GEOTECHNICAL INVESTIGATION - REVISED

EASTERN OREGON UNIVERSITY BASEBALL AND SOCCER FIELDS

Near the NEC of C Avenue and 6th Street

La Grande, OR

PREPARED FOR:

Mr. David Moore
Eastern Oregon University
One University Boulevard
La Grande, OR 97850

PREPARED BY:

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2791 South Victory View Way
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July 19, 2021
B211531g

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Atlas No. B211531g

Mr. David Moore
Eastern Oregon University
One University Boulevard
La Grande, OR 97850

Subject: **Geotechnical Investigation - Revised**
Eastern Oregon University Baseball and Soccer Fields
Near the NEC of C Avenue and 6th Street
La Grande, OR

Dear Mr. Moore:

In compliance with your instructions, Atlas has conducted a soils exploration and foundation evaluation for the above referenced development. Fieldwork for this investigation was conducted on June 2 and 3, 2021. Data have been analyzed to evaluate pertinent geotechnical conditions. Results of this investigation, together with our recommendations, are to be found in the following report. We have provided a PDF copy for your review and distribution.

This report has been revised to include comments on proposed retaining walls for the project site and existing drainage facilities.

Often, questions arise concerning soil conditions because of design and construction details that occur on a project. Atlas would be pleased to continue our role as geotechnical engineers during project implementation.

If you have any questions, please call us at (208) 376-4748.

Respectfully submitted,

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1. INTRODUCTION

This report presents results of a geotechnical investigation and analysis in support of data utilized in design of structures as defined in the 2019 Oregon Structural Specialty Code (OSSC). Information in support of groundwater and stormwater issues pertinent to the practice of Civil Engineering is included. Observations and recommendations relevant to the earthwork phase of the project are also presented. Revisions in plans or drawings for the proposed development from those enumerated in this report should be brought to the attention of the soils engineer to determine whether changes in the provided recommendations are required. Deviations from noted subsurface conditions, if encountered during construction, should also be brought to the attention of the soils engineer.

1.1 Project Description

The proposed development is in the south-central portion of the City of La Grande, Union County, OR, and occupies a portion of the SW¼ of Section 8, Township 3 South, Range 38 East, Willamette Meridian. This project will consist of construction of a baseball field and soccer field. Dugouts, stands, light poles, and foul poles are anticipated as part of the baseball field. Atlas was also informed that the western portion of the site will have a maximum cut of approximately 10 feet and the eastern portion of the site will be filled approximately 12 feet in the deepest location. Total settlements are limited to 1 inch. Loads of up to 2,000 pounds per lineal foot for wall footings, and column loads of up to 25,000 pounds were assumed for settlement calculations. Additionally, assumptions have been made for traffic loading of pavements. Retaining walls in the form of dug out walls are anticipated as part of the project. Atlas has not been informed of the proposed grading plan. Systems for disposal of stormwater and drainage for ballfields is unknown at this time.

1.2 Authorization

Authorization to perform this exploration and analysis was given in the form of a written authorization to proceed from Mr. David Moore of Eastern Oregon University to Jacob Schlador of Atlas Technical Consultants (Atlas), on May 26, 2021. Said authorization is subject to terms, conditions, and limitations described in the Professional Services Contract entered into between Eastern Oregon University and Atlas. Our scope of services for the proposed development has been provided in our proposal dated May 10, 2021 and repeated below.

1.3 Scope of Investigation

The scope of this investigation included review of geologic literature and existing available geotechnical studies of the area, visual site reconnaissance of the immediate site, subsurface exploration of the site, field and laboratory testing of materials collected, and engineering analysis and evaluation of foundation materials.

2. SITE DESCRIPTION

2.1 Site Access

Access to the site may be gained via Interstate 84 to the US-30/OR-203 exit. Proceed northwest on US-30/OR-203 approximately 1.7 miles to its intersection with Gekeler Lane. From this intersection, proceed west on Gekeler Lane 1.2 miles to where Gekeler Lane becomes C Avenue. Continue west on C Avenue for 0.2 mile to its intersection with 6th Street. The site occupies the northeast corner of this intersection. The location is depicted on site maps included in the **Appendix**.

2.2 Regional Geology

The site is located within the La Grande Basin, a graben in the Blue Mountains of Eastern Oregon. The area has been referred to as “a geological wrecking yard: of 240-200 million year old andesitic and rhyolitic volcanics, and 16-20 million year old Columbia River flood basalts and Powder River andesites, all deformed by blocking faulting and carve by Pleistocene glaciers. Locally, soils consist primarily of various clays that are underlain by basalt formations.

The basin dimensions are roughly 30 miles long by 12 miles wide, and consist of a topographic and structural depression with a maximum structural relief of over 5,700 feet, with the top of the middle to late Miocene Columbia River Basalt Group down-dropped to lower than 700 feet above sea level. Late Miocene or early Pliocene and younger alluvial and lacustrine sediments have filled the basin to an elevation of about 2,900 feet.

Downdropping of the basin has been attributed to dip-slip movement on north-northwest-striking faults, or more recently to the suggestion that the La Grande Basin is a complex pull-apart structure in a north-northwest striking, right-lateral fault system. Strike-slip faulting is recorded along the western side of the basing by north-northwest striking vertical faults. Evidence of faulting along this margin comes from many sources, including deflections to the right in the Grande Ronde River where it is crossed by major faults, and thrust faults in bedrock near Hot Lake.

Evidence for Quaternary faulting is present, although most of the scarps in the area do not show signs of recent movement. Two features that may record Holocene faulting include a 0.6 mile long scarp in alluvial sediments near Union and a small thrust fault in terrace gravel south of La Grande.

Earthquake epicenters in the area suggest that the basin is still tectonically active. The north-northwest-striking faults in the La Grande area are part of a wide set of right-lateral faults in central and eastern Oregon. Movement on these faults may be because of northwestward extension within the Basin and Range Province relative to the Columbia Plateau or possibly to a wide zone of right-lateral interaction between the Pacific and North American plates.

2.3 General Site Characteristics

The site to be developed is approximately 13.0 acres in size. Currently, the western half of the site exists as a landscaped grass field. The eastern half of the site consists of undeveloped land. Along the northern and eastern property boundaries, the Eastern Oregon University Campus is present. To the south and west of the site are existing residential properties.

Vegetation on the site consists of shrubs and grasses in the western half of the site. On the eastern half of the site, sagebrush, bunchgrass, and other native weeds and grasses were present. A stockpile of material was present in the northeast corner of the project site. The site has three flat and level tiers. Each tier fell approximately 2 to 3 feet in elevation with the western side of the site being approximately 6 feet higher in elevation than the east end of the site.

Regional drainage is north and east toward the Grande Ronde River. Stormwater drainage for the site is achieved by percolation through surficial soils. The site is situated so that it is unlikely that it will receive any drainage from off-site sources. Stormwater drainage collection and retention systems are in place in the form of French Drains underneath the soccer fields in the southern portion of the site and were noted in the form of curbs, gutters, and drop inlets along C Avenue and 6th Street. However, Atlas was informed that the drainage system along 6th Street does not provide adequate area for 6th Street.

2.4 Regional Site Climatology and Geochemistry

According to the Western Regional Climate Center, the average precipitation near La Grande is on the order of 9 to 10 inches per year, with an annual snowfall of approximately 36 inches. The monthly mean daily temperatures range from 18°F to 84°F, with daily extremes ranging from roughly -21°F to 104°F. Winds are generally from the northwest or south with an annual average wind speed of approximately 6.5 miles per hour (mph) and a maximum of 66 mph. Soils and sediments in the area are primarily derived from siliceous materials and exhibit low electro-chemical potential for corrosion of metals or concretes. Local aggregates are generally appropriate for Portland cement and lime cement mixtures. Surface water, groundwater, and soils in the region typically have pH levels ranging from 6.6 to 8.0.

3. SEISMIC SITE EVALUATION

3.1 Geoseismic Setting

Soils on site are classed as Site Class D in accordance with Chapter 20 of the American Society of Civil Engineers (ASCE) publication ASCE/SEI 7-16. Structures constructed on this site should be designed per IBC requirements for such a seismic classification. Our investigation did not reveal hazards resulting from potential earthquake motions including: slope instability, liquefaction, and surface rupture caused by faulting or lateral spreading. Incidence and anticipated acceleration of seismic activity in the area is low.

3.2 Seismic Design Parameter Values

The United States Geological Survey National Seismic Hazard Maps (2008), includes a peak ground acceleration map. The map for 2% probability of exceedance in 50 years in the Western United States in standard gravity (g) indicates that a peak ground acceleration of 0.223 is appropriate for the project site based on a Site Class D.

The following section provides an assessment of the earthquake-induced earthquake loads for the site based on the Risk-Targeted Maximum Considered Earthquake (MCE_R). The MCE_R spectral response acceleration for short periods, S_{MS}, and at 1-second period, S_{M1}, are adjusted for site class effects as required by the 2019 OSSC. Design spectral response acceleration parameters as presented in the 2019 OSSC are defined as a 5% damped design spectral response acceleration at short periods, S_{DS}, and at 1-second period, S_{D1}.

The USGS National Seismic Hazards Mapping Project includes a program that provides values for ground motion at a selected site based on the same data that were used to prepare the USGS ground motion maps. The maps were developed using attenuation relationships for soft rock sites; the source model, assumptions, and empirical relationships used in preparation of the maps are described in Petersen and others (1996).

Table 1 – Seismic Design Values

Seismic Design Parameter	Design Value
Site Class	D “Stiff Soil”
S_s	0.331 (g)
S_1	0.121 (g)
F_a	1.535
F_v	2.357
S_{MS}	0.508
S_{M1}	0.286
S_{DS}	0.339
S_{D1}	0.191

4. SOILS EXPLORATION

4.1 Exploration and Sampling Procedures

Field exploration conducted to determine engineering characteristics of subsurface materials included a reconnaissance of the project site and investigation by soil boring. Borings were located in the field by means of a Global Positioning System (GPS) device and are reportedly accurate to within ten feet. Borings were advanced by means of a truck-mounted drilling rig equipped with continuous flight hollow-stem augers. At specified depths, samples were obtained using a standard split-spoon sampler and Standard Penetration Test (SPT) blow counts were recorded. Uncorrected SPT blow counts are provided on logs, which can be found in the **Appendix**. Delayed water level observations were made in open borings to evaluate groundwater levels. At completion of exploration, borings were backfilled with bentonite holeplug.

Samples have been visually classified in the field by professional staff, identified according to boring number and depth, placed in sealed containers, and transported to our laboratory for additional testing. Subsurface materials have been described in detail on logs provided in the **Appendix**. Results of field and laboratory tests are also presented in the **Appendix**. Atlas recommends that these logs **not** be used to estimate fill material quantities.

4.2 Laboratory Testing Program

Along with our field investigation, a supplemental laboratory testing program was conducted to determine additional pertinent engineering characteristics of subsurface materials necessary in an analysis of anticipated behavior of the proposed structures. Laboratory tests were conducted in accordance with current applicable American Society for Testing and Materials (ASTM) specifications, and results of these tests are to be found in the **Appendix**. The laboratory testing program for this report included: Atterberg Limits Testing – ASTM D4318 and Grain Size Analysis – ASTM C117/C136.

4.3 Soil and Sediment Profile

The profile below represents a generalized interpretation for the project site. Note that on site soils strata, encountered between boring locations, may vary from the individual soil profiles presented in the logs, which can be found in the **Appendix**.

In boring 2, poorly graded gravel with sand fills were encountered at ground surface. Poorly graded gravel with sand fills were dark brown, slightly moist, loose, and contained fine to coarse-grained sand and fine gravel. At ground surface throughout the majority of the site were fat clay soils. Fat clay soils were black to dark brown, slightly moist, medium stiff to hard, and contained fine to coarse-grained sand and in some instances contained fine gravel.

Underlying the surficial fat clay soils and at ground surface in a limited number of borings were clayey gravel with sand and clayey sand sediments. These sediments were dark brown, black, brown, and light brown, slightly moist to saturated, loose to very dense, and contained fine to coarse-grained sand and fine to coarse gravel. In boring 8, silty sand with gravel sediments were encountered at depth. Silty sands with gravel were dark brown, slightly moist, very dense, and contained fine to coarse-grained sand and fine gravel. At depth within boring 3 were poorly graded gravel with sand sediments. These sediments were gray, saturated, very dense, and contained fine to coarse-grained sand and fine to coarse gravel.

During excavation, boring sidewalls were generally stable. However, moisture contents will affect wall competency with saturated soils having a tendency to readily slough when under load and unsupported.

4.4 Volatile Organic Scan

No environmental concerns were identified prior to commencement of the investigation. Therefore, soils obtained during on-site activities were not assessed for volatile organic compounds by portable photoionization detector. Samples obtained during our exploration activities exhibited no odors or discoloration typically associated with this type of contamination. Groundwater encountered did not exhibit obvious signs of contamination.

5. SITE HYDROLOGY

Existing surface drainage conditions are defined in the **General Site Characteristics** section. Information provided in this section is limited to observations made at the time of the investigation. Either regional or local ordinances may require information beyond the scope of this report.

5.1 Groundwater

During this field investigation, groundwater/seepage was encountered in boring 3 at a depth of 13.2 feet bgs. Soil moistures in the borings were generally dry to slightly moist within surficial soils. Within the clayey sands in boring 3, soil moistures graded from slightly moist to saturated as the water table was approached and penetrated. In the vicinity of the project site, groundwater levels are controlled in large part by residential and commercial irrigation activity and leakage from nearby canals. Maximum groundwater elevations likely occur during the later portion of the irrigation season.

During a previous investigation performed approximately 0.15 mile to the northeast of the project site in October 2018; groundwater was encountered at depths ranging from 18.5 to 29.2 feet bgs. Furthermore, according to Oregon Department of Water Resources well log data within approximately ¼-mile of the project site, groundwater was measured at depths ranging between 15 and 30 feet bgs.

Based on evidence of this investigation and background knowledge of the area, Atlas estimates groundwater/seepage depths to remain greater than approximately 12 feet bgs throughout the year.

5.2 Soil Infiltration Rates

Soil permeability, which is a measure of the ability of a soil to transmit a fluid, was not tested in the field. Given the absence of direct measurements, for this report an estimation of infiltration is presented using generally recognized values for each soil type and gradation. Of soils comprising the generalized soil profile for this study, fat clay soils generally offer little permeability, with typical hydraulic infiltration rates of less than 2 inches per hour. Clayey sand and clayey gravel sediments typically have infiltration rates ranging from 2 to 6 inches per hour. Silty sand with gravel sediments usually display rates of 4 to 8 inches per hour. Poorly graded sand with gravel sediments typically exhibit infiltration values in excess of 12 inches per hour. However, the presence of groundwater will significantly reduce these estimated rates.

The presence of shallow clayey soils will limit drainage; therefore, Atlas recommends that infiltration testing be conducted to determine site specific infiltration rates. However, for preliminary design purposes, an infiltration rate of 1/2 inch per hour can be assumed.

Given the relatively limited infiltration capacity of the existing soils, specialized drainage systems should be considered for ballfields, to avoid ponding water conditions and/or soft surface conditions. Further onsite testing is recommended, based on specific system requiremens.

6. LATERAL EARTH PRESSURES

Retaining, below-grade, or basement walls will be subject to lateral earth pressures. The magnitude of earth pressure is a function of both type and compaction of backfill behind walls within the "active" zone, and allowable rotation of the top of the wall. The active zone is defined as the wedge of soil between the surface of the wall and a plane inclined 32 degrees from vertical passing through the base of the wall. All clay and clayey soils must be completely removed from within the active zone. When dealing with lateral earth pressures on a gravity block, a sliding frictional coefficient of 0.45 is appropriate considering granular structural fill under typical conditions.

A state of plastic equilibrium is when the subject material is considered to be 1) homogeneous and unbounded and 2) at the point of incipient instability. This state is evaluated on the basis of unit weight, mechanical properties, and the definition of instability. For the purpose of this report, it is assumed that imported granular fill material will be the materials of concern regarding lateral earth pressures. If other materials are considered for use, Atlas must be contacted to provide alternate lateral earth pressure information. Furthermore, changes in natural soil moisture, such as can be imposed by site stormwater systems, can change the values listed below.

Below-grade restrained walls, such as basement walls, should be designed based on at-rest pressures. Active pressures are appropriate under conditions where the wall moves or rotates away from the soil mass at failure. Passive pressures are used for conditions where the wall moves toward the soil mass at failure. Lateral movement of the top of the wall equal to 0.001 times the height of the wall will be necessary for the "active" pressure condition for imported granular structural backfill.

6.1 Retaining Wall Backfill Materials

Clay and clayey soils are not suitable for use as backfill on the soil side of walls. For lateral earth pressure analysis, imported, compacted, structural material, must be used to backfill the soil side of walls, must demonstrate the following characteristics:

Table 2 – Lateral Earth Pressure Values for Fill Materials

Soil Type: Compacted Sandy Gravel Fill					
Internal Friction Angle:	35	°	Dry Unit Weight:	128	pcf
Cohesion:	N/A		Bouyant Unit Weight:	83	pcf
Natural Void Ratio:	0.4		Natural Moisture:	5	%
Ground Acceleration^2:	0.223		Backfill Slope:	0	°
At rest lateral earth pressure:	57	pcf[1]		K_0=	0.43
Active lateral earth pressure:	36	pcf[1]		K_a=	0.27
Passive lateral earth pressure:	496	pcf[1]		K_p=	3.69
Seismic active lateral earth pressure:	59	pcf[1]		K_{ae}=	0.44
Seismic passive lateral earth pressure:	385	pcf[1]		K_{pe}=	2.87

[1] Lateral earth pressure values are in pounds per square foot, per foot of wall (psf/ft). Alternately, the values presented may also be considered as equivalent fluid with units of pounds per cubic foot (pcf).
[2] Ground acceleration obtained from the USGS Seismic Design Maps.

Please note that the values for seismic lateral earth pressures are calculated using both the static and seismic coefficients. The effect of seismic conditions alone is the difference between the static and seismic lateral earth pressures presented above. Also, the expected pressure diagram is considered to be an inverted triangular force, with the maximum force at the ground surface.

In the case that another material is used for backfill, Atlas should be consulted for alternate lateral earth pressure values. Granular structural fill should consist of 4-inch-minus select, clean, granular soil with no more than 30 percent oversize (greater than ¾-inch) material and no more than 5 percent non-plastic fines (passing the No. 200 sieve). Retaining wall and basement backfill must be placed in accordance with recommendations in the **Structural Fill** section of this report and must be properly compacted and tested.

Lateral earth pressure values do not incorporate specific factors of safety, and are only applicable for non-surcharged, drained conditions. Factors of safety, if applicable, should be integrated into the structural design of the wall. The preceding values are presented for idealized conditions relating to simple shallow structures. For complex structures, deep structures, or structures with significant perimeter landscaping, a soils engineer should be retained as part of the design team in developing appropriate project design parameters and construction specifications.

6.2 Retaining Wall Drainage

Atlas recommends that a drainage system be incorporated into the retained soil mass. This can be accomplished by installing wall and toe drains as a part of each soil-supporting wall system. In areas where there is potential for significantly high soil moistures within the supported soil mass, installation of drains within the soil mass is recommended. Particular consideration of roof drain effluent and irrigation water must be made. Further, these drainage systems must be separate from other retaining wall/foundation systems. If the granular structural fill option to reduce lateral pressures is used, a compacted low permeability soil cap is recommended within the upper 2 feet of the surface to limit surface water infiltration behind the walls.

7. FOUNDATION AND SLAB DISCUSSION AND RECOMMENDATIONS

Various foundation types have been considered for support of the proposed development. Two requirements must be met in the design of foundations. First, the applied bearing stress must be less than the ultimate bearing capacity of foundation soils to maintain stability. Second, total and differential settlement must not exceed an amount that will produce an adverse behavior of the superstructure. Allowable settlement is usually exceeded before bearing capacity considerations become important; thus, allowable bearing pressure is normally controlled by settlement considerations.

Considering subsurface conditions and the proposed construction, it is recommended that the structures (bleachers and outbuildings) be founded upon conventional spread footings and continuous wall footings and poles founded on piers (drilled shaft). Total settlements should not exceed 1 inch if the following design and construction recommendations are observed.

7.1 Spread and Continuous Wall Foundation Design Recommendations

Based on data obtained from the site and test results from various laboratory tests performed, Atlas recommends the following guidelines for the net allowable soil bearing capacity:

Table 3 – Soil Bearing Capacity

Footing Depth	Subgrade Compaction	Net Allowable Soil Bearing Capacity
Footings must bear on competent, compacted, native clayey gravel with sand sediments, clayey sand with gravel sediments, or compacted structural fill. Existing fill materials and organic materials (if encountered) must be completely removed from below foundation elements.[1] Excavation depths ranging from roughly 0.5 to 4.5 feet bgs should be anticipated to expose proper bearing soils.[2] Exposed native soils must be prepared as follows: 1. Sacrify and moisture condition the upper 12 inches to within 2 percent of optimum moisture content. 2. Compact the moisture conditioned soils to 92 to 98 percent of the maximum dry density as determined by ASTM D698	92 to 98% of ASTM D698 for Native Soils 95% of ASTM D1557 for Structural Fill	2,000 lbs/ft^2

[1] It will be required for Atlas personnel to verify the bearing soil suitability for each structure at the time of construction.
[2] Depending on the time of year construction takes place, the subgrade soils may be unstable because of high moisture contents. If unstable conditions are encountered, over-excavation and replacement with granular structural fill and/or use of geotextiles may be required.

The following sliding frictional coefficient values should be used: 1) 0.35 for footings bearing on native fat clay soils and clayey sand sediments and 2) 0.45 for footings bearing on granular structural fill. A passive lateral earth pressure of 280 pounds per square foot per foot (psf/ft) should be used for fat clay soils and 339 psf/ft should be used for clayey gravel and clayey sand sediments. For compacted sandy gravel fill, a passive lateral earth pressure of 496 psf/ft should be used.

Footings should be proportioned to meet either the stated soil bearing capacity or the 2019 OSSC minimum requirements. Total settlement should be limited to approximately 1 inch, and differential settlement should be limited to approximately ½ inch. Objectionable soil types encountered at the bottom of footing excavations should be removed and replaced with structural fill. Excessively loose or soft areas that are encountered in the footings subgrade will require over-excavation and backfilling with structural fill. To minimize the effects of slight differential movement that may occur because of variations in the character of supporting soils and seasonal moisture content, Atlas recommends continuous footings be suitably reinforced to make them as rigid as possible. For frost protection, the bottom of external footings should be 30 inches below finished grade.

7.2 Drilled Shaft (Light Poles) Foundation Design Recommendations

Based on data obtained from the site and test results from various laboratory tests performed, Atlas recommends the following guidelines for the net allowable soil bearing capacity:

Table 4 – Soil Bearing Capacity

Drilled Shaft Depth	Subgrade Compaction	Net Allowable Soil End - Bearing Capacity
Drilled shaft foundations must bear on competent, undisturbed clayey gravel with sand sediments, clayey sand with gravel sediments, or compacted structural fill. Existing fill materials and organic materials (if encountered) must be completely removed from below foundation elements.[1] Excavation depths ranging from roughly 0.5 to 4.5 feet bgs should be anticipated to expose proper bearing soils.[2]	95% of ASTM D1557 for Structural Fill	4,000 lbs/ft^2

[1] It will be required for Atlas personnel to verify the bearing soil suitability for each structure at the time of construction. Drilled shafts shall be designed and constructed in accordance American Concrete Institute 336.1.

[2] Depending on the time of year construction takes place, the subgrade soils may be unstable because of high moisture contents. If unstable conditions are encountered, over-excavation and replacement with granular structural fill and/or use of geotextiles may be required.

Once the diameter and depth of the concrete caissons has been determined, Atlas will be able to provide skin friction values for use in design. Note that when designing the drilled shafts to account for both end bearing and skin friction, some vertical mobilization of the drilled shaft will be required in order to attain the full end bearing.

7.3 Foundation Drain Recommendations

Considering the presence of shallow clayey soils across the site, Atlas recommends that a foundation drain be installed. The drain should be placed at the footing elevation, sloped at least 2 percent, and be directed to a suitable discharge point at least 10 feet away from the structure. Discharge points should be protected to prevent erosion and clogging. However, if hardscaping is present immediately surrounding the structure, foundation drains are not needed.

7.4 Floor Slab-on-Grade

Uncontrolled fill was encountered in the vicinity of boring 2. Atlas recommends that these fill materials be removed to a depth of at least 2 feet below existing grade. If fill materials remain after excavation, the exposed subgrade must be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. The excavated fill materials can be replaced in accordance with the **Structural Fill** section provided that all organic material and/or debris is completely removed. Once final grades have been determined, Atlas is available to provide additional recommendations.

Potential movements associated with seasonal moisture variation within expansive clay soils are anticipated to be on the order of 0 to 2 inches, depending on locations. Considering this, moisture conditioning of the clay soil will be required to prevent movement of ground-supported slabs. Atlas personnel must be present to identify clay soils in the field. Recommendations for slabs constructed over exposed expansive clays are as follows:

1. Scarify and moisture condition the upper 12 inches of the exposed clays to within 2 percent of optimum moisture content and compact the soils to 92 to 98 percent of the maximum dry density per ASTM D698.
2. Place 12 inches minimum depth of structural fill over moisture conditioned clay. Structural fill should be placed as soon as possible after compaction of clay soils in order to limit moisture loss within the upper clays. Structural fill must be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557.
3. Slabs should be 5 inches minimum in thickness and be reinforced.

Organic, loose, or obviously compressive materials must be removed prior to placement of concrete floors or floor-supporting fill. In addition, the remaining subgrade should be treated in accordance with guidelines presented in the **Earthwork** section. Areas of excessive yielding should be excavated and backfilled with structural fill. Fill used to increase the elevation of the floor slab should meet requirements detailed in the **Structural Fill** section. Fill materials must be compacted to a minimum 95 percent of the maximum dry density as determined by ASTM D1557.

A free-draining granular mat should be provided below slabs-on-grade to provide drainage and a uniform and stable bearing surface. This should be a minimum of 4 inches in thickness and properly compacted. The mat should consist of a sand and gravel mixture, complying with Oregon Department of Transportation (ODOT) specifications for ¾-inch crushed aggregate. The granular mat should be compacted to no less than 95 percent of the maximum dry density as determined by ASTM D1557. A moisture-retarder should be placed beneath floor slabs to minimize potential ground moisture effects on moisture-sensitive floor coverings. The moisture-retarder should be at least 15-mil in thickness and have a permeance of less than 0.01 US perms as determined by ASTM E96. Placement of the moisture-retarder will require special consideration with regard to effects on the slab-on-grade and should adhere to recommendations outlined in the ACI 302.1R and ASTM E1745 publications. Upon request, Atlas can provide further consultation regarding installation.

8. CONSTRUCTION CONSIDERATIONS

Recommendations in this report are based upon structural elements of the project being founded on competent, native fat clay soils, clayey gravel sediments, clayey sand sediments, or compacted structural fill. Structural areas should be stripped to an elevation that exposes these soil types.

8.1 Earthwork

Excessively organic soils, deleterious materials, or disturbed soils generally undergo high volume changes when subjected to loads, which is detrimental to subgrade behavior in the area of pavements, floor slabs, structural fills, and foundations. Sagebrush, brush, and thick grasses with associated root systems were noted at the time of our investigation. It is recommended that organic or disturbed soils, if encountered, be removed to depths of 1 foot (minimum), and wasted or stockpiled for later use. Stripping depths should be adjusted in the field to assure that the entire root zone or disturbed zone or topsoil are removed prior to placement and compaction of structural fill materials. Exact removal depths should be determined during grading operations by Atlas personnel, and should be based upon subgrade soil type, composition, and firmness or soil stability. If underground storage tanks, underground utilities, wells, or septic systems are discovered during construction activities, they must be decommissioned then removed or abandoned in accordance with governing Federal, State, and local agencies. Excavations developed as the result of such removal must be backfilled with structural fill materials as defined in the **Structural Fill** section.

Atlas should oversee subgrade conditions (i.e., moisture content) as well as placement and compaction of new fill (if required) after native soils are excavated to design grade. Recommendations for structural fill presented in this report can be used to minimize volume changes and differential settlements that are detrimental to the behavior of footings, pavements, and floor slabs. Sufficient density tests should be performed to properly monitor compaction. For structural fill beneath building structures, one in-place density test per lift for every 5,000 square feet is recommended. In parking and driveway areas, this can be decreased to one test per lift for every 10,000 square feet.

8.2 Dry Weather

If construction is to be conducted during dry seasonal conditions, many problems associated with soft soils may be avoided. However, some rutting of subgrade soils may be induced by shallow groundwater conditions related to springtime runoff or irrigation activities during late summer through early fall. Solutions to problems associated with soft subgrade soils are outlined in the **Soft Subgrade Soils** section. Problems may also arise because of lack of moisture in native and fill soils at time of placement. This will require the addition of water to achieve near-optimum moisture levels. Low-cohesion soils exposed in excavations may become friable, increasing chances of sloughing or caving. Measures to control excessive dust should be considered as part of the overall health and safety management plan.

8.3 Wet Weather

If construction is to be conducted during wet seasonal conditions (commonly from mid-November through May), problems associated with soft soils must be considered as part of the construction plan. During this time of year, fine-grained soils such as silts and clays will become unstable with increased moisture content, and eventually deform or rut. Additionally, constant low temperatures reduce the possibility of drying soils to near optimum conditions.

8.4 Soft Subgrade Soils

Shallow fine-grained subgrade soils that are high in moisture content should be expected to pump and rut under construction traffic. During periods of wet weather, construction may become very difficult if not impossible. The following recommendations and options have been included for dealing with soft subgrade conditions:

- Track-mounted vehicles should be used to strip the subgrade of root matter and other deleterious debris. Heavy rubber-tired equipment should be prohibited from operating directly on the native subgrade and areas in which structural fill materials have been placed. Construction traffic should be restricted to designated roadways that do not cross, or cross on a limited basis, proposed roadway or parking areas.
- Soft areas can be over-excavated and replaced with granular structural fill.
- Construction roadways on soft subgrade soils should consist of a minimum 2-foot thickness of large cobbles of 4 to 6 inches in diameter with sufficient sand and fines to fill voids. Construction entrances should consist of a 6-inch thickness of clean, 2-inch minimum, angular drain-rock and must be a minimum of 10 feet wide and 30 to 50 feet long. During the construction process, top dressing of the entrance may be required for maintenance.
- Scarification and aeration of subgrade soils can be employed to reduce the moisture content of wet subgrade soils. After stripping is complete, the exposed subgrade should be ripped or disked to a depth of 1½ feet and allowed to air dry for 2 to 4 weeks. Further disking should be performed on a weekly basis to aid the aeration process.
- Alternative soil stabilization methods include use of geotextiles, lime, and cement stabilization. Atlas is available to provide recommendations and guidelines at your request.

8.5 Frozen Subgrade Soils

Prior to placement of structural fill materials or foundation elements, frozen subgrade soils must either be allowed to thaw or be stripped to depths that expose non-frozen soils and wasted or stockpiled for later use. Stockpiled materials must be allowed to thaw and return to near-optimal conditions prior to use as structural fill.

The onsite, shallow clayey and silty soils are susceptible to frost heave during freezing temperatures. For exterior flatwork and other structural elements, adequate drainage away from subgrades is critical. Compaction and use of structural fill will also help to mitigate the potential for frost heave. Complete removal of frost susceptible soils for the full frost depth, followed by replacement with a non-frost susceptible structural fill, can also be used to mitigate the potential for frost heave. Atlas is available to provide further guidance/assistance upon request.

8.6 Structural Fill

Soils recommended for use as granular structural fill are those classified as GW, GP, SW, and SP in accordance with the Unified Soil Classification System (USCS) (ASTM D2487). Use of silty soils (USCS designation of GM, SM, and ML) as structural fill may be acceptable. However, use of silty soils (GM, SM, and ML) as structural fill below footings is prohibited. These materials require very high moisture contents for compaction and require a long time to dry out if natural moisture contents are too high and may also be susceptible to frost heave under certain conditions. Therefore, these materials can be quite difficult to work with as moisture content, lift thickness, and compactive effort becomes difficult to control. If silty soil is used for structural fill, lift thicknesses should not exceed 6 inches (loose), and fill material moisture must be closely monitored at both the working elevation and the elevations of materials already placed. Following placement, silty soils must be protected from degradation resulting from construction traffic or subsequent construction.

Recommended granular structural fill materials, those classified as GW, GP, SW, and SP, should consist of a 6-inch minus select, clean, granular soil with no more than 50 percent oversize (greater than ¾-inch) material and no more than 12 percent fines (passing No. 200 sieve). These fill materials should be placed in layers not to exceed 12 inches in loose thickness. Prior to placement of structural fill materials, surfaces must be prepared as outlined in the **Construction Considerations** section. Structural fill material should be moisture-conditioned to achieve optimum moisture content prior to compaction. For structural fill below footings, areas of compacted backfill must extend outside the perimeter of the footings for a distance equal to the thickness of fill between the bottom of foundation and underlying soils, or 5 feet, whichever is less. All fill materials must be monitored during placement and tested to confirm compaction requirements, outlined below, have been achieved.

Each layer of structural fill must be compacted, as outlined below:

- Below Structures and Rigid Pavements: A minimum of 95 percent of the maximum dry density as determined by ASTM D1557.
- Below Flexible Pavements and Landscaped Sports Fields: A minimum of 92 percent of the maximum dry density as determined by ASTM D1557 or 95 percent of the maximum dry density as determined by ASTM D698.

The ASTM D1557 test method must be used for samples containing up to 40 percent oversize (greater than ¾-inch) particles. If material contains more than 40 percent but less than 50 percent oversize particles, compaction of fill must be confirmed by proof rolling each lift with a 10-ton vibratory roller (or equivalent) until the maximum density has been achieved. Density testing must be performed after each proof rolling pass until the in-place density test results indicate a drop (or no increase) in the dry density, defined as maximum density or “break over” point. The number of required passes should be used as the requirements on the remainder of fill placement. Material should contain sufficient fines to fill void spaces, and must not contain more than 50 percent oversize particles.

8.7 Cut and Fill Recommendations

It is Atlas' understanding that the east side of the project needs to be elevated approximately 10 to 12 feet and west side of the site needs to be cut approximately 10 feet. It is anticipated that the onsite materials on the west side of the project will be used to fill the east side of the site. The soils encountered on the west side of the project site consisted of CH, SC, and GC soils. The use of these clayey soils (USCS designation of GC, SC, CL, and CH) as fill within the proposed field areas is acceptable. However, use of clayey soils (GC, SC, CL, and CH) as structural fill below footings is prohibited. These materials require very high moisture contents for compaction and require a long time to dry out if natural moisture contents are too high and may also be susceptible to frost heave under certain conditions. Therefore, these materials can be quite difficult to work with as moisture content, lift thickness, and compactive effort becomes difficult to control. If clayey soil is used for structural fill, lift thicknesses should not exceed 6 inches (loose), and fill material moisture must be closely monitored at both the working elevation and the elevations of materials already placed. Following placement, clayey soils must be protected from degradation resulting from construction traffic or subsequent construction.

It is noted that constructed fill zones of up to 12 feet are expected for the project. Atlas recommends that these deeper fill areas be constructed with compacted granular structural fill, and allowed to consolidate for a minimum of 3 months prior to construction of structures. If fine-grained soils are used as fill, additional time to allow for consolidation will be required.

In the vicinity of boring 3, cut operations may encounter groundwater/seepage at final grades. If groundwater/seepage is encountered, Atlas should be contacted to provide mitigation measures prior to final grading.

8.8 Backfill of Walls

Backfill materials must conform to the requirements of structural fill, as defined in this report. For wall heights greater than 2.5 feet, the maximum material size should not exceed 4 inches in diameter. Placing oversized material against rigid surfaces interferes with proper compaction, and can induce excessive point loads on walls. Backfill shall not commence until the wall has gained sufficient strength to resist placement and compaction forces. Further, retaining walls above 2.5 feet in height shall be backfilled in a manner that will limit the potential for damage from compaction methods and/or equipment. It is recommended that only small hand-operated compaction equipment be used for compaction of backfill within a horizontal distance equal to the height of the wall, measured from the back face of the wall.

Backfill should be compacted in accordance with the specifications for structural fill, except in those areas where it is determined that future settlement is not a concern, such as planter areas. In nonstructural areas, backfill must be compacted to a firm and unyielding condition.

8.9 Excavations

Shallow excavations that do not exceed 4 feet in depth may be constructed with side slopes approaching vertical. Below this depth, it is recommended that slopes be constructed in accordance with Occupational Safety and Health Administration (OSHA) regulations, Section 1926, Subpart P. Based on these regulations, on-site soils are classified as type "C" soil, and as such, excavations within these soils should be constructed at a maximum slope of 1½ feet horizontal to 1 foot vertical (1½:1) for excavations up to 20 feet in height. Excavations in excess of 20 feet will require additional analysis. Note that these slope angles are considered stable for short-term conditions only, and will not be stable for long-term conditions.

During the subsurface exploration, boring sidewalls generally exhibited little indication of collapse; however, sloughing of native granular sediments from boring sidewalls was observed, particularly after penetration of the water table. For deep excavations, native granular sediments cannot be expected to remain in position. These materials are prone to failure and may collapse, thereby undermining upper soil layers. This is especially true when excavations approach depths near the water table. Care must be taken to ensure that excavations are properly backfilled in accordance with procedures outlined in this report.

8.10 Groundwater Control

Groundwater was encountered during the investigation but is anticipated to be below the depth of most construction. Excavations below the water table will require a dewatering program. Dewatering will be required prior to placement of fill materials. Placement of concrete can be accomplished through water by the use of a treme. It may be possible to discharge dewatering effluent to remote portions of the site, to a sump, or to a pit. This will essentially recycle effluent, thus eliminating the need to enter into agreements with local drainage authorities. Should the scope of the proposed project change, Atlas should be contacted to provide more detailed groundwater control measures.

Special precautions may be required for control of surface runoff and subsurface seepage. It is recommended that runoff be directed away from open excavations. Clayey soils may become soft and pump if subjected to excessive traffic during time of surface runoff. Ponded water in construction areas should be drained through methods such as trenching, sloping, crowning grades, nightly smooth drum rolling, or installing a French drain system. Additionally, temporary or permanent driveway sections should be constructed if extended wet weather is forecasted.

9. GENERAL COMMENTS

Based on the subsurface conditions encountered during this investigation and available information regarding the proposed development, the site is adequate for the planned construction. When plans and specifications are complete, and if significant changes are made in the character or location of the proposed structures, consultation with Atlas must be arranged as supplementary recommendations may be required. Suitability of subgrade soils and compaction of structural fill materials must be verified by Atlas personnel prior to placement of structural elements. Additionally, monitoring and testing should be performed to verify that suitable materials are used for structural fill and that proper placement and compaction techniques are utilized.

10. REFERENCES

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Appendix I WARRANTY AND LIMITING CONDITIONS

Atlas warrants that findings and conclusions contained herein have been formulated in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics, and engineering geology only for the site and project described in this report. These engineering methods have been developed to provide the client with information regarding apparent or potential engineering conditions relating to the site within the scope cited above and are necessarily limited to conditions observed at the time of the site visit and research. Field observations and research reported herein are considered sufficient in detail and scope to form a reasonable basis for the purposes cited above.

Exclusive Use

This report was prepared for exclusive use of the property owner(s), at the time of the report, and their retained design consultants (“Client”). Conclusions and recommendations presented in this report are based on the agreed-upon scope of work outlined in this report together with the Contract for Professional Services between the Client and Atlas Technical Consultants (“Consultant”). Use or misuse of this report, or reliance upon findings hereof, by parties other than the Client is at their own risk. Neither Client nor Consultant make representation of warranty to such other parties as to accuracy or completeness of this report or suitability of its use by such other parties for purposes whatsoever, known or unknown, to Client or Consultant. Neither Client nor Consultant shall have liability to indemnify or hold harmless third parties for losses incurred by actual or purported use or misuse of this report. No other warranties are implied or expressed.

Report Recommendations are Limited and Subject to Misinterpretation

There is a distinct possibility that conditions may exist that could not be identified within the scope of the investigation or that were not apparent during our site investigation. Findings of this report are limited to data collected from noted explorations advanced and do not account for unidentified fill zones, unsuitable soil types or conditions, and variability in soil moisture and groundwater conditions. To avoid possible misinterpretations of findings, conclusions, and implications of this report, Atlas should be retained to explain the report contents to other design professionals as well as construction professionals.

Since actual subsurface conditions on the site can only be verified by earthwork, note that construction recommendations are based on general assumptions from selective observations and selective field exploratory sampling. Upon commencement of construction, such conditions may be identified that require corrective actions, and these required corrective actions may impact the project budget. Therefore, construction recommendations in this report should be considered preliminary, and Atlas should be retained to observe actual subsurface conditions during earthwork construction activities to provide additional construction recommendations as needed.

Since geotechnical reports are subject to misinterpretation, **do not** separate the soil logs from the report. Rather, provide a copy of, or authorize for their use, the complete report to other design professionals or contractors. Locations of exploratory sites referenced within this report should be considered approximate locations only. For more accurate locations, services of a professional land surveyor are recommended.

This report is also limited to information available at the time it was prepared. In the event additional information is provided to Atlas following publication of our report, it will be forwarded to the client for evaluation in the form received.

Environmental Concerns

Comments in this report concerning either onsite conditions or observations, including soil appearances and odors, are provided as general information. These comments are not intended to describe, quantify, or evaluate environmental concerns or situations. Since personnel, skills, procedures, standards, and equipment differ, a geotechnical investigation report is not intended to substitute for a geoenvironmental investigation or a Phase II/III Environmental Site Assessment. If environmental services are needed, Atlas can provide, via a separate contract, those personnel who are trained to investigate and delineate soil and water contamination.

Vicinity Map

Figure 1

MAP NOTES:

- Delorme Street Atlas
- Not to Scale

LEGEND

Approximate Site Location	●

Eastern Oregon University
Baseball and Soccer Fields

Near the NEC of C Avenue and 6th Street
La Grande, OR

Modified from DeLorme by: JBS
June 28, 2021
Drawing: B211531g

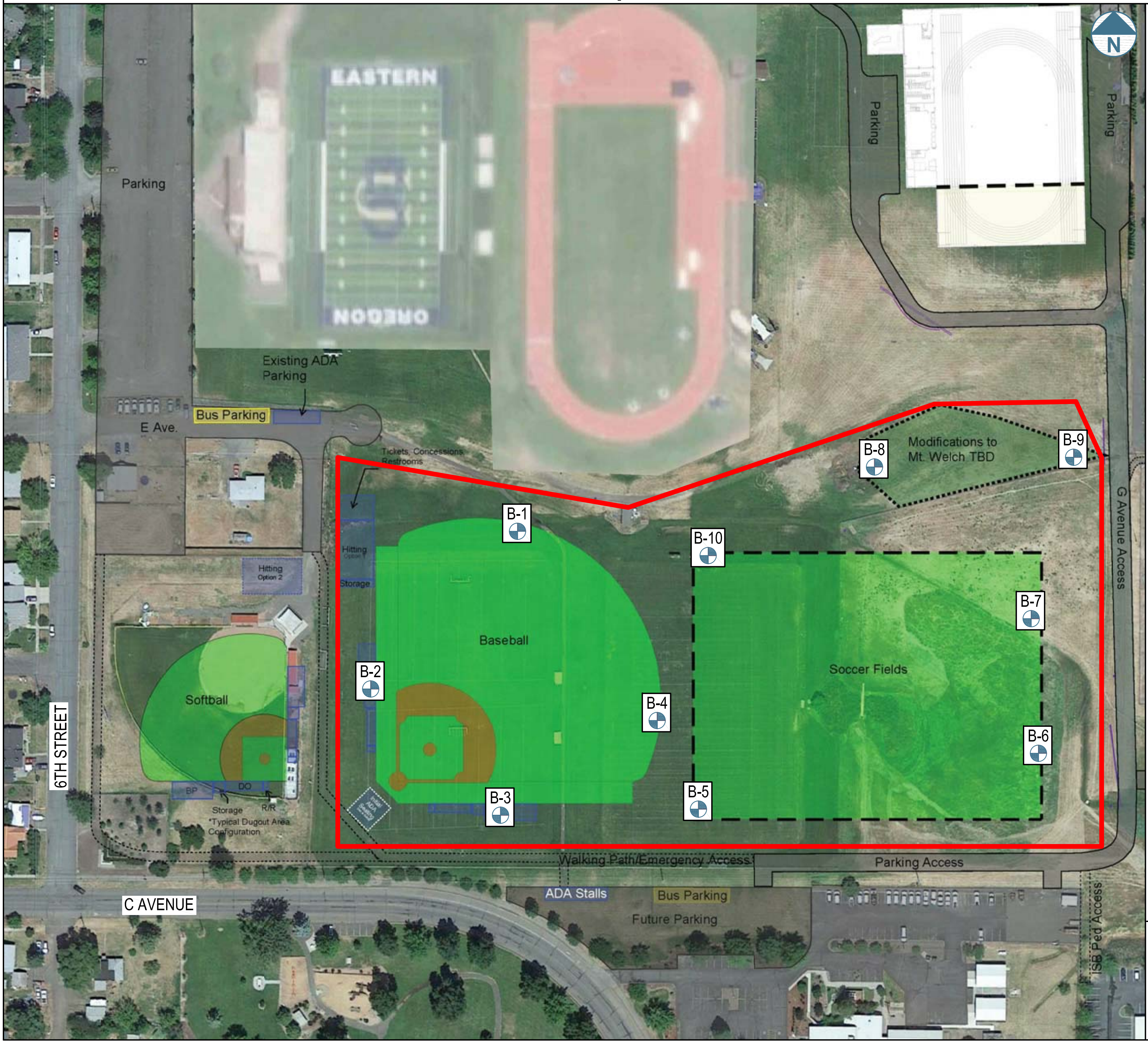
ATLAS

2791 S. Victory View Way
Boise, ID 83709

Phone: (208) 376-4748
Fax: (208) 322-6515
Web: oneatlas.com

Site Map

Figure 2



NOTES:

- Not to Scale

LEGEND

Approximate Site Boundary	🟥
Approximate Atlas Boring Location	◐

Eastern Oregon University
Baseball and Soccer Fields
Near the NEC of C Avenue and 6th Street
La Grande, OR

Modified by: JBS
June 28, 2021
Drawing: B211531g

ATLAS

2791 S. Victory View Way
Boise, ID 83709

Phone: (208) 376-4748
Fax: (208) 322-6515
Web: oneatlas.com

FIELD BORING LOG

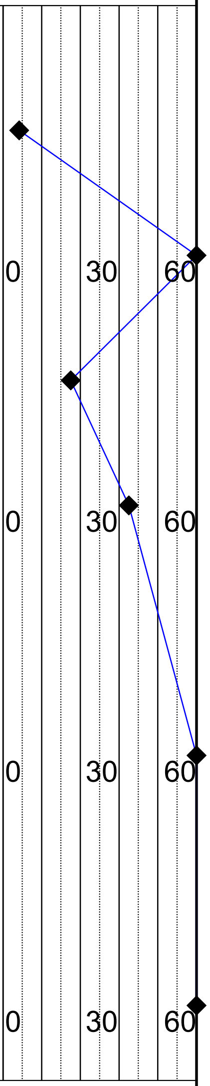
BORING NO.: B-1

TOTAL DEPTH: 21.5

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	Eastern Oregon University	**DRILLING CO.:**	Haztech Drilling, Inc.
LOCATION:	NEC of C Avenue and 6th Street La Grande, OR	**METHOD OF DRILLING:**	6" Hollow Stem Auger
		SAMPLING METHODS:	Split Spoon
JOB NO.:	B211531g	**DATES DRILLED:**	June 2, 2021
LOGGED BY:	Bailey Hereford	**LATITUDE/LONGITUDE:**	45.315512, -118.092617

▼ Water level during drilling ◪ Standard Split Spoon ☒ Auger Sample ▥ California Sampler

DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0	▨	CLAYEY GRAVEL WITH SAND (GC): Dark brown to brown, slightly moist, loose to very dense, with fine to coarse-grained sand and fine to coarse gravel.							
							◪	2,2,3	
5							◪	15,45,40	
							◪	8,10,11	
10							◪	5,18,21	
15							◪	40,50 for 4"	
20							◪	20,28,34	



FIELD BORING LOG

BORING NO.: B-2

TOTAL DEPTH: 21.5

PROJECT INFORMATION

PROJECT: Eastern Oregon University

LOCATION: NEC of C Avenue and 6th Street
La Grande, OR

JOB NO.: B211531g

LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.

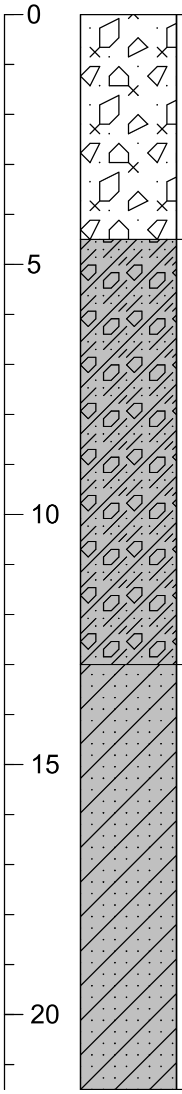
METHOD OF DRILLING: 6" Hollow Stem Auger

SAMPLING METHODS: Split Spoon

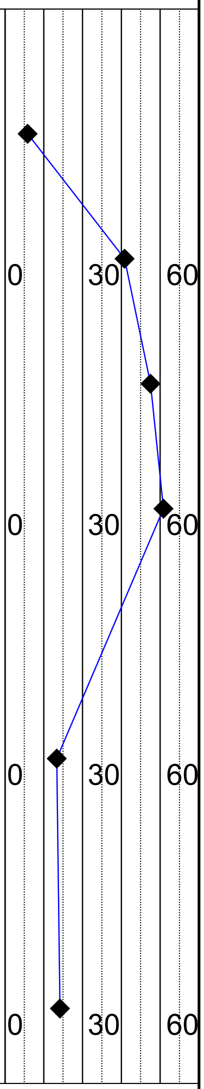
DATES DRILLED: June 2, 2021

LATITUDE/LONGITUDE: 45.314959, -118.092812

▼ Water level during drilling ◪ Standard Split Spoon ☒ Auger Sample ▥ California Sampler



DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
		POORLY GRADED GRAVEL WITH SAND FILL (GP-FILL): Dark brown, slightly moist, loose, with fine to coarse-grained sand and fine gravel.					◪	1,1,6	
		CLAYEY GRAVEL WITH SAND (GC): Dark brown, slightly moist, dense, with fine to coarse-grained sand and fine to coarse gravel.					◪	13,15,22	
							◪	11,21,24	
							◪	15,25,24	
		CLAYEY SAND (SC): Dark brown to light brown, slightly moist to moist, medium dense, with fine to medium-grained sand.					◪	6,8,8	
							◪	3,7,10	



FIELD BORING LOG

BORING NO.: B-3
TOTAL DEPTH: 21.5

PROJECT INFORMATION

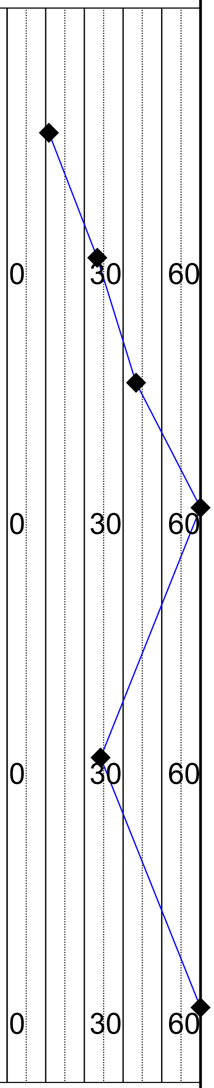
PROJECT: Eastern Oregon University
LOCATION: NEC of C Avenue and 6th Street
La Grande, OR
JOB NO.: B211531g
LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.
METHOD OF DRILLING: 6" Hollow Stem Auger
SAMPLING METHODS: Split Spoon
DATES DRILLED: June 2, 2021
LATITUDE/LONGITUDE: 45.314629, -118.091269

▼ Water level during drilling
◣ Standard Split Spoon
☒ Auger Sample
▨ California Sampler

DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0		FAT CLAY (CH): Black, slightly moist, and stiff.					◣	2,6,7	
5 10		CLAYEY GRAVEL WITH SAND (GC): Dark brown, slightly moist, medium to very dense, with fine to coarse-grained sand and fine to coarse gravel.					◣ ◣ ◣	16,16,12 10,19,21 23,50,50 for 3"	
▼ 15		CLAYEY SAND (SC): Brown, slightly moist to saturated, medium dense, with fine to medium-grained sand.					◣	6,11,18	
20		POORLY GRADED SAND WITH GRAVEL (SP): Gray, saturated, very dense, with fine to coarse-grained sand and fine to coarse gravel.					◣	8,15,50	



FIELD BORING LOG

BORING NO.: B-4

TOTAL DEPTH: 21.5

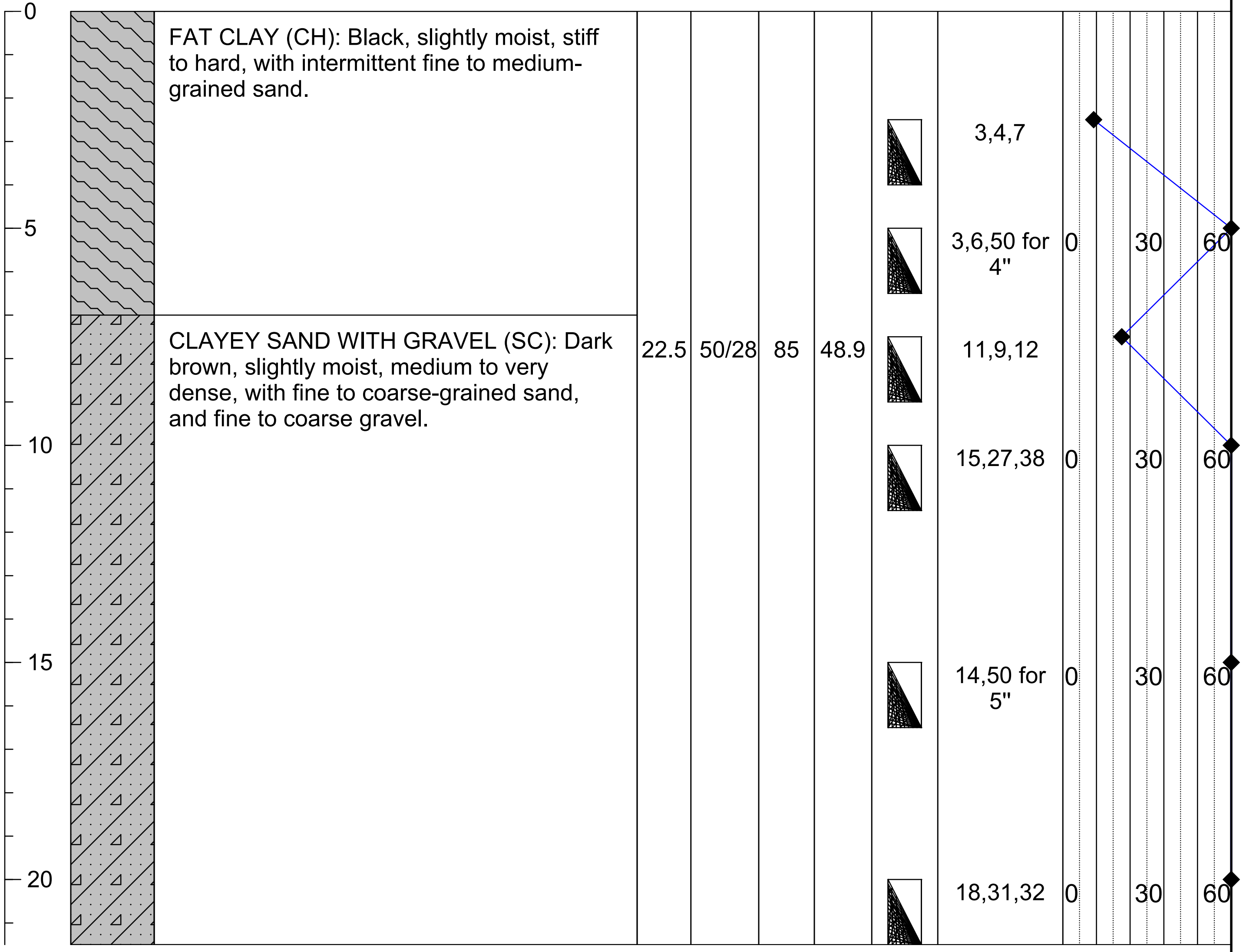
PROJECT INFORMATION

PROJECT:	Eastern Oregon University
LOCATION:	NEC of C Avenue and 6th Street La Grande, OR
JOB NO.:	B211531g
LOGGED BY:	Bailey Hereford

DRILLING INFORMATION

DRILLING CO.:	Haztech Drilling, Inc.
METHOD OF DRILLING:	6" Hollow Stem Auger
SAMPLING METHODS:	Split Spoon
DATES DRILLED:	June 3, 2021
LATITUDE/LONGITUDE:	45.314590, -118.092160

▼ Water level during drilling ◪ Standard Split Spoon ☒ Auger Sample ▥ California Sampler



DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0		FAT CLAY (CH): Black, slightly moist, stiff to hard, with intermittent fine to medium-grained sand.							
							◪	3,4,7	
5							◪	3,6,50 for 4"	
		CLAYEY SAND WITH GRAVEL (SC): Dark brown, slightly moist, medium to very dense, with fine to coarse-grained sand, and fine to coarse gravel.	22.5	50/28	85	48.9	◪	11,9,12	
10							◪	15,27,38	
15							◪	14,50 for 5"	
20							◪	18,31,32	

FIELD BORING LOG

BORING NO.: B-5

TOTAL DEPTH: 11.5

PROJECT INFORMATION

PROJECT: Eastern Oregon University

LOCATION: NEC of C Avenue and 6th Street
La Grande, OR

JOB NO.: B211531g

LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.

METHOD OF DRILLING: 6" Hollow Stem Auger

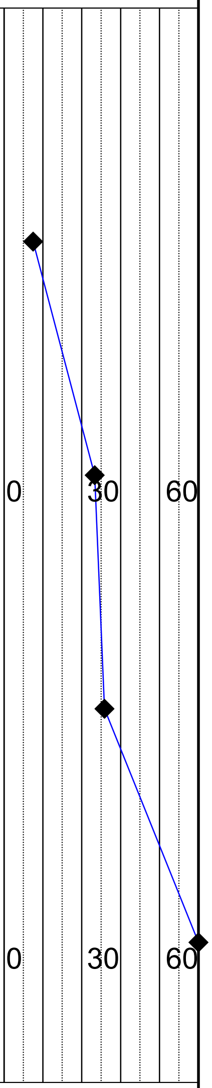
SAMPLING METHODS: Split Spoon

DATES DRILLED: June 3, 2021

LATITUDE/LONGITUDE: 45.314546, -118.090887

▼ Water level during drilling ◩ Standard Split Spoon ☒ Auger Sample ▥ California Sampler

DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0	▨	CLAYEY GRAVEL WITH SAND (GC): Black to dark brown, slightly moist, loose to very dense, with fine to coarse-grained sand and fine to coarse gravel.							
							◩	2,5,4	
5			22.0	60/37	66	42.5	◩	3,10,18	
							◩	11,15,16	
10							◩	50 for 5"	



FIELD BORING LOG

BORING NO.: B-6

TOTAL DEPTH: 6.5

PROJECT INFORMATION

PROJECT: Eastern Oregon University

LOCATION: NEC of C Avenue and 6th Street
La Grande, OR

JOB NO.: B211531g

LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.

METHOD OF DRILLING: 6" Hollow Stem Auger

SAMPLING METHODS: Split Spoon

DATES DRILLED: June 3, 2021

LATITUDE/LONGITUDE: 45.315392, -118.090912

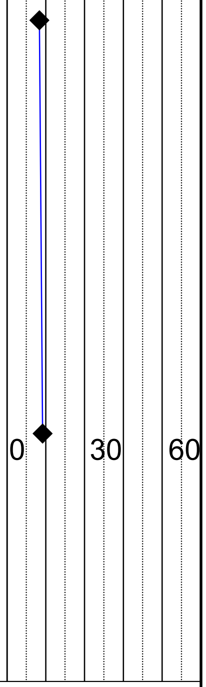
▼ Water level during drilling

◩ Standard Split Spoon

☒ Auger Sample

▥ California Sampler

DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0		FAT CLAY (CH): Black, slightly moist, and stiff.					◩	2,5,5	
5		FAT CLAY WITH GRAVEL (CH): Black to dark brown, slightly moist, stiff, with fine to coarse-grained sand and fine gravel.					◩	5,6,5	



FIELD BORING LOG

BORING NO.: B-7

TOTAL DEPTH: 11.5

PROJECT INFORMATION

PROJECT: Eastern Oregon University

LOCATION: NEC of C Avenue and 6th Street
La Grande, OR

JOB NO.: B211531g

LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.

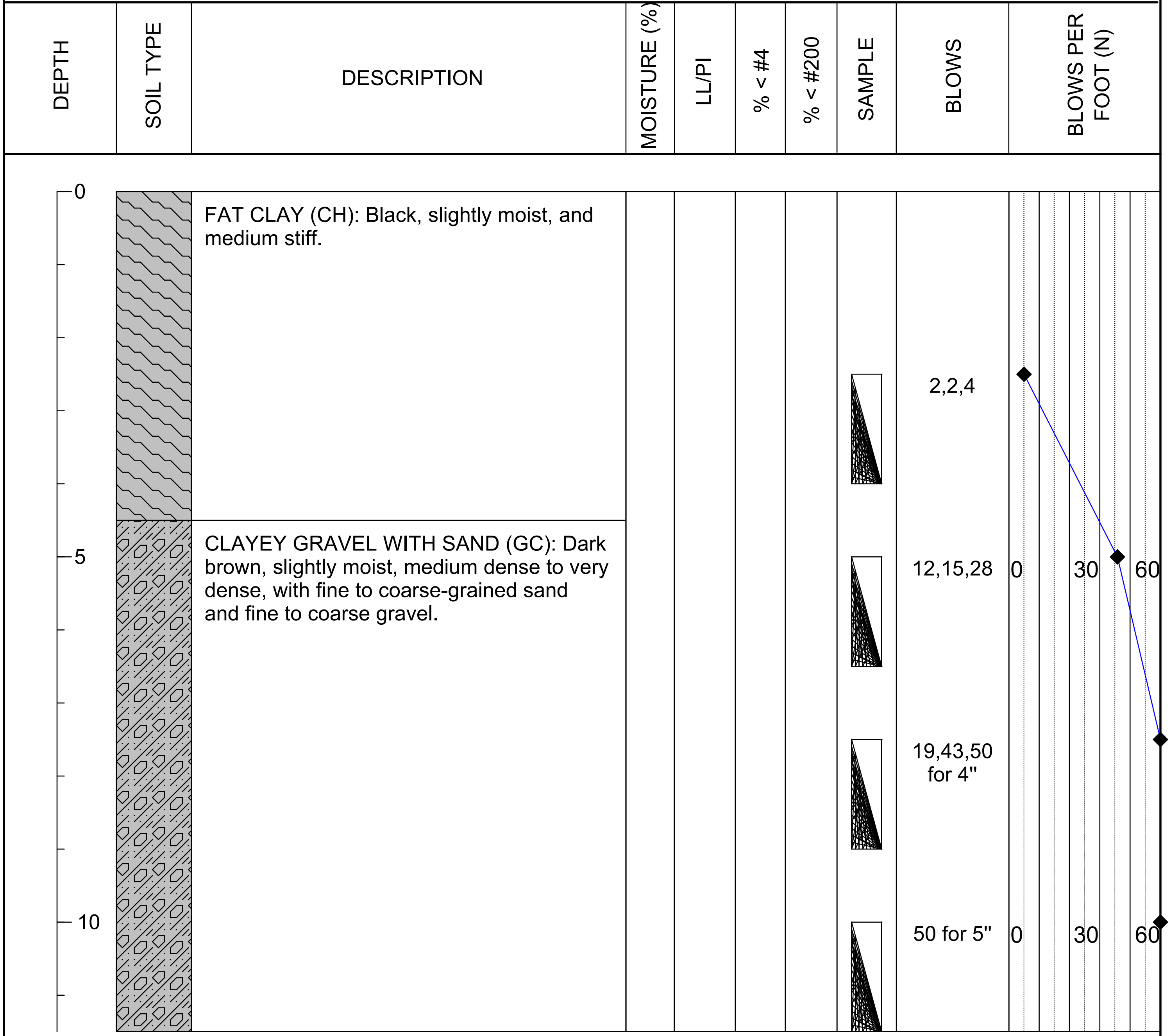
METHOD OF DRILLING: 6" Hollow Stem Auger

SAMPLING METHODS: Split Spoon

DATES DRILLED: June 3, 2021

LATITUDE/LONGITUDE: 45.314692, -118.089181

▼ Water level during drilling ◩ Standard Split Spoon ☒ Auger Sample ▥ California Sampler



DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0		FAT CLAY (CH): Black, slightly moist, and medium stiff.							
							◩	2,2,4	
5		CLAYEY GRAVEL WITH SAND (GC): Dark brown, slightly moist, medium dense to very dense, with fine to coarse-grained sand and fine to coarse gravel.							
							◩	12,15,28	0 30 60
							◩	19,43,50 for 4"	
10							◩	50 for 5"	0 30 60

ATLAS

FIELD BORING LOG

BORING NO.: B-8

TOTAL DEPTH: 6.5

PROJECT INFORMATION

PROJECT: Eastern Oregon University

LOCATION: NEC of C Avenue and 6th Street
La Grande, OR

JOB NO.: B211531g

LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.

METHOD OF DRILLING: 6" Hollow Stem Auger

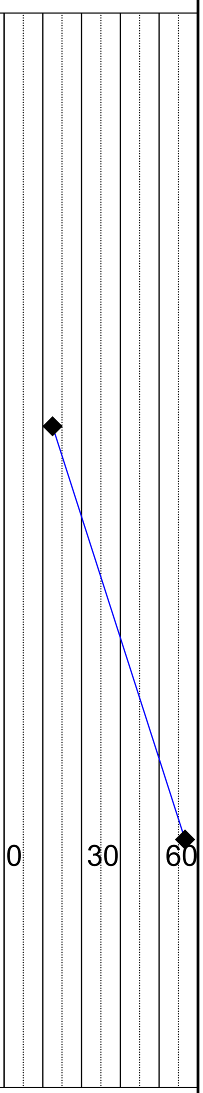
SAMPLING METHODS: Split Spoon

DATES DRILLED: June 3, 2021

LATITUDE/LONGITUDE: 45.314904, -118.089471

▼ Water level during drilling ◩ Standard Split Spoon ☒ Auger Sample ▥ California Sampler

DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0	▨	FAT CLAY (CH): Black, slightly moist, and stiff to very stiff.							
							◩	4,6,9	
5	▨	SILTY SAND WITH GRAVEL (SM): Dark brown, slightly moist, very dense, with fine to coarse-grained sand and fine gravel.	16.7	41/11	73	23.4	◩	13,22,34	



FIELD BORING LOG

BORING NO.: B-9

TOTAL DEPTH: 11.5

PROJECT INFORMATION

PROJECT: Eastern Oregon University

LOCATION: NEC of C Avenue and 6th Street
La Grande, OR

JOB NO.: B211531g

LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.

METHOD OF DRILLING: 6" Hollow Stem Auger

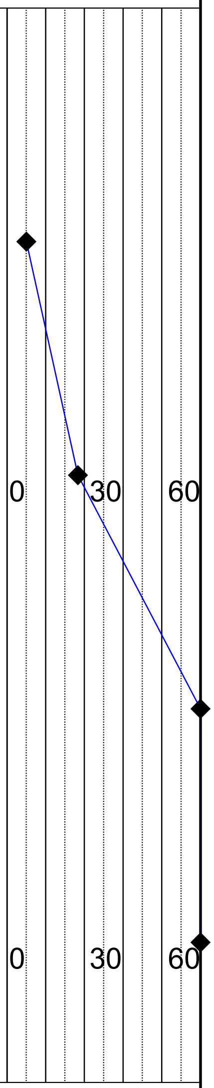
SAMPLING METHODS: Split Spoon

DATES DRILLED: June 3, 2021

LATITUDE/LONGITUDE: 45.315349, -118.089926

▼ Water level during drilling ◩ Standard Split Spoon ☒ Auger Sample ▨ California Sampler

DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0	▨	FAT CLAY (CH): Black, slightly moist, and medium stiff to very stiff.							
							◩	3,3,3	
5							◩	5,11,11	
	▨	CLAYEY GRAVEL WITH SAND (GC): Dark brown, slightly moist, very dense, with fine to coarse-grained sand and fine to coarse gravel.					◩	12,43,50 for 3"	
10							◩	50 for 4"	



ATLAS

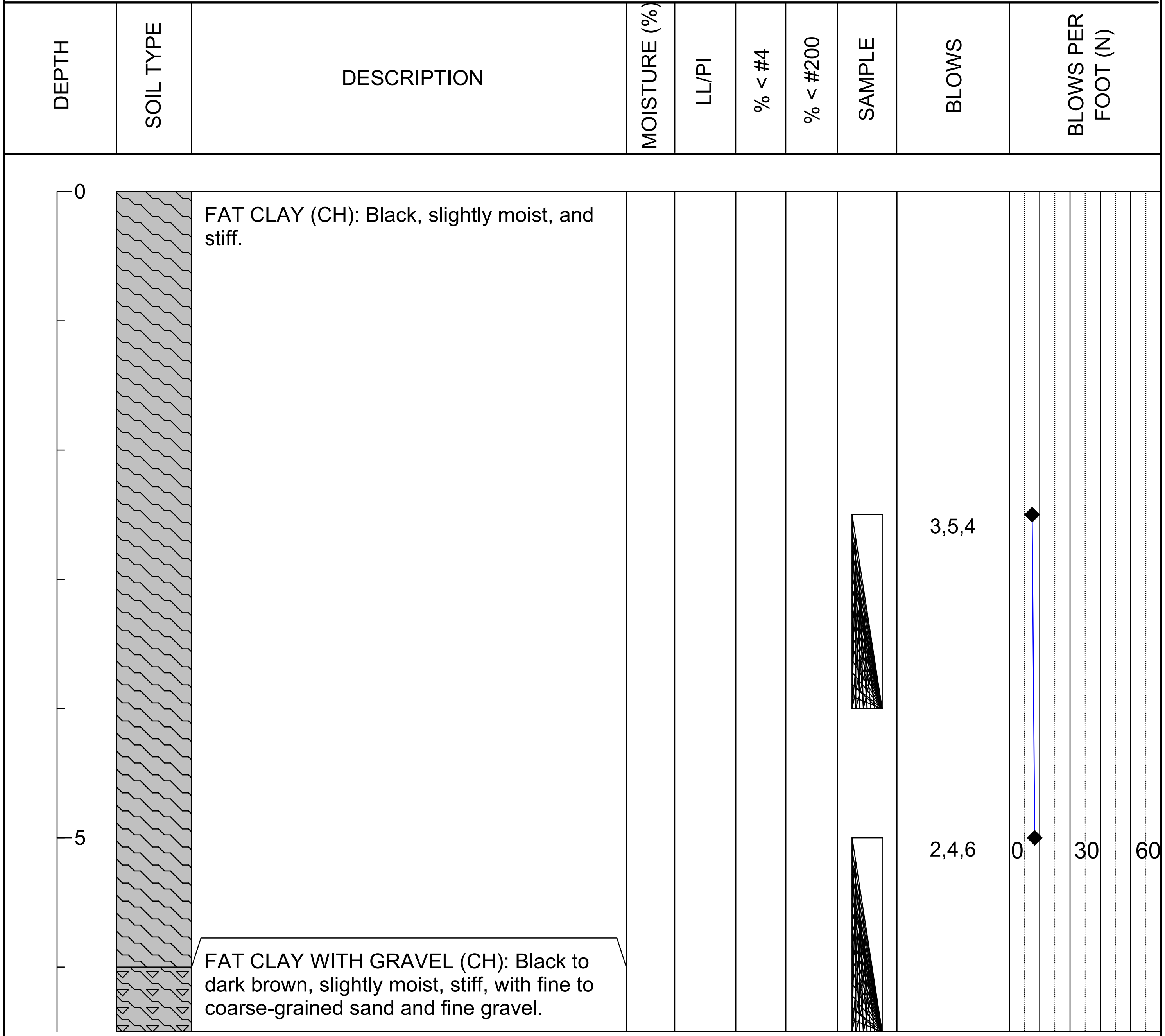
FIELD BORING LOG

BORING NO.: B-10

TOTAL DEPTH: 6.5

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	Eastern Oregon University	**DRILLING CO.:**	Haztech Drilling, Inc.
LOCATION:	NEC of C Avenue and 6th Street La Grande, OR	**METHOD OF DRILLING:**	6" Hollow Stem Auger
		SAMPLING METHODS:	Split Spoon
JOB NO.:	B211531g	**DATES DRILLED:**	June 3, 2021
LOGGED BY:	Bailey Hereford	**LATITUDE/LONGITUDE:**	45.315404, -118.089531

▼ Water level during drilling ◪ Standard Split Spoon ☒ Auger Sample ▥ California Sampler



FAT CLAY (CH): Black, slightly moist, and stiff.

FAT CLAY WITH GRAVEL (CH): Black to dark brown, slightly moist, stiff, with fine to coarse-grained sand and fine gravel.

FIELD BORING LOG

BORING NO.: B-2
TOTAL DEPTH: 21.5

PROJECT INFORMATION

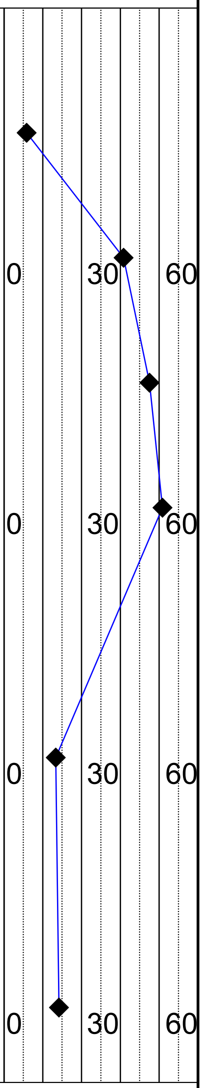
PROJECT: Eastern Oregon University
LOCATION: NEC of C Avenue and 6th Street
La Grande, OR
JOB NO.: B211531g
LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.
METHOD OF DRILLING: 6" Hollow Stem Auger
SAMPLING METHODS: Split Spoon
DATES DRILLED: June 2, 2021
LATITUDE/LONGITUDE: 45.314959, -118.092812

▼ Water level during drilling	◩ Standard Split Spoon	☒ Auger Sample	▨ California Sampler

DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0		POORLY GRADED GRAVEL WITH SAND FILL (GP-FILL): Dark brown, slightly moist, loose, with fine to coarse-grained sand and fine gravel.							
							◩	1,1,6	
5		CLAYEY GRAVEL WITH SAND (GC): Dark brown, slightly moist, dense, with fine to coarse-grained sand and fine to coarse gravel.					◩	13,15,22	
							◩	11,21,24	
10							◩	15,25,24	
		CLAYEY SAND (SC): Dark brown to light brown, slightly moist to moist, medium dense, with fine to medium-grained sand.							
15							◩	6,8,8	
20							◩	3,7,10	



FIELD BORING LOG

BORING NO.: B-3
TOTAL DEPTH: 21.5'

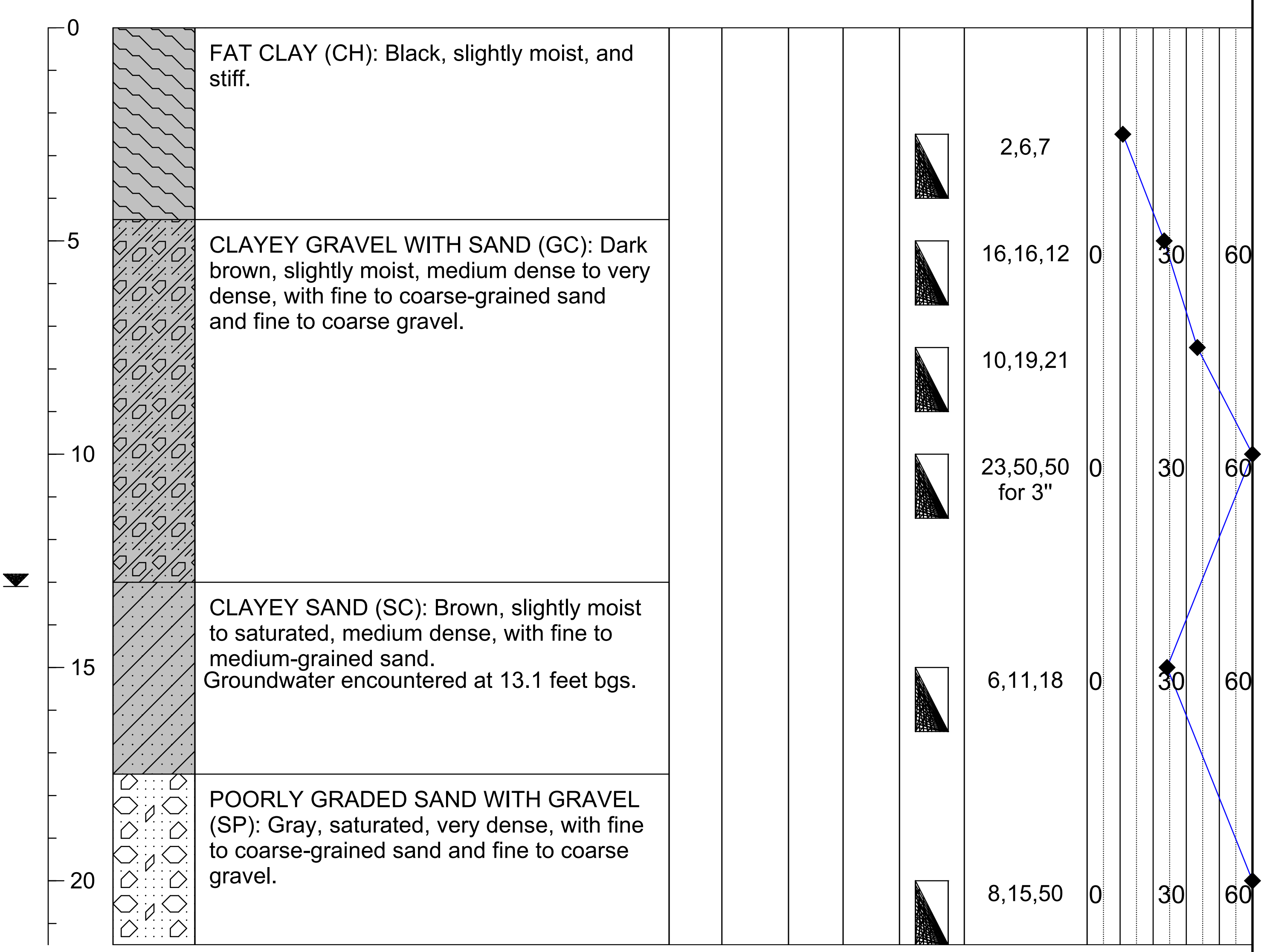
PROJECT INFORMATION

PROJECT:	Eastern Oregon University
LOCATION:	NEC of C Avenue and 6th Street La Grande, OR
JOB NO.:	B211531g
LOGGED BY:	Bailey Hereford

DRILLING INFORMATION

DRILLING CO.:	Haztech Drilling, Inc.
METHOD OF DRILLING:	6" Hollow Stem Auger
SAMPLING METHODS:	Split Spoon
DATES DRILLED:	June 2, 2021
LATITUDE/LONGITUDE:	45.314629, -118.091269

▼ Water level during drilling ◪ Standard Split Spoon ☒ Auger Sample ▮ California Sampler



DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
		FAT CLAY (CH): Black, slightly moist, and stiff.					◪	2,6,7	
		CLAYEY GRAVEL WITH SAND (GC): Dark brown, slightly moist, medium dense to very dense, with fine to coarse-grained sand and fine to coarse gravel.					◪ ◪ ◪	16,16,12 10,19,21 23,50,50 for 3"	
		CLAYEY SAND (SC): Brown, slightly moist to saturated, medium dense, with fine to medium-grained sand. Groundwater encountered at 13.1 feet bgs.					◪	6,11,18	
		POORLY GRADED SAND WITH GRAVEL (SP): Gray, saturated, very dense, with fine to coarse-grained sand and fine to coarse gravel.					◪	8,15,50	

FIELD BORING LOG

BORING NO.: B-4
TOTAL DEPTH: 21.5

PROJECT INFORMATION

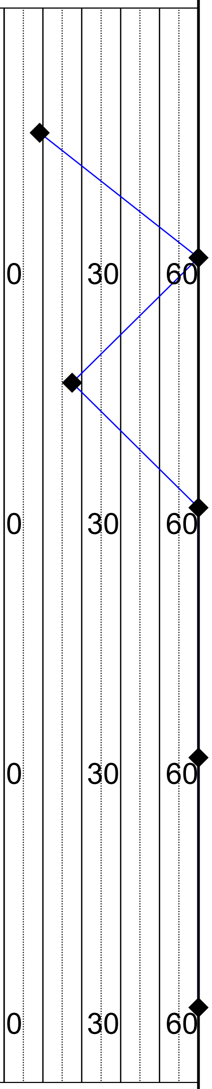
PROJECT: Eastern Oregon University
LOCATION: NEC of C Avenue and 6th Street
La Grande, OR
JOB NO.: B211531g
LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.
METHOD OF DRILLING: 6" Hollow Stem Auger
SAMPLING METHODS: Split Spoon
DATES DRILLED: June 3, 2021
LATITUDE/LONGITUDE: 45.314590, -118.092160

▼ Water level during drilling ◩ Standard Split Spoon ☒ Auger Sample ▥ California Sampler

DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0	▨	FAT CLAY (CH): Black, slightly moist, stiff to hard, with intermittent fine to medium-grained sand.							
							◩	3,4,7	
5							◩	3,6,50 for 4"	
	▨	CLAYEY SAND WITH GRAVEL (SC): Dark brown, slightly moist, medium to very dense, with fine to coarse-grained sand, and fine to coarse gravel.	22.5	50/28	85	48.9	◩	11,9,12	
10							◩	15,27,38	
15							◩	14,50 for 5"	
20							◩	18,31,32	



ATLAS

FIELD BORING LOG

BORING NO.: B-5
TOTAL DEPTH: 11.5

PROJECT INFORMATION

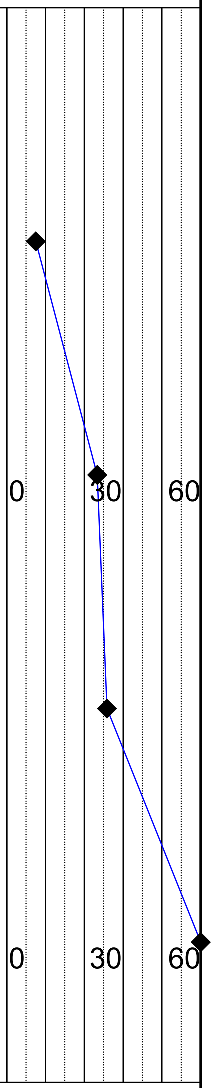
PROJECT: Eastern Oregon University
LOCATION: NEC of C Avenue and 6th Street
La Grande, OR
JOB NO.: B211531g
LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.
METHOD OF DRILLING: 6" Hollow Stem Auger
SAMPLING METHODS: Split Spoon
DATES DRILLED: June 3, 2021
LATITUDE/LONGITUDE: 45.314546, -118.090887

▼ Water level during drilling ◪ Standard Split Spoon ☒ Auger Sample ▥ California Sampler

DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0	▨	CLAYEY GRAVEL WITH SAND (GC): Black to dark brown, slightly moist, loose to very dense, with fine to coarse-grained sand and fine to coarse gravel.							
							◪	2,5,4	
5			22.0	60/37	66	42.5	◪	3,10,18	0 30 60
							◪	11,15,16	
10							◪	50 for 5"	0 30 60



ATLAS

FIELD BORING LOG

BORING NO.: B-6

TOTAL DEPTH: 6.5

PROJECT INFORMATION

PROJECT: Eastern Oregon University

LOCATION: NEC of C Avenue and 6th Street
La Grande, OR

JOB NO.: B211531g

LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.

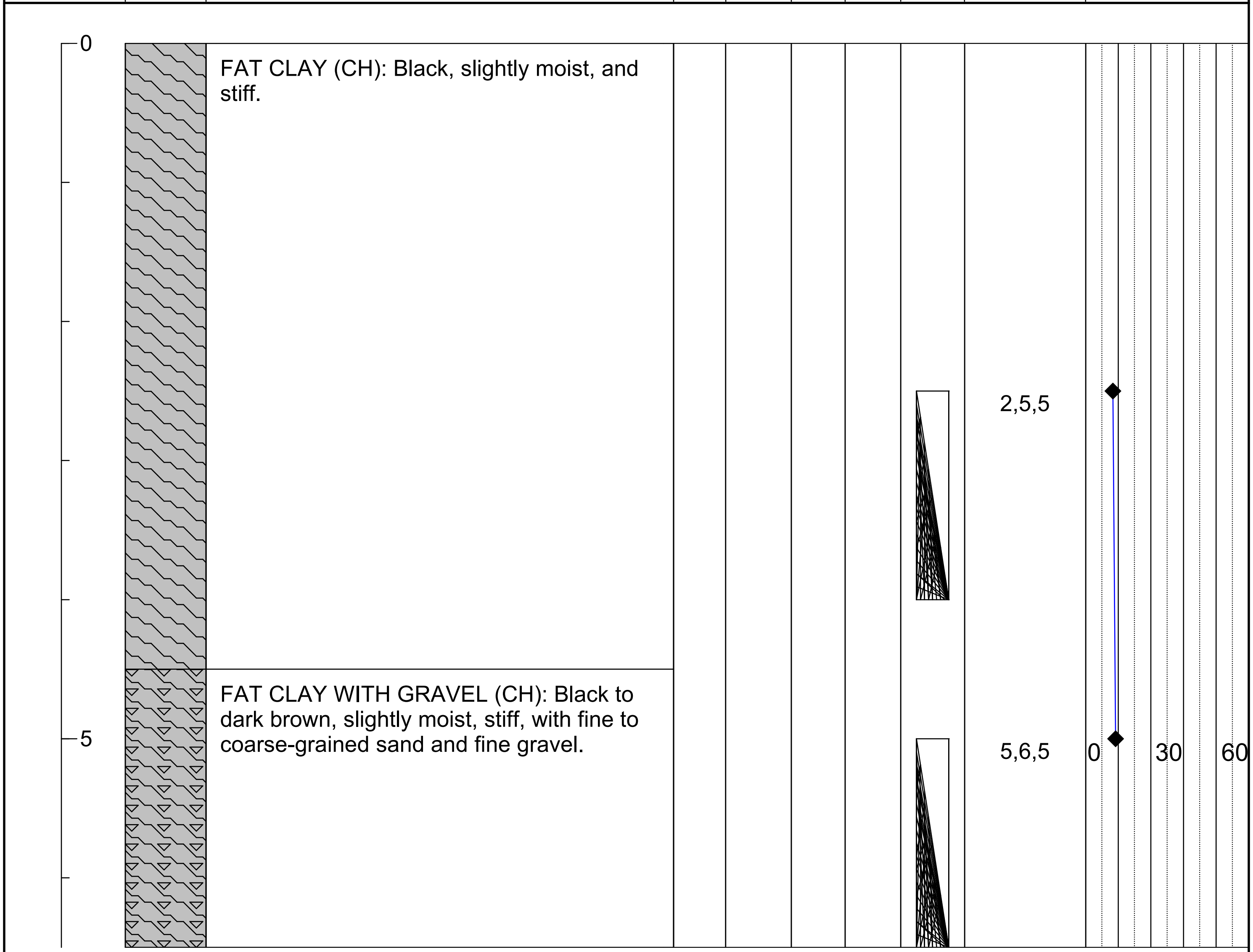
METHOD OF DRILLING: 6" Hollow Stem Auger

SAMPLING METHODS: Split Spoon

DATES DRILLED: June 3, 2021

LATITUDE/LONGITUDE: 45.315392, -118.090912

▼ Water level during drilling ◩ Standard Split Spoon ☒ Auger Sample ▥ California Sampler



DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0	CH	FAT CLAY (CH): Black, slightly moist, and stiff.					◩	2,5,5	
	CH	FAT CLAY WITH GRAVEL (CH): Black to dark brown, slightly moist, stiff, with fine to coarse-grained sand and fine gravel.					◩	5,6,5	

FIELD BORING LOG

BORING NO.: B-7

TOTAL DEPTH: 11.5

PROJECT INFORMATION

PROJECT: Eastern Oregon University

LOCATION: NEC of C Avenue and 6th Street
La Grande, OR

JOB NO.: B211531g

LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.

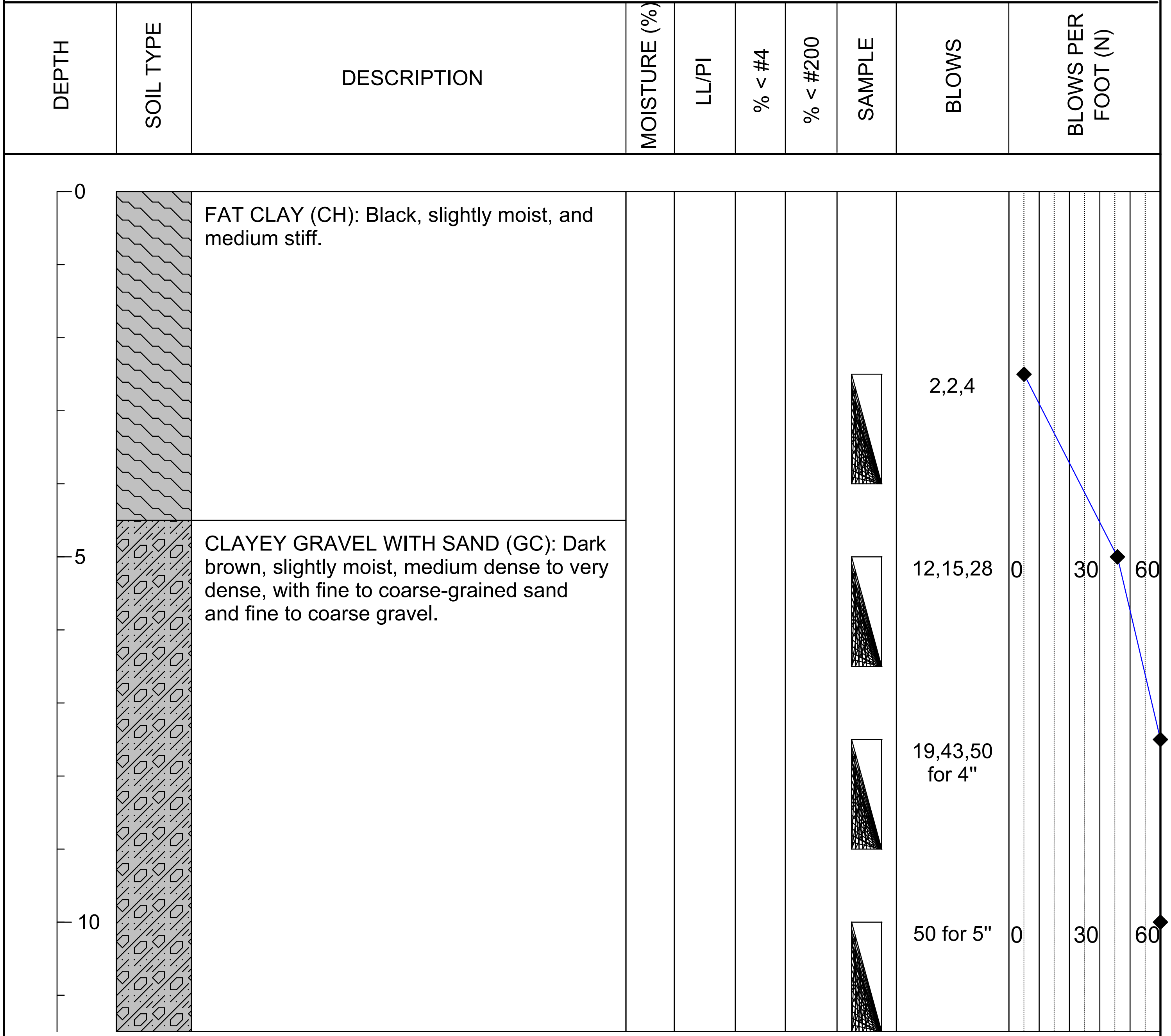
METHOD OF DRILLING: 6" Hollow Stem Auger

SAMPLING METHODS: Split Spoon

DATES DRILLED: June 3, 2021

LATITUDE/LONGITUDE: 45.314692, -118.089181

▼ Water level during drilling ◩ Standard Split Spoon ☒ Auger Sample ▥ California Sampler



FAT CLAY (CH): Black, slightly moist, and medium stiff.

2,2,4

CLAYEY GRAVEL WITH SAND (GC): Dark brown, slightly moist, medium dense to very dense, with fine to coarse-grained sand and fine to coarse gravel.

12,15,28

19,43,50 for 4"

50 for 5"

ATLAS

FIELD BORING LOG

BORING NO.: B-8

TOTAL DEPTH: 6.5

PROJECT INFORMATION

PROJECT: Eastern Oregon University

LOCATION: NEC of C Avenue and 6th Street
La Grande, OR

JOB NO.: B211531g

LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.

METHOD OF DRILLING: 6" Hollow Stem Auger

SAMPLING METHODS: Split Spoon

DATES DRILLED: June 3, 2021

LATITUDE/LONGITUDE: 45.314904, -118.089471

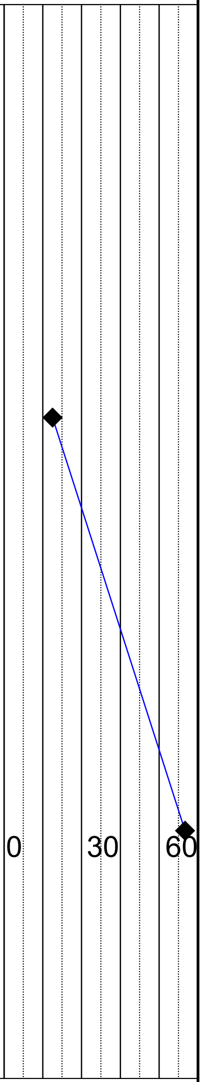
▼ Water level during drilling

◩ Standard Split Spoon

☒ Auger Sample

▥ California Sampler

DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0		FAT CLAY (CH): Black, slightly moist, and stiff to very stiff.							
							◩	4,6,9	
		SILTY SAND WITH GRAVEL (SM): Dark brown, slightly moist, very dense, with fine to coarse-grained sand and fine gravel.							
5			16.7	41/11	73	23.4	◩	13,22,34	



FIELD BORING LOG

BORING NO.: B-9

TOTAL DEPTH: 11.5

PROJECT INFORMATION

PROJECT: Eastern Oregon University

LOCATION: NEC of C Avenue and 6th Street
La Grande, OR

JOB NO.: B211531g

LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.

METHOD OF DRILLING: 6" Hollow Stem Auger

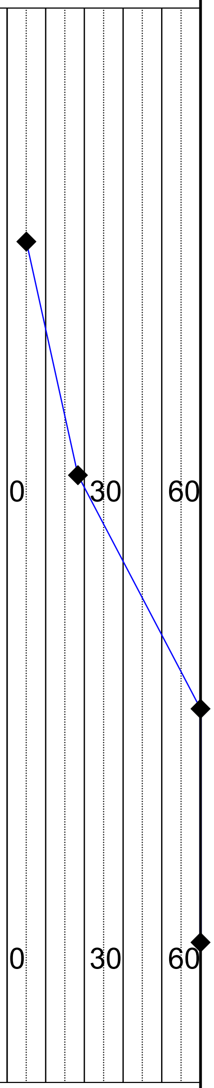
SAMPLING METHODS: Split Spoon

DATES DRILLED: June 3, 2021

LATITUDE/LONGITUDE: 45.315349, -118.089926

▼ Water level during drilling ◪ Standard Split Spoon ☒ Auger Sample ▯ California Sampler

DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0		FAT CLAY (CH): Black, slightly moist, and medium stiff to very stiff.							
							◪	3,3,3	
5							◪	5,11,11	
		CLAYEY GRAVEL WITH SAND (GC): Dark brown, slightly moist, very dense, with fine to coarse-grained sand and fine to coarse gravel.					◪	12,43,50 for 3"	
10							◪	50 for 4"	



FIELD BORING LOG

BORING NO.: B-10

TOTAL DEPTH: 6.5

PROJECT INFORMATION

PROJECT: Eastern Oregon University

LOCATION: NEC of C Avenue and 6th Street
La Grande, OR

JOB NO.: B211531g

LOGGED BY: Bailey Hereford

DRILLING INFORMATION

DRILLING CO.: Haztech Drilling, Inc.

METHOD OF DRILLING: 6" Hollow Stem Auger

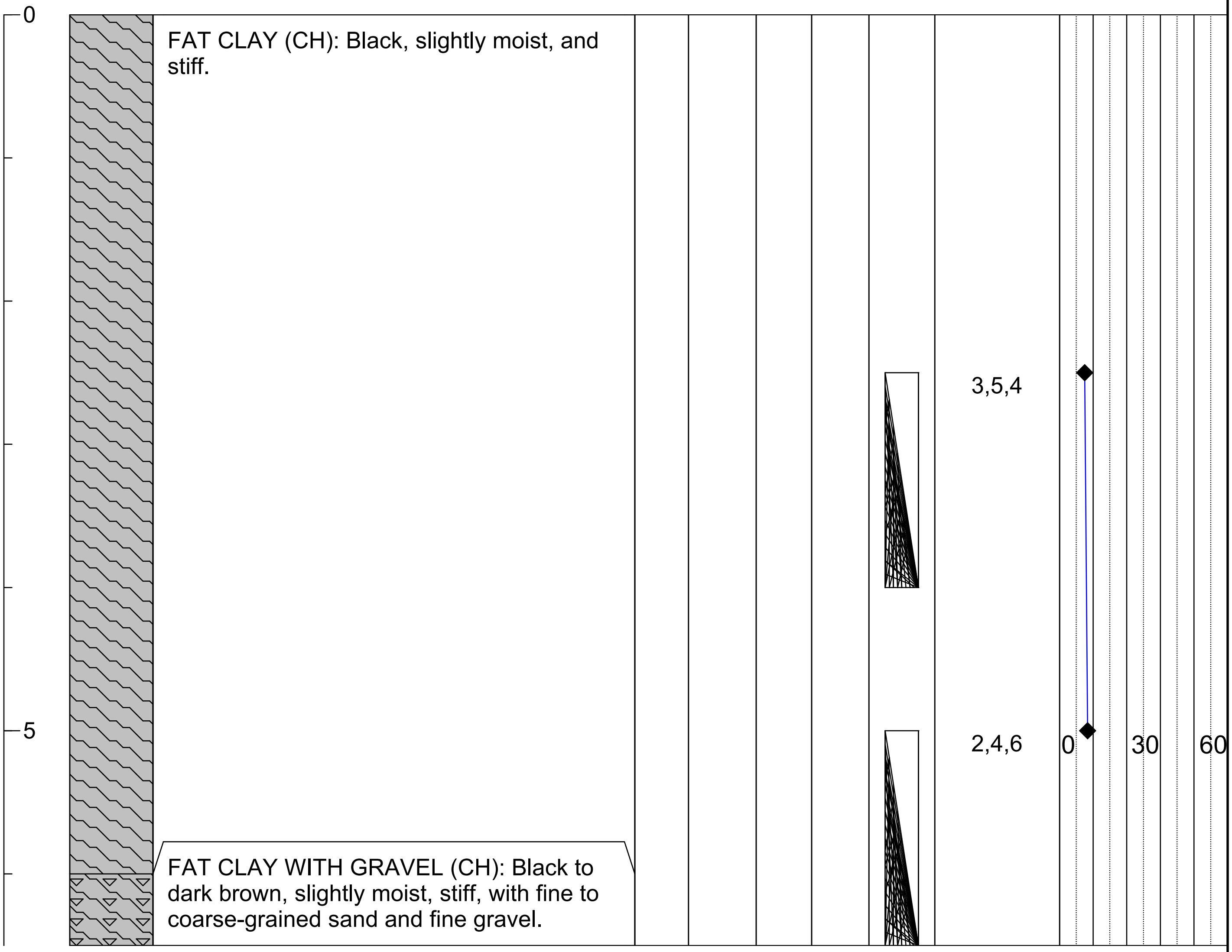
SAMPLING METHODS: Split Spoon

DATES DRILLED: June 3, 2021

LATITUDE/LONGITUDE: 45.315404, -118.089531

▼ Water level during drilling ◪ Standard Split Spoon ☒ Auger Sample ▥ California Sampler

DEPTH	SOIL TYPE	DESCRIPTION	MOISTURE (%)	LL/PI	% < #4	% < #200	SAMPLE	BLOWS	BLOWS PER FOOT (N)
0		FAT CLAY (CH): Black, slightly moist, and stiff.							
							◪	3,5,4	
5							◪	2,4,6	
		FAT CLAY WITH GRAVEL (CH): Black to dark brown, slightly moist, stiff, with fine to coarse-grained sand and fine gravel.							



Appendix V GEOTECHNICAL GENERAL NOTES

Unified Soil Classification System

Major Divisions		Symbol	Soil Descriptions
Coarse-Grained Soils < 50% passes No.200 sieve	Gravel & Gravelly Soils < 50% coarse	GW	Well-graded gravels; gravel/sand mixtures with little or no fines
		GP	Poorly-graded gravels; gravel/sand mixtures with little or no fines
		GM	Silty gravels; poorly-graded gravel/sand/silt mixtures
		GC	Clayey gravels; poorly-graded gravel/sand/clay mixtures
	Sand & Sandy Soils > 50% coarse fraction	SW	Well-graded sands; gravelly sands with little or no fines
		SP	Poorly-graded sands; gravelly sands with little or no fines
		SM	Silty sands; poorly-graded sand/gravel/silt mixtures
		SC	Clayey sands; poorly-graded sand/gravel/clay mixtures
Fine-Grained Soils > 50% passes No.200 sieve	Silts & Clays LL < 50	ML	Inorganic silts; sandy, gravelly or clayey silts
		CL	Lean clays; inorganic, gravelly, sandy, or silty, low to medium-plasticity clays
		OL	Organic, low-plasticity clays and silts
	Silts & Clays LL > 50	MH	Inorganic, elastic silts; sandy, gravelly or clayey elastic silts
		CH	Fat clays; high-plasticity, inorganic clays
		OH	Organic, medium to high-plasticity clays and silts
Highly Organic Soils		PT	Peat, humus, hydric soils with high organic content

Relative Density and Consistency Classification

Coarse-Grained Soils	SPT Blow Counts (N)
Very Loose:	< 4
Loose:	4-10
Medium Dense:	10-30
Dense:	30-50
Very Dense:	> 50
Fine-Grained Soils	**SPT Blow Counts (N)**
Very Soft:	< 2
Soft:	2-4
Medium Stiff:	4-8
Stiff:	8-15
Very Stiff:	15-30
Hard:	> 30

Moisture Content and Cementation Classification

Description	Field Test
Dry	Absence of moisture, dry to touch
Slightly Moist	Damp, but no visible moisture
Moist	Visible moisture
Wet	Visible free water
Saturated	Soil is usually below water table
Description	**Field Test**
Weak	Crumbles or breaks with handling or slight finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

Particle Size

Boulders:	> 12 in.
Cobbles:	12 to 3 in.
Gravel:	3 in. to 5 mm
Coarse-Grained Sand:	5 to 0.6 mm
Medium-Grained Sand:	0.6 to 0.2 mm
Fine-Grained Sand:	0.2 to 0.075 mm
Silts:	0.075 to 0.005 mm
Clays:	< 0.005 mm

Acronym List

GS	grab sample
LL	Liquid Limit
M	moisture content
NP	non-plastic
PI	Plasticity Index
Q_p	penetrometer value, unconfined compressive strength, tsf
V	vane value, ultimate shearing strength, tsf

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:
- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:
- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

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