APPENDIX B: PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT

Preliminary Geotechnical Investigation Report

Horse Heaven Wind Project

Benton County, WA

June 5, 2020

PREPARED FOR:

SCOUT CLEAN ENERGY

PREPARED BY:

Westwood

Westwood

Preliminary Geotechnical Investigation Report

Horse Heaven Wind Project

Benton County, WA

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Table of Contents

Tables

Attachments

Exhibits

Tables

Appendices

Executive Summary

Westwood Professional Services (Wharveestwood) is pleased to present this preliminary geotechnical investigation report to Horse Heaven Wind Farm, LLC for the proposed Horse Heaven Wind Project (Project) located in Benton County, Washington. The scope of work for this investigation included subsurface exploration, field and laboratory testing, engineering analysis, and preparation of this preliminary report for the proposed wind project. This investigation has revealed no subsurface conditions that would preclude development of the proposed project, although the loose silt on site may exhibit collapse potential, and excavations into shallow basalt bedrock may require the use of rippers, rock hammers, or even blasting where more competent rock exists at shallow depths.

Based on the information obtained from 17 soil borings with standard penetration tests (SPT) performed with the turbine array area, the subsurface conditions at the site generally consists of very loose to medium dense silt, known as wind-blown loess, with varying amounts of sand. The loose to very loose silt is susceptible to collapse upon wetting. Basalt bedrock of varying degrees of weathering was encountered at six boring locations between depths of 5 to 45 feet below ground surface. None of the borings encountered ground water during the investigation. Short term observations in silty soil may not accurately reflect the long-term water level, and fluctuations should be expected. Piezometers may be installed during the detailed full geotechnical investigation to better define depth to groundwater at turbine locations.

Four additional soil borings were performed along the proposed underground portion of the project transmission line, and results of those borings are presented in the Geotechnical Investigation Report, Horse Heaven Wind Project Transmission Line Vineyard Crossing, prepared by Westwood and dated May 22, 2020.

The below summary of recommendations may be used for preliminary wind turbine foundation designs for the locations investigated. Some turbine locations may have loose collapsible silt that requires subgrade improvement (e.g., over-excavation and replacement, etc.) in order to follow the recommendations below, as outlined in this report. A detailed full geotechnical investigation will be necessary to provide recommendations for final design at all turbine locations.

- Depth to groundwater = greater than 35 feet (locally may be shallower)
- Foundation backfill density (moist) = 95 pcf
- Gross allowable bearing capacity, normal loads = 3,200 psf
- Gross allowable bearing capacity, extreme loads = 3,900 psf
- Settlement = 1 inch (approximately 0.11 degrees rotation)

The shallow soil below the root zone is generally considered adequate subgrade for gravel access roads, and in general up to 12 inches of aggregate may be suitable depending on subgrade moisture, strength, and soil type. Less aggregate may be used if the subgrade is chemically or mechanically stabilized (e.g., with cement or geotextile reinforcement). Preliminary access road design may use a California bearing ratio (CBR) of 4 for subgrade prepared in accordance with the recommendations in this report.

Shallow foundations may be used to support substation equipment, although some subgrade improvement may be required to reduce collapse potential. Mat and spread foundations should bear at least 2 feet below grade or on 2 feet of select structural fill. Preliminary designs of large slab-on-grade equipment foundations (i.e., 10 to 20 feet wide) may use a maximum allowable gross bearing capacity of 2,000 psf and conventional spread and strip footing foundations (i.e., 4 feet wide) may use a maximum allowable gross bearing capacity of 1,500 psf.

This executive summary should be read in context of the entire report for full understanding of the subsurface conditions encountered and preliminary recommendations.

1.0 Introduction

This report presents the findings of the preliminary geotechnical investigation conducted by Westwood Professional Services (Westwood) for the proposed Horse Heaven Wind Project (Project) located in Benton County, Washington, approximately 8 to 12 miles west and south of the city of Kennewick (Exhibit 1). The primary purpose of this report is to provide preliminary geotechnical testing and analysis to support the development and preliminary design of the proposed project. This preliminary investigation focuses on 17 boring locations distributed throughout the site, representative of the areas where wind turbines may be placed, and one boring location representative of a proposed substation location. The services provided were in general conformance with the scope of work and assumptions outlined in the Work Order dated March 3rd, 2020. This report is intended for exclusive use by Horse Heaven Wind Farm, LLC. A subsequent investigation will be necessary to more accurately characterize the subsurface conditions across the site, including at all final turbine locations, substation, MET towers, and O&M building.

1.1 Project Description

Westwood understands the proposed project will consist of approximately 248 wind turbines, access roads, electrical collection system, transmission line, and collector substation. Westwood understands the GE 3.03-140 wind turbines with 81 m hub-height are currently be assumed for the project layout. The turbines are spread across a number of agricultural fields and grassland, located approximately 8 to 12 miles south and west of Kennewick, Washington. Topography across the project site can be described as low to high relief hills, ridge lines and lightly undulating plains. Ground elevations at the boring locations varies between 1,046 ft (WTG-235) to 1,929 ft (WTG-180). The preliminary recommendations in this report are based on the data collected at the select wind turbine and substation boring locations.

2.0 Methods

A preliminary geotechnical investigation program was completed by Westwood with field work performed between April 6th and 17th, 2020. Environmental West Exploration was retained by Westwood to perform geotechnical drilling with standard penetration testing (SPT) and rock coring. Soil Engineering Testing (SET) and OMNNI Associates performed laboratory testing on soil samples collected during the investigation. A Westwood geotechnical representative coordinated the field work, logged the soil borings, and collected samples. The field investigation consisted of the following:

- Conducting soil borings at 16 proposed wind turbine locations to a target depth of 60 ft below ground surface (bgs) or auger refusal. If auger refusal was encountered beyond 30 ft depth, the boring was terminated. If refusal was encountered shallower than 30 ft, rock coring was performed 5 to 20 feet beyond the depth of refusal.
- Conducting one soil boring at the representative substation (Sub-01) to a target depth of 50 ft bgs or auger refusal, whichever is shallower.
- Performing four electrical resistivity surveys along two perpendicular profiles, including two at proposed turbine locations and two at the representative substation location.
- Collecting soil samples at all boring locations for laboratory testing.

Geotechnical test locations are shown on Exhibit 1. Soil boring locations were provided by Scout Clean Energy, LLC based on the site layout available at the time of the field work. All test locations were staked by a Westwood survey crew. Coordinates and elevations are provided on the boring logs.

Four additional soil borings (Geotech H, H-1, I, and J) were performed along the proposed underground portion of the project transmission line, and results of those borings are presented in the Geotechnical Investigation Report, Horse Heaven Wind Project Transmission Line Vineyard Crossing, prepared by Westwood and dated May 22, 2020.

2.1 Soil Borings

Soil borings were drilled using air rotary and rock coring drilling techniques, and soil samples were obtained using an automatic hammer and split-spoon samplers in general accordance with ASTM D1586. Standard penetration test (SPT) N-values are recorded on boring logs and summarized in Table 3. A number of attempts were made to collect undisturbed samples of fine-grained soil using thin-walled (Shelby) tubes; however, these attempts were unsuccessful. In general, soil samples were collected every 2.5 feet in the upper 15 feet and at 5-foot intervals thereafter to the explored depth or auger refusal. Air rotary rock coring was performed at two wind turbine locations using NQ wire-line coring techniques. A Westwood geotechnical representative logged the borings and collected the soil/rock samples. Four bulk soil samples were also collected from shallow auger cuttings for laboratory testing. Soil samples were shipped to SET and OMNNI for laboratory testing. Soil boring logs are included in Appendix A.

2.2 Laboratory Testing

Laboratory tests were conducted on representative soil samples to aid in classification and evaluation of the physical properties and engineering characteristics of the material. Soil samples were sent to SET and OMNNI for testing, which included the following:

- Moisture content (ASTM D2216)
- Sieve analysis (ASTM D422 and D1140)
- Atterberg limits (ASTM D4318)
- Standard Proctor moisture-density relationship (ASTM D698)
- Chemical analysis (pH, Sulfates, Chlorides)
- California bearing ratio (CBR) (ASTM D1883)
- Thermal resistivity with dry-out curves (ASTM D5334)

A summary of laboratory testing results is included in Table 1, and complete test reports are included in Appendix B.

Bulk samples collected for thermal resistivity tests were prepared near the as-received moisture contents and compacted to 90% of the standard Proctor maximum dry density, representing the compaction conditions typical of a backfilled utility trench, and subsequently dried out to zero moisture. Thermal resistivity measurements were taken at the compacted moisture content, zero moisture, and at several intermediate moisture contents during drying. Results of the thermal resistivity tests are discussed in Section 4.1.66 and test reports are included in Appendix B. A summary of laboratory testing results is included in Table 1.

2.3 Electrical Resistivity Testing

Electrical resistivity measurements were taken at four test locations, including two at the proposed substation, as shown on Exhibit 1. Tests were performed using the Wenner Four-

Electrode Method and an AEMC Instruments Model 6470-B Multi-Function Digital Ground Resistance Tester, in general accordance with ASTM G57. At each wind turbine test location, resistivity tests were performed along two perpendicular profiles with an electrode spacing of 2, 5, 10, 20, 30, 50, and 100 feet. At the substation location, resistivity tests were performed along four profiles with an electrode spacing of 5, 10, 20, 30, 50, 100, and 200 feet. Refer to 5.1.8 and the attached Table 2 for results of the electrical resistivity tests.

3.0 Site Conditions

3.1 Regional Geology

The Horse Heaven Wind Project is located within the Columbia Basin Physiographic Province of Washington State, at the eastern edge of the Yakima Fold Belt. The Columbia Basin Province topography is characterized by steep river canyons, broad plateaus, and ridges. Sediments within the region are primarily wind-blown loess and glaciolacustrine deposits, underlain by thousands of feet of Columbia River Basalt Group lava flows. Near the project site, the surficial sediments and the basalt flows beneath are deformed by the regional Yakima fold and thrust belt (Washington State DNR, 2020).

The series of basaltic lava flows that make up the Columbia River Basalt Group erupted between 17 million and 6 million years ago from deep fissures. These fissures were likely sourced from the same mantle hot spot that is presently beneath the Yellowstone Caldera and flowed away from eruption centers to now cover an approximate 87,000 square miles (Alt and Hyndman, 1985; NPS, 2018; Washington State DNR, 2020). Approximately 10 million years ago, while the Columbia River basalts were forming, north-south tectonic compression created the Yakima Fold Belt, which covers 5,500 square miles including the Project site. The folding formed the basaltic bedrock and overlying sediment into alternating ridges and valleys generally oriented east-west with fold wavelengths of 1 to 10 miles and amplitudes of up to 2,000 feet (Reidel et al., 2003).

During the most recent glaciation of the Pleistocene Ice Age, approximately 15,000 to 10,000 years ago, the glacial ice sheet dammed the Clark Fork River in Northern Idaho and created Glacial Lake Missoula. The massive glacial lake grew over time until it built up enough pressure to burst through the glacial dam, unleashing floodwaters across Washington State towards the Pacific Ocean. The floodwater stripped away topsoil and carved immense channel systems into the basaltic bedrock, leaving behind a landscape known as channeled scablands, named for the evidence of massive erosion and barren terrain punctuated by repeating tracks of plateaus, basins, and channels. Several similar glacial lake build-up and flooding events followed, further developing the landscape (Montana Natural History Center, 2005).

The sediments eroded by the glacial flooding events were deposited in western Washington State and became a significant source area for prevailing southwesterly winds to re-transport the now eolian sediment back into the Columbia Basin (Sweeny et al., 2017). These sediments were originally glaciolacustrine deposits from both the glacial lakes of the Pleistocene Ice Age and the ancient lakes formed during the eruptions of the Columbia River Basalts. Volcanic ash from Miocene volcanos were also deposited, and mixed in the lacustrine basins (Smiley and Rember, 1979). These wide-spread loess deposits of the Columbia Basin are widely used for agriculture, are highly erodible, and are infamous for dust storms and erosion channels in the prevailing wind direction (Bryan, 1927).

Based on Web Soil Survey data available through the United States Department of Agriculture (USDA, 2020), a number of soil units are mapped within the WTG area, as shown on Exhibit 2. The most prominent soil unit is the Ritzville silt loam, which is mapped as silt (ML) loess, as are the majority of the numerous smaller units intermixed within the proposed project area. The Geologic Map of Washington (Washington Division of Mines and Geology, 1961; Exhibit 3) maps the project area as Quaternary non-marine deposits that are homogenous, unconsolidated, loessial and glaciolacustrine deposits that are fine-grained sand and silt with some gravel, clay and diatomaceous earth, and Miocene-Plliocene volcanic rocks described as dark-gray, fine-grained basalt commonly interbedded with conglomerate, sandstone, and siltstone.

3.2 Geohazards

3.2.1 Karst

Karst features generally develop in areas with wet subsurface conditions and soluble rock that may dissolve over time to form underground caves and ground instability. Karst geology can be particularly hazardous as caves develop slowly, while failures are rapid, often causing several feet of subsidence. According to the USGS map of Karst Hazard Potential in the United States (Weary and Doctor, 2014), the project site is not mapped in an area of karst potential. Basaltic bedrock was identified at several boring locations based on air rotary cuttings and core samples. Basalt is an igneous rock not associated with karst formations and samples showed no evidence of dissolution features. Igneous rock can form voids or lava tubes during its formation; however, the Columbia River Basalt is very old and no core barrel drops or sudden loss of coring fluid were observed. In general, the potential for subsurface voids on site is considered very low.

3.2.2 Soil Expansion and Collapse

Expansive soils have the potential to undergo volume expansion upon changes in moisture content such as from rainfall, irrigation, perched groundwater, or drought. Expansive soils are mostly found in arid and semiarid areas around the world and contain a large percentage of lightly weathered clay minerals. In general, the shallow soil on site was silty and sandy with a relatively low clay content. The USDA classifies the soil on site as generally having a low potential for soil expansion. The potential for swelling soils to impact project infrastructure is considered low.

Soil collapse occurs when a relatively loose, dry, low density material is inundated with water and subjected to a load. Loess and alluvially deposited silt are particularly prone to collapse, as their depositional environment facilitates a loose, low density profile. The shallow soil encountered during the investigation was typically dry, loose, and wind-blown silt (i.e. loess), so the overall collapse potential is generally considered moderate to high. Although attempts were made to collect an undisturbed sample for laboratory collapse testing, a thin-walled Shelby tube was unable to advance into the soil, so no collapse tests were performed. Collapse potential tests are recommended during the full geotechnical investigation. The subgrade preparation and compaction recommendations in Sections 4.1.8, 4.2.6 and 4.6.1 should be followed to mitigate the risks associated with collapsible soils.

3.2.3 Seismicity

The state of Washington is one of the most seismically active states in the country, although the most significant earthquake risk is generally isolated to the western portion of the state around the Cascadia subduction zone (WA DNR, 2020). Based on USGS and

Washington DNR geologic mapping, a number of Quaternary fault systems run through and nearby the proposed project site. In particular, both the Wallula and Horse Heaven Hills structures fault systems are mapped within the proposed WTG array. The locations of these fault systems are generally inferred rather than well constrained, and the faults are expected to slip at a rate of less than 0.2 mm/year (USGS, 2020a). Although several mapped faults lie within the project site, the state of Washington maps the area within a region of low shaking hazard (WA DNR, 2020).

According to the USGS (USGS, 2020b), there have been 93 earthquake events that have occurred within 50 miles of the site in the past 50 years. Three (3) of these events were recorded with a magnitude of 4.0 or greater, with the largest events measuring at 4.3 on the Richter magnitude scale (1979 and 1991). It should be noted that a number of the seismic events recorded by the USGS are noted as “explosions” and may not be the result of tectonic activity. According to USGS ShakeMaps available for nearby earthquakes (USGS, 2020b), the events would have been expected to reach a maximum shaking intensity classification of III on the Modified Mercalli Intensity (MMI) scale, indicative of a small earthquake felt by persons indoors, especially on the upper floors of buildings, with shaking roughly equivalent to the passing of a truck. It is likely that little to negligible shaking was felt at the project site during any of these events. The USGS Short-term Seismicity Model (USGS, 2018) maps the project site in an area with less than a 1% chance of experiencing a ground shaking event with an MMI of VI or greater each year, defined as an event where minor damage to infrastructure is possible. Seismicity is not expected to significantly impact the final investigation, construction, or operation of this Project, although seismic design parameters should be taken into consideration during the design of foundations and other structures on site. See Exhibit 4 for a map of nearby faults and earthquake events, and Section 4.3.2 for seismic design values that should be accounted for in the design of structures on site.

3.2.4 Volcanoes

Southern Washington lies within the Cascade Volcano chain, a historically volcanically active region in the northwestern United States. The Cascade Volcanoes run from Lassen Peak in northern California up through Oregon and Washington to its northernmost peak, Mount Baker, near the Canadian border. The Cascade Volcanoes are considered active and expected to erupt again (USGS, 2020c). The most recent major eruption occurred in 1980 at Mount St. Helens when the volcano erupted and subsequently collapsed. A smaller lava eruption occurred at Mount St. Helens in 2004. The nearest mapped volcanic feature to the site is Mount Adams, which lies approximately 100 miles west of the project site (USGS, 2020c). Mount St. Helens, which has deposited ash throughout southeastern Washington on multiple occasions (Associated Press, 1991), is located approximately 125 miles west of the project site. The potential for volcanic activity to impact project development or operation is generally considered low, although the seismic activity associated with regional volcanic activity may trigger earthquake events throughout the region and cover the site in volcanic ash.

3.3 Subsurface Stratigraphy

Based on the conditions encountered at the soil boring locations, the general stratigraphic profile is described as follows:

- **Topsoil.** Topsoil ranges from nearly non-existent to approximately 4 inches. The topsoil encountered was generally light brown and silty with low to moderate organics and active roots. Topsoil depths could be greater in some portions of the site, particularly in topographic low areas and pastureland.
- **Silt, Silt with Sand, Sandy Silt (ML).** Underlying the topsoil at each boring location is wind-blown silt, known as loess, with varying amounts of sand. This material is typically light brown to brown, dry to damp, very loose to medium dense, and occasionally lightly cemented. This layer was encountered between 5 feet to greater than 60 feet thick and occasionally extended to the underlying basaltic bedrock.
- **Silty Sand (SM).** Periodically underlying the silt is silty sand with varying amounts of gravel. This unit was typically light brown to brown, dry to damp, and medium dense to very dense.
- **Basalt.** Basalt bedrock was encountered at six boring locations at depths between 5 feet and 45 feet below ground surface (Table 4). Weathering of the rock mass varied from moderately to highly weathered with rock quality designation (RQD) values between 0 and 20.

More detailed descriptions of the subsurface conditions are provided on the boring logs found in Appendix A. Rock coring photo logs are provided along with the boring logs in Appendix A.

3.4 Groundwater

Boreholes were observed during and shortly after drilling for the presence and level of groundwater. During the investigation, a static groundwater level was not observed in any of the boreholes. A predominately fine-grained subsurface profile does not lend itself to accurate short-term groundwater level measurements due to the soil's low permeability and tendency to create perched water tables. Local water well logs from within the project boundary suggest groundwater may be within 35 to 85 feet below ground surface (WDE, 2020). Although groundwater is not anticipated to impact project design or construction, piezometers may be installed during the final investigation to provide more accurate ground water measurements over a longer duration and assess the potential for perched groundwater above bedrock. Refer to Sections 4.2.2 for recommendations regarding groundwater.

4.0 Discussion and Recommendations

4.1 Soil Properties

4.1.1 Moisture and Density

The *in situ* gravimetric moisture content of the soil on site ranges from approximately 2% to 15%, with an average moisture content of 8%.

The *in situ* moist unit weight of soil on site can be estimated to be 80 to 110 pcf for all soil types. Based on laboratory analyses of rock core samples, the *in situ* unit weight of basalt on site is 170 pcf. For preliminary wind turbine foundation design purposes, the recommended long-term moist unit weight of the foundation backfill is 95 pcf. This represents native silt or sand backfill with a dry density of 90 pcf and moisture content of approximately 5%.

4.1.2 Friction Angle

The friction angle of the silty loess encountered onsite was estimated to range from 28° to greater than 40° using correlations to SPT blowcounts, indicative of very loose to very dense. A design friction angle of 28° is recommend for the loose silt and 30° for the medium dense silt for preliminary design.

4.1.3 Compressibility

It is expected that the shallow soil may be susceptible to elastic settlement upon loading. The loose silt is also susceptible to collapse, as discussed in Section 4.1.8. It is assumed shallow foundations will bear on medium dense material with low collapse potential. The compressibility of the medium dense silt encountered was estimated using typical published values and correlations to test results. A Young's modulus of 150,000 psf is recommended for the medium dense silt based on correlations to SPT blowcounts. Refer to Section 4.1.8 for a discussion on collapse potential, and Sections 4.4.3 and 4.6.1 for a discussion on the settlement of foundations.

4.1.4 California Bearing Ratio

The field strength of access road subgrade may be assessed using the California Bearing Ratio (CBR). One shallow soil sample was collected between 1 ft and 4 ft bgs at boring location WTG-211. The silt specimen was prepared at approximately 90% and 95% of the standard Proctor maximum dry density (MDD) and at optimum moisture content (ASTM D698). Test results demonstrated a CBR of 2.9 at 90% MDD and 6.3 at 95% MDD. A preliminary design CBR of 4 may be assumed for 95% compaction effort. Refer to Section 4.7 for recommendations on access road design.

4.1.5 Electrical Resistivity

Electrical resistivity measurements were collected at two locations within the proposed substation footprint and at two WTG boring locations using the Wenner Four-Electrode Method in accordance with ASTM G57 using electrode spacings between 5 ft and 200 ft. Electrical resistivity generally varies with material type and moisture content, and ranges on site between 7,500 ohm-meters (Ω-m) and 21,400 Ω-m based on test results. These observed values are generally within typical published values silty/sandy soil and igneous rock (Palacky, 1987). Results of the electrical resistivity tests are presented in Table 2. Refer to Section 2.3 for additional information on the electrical resistivity test method.

4.1.6 Thermal Resistivity

Thermal resistivity dry-out curves were developed for shallow soil samples collected at three boring locations, SS-01, WTG-141, and WTG-235, between 1 and 4 feet bgs. The thermal resistivity of the soil varied with soil type and moisture content, and ranged from 128°C·cm/W (WTG0-141, wet) to 592°C·cm/W (SS-01, dry). Results of the thermal resistivity tests are included in Appendix B. The underground cable designer shall choose an appropriate thermal resistivity (rho) value for trench backfill with consideration to soil drying due to environmental factors as well as cable heat generation.

4.1.7 Soil Corrosivity

The chemical constituent test results indicate that the soil has a pH ranging from 8.1 to 9.0. Soluble sulfates were measured as high as 229 mg/kg and soluble chlorides measured up to 50 mg/kg. Chloride exposure is considered moderate with concrete exposure class C1, and sulfate exposure is considered moderate with concrete exposure class S1, which will require Type II cement (ACI, 2014). Test results are presented in Appendix B and summarized in Table 1.

4.1.8 Collapse Potential

Wind turbine foundations and lightly loaded shallow foundations on site (i.e. substation, O&M building, etc.) may be susceptible to the impacts of soil collapse if bearing on loose silt. Soil borings suggest very loose to loose silt exists across the site, including within the proposed substation footprint. Based on Westwood's experience on nearby projects, the loose silt may have a collapse potential of up to 4% or greater. Refer to Section 3.2.2 for additional discussion on collapsible soil, and Sections 4.5 and 4.6 for foundation recommendations. Further investigation and testing should be performed on the shallow silt during the full geotechnical investigation to evaluate collapse potential.

4.1.9 Compressive Strength of Rock

Two laboratory unconfined compressive strength tests were performed on basalt core samples. The compressive strength of the samples were found to be 470 tsf and 2,415 tsf. The variability in compressive strength results reflects the variability in degree of fracturing and weathering of the basalt on site. Test reports and photos of the rock cores are included in Appendix B.

4.2 General Earthwork Considerations

4.2.1 Clearing and Grubbing

Prior to site grading activities, existing vegetation, trees, large roots, topsoil, uncontrolled fill, frozen soil, and abandoned underground utilities should be removed from the proposed structural (foundation) areas and areas to receive fill. Areas disturbed during demolition and clearing should be properly backfilled and compacted as described in Section 4.2.5.

Topsoil, frozen soil, or organic material should not be used for structural fill and should be stockpiled away from native excavated soil. This material may be used as fill in non-structural areas outside of the foundation, assembly area, access road, crane pad, and crane walk areas where soil strength and compressibility would not impact site infrastructure or construction.

4.2.2 Excavation Safety

Overburden soil at the site can generally be excavated with conventional excavation equipment, such as backhoes, dozers, loaders, or scrapers. Bedrock is sufficiently deep where it will not impact excavations at the majority of turbine locations; however, one boring (WTG-235) encountered bedrock around 5 feet bgs, shallower than the anticipated turbine foundation excavation depths (9-12 ft bgs). See Table 4 for a summary of depth to bedrock and Section 4.2.3 for more discussion on rock rippability. Excavations should be constructed using safe side slopes unless adequately shored and/or braced as necessary for construction and safety. Per Occupational Safety and Health Administration (OSHA) Part 1926, the soil on site may generally be inferred to be a Type C material, although it is the responsibility of the competent field personnel to verify *in situ* conditions during construction. Excavations should be constructed in conformance with applicable federal, state, and local standards.

Groundwater was not encountered at in any of the boring locations. Although groundwater is not anticipated to be within the excavation depths, some dewatering of excavations may be required to remove precipitation and surface water runoff, particularly at turbines bearing on top of rock where water has a tendency to pond. Water and snow should be prevented from accumulating in foundation excavations at the time of foundation material placement. Sumps and portable pumps can generally be used to control water within these excavations for relatively short time periods. Excavations should be kept free of standing water and snow during foundation construction. The foundation subgrade should be inspected by the construction-phase geotechnical engineer, or their representative, after excavation and before placement of materials to verify water control.

4.2.3 Rock Rippability

Bedrock was encountered shallower than the anticipated turbine foundation excavation depths (less than 12 feet bgs) at one of the 17 boring locations. The rock generally consisted of basalt with the degree of weathering ranging from moderately to highly weathered. Highly weathered rock near the top of the rock surface is estimated to be mostly rippable based on the RQD and ease of drilling. Blasting may be required if more competent bedrock is encountered at shallow depths. Seismic compressive wave testing (P-Waves) is recommended to be completed during the final investigation to better assess rock rippability.

4.2.4 Permanent Cut and Fill Slopes

Cut slopes in native soil may be designed at an inclination of 4H:1V or flatter. Fill slopes constructed with the native soil found on site should be designed for a slope inclination of 4H:1V or flatter. Fill slopes should be constructed in horizontal lifts in accordance with the recommendations in Section 4.2.5. Fill slopes should be benched into the existing slope to prevent movement between the fill and native soils. Benches should be approved by the geotechnical engineer prior to placement of fill. Positive drainage is required at benched areas and at the toe of fill to remove surface water and minimize soil saturation. Appropriate erosion control measures (e.g., vegetation or erosion control matting) should be implemented immediately after cut and fill slopes are constructed to reduce the potential for significant erosion.

Steeper cut and fill slopes may be acceptable if adequate erosion control and/or reinforcement are utilized. Additional testing and/or analyses may be required for steeper slopes. The geotechnical engineer should be consulted if steeper slopes are desired. Global stability analyses are beyond the scope of this investigation; however, it should be noted that significant slopes were prevalent throughout the site. Vehicles, cranes, material storage, and foundations should be located a safe distance (as determined by the construction phase geotechnical engineer) from the top of steep slopes to avoid slope instability. Global slope stability analyses may be performed as needed once design grades and site specific vehicle and crane loading information become available.

4.2.5 Fill Placement and Compaction

The native soil encountered throughout the site may be used as structural fill for road embankments and wind turbine assembly areas, and may be suitable for backfilling around and above turbine foundations, provided that organics, frozen soil, foreign material, and rock fragments larger than 6 inches in diameter are removed and all compaction requirements are met. Backfill material within 1 foot of foundations should have no particle sizes greater than 1 inch. The moisture content of the fill should be adjusted, as necessary, to achieve compaction, although the native silt is expected to be sensitive to the addition of moisture, and as a result conditioning to near optimum moisture content may be challenging. See Table 4.2.5 below for additional recommendations.

Table 4.2.5 Fill and Backfill Material Recommendations.

Material	Uses	Loose Lift Thickness	Required Compaction[2]	Moisture Content[2]
Imported select structural fill[1]	Fill below turbine foundation, access roads, or crane pad over-excavations	≤ 12" with heavy compaction equipment	≥ 98%	±3% of optimum moisture
Non-organic native silt and sand	Foundation backfill, embankments, and general site grading	≤ 9" with heavy compaction equipment ≤ 6" with hand compaction equipment	≥ 95%	±3% of optimum moisture
Native topsoil and organic soil (OL, OH)	Landscaping non-structural areas	N/A	N/A	N/A

[1] See Section 4.2.56 for detailed structural fill recommendations

[2] Relative to the standard Proctor maximum dry density and optimum moisture content (ASTM D698)

4.2.6 Excavation Below Subgrade Procedures

Disturbance to subgrades prepared for foundations, access roads, crane walks, crane pads, and areas to be filled should be minimized. Fine-grained silty soils are particularly sensitive to disturbance from repeated traffic loading and excessive moisture due to surface water runoff, seepage, or precipitation, which are likely to degrade subgrade soil. Care should be taken to limit disturbance to subgrade soils across the site and prevent ponding water by promoting positive drainage. Where unsuitable subgrade is encountered, as discussed in Sections 4.4.1, 4.5.2, and 4.6.1, excavation of subgrade and replacement with suitable structural fill will be required.

If soft/loose, disturbed, or otherwise unsuitable foundation bearing soil is encountered, as determined by quality control testing described in Section 4.4.1, the subgrade should be scarified, moisture conditioned, and re-compacted to 98% of the standard Proctor maximum dry density and within 3% of optimum moisture content. Subgrade shall be uniform, such that the foundation does not bear on part soil and part rock. The excavation may also be extended deeper until suitable and uniform soil or rock is reached and backfilled up to the required subgrade elevation with select structural fill. Over-excavations below foundations should extend laterally beyond all edges of the footing. The lateral extent should be at least 12 inches per foot (1H:1V) of over-excavation depth below foundation base elevation. All over-excavations should be sloped or shored as required by OSHA regulations to provide stability and safe working conditions. All over-excavations should be free of water and snow prior to backfilling. Select structural fill should consist of well-graded coarse-grained material, such as the Oregon DOT Dense-Graded Base Aggregate with a maximum particle size of 1.5 inches. If imported structural fill is used to backfill foundations, a minimum 12 inch thick cap of silt should be placed on top of the structural fill to minimize surface water infiltration into the backfill.

4.3 General Foundation Considerations

4.3.1 Lateral Resistance

A friction factor of 0.35 may be used for the ultimate frictional resistance to lateral sliding along the base of concrete footings founded on properly compacted subgrade. We recommend a factor of safety of 1.5 or greater to determine the allowable frictional resistance to lateral sliding.

4.3.2 Seismic Considerations

At the time of this report the State of Washington has adopted the 2015 International Building Code with amendments. The maximum considered earthquake spectral response accelerations are presented in Table 4.3.2 below (IBC, 2015).

Table 4.3.1 Seismic Design Parameters

Parameter	Design Value
Reference	2015 IBC
Site Class	C
Occupancy Category	I/II/III
Mapped Spectral Acceleration for Short (0.2 sec) Periods – S_s	0.415 g
Mapped Spectral Acceleration for 1-second Periods – S_1	0.159 g
Acceleration-Based Site Coefficient – F_a	1.2
Velocity-Based Site Coefficient – F_v	1.641
Max. Considered Spectral Response Acceleration – S_{MS}	0.498 g
Max. Considered Spectral Response Acceleration – S_{M1}	0.262 g
Design Spectral Response Acceleration (Short Periods) – S_{DS}	0.332 g
Design Spectral Response Acceleration (1-second Period) – S_{D1}	0.174 g

4.3.3 Frost Depth

Frost action can result in differential heaving and a reduction in soil strength during periods of thaw. The degree of frost action is based on frost depth, availability of water, and frost-susceptibility of shallow soil. The most severe effects of frost heave occur when ice lenses form in the voids of soil containing fine particles (i.e., silt and clay). Shallow foundations (or the structures they support) can be damaged if the foundations bear above soils that experience frost heave. The bearing capacity of soil is also reduced during periods of thaw, which can reduce the lateral capacity of pile foundations and cause bearing capacity and/or settlement issues for shallow foundations bearing above the frost depth.

The recommended design frost depth for the area is 2 ft (Benton County, 2020). Critical foundations and pipes should be placed a minimum of 2 ft below final grade or on non-frost susceptible soil extending to a depth of 2 ft for protection against frost, unless they are designed to accommodate the effects of frost. Refer to Section 4.6.1 for additional recommendations regarding frost protection of shallow foundations.

4.4 Preliminary Wind Turbine Foundation Design Parameters

Several different wind turbine foundation types may be feasible at this site due to the variability in depth to, and competency of, bedrock; however, it is expected that shallow spread (gravity) foundations will be the most prevalent foundation type on site. Internal concrete shear and overturning are the likely failure mechanisms controlling spread foundation design. The soil and rock beneath the anticipated turbine foundation bearing depths typically exhibits sufficient properties to support spread foundations, following the recommended ground improvement presented in Section 4.5.2. Rock anchor or pile and anchor combination foundations may also be feasible where bedrock is less than 7 feet and 20 feet, respectively. Soil and rock parameters recommended for use in preliminary turbine foundation design are discussed in Section 4.1. Actual foundation selection and sizing will be determined as a part of the foundation design following the final geotechnical investigation and selection of the project turbine model(s).

In preparation of this report, it was assumed that conventional shallow spread foundations would be used to support the wind turbines. The subsurface conditions encountered during this investigation suggest that wind turbines may be supported by spread foundations bearing on suitable native soil, bedrock, or select structural fill. A turbine load document for a GE 3.03-140 at 81m hub-height was provided to Westwood as the base case turbine at the time of this report. Foundations are assumed to consist of an octagonal or circular spread footing with a diameter of approximately 60 ft bearing 10 ft bgs. Recommendations in this report are based on the assumed foundation dimensions and subsurface conditions found at the site, and these recommendations should be re-evaluated during the detailed full geotechnical investigation, once the turbine model, final load documents, and preliminary foundation designs are completed.

4.4.1 Subgrade Preparation and Testing

Wind turbine foundations should bear on the native medium dense to very dense silt and sand, bedrock with various degrees of weathering, or, if required, compacted select structural fill, as discussed in Sections 4.2.6. Foundations should not bear directly on loose silt if exposed at the excavation surface due to the potential for settlement and collapse (Section 4.1.8). Refer to Section 4.5.2 for additional discussion on subgrade remediation for collapsible soil. Foundation subgrade should consist of a uniform bearing material, such that the foundation does not bear on part soil and part rock. Care should be taken during foundation excavations to minimize disturbance of the subgrade. The subgrade surface soil should be compacted to 98% of the standard Proctor maximum dry density (ASTM D698). If encountered, soft/loose soil, frozen soil, and rock fragments larger than 6 inches should be removed. The foundation subgrade should be inspected by a qualified geotechnical engineer, or their representative, after excavation and before placement of materials to confirm conditions. Field inspection and quality control of the subgrade may identify the need for additional subgrade modification. Where foundations do not bear entirely on rock, dynamic cone penetrometer (DCP) testing is recommended to confirm subgrade soil strength and identify areas of loose silt or sand.

The foundation subgrade should be protected against freezing and snow/water accumulation after inspection and prior to foundation placement. To facilitate turbine foundation construction and to protect the subgrade, a minimum 2- to 3 inch–thick layer of lean concrete (mud mat) over the subgrade is recommended. During winter construction, heating of the subgrade may be necessary to protect the subgrade from freezing.

4.4.2 Bearing Capacity

Preliminary design of wind turbine spread footing foundations supported on suitable subgrade may be designed for a maximum allowable gross bearing capacity of 3,200 psf during normal loading conditions and 3,900 psf for extreme loading conditions. This bearing capacity likely exceeds the actual bearing pressures that may develop from a spread footing foundation design used for this site. The recommended allowable bearing pressure is based on an assumed foundation radius of 30 ft, embedment depth of 10 feet, and a factor of safety of 3.0 for normal wind loading conditions and 2.25 for extreme loading conditions.

4.4.3 Differential Settlement

Differential settlement or rotation of the foundation was evaluated under normal operating loads. Normal operating loads result in an eccentrically loaded foundation with a higher bearing pressure than the dead load condition. Under normal operating loads the leeward side of the foundation carries the majority of the load compared to the windward side of the foundation, causing differential settlement or rotation of the foundation.

Elastic settlement is expected to be the controlling mode of settlement. Results of the settlement analyses indicate that the assumed turbine foundation, consisting of a 60-foot diameter spread footing embedded approximately 10 feet bgs with a gross bearing pressure of 3,200 psf, will experience a total settlement of approximately 1.0 inch and a differential rotation of approximately 0.12 degrees across the foundation width, which is less than the GE wind turbine maximum allowable differential foundation tilt of 0.17 degrees. This assumes the wind turbine bearing on suitable subgrade, as discussed in Section 4.4.1, and does not account for settlement associated with soil collapse due to a wetting front.

4.4.4 Rotational Stiffness

No shear wave velocities were measured on site as part of this preliminary investigation, and therefore a dynamic shear modulus was not determined and rotational stiffness could not be evaluated. Geophysical tests should be performed during the full geotechnical investigation to evaluate dynamic soil response of the subsurface materials.

4.5 Special Geotechnical Considerations

4.5.1 Shallow Bedrock

Basalt bedrock was encountered at depths between 5 and 45 ft bgs at six of the boring locations (WTG-123, WTG-196, WTG-223, WTG-225, WTG-229, and WTG-235).

Bedrock was encountered within anticipated foundation bearing depths (less than 10 ft bgs) at one boring (WTG-235). Refer to Section 4.2.3 for a discussion on rock rippability.

4.5.2 Ground Improvement

Very loose to loose silt (loess) was encountered at all boring locations and extended to depths ranging from 2 ft to 35 ft bgs. Loose silt poses a potential for collapse when saturated (Section 4.1.8), and some form of ground improvement may be required where loose silt exists below the foundation embedment depths to strengthen the subgrade, or alternate foundation designs may be warranted. See Table 4 for a summary of the depth of loose silt at boring locations. Where the loose silt is relatively shallow, typically no more than 4 feet to 6 feet below the bottom of the foundation, the removal and re-compaction or replacement with a compacted select structural fill is recommended (refer to Section 4.2.6), or the foundation can bear deeper, below the weak material. At greater improvement depths, this method can become prohibitively expensive, and deep soil improvement techniques may be required.

At wind turbine locations where the loose silt extends more than 4 to 6 feet below the foundation embedment depth, an alternate economical option may be the use of stone columns (i.e., Rammed Aggregate Piers, Vibro Aggregate Piers, or Geopiers), which are 2 to 3 foot diameter vertical columns constructed by compacting lifts of aggregate in drilled shafts through vibratory or ramming methods. The columns are typically spaced 5 to 10 feet on center, and range in depths from 5 to 30 feet bgs. Once constructed, the foundation bearing pressures will be transferred to the stiffer stone columns, circumventing the collapsible soil to a more competent deeper layer to improve bearing capacity and reduce settlement. The site-specific stone column design is dependent on subsurface conditions, required bearing capacities, and type of stone column used. If required for this site, the stone column ground improvement design may be provided by the stone column installation contractor during final design. Load testing of the stone columns should also be carried out by the contractor prior to foundation construction to verify sufficient capacity.

The anticipated depth of significant moisture changes may also be evaluated during the full geotechnical investigation, as models may show a low potential for a wetting front to actually reach depths below the turbine foundations. Collapse potential may also be mitigated by capping backfill with clay or geomembrane to limit groundwater infiltration.

4.6 Substation Foundations

4.6.1 Shallow Foundations

Results of the investigation suggest that shallow spread/strip footings and mat foundations may be feasible at the proposed substation location (SS-01 boring location), although consideration should be given to the collapse potential and low strength of the very loose and loose shallow silt encountered on site. Foundations should bear on a uniform subgrade. If the shallow foundations bear on native loose silt, preliminary designs of large slab-on-grade equipment foundations (i.e. 10 to 20 feet wide) and conventional spread and strip footings (i.e., 4 feet wide) may use a maximum allowable bearing capacity of 500 psf. In general, it is recommended that shallow foundations do not bear on native loose silt due to the potential for soil collapse. Deep foundation systems, such as drilled shafts and stone piers (see Section 4.5.2) extending to more competent soil, may be an economical alternative.

The collapse potential of the subgrade soil can be reduced by over-excavating the loose silt to a minimum depth of 2 feet below the bottom of foundations and either re-compacting the native soil or replacing it with select structural fill, in accordance with Section 4.2.5. Provided the recommendations of this report are followed, including subgrade preparation recommendations in Section 4.2.6, preliminary designs of shallow foundations may use a maximum allowable gross bearing capacity of 1,000 psf when bearing on select structural fill over compacted native soil.

A total estimated settlement of less than 1 inch is anticipated for shallow foundations bearing on properly prepared subgrade. Differential settlement can generally be assumed to be ½ to ¾ of the total settlement. Proper drainage should be provided around foundations to minimize the potential for soil collapse and associated foundation movement. Shallow foundations should be reinforced as necessary to reduce the potential for damage caused by differential movement.

A vertical modulus of subgrade reaction of 75 pounds per cubic inch (pci) may be used for mat foundations bearing on a minimum 12 inches of structural fill. This vertical modulus of subgrade reaction represents a 1 foot square foundation and should be modified as needed for larger foundation sizes.

4.6.2 Drilled Pier/Shafts

Various substation structures/equipment may also be supported on concrete piers/shafts. Substation piers should have a minimum diameter of 18 inches and should extend through the loose silt (loess) and bear on the underlying medium dense silty sand to minimize impacts from collapsible soil.

4.6.2.1 Axial Capacity

Deep foundations will develop their capacity through a combination of skin friction and end bearing when in compression and skin friction alone when in uplift. Table 4.6.2.1 provides recommended skin friction and end bearing values for the preliminary design of drilled pier foundations based on the soil encountered in the substation boring. Skin friction and end bearing values provided are ultimate and do not include a safety factor. Appropriate safety factors or resistance factors should be applied by the foundation designer, in accordance with industry standards. A minimum safety factor of 2 is recommended for skin friction and 3 for end bearing.

Table 4.6.2.1 Axial Capacity Preliminary Design Parameters for Substation Structures

Depth (ft)	Material	Effective Unit Weight (pcf)	Ultimate Skin Friction (psf)	Ultimate End Bearing (psf)
0 – 2	Ignore due to seasonal moisture changes and frost.			
2 – 20	Silt	90	150	NA
20 – 50	Silty Sand	110	750	20,000

4.6.2.2 Lateral Capacity

The lateral response of the piers and drilled shafts may be modeled using the software program LPile by Ensoft, Inc. The recommended LPile input parameters for preliminary design of drilled piers at the proposed substation are provided in Table 4.6.2.2 below.

Table 4.6.2.2 Lateral Capacity Design Preliminary Parameters for Substation Structures

Depth (ft)	LPile Soil Model	Effective Unit Weight (pcf)	Friction Angle (deg)
0 – 2	Ignore due to seasonal moisture changes		
2 – 20	Sand (Reese)	90	28
20 – 50	Sand (Reese)	110	33

4.7 Access Roads

Access roads to accommodate construction equipment and deliveries will be required during construction. The access roads will also facilitate long-term operation and maintenance of the facility. These roads will be subjected to heavy loads, but only for limited duration and frequency. The suitability of the shallow site soil for use as access roads will depend primarily on the strength and moisture condition of the soil at the time the traffic occurs. The shallow soil on site below the root zone is generally considered adequate subgrade for gravel access roads. In general, up to 12 inches of aggregate may be suitable to support construction traffic depending on subgrade moisture, strength, compaction effort, and soil type. Less aggregate, such as 6 to 8 inches, may be used if the subgrade is chemically or mechanically stabilized (e.g., with cement or a mid-strength geotextile reinforcement, such as Mirafi HP270). Refer to Section 4.1.44 for recommended CBR value for preliminary access road and laydown yard design. Access road design criteria, such as traffic loads, were not known at the time of this report. The geotechnical/civil engineer should be contacted for the final road section design.

Low strength material and precipitation are the limiting conditions for access roads. Strengthening the subgrade with crushed rock, geosynthetics, or other suitable material, and/or mixing the base material with additives such as cement or quick lime will minimize damage to the subgrade. Establishing adequate side ditches and other surface water control features will help to reduce damage caused by surface water and saturated road subgrade conditions.

It is expected that aggregate-surfaced access roads and laydown yards will require ongoing maintenance to keep them in a serviceable condition, regardless of the aggregate thickness and subgrade preparation. It is not practical to design an aggregate section of adequate thickness that prevents ongoing maintenance. Ruts, depressions, and soft subgrade should be repaired as needed to facilitate traffic. Additional aggregate may be placed in ruts and depressions, or the entire aggregate section and soft subgrade may be removed and replaced with a new aggregate section.

For access roads and laydown yards, surface vegetation root zones, highly organic surface soil, and other soft or otherwise unsuitable material should be stripped and the surface graded to provide positive drainage. In order to identify potentially unsuitable soil, the subgrade should be compacted and subsequently proof-rolled with a fully loaded tandem axle or tri-axle truck with a minimum gross weight of 25 tons and minimum axle loading of 10 tons. Subgrade preparation should be monitored by a representative of the construction-phase geotechnical engineer at the time of construction. At locations where pumping or unacceptable rutting of the subgrade occurs (greater than 1.5 inches), the soft soil should be scarified, moisture conditioned, and re-compacted, or removed and replaced with properly compacted fill in accordance with Section 4.2.5.

4.8 Construction Considerations

To a large degree, satisfactory foundation and earthwork performance depends on construction quality control; therefore, subgrade preparation, subgrade compaction, proof-rolling, and placement and compaction of fill and backfill material should be observed and tested by qualified personnel. In addition, qualified staff who are experienced with the foundation design requirements should monitor and document foundation preparation and construction activities.

5.0 Limitations

This report has been prepared in accordance with generally accepted geotechnical engineering practice for the exclusive use by Horse Heaven Wind Farm, LLC for the Horse Heaven Wind Project. The geotechnical investigation detailed in this report was preliminary. A subsequent investigation will be necessary to more accurately characterize the subsurface conditions across the site, including at all turbine locations, access roads, the substation, MET towers, and O&M Building. The primary focus of this report was preliminary recommendations for site grading activities, wind turbine foundation design, substation foundations, and access roads.

The borings are representative of the subsurface conditions at the sampled locations and intervals, and therefore do not necessarily reflect strata variations that may exist between sampled locations and intervals. If variations from the subsurface conditions described in this study are noted during construction, recommendations in this report must be re-evaluated. Any user of this report should verify all boring locations against the final location of the respective infrastructure to determine if infrastructure has moved prior to using the recommendations provided by Westwood. In the event that any changes in the nature, design, or location of the facilities are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and the conclusions of this report are modified or verified in writing by Westwood. Westwood is not responsible for any claims, damages, or liability associated with the interpretation of subsurface data by others.

After plans for the facility are developed in sufficient detail and project-specific wind turbine foundation load documents and preliminary foundation designs are available, Westwood should be consulted regarding additional subsurface information required to arrive at final recommendations for design and construction.

6.0 References

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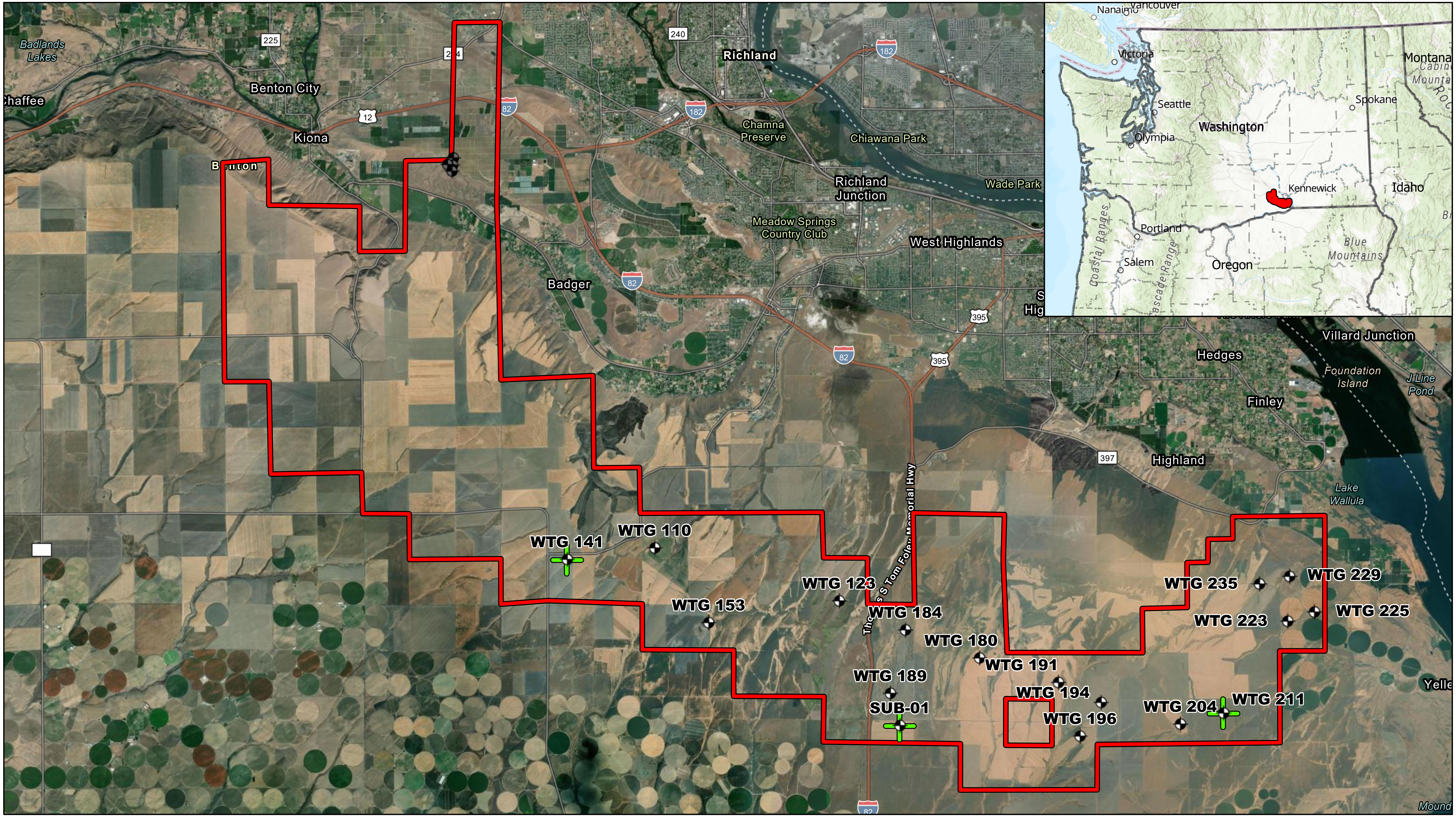
Exhibits



Data Source(s): Westwood (2020); .

Legend

- ⯐ Boring Locations
- ⯐ Under Ground T-Line Boring Locations
- ✚ Electrical Resistivity Test Locations
- 🟥 Project Boundary

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Horse Heaven Wind Project

Benton County, WA

Geotechnical Investigation Overview Map

EXHIBIT 1

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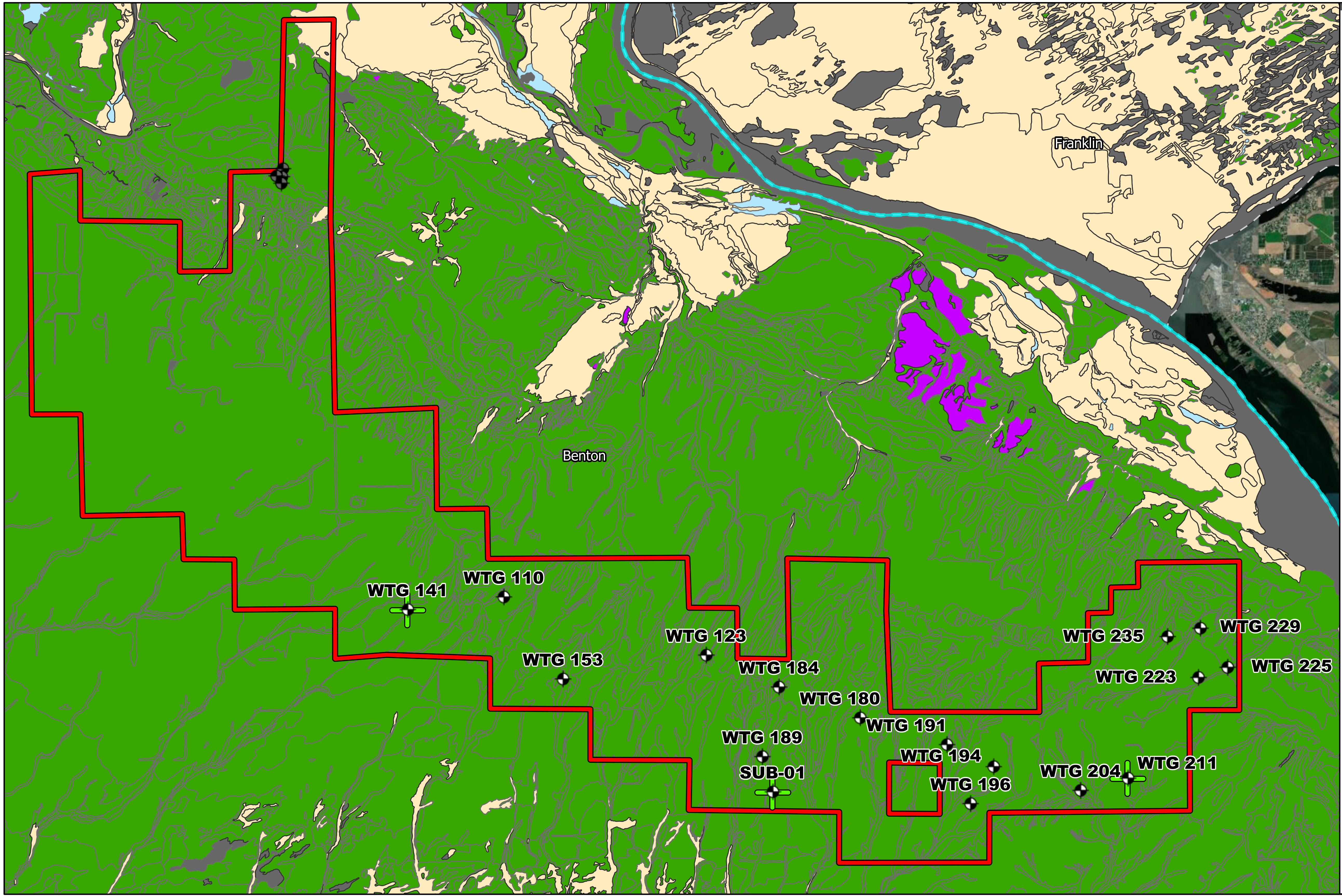

Map Unit Symbol	Map Unit Name
BbA	Burbank loamy fine sand, 0 to 2 percent slopes
BbC	Burbank loamy fine sand, 0 to 15 percent slopes
BbD	Burbank loamy fine sand, 2 to 15 percent slopes
BdE	Burbank loamy fine sand, basalt substratum, 0 to 30 percent slopes
BfE	Burbank rocky loamy fine sand, basalt substratum, 0 to 30 percent slopes
BlA	Burbank loamy fine sand, gravelly substratum, 0 to 2 percent slopes
BlD	Burbank loamy fine sand, gravelly substratum, 2 to 15 percent slopes
BmAB	Burke silt loam, 0 to 5 percent slopes
BmC	Burke silt loam, 5 to 8 percent slopes
BmE3	Burke silt loam, 15 to 30 percent slopes, severely eroded
BmF	Burke silt loam, 30 to 65 percent slopes
BnB	Burke silt loam, shallow, 0 to 5 percent slopes
BnC	Burke silt loam, shallow, 5 to 8 percent slopes
BoD2	Burke very fine sandy loam, 0 to 15 percent slopes, eroded
BrC2	Burke very fine sandy loam, shallow, 0 to 8 percent slopes, eroded
Du	Dune land
EfB	Ellisforde silt loam, 0 to 5 percent slopes
EfE3	Ellisforde silt loam, 15 to 30 percent slopes, severely eroded
EsA	Esquatzel fine sandy loam, 0 to 2 percent slopes
EsB	Esquatzel fine sandy loam, 0 to 5 percent slopes
EuA	Esquatzel silt loam, 0 to 2 percent slopes
EuAB	Esquatzel silt loam, 0 to 5 percent slopes
EuB	Esquatzel silt loam, 2 to 5 percent slopes
FeA	Finley fine sandy loam, 0 to 2 percent slopes
FeB	Finley fine sandy loam, 2 to 5 percent slopes
FeC	Finley fine sandy loam, 0 to 15 percent slopes
FeD	Finley fine sandy loam, 5 to 15 percent slopes
FfE	Finley stony fine sandy loam, 0 to 30 percent slopes
FgB	Finley gravelly fine sandy loam, 2 to 5 percent slopes
FnA	Finley fine sandy loam, moderately deep, 0 to 2 percent slopes
FnB	Finley fine sandy loam, moderately deep, 2 to 5 percent slopes
HeA	Hezel loamy fine sand, 0 to 2 percent slopes
HeD	Hezel loamy fine sand, 2 to 15 percent slopes
HeE	Hezel loamy fine sand, 0 to 30 percent slopes
KeA	Kennewick silt loam, 0 to 2 percent slopes
KeB	Kennewick silt loam, 2 to 5 percent slopes
KeC	Kennewick silt loam, 5 to 8 percent slopes
KeD	Kennewick silt loam, 8 to 15 percent slopes
KeE3	Kennewick silt loam, 15 to 30 percent slopes, severely eroded
KnE	Kiona very stony silt loam, 0 to 30 percent slopes
KnF	Kiona very stony silt loam, 30 to 65 percent slopes
KoC	Koehler loamy fine sand, 0 to 8 percent slopes
PITS	Pits
PaA	Pasco fine sandy loam, 0 to 2 percent slopes
PcA	Pasco silt loam, 0 to 2 percent slopes
PoA	Prosser silt loam, 0 to 2 percent slopes
PoB	Prosser silt loam, 2 to 5 percent slopes
PoD	Prosser silt loam, 5 to 15 percent slopes
PoE	Prosser silt loam, 0 to 30 percent slopes
PrD2	Prosser very fine sandy loam, 0 to 15 percent slopes, eroded,
QuA	Quincy loamy sand, 0 to 2 percent slopes
QuD	Quincy loamy sand, 2 to 15 percent slopes
QuE	Quincy loamy sand, 0 to 30 percent
QyE	Quincy loamy sand, moderately shallow, 0 to 30 percent slopes
ReB	Ritzville silt loam, 0 to 5 percent slopes
ReE3	Ritzville silt loam, 15 to 30 percent slopes, severely eroded
ReF	Ritzville silt loam, 30 to 65 percent slopes,
RfD2	Ritzville very fine sandy loam, 0 to 15 percent slopes, eroded,
Rh	Riverwash
Ro	Rock outcrop
ScA	Scooteney silt loam, 0 to 2 percent slopes,
ScAB	Scooteney silt loam, 0 to 5 percent slopes
ScB	Scootney silt loam, 2 to 5 percent slopes
ScC	Scooteney silt loam, 5 to 8 percent slopes
SdA	Scooteney silt loam, gravelly subsoil, 0 to 2 percent slopes
SdB	Scooteney silt loam, gravelly subsoil, 2 to 5 percent slopes
SdD	Scooteney silt loam, gravelly subsoil, 5 to 15 percent slopes
SeE	Scooteney stony silt loam, 0 to 30 percent slopes
ShAB	Shano silt loam, 0 to 5 percent slopes
ShE3	Shano silt loam, 15 to 30 percent slopes, severely eroded
ShF	Shano silt loam, 30 to 65 percent slopes
SnD2	Shano very fine sandy loam, 0 to 15 percent slopes, eroded,
SnE2	Shano very fine sandy loam, 15 to 30 percent slopes, eroded
SrB	Starbuck silt loam, 0 to 5 percent slopes
SrBC	Starbuck silt loam, 0 to 8 percent slopes
SrC	Starbuck silt loam, 5 to 8 percent slopes
SsE	Starbuck rocky silt loam, 5 to 45 percent slopes
StD	Starbuck stony silt loam, 0 to 15 percent slopes,
UmB	Umapine silt loam, 0 to 5 percent slopes

Data Source(s): Westwood (2020); .

Legend

- ⊕ Boring Locations
- ⊕ Under Ground T-Line Boring Locations
- ✚ Electrical Resistivity Test Locations
- ▭ Project Boundary

Unified Soil Classifications

- ■ No Classification Given
- ■ CL-ML
- ■ GM
- ■ GP-GM
- ■ ML
- ■ SM
- ■ SP-SM
- ▭ County Boundary

Horse Heaven Wind Project

Benton County, WA

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Local Soils Map

EXHIBIT 2

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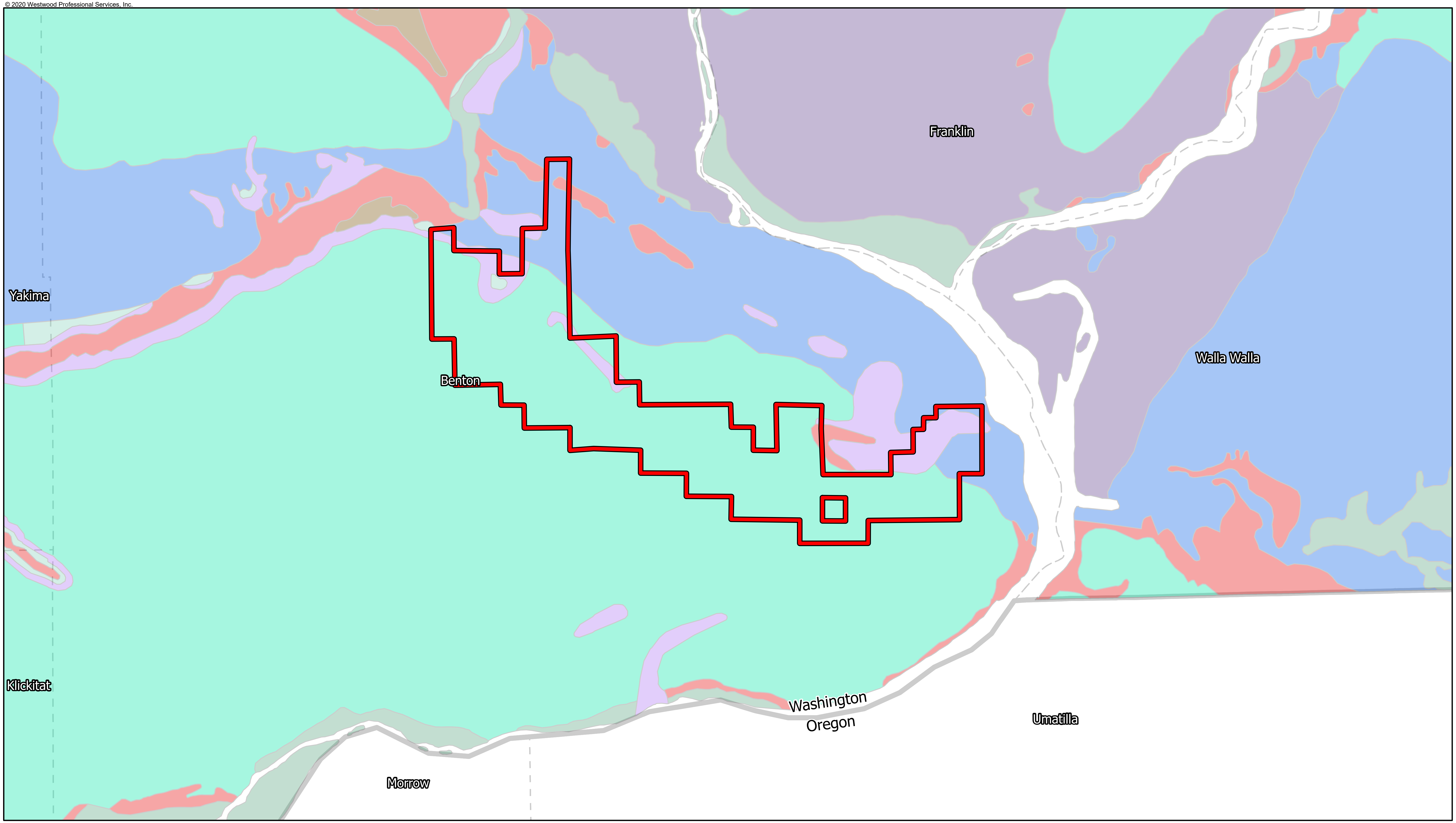

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Data Source(s): Westwood (2020); ESRI WMS World Imagery (Accessed 2020); Census Bureau(2019); US Geological Survey (2020).

Legend

- 🟥 Project Boundary
- ☐ State Boundary
- ⬚ County Boundary

Geologic Unit Symbol | Geologic Unit Name | Geologic Unit Age

- 🟩 Qa | Alluvium | Holocene
- 🟦 Qgl | Glaciolacustrine deposits | Pleistocene
- 🟫 Qs | Landslide and mudflow deposits | Holocene
- 🟥 Mv | Miocene volcanic rocks | Middle Miocene
- ▢ MPLc | Miocene-Pliocene nonmarine rocks | Miocene-Pliocene
- 🟪 WAMIPOv | Miocene-Pliocene volcanic rocks | Miocene-Pliocene
- 🟩 Qce | Quaternary nonmarine deposits | Pleistocene
- 🟪 Qg10 | Younger glacial drift | Pleistocene

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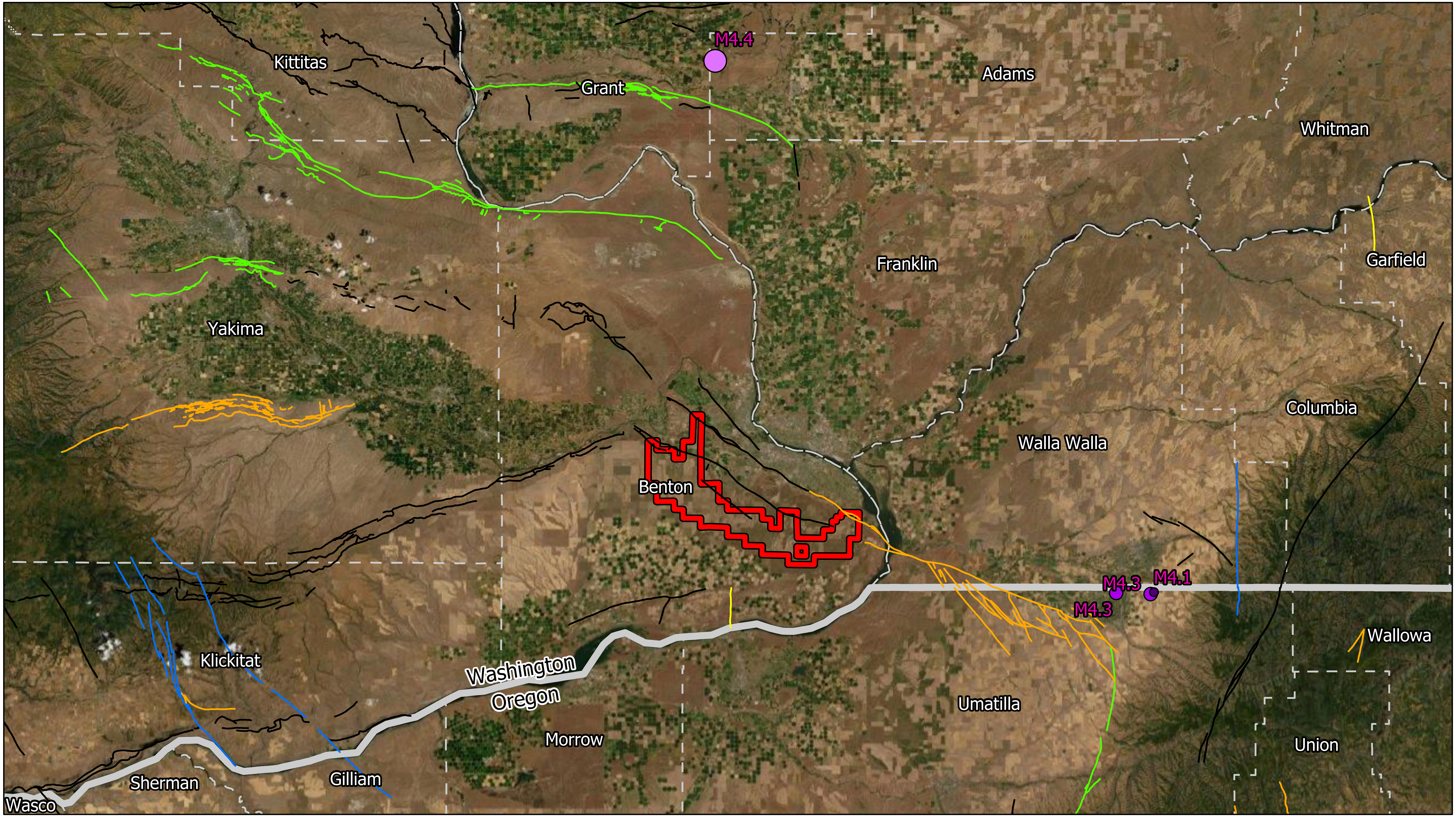
Horse Heaven Wind Project

Benton County, WA

Local Geology Map

EXHIBIT 3



Data Source(s): Westwood (2020); ESRI WMS World Imagery (Accessed 2020); Census Bureau (2019); U.S. Geological Survey (2020).

Legend

- 🟥 Project Boundary
- ▭ State Boundary
- ⬚ County Boundary

Quaternary Fault Lines

- — Historical (<150 Years)
- — Latest Quaternary (<15,000 Years)
- — Late Quaternary (<130,000 Years)
- — Middle and Late Quaternary (<750,000 Years)
- — Undifferentiated Quaternary (<1.6 million Years)
- — class B (Various Age)
- — Unspecified

Historical Earthquakes by Magnitude

- ● ≤4.1
- ● ≤4.3
- ● ≤4.4

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Horse Heaven Wind Project

Benton County, WA

N

0 15 Miles

Seismic Map

EXHIBIT 4

Map Document: N:\0020776.01\GIS\ArcPro\Horse Heaven - geotech\Horse Heaven - geotech.aprx 5/29/2020 1:15 PM LRLefebvre

Tables

Westwood

Table 1

Laboratory Soil Test Data Summary(1)

Horse Heaven Wind Project - Benton County, Washington

BORING ID	SAMPLE ID	SAMPLE DEPTH (ft)	GRAIN-SIZE DISTRIBUTION(2)(5)				NATURAL MOISTURE CONTENT (%)	ATTERBERG LIMITS		pH	Sulfate Ions (mg/kg)	Chloride Ions (mg/kg)	Miller Box Electrical Resistiivty (Ω-cm)		USCS CLASSIFICATION(4)(5)	STANDARD PROCTOR		Thermal Resistivity (°C-cm/W)	
			% Gravel	% Sand	% Silt	% Clay		LL	PI				As-Received	Saturated		MAX DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)	SATURATED	DRY
SS-01	6	12.5' - 14'	0	13	87		2.0			8.2	223	16.9	256,700	2,100	Silt (ML)				
T-110	3	5' - 6.5'					13.7												
T-123	5	10' - 11.5'	0	2	98		6.1								Silt (ML)				
T-141	4	7.5' - 9'	0	3	97		10.6								Silt (ML)				
T-153	8	20' - 21.5'					9.0			8.3	79.6	< 9.2	16,000	2,500					
T-180	2	2.5' - 4'					15.0	NC	NP						Silt (ML)				
T-184	11	35' - 40'					5.6			8.1	24.7	49.3	64,300	3,800					
T-189	7	15' - 16.5'					8.2												
T-191	9	25' - 26.5'	0	2	98		5.3								Silt (ML)				
T-194	5	10' - 11.5'					9.5			9.0	13.2	< 9.2	18,700	2,900					
T-196	6	12.5' - 14'	0	8	92		11.2								Silt (ML)				
T-204	9	25' - 26.5'	0	7	93		8.5								Silt (ML)				
T-211	1	0' - 1.5'	0	14	86		10.1	NC	NP						Silt (ML)				
T-223	8	20' - 21.5'					7.9			8.3	229	< 9.2	14,700	2,100					
T-225	3	5' - 6.5'	0	20	80		6.9								Silt w/ Sand (ML)				
T-229	6	12.5' - 14'					10.2												
T-235	1	0' - 1.5'					5.0												
SS-01	Bulk	1' - 4'	0	25	70	5	7.9								Silt w/ Sand (ML)	92.8	20.4	169	592
T-141	Bulk	1' - 4'	0	11	84	5	11.5	NC	NP						Silt (ML)	103.1	17.3	128	530
T-211	Bulk	1' - 4'	0	18	76	7	4.5								Silt w/ Sand (ML)	98.6	19.5	308	587
T-235	Bulk	1' - 4'	0	13	84	3	9.8								Silt (ML)	99.9	18.3		

Footnotes:

(1) Additional laboratory test results, including thermal resistivity, california bearing ratio, chemical consitituent, and consolidation tests can be found in Appendix B.

(2) % Gravel = part. greater than 4.75 mm (#4 sieve); % Sand = part. between 0.075 mm (#200 sieve) and 4.75 mm (#4 sieve); % Silt = part. between 0.002 mm and 0.075 mm (#200 sieve); % Clay = part. smaller than 0.002 mm.

(3) Some samples were combined to achieve sufficient volume and were taken from same soil stratum.

(4) Visual classification, informed where possible by laboratory testing

(5) Represents soil fraction captured in split spoon, does not include cobbles/large gravel that may have been in profile.

TWT = thin walled tube

Created by: C. Enos 5/25/2020
Checked by: D. Welch 5/25/2020

Table 2: Electrical Resistivity Test Results
Wenner 4-Electrode Method
Horse Heaven Wind Project - Benton County, Washington

WTG-141	Latitude	Longitude
Location:	46.114375	-119.360955

Site Description: 65°F, sunny, slopes to S, ML, tilled crop field, damp

Date: 4/6/2020

North-South Transect

ELECTRODE SPACING		APPARENT RESISTIVITY	
(feet)	(meters)	ohm-feet	ohm-meters
5	1.5	364	111
10	3.0	367	112
20	6.1	302	92.2
30	9.1	273	83.2
50	15.2	265	80.8
100	30.5	407	124

East-West Transect

ELECTRODE SPACING		APPARENT RESISTIVITY	
(feet)	(meters)	ohm-feet	ohm-meters
5	1.5	397	121
10	3.0	367	112
20	6.1	294	89.6
30	9.1	255	77.7
50	15.2	248	75.7
100	30.5	367	112

WTG-211	Latitude	Longitude
Location:	46.061981	-119.061421

Site Description: 50°F, partly cloudy, flat, ML, tilled crop field, damp

Date: 4/6/2020

North-South Transect

ELECTRODE SPACING		APPARENT RESISTIVITY	
(feet)	(meters)	ohm-feet	ohm-meters
5	1.5	502	153
10	3.0	512	156
20	6.1	518	158
30	9.1	515	157
50	15.2	522	159
100	30.5	666	203

East-West Transect

ELECTRODE SPACING		APPARENT RESISTIVITY	
(feet)	(meters)	ohm-feet	ohm-meters
5	1.5	492	150
10	3.0	528	161
20	6.1	502	153
30	9.1	502	153
50	15.2	522	159
100	30.5	656	200

Table 2: Electrical Resistivity Test Results
Wenner 4-Electrode Method
Horse Heaven Wind Project - Benton County, Washington

SS-01	Latitude	Longitude
Location:	46.059798	-119.209694

Site Description: 50°F, sunny, lightly undulating, ML, crop field, damp

Date: 4/6/2020

North-South Transect

ELECTRODE SPACING		APPARENT RESISTIVITY	
(feet)	(meters)	ohm-feet	ohm-meters
5	1.5	492	150
10	3.0	413	126
20	6.1	512	156
30	9.1	561	171
50	15.2	610	186
100	30.5	620	189
200	61.0	702	214

East-West Transect

ELECTRODE SPACING		APPARENT RESISTIVITY	
(feet)	(meters)	ohm-feet	ohm-meters
5	1.5	525	160
10	3.0	426	130
20	6.1	492	150
30	9.1	541	165
50	15.2	604	184
100	30.5	380	116
200	61.0	420	128

SS-01	Latitude	Longitude
Location:	46.059798	-119.209694

Site Description: 60°F, sunny, lightly undulating, ML, crop field, damp

Date: 4/6/2020

North-South Transect

ELECTRODE SPACING		APPARENT RESISTIVITY	
(feet)	(meters)	ohm-feet	ohm-meters
5	1.5	508	155
10	3.0	433	132
20	6.1	505	154
30	9.1	564	172
50	15.2	538	164
100	30.5	672	205
200	61.0	613	187

East-West Transect

ELECTRODE SPACING		APPARENT RESISTIVITY	
(feet)	(meters)	ohm-feet	ohm-meters
5	1.5	495	151
10	3.0	420	128
20	6.1	499	152
30	9.1	551	168
50	15.2	581	177
100	30.5	577	176
200	61.0	407	124

Table 3
SPT N-Value Summary
Horse Heaven Wind Project - Benton County, Washington

Depth (ft)	Sub-01	WTG-110	WTG-123	WTG-141	WTG-153	WTG-180	WTG-184	WTG-189	WTG-191	WTG-194	WTG-196	WTG-204	WTG-211	WTG-223	WTG-225	WTG-229	WTG-235
0-1.5	3	4	5	4	3	9	3	4	2	4	4	3	4	5	8	9	7
2.5-4	3	4	8	4	3	2	4	4	5	6	5	3	5	9	11	4	
5-6.5	4	2	6	3	3	2	3	3	2	5	5	2	6	4	9	2	REF
7.5-9	5	9	11	1	2	4	3	4	5	2	2	2	4	4	19	2	REF
10-11.5	6	8	7	2	4	4	3	4	5	2	3	3	4	3	REF	8	REF
12.5-14	6		8	4	3	4	4	3	2	1	3	4	7	3	92	11	REF
15-16.5	6	40	12	5	8	3	2	7	2	0	15	3	4	8	REF	14	REF
20-21.5	20	7	25	REF	31	12	11	6	5	12	REF	9	8	6	REF	41	
25-26.5	13	27	41	9	27	9	21	46	7	5	REF	40	31	10	REF	REF	
30-31.5	10	32	22	45	21	11	14	8	6	12	REF	11	12	14	REF	REF	
35-36.5	12	18	19	35	74	37	32	10	24	13	REF	36	16	REF			
40-41.5	22	25	39	59	18	9	20	19	29	17		21	13	28			
45-46.5	23		REF	42	21	44	21	37	24	REF		27	44				
50-51.5	37	19	52	54	10	28	22		19	19		28	REF	REF			
55-56.5'		26	31	48	25	56	37	30	43	23		20	24				
60-61.5'		66	65	REF	87	25	28	22	20	43		30	33				

Legend:

🟦	Silt, Silt with Sand (ML)
🟧	Silty Sand (SM)
⬛	Basalt Bedrock

REF = SPT Refusal

Table 4
Depth of Loose Silt and Bedrock Summary
Horse Heaven Wind Project - Benton County, Washington

Boring	Depth of Loose Silt (ft)	Depth to Basalt Bedrock (ft)
Sub-01	20	> 50
WTG-110	25	> 60
WTG-123	15	38(1)
WTG-141	30	> 60
WTG-153	25	> 60
WTG-180	30	> 60
WTG-184	20	> 60
WTG-189	25	> 60
WTG-191	35	> 60
WTG-194	30	> 60
WTG-196	15	19
WTG-204	25	> 60
WTG-211	25	> 60
WTG-223	25	48
WTG-225	7.5	15
WTG-229	12.5	21
WTG-235	5	5

(1) Rock transitions back into soil

Appendix A

Soil Boring Logs and Rock Core Photo Logs

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SOIL BORING LOG

BORING NO. SS-01

Page 1 of 1

Facility/Project Name: Horse Heaven Wind Project Benton County, Washington		Boring Location: Lat: 46.059798 Long: -119.209694	Surface Elev. (ft): ---	Total Depth (ft bgs): 50.0	Borehole Dia. (in): 5.5
Drilling Firm: Environmental West	Drilling Method: Air Rotary Autohammer SPT	Personnel: Logger - Chris Enos Driller - Brent Johnson	Date Started: 4/14/20	Date Completed: 4/14/20	Water Depth (ft bgs): DNE

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	MOISTURE CONTENT (%)	P 200 (%)
1 SS	100	2 2 1	7.9	75
2 SS	100	1 1 2		
3 SS	89	2 2 2		
4 SS	100	2 2 3		
5 SS	100	3 3 3		
6 SS	100	3 3 3	2.0	87
7 SS	100	3 3 3		
8 SS	89	8 9 11		
9 SS	100	4 6 7		
10 SS	100	3 5 5		
11 SS	83	3 4 8		
12 SS	100	6 9 13		
13 SS	94	8 11 12		
14 SS	100	11 12 25		

DEPTH IN FEET: 10, 20, 30, 40, 50, 60

LITHOLOGIC DESCRIPTION

TOPSOIL - 2" thick, SILTY, dry

SILT w/ SAND (ML) - brown, dry to damp, loose. — USCS: ML

SILT (ML) - brown, dry to damp, loose. — USCS: ML

SILTY SAND (SM) - light yellowish brown, dry, loose to dense. — USCS: SM

- light brown

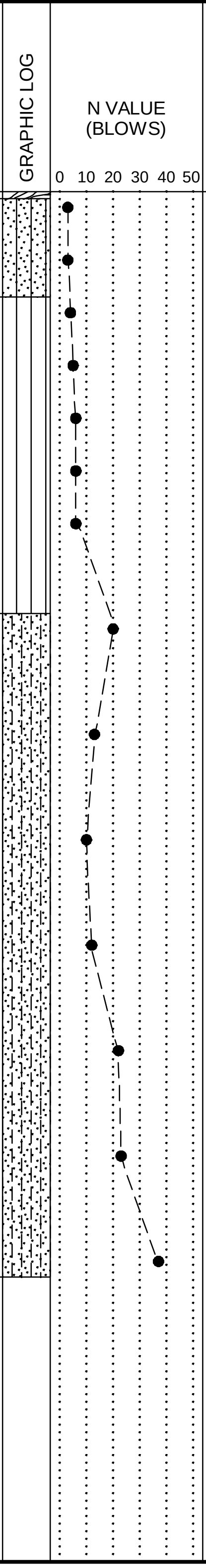
- very light brown

- light brown

BORING TERMINATED AT 51.5 FT.
TARGET DEPTH REACHED.

COMMENTS: Coordinates are NAD83 Datum.

POCKET PEN (TSF) | COMPRESSIVE STRENGTH (TSF) | LIQUID LIMIT | PLASTICITY INDEX



Checked By:	Date:	Approved By:	Date:	Firm:
Devin Welch	5/21/20	Sam Jorgensen	5/29/20	Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

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SOIL BORING LOG

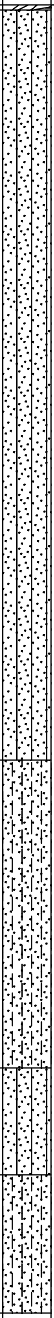
BORING NO. WTG-110

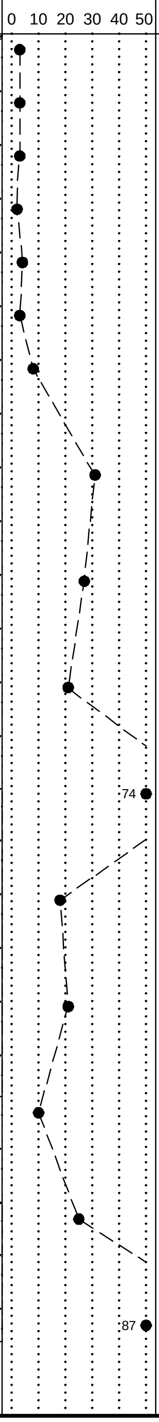
Page 1 of 1

Facility/Project Name: Horse Heaven Wind Project Benton County, Washington		Boring Location: Lat: 46.117632 Long: -119.320751	Surface Elev. (ft): ---	Total Depth (ft bgs): 60.0	Borehole Dia. (in): 5.5
Drilling Firm: Environmental West	Drilling Method: Air Rotary Autohammer SPT	Personnel: Logger - Adam McDaniel Driller - Brent Johnson	Date Started: 4/10/20	Date Completed: 4/10/20	Water Depth (ft bgs) DNE

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	MOISTURE CONTENT (%)	COMMENTS
1 SS	100	1 1 2		**TOPSOIL** - 1" thick, SILTY, dry **SILT w/ SAND (ML)** - light brown, dry, very loose to dense.	ML		Coordinates are NAD83 Datum.
2 SS	100	2 1 2					
3 SS	100	2 1 2				13.7	
4 SS	89	2 1 1					
5 SS	100	3 2 2	10				
6 SS	100	1 2 1					
7 SS	100	4 4 4					
8 SS	100	11 13 18	20				
9 SS	100	12 11 16					
10 SS	100	11 10 11	30				
11 SS	56	12 28 46		**SILTY SAND (SM)** - light brown, dry, medium dense to very dense. - few gravel, possibly highly weathered rock	SM		
12 SS	100	7 8 10	40				
13 SS	100	8 9 12					
14 SS	100	3 3 7	50	**SILT w/ SAND (ML)** - light brown, dry, medium dense, few gravel.	ML		
15 SS	100	5 7 18		**SILTY SAND (SM)** - brown, dry, medium dense to very dense.	SM		
16 SS	100	18 42 45	60	- interbedded basalt, highly weathered			
				BORING TERMINATED AT 61.5 FT. TARGET DEPTH REACHED.			

Columns without entries: POCKET PEN (TSF), COMPRESSIVE STRENGTH (TSF), LIQUID LIMIT, PLASTICITY INDEX, P 200 (%)





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Devin Welch	5/21/20	Sam Jorgensen	5/29/20	Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

Westwood

SOIL BORING LOG

BORING NO. WTG-123

Page 1 of 1

Facility/Project Name: Horse Heaven Wind Project Benton County, Washington		Boring Location: Lat: 46.099832 Long: -119.236594	Surface Elev. (ft): ---	Total Depth (ft bgs): 60.0	Borehole Dia. (in): 5.5
Drilling Firm: Environmental West	Drilling Method: Air Rotary Autohammer SPT	Personnel: Logger - Chris Enos Driller - Brent Johnson	Date Started: 4/13/20	Date Completed: 4/13/20	Water Depth (ft bgs) DNE

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	MOISTURE CONTENT (%)	P 200 (%)
1 SS	89	2 2 3		
2 SS	100	1 3 5		
3 SS	100	5 3 3		
4 SS	100	4 5 6		
5 SS	83	4 3 4	6.1	98
6 SS	100	4 4 4		
7 SS	89	7 6 6		
8 SS	100	8 9 16		
9 SS	100	14 20 21		
10 SS	100	7 8 14		
11 SS	100	7 8 11		
12 SS	100	10 15 24		
13 SS	165	41 50/5		
14 SS	100	14 22 30		
15 SS	100	11 13 18		
16 SS	100	25 29 36		

DEPTH IN FEET: 10, 20, 30, 40, 50, 60

LITHOLOGIC DESCRIPTION

TOPSOIL - 3" thick, SILTY, dry

SILT (ML) - light brown, dry, loose to dense. (USCS: ML)

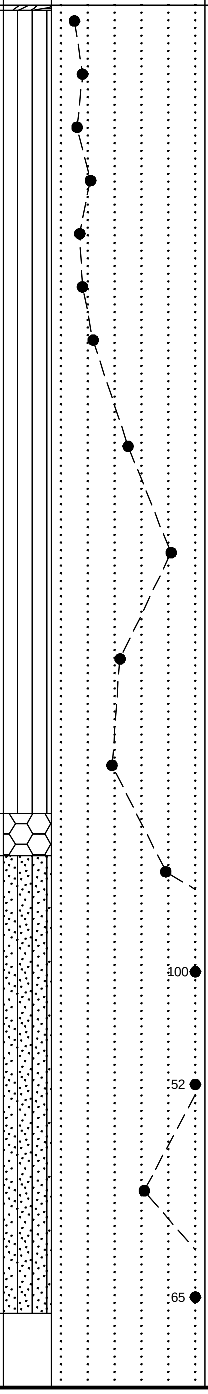
- brown

- 1" thick sand lens

BASALT - gray, dry, highly weathered.

SILT w/ SAND (ML) - light brown, dry to damp, dense to very dense. (USCS: ML)

BORING TERMINATED AT 61.5 FT.
TARGET DEPTH REACHED.



POCKET PEN (TSF) | COMPRESSIVE STRENGTH (TSF) | LIQUID LIMIT | PLASTICITY INDEX

COMMENTS: Coordinates are NAD83 Datum.

Checked By:	Date:	Approved By:	Date:	Firm:
Devin Welch	5/21/20	Sam Jorgensen	5/29/20	Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

Westwood

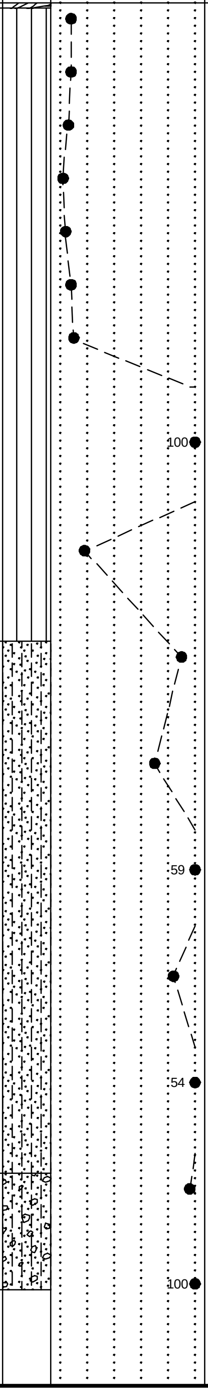
SOIL BORING LOG

BORING NO. WTG-141

Page 1 of 1

Facility/Project Name: Horse Heaven Wind Project Benton County, Washington		Boring Location: Lat: 46.114375 Long: -119.360955	Surface Elev. (ft): ---	Total Depth (ft bgs): 60.0	Borehole Dia. (in): 5.5
Drilling Firm: Environmental West	Drilling Method: Air Rotary Autohammer SPT	Personnel: Logger - Adam McDaniel Driller - Brent Johnson	Date Started: 4/9/20	Date Completed: 4/9/20	Water Depth (ft bgs) DNE

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 SS	100	2 1 3		**TOPSOIL** - 2" thick, SILTY, dry **SILT (ML)** - light brown to brown, dry, very loose to loose.				11.5	NC	NP	89	Coordinates are NAD83 Datum.
2 SS	100	2 2 2										
3 SS	100	1 1 2										
4 SS	100	2 1 0						10.6			97	
5 SS	100	2 1 1	10									
6 SS	100	3 2 2										
7 SS	100	2 2 3			ML							
8 SS	103	7 40 50/4	20	- 6" thick interbedded basalt, highly weathered.								
9 SS	100	3 4 5										
10 SS	100	15 21 24	30	**SILTY SAND (SM)** - light brown, dry, dense to very dense.								
11 SS	100	4 7 28										
12 SS	100	28 24 35	40									
13 SS	100	11 13 39			SM							
14 SS	100	4 11 43	50									
15 SS	100	16 18 30		**SILTY SAND w/ GRAVEL (SM)** - pinkish brown, dry, dense.	SM							
16 SS	99	50/5	60	- interbedded basalt, highly weathered. **BORING TERMINATED AT 60.5 FT. TARGET DEPTH REACHED.**								



Checked By: Devin Welch	Date: 5/21/20	Approved By: Sam Jorgensen	Date: 5/29/20	Firm: Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

WW_BORING LOG_PP HORSE HEAVEN WIND_TURBINE_BORINGLOGS.GPJ RMT_CORP.GDT 6/1/20

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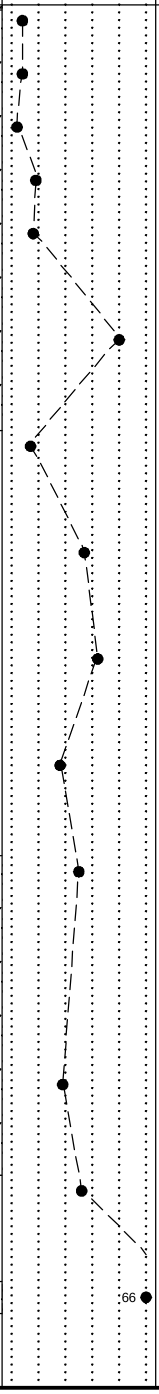
SOIL BORING LOG

BORING NO. WTG-153

Page 1 of 1

Facility/Project Name: Horse Heaven Wind Project Benton County, Washington		Boring Location: Lat: 46.093548 Long: -119.296561	Surface Elev. (ft): ---	Total Depth (ft bgs): 60.0	Borehole Dia. (in): 5.5
Drilling Firm: Environmental West	Drilling Method: Air Rotary Autohammer SPT	Personnel: Logger - Adam McDaniel Driller - Brent Johnson	Date Started: 4/9/20	Date Completed: 4/9/20	Water Depth (ft bgs) DNE

SAMPLE														
NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	POCKET PEN (TSF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 SS	100	2 1 3		**TOPSOIL** - 2" thick, SILTY, dry **SILT w/ SAND (ML)** - light brown, dry to damp, very loose to dense.										Coordinates are NAD83 Datum.
2 SS	100	2 2 2												
3 SS	100	1 1 1												
4 SS	100	2 4 5												
5 SS	78	5 4 4	10		ML									
7 SS	100	8 20 20		- brown										
8 SS	67	4 3 4	20	**SILT (ML)** - brown, dry to damp, loose to dense.						9.0				
9 SS	100	19 14 13												
10 SS	100	10 14 18	30		ML									
11 SS	100	6 9 9												
12 SS	100	7 10 15	40	**SILT w/ SAND (ML)** - light brown, dry to damp, medium dense.	ML									
14 SS	100	5 7 12	50											
15 SS	100	9 11 15		**SILT (ML)** - light brown, dry, medium dense.	ML									
16 SS	100	28 31 35	60	**SANDY SILT (SM)** - light brown, dry, very dense. **BORING TERMINATED AT 61.5 FT. TARGET DEPTH REACHED.**	SM		66							



Checked By: Devin Welch	Date: 5/21/20	Approved By: Sam Jorgensen	Date: 5/29/20	Firm: Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

Westwood

SOIL BORING LOG

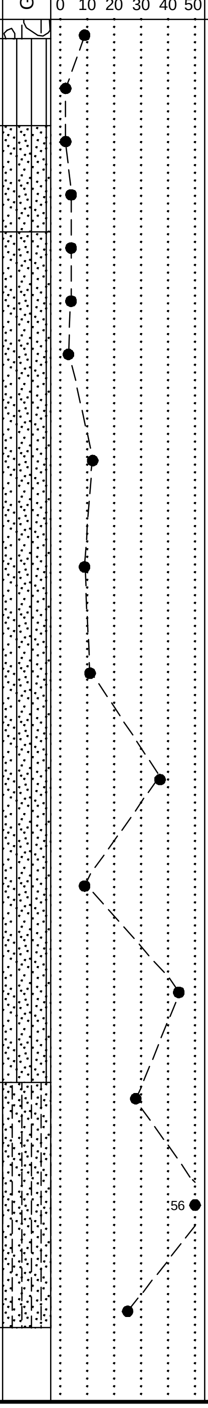
BORING NO. WTG-180

Page 1 of 1

Facility/Project Name: Horse Heaven Wind Project Benton County, Washington		Boring Location: Lat: 46.080901 Long: -119.172726	Surface Elev. (ft): ---	Total Depth (ft bgs): 60.0	Borehole Dia. (in): 5.5	
Drilling Firm: Environmental West	Drilling Method: Air Rotary Autohammer SPT	Personnel: Logger - Chris Enos Driller - Brent Johnson	Date Started: 4/14/20	Date Completed: 4/14/20	Water Depth (ft bgs) DNE	

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 SS	61	4 5 4		**FILL** - 11" thick access road, GRAVELLY and SILTY, dry								Coordinates are NAD83 Datum.
2 SS	72	1 1 1		**SILT (ML)** - brown, damp, very loose, few sand, few clay	ML			15.0	NC	NP		
3 SS	89	0 1 1		**SILT w/ SAND (ML)** - light brown, dry to damp, very loose.	ML							
4 SS	100	2 2 2										
5 SS	100	2 2 2	10	**SANDY SILT (ML)** - light brown, dry to damp, loose to dense.	ML							
6 SS	100	3 2 2										
7 SS	89	2 1 2										
8 SS	100	1 3 9	20									
9 SS	100	3 4 5										
10 SS	100	3 5 6	30									
11 SS	100	6 14 23										
12 SS	100	4 3 6	40	- trace gravel								
13 SS	100	16 18 26		- trace clay, 1" thick sand lens								
14 SS	100	9 12 16	50	**SILTY SAND (SM)** - light yellowish brown, dry, medium dense to very dense.	SM							
15 SS	83	23 27 29		- very light brown, light cementation								
16 SS	100	9 12 13	60									
				BORING TERMINATED AT 61.5 FT. TARGET DEPTH REACHED.								

GRAPHIC LOG — N VALUE (BLOWS)



Checked By: Devin Welch	Date: 5/21/20	Approved By: Sam Jorgensen	Date: 5/29/20	Firm: Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

Westwood

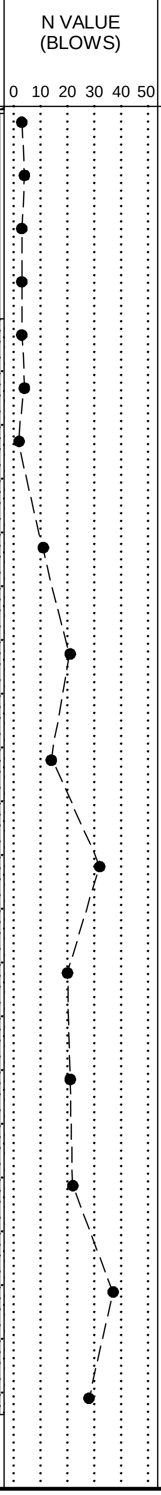
SOIL BORING LOG

BORING NO. WTG-184

Page 1 of 1

Facility/Project Name: Horse Heaven Wind Project Benton County, Washington	Boring Location: Lat: 46.090224 Long: -119.206463	Surface Elev. (ft): ---	Total Depth (ft bgs): 60.0	Borehole Dia. (in): 5.5	
Drilling Firm: Environmental West	Drilling Method: Air Rotary Autohammer SPT	Personnel: Logger - Chris Enos Driller - Brent Johnson	Date Started: 4/13/20	Date Completed: 4/13/20	Water Depth (ft bgs) DNE

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 SS	100	1 2 1		**TOPSOIL** - 2" thick, SILTY, dry **SILT (ML)** - brown, dry to damp, very loose, few sand.								Coordinates are NAD83 Datum.
2 SS	100	2 2 2										
3 SS	78	2 1 2			ML							
4 SS	94	2 1 2										
5 SS	100	2 1 2	10	**SILT w/ SAND (ML)** - light brown, dry to damp, very loose to dense.								
6 SS	83	2 2 2										
7 SS	89	2 1 1										
8 SS	100	3 4 7	20									
9 SS	100	6 9 12										
10 SS	83	5 7 7	30									
11 SS	78	17 15 17			ML			5.6				
12 SS	100	7 9 11	40									
13 SS	83	8 9 12										
14 SS	94	8 8 14	50									
15 SS	100	16 18 19										
16 SS	89	14 12 16	60									
				BORING TERMINATED AT 61.5 FT. TARGET DEPTH REACHED.								



Checked By: Devin Welch	Date: 5/21/20	Approved By: Sam Jorgensen	Date: 5/29/20	Firm: Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

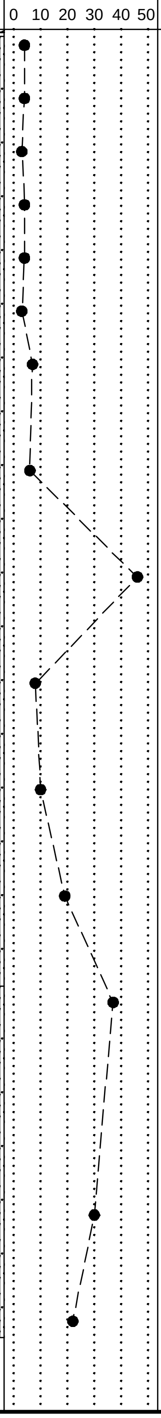
Westwood

SOIL BORING LOG

BORING NO. WTG-189

Facility/Project Name: Horse Heaven Wind Project Benton County, Washington	Boring Location: Lat: 46.070085 Long: -119.213842	Surface Elev. (ft): ---	Total Depth (ft bgs): 60.0	Borehole Dia. (in): 5.5	
Drilling Firm: Environmental West	Drilling Method: Air Rotary Autohammer SPT	Personnel: Logger - Chris Enos Driller - Brent Johnson	Date Started: 4/13/20	Date Completed: 4/14/20	Water Depth (ft bgs) DNE

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	SAMPLE BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS)	POCKET PEN (TSF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 SS	89	2 2 2		**TOPSOIL** - 2" thick, SILTY, dry **SILT w/ SAND (ML)** - light brown, dry to damp, very loose to dense.										Coordinates are NAD83 Datum.
2 SS	100	2 2 2		- brown										
3 SS	89	2 1 2		- light brown										
4 SS	100	3 2 2												
5 SS	100	2 1 3	10	- very light brown										
6 SS	100	3 2 1												
7 SS	100	2 3 4								8.2				
8 SS	100	2 2 4	20	- brown, 1" thick sand lens	ML									
9 SS	100	11 20 26		- light brown										
10 SS	83	3 4 4	30											
11 SS	100	3 4 6												
12 SS	100	6 9 10	40											
13 SS	83	18 18 19		**SANDY SILT (ML)** - very light brown, dry, medium dense to dense.										
			50		ML									
15 SS	83	13 15 15		- light brown, trace gravel										
16 SS	100	7 8 14	60											
				BORING TERMINATED AT 61.5 FT. **TARGET DEPTH REACHED.**										



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Westwood

SOIL BORING LOG

BORING NO. WTG-191

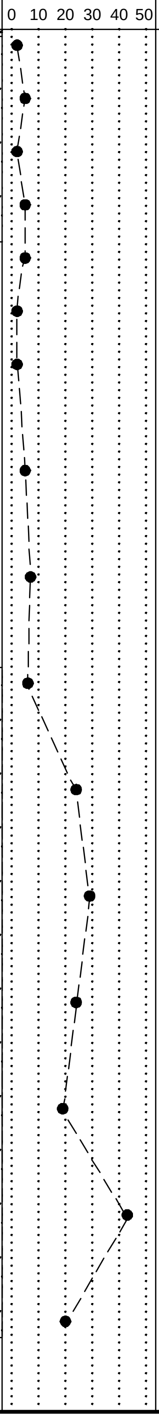
Page 1 of 1

Facility/Project Name: Horse Heaven Wind Project Benton County, Washington		Boring Location: Lat: 46.072676 Long: -119.136775	Surface Elev. (ft): ---	Total Depth (ft bgs): 60.0	Borehole Dia. (in): 5.5
Drilling Firm: Environmental West	Drilling Method: Air Rotary Autohammer SPT	Personnel: Logger - Chris Enos Driller - Brent Johnson	Date Started: 4/14/20	Date Completed: 4/15/20	Water Depth (ft bgs): DNE

DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS
0	**TOPSOIL** - 2" thick, SILTY, dry	
	SILT w/ SAND (ML) - brown to light brown, dry to damp, very loose to loose.	ML
10	**SILT (ML)** - light brown, dry to damp, very loose to loose, trace clay.	ML
30	**SILTY SAND (SM)** - light brown, dry, loose to dense. - light cementation - trace clay	SM
	BORING TERMINATED AT 61.5 FT. TARGET DEPTH REACHED.	

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	POCKET PEN (TSF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 SS	100	1 1 1							Coordinates are NAD83 Datum.
2 SS	100	2 3 2							
3 SS	100	2 1 1							
4 SS	89	2 3 2							
5 SS	100	2 2 3							
6 SS	100	2 1 1							
7 SS	100	1 1 1							
8 SS	83	2 2 3							
9 SS	100	3 3 4			5.3			98	
10 SS	100	3 2 4							
11 SS	83	9 12 12							
12 SS	78	7 10 19							
13 SS	100	15 11 13							
14 SS	94	6 8 11							
15 SS	100	21 20 23							
16 SS	83	8 9 11							

N VALUE (BLOWS)



Checked By:	Date:	Approved By:	Date:	Firm:
Devin Welch	5/21/20	Sam Jorgensen	5/29/20	Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

Westwood

SOIL BORING LOG

BORING NO. WTG-194

Page 1 of 1

Facility/Project Name: Horse Heaven Wind Project Benton County, Washington		Boring Location: Lat: 46.066068 Long: -119.117379	Surface Elev. (ft): ---	Total Depth (ft bgs): 60.0	Borehole Dia. (in): 5.5
Drilling Firm: Environmental West	Drilling Method: Air Rotary Autohammer SPT	Personnel: Logger - Chris Enos Driller - Brent Johnson	Date Started: 4/15/20	Date Completed: 4/15/20	Water Depth (ft bgs): DNE

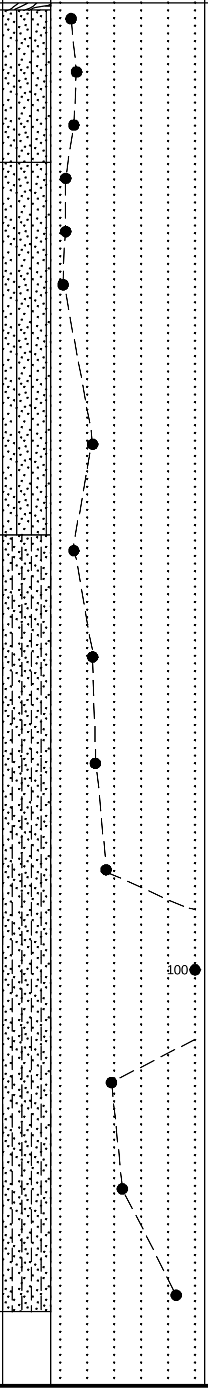
SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	MOISTURE CONTENT (%)
1 SS	100	1 2 2	
2 SS	100	3 2 4	
3 SS	89	2 2 3	
4 SS	100	0 1 1	
5 SS	83	2 1 1	9.5
6 SS	100	0 0 1	
8 SS	100	5 5 7	
9 SS	100	2 2 3	
10 SS	100	3 5 7	
11 SS	100	5 5 8	
12 SS	100	5 8 9	
13 SS	92	43 50/5	
14 SS	100	5 8 11	
15 SS	94	6 10 13	
16 SS	100	7 16 27	

DEPTH IN FEET: 10, 20, 30, 40, 50, 60

LITHOLOGIC DESCRIPTION	USCS
TOPSOIL - 4" thick, SILTY, dry	
SILT w/ SAND (ML) - brown, damp, loose.	ML
SANDY SILT (ML) - light brown, dry to damp, very loose to medium dense. - brown - light cementation	ML
SILTY SAND (SM) - light yellowish brown, dry, loose to very dense. - trace gravel - very light yellowish brown - very light brown - trace gravel	SM
BORING TERMINATED AT 61.5 FT. TARGET DEPTH REACHED.	

POCKET PEN (TSF) | COMPRESSIVE STRENGTH (TSF) | LIQUID LIMIT | PLASTICITY INDEX | P 200 (%)

COMMENTS: Coordinates are NAD83 Datum.



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Devin Welch	5/21/20	Sam Jorgensen	5/29/20	Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

Westwood

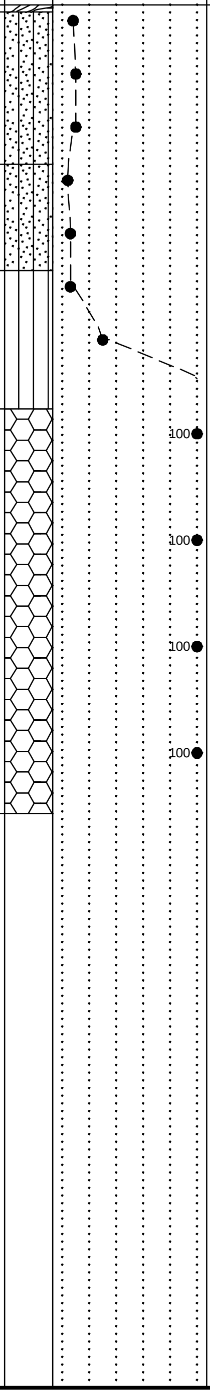
SOIL BORING LOG

BORING NO. WTG-196

Page 1 of 1

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Horse Heaven Wind Project Benton County, Washington	Lat: 46.055417 Long: -119.127289	---	60.0	5.5

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs)
Environmental West	Air Rotary Autohammer SPT	Logger - Chris Enos Driller - Brent Johnson	4/15/20	4/15/20	DNE



SAMPLE											
NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 SS	100	2 2 2		**TOPSOIL** - 2" thick, SILTY, dry								Coordinates are NAD83 Datum.
2 SS	100	2 2 3		**SILT w/ SAND (ML)** - brown, dry to damp, loose, few clay.	ML							
3 SS	100	2 3 2										
4 SS	89	0 1 1		**SANDY SILT (ML)** - light brown, dry, very loose, trace clay.								
5 SS	100	2 1 2	10		ML							
6 SS	100	2 1 2		**SILT (ML)** - brown, dry, very loose to medium dense, trace clay.				11.2			92	
7 SS	100	10 9 6			ML							
8 SS	76	50/3	20	**BASALT** - dark gray, dry, highly weathered.								
9 SS	0	50/2										
10 SS	0	50/1	30									
11 SS	0	50/1		- more competent rock								
			40	**BORING TERMINATED AT 38 FT DUE TO AUGER REFUSAL.**								
			50									
			60									

Checked By:	Date:	Approved By:	Date:	Firm:
Devin Welch	5/21/20	Sam Jorgensen	5/29/20	Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

Westwood

SOIL BORING LOG

BORING NO. WTG-204

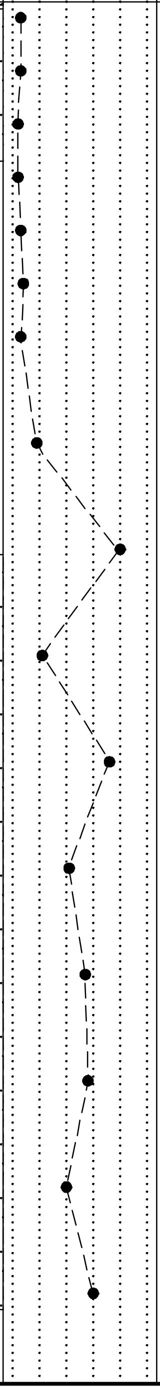
Page 1 of 1

Facility/Project Name: Horse Heaven Wind Project Benton County, Washington		Boring Location: Lat: 46.058714 Long: -119.081302	Surface Elev. (ft): ---	Total Depth (ft bgs): 60.0	Borehole Dia. (in): 5.5
Drilling Firm: Environmental West	Drilling Method: Air Rotary Autohammer SPT	Personnel: Logger - Chris Enos Driller - Brent Johnson	Date Started: 4/15/20	Date Completed: 4/16/20	Water Depth (ft bgs): DNE

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 SS	100	2 1 2		**TOPSOIL** - 2" thick, SILTY, dry **SILT w/ SAND (ML)** - brown, dry to damp, very loose to loose, trace clay.	ML							Coordinates are NAD83 Datum.
2 SS	100	2 2 1										
3 SS	83	1 1 1										
4 SS	78	2 1 1		**SILT (ML)** - light brown, dry, very loose to dense.	ML							
5 SS	100	2 1 2	10									
6 SS	100	2 2 2										
7 SS	100	2 2 1										
8 SS	94	2 2 7	20	- brown								
9 SS	100	12 18 22		- light brown **SILTY SAND (SM)** - light yellowish brown, dry, medium dense to dense.	SM			8.5			93	
10 SS	100	3 5 6	30									
11 SS	100	10 15 21										
12 SS	67	9 9 12	40									
13 SS	83	8 12 15		- light brown								
14 SS	100	10 10 18	50	- few gravel								
15 SS	89	8 9 11										
16 SS	100	11 13 17	60									
				BORING TERMINATED AT 61.5 FT. **TARGET DEPTH REACHED.**								

GRAPHIC LOG

N VALUE (BLOWS)



Checked By:	Date:	Approved By:	Date:	Firm:
Devin Welch	5/21/20	Sam Jorgensen	5/29/20	Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

Westwood

SOIL BORING LOG

BORING NO. WTG-211

Page 1 of 1

Facility/Project Name: Horse Heaven Wind Project Benton County, Washington		Boring Location: Lat: 46.061981 Long: -119.061421	Surface Elev. (ft): ---	Total Depth (ft bgs): 60.0	Borehole Dia. (in): 5.5
Drilling Firm: Environmental West	Drilling Method: Air Rotary Autohammer SPT	Personnel: Logger - Chris Enos Driller - Brent Johnson	Date Started: 4/16/20	Date Completed: 4/16/20	Water Depth (ft bgs): DNE

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	SAMPLE BLOW COUNTS	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)
1 SS	100	1 2 2	10.1	NC	NP	86
2 SS	100	1 1 4	4.5			83
3 SS	100	3 3 3				
4 SS	100	1 2 2				
5 SS	89	2 2 2				
6 SS	100	3 4 3				
7 SS	83	2 2 2				
8 SS	100	2 4 4				
9 SS	94	14 17 14				
10 SS	89	5 5 7				
11 SS	100	5 7 9				
12 SS	94	5 6 7				
13 SS	100	15 20 24				
14 SS	73	25 50/5				
15 SS	72	9 11 13				
16 SS	100	10 13 20				

DEPTH IN FEET: 10, 20, 30, 40, 50, 60

LITHOLOGIC DESCRIPTION

TOPSOIL - 3" thick, SILTY, dry

SILT w/ SAND (ML) - brown, dry to damp, loose to very dense.

- light brown

-trace clay

- brown

-few clay

- light brown

- light cementation

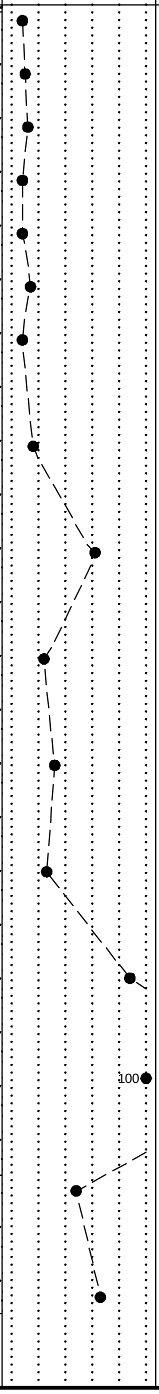
- few gravel

SANDY SILT (ML) - light brown, dry, medium dense to dense, few gravel.

BORING TERMINATED AT 61.5 FT. TARGET DEPTH REACHED.

USCS: ML (SILT w/ SAND); ML (SANDY SILT)

COMMENTS: Coordinates are NAD83 Datum.



Checked By: Devin Welch	Date: 5/21/20	Approved By: Sam Jorgensen	Date: 5/29/20	Firm: Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

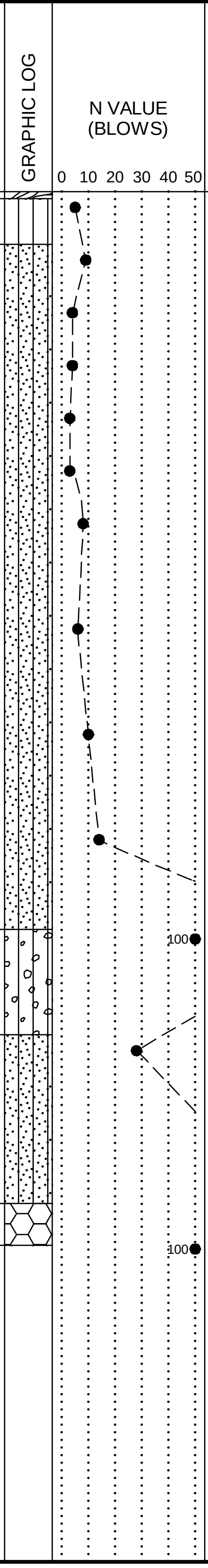
Westwood

SOIL BORING LOG

BORING NO. WTG-223

Facility/Project Name: Horse Heaven Wind Project Benton County, Washington		Boring Location: Lat: 46.090871 Long: -119.031283	Surface Elev. (ft): ---	Total Depth (ft bgs): 60.0	Borehole Dia. (in): 5.5
Drilling Firm: Environmental West	Drilling Method: Air Rotary Autohammer SPT	Personnel: Logger - Chris Enos Driller - Brent Johnson	Date Started: 4/16/20	Date Completed: 4/16/20	Water Depth (ft bgs) DNE

SAMPLE												
NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	POCKET PEN (TSF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 SS	100	2 2 3		**TOPSOIL** - 3" thick, SILTY, dry **SILT (ML)** - brown, dry, loose.	ML							Coordinates are NAD83 Datum.
2 SS	83	3 4 5		**SILT w/ SAND (ML)** - brown, dry, very loose to medium dense. - light brown	ML							
3 SS	89	2 2 2										
4 SS	100	2 1 3										
5 SS	89	2 1 2	10									
6 SS	100	0 1 2										
7 SS	100	3 3 5		-trace clay								
8 SS	100	3 2 4	20	- light yellowish brown				7.9				
9 SS	100	4 4 6										
10 SS	100	6 5 9	30									
11 SS	92	19 50/5		**SILT w/ GRAVEL (ML)** - light yellowish brown, dry, very dense, few sand.	ML							
12 SS	67	14 13 15	40	**SANDY SILT (ML)** - very light brown, dry, medium dense, trace gravel.	ML							
				BASALT - dark gray, dry, highly weathered.								
14 SS	0	50/1	50	**BORING TERMINATED AT 50 FT DUE TO AUGER REFUSAL.**								
			60									



Checked By: Devin Welch	Date: 5/21/20	Approved By: Sam Jorgensen	Date: 5/29/20	Firm: Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

Westwood

SOIL BORING LOG

BORING NO. WTG-225

Page 1 of 1

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Horse Heaven Wind Project Benton County, Washington	Lat: 46.093655 Long: -119.018966	---	35.0	5.5

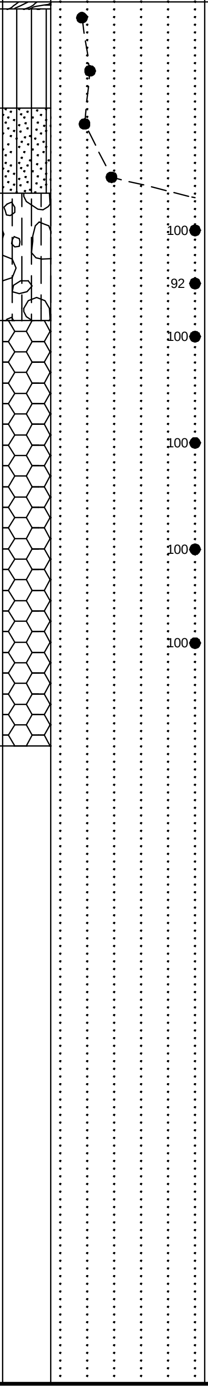
Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs)
Environmental West	Air Rotary + NQ Coring Autohammer SPT	Logger - Chris Enos Driller - Brent Johnson	4/16/20	4/17/20	DNE

SAMPLE NUMBER AND TYPE	RECOVERY (%) (RQD)	BLOW COUNTS	MOISTURE CONTENT (%)	P 200 (%)
1 SS	100	5 3 5		
2 SS	100	4 5 6		
3 SS	89	4 5 4	6.9	80
4 SS	72	7 5 14		
5 SS	67	31 37 50/4		
6 SS	100	31 43 49		
7 SS	0	50/1		
8 SS	0	50/1		
9 SS	0	50/1		
10 SS	0	50/0		
11 RC	80 (20)			

DEPTH IN FEET: 10, 20, 30, 40, 50, 60

LITHOLOGIC DESCRIPTION	USCS
TOPSOIL - 4" thick, SILTY, dry	
SILT (ML) - brown, dry, loose to medium dense. - light brown	ML
SILT w/ SAND (ML) - light brown, dry, loose to medium dense, 3" gravel lens.	ML
POORLY GRADED GRAVEL w/ SILT (GP-GM) - light brown, dry, very dense. - 2" thick white chalky inclusion - highly decomposed 4" thick saprolite inclusion	GP-GM
BASALT - dark gray, dry, highly weathered. - gray to dark gray, moderately weathered, moderately to highly fractured, alternating layers of sound, fresh rock and decomposed rock.	
BORING TERMINATED AT 35 FT. TARGET DEPTH REACHED.	

POCKET PEN (TSF) | COMPRESSIVE STRENGTH (TSF) | LIQUID LIMIT | PLASTICITY INDEX



COMMENTS: Coordinates are NAD83 Datum.

Checked By:	Date:	Approved By:	Date:	Firm:
Devin Welch	5/21/20	Sam Jorgensen	5/29/20	Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

Westwood

SOIL BORING LOG

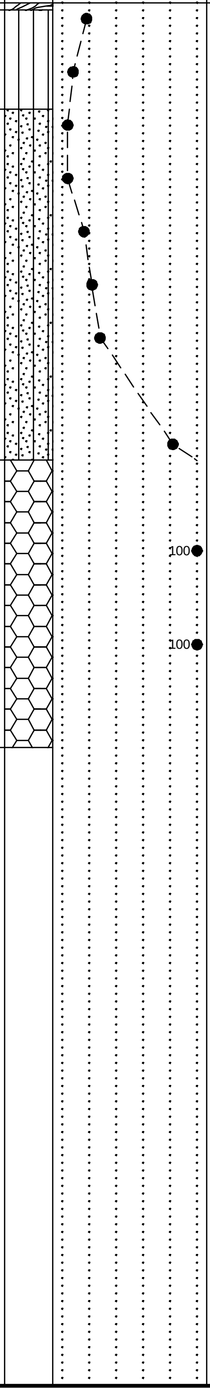
BORING NO. WTG-229

Page 1 of 1

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Horse Heaven Wind Project Benton County, Washington	Lat: 46.105158 Long: -119.030056	---	60.0	5.5

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs)
Environmental West	Air Rotary Autohammer SPT	Logger - Chris Enos Driller - Brent Johnson	4/17/20	4/17/20	DNE

SAMPLE														
NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS)	POCKET PEN (TSF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 SS	100	3 4 5		**TOPSOIL** - 4" thick, SILTY, dry **SILT (ML)** - light brown, dry to damp, loose, few sand.	ML									Coordinates are NAD83 Datum.
2 SS	83	3 2 2												
3 SS	100	0 1 1		**SILT w/ SAND (ML)** - light brown, dry, very loose to medium dense.										
4 SS	89	1 1 1												
5 SS	100	5 3 5	10	- light yellowish brown										
6 SS	100	2 4 7			ML					10.2				
7 SS	100	6 7 7												
8 SS	100	4 7 34	20	**BASALT** - dark gray, dry, highly weathered.										
9 SS	0	50/1.5												
10 SS	0	50/0.5	30											
				BORING TERMINATED AT 35 FT. **TARGET DEPTH REACHED.**										
			40											
			50											
			60											



Checked By:	Date:	Approved By:	Date:	Firm:
Devin Welch	5/21/20	Sam Jorgensen	5/29/20	Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

Westwood

SOIL BORING LOG

BORING NO. WTG-235

Facility/Project Name:	Boring Location:	Surface Elev. (ft):	Total Depth (ft bgs):	Borehole Dia. (in):
Horse Heaven Wind Project Benton County, Washington	Lat: 46.102906 Long: -119.04385	---	30.0	5.5

Drilling Firm:	Drilling Method:	Personnel:	Date Started:	Date Completed:	Water Depth (ft bgs)
Environmental West	Air Rotary + NQ Coring Autohammer SPT	Logger - Chris Enos Driller - Brent Johnson	4/17/20	4/17/20	DNE

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%) (RQD)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	N VALUE (BLOWS) 0 10 20 30 40 50	POCKET PEN (TSF)	COMPRESSIVE STRENGTH (TSF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTICITY INDEX	P 200 (%)	COMMENTS
1 SS	100	3 2 5		**TOPSOIL** - 3" thick, SILTY, dry **SILT (ML)** - light brown, dry, loose, few sand.	ML		●			5.0			87	Coordinates are NAD83 Datum.
3 SS	0	50/1		**BASALT** - dark gray, dry, highly weathered.			100●							
4 SS	0	50/1.5					100●							
5 SS	0	50/1	10				100●							
6 SS	0	50/1		- decomposed rock from 13' to 15'			100●							
7 SS	0	50/1					100●							
			20	- gray to dark gray, moderately to highly weathered, moderately to extremely fractured, alternating layers of sound, fresh rock and decomposed rock.										
8 RC	40 (0)													
9 RC	83 (7)													
			30	**BORING TERMINATED AT 30 FT. TARGET DEPTH REACHED.**										
			40											
			50											
			60											

Checked By:	Date:	Approved By:	Date:	Firm:
Devin Welch	5/21/20	Sam Jorgensen	5/29/20	Westwood Professional Services (608) 821-6600 1800 Deming Way Suite 102 Middleton, WI 53562 Middleton, WI, 53562

Appendix B

Laboratory Testing Report

ENGINEERING
ARCHITECTURE
ENVIRONMENTAL

OMNNI
ASSOCIATES
a Westwood company

ONE SYSTEMS DRIVE
APPLETON, WI 54914-1654
1-800-571-6677
920-735-6900
FAX 920-830-6100

L

LABORATORY TESTS OF SOILS

ASTM: D2216, D4318, D6913

Project: Horse Heaven Wind Project; Prelim Turbine Geotech - Benton County , WA

Report To: Scout Clean Energy **Date:** 5/4/2020

Westwood Prj. No. R0020776.01, Phase 8210, Task 8211

Date Delivered: 4/27/2020

			Moisture	Atterberg Limits*			Percent Passing				
Boring	**Depth**	**Sample**	**Content**	**LL**	**PL**	**PI**	**#4**	**#10**	**#40**	**#100**	**#200**
SS-01	12.5' - 14'	6	2.0%				100	100	100	98	87
T-110	5' - 6.5'	3	13.7%								
T-123	10' - 11.5'	5	6.1%				100	100	100	100	98
T-141	7.5' - 9'	4	10.6%				100	100	100	100	97
T-153	20' - 21.5'	8	9.0%								
T-180	2.5' - 4'	2	15.0%	NC	NP	NP					
T-184	35' - 40'	11	5.6%								
T-189	15' - 16.5'	7	8.2%								
T-191	25' - 26.5'	9	5.3%				100	100	100	100	98
T-194	10' - 11.5'	5	9.5%								
T-196	12.5' - 14'	6	11.2%				100	100	99	98	92
T-204	25' - 26.5'	9	8.5%				100	100	100	98	93
T-211	0' - 1.5'	1	10.1%	NC	NP	NP	100	100	100	98	86
T-223	20' - 21.5'	8	7.9%								
T-225	5' - 6.5'	3	6.9%				100	99	96	91	80
T-229	12.5' - 14'	6	10.2%								
T-235	0' - 1.5'	1	5.0%								

* NC = Non-cohesive NP = Non-plastic

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920-735-6900
FAX 920-830-6100

REPORT OF: LABORATORY TESTS OF SOILS

Project: Horse Heaven Wind Project; Prelim Turbine
Geotech - Benton County , WA
Report To: Scout Clean Energy **Date:** 5/7/2020

Westwood Prj. No. R0020776.01, Phase 8210, Task 8211
Date Delivered: 4/27/2020
Tests Performed: Grain Size Analysis

Boring No.	SS-01	T235
Sample No.	Bulk	Bulk
Depth	1-4'	1-4'
USCS Classification:	SILT w/ SAND, dark brown (ML)	SILT w/ SAND, dark brown (ML)
USDA/ NRCS Classification:	Sandy Loam	Loam

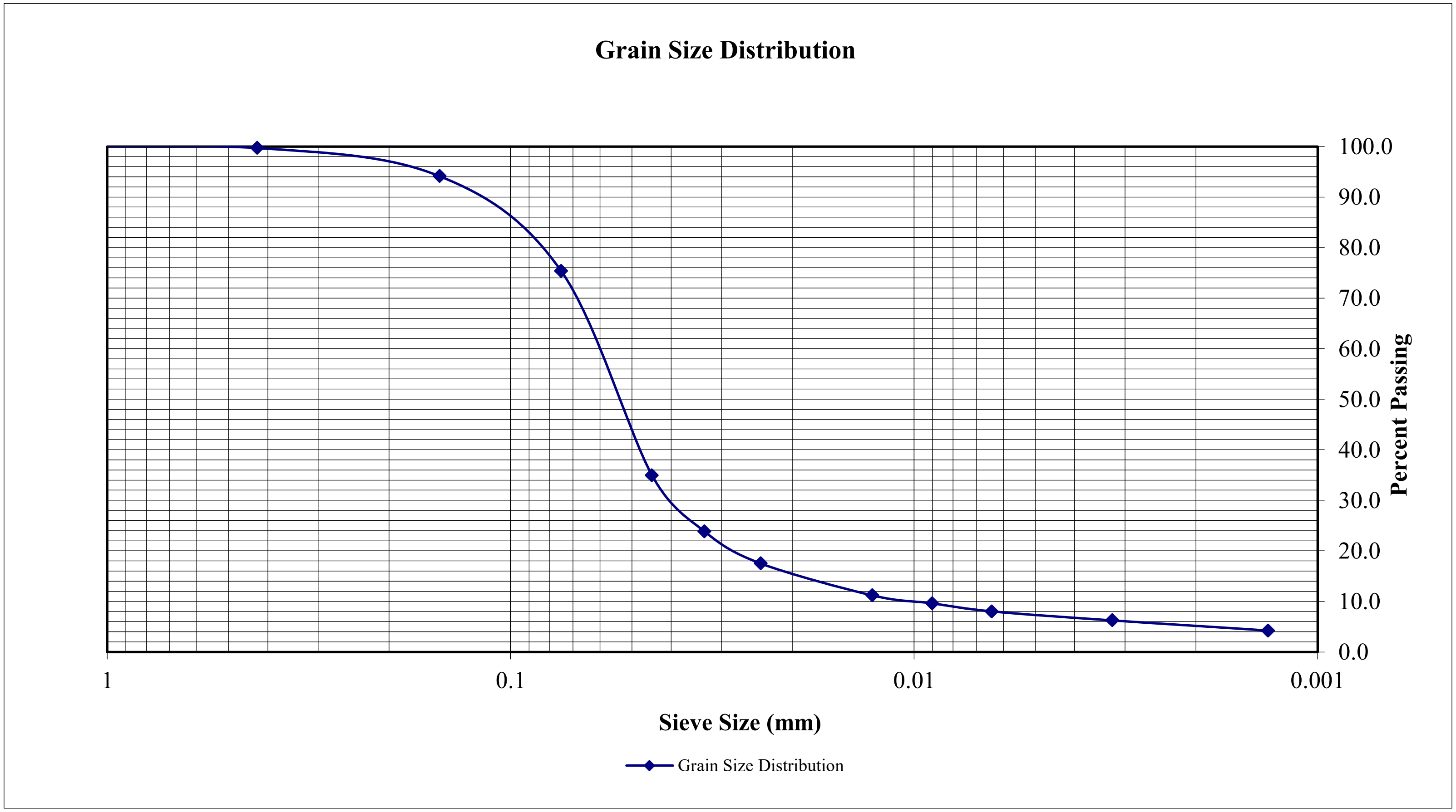
TEST RESULTS;

Grain Size Analysis (ASTM:D6913 & D7928)

SIEVE SIZE	% PASSING	
#10 (2.0 mm)	100	100
#40 (.425 mm)	100	99
#100 (.15 mm)	94	96
#200 (.075 mm)	75	82
.050 mm	42.1	49.0
.020 mm	15.3	21.7
.005 mm	7.3	9.7
.002 mm	4.8	6.5

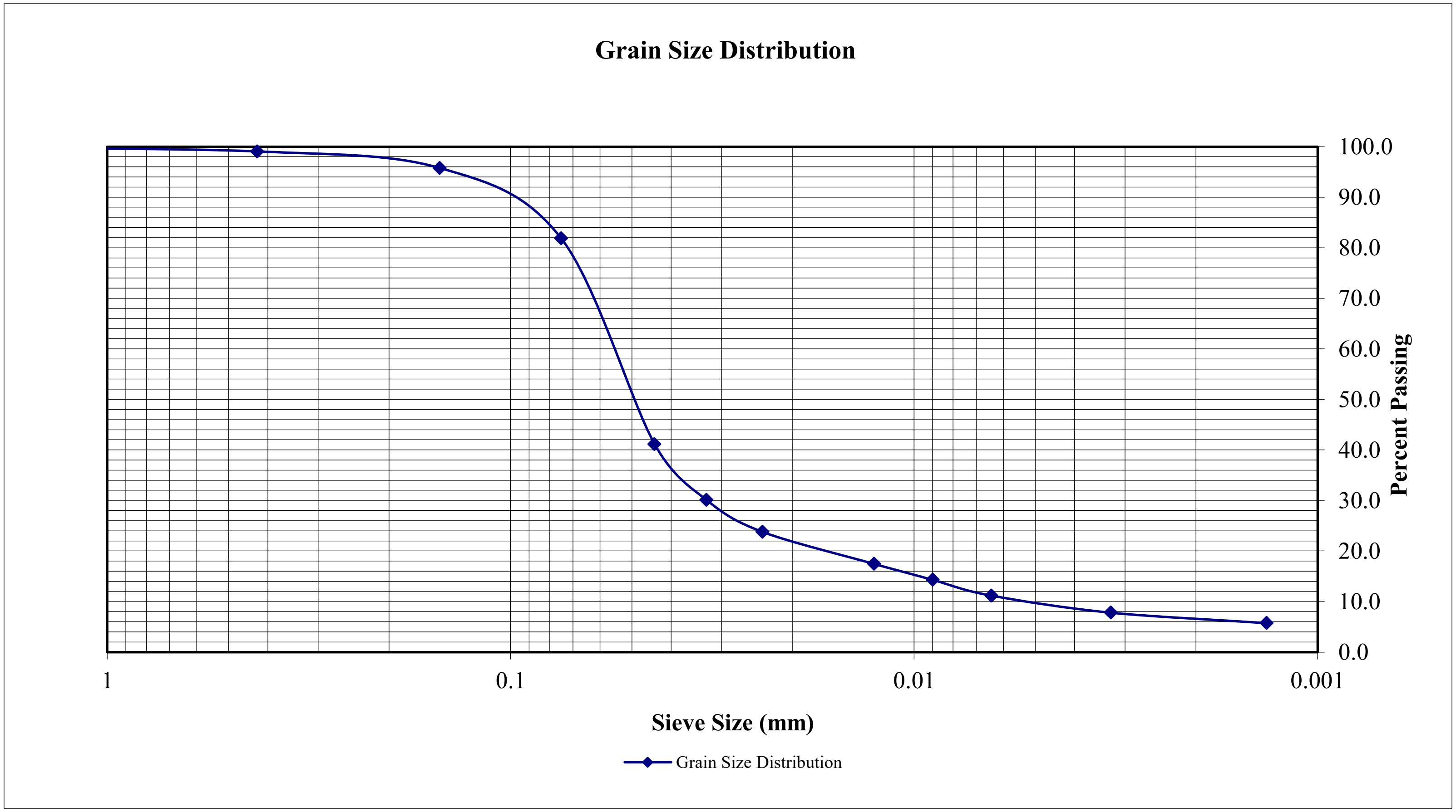
Project: Horse Heaven Wind Project; Prelim Turbine Geotech - Benton County , WA
Report To: Scout Clean Energy **Date:** 5/7/2020
Westwood Prj. No. R0020776.01, Phase 8210, Task 8211

Boring No. SS-01
Sample No. Bulk
Depth 1-4'



Project: Horse Heaven Wind Project; Prelim Turbine Geotech - Benton County , WA
Report To: Scout Clean Energy **Date:** 5/7/2020
Westwood Prj. No. R0020776.01, Phase 8210, Task 8211

Boring No. T235
Sample No. Bulk
Depth 1-4'



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APPLETON, WI 54914-1654
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FAX 920-830-6100

REPORT OF: LABORATORY TESTS OF SOILS

Project: Horse Heaven Wind Project; Prelim Turbine Geotech -
Benton County , WA

Report To: Scout Clean Energy **Date:** 4/22/2020

Westwood Prj. No.	R0020776.01, Phase 8210, Task 8211
Date Delivered:	4/14/2020
Tests Performed:	Grain Size Analysis

Boring No.	B-T141
Sample No.	Bulk
Depth	1' - 3'
USCS Classification:	SILT, brown (ML)
USDA/ NRCS Classification:	Sandy Loam

TEST RESULTS;

Grain Size Analysis (ASTM:D6913 & D7928)

SIEVE SIZE	% PASSING
#4 (.475 mm)	100
#10 (2.0 mm)	100
#40 (.425 mm)	100
#100 (.15 mm)	98
#200 (.075 mm)	89
.050 mm	62.2
.020 mm	27.1
.005 mm	7.8
.002 mm	4.8

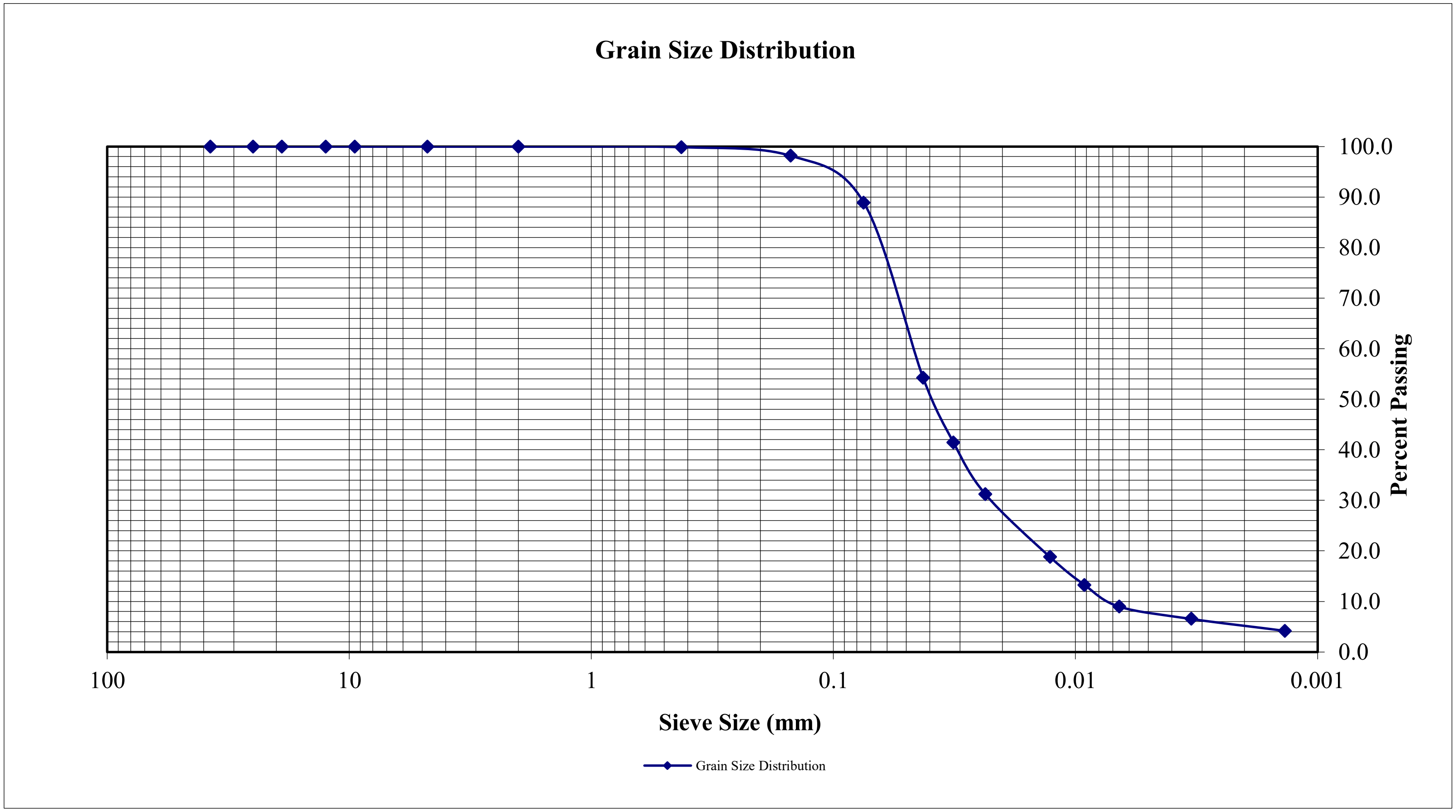
Atterberg Limits (ASTM: D4318)

Liquid Limit, LL (%)	NC
Plastic Limit, PL (%)	NP
Platicity Index (%)	NP

* NC = Non-cohesive NP = Non-plastic

Project: Horse Heaven Wind Project; Prelim Turbine Geotech - Benton County , WA
Report To: Scout Clean Energy **Date:** 4/22/2020
Westwood Prj. No. R0020776.01, Phase 8210, Task 8211

Boring No. B-T141
Sample No. Bulk
Depth 1' - 3'



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LABORATORY TESTS OF SOILS

ASTM: G187, D4972

Project: Horse Heaven Wind Project; Prelim Turbine Geotech - Benton County , WA
Report To: Scout Clean Energy **Date:** 5/6/2020

Westwood Prj. No. R0020776.01, Phase 8210, Task 8211
Date Delivered: 4/27/2020

			Electrical Resistivity								
			As-Received				Saturated				
Boring	**Depth**	**Sample**	**Moist%**	**Temp. °C**	**Resistance (Ohms)**	**Resistivity (Ohms-cm)***	**Moist%**	**Temp. °C**	**Resistance (Ohms)**	**Resistivity (Ohms-cm)***	**pH**
SS-01	12.5' - 14'	6	2.0	23.1	385,000	256,700	24.4	23.2	3,100	2,100	8.2
T153	20' - 21.5'	8	9.0	23.0	24,000	16,000	24.8	24.3	3,800	2,500	8.3
T184	35' - 40'	11	5.6	23.6	96,500	64,300	26.8	24.3	5,700	3,800	8.1
T-194	10'-11.5'	5	9.5	23.6	28,000	18,700	25.3	24.3	4,300	2,900	9.0
T-223	20' - 21.5'	8	7.9	23.9	22,000	14,700	27.7	24.3	3,100	2,100	8.3

* Soil box factor = 0.67

MOISTURE-DENSITY CURVE

Project: Horse Heaven Wind Project; Prelim Turbine Geotech - Benton County , WA

Westwood Prj. No.: R0020776.01, Phase 8210, Task 8211

Report To: Scout Clean Energy

Date: 4/22/2020

Boring Number: B-T141 **Depth:** 1' - 3'

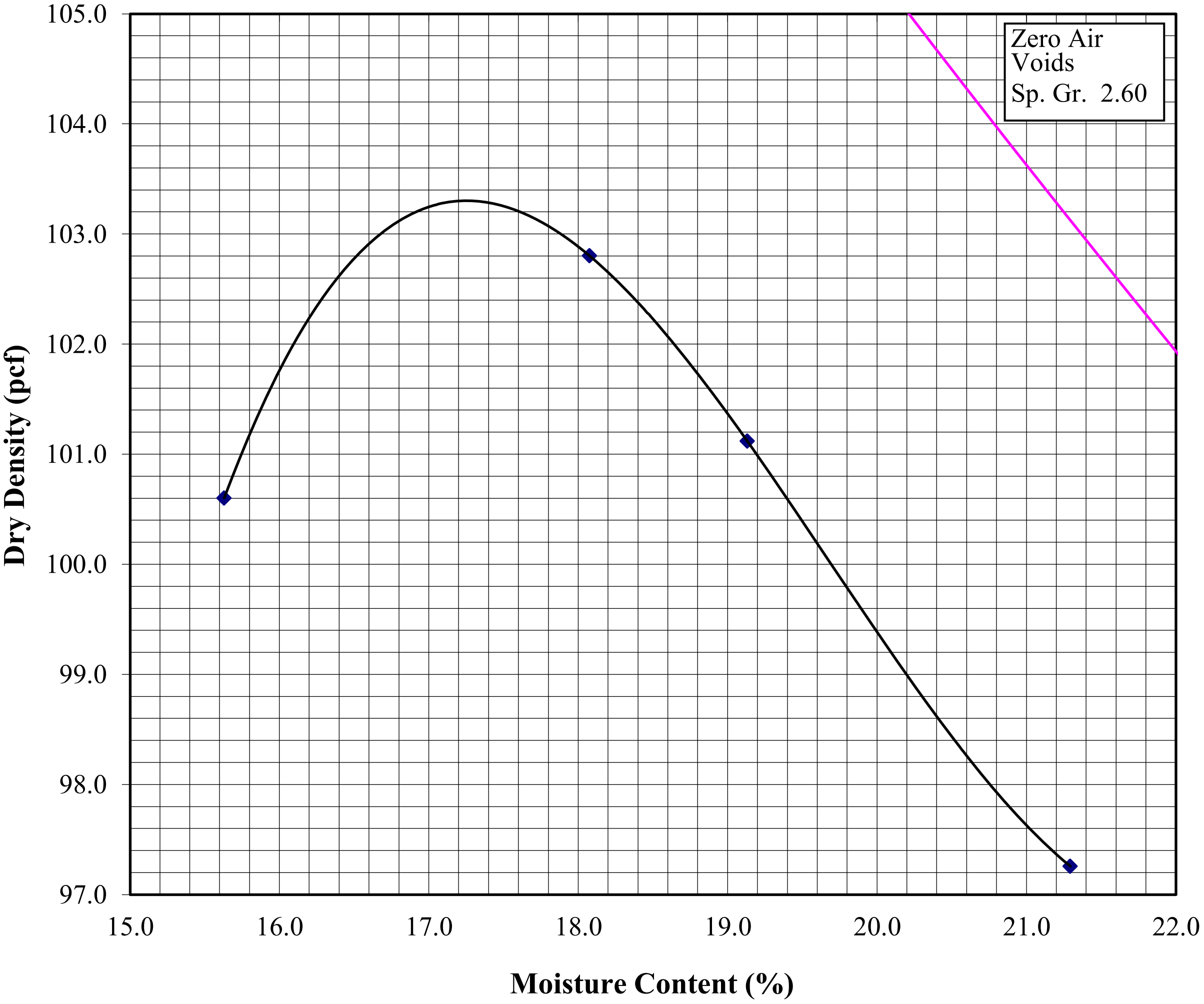
Unified Soils Classification (ASTM:D2487): SILT, brown (ML)

Tests Method: ASTM:D698, Method B

Preparation: Wet **Manual Hammer**

Max. Dry Density (pcf): 103.1 **Optimum Moisture (%):** 17.3

As-received Moisture (%): 11.5



Reviewed By: ______________________

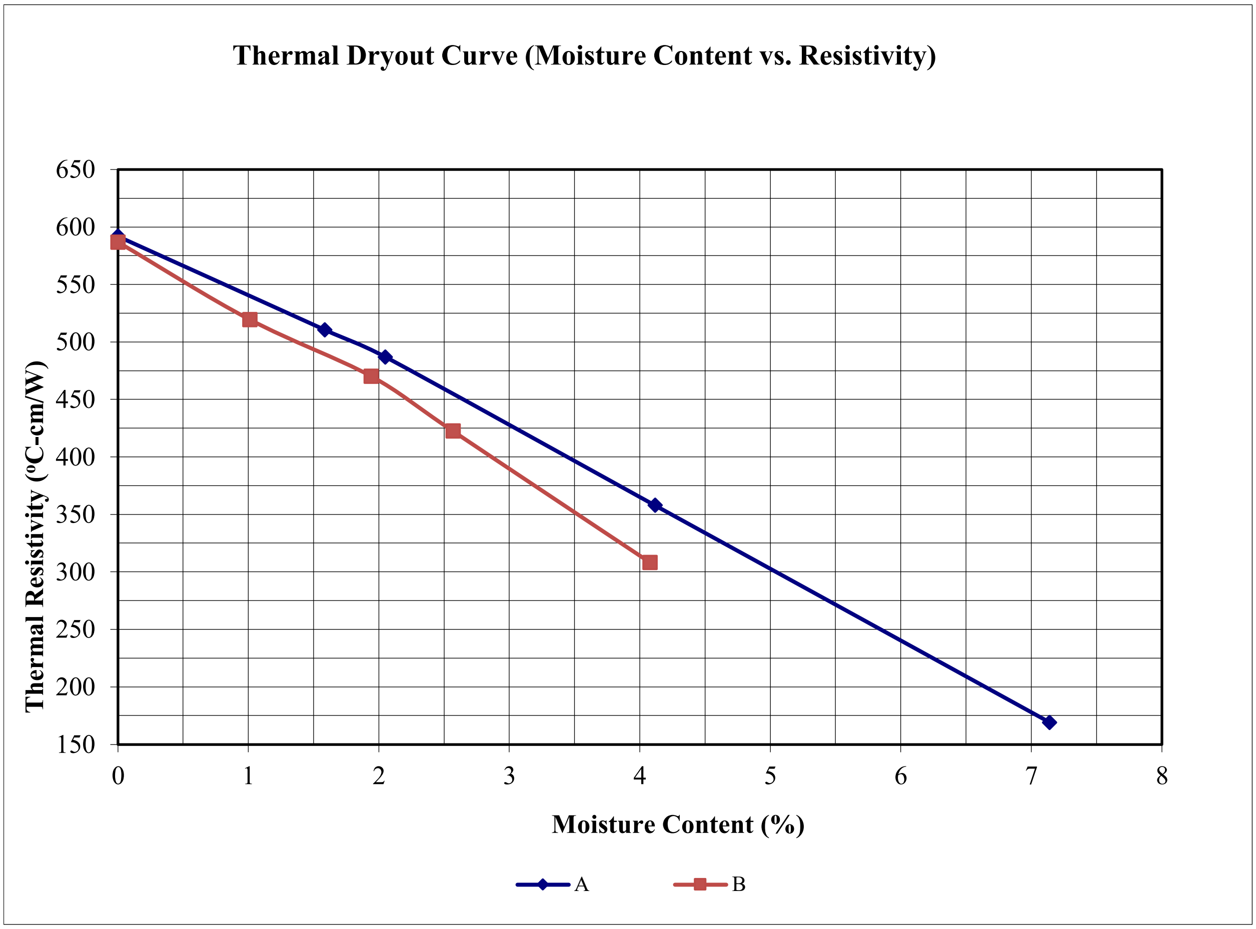
Paul R. Eggen

Project: Horse Heaven Wind Project; Prelim Turbine Geotech - Benton County , WA

Report To: Scout Clean Energy

Westwood Project No. R0020776.01, Phase 8210, Task 8211 **Date:** 5/15/2020

					Initial Condition			Thermal Resistivity Results	
Reconstiuted Specimen	**Boring**	**Depth**	**Soil Type**	**Proctor Method**	**Sample Comp. (%)**	**Dry Density (pcf)**	**Moisture Content (%)**	**Moisture (%)**	**Thermal Resistivity (°C-cm/W)**
A	SS-01	1-4'	ML	ASTM: D698, B	90	84.5	7.1	0	592
								1.6	511
								2.0	487
								4.1	358
								7.1	169
B	T-235	1-4'	ML	ASTM: D698, B	90	88.9	4.1	0	587
								1.0	519
								1.9	470
								2.6	422
								4.1	308


Thermal Dryout Curve (Moisture Content vs. Resistivity)

MOISTURE-DENSITY CURVE

Project: Horse Heaven Wind Project; Prelim Turbine Geotech - Benton County , WA

Westwood Prj. No.: R0020776.01, Phase 8210, Task

Report To: Scout Clean Energy

Date: 5/4/2020

Boring Number: SS-01 **Depth:** 1-4'

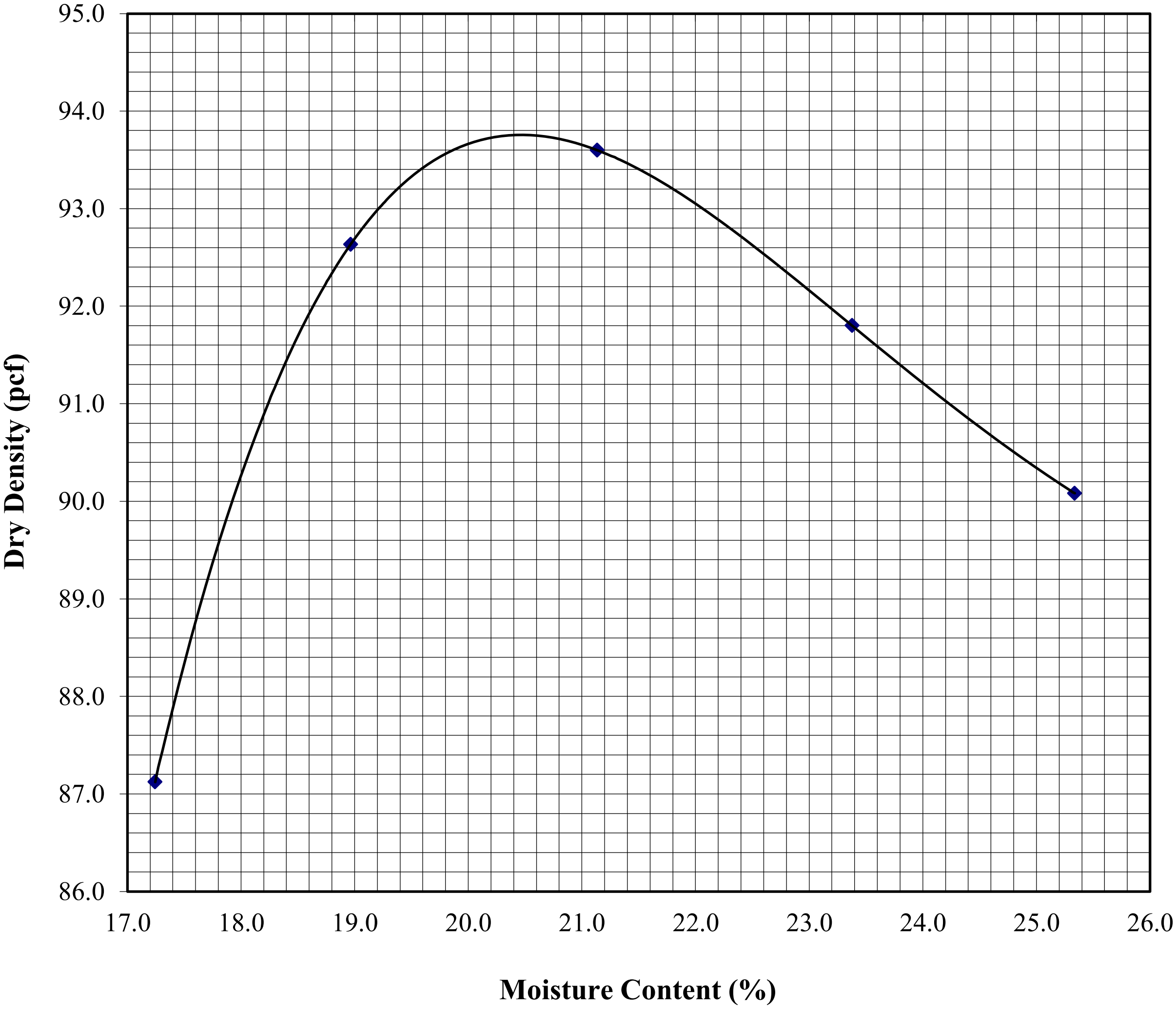
Unified Soils Classification (ASTM:D2487): SILT w/ SAND, dark brown (ML)

Tests Method: ASTM:D698, Method B

Preparation: Wet **Manual Hammer**

Max. Dry Density (pcf): 93.8 **Optimum Moisture (%):** 20.4

As-received Moisture (%): 7.9



Reviewed By: ______________________

Paul R. Eggen

OMNNI ASSOCIATES
a Westwood company

MOISTURE-DENSITY CURVE

Project: Horse Heaven Wind Project; Prelim Turbine Geotech - Benton County , WA

Westwood Prj. No.: R0020776.01, Phase 8210, Task 8211

Report To: Scout Clean Energy

Date: 5/4/2020

Boring Number: T-235 **Depth:** 1-4'

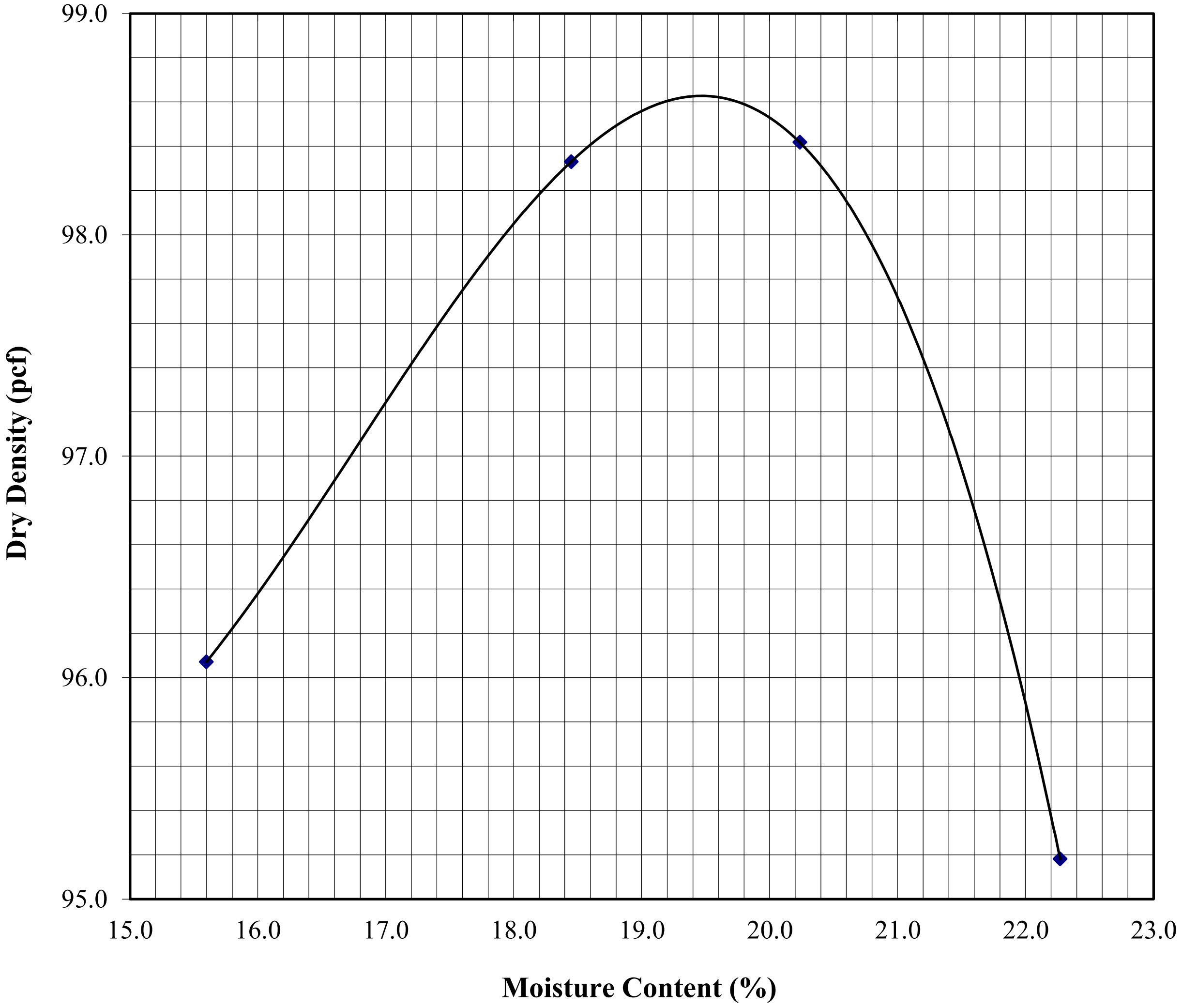
Unified Soils Classification (ASTM:D2487): SILT w/ SAND, dark brown (ML)

Tests Method: ASTM:D698, Method B

Preparation: Wet **Manual Hammer**

Max. Dry Density (pcf): 98.6 **Optimum Moisture (%):** 19.5

As-received Moisture (%): 4.5



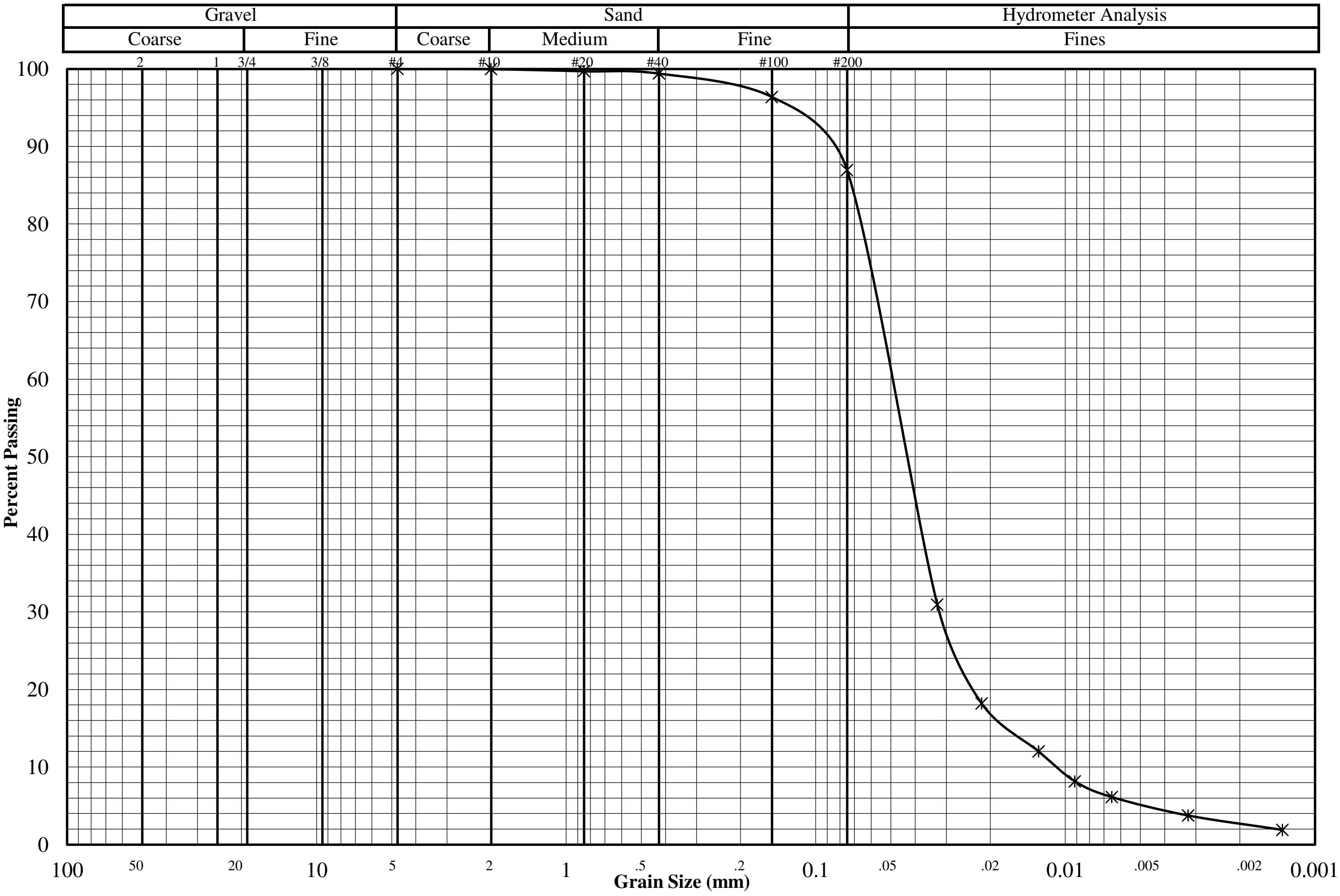
Reviewed By: ______________________

Paul R. Eggen

Grain Size Distribution ASTM D422

Project:	Horse Heaven	**Job No. :**	**12516**
		Test Date:	4/30/20
Reported To:	Westwood Surveying & Engineering	**Report Date:**	5/6/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
∗	T-211		1-4	Bulk	Silt (ML)
●					
◇					



Other Tests

	∗	●	◇
Liquid Limit			
Plastic Limit			
Plasticity Index			
Water Content	9.8		
Dry Density (pcf)			
Specific Gravity	2.68*		
Porosity			
Organic Content			
pH			
Shrinkage Limit			
Penetrometer			
Qu (psf)			

(* = assumed)

Percent Passing

	∗	●	◇
Mass (g)	16242.0		
2"			
1.5"			
1"			
3/4"			
3/8"			
#4	100.0		
#10	100.0		
#20	99.7		
#40	99.4		
#100	96.4		
#200	86.9		

	∗	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

Grain Size Distribution ASTM D422

Job No. : **12516**

Project:	Horse Heaven	Test Date:	4/30/20
Reported To:	Westwood Surveying & Engineering	Report Date:	5/6/20

	Location / Boring No.	Sample No.	Depth (ft)	Sample Type	Soil Classification
Spec 1	T-211		1-4	Bulk	Silt (ML)
Spec 2					
Spec 3					

Sieve Data

Specimen 1		Specimen 2		Specimen 3	
Sieve	% Passing	Sieve	% Passing	Sieve	% Passing
2"		2"		2"	
1.5"		1.5"		1.5"	
1"		1"		1"	
3/4"		3/4"		3/4"	
3/8"		3/8"		3/8"	
#4	100.0	#4		#4	
#10	100.0	#10		#10	
#20	99.7	#20		#20	
#40	99.4	#40		#40	
#100	96.4	#100		#100	
#200	86.9	#200		#200	

Hydrometer Data

Specimen 1		Specimen 2		Specimen 3	
Diameter (mm)	% Passing	Diameter	% Passing	Diameter	% Passing
0.033	30.9				
0.022	18.2				
0.013	12.0				
0.009	8.2				
0.007	6.1				
0.003	3.8				
0.001	1.9				

Remarks

Specimen 1	Specimen 2	Specimen 3

Moisture Density Curve ASTM: D698, Method B

Project: **Horse Heaven** Date: **5/4/20**

Client: **Westwood Surveying & Engineering** Job No. **12516**

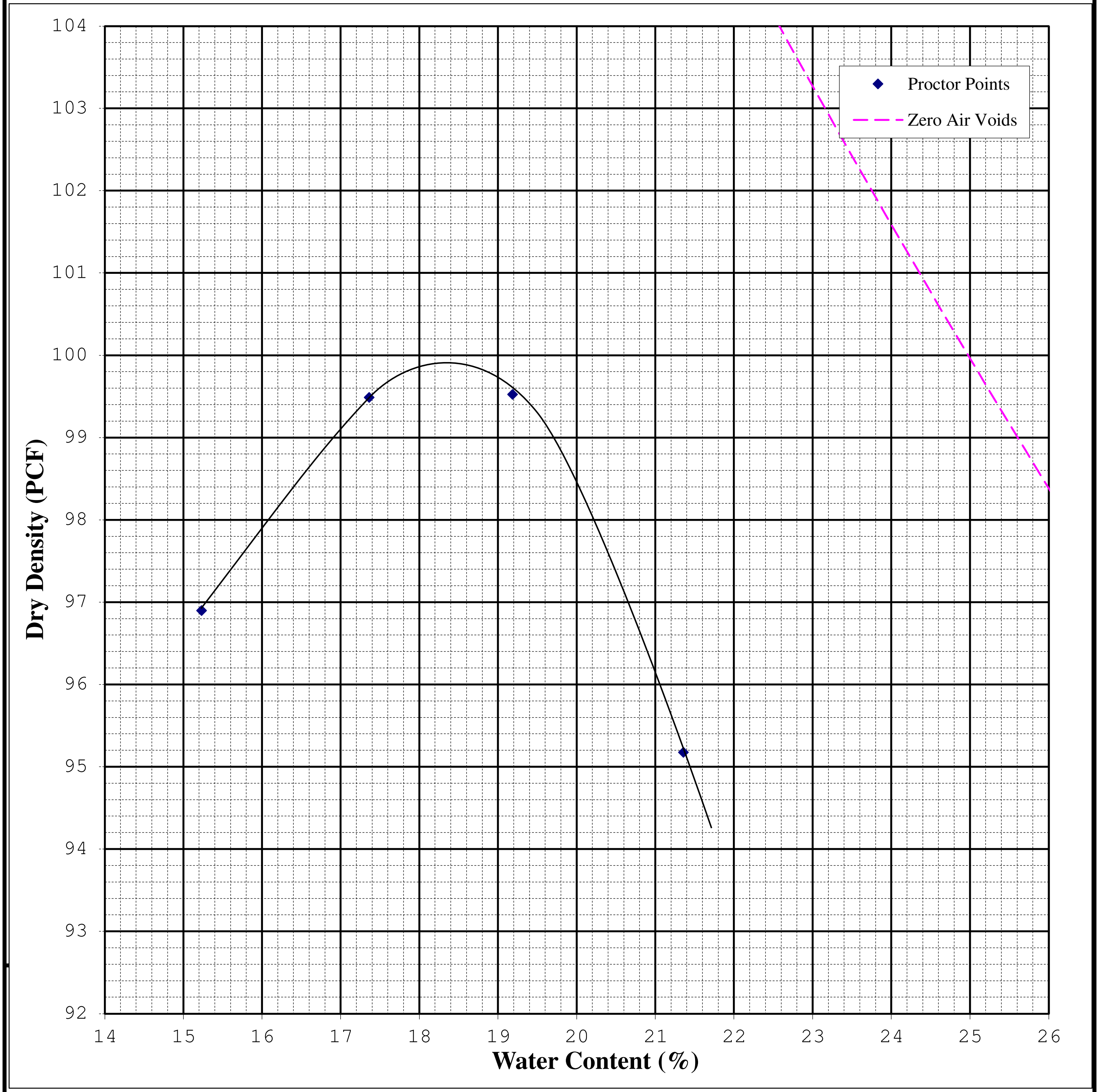
Boring No. **T-211** Sample: Depth(ft): **1-4** Location:

Soil Type: **Silt (ML)**

As Received W.C. (%): **9.8** LL: PL: PI: Specific Gravity: **2.67** *Assumed

◆ △ ◆ △

Maximum Dry Density (pcf): **99.9** ______ Opt. Water Content (%): **18.3** ______



9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

SET-R18a

California Bearing Ratio ASTM:D1883

Project:	Horse Heaven	Job:	**12516**
Client:	Westwood Surveying & Engineering	Date:	5/13/20

Boring #: T-211
Sample:
Depth (ft): 1-4 Type: Bulk
Location:
Classification: Silt (ML)

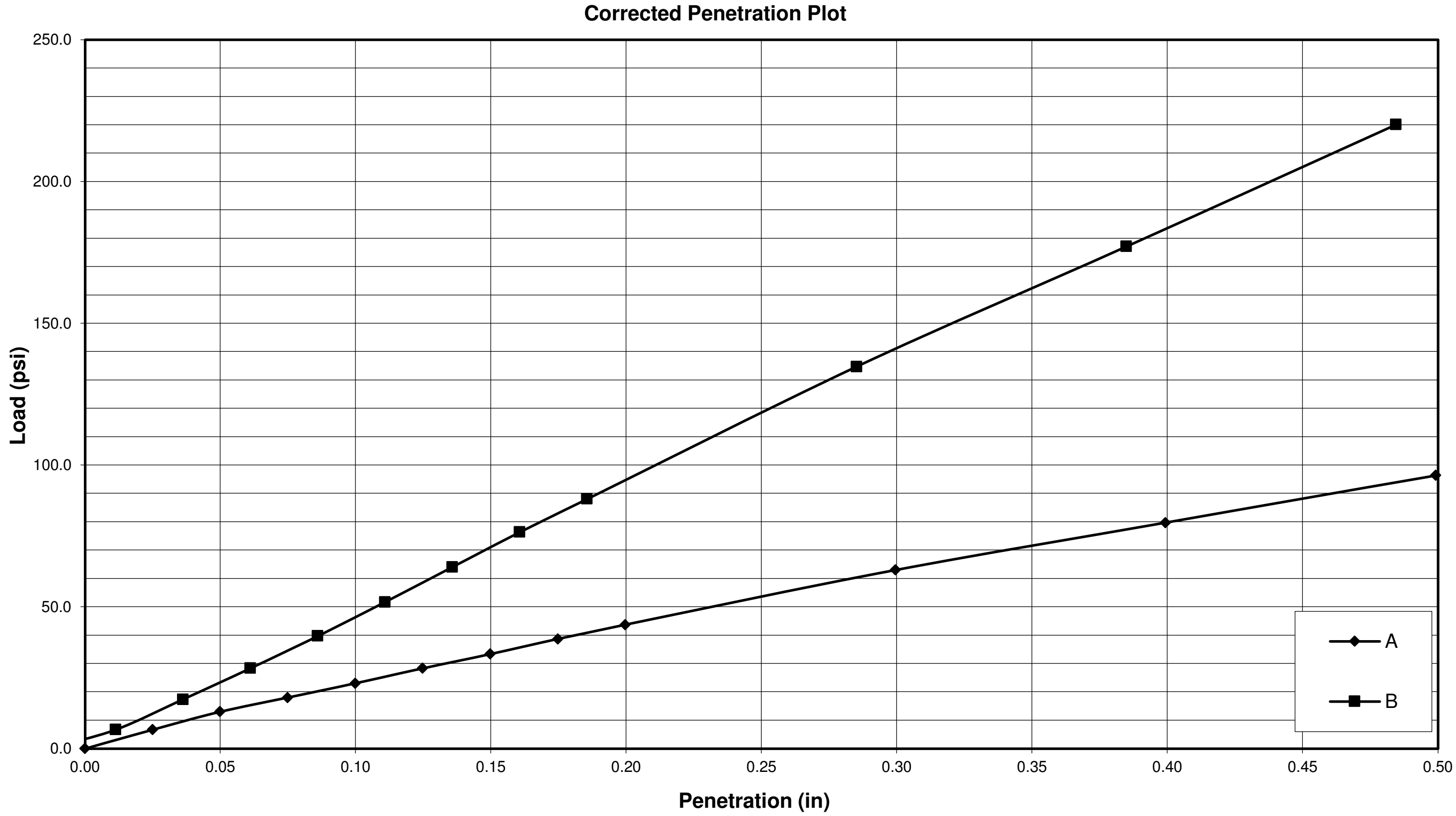
Procedural Method:
Specimens compacted to approximately 90% and 95% of maximum standard proctor density at optimum moisture content. Specimens soaked for a period of 4 days before CBR test was performed.

Laboratory Moisture-Density Values		Index Properties	
Method:	ASTM:D698 Method B	LL:	Gs:
Maximum Dry Density (PCF):	99.9	PL:	Organic Content:
Optimum Water Content:	18.3%	PI:	pH:

Initial Molding Conditions

Specimen	A	B	
Compaction Hammer:	5 lb	5 lb	
Number of Layers:	3	3	
Blows per Layer:	NA	NA	
Initial Moisture Content:	18.3%	18.3%	
Initial Dry Density (PCF)	89.9	94.9	
Relative Compaction	90.0%	95.0%	
Soaking Phase			
Days Soaked	4	4	
Surcharge (psf)	50	50	
Total Swell (%)	0.1%	0.4%	
Penetration Phase			
Surcharge (psf)	50	50	
Corrected CBR Values			
at 0.1 inch (%)	2.3%	4.7%	
at 0.2 inch (%)	**2.9%**	**6.3%**	
Moisture Content After Penetration			
Top 1" of Specimen:	24.5%	22.4%	
Average of specimen:	24.0%	21.0%	

Stress vs. Penetration Graph



California Bearing Ratio ASTM:D1883

Project:	Horse Heaven	Job:	12516
Client:	Westwood Surveying & Engineering	Date:	5/13/20

Boring #: T-211

Sample:

Depth (ft): 1-4

Type: Bulk

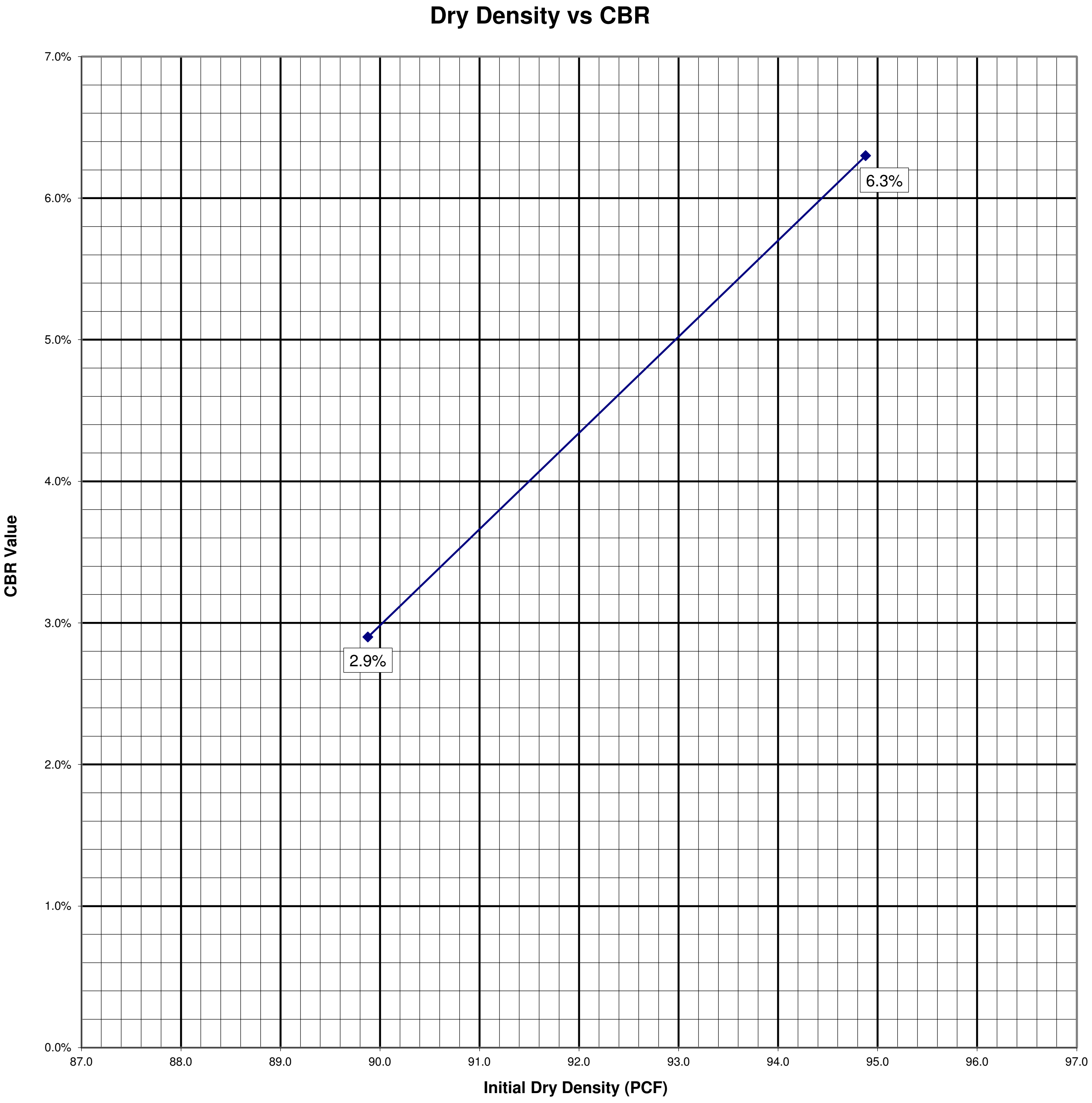
Location:

Procedural Method:

Specimens compacted to approximately 90% and 95% of maximum standard proctor density at optimum moisture content. Specimens soaked for a period of 4 days before CBR test was performed.

Classification: Silt (ML)

Test Plot



Synergy Environmental Lab, INC

1990 Prospect Ct., Appleton, WI 54914 *P 920-830-2455 * F 920-733-0631

PAUL EGGEN
OMNNI ASSOCIATES INC
ONE SYSTEMS DRIVE
APPLETON WI 54914-1654

Report Date *26-May-20*

Project Name HORSE HEAVEN WIND PROJECT **Invoice #** E37856
Project # 0026747.11

Lab Code 5037856A
Sample ID SS-01 6
Sample Matrix Soil
Sample Date

	Result	Unit	LOD	LOQ	Dil	Method	Ext Date	Run Date	Analyst	Code
General										
General										
Solids Percent	99.5	%			1	5021		5/7/2020	MJR	1
Wet Chemistry										
General										
Sulfate, Unfiltered	223	mg/kg	12.9	43	1	9056		5/14/2020	ESC	1
Chlorides, Unfiltered	16.9 "J"	mg/kg	9.2	30.7	1	9056		5/14/2020	ESC	1

Lab Code 5037856B
Sample ID T153 8
Sample Matrix Soil
Sample Date

	Result	Unit	LOD	LOQ	Dil	Method	Ext Date	Run Date	Analyst	Code
General										
General										
Solids Percent	98.6	%			1	5021		5/7/2020	MJR	1
Wet Chemistry										
General										
Sulfate, Unfiltered	79.6	mg/kg	12.9	43	1	9056		5/14/2020	ESC	1
Chlorides, Unfiltered	< 9.2	mg/kg	9.2	30.7	1	9056		5/14/2020	ESC	1

Lab Code 5037856C
Sample ID T-184 11
Sample Matrix Soil
Sample Date

	Result	Unit	LOD	LOQ	Dil	Method	Ext Date	Run Date	Analyst	Code
General										
General										
Solids Percent	99.0	%			1	5021		5/7/2020	MJR	1
Wet Chemistry										
General										
Sulfate, Unfiltered	24.7 "J"	mg/kg	12.9	43	1	9056		5/14/2020	ESC	1
Chlorides, Unfiltered	49.3	mg/kg	9.2	30.7	1	9056		5/14/2020	ESC	1

Lab Code 5037856D
Sample ID T-194 5
Sample Matrix Soil
Sample Date

	Result	Unit	LOD	LOQ	Dil	Method	Ext Date	Run Date	Analyst	Code
General										
General										
Solids Percent	99.3	%			1	5021		5/7/2020	MJR	1
Wet Chemistry										
General										
Sulfate, Unfiltered	13.2 "J"	mg/kg	12.9	43	1	9056		5/14/2020	ESC	1
Chlorides, Unfiltered	< 9.2	mg/kg	9.2	30.7	1	9056		5/14/2020	ESC	1

Lab Code 5037856E
Sample ID T-223 8
Sample Matrix Soil
Sample Date

	Result	Unit	LOD	LOQ	Dil	Method	Ext Date	Run Date	Analyst	Code
General										
General										
Solids Percent	98.8	%			1	5021		5/7/2020	MJR	1
Wet Chemistry										
General										
Sulfate, Unfiltered	229	mg/kg	12.9	43	1	9056		5/14/2020	ESC	1
Chlorides, Unfiltered	< 9.2	mg/kg	9.2	30.7	1	9056		5/14/2020	ESC	1

"J" Flag: Analyte detected between LOD and LOQ LOD Limit of Detection LOQ Limit of Quantitation

Code	*Comment*
1	Laboratory QC within limits.

ESC denotes sub contract lab - Certification #998093910

All solid sample results reported on a dry weight basis unless otherwise indicated. All LOD's and LOQ's are adjusted for dilutions but not dry weight. Subcontracted results are denoted by SUB in the analyst field.

Authorized Signature