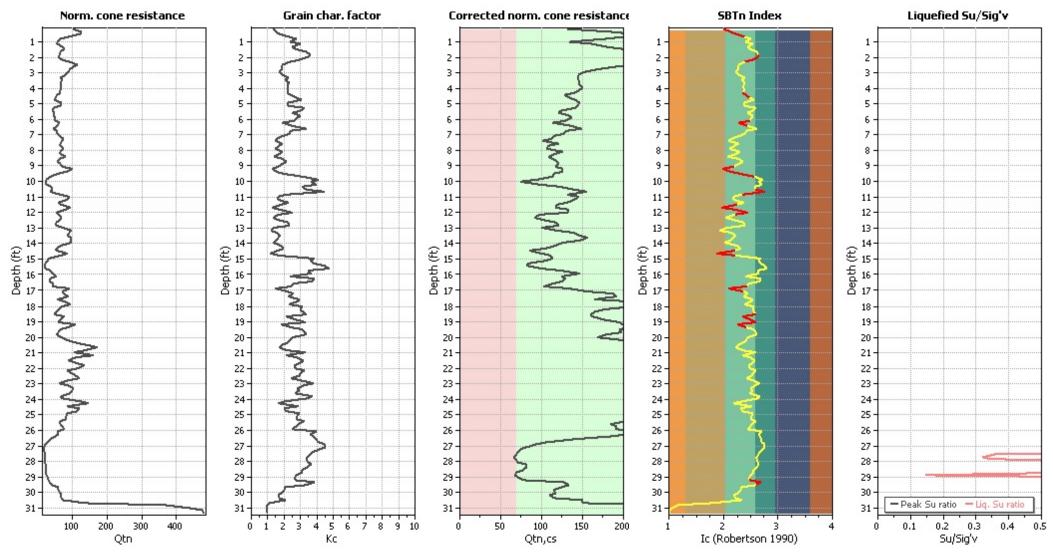
Liquefaction analysis summary plo



Input parameters and analysis data

Depth to water table (erthq.): 3.00 ft Analysis method: Robertson (2009) Fill weight: N/A Fines correction method: Robertson (2009) Average results interval: Transition detect. applied: Yes Based on Ic value Ic cut-off value: 2.60 No Points to test: K_{σ} applied: 7.82 Unit weight calculation: Based on SBT Clay like behavior applied: All soils Earthquake magnitude M_w: Peak ground acceleration: 0.39 Limit depth applied: No Depth to water table (insitu): 7.50 ft Fill height: N/A Limit depth: N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

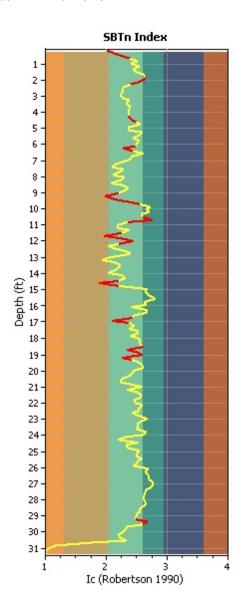
Robertson (2009) Depth to water table (erthq.): 3.00 ft Fill weight: N/A Analysis method: Fines correction method: Robertson (2009) Average results interval: Transition detect. applied: Yes Based on Ic value Ic cut-off value: 2.60 No Points to test: K_{σ} applied: Unit weight calculation: Based on SBT Clay like behavior applied: Earthquake magnitude M_w: 7.82 All soils 0.39 Use fill: Limit depth applied: Peak ground acceleration: No Depth to water table (insitu): 7.50 ft Fill height: N/A Limit depth: N/A

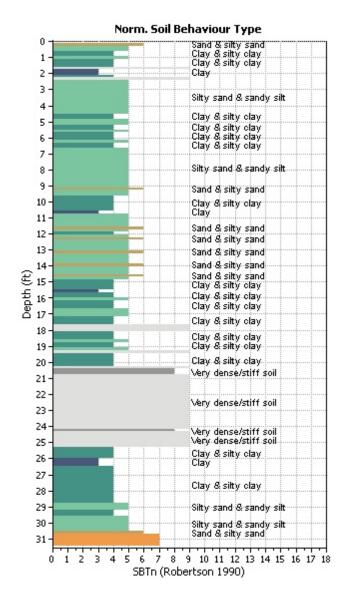
TRANSITION LAYER DETECTION ALGORITHM REPORT Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between 1.80 < I_c < 3.0) and a rate of change of I_c . Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.





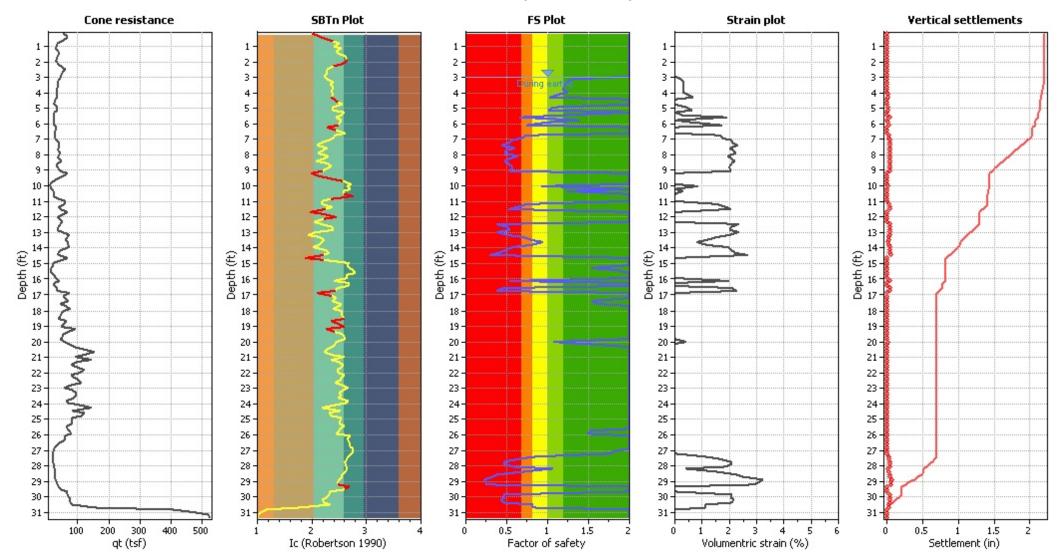
Transition layer algorithm properties

 $\begin{array}{lll} I_c \text{ minimum check value:} & 1.70 \\ I_c \text{ maximum check value:} & 3.00 \\ I_c \text{ change ratio value:} & 0.0250 \\ \text{Minimum number of points in layer:} & 3 \end{array}$

General statistics

Total points in CPT file: 191
Total points excluded: 44
Exclusion percentage: 23.04%
Number of layers detected: 13

Estimation of post-earthquake settlements



Abbreviations

 q_t : Total cone resistance (cone resistance q_c corrected for pore water effects)

I_c: Soil Behaviour Type Index

FS: Calculated Factor of Safety against liquefaction

Volumentric strain: Post-liquefaction volumentric strain



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LIQUEFACTION ANALYSIS REPORT

Project title: LCMS Location: La Center

CPT file: 18140 CPT-3 Text File Input parameters and analysis data

Analysis method: Robertson (2009) Fines correction method: Robertson (2009) Points to test: Based on Ic value

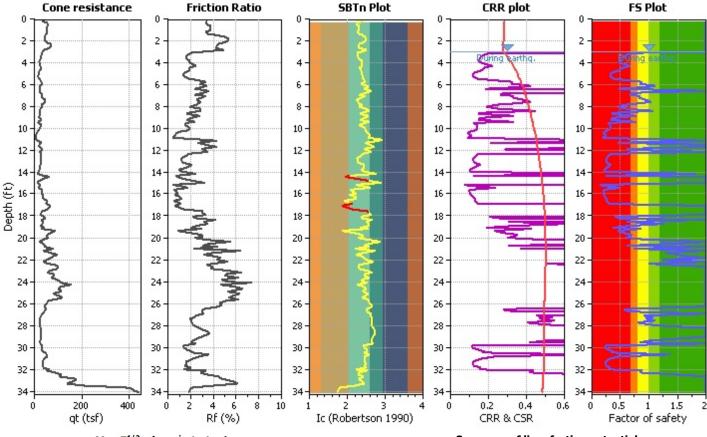
Earthquake magnitude M_w: 7.82 Peak ground acceleration: 0.39

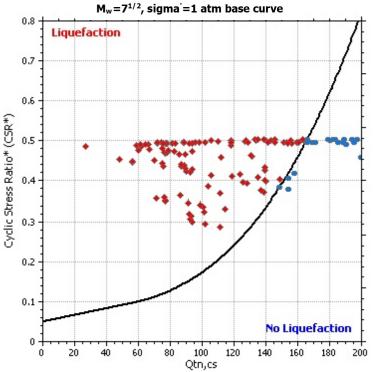
G.W.T. (in-situ): G.W.T. (earthq.): Ic cut-off value:

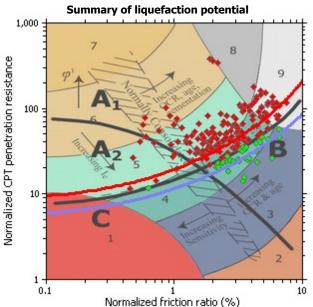
8.00 ft 3.00 ft Average results interval: 1 2.60 Unit weight calculation: Based on SBT Use fill: Nο Fill height: N/A Fill weight: N/A Trans. detect. applied: Yes K_{σ} applied: No

Clay like behavior applied: All soils Limit depth applied: No Limit depth: MSF method:

N/A Method based



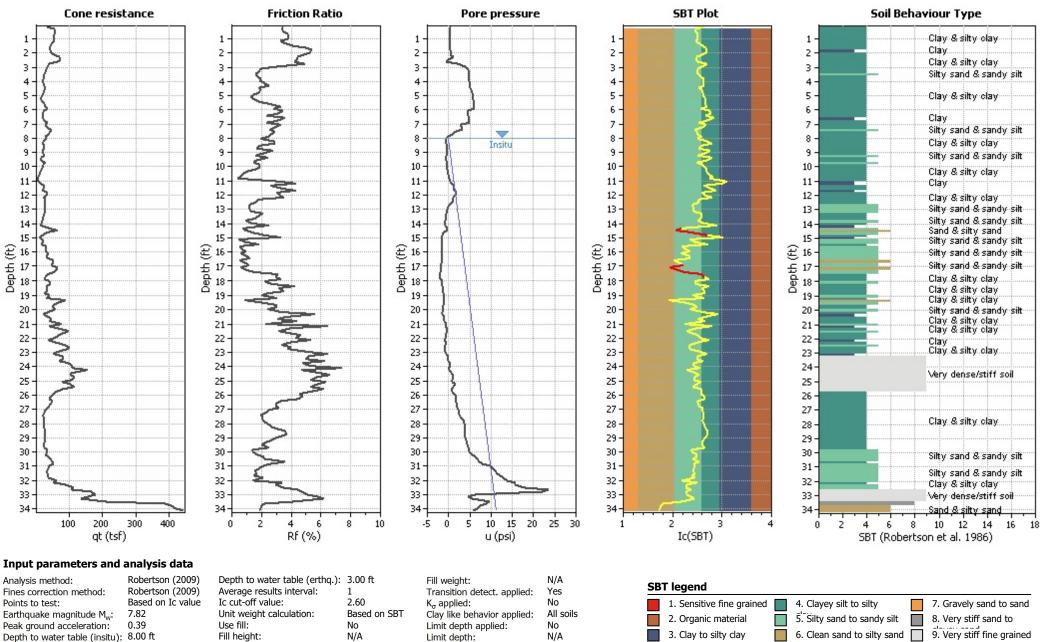




Zone A₁: Cyclic liquefaction likely depending on size and duration of cyclic loading Zone A2: Cyclic liquefaction and strength loss likely depending on loading and ground

Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plo



0.39

Peak ground acceleration:

Depth to water table (insitu): 8.00 ft

CPT basic interpretation plots (normaliz SBTn Plot Norm, friction ratio Nom. pore pressure ratio Norm. Soil Behaviour Type Norm, cone resistance Clay & silty clay Silty sand & sandy silt Clay & silty clay 2 2 Very densé/stiff soil 3 3 3 3 Silty sand & sandy silt 5 Clay & silty clay Silty sand & sandy silt 6 6 6 7 Clay & silty clay Silty sand & sandy silt 8 8 8 Clay & silty clay 9 9 Silty sand & sandy silt 10 10 10 -Silty sand & sandy silt 10 10 Clay & silty clay 11 11 11 -11 11 Clay & silty clay 12 12 12 12 12 13 13 13 13 13 Silty sand & sandy silt 14 14 14 14 14 Clav & silty clav Clay & silty clay Clay & silty clay 15 15 15 15 15 Ebth (F) £ 16 £ 16 £ 16 £ 16 Sand & silty sand 18 th Dep 18 £ 17 Silty sand & sandy silt g 18 Clay & silty clay. Cláv & silty clav 19 19 -19 19 19 Sand & silty sand 20 20 20 20 20 Clay & silty clay 21 21 21 21 Silty sand & sandy silt 21 Clay & silty clay Clay & silty clay 22 22 22 22 -22 23 23 23 23 23 Very dense/stiff soil 24 24 24-24 24 Very dense/stiff soil 25 25 25 25 25 26 26 26 26 26 27 27 27 27 27 -Clay & silty clay 28 28 28 28 28 29 29 29 29 -29 -30 30 30 30 Silty sand & sandy silt 30 Clay & silty clay 31 31 31 31 31 32 32 32 32 -Clay & silty clay. 32 33 33 33 33 -33 Very dense/stiff soil 34 34 34-34 34 Sand & silty sand 50 150 200 10 -0.2 0 0.2 0.4 0.6 0.8 8 10 12 14 16 18 100 0 8 6 Fr (%) Qtn Ic (Robertson 1990) Ва SBTn (Robertson 1990) Input parameters and analysis data Robertson (2009) Depth to water table (erthq.): 3.00 ft N/A Analysis method: Fill weight: SBTn legend Average results interval: Robertson (2009) Yes Fines correction method: Transition detect. applied: Based on Ic value Ic cut-off value: 2.60 Points to test: K_{σ} applied: No 4. Clayey silt to silty 7. Gravely sand to sand 1. Sensitive fine grained Unit weight calculation: Earthquake magnitude M.,; 7.82 Based on SBT Clay like behavior applied: All soils 5. Silty sand to sandy silt 2. Organic material 8. Very stiff sand to

CLiq v.2.1.6.11 - CPT Liquefaction Assessment Software - Report created on: 10/2/2018, 5:43:10 AM
Project file: S:\Projects\18\18084 - La Center Middle School (ESD 112)\Geotechnical (ASR)\2018 - Phase Full 2 Geo Report\Analysis\LCMS DEL CLIQ2.clg

No

N/A

Limit depth applied:

Limit depth:

No

N/A

3. Clay to silty clay

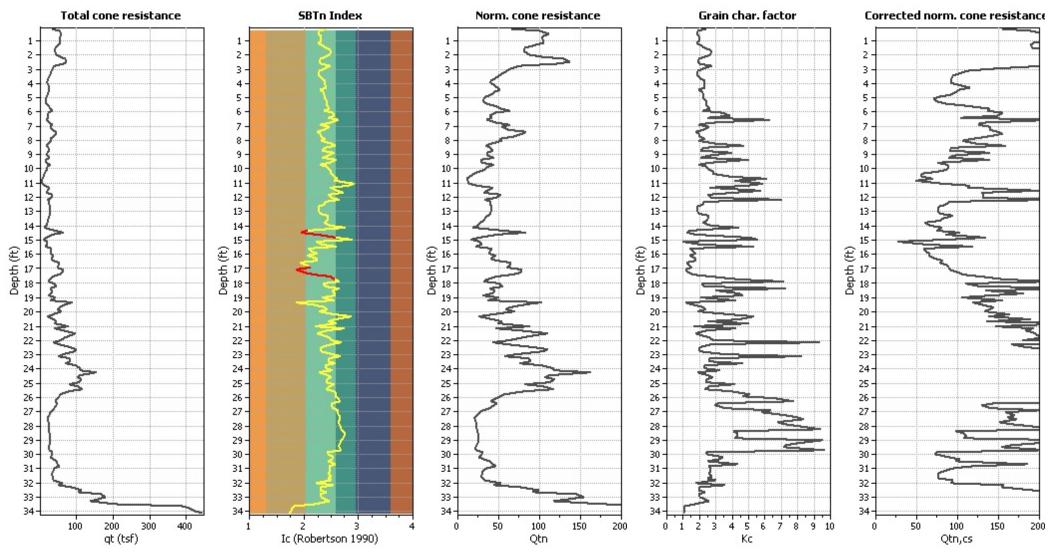
Use fill:

Fill height:

9. Very stiff fine grained

6. Clean sand to silty sand

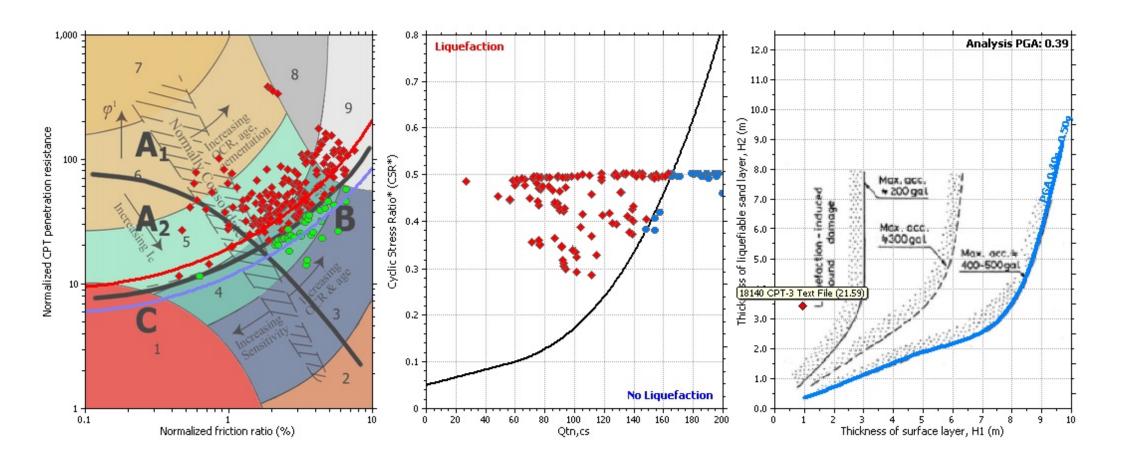
Liquefaction analysis overall plots (intermediate resu



Input parameters and analysis data

Analysis method: Robertson (2009) Depth to water table (erthq.): 3.00 ft Fill weight: N/A Fines correction method: Robertson (2009) Average results interval: Transition detect. applied: Yes Based on Ic value Ic cut-off value: 2.60 No Points to test: K_{σ} applied: Unit weight calculation: Based on SBT Clay like behavior applied: All soils Earthquake magnitude M_w: 7.82 Peak ground acceleration: 0.39 Limit depth applied: No Depth to water table (insitu): 8.00 ft Fill height: N/A Limit depth: N/A

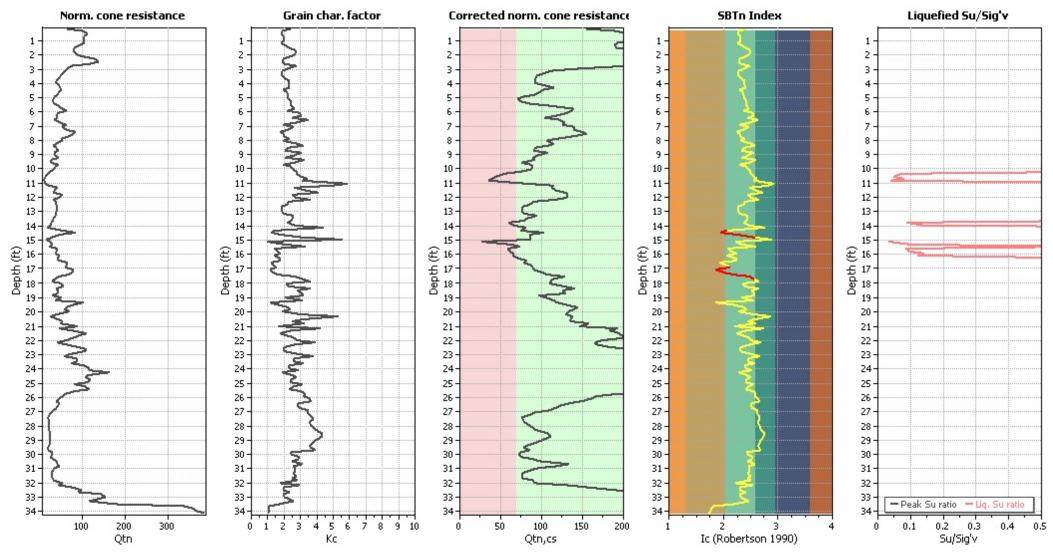
Liquefaction analysis summary plo



Input parameters and analysis data

Depth to water table (erthq.): 3.00 ft Analysis method: Robertson (2009) Fill weight: N/A Fines correction method: Robertson (2009) Average results interval: Transition detect. applied: Yes Based on Ic value Ic cut-off value: 2.60 No Points to test: K_{σ} applied: 7.82 Unit weight calculation: Based on SBT Clay like behavior applied: All soils Earthquake magnitude M_w: Peak ground acceleration: 0.39 Limit depth applied: No Depth to water table (insitu): 8.00 ft Fill height: N/A Limit depth: N/A

Check for strength loss plots (Robertson (2010))



Input parameters and analysis data

Analysis method: Fines correction method: Robertson (2009) Based on Ic value Points to test: Earthquake magnitude M_w: 7.82 Peak ground acceleration: 0.39 Depth to water table (insitu): 8.00 ft

Robertson (2009)

Fill height:

Depth to water table (erthq.): 3.00 ft Average results interval: Ic cut-off value: 2.60 Unit weight calculation: Based on SBT Use fill:

Fill weight: N/A Transition detect. applied: Yes K_{σ} applied: No Clay like behavior applied: All soils Limit depth applied: No Limit depth: N/A

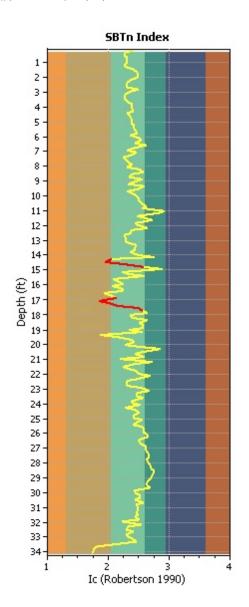
N/A

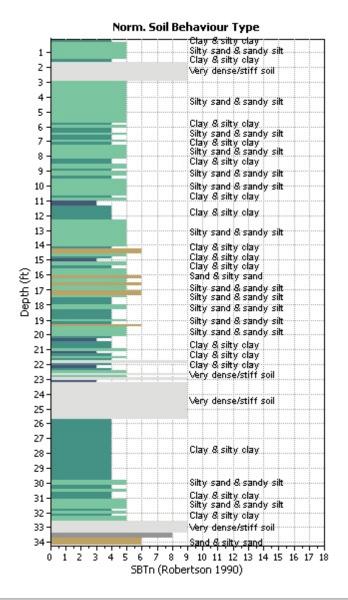
TRANSITION LAYER DETECTION ALGORITHM REPORT Summary Details & Plots

Short description

The software will delete data when the cone is in transition from either clay to sand or vise-versa. To do this the software requires a range of I_c values over which the transition will be defined (typically somewhere between 1.80 < I_c < 3.0) and a rate of change of I_c . Transitions typically occur when the rate of change of I_c is fast (i.e. delta I_c is small).

The SBT_n plot below, displays in red the detected transition layers based on the parameters listed below the graphs.





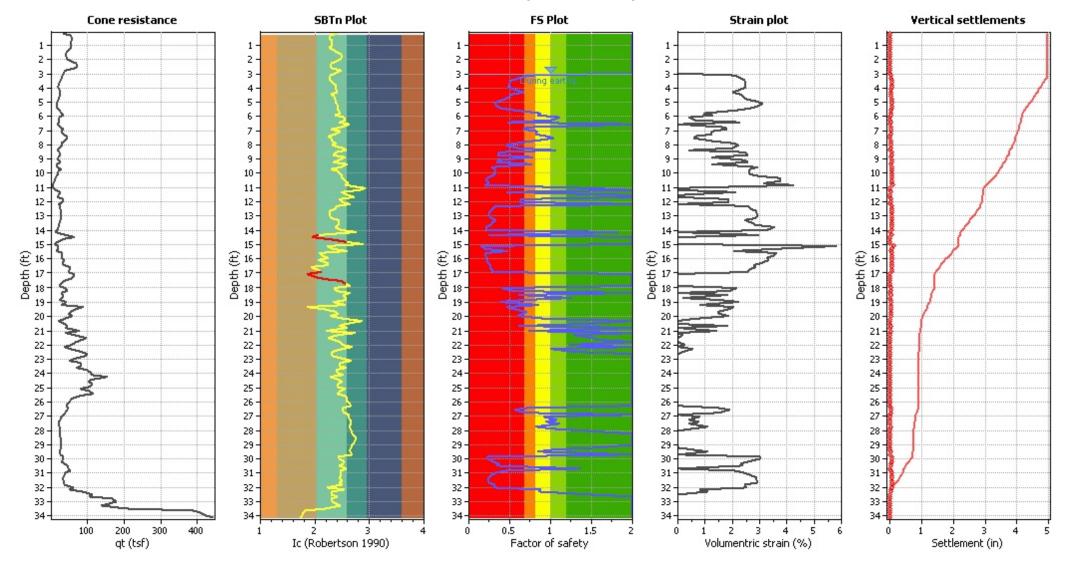
Transition layer algorithm properties

 $\begin{array}{ll} I_c \text{ minimum check value:} & 1.76 \\ I_c \text{ maximum check value:} & 3.32 \\ I_c \text{ change ratio value:} & 0.0250 \\ \text{Minimum number of points in layer:} & 4 \end{array}$

General statistics

Total points in CPT file: 208
Total points excluded: 10
Exclusion percentage: 4.81%
Number of layers detected: 2

Estimation of post-earthquake settlements



Abbreviations

 q_t : Total cone resistance (cone resistance q_c corrected for pore water effects)

I_c: Soil Behaviour Type Index

FS: Calculated Factor of Safety against liquefaction

Volumentric strain: Post-liquefaction volumentric strain

REPORT LIMITATIONS	APPENDIX F	MATION



Date: October 3, 2018

Project: La Center Middle School Vancouver, Washington

Geotechnical and Environmental Report Limitations and Important Information

Report Purpose, Use, and Standard of Care

This report has been prepared in accordance with standard fundamental principles and practices of geotechnical engineering and/or environmental consulting, and in a manner consistent with the level of care and skill typical of currently practicing local engineers and consultants. This report has been prepared to meet the specific needs of specific individuals for the indicated site. It may not be adequate for use by other consultants, contractors, or engineers, or if change in project ownership has occurred. It should not be used for any other reason than its stated purpose without prior consultation with Columbia West Engineering, Inc. (Columbia West). It is a unique report and not applicable for any other site or project. If site conditions are altered, or if modifications to the project description or proposed plans are made after the date of this report, it may not be valid. Columbia West cannot accept responsibility for use of this report by other individuals for unauthorized purposes, or if problems occur resulting from changes in site conditions for which Columbia West was not aware or informed.

Report Conclusions and Preliminary Nature

This geotechnical or environmental report should be considered preliminary and summary in nature. The recommendations contained herein have been established by engineering interpretations of subsurface soils based upon conditions observed during site exploration. The exploration and associated laboratory analysis of collected representative samples identifies soil conditions at specific discreet locations. It is assumed that these conditions are indicative of actual conditions throughout the subject property. However, soil conditions may differ between tested locations at different seasonal times of the year, either by natural causes or human activity. Distinction between soil types may be more abrupt or gradual than indicated on the soil logs. This report is not intended to stand alone without understanding of concomitant instructions, correspondence, communication, or potential supplemental reports that may have been provided to the client.

Because this report is based upon observations obtained at the time of exploration, its adequacy may be compromised with time. This is particularly relevant in the case of natural disasters, earthquakes, floods, or other significant events. Report conclusions or interpretations may also be subject to revision if significant development or other manmade impacts occur within or in proximity to the subject property. Groundwater conditions, if presented in this report, reflect observed conditions at the time of investigation. These conditions may change annually, seasonally or as a result of adjacent development.

Additional Investigation and Construction QA/QC

Columbia West should be consulted prior to construction to assess whether additional investigation above and beyond that presented in this report is necessary. Even slight variations in soil or site conditions may produce impacts to the performance of structural facilities if not adequately addressed. This underscores the importance of diligent QA/QC construction observation and testing to verify soil conditions do not differ materially or significantly from the interpreted conditions utilized for preparation of this report.

Therefore, this report contains several recommendations for field observation and testing by Columbia West personnel during construction activities. Actual subsurface conditions are more readily observed and discerned during the earthwork phase of construction when soils are exposed. Columbia West cannot accept responsibility for deviations from recommendations described in this report or future

performance of structural facilities if another consultant is retained during the construction phase or Columbia West is not engaged to provide construction observation to the full extent recommended.

Collected Samples

Uncontaminated samples of soil or rock collected in connection with this report will be retained for thirty days. Retention of such samples beyond thirty days will occur only at client's request and in return for payment of storage charges incurred. All contaminated or environmentally impacted materials or samples are the sole property of the client. Client maintains responsibility for proper disposal.

Report Contents

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