Appendix B: Construction Storm Water Pollution Prevention Plan

Construction/Storm Water Pollution Prevention Plan

Astoria Station

Deuel County, South Dakota

Site Contact:

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DWG#: SWPPP-ASTORIA STATION

ASTORIA STATION
SIMPLE CYCLE PROJECT
STORMWATER POLLUTION PREVENTION PLAN

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ASTORIA STATION
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1.0 INTRODUCTION

The South Dakota Department of Environment & Natural Resources (SDDENR) Construction General Permit (CGP) includes provisions for development of a Stormwater Pollution Prevention Plan (SWPPP) to maximize potential benefits of pollution prevention and sediment and erosion control measures at construction sites. A copy of CGP No. SDR 100000 is included in Appendix A of this document.

Otter Tail is planning to build a simple cycle power plant at Astoria, South Dakota. Total acreage of the project and total disturbed acreage is 17.0 acres. Appendix C shows the general location of the proposed construction.

Astoria storm sewer system consisting of multiple storm drain inlets, manholes and sewer piping, vegetated swales and culverts will be installed to convey runoff to a sediment basin. Soil disturbing activities will include: clearing and grubbing; installing stabilized construction exits; installing temporary erosion and sediment controls; grading; excavation for the sediment basin, storm drain inlets, underground utilities, building foundations; construction of roads; and preparation for final seeding, mulching, and landscaping.

2.0 SWPPP COORDINATOR AND DUTIES

The construction site SWPPP coordinator for the project will be Keith Kelly of Otter Tail Power Company. The SWPPP coordinator has been trained in Stormwater Pollution Prevention. Duties of the SWPPP coordinator include but are not limited to the following:

- Implement the SWPPP and maintain a copy of the plan in a location where it is readily available;
- Post and maintain Construction Site Notice, located in Appendix A, in a location where it is readily available for viewing by the general public;
- Identify potential pollutant sources and necessary erosion and/or sediment controls;
- Identify the locations of all erosion and/or sediment controls on the site map;
- Ensure that the site map is up to date at all times;
- Conduct or oversee inspections and monitoring activities; and
- Retain inspection reports with the plan.

The SWPPP coordinator is also responsible for recording dates when:

- Major grading activities occur;
- Construction activities temporarily or permanently cease on a portion of the site; and
- Stabilization measures are initiated, see the form provided in Appendix E.

3.0 FACILITY DESCRIPTION

3.1 Site Location

Astoria Station is located in Section 22, Township 113 North, Range 48 west, Deuel County, South Dakota. Physical address of the project is 19333 482nd Avenue, Astoria, SD 57213. See the general location map located in Appendix C.

3.2 Construction Activities

Silt fence, stabilized construction exit, storm sewer, and vegetated ditches/swales will be installed to convey runoff to a sediment basin. Soil disturbing activities will include: clearing and grubbing; installing temporary erosion and sediment controls; grading; excavation for the sediment basin, storm drain inlets, underground utilities, building foundations; construction of roads; and preparation for final seeding and mulching.

3.3 Waters

The site plans located in Appendix C show the project location. Unnamed wetlands are located adjacent to the site. No adverse impacts to these bodies of water are anticipated.

This project is not located within a Municipal Separate Storm Sewer System (MS4). Construction-related land clearing will be limited to the project site**.** Best engineering practices for erosion control will be employed to reduce the potential for sediment transport by surface water flows to local streams and/or any potential groundwater recharge areas during heavy rainfall events.

3.4 Soils

Geotechnical exploration and testing was performed by Braun Intertec during month of July and August of 2018. Geotechnical report is provided in Appendix F.

3.5 Construction Types

The overall sequence of construction activities can be divided into three general periods:

- Site preparation;
- Construction; and
- Post-construction maintenance.

Site preparation consists of:

- Installing temporary erosion and sedimentation controls;

- Clearing and grubbing;
- Topsoil stripping;
- Site grading; and
- Installing construction access roads as needed.

Post-construction maintenance activities include:

- Stabilizing areas disturbed by construction; and
- Removing all temporary sediment and erosion controls.

Construction is scheduled to begin in June 2019 and end in November 2020.

3.6 Site Maps

The site maps in Appendix C show the following:

- Construction site,
- Receiving water,
- Drainage patterns, and approximate slopes after major construction,
- Areas of soil disturbance,
- Locations of all major structural and non-structural controls either planned or in place,
- Locations of stabilization practices (will be plotted when installed),
- Surface waters (including wetlands) either adjacent or in close proximity
- Vehicle entrance and exit locations, and
- Pollutant generating activities

As mentioned in section 2.0, the SWPPP coordinator is responsible for making any adjustments or modifications, based on actual site conditions, to the erosion controls and their locations. Any adjustments or modifications will be recorded on the site maps that accompany the SWPPP. S&L will incorporate any changes to the BMP plans as needed following regular inspections of the Project Site.

4.0 IDENTIFICATION OF POTENTIAL STORMWATER CONTAMINANTS

The primary pollutant source for the project is sediment from disturbed soil within the construction area. Construction activity will be managed to reduce erosion, sedimentation and accumulation of soils in the surrounding watershed. The following soil-disturbing activities are anticipated:

- Clearing and grubbing; and
- Grading the construction site

Potential non-sediment pollutants within the construction area may come from vehicle fluids such as gasoline, oil, transmission fluid, grease, antifreeze, etc., but are not anticipated to be components of any stormwater that is discharged from the site.

5.0 STORMWATER MANAGEMENT CONTROLS

The purpose of this section is to identify the types of temporary and permanent erosion and sediment controls that will be used during construction activities. The controls will provide soil stabilization for disturbed areas and structural controls to divert runoff and remove sediment. This section will also address control of other potential stormwater pollutant sources such as waste disposal, control of vehicle traffic, and sanitary waste disposal.

5.1 Temporary and Permanent Erosion Control Practices

The SWPPP coordinator is responsible for making sure that the construction contractor is implementing all measures necessary to prevent the erosion of soil within the construction limits and prevent pollutant discharges.

The SWPPP coordinator is responsible for making sure the construction contractor adjusts or modifies the erosion controls and their locations, based upon actual field conditions. All measures necessary shall be implemented to prevent the erosion of soil within the limits of construction and to prevent pollutant discharges. To ensure permit compliance, the site maps will be updated as the work progresses to show the actual erosion and sedimentation control locations.

For this project, it is anticipated that the proper implementation and maintenance of silt fences will be sufficient to control most of the potential erosion from any anticipated storm events. All silt fences (or any other necessary alternative erosion control devices) will be installed and functional prior to beginning construction activities in the affected area. Upon determination that an erosion control measure is not functioning properly or is determined to be inadequate, repairs and/or additional erosion control measures will be implemented prior to the next rainfall event. If it is not practicable to modify the inadequate control measure prior to the next rainfall event, this reason will be documented in the SWPPP. When BMPs are intentionally disabled, run-over, or otherwise rendered ineffective, they will be replaced or corrected immediately.

The erosion and sedimentation control implementation strategy is to prevent or reduce the amount of pollutants (typically sediment) from entering stormwater runoff. The decision to install sediment barriers will be made based on specific evaluations of the work sites and will target loose soil and low points in a manner to control the discharges and limit soil loss. On flat grades where the disturbed ground is buffered by undisturbed vegetation on the project site, there is only a limited need for sediment barriers, generally at the local low points.

Temporary Stormwater Controls and Stabilization Practices:

This project will use the following temporary controls and stabilization practices:

- Sediment Barriers: Project will utilize primarily silt fences. Straw bale erosion check for swale/ditch/inlet, and stabilized construction entrances will be installed as needed.
- Temporary Stabilization: Primarily re-seeding will occur immediately when ground disturbing activities will cease for at least fourteen (14) days.
- Vegetated Buffers: Uncleaned zones adjacent to the project site will be utilized when feasible; if deemed unfeasible, appropriate controls will be used in place of the buffers

Permanent Stormwater Controls and Stabilization Practices:

Permanent controls will rely on native vegetation to finally stabilize the areas disturbed by construction. Assuming the root systems of the original vegetation remain viable after clearing, this vegetation is expected to return once construction traffic has stopped. It is expected that the original vegetation will require at least one growing season to re-establish. Disturbed areas where the original vegetation does not return will be stabilized using native grasses and/or plants as stipulated in the project clearing specifications.

The sediment basin will be constructed in the north side of the construction site to remove sediment from stormwater runoff. The basin will be designed to meet South Dakota Drainage Manual criteria. The basin will drain—through a riser pipe open at the top with a trash rack and outlet pipe with anti-seep collars—to a riprap spillway leading to a level spreader, which will discharge to the wetland. The slopes of the basin will be stabilized using seeded topsoil. Influent to the basin will be supplied by a stormwater pipe on the south end of the basin as well as two culverts, one each at the southeast and southwest portions of the basin. The sediment basin will be converted to a permanent detention basin following completion of construction activities at the site.

Stabilization measures will be initiated “immediately” or as soon as practicable, but no later than the end of the following working day in portions of the site where construction activities will temporarily or permanently cease for fourteen (14) days. Stabilization activities will be complete no later than fourteen (14) calendar days after earth disturbing activities have ceased. After the construction activities are complete and the disturbed areas are stabilized, the erosion and sedimentation controls will be removed.

5.2 Other Pollution Prevention Controls

- Off-Site Tracking – The construction site including entrances and staging areas will be cleaned regularly to keep them clear of materials, debris, and trash.
- Dust Control/Soil Compaction – The minimum amount of water necessary for dust control/soil compaction will be used. There will not be any runoff from water used for this purpose.
- Waste Disposal – All solid waste from the site must be properly removed and disposed of in accordance with SDDENR regulations. If welding rods are used the waste will be collected and disposed of properly. Any vehicle leaks on site shall be cleaned up and the waste shall be disposed of properly.
- State/local waste disposal – Sanitary sewer and septic system regulations are not applicable to this project. Where necessary and appropriate, portable toilets will be located for collection of sanitary wastes. Corresponding sanitary waste disposal will be accomplished in accordance with applicable local/state ordinances.
- Spill Prevention and Response – Currently there is no intention of utilizing any hazardous substance or store reportable quantities of oil/gas onsite. However, if a situation does occur that such materials are kept onsite, appropriate spill prevention and response measures will be implemented at that time. When conducting stormwater inspections, the SWPPP coordinator will inspect for any potential spills, leaks, or other releases that may occur.

Pollution Sources Other Than Construction:

Concrete truck wash out water shall be discharged to a leak proof containment or pit at the construction site where structural controls have been established to prevent wash water leaving the project site. A sign will be erected adjacent to the washout area directing personnel to use the washout area for concrete disposal and washout wastes. Discharges are limited to land disposal of wash out water from concrete trucks. Generally, the concrete washout areas are located near stabilized construction entrances and exits. Concrete washout containment practices will be transported along the line as needed throughout construction. These location changes will be updated on the SWPPP during construction. These areas have been identifies on the detailed site maps included in Appendix C.

5.3 Approved State or Local Plans

The criteria listed in this SWPPP are consistent with State and local requirements.

6.0 MAINTENANCE/INSPECTION PROCEDURES

6.1 Inspections and Maintenance

Visual inspections of the disturbed areas that have not been stabilized, storage areas, structural control measures, vehicle entrance and exit sites, and the cleared and graded areas of the construction site will be performed at least once every 14 calendar days and within 24 hours after a significant rainfall event (0.5 inches or more). Inspection frequency may be reduced to the following schedule given the respective conditions are applicable:

- Once every month; applicable when site is temporarily stabilized, finally stabilized, or winter conditions are present
- Once every month and within 24 hours of significant rainfall event (0.5 inches or more); applicable when site is within a drought stricken area. Drought conditions will be determined using the National Oceanic and Atmospheric Administration's U.S. Season Drought Outlook; the maps illustrating drought conditions can also be found online at: http://www.cpc.ncep.noaa.gov/products/expert_assessment/seasonal_drought.html

The frequency of a site inspection will ONLY be changed at the start of each month and will be noted on the site inspection form. Reasoning for changes to site inspection frequency will also be given on the site inspection form. Inspections will be conducted by the SWPPP coordinator. The inspection will verify that the BMPs are in good condition and are functioning properly.

The following inspection and maintenance practices will be used to maintain erosion and sediment controls:

- Built-up sediment will be removed from silt fencing when it has reached one-third the height of the fence;
- Silt fences will be inspected for depth of sediment, tears, fabric attachment to the fence posts, and to see that the fence posts are firmly in the ground;
- Straw bales degrade, especially when exposed to moisture. Rotting bales will need to be replaced on a regular basis. Replace or repair damaged bales as needed.
- Temporary and permanent seeding will be inspected for bare spots, washouts, and healthy growth; and
- Any stabilized construction entrances will be inspected for sediment tracked on roads, clean gravel, and to make sure that any culverts beneath the entrance are working and that all traffic use the stabilized entrances when accessing the site.

If existing BMPs are modified or if additional BMPs are needed, an implementation schedule must be described in the inspection report, and if practicable, those changes will be implemented before the next storm event.

Completed forms will be maintained with the SWPPP during the entire construction project. Following construction, the SWPPP, including the completed inspection forms, should be sent to Otter Tail Power Environmental Services to be maintained for a period of three years as required in the CGP.

The SWPPP will be amended whenever:

- There is a change in design, construction, operation, or maintenance that has a significant effect on the discharge of pollutants to the waters of the State that has not been addressed in the SWPPP; or
- Inspections or investigations by site operators, local, state or federal officials indicate the SWPPP is proving ineffective in eliminating or significantly minimizing pollutants, or otherwise not achieving the general objectives of controlling pollutants in storm water discharges associated with construction activity; or
- There is a change in the SWPPP Coordinator or SWPPP Inspector.

Should an amendment be required, the SWPPP coordinator shall contact Otter Tail Environmental Services to amend the plan and note the revision in Appendix D on the SWPPP Amendments Form.

All individuals other than the SWPPP Coordinator that are responsible for the following will receive appropriate stormwater training from the SWPPP Coordinator prior to conducting any such activities:

- Personnel who are responsible for the design, installation, maintenance, and/or repair of stormwater controls, including pollution prevention measures;
- Personnel who are responsible for taking corrective actions as required.

6.2 SWPPP Coordinator/Inspector Qualifications

The SWPPP coordinator, Keith Kelly has been involved in numerous construction projects and is knowledgeable in the requirements of South Dakotas' General Construction Storm Water Permit.

7.0 Eligible Non-Stormwater Discharge(s)

The following non-stormwater discharges are expected from this site:

______Fire hydrant flushing
_____Waters used to wash vehicles where detergents are not used
______Potable water sources including waterline flushing
______Routine external building wash down which does not use detergents
______Pavement wash-waters where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and

detergents are not used
______Air conditioning condensate
______Uncontaminated ground water or spring water
______Foundation or footing drains where flows are not contaminated with process materials such as solvent

8.0 Corporate Certification

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Mark Thoma
Name

Manager, Environmental Services
Title

Mark Thoma
Signature

3/22/19
Date

ASTORIA STATION
SIMPLE CYCLE PROJECT
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APPENDIX A

SDDENR CONSTRUCTION GENERAL PERMIT (SDR 100000)

Permit Number: SDR100000

SOUTH DAKOTA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

General Permit Authorizing Stormwater Discharges Associated with Construction Activities Under the South Dakota Surface Water Discharge System

In compliance with the provisions of the South Dakota Water Pollution Control Act and the Administrative Rules of South Dakota (ARSD), Article 74:52, owners and operators of stormwater discharges from **construction activities**, located in the state of South Dakota are authorized to discharge in accordance with the conditions and requirements set forth herein.

This General Permit shall become effective on April 1, 2018.

General permit coverage for the [PERMITTEE] shall become effective [EFFECTIVE DATE].

This General Permit and the authorization to discharge shall expire at midnight, **March 31, 2023.**

Signed this **23rd** day of **March, 2018,**

Authorized Permitting Official

Steven M. Pirner
Secretary
Department of Environment and Natural Resources

Note: *This page will be replaced with a copy containing the assigned permit number once coverage has been authorized.*

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1.0 DEFINITIONS

ARSD – Administrative Rules of South Dakota.

Best Management Practices (**BMPs**) – the schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants from the construction site. BMPs also include treatment requirements, operating procedures, and practices to control construction site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Borrow Areas – the areas where materials are dug for use as fill, either onsite or offsite.

Commencement of Construction Activities – the initial disturbance of soils (or 'breaking ground') associated with clearing, grading, or excavating activities or other construction-related activities (e.g., stockpiling of fill material).

Construction Site – the land or water area where construction activities will occur and where control measures will be installed and maintained. The construction site includes construction support activities, which may be located at a different part of the property from where the primary construction activity will take place, or on a different piece of property altogether. The construction site is often a smaller subset of the lot or parcel within which the project is taking place.

Construction Site Washout – as used in this general permit, refers to any wash waters derived from the cleaning of construction trucks and/or equipment including, but not limited to, concrete, mortar, grout, stucco, form release oils, paints, curing compounds, and other construction materials.

Construction Support Activity – a construction-related activity that specifically supports the construction activity and can include activities associated with concrete or asphalt batch plants, equipment staging yards, materials storage areas, excavated material disposal areas, and borrow areas.

Construction Waste – discarded material including, but not limited to, packaging materials, scrap construction materials, masonry products, timber, steel, pipe, electrical cuttings, plastics, and Styrofoam.

Control Measures – as used in this general permit, refer to any best management practice or other method, including narrative effluent limits, used to minimize erosion and sedimentation, and thereby prevent or reduce the discharge of pollutants to surface waters of the state.

Corrective Action – as used in this general permit, refers to any action taken to (1) repair, modify, or replace any control measure used at the site; (2) clean up and dispose of spills, releases, or other deposits found on the site; or (3) remedy a permit violation.

Dewatering – the act of draining or pumping rain water, ground water, or surface waters from building foundations, vaults, trenches, and other areas of the construction site.

Discharge – the addition of any pollutant or combination of pollutants to surface waters of the state from any point source.

Earth-Disturbing Activities – as used in this general permit, means actions taken to alter the existing vegetation and/or underlying soil of a site.

Effective Operating Condition – as used in this general permit, means a control measure is kept in effective operating condition if it has been implemented and maintained in such a manner that it is working as designed to minimize pollutant discharges.

Final Stabilization – on areas not covered by permanent structures, means either (1) vegetation has been established that provides a uniform (e.g., evenly distributed, without large bare areas) perennial vegetative cover with a density of 70 percent of the natural background vegetative cover, (2) permanent non-vegetative stabilization methods have been implemented to provide effective cover for exposed portions of the site, or (3) disturbed portions of a construction site on land used for agricultural purposes must be returned to pre-construction agricultural use.

Historic Property – any building, structure, object, district, area, or site that is significant in the history, architecture, archaeology, paleontology, or culture of the state, its communities or the nation as stated in SDCL 1-19A-2.

Infeasible – as used in this general permit, means not technologically possible or not economically practicable and achievable in light of best industry practices.

Larger Common Plan of Development or Sale – a contiguous area where multiple separate and distinct land disturbing activities may be taking place at different times, on different schedules, but under one proposed plan. “One plan” is broadly defined as any announcement or piece of documentation (including a sign, public notice or hearing, sales pitch, advertisement, drawing, permit application, zoning request, computer design, etc.) or physical demarcation (including boundary signs, lot stakes, surveyor markings, etc.) indicating construction activities may occur on a specific plot.

Minimize – to reduce and/or eliminate to the extent achievable using control measures that are technologically available and economically achievable and practicable in light of best industry practices.

Municipal Separate Storm Sewer System – a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels, or storm drains) that is owned or operated by the state or a municipality and is designed or used for collecting or conveying stormwater. This definition does not include combined sewers or conveyances that are part of a publicly-owned treatment works, as defined by ARSD 74:52:01:01(36).

Municipality – a city, town, county, district, sanitary district, or other public body created by or under state law with jurisdiction over the disposal of sewage, industrial wastes, or other wastes.

Natural Buffer – as used in this general permit, means an area of undisturbed natural cover surrounding surface waters within which construction activities are restricted. Natural cover includes the vegetation, exposed rock, or barren ground that exists prior to commencement of construction activities.

Nonpoint Source – a source of pollution that is not defined as a point source.

Non-Stormwater Discharges – discharges that do not originate from runoff events. They can include, but are not limited to, discharges of process water, air conditioner condensate, non-contact cooling water, vehicle wash water, sanitary wastes, construction washout water, paint wash water, irrigation water, or pipe testing water.

Notice of Intent or **NOI** – the form (electronic or paper) provided by the Secretary required for authorization of coverage under this general permit (Appendix A).

Notice of Termination or **NOT** – the form (electronic or paper) provided by the Secretary required for terminating coverage under this general permit (Appendix B).

Operator – as used in this general permit and in the context of stormwater discharges associated with construction activity means any party associated with a construction project that meets either of the following two criteria:

1. The party has operational control over construction plans and specifications, including the ability to make modifications to those plans and specifications; or
2. The party has day-to-day operational control of those activities at a project that are necessary to ensure compliance with the general permit conditions (e.g., they are authorized to direct workers at a site to carry out activities required by the general permit).

The operator, along with the owner, is responsible for ensuring compliance with all conditions of this general permit and with development and implementation of the stormwater pollution prevention plan.

Pesticide – any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pests, or any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.

Note: drugs used to control diseases of humans or animals (such as livestock and pets) are not considered pesticides; such drugs are regulated by the Food and Drug Administration. Fertilizers, nutrients, and other substances used to promote plant survival and health are not considered plant growth regulators and thus are not pesticides. Biological control agents, except for certain microorganisms, are exempted from regulation as pesticides under FIFRA. (Biological control agents include beneficial predators such as birds or ladybugs that eat insect pests, parasitic wasps, fish, etc.)

Point Source – any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, animal feeding operation, or vessel or other floating craft from which pollutants are or may be discharge. Construction sites disturbing one (1) or more acres are point sources. Therefore, any water flowing off the construction site constitutes a discharge and must be covered by a Surface Water Discharge permit.

Pollutant-Generating Activities – at construction sites, as used in this general permit, means those activities that lead to or could lead to the generation of pollutants, either as a result of earth-disturbance or a related construction support activity. Some of the types of pollutants that are typically found at construction sites are:

1. Sediment;
2. Nutrients;
3. Heavy metals;
4. Pesticides and herbicides;
5. Oil and grease;
6. Bacteria and viruses;
7. Trash, debris, and solids;
8. Treatment polymers; and
9. Any other toxic chemicals.

Prohibited Discharges – as used in this general permit, means discharges that are not allowed under this general permit, see Section 2.3.

Qualified Local Program – a municipal program for stormwater discharges associated with construction sites that has been formally approved by SDDENR to act in lieu of the state program.

Regulated Substance – the compounds designated by the department under South Dakota Codified Law §§ 23A-27-25, 34A-1-39, 34A-6-1.3(17), 34A-11-9, 34A-12-1 to 34A-12-15, inclusive, 45-6B-70, 45-6C-45, 45-6D-60, and 45-9-68, including pesticides and fertilizers regulated by the Department of Agriculture; the hazardous substances designated by the federal Environmental Protection Agency pursuant to section 311 of the Federal Water Pollution Control Act and Clean Water Act (33 United States Code sections 1251 to 1387, inclusive), as amended to January 1, 2011; the toxic pollutants designated by Congress or the Federal Environmental Protection Agency pursuant to section 307 of the Toxic Substances Control Act (15 United States Code sections 2601 to 2671, inclusive), as amended to January 1, 2011; the hazardous substances designated by the Federal Environmental Protection Agency pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (42 United States code sections 9601 to 9675, inclusive), as amended to January 1, 2011; and petroleum, petroleum substances, oil, gasoline, kerosene, fuel oil, oil sludge, oil refuse, oil mixed with other wastes, crude oils, substances, or additives to be utilized in the refining or blending of crude petroleum or petroleum stock, and any other oil or petroleum substance. This term does not include sewage and sewage sludge.

Runoff Event – a precipitation event or snowmelt that results in a measurable amount of surface runoff.

SDDENR – the South Dakota Department of Environment and Natural Resources.

Secretary – the Secretary of the South Dakota Department of Environment and Natural Resources, or an authorized representative.

Section 303(d) List or 303(d) List – a list of South Dakota's water quality-limited surface waters requiring the development of Total Maximum Daily Loads (TMDLs) to comply with Section 303(d) Report is available on the SDDENR website. A link to a map of 303(d) listed waters, waters with approved TMDLs is available on the SDDENR stormwater webpage.

Stormwater – means, for the purpose of this general permit, stormwater runoff, snowmelt runoff, or surface runoff.

Stormwater Associated with Construction Activity – means a discharge of pollutants in stormwater to surface waters of the state from areas where construction site or construction support activities occur.

Stormwater Associated with Industrial Activity – means stormwater runoff, snow melt runoff, or surface runoff and drainage from industrial activities as defined in 40 C.F.R. Section 122.26(b)(14) (July 1, 2016).

Stormwater Pollution Prevention Plan or **SWPPP –** means a site-specific, written document that, among other things: 1) identifies potential sources of stormwater pollution at the construction site; 2) describes control measures to reduce or eliminate pollutants in stormwater discharges from the construction site; and 3) identifies procedures the owner or operator will implement to comply with the terms and conditions of this general permit. See Section 5.0 for details on the requirements for a SWPPP.

Surface Waters of the State – lakes, ponds, streams, rivers, wetlands, and any other body or accumulation of water on the land surface that is considered to be waters of the state, but not waste treatment systems, including treatment ponds, lagoons, leachate collection ponds, or stormwater retention ponds designed to meet the requirements of the federal Clean Water Act.

Surface Water Quality Standards – water quality standards adopted pursuant to South Dakota Codified Law §§ 34A-2-10 and 34A-2-11 or actual existing beneficial uses, whichever is higher, and effluent standards adopted pursuant to SDCL § 34A-2-13 or pursuant to the best professional judgment of the Secretary, whichever is applicable. If waters have more than one designated beneficial use and criteria are established for a parameter that is common to two or more uses, such as pH, the more restrictive criterion for the common parameter applies.

Temporary Stabilization – means a condition where exposed soils or disturbed areas are provided a temporary vegetative and/or non-vegetative protective cover to prevent erosion and sediment loss. Temporary stabilization may include temporary seeding, geotextiles, mulches, and other techniques to reduce or eliminate erosion until either final stabilization can be achieved or until further construction activities take place to re-disturb the area.

Total Maximum Daily Load or **TMDL** – means the sum of the individual wasteload allocations for point sources, load allocations for nonpoint sources, and natural background. TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measures.

Upset – an exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

U.S. EPA – the United States Environmental Protection Agency.

Waters of the State – all waters within the jurisdiction of this state, including all streams, lakes, ponds, impounding reservoirs, marshes, watercourses, waterways, wells, springs, irrigation systems, drainage systems, and all other bodies or accumulations of water, surface and underground, natural or artificial, public or private, situated wholly or partly within or bordering upon the state.

Work Day – means, for the purpose of this general permit, a calendar day on which construction activities will take place.

2.0 COVERAGE UNDER THIS GENERAL PERMIT

2.1 Eligibility Requirements

This general permit shall apply to stormwater discharges from construction sites located within the state of South Dakota. Only those projects that meet all of the following eligibility requirements may be covered under this general permit:

1. You are the owner or operator of the construction project for which discharge will be covered under this general permit. The owner must obtain coverage under this general permit and all operators at the site must comply with the permit conditions.
2. Your project:
   a. Will disturb one (1) or more acres of land; or
   b. Will disturb less than one (1) acre of land but is part of a larger common plan of development or sale that will ultimately disturb one (1) or more acres of land; or
   c. Is less than one (1) acre, but has construction support activities required to be covered and the total area exceeds one (1) or more acres of land; or
   d. Has been designated by the Secretary or the United States Environmental Protection Agency (U.S. EPA) as needing a permit.
3. You have complied with all applicable requirements imposed by the applicable county, city, or other local government entities.
4. If your project will encroach, damage, or destroy a historic property included in the national register of historic places or the state register of historic places located in South Dakota, you must have approval from the South Dakota State Historic Preservation Office prior to submitting the Notice of Intent (NOI). You must attach an approval letter from the State Historic Preservation Office with the NOI.

2.2 Discharges Authorized

The following discharges shall be authorized under this general permit:

1. Stormwater discharges from projects detailed in Section 2.1.2.
2. Stormwater discharges from construction support activities provided:
   a. The support activity is directly related to the construction site required to have permit coverage;
   b. The support activity does not continue to operate beyond the completion of the construction activity at the project it supports. If the support activity continues past the initial permitted project, you must obtain a separate permit for those activities;

    c. The support activity is included in the SWPPP as required by Section 5.0; and
    d. Control measures are implemented for discharges from the support activity area.

3. Stormwater construction discharges combined with discharges from an industrial source, as long as:
    a. The industrial source is located on the same site as your construction activity; and
    b. You may not combine stormwater discharges from industrial and construction activities unless each source is covered by its own permit, or are not required to obtain permit coverage.

4. Discharges to waters for which there is a total maximum daily load (TMDL) allocation for sediment, suspended solids, and turbidity are covered only if you develop a SWPPP that is consistent with the assumptions, allocations, and requirements in the approved TMDL. If a specific numeric wasteload allocation has been established that would apply to discharges from construction activity, the permittee must incorporate that allocation into the SWPPP and implement necessary steps to meet that allocation.

2.3 Discharges Not Authorized

The following discharges are not authorized by this general permit:

1. **Post-Construction Discharges**. This general permit is not designed to address post-construction discharges after you have completed construction activities and achieved final stabilization at the site. Stormwater discharges associated with industrial activities must obtain coverage under a separate stormwater permit.

2. **Discharges Mixed with Non-Stormwater**. This general permit does not authorize discharges of non-stormwater.

3. **Discharges of Fill Material**. This general permit does not authorize you to discharge fill material into surface waters of the state. You are required to obtain a Section 404 federal Clean Water Act permit from the U.S. Army Corps of Engineers.

4. **Discharges Threatening Water Quality**. This general permit does not authorize your discharge from a construction site if the discharge will cause, or have the reasonable potential to cause or contribute to, violations of Surface Water Quality Standards. In such cases, the Secretary may deny you coverage under the general permit or require you to obtain an individual Surface Water Discharge permit.

5. **Discharges Threatening Endangered Species**. This general permit does not authorize your discharge from a construction site if the discharge will not ensure the protection of species that are federally-listed as endangered under the federal Endangered Species Act.

6. **Discharges of Regulated Substances**. This general permit does not authorize you to discharge regulated substances, hazardous substances, or oil resulting from onsite spills. You are subject to the federal reporting requirements of 40 CFR Part 110, Part 117, and Part 302 relating to spills or other releases of oils or hazardous substances. You must report spills in excess of the reportable quantities as required in Section 7.1.

2.4 Requesting Permit Coverage

To request coverage under this general permit, you must submit a complete and accurate Notice of Intent (NOI) (Appendix A) to SDDENR at least **15 calendar days** prior to the commencement of construction activities at the site. ***The NOI must be signed by the owner of the property where construction activities will occur.***

1. You must identify the person(s) responsible for day-to-day operations at the construction site, if different from the owner. A Contractor Authorization Form, included in Appendix C, must be submitted to SDDENR as soon as a contractor is identified if the contractor was not identified on the NOI.

2. You are not prohibited from submitting a late NOI. When you submit a late NOI, your authorization to discharge is only for discharges that occur after SDDENR grants coverage. SDDENR reserves the right to take appropriate enforcement action for any unpermitted discharges that may have occurred between the commencement of construction activities and the time authorization for your discharge is granted.

3. SDDENR will not process incomplete NOIs.

4. You must submit a completed and signed NOI to SDDENR by emailing the NOI to stormwater@state.sd.us, or mailing the NOI to SDDENR at the address in Section 7.3.

5. SDDENR will review each complete NOI and make a decision to grant or deny coverage or request additional information. You will receive an authorization letter from SDDENR if permit coverage is granted for your project.

6. Upon the effective date of this general permit, the Secretary will terminate the existing general permit.

    a. If you are authorized under the existing general permit and you have submitted the Notice of Intent for Reauthorization Form (found in Appendix E) prior to permit expiration date, your coverage will automatically continue under the new general permit. Once the new general permit is issued, you will receive an authorization letter from SDDENR notifying you of the continued coverage.

b. Projects covered under the existing general permit must be in compliance with the conditions in the new general permit by **October 1, 2018.** You must still maintain compliance with all requirements in the existing general permit during the grace period. SDDENR may grant additional time on a case by case basis if necessary. To obtain such an extension, you must request it from SDDENR in writing.

2.5 Transferring Permit Coverage

If a new owner purchases a construction site or a portion of the site covered under this general permit, you are responsible for notifying the new owner(s) of the general permit requirements and communicating the importance of achieving final stabilization on the site. You must transfer permit coverage to the new owner. Appendix D includes a form for transferring permit coverage for all or a portion of a project or development to a new owner.

2.6 Terminating Permit Coverage

Until the Secretary terminates your coverage under this general permit, you are required to comply with all conditions and effluent limits in this general permit. To terminate coverage, you are required to submit a complete and accurate Notice of Termination (NOT), found in Appendix B, and signed in accordance with Section 7.4. You must submit the NOT within **30 calendar days** of meeting any one of the following conditions.

1. You have completed all earth-disturbing activities at your site and, if applicable, all construction support activities covered by this general permit, and you have met all the following requirements:

   a. You have met the stabilization requirements listed in Section 3.19 and have reached final stabilization for any areas disturbed during construction and over which you had control during the construction activities;

   b. You have removed and properly disposed of all temporary construction materials, waste and waste handling devices, and have removed all equipment and vehicles that were used during construction, unless intended for long-term use on the site following termination of your general permit coverage;

   c. You have removed and properly disposed of all temporary control measures, including silt fence, and of which you installed and maintained during construction, except those that are intended for long-term use following termination of your general permit coverage; and

   d. You have removed all potential pollutants and pollutant-generating activities associated with construction.

2. You have obtained coverage under an individual or alternative general permit that addresses the discharges from the construction site.

2.7 Reporting Requirements

On October 22, 2015, the U.S. EPA published in the federal register a rule that has made electronic reporting of permit and compliance monitoring information mandatory for all National Pollution Discharge Elimination System (NPDES) permits. These are referred to as Surface Water Discharge (SWD) permits in South Dakota. The final rule became effective December 21, 2015.

Phase II of the final rule requires that authorized state NPDES programs begin electronically collecting, managing, and sharing construction stormwater permitting information by December 21, 2020. This includes general permit reports such as Notices of Intent (NOI), Notices of Termination (NOT), and all other remaining NPDES program reports. SDDENR is currently developing programs to meet this requirement and will notify facilities as they become available.

Electronic reporting will be required once SDDENR has fully developed an electronic reporting system. In the interim, all general permit reports must be submitted by email (stormwater@state.sd.us), or to the address listed in Section 7.3.

A hybrid approach will be available for owners/operators that do not expect to submit NOIs for multiple projects. This approach will provide users the ability to electronically submit the data for construction stormwater general permit reports without using the electronic signature verification process. Following electronic submittal of the reports, a hard copy of the Certification of Applicant with an original signature must be mailed to SDDENR.

2.8 Requiring an Individual Permit or an Alternative General Permit

SDDENR may either deny coverage or require you to apply for an individual Surface Water Discharge permit or an alternative general permit. In considering whether we deny coverage or require an alternative permit, the following will be taken into consideration:

1. You cannot comply with the conditions of this general permit;
2. There has been a change in the availability of demonstrated technologies or practices for the control or abatement of pollutants applicable to construction sites;
3. Effluent limitation guidelines are promulgated or revised for point sources covered by this general permit;
4. A water quality management plan is approved containing requirements applicable to your construction site;
5. Your discharge is a significant contributor of pollution to surface waters of the state or it presents a health hazard; or

6. You are discharging to an impaired water body and the best management practices are not sufficient to implement the assigned wasteload allocations in a Total Maximum Daily Load (TMDL) approved by the U.S. EPA.

2.9 Continuation of Coverage for Expired General Permit

If you wish to continue to be covered by this general permit after its expiration date, you must submit a Notice of Intent for Reauthorization (Appendix E). An expired general permit continues in full force and effect until a new general permit is issued. You will continue to have coverage under the current general permit until a new general permit is issued.

2.10 Requirement to Post Notice of Your General Permit Coverage

You must post a sign or other notice at a safe, publicly accessible location near the project site.

1. At a minimum, your notice must include the general permit tracking number (found on the cover page of your general permit and in the authorization letter) and a contact name and phone number for obtaining additional project information.

2. The notice must be located so that it is visible from the public road that is nearest to the active part of the construction site and must be readily viewed from a public right-of-way.

2.11 Property Rights

1. The Secretary's issuance of this general permit, adoption of design criteria, and approval of plans and specifications, does not convey any property rights of any sort, any exclusive privileges, any authorization to damage, injure or use any private property, any authority to invade personal rights, any authority to violate federal, state or local laws or regulations, or any taking, condemnation or use of eminent domain against any property owned by third parties.

2. The State does not warrant that your compliance with this general permit, design criteria, approved plans and specifications, and operation under this general permit, will not cause damage, injury or use of private property, an invasion of personal rights, or violation of federal, state or local laws or regulations. You are solely and severally liable for all damage, injury or use of private property, invasion of personal rights, infringement of federal, state or local laws and regulations, or taking or condemnation of property owned by third parties, that may result from actions taken under this general permit.

2.12 Reopener Provisions

SDDENR may reopen and modify this general permit to include appropriate conditions (following proper administrative procedures) if state or federal statutes or regulations change.

2.13 Severability

If any portion of the general permit is found to be void or is challenged, the remaining permit requirements shall remain valid and enforceable.

2.14 Permit Actions

This general permit may be modified, revoked and reissued, or terminated by the Secretary for cause. Any request for such changes does not stay any permit condition.

3.0 EFFLUENT LIMITS

You are required to comply with the following effluent limits for discharges from your construction site and/or from construction support activities representing the degree of effluent reduction attainable through the best practicable control technology currently available to minimize the pollutants present in the discharges. In order to achieve compliance with the conditions of this permit, you are required to address the following effluent limits by developing a Stormwater Pollution Prevention Plan (SWPPP) as required in Section 5.0. If you determine any of the following limits are infeasible, you must document your rationale in your SWPPP.

Stormwater discharges regulated under this general permit that may discharge to a surface water with an approved TMDL for sediment, total suspended solids, or turbidity must be consistent with the TMDL and any associated wasteload allocation (WLA) for construction or stormwater related discharges. In most cases compliance with this permit will be considered adequate, unless otherwise notified by the Secretary. The Secretary may require an individual permit, as referenced in Section 2.8, should compliance with this general permit be deemed insufficient to meet relevant WLAs.

3.1 Proper Operation and Maintenance

You must properly operate and maintain all sediment and erosion controls, best management practices, treatment systems, and any other control(s) used to achieve compliance with the conditions of this general permit in accordance with manufacturer's specifications, good engineering practices, and design specifications of the SWPPP.

3.2 Erosion and Sediment Control Requirements

1. You must design, install, and maintain effective erosion and sediment controls to minimize soil erosion and the discharge of pollutants during earth-disturbing activities. The stormwater controls must be designed to function properly and withstand a 2-year, 24-hour precipitation event. See Appendix F for instructions to determine your construction site's precipitation for a 2-year, 24-hour event.

2. You must account for the following factors when designing your erosion and sediment controls:

   a. The nature of resulting stormwater runoff and run-on at the construction site, including factors such as expected flow from impervious surfaces, slopes, and site drainage features. Controls must be able to control stormwater volume, velocity, and flow rates from a 2-year, 24-hour precipitation event across the construction site.

   b. Anticipated soil characteristics at the construction site, including soil type and range of particle sizes.

3.3 Installation Requirements

1. You must complete installation of down gradient erosion and sediment controls before any land disturbing activity takes place in order to control discharges.

2. You must install all other control measures planned for each phase of the project as described in your SWPPP as soon as conditions on the site allow.

3. You must install all control measures using good engineering practices and follow the manufacturer's specifications. Any departures from the manufacturer's specifications must reflect good engineering practices and must be explained in your SWPPP.

3.4 Perimeter Controls

You must have effective down gradient sediment controls, and controls for any side slope boundaries deemed appropriate for individual site conditions, to minimize pollutant discharges from the construction site.

3.5 Sediment Basins

If you use a sediment basin to control the discharge of sediment from the site, you must meet the requirements listed below.

1. Sediment basins must be designed, constructed, and operated in accordance with the requirements found in your local city or county drainage board.

2. Outlet structures must withdraw water from the surface of the sediment basin or impoundment to allow for proper sediment removal in the pond.

3. Erosion controls and velocity dissipation devices must be used to prevent erosion within the sediment basin as well as at inlets and outlets from the basin.

4. Sediment basins must be situated outside of surface waters and any natural buffers established under Section 3.10. The basins must be designed to avoid collecting water from wetlands and other water bodies.

3.6 Minimize Sediment Track-Out

You must minimize the track-out of sediment from the construction site where vehicles leave the site. To comply with this requirement, you must:

1. Restrict vehicle use to properly designated access points;

2. Use appropriate stabilization techniques at all construction site access point(s) so sediment removal occurs prior to vehicle exit.

3. Where sediment has been tracked out from your site onto offsite streets, other paved areas, and/or sidewalks, remove the deposited sediment by the end of the same work

day in which the track-out occurs. You must remove the track-out by sweeping, shoveling, or vacuuming these surfaces, or by using other similarly effective means of sediment removal. You are prohibited from hosing or sweeping tracked-out sediment into storm drain inlet, surface waters of the state, or any stormwater conveyance unless the conveyance is connected to a sediment basin, sediment trap, or similar effective control. You must obtain approval from the owner of the sediment traps before hosing or sweeping sediment into those controls.

3.7 Remove Offsite Accumulation

If sediment escapes the construction site, you must initiate removal of the offsite accumulations to minimize impacts by the end of the same work day. You must revise your SWPPP and implement controls to minimize further offsite accumulation.

3.8 Minimize Dust

You must minimize the generation of dust at the construction site to avoid pollutants from being deposited into surface waters of the state. This can be accomplished through the appropriate application of water or other dust suppression techniques.

3.9 Minimize Run-on

You must minimize run-on to your construction site.

3.10 Provide Natural Buffers

You must comply with the following requirements if disturbed portions of the construction site are within fifty (50) feet of 1) a lake assigned immersion recreation or limited contact recreational beneficial uses in ARSD 74:51:02:02 and listed in ARSD 74:51:02:04; or 2) a river or stream assigned any of the warmwater or coldwater fish life propagation beneficial uses in ARSD 74:51:03:02 and listed in ARSD 74:51:03:04 to 74:51:03:27, inclusive.

1. Provide and maintain a 50-foot undisturbed natural buffer.

    a. When the natural buffer between the disturbed area(s) and surface waters of the state is less than fifty (50) feet, you must provide a combination of undisturbed buffer and supplemental erosion and sediment controls that achieves the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.

    b. When no undisturbed buffer can be provided between the disturbed area(s) and surface waters of the state, you must provide erosion and sediment controls that achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.

    c. Document in your SWPPP how any undisturbed natural buffer and the supplemented erosion and sediment controls achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.

2. Direct surface runoff to vegetated areas and maximize stormwater infiltration to reduce pollutant discharges.

3. Delineate and clearly mark all natural buffer areas with flags, tape, or other similar marking device. No construction or other activity should occur in the delineated buffer area.

4. **Exception.** You are not required to maintain a 50-foot undisturbed natural buffer or install additional controls if there is no discharge of stormwater to surface waters of the state through the area between your site and the surface waters. This includes situations where you have implemented control measures, such as a berm or other barrier, to prevent such discharges.

3.11 Preserve Topsoil

You must preserve native topsoil on your site, unless infeasible. Preserving topsoil is not required where the intended function of a specific area of the site dictates that the topsoil be disturbed or removed.

3.12 Minimize Steep Slope Disturbance

You must minimize the disturbance of slopes that are greater than a three horizontal to one vertical (3:1) slope, unless infeasible.

3.13 Protect Storm Drain Inlets

1. You must protect all storm drain inlets that receive stormwater flows from the construction site by using appropriate best management practices during construction to minimize the discharge of pollutants from the site.

2. You must maintain the inlet protection until you have permanently stabilized all sources that have the potential to discharge pollutants to the inlet. If local officials require you to remove the inlet controls during the winter, you must install alternative controls to prevent sediment from entering the storm drain inlet.

3.14 Erosive Velocity Control

1. You must use erosion controls and velocity dissipation devices where necessary along the length of stormwater conveyance channels and outlets to minimize erosion of the channel, adjacent stream bank, slope, and downstream waters.

2. You must provide energy dissipation BMPs prior to connecting pipe or culvert outlets to surface water.

3. You must control the stormwater discharges, including both peak flowrates and total stormwater volume, to minimize channel and streambank erosion and scour in the immediate vicinity of discharge points.

3.15 Minimize Soil Compaction

In areas of your site where final vegetative stabilization or infiltration will occur, you must either:

1. Restrict vehicle and equipment use in these locations to avoid soil compaction; or
2. Condition areas of compacted soil prior to seeding or planting to support vegetation growth.
3. **Exception.** You are not required to minimize soil compaction where the intended function of a specific area of the site dictates that soil be compacted.

3.16 Minimize Exposed Soil

You must schedule and sequence soil disturbing and stabilizing activities to minimize the amount and duration of soil exposure to erosion and sedimentation by wind, rain, surface runoff, and vehicle tracking. Consider factors such as high precipitation seasons when scheduling soil disturbing activities.

3.17 Protect Stockpiles

For any stockpiles or land clearing debris you must:

1. Locate the stockpiles and debris outside of any natural buffers established as required in Section 3.10 and away from any stormwater conveyances, drain inlets, and areas where stormwater flow is concentrated;
2. Protect the stockpiles debris from contact with stormwater run-on by using temporary sediment controls, berms, or other BMPs;
3. Properly maintain and position stockpiles to minimize dust generation and wind transport of sediment; and
4. Minimize stormwater runoff from the piles by properly positioning stockpiles and debris or installing effective sediment controls.
5. You are prohibited from placing stockpiles in surface waters of the state.

3.18 Stabilization Requirements

You are required to stabilize exposed portions of your site in accordance with the requirements of this section. You are responsible for implementing winter stabilization methods during frozen ground conditions if the site was not stabilized prior to the ground freezing.

1. **Deadline to Initiate Stabilization.** You must begin soil stabilization measures by the following work day whenever earth-disturbing activities have permanently or temporarily ceased on any portion of the site.

   a. Earth-disturbing activities have permanently ceased when you complete clearing, grading, and excavation within any area of your site that will not include permanent structures.

   b. Earth-disturbing activities have temporarily ceased when you cease clearing, grading, and excavation within any area for a period of at least **14 calendar days**, but will resume such activities in the future.

2. **Deadline to Complete Temporary Stabilization**. As soon as practicable, but no later than **14 calendar days** after initiating soil stabilization measures, you are required to have completed:

   a. All activities necessary to initially seed or plant the area to be stabilized for vegetative stabilization practices.

   b. The installation or application of all non-vegetative measures.

   c. As soon as practicable after seeding or planting, select, design, and install non-vegetative erosion controls (e.g., mulch or rolled erosion control products) to prevent erosion on the seeded or planted areas while vegetation establishes.

3. **Criteria for Final Stabilization**. To be considered as having reached final stabilization, you must meet the criteria below based on the type of cover you are using.

   a. **Vegetative Stabilization**. If you are seeding or planting vegetation to stabilize the site, you must meet the following requirements:

      i. Provide 70 percent or more of the density of coverage that was provided by vegetation prior to commencement of construction activities.

      ii. Provide perennial vegetative cover.

      iii. Minimize the presence of invasive species.

   b. **Non-Vegetative Stabilization**. If you are using non-vegetative controls for final stabilization at your site, the controls must provide effective cover to properly stabilize the exposed portions of your site.

   c. **Return to Pre-construction Agricultural Land Use.** For construction projects on land used for agricultural purposes, final stabilization may be accomplished by returning the disturbed land to its pre-construction agricultural use. Areas disturbed that were not previously used for agricultural purposes, such as buffer strips immediately next to surface waters and areas not being returned to pre-agricultural use must meet the final stabilization criteria listed in (a) and (b) above.

4. **Site Specific Stabilization Requirements**. If you are constructing in the specific areas listed below, you must complete the following stabilization requirements as soon as practicable, but no later than the deadlines listed below after initiating soil stabilization measures:

    a. Stream diversions or drainage ditches that divert water around or drain water from your construction site must be stabilized with appropriate controls prior to connection with any surface water.

    b. For stockpiles that will be unused for 14 or more days, provide cover or appropriate temporary stabilization consistent with Section 3.18.

3.19 Maintenance Requirements

1. **Effective operating condition.** You must ensure that all erosion and sediment controls remain in effective operating condition until final stabilization is complete. At a minimum, you must:

    a. Remove sediment from sedimentation basins when the design capacity has been reduced by 50% or more.

    b. Remove sediment from sediment controls before the deposit reaches 50% of the above-ground height of the control.

    c. Repair vegetative buffers if they become silt-covered, contain rills, or are otherwise rendered ineffective.

    d. You must repair and stabilize eroded areas by the end of the same work day they are identified. If repair is infeasible, you must implement alternative control measures.

    e. Clean inlet protection devices when sediment accumulates, or when the filter becomes clogged, or performance is compromised.

    f. Ensure that all controls remain in effective operating condition and are protected from activities that would reduce their effectiveness.

    g. All nonfunctional BMPs must be repaired, replaced, maintained or supplemented with functional BMPs. If a nonfunctioning BMP is supplemented, the nonfunctional BMP shall be removed.

2. **Deadline for maintenance.** If you find a problem or if your inspections identify that control measures are not operating effectively, you must make the necessary repairs or modifications as follows:

   a. If you discover a problem that does not require repair or replacement, you must initiate work to fix the problem on the same day. If the problem is identified at a time in the work day when it is too late to complete the corrective actions, you must initiate work to fix the problem on the following work day or before the next anticipated runoff event, whichever comes first.

   b. If you need to install new erosion or sediment controls or need to complete repairs, you must complete the work before the next anticipated runoff event or by no later than seven (7) calendar days from the time the problem is discovered, whichever comes first.

   c. You must modify your SWPPP within seven (7) calendar days of completing the work. The SWPPP must address any changes to the controls and must detail the necessary steps to prevent similar damage in the future.

3.20 Pollution Prevention Procedures

You must design, install, implement, and maintain effective pollution prevention measures to minimize the discharge of pollutants from the activities listed below. Spills must be reported as required in Section 7.1 of this general permit.

1. **Prohibited Discharges.** You are prohibited from discharging the following from your construction site:

   a. Wastewater from washout and cleanout of concrete, stucco, paint, form release oils, curing compounds, and other construction materials.

   b. Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance.

   c. Detergents, soaps, or solvents used in vehicle and equipment washing.

   d. Toxic or hazardous substances from a spill or other release.

   e. Waste, garbage, floatable debris, construction debris, and sanitary waste.

2. **Fueling and Maintenance of Equipment or Vehicles**. If you fuel or maintain equipment or vehicles at your site, you must minimize the discharge of spilled or leaked materials from the area where these activities take place.

3. **Washing of Equipment and Vehicles**. You must provide an effective means of minimizing the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other types of washing. The washing must be limited to a defined area of the site and must be properly disposed.

4. **Management of Construction Products, Chemicals, Materials, and Wastes**. You must properly store, handle, and dispose of any construction products and materials, chemicals, landscape materials, and wastes in order to minimize the exposure to stormwater. Products or wastes that are either not a source of contamination to stormwater or are designed to be exposed to stormwater are not held to this requirement. Requirements are as follows:

    a. You must cover or otherwise protect any materials that have the potential to leach pollutants in order to minimize contact with stormwater and prevent the discharge of pollutants.

    b. Clean up spills by the end of the same work day in which the spill occurred, using dry clean-up methods where possible, and dispose of used materials properly. Do not clean surfaces or spills by hosing the area down. Eliminate the source of the spill to prevent a discharge or continuation of an ongoing discharge.

    c. For registered pesticides and fertilizers, you must comply with all application and disposal requirements included on the label. Pesticides and fertilizers must be stored under cover or other effective means designed to minimize contact with stormwater. You must document any departures from the manufacturer's specifications for applying fertilizers and pesticides.

    d. Store all diesel fuel, oil, hydraulic fluids, other petroleum products, and other chemicals and products in water-tight container.

    e. Hazardous or toxic wastes that may be present at construction sites include, but are not limited to, paints, solvents, petroleum-based products, wood preservatives, additives, curing compounds, acids, and alkaline materials. For these materials and wastes, you must:

        i. Separate hazardous or toxic wastes and materials from construction and domestic waste.

        ii. Store hazardous or toxic wastes and materials in sealed containers and provide secondary containment as applicable. These containers must be constructed of suitable materials to prevent leakage and corrosion. These containers must be labeled in accordance with the applicable Resource Conservation and Recovery Act (RCRA) requirements and all other applicable federal, state, or local requirements.

        iii. Dispose of hazardous or toxic wastes in accordance with the manufacturer's recommended method of disposal and in compliance with federal, state, and local requirements.

f. You must provide effective containment for all liquid and solid wastes generated by washout operations including, but not limited to, concrete, stucco, paint, form release oils, curing compounds, and other construction materials related to the construction activity. For these materials and wastes, you must comply with the following requirements:

    i. Designate areas to be used for washout and cleanout activities. The containment must be designed so that it does not result in runoff from washout operations or during runoff events;

    ii. Install signs adjacent to each washout facility directing site personnel to use the proper facilities for concrete disposal and other washout wastes;

    iii. Direct all wash water into a leak-proof container or leak-proof pit;

    iv. Do not dump liquid wastes in the storm sewers; and,

    v. Clean up and properly dispose of any accumulated wastes in designated waste containers.

g. You must provide proper waste disposal receptacles of sufficient size and number to handle construction wastes including, but not limited to, packaging materials, scrap construction materials, masonry products, timber, pipe, and electrical cuttings, plastics, Styrofoam®, concrete, and other trash or building materials.

    i. For sanitary waste, you must position portable toilets so they are secure and will not be tipped or knocked over. You must properly remove and dispose of wastes from the portable toilets.

3.21 Construction Dewatering

You are prohibited from discharging from dewatering activities, including discharges from dewatering of trenches and excavation, unless the discharges are managed by the following controls:

1. You shall not discharge toxic pollutants in toxic amounts.

2. Your discharge shall not impart a visible film or sheen to the surface of the receiving water or adjoining shoreline.

3. Your discharge shall not contain visible pollutants. You must visually monitor the discharge for suspended solids. If you observe suspended solids in the discharge, you must implement the following requirements:

    a. You must install additional best management practices and update your stormwater pollution prevention plan to reduce the visible solids.

   b. You must sample the dewatering discharge for total suspended solids on a daily basis until there is no longer a discharge of visible solids. The samples must be analyzed in accordance with Title 40 of the Code of Federal Regulations, Part 136. If the total suspended solids value exceeds 53 mg/L in any sample or measurement, you must cease the dewatering discharge to surface waters of the state until you can demonstrate the additional best management practices are sufficient to eliminate the visible pollutants. You must also document this in your stormwater pollution prevention plan (SWPPP).

4. You must use best management practices to minimize or prevent stream channel scouring or erosion caused by dewatering discharges.

5. You cannot add chemicals to the discharge without prior approval from SDDENR.

6. You must obtain a Temporary Water Right. Contact SDDENR Water Rights Program at (605) 773-3352 for more information and to obtain a temporary water right.

4.0 INSPECTION REQUIREMENTS

You are required to conduct site inspections to determine the effectiveness of your control measures and your compliance with the conditions of the general permit.

4.1 Person(s) Responsible for Inspecting the Site

The person(s) inspecting your site may be a member of your staff or a third party you hire to conduct the inspections. You are responsible for ensuring the person who conducts the inspection is knowledgeable in the principles and practice of erosion and sediment controls and pollution, possesses the skills to assess conditions at the site that could impact stormwater quality, and is able to assess the effectiveness of any control measures selected and installed to meet the requirements of the general permit.

4.2 Frequency of Inspections

At a minimum, you must conduct a site inspection at the following frequencies:

1. Once every 7 calendar days; or

2. Once every 14 calendar days **and** within 24 hours of precipitation that exceeds 0.25 inches or snowmelt that generates runoff. You must keep a properly maintained rain gauge on your site.

4.3 Reduction of Inspection Frequency

You may reduce your inspection frequency from the requirements above under the following circumstances. You must document the beginning and ending dates of these periods in your inspection records.

1. **Partial final stabilization.** You may reduce the frequency of inspections to once per month on any portion of your site where you have reached final stabilization. If construction activity resumes in this portion at a later date, you must increase the frequency as required in Section 4.2 above.

2. **Frozen conditions.** If you are suspending earth-disturbing activities due to frozen conditions and all disturbed areas of the site have been temporarily or permanently stabilized as required in Section 3.19, you shall conduct inspections at least once per month. You must resume weekly inspections by no later than March 1st of each year until your site is permanently stabilized and you have submitted a Notice of Termination (NOT) in accordance with Section 2.6.

4.4 Areas that Need to Be Inspected

During your site inspections you must, at a minimum, inspect the following areas:

1. All areas that have been cleared, graded, or excavated and have not yet reached final stabilization;

2. All sediment and erosion control measures and best management practices, including inlet protection;

3. Vegetated buffers;

4. Stockpiles, chemical and fuel storage, fertilizer and pesticide storage and other material, waste, borrow, and/or equipment storage and maintenance areas;

5. All areas where stormwater typically flows within the site, including drainage ways designed to divert, convey, and/or treat stormwater;

6. All points of discharge from the site including surface waters, drainage ditches, and conveyance systems; and,

7. All dewatering activities at the site.

8. **Exception.** You are not required to inspect areas that, at the time of the inspection, are unsafe for your inspection personnel. A detailed description of the situation must be documented in your inspection records explaining the reason the site conditions prevented the inspection.

4.5 Requirements for Inspections

During your site inspections you must, at a minimum:

1. Check whether all erosion and sediment controls and best management practices are implemented and functioning to minimize pollutant discharges. Determine if you need to replace, repair, or maintain any controls.

2. Check for spills, leaks, or other accumulation of pollutants on the site, or for the presence of conditions that could lead to spills, leaks, or other accumulations of pollutants on site. Determine if you need to install additional controls or take corrective actions to prevent the discharge of these pollutants.

3. Determine if site conditions have changed and if current controls are still effective in controlling pollutants from leaving your site. Identify any locations where new or modified control measures are necessary.

4. Check for signs of erosion, scour, and sediment deposits that have occurred on or off the construction site:

    a. Inspect the discharge points and, where applicable, the banks of any surface waters of the state flowing within your property boundaries or immediately adjacent to your property.

    b. Identify areas where you need to correct erosion and remove sediment.

   c. Determine if you need controls to reduce the velocity of the discharge or prevent further erosion and sedimentation.

5. If a discharge is occurring during your inspection, you are required to:
   a. Identify all points of the property where there is a discharge;
   b. Observe and document the visual quality of the stormwater discharge and note the characteristics of the discharge, including color, odor, floating, settled, or suspended solids, foam, oil sheen, and other obvious indicators of stormwater pollutants; and
   c. Document whether your control measures are operating effectively. Describe any controls that are not clearly operating as intended or are in need of maintenance.
6. Identify all incidents of noncompliance that you observe.
7. Based on the results of your inspection, you must initiate corrective action(s) where needed.

4.6 Inspection Report

You must complete an inspection report in conjunction with each site inspection.

1. Each inspection report must be maintained in accordance with the requirements in Section 7.3 and must include the following information;
   a. Date and time of the inspection.
   b. Names and titles of the personnel conducting the inspection.
   c. Date and amount of most recent precipitation event, as well as if runoff was flowing onsite and/or offsite at the time of the inspection.
   d. A summary of your inspection findings, covering, at a minimum, the observations you made as required in Sections 4.4. and 4.5;
   e. Specific locations where maintenance, additional best management practices, cleanup, or corrective action is needed;
   f. The results of the total suspended solids levels in any dewatering discharge, as required by Section 3.21; and
   g. A summary of any corrective actions taken in response to the inspection findings, including any changes made to the SWPPP.

2. If you have determined it is unsafe to inspect a portion of your site, you must describe the reason(s) you found it to be unsafe and specify the locations that were not inspected.
3. If an inspection does not identify any incidents of noncompliance, you must include a statement in the report that the site is in compliance with the SWPPP and the general permit.
4. You must sign and certify each inspection report in accordance with the signatory requirements found in Section 7.4.

5.0 STORMWATER POLLUTION PREVENTION PLAN

You must develop a stormwater pollution prevention plan, also referred to as a "SWPPP," to be covered under this general permit. Stormwater management documents developed under other regulatory programs may be included or incorporated by reference in the SWPPP, or used in whole as a SWPPP if it meets the requirements of this section.

5.1 SWPPP Deadlines

1. You must develop the SWPPP **prior** to the submittal of the NOI.

   Note: If you were covered under the February 1, 2010, general permit and reauthorized under this general permit, you must update your SWPPP to comply with the conditions of this general permit by **October 1, 2018**.

2. You must implement and maintain the SWPPP for any construction activity requiring this general permit until final stabilization is reached.

5.2 TMDL

For projects that discharge stormwater to a water body listed as impaired under section 303(d) of the Federal Clean Water Act due to sediment, suspended solids, or turbidity, you must identify the water body and impairment in the SWPPP. Your SWPPP must describe and conform to any Wasteload Allocation (WLA) for the water body as required in Section 2.2.4

5.3 SWPPP Contents

You must develop your SWPPP to ensure compliance with the effluent limits in Section 3.0. Your SWPPP must include the following information, at a minimum.

1. **Personnel**. Your SWPPP must identify those person(s), by name or position, who are knowledgeable and experienced in the application of erosion and sediment control BMPs and who are responsible for the development and implementation of any portion of the SWPPP, for any later modifications to the SWPPP, and for compliance with the requirements of this general permit.

2. **Staff Training**. The SWPPP shall outline how employees and responsible parties shall be trained on the implementation of the SWPPP. Training must be provided at least annually, as new employees or responsible parties are hired, or as necessary to ensure compliance with the SWPPP and this general permit. Employees and responsible parties include individuals who are responsible for conducting inspections or for the design, installation, maintenance, or repair of stormwater controls.

3. **Description of Construction Activities**. Your SWPPP must include a narrative description of the nature of your construction activities, including the following:

   a. A description of the overall project and type of construction activities to occur on the site and a description of the final completed project;

   b. The total size of the project and total area expected to be disturbed by construction activities;

   c. The maximum area expected to be disturbed at any one time;

   d. Description of the existing vegetation at the site and an estimate of the percent of vegetative ground cover;

   e. A description of the soil within the disturbed areas;

   f. The name of the surface waters or municipal separate storm sewer system at or near the disturbed area that could potentially receive discharges from the project site;

   g. Any construction support activity areas; and,

   h. The intended sequence and estimated dates of construction activity for the following:

      i. Implementation of BMPs, including when they will be operational and an explanation of how you will ensure the control measures are installed by the time each phase of earth-disturbing activity begins.

      ii. Commencement and duration of earth-disturbing activities, including clearing and grubbing, mass grading, site preparation (i.e., excavating, cutting and filling), final grading, and creation of soil and vegetation stockpiles requiring stabilization.

      iii. Cessation, temporary or permanent, of construction activities on the site or in designated portions of the site.

4. **Site Map.** You must include a legible site map depicting the following features and boundaries of the project:

   a. Pre-construction site conditions, including existing vegetative and non-vegetative cover (e.g. – forest, pasture, pavement, structures, etc.);

   b. Locations where earth-disturbing activities will occur, noting any phasing of construction activities;

   c. Approximate slopes before and after major grading activities. Note areas with a slope greater than three horizontal to one vertical (3:1);

   d. Topography of the site;

e. Drainage patterns of stormwater and authorized non-stormwater flows from the site property before and after major grading activities. Mark the flow direction with arrows on the map.

f. Locations and names, where appropriate, of all surface waters of the state that exist within or in the immediate vicinity of the site and could potentially receive discharges from the project site.

g. Locations of any surface water crossings, noting areas where work near waterbodies is necessary;

h. Location of any stormwater conveyances including, but not limited to, sediment ponds, ditches, pipes, swales, stormwater diversions, culverts, and ditch blocks;

i. Discharge locations, including locations of any storm drain inlets on or in the immediate vicinity of the site that could potentially receive discharges from the project site;

j. Locations where stormwater or allowable non-stormwater will be discharged to surface waters of the state on or in the immediate vicinity of the site.

k. Locations where sediment, soil, or other construction materials will be stockpiled;

l. Designated site access points;

m. Locations of structures and other impervious surfaces upon completion of construction;

n. Natural buffer boundaries and widths;

o. Locations of fueling activity, vehicle and equipment maintenance areas, designated wash water collection areas, lubricant and chemical storage, paint storage, material storage, staging areas, and debris collection areas;

p. Locations of all activities that could potentially generate pollutants at the site, such as dumpsters, chemical storage, construction site washout, portable toilets, or equipment storage.

q. Location and types of all sediment and erosions controls, velocity dissipation devices, post-construction controls, and all other BMPs used on the site.

r. Locations of construction support activities covered by this general permit.

5. **Description and Maintenance of Control Measures.** Your SWPPP must include a narrative description of the erosion and sediment control measures that will be implemented during construction at your site to meet the conditions of this general permit. For each control measure you must provide a narrative on the following:

   a. A timeframe for the installation, maintenance, and removal (if necessary) of all selected BMPs for each phase of construction activity;

   b. Your rationale for the selection of all BMPs, including calculations as necessary;

   c. Whether selected BMPs are temporary or permanent;

   d. A description of maintenance specifications and procedures;

   e. A description of structural diversion practices intended to divert flows from exposed soils, store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site;

   f. A description of the removal of any temporary stormwater conveyance; and

   g. A description of the temporary and final stabilization of areas of exposed soil where construction activities have been completed or temporarily ceased. Your SWPPP must describe the specific vegetative and/or non-vegetative practices you will use to comply with the stabilization requirements in Section 3.19, along with the reasons for choosing each practice.

6. **Procedures for Inspections.** The SWPPP must describe the procedures you will follow for conducting site inspections and, where necessary, taking corrective actions. The following information must also be included in your SWPPP:

   a. Personnel responsible for conducting inspections;

   b. Required frequency of inspections;

   c. Rationale for reduction of inspection frequency; and,

   d. Any inspection checklists or other forms that you will use.

7. **Post Construction Stormwater Management.** You must identify stormwater management practices that will be installed during the construction process to control pollutants in stormwater discharges occurring after construction operations have been completed. Maintenance for onsite stormwater management features is the responsibility of the permittee until the NOT is submitted or the feature is accepted by the party responsible for long term maintenance. The following information must be included in your SWPPP:

   a. An explanation of the technical basis used to select the practices to control pollution where flows exceed pre-development levels;

   b. A description of structural stormwater management practices such as stormwater ponds, open vegetated swales, natural depressions to allow infiltration of runoff onsite, and sequential systems that combine several practices or other post construction stormwater management features; and

c. The location of velocity and energy dissipation devices placed at discharge points and appropriate erosion protection for outfall channels and ditches.

8. **Pollution Prevention Procedures**

    a. **Spill Prevention and Response Procedures**. Your SWPPP must describe the procedures you will follow to prevent and respond to spills and leaks, including:

        i. Procedures for expeditiously stopping, containing, and cleaning up spills, leaks, and other releases. The SWPPP must identify the name or position of the employee(s) responsible for detection and response of spills and leaks;

        ii. Procedures for notification of appropriate facility personnel, emergency response agencies, and regulatory agencies as required by Section 7.1; and,

        iii. Ways to prevent reoccurrence of such releases and steps to prevent any such releases from contaminating stormwater runoff. The SWPPP shall be modified and changes implemented as appropriate.

    b. **Waste Management Procedures**. The SWPPP must describe procedures for how you will handle and dispose of all wastes generated at your site, including, but not limited to, clearing and demolition debris, sediment removed from the site, construction and domestic waste, hazardous or toxic waste, and sanitary waste.

9. **Construction Site Pollutants**

    a. You must include information in your SWPPP about all activities that could generate pollutants at your site. Examples of pollutant-generating activities include, but are not limited to: paving operations; concrete, paint, and stucco washout; solid waste storage and disposal; storage of fertilizers, pesticides, solvents, fuels, and soils. You must include in your SWPPP a description of the removal of construction equipment and vehicles and any cessation of any pollutant generating activities.

    b. You must include an inventory of the pollutants and chemicals associated with your construction activity and consider where potential spills and leaks could occur.

    c. If SDDENR approves the use of water treatment chemicals, your SWPPP must include:

        i. A listing of all water treatment chemicals planned for use at the site and why these chemicals were selected;

        ii. The proper dosage and method of application for all water treatment chemicals;

        iii. All applicable Safety Data Sheets (SDS) for chemicals planned to be used;

        iv. Schematic drawings of any controls or treatment system used for the application of the water treatment chemicals;

        v. A description of how the chemicals will be stored;

        vi. Copies of the applicable manufacturer's specifications regarding the use of the water treatment chemicals and chemical treatment systems;

        vii. A description of the training that personnel who handle, apply, or store the chemicals have received or will receive prior to the use of water treatment chemicals and chemical treatment systems;

        viii. A description of safe handling, spill prevention, and spill response procedures; and

        ix. A copy of the approval letter from SDDENR, approving the use of the water treatment chemicals and/or chemical treatment system.

10. **Non-Stormwater Discharges.** You must identify in your SWPPP all sources of non-stormwater discharges.

11. **Infeasibility Documentation.** If you determine it is infeasible to comply with any of the requirements of this general permit, you must thoroughly document your rationale in your SWPPP.

5.4 SWPPP Certification

You must sign and date your SWPPP as required by Section 7.4.

5.5 Required SWPPP Modifications

1. **Conditions Requiring SWPPP Modification**. You must modify your SWPPP, including the site map(s), in response to any of the following conditions:

    a. When you have a new operator responsible for implementation of any part the SWPPP.

    b. When you make changes to your construction plans, sediment and erosion control measures, or any best management practices at your site that are no longer accurately reflected in your SWPPP. This includes changes made in response to corrective actions triggered by inspections.

c. To reflect areas on your site map where operational control has been transferred (including the date of the transfer) or has been covered under a new permit since initiating coverage under this general permit.

d. If inspections by site staff, local officials, SDDENR, or U.S. EPA determine that SWPPP modifications are necessary for compliance with this general permit.

e. To reflect any revisions to applicable federal, state, or local requirements that affect the control measures implemented at the site.

f. If approved by the Secretary, to reflect any changes in chemical water treatment systems or controls, including the use of a different water treatment chemical, different dosage rates, or different areas or methods of application.

2. **Deadlines for SWPPP Modification**. You must complete the required revisions to the SWPPP within 7 calendar days following any of the items listed above.

3. **Documentation of Modifications to the Plan**. You are required to maintain records showing the dates of all SWPPP modifications. The records must include the name of the person authorizing each change and a brief summary of all changes.

4. **Certification Requirements**. All modifications made to your SWPPP must be signed and certified as required in Section 7.4.

5. **Required Notice to Other Operators**. If there are multiple operators at the site, you must notify each operator that may be impacted by the change to the SWPPP within 24 hours.

6.0 SPECIAL CONDITIONS

6.1 Qualified Local Programs

1. To receive approval as a qualified local program, SDDENR will review the local requirements to ensure they comply with both state and federal requirements. SDDENR may authorize minor variations and alternative standards in lieu of the specific conditions of the general permit based upon the unique comprehensive control measures established in the qualifying local program. SDDENR will review each qualifying local program for recertification during the renewal of its municipal separate storm sewer system permit.

2. If a construction site is within the jurisdiction of a qualifying local program, the operator shall submit a Notice of Intent (NOI) to SDDENR to be covered under the general permit and comply with all requirements of the qualifying local program. Compliance with the qualifying local program requirements is deemed to be compliance with this general permit. A violation of qualifying local program requirements is also a violation of this general permit.

3. At this time only the City of Sioux Falls is meeting SDDENR's minimum requirements. If additional municipalities are approved as a Qualifying Local Program in the future, a modification to this general permit will be offered for public comment in the municipality's local newspaper.

7.0 REPORTING AND RECORDKEEPING REQUIREMENTS

7.1 Emergency Spill Notification

1. You must report a release or spill of a regulated substance (including petroleum and petroleum products) to SDDENR as soon as you become aware of it if any one of the following conditions exists:

   a. The release or spill threatens or is in a position to threaten waters of the state (surface water or ground water);

   b. The release or spill causes an immediate danger to human health or safety;

   c. The release or spill exceeds 25 gallons;

   d. The release or spill causes a sheen on surface water;

   e. The release or spill of any substance that exceeds the ground water quality standards of ARSD Chapter 74:54:01;

   f. The release or spill of any substance that exceeds the surface water quality standards of ARSD Chapter 74:51:01;

   g. The release or spill of any substance that harms or threatens to harm wildlife or aquatic life;

   h. The release or spill of crude oil in field activities under SDCL chapter 45-9 is greater than 1 barrel (42 gallons); or

   i. The release or spill is required to be reported according to Superfund Amendments and Reauthorization Act (SARA) Title III List of Lists, Consolidated List of Chemicals Subject to Reporting Under the Emergency Planning and Community Right to Know Act, US Environmental Protection Agency.

2. To report a release or spill, call SDDENR at 605-773-3296 during regular office hours (8 a.m. to 5 p.m. Central Standard Time). To report the release after hours, on weekends or holidays, call South Dakota Emergency Management at 605-773-3231. Reporting the release to SDDENR does not meet any obligation for reporting to other state, local, or federal agencies. Therefore, you must also contact local authorities to determine the local reporting requirements for releases. A written report of the unauthorized release of any regulated substance, including quantity discharged and the location of the discharge shall be sent to SDDENR within 14 days of the discharge.

7.2 Planned Changes

You must notify SDDENR as soon as possible of any planned physical alterations or additions to your site. Notice is required only when the alteration or addition could significantly change the nature or increase the quantity of pollutant discharged, or could result in noncompliance with permit conditions. This notification also applies to pollutants that are not addressed by the effluent limits in Section 3.0.

7.3 Records Contents & Retention

1. You must maintain onsite, or make readily available to SDDENR, the following documents:

    a. The SWPPP, including all certificates, reports, records, or other information required by this general permit.

    b. A copy of the Notice of Intent (NOI) submitted to SDDENR, along with any correspondence related to coverage under this general permit.

    c. A copy of the authorization letter you receive from SDDENR granting coverage under this general permit.

    d. A copy of this general permit.

2. You must retain copies of the SWPPP, your inspection records, all reports required by this general permit, and records of the date you used to complete the NOI and NOT for a period of at least three (3) years from the date you terminate your coverage under the general permit. SDDENR may extend the time period for retaining your records with a written notification to you.

3. You must submit all reports and documents required to be submitted to SDDENR by this general permit by email (stormwater@state.sd.us), or to the address below:

    SD Department of Environment and Natural Resources
    Surface Water Quality Program
    523 East Capitol
    Pierre, SD 57501

7.4 Signatory Requirements

1. All applications submitted to SDDENR under this general permit must be signed by either a principal executive officer or ranking elected official.

2. All reports required by the general permit and other information requested by SDDENR shall be signed by the person described in Paragraph 1 above or by a duly authorized representative of that person. A person is a duly authorized representative if:

    a. The authorization is made in writing by a person described in Paragraph 1 above and submitted to SDDENR; and

    b. The authorized representative must have responsibility for the overall operation of the site, such as the superintendent, or have overall responsibility for environmental matters. A duly authorized representative may be either a named individual or any individual occupying a named position.

3. If the authorization under Paragraph 2 above is no longer accurate, you must submit a new authorization to SDDENR.

4. You must include the following certification statement with all documents signed under this section:

    I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure qualified personal properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

7.5 Duty to Provide Information

1. You must provide, within a reasonable period of time, any information SDDENR requests to determine whether cause exists for modifying, revoking and reissuing, or terminating this general permit, or to determine compliance with the general permit.

2. You must provide to SDDENR, upon request, copies of the records required to be kept by this general permit.

3. You must make your SWPPP available to SDDENR, U.S. EPA, or your local storm sewer operator upon request.

4. If you become aware that you failed to submit any relevant facts or submitted incorrect information in your NOI, you must promptly submit such facts or information.

5. You must provide SDDENR with an updated point of contact including a mailing address.

7.6 Availability of Information

1. Except for data determined to be confidential under ARSD Section 74:52:02:17, all reports you prepare and submit in accordance with the terms of this general permit must be available for public inspection at the offices of SDDENR.

2. Your name and address, the NOI and NOT, your SWPPP, and your inspection records will not be considered confidential.

8.0 COMPLIANCE REQUIREMENTS

8.1 Duty to Comply

1. You must comply with all conditions of this general permit. Any permit noncompliance is a violation of the South Dakota Water Pollution Control Act and the federal Clean Water Act. A violation is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or for denial of a permit renewal application.

2. If you violate a condition of the general permit or make any false statement, representation, or certification, you may be subject to enforcement action under South Dakota Codified Law, Chapter 34A-2.

3. You are responsible for complying with all local ordinance and requirements. Local governments may have additional or more stringent requirements than those included in this general permit.

8.2 Duty to Mitigate

You must take all reasonable steps to minimize or prevent any discharge of pollutants in violation of this general permit if it has a reasonable likelihood of adversely affecting human health or the environment.

8.3 Need to Halt or Reduce Activity Not a Defense

It is not a defense for you in an enforcement action that it would have been necessary to halt or reduce your construction activity to maintain compliance with the conditions of the general permit.

8.4 Upset Conditions

1. An upset constitutes an affirmative defense to an action brought for noncompliance with technology-based permit effluent limits if the requirements of Paragraph 2 of this section are met. You will have an opportunity for a judicial determination on any claim of an upset only if SDDENR or U.S EPA bring an enforcement action for noncompliance with technology-based effluent limits.

2. If you wish to establish an affirmative defense of any upset, you must demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

    a. An upset occurred and you can identify the cause of the upset;

    b. You were properly operating the pollution controls at your site;

   c. You notified SDDENR within 24 hours of becoming aware of the upset. To report a release or spill, call SDDENR at 605-773-3296 during regular office hours (8 a.m. to 5 p.m. Central Standard Time). To report the release after hours, on weekends or holidays, call South Dakota Emergency Management at 605-773-3231.

   d. You complied with the mitigation measures required under Section 8.2.

3. In any enforcement proceeding, you have the burden of proof to establish and document that an upset occurred.

8.5 Removed Substances

Collected solids, sludge, grit, or other pollutants removed in the course of treatment shall be properly disposed of in a manner to prevent any pollutant from entering surface waters of the state or creating a health hazard.

8.6 Inspections and Entry

You must allow SDDENR, U.S. EPA, or the operator of a municipal separate storm sewer system receiving your discharges to:

1. Enter your construction site and enter areas where you keep the records required by the general permit;

2. Have access to and copy, at reasonable times, any records that you must keep under the conditions of the general permit;

3. Inspect, at reasonable times, any facilities, equipment (including monitoring and control equipment), practices, or operations regulated under this general permit; and

4. At reasonable times, sample or monitor any substances or parameters at any location for the purpose of ensuring permit compliance or as otherwise authorized by the South Dakota Water Pollution Control Act (SDCL 34A-2).

8.7 Oil and Hazardous Substance Liability

Nothing in this general permit shall relieve you from any responsibilities, liabilities, or penalties you may be subject to under Section 311 of the federal Clean Water Act.

8.8 Penalties for Violations of general permit Conditions

1. If you violate a condition of the general permit, you are in violation of the provisions of SDCL 34A-2-36 and subject to penalties under SDCL 34A-2-75. In addition to a jail sentence authorized by SDCL 22-6-2, you can be subject to a criminal fine not to exceed $10,000 per day per violation. You can also be subject to a civil penalty not to exceed $10,000 per day per violation, or for damages to the environment of this state.

2. Except as provided above in the Upset Conditions in Section 8.4, nothing in this general permit relieves you of the civil or criminal penalties for noncompliance.

8.9 Penalties for Falsification of Reports

1. If you knowingly make any false statement, representation, or certification in any record or other document submitted or required to be maintained under this general permit, you are in violation of the provisions of SDCL 34A-2-77 and subject to penalties under SDCL 34A-2-75.

2. If you falsify, tamper with, or knowingly render inaccurate any monitoring device or method required to be maintained under this general permit, you are in violation of the provisions of SDCL 34A-2-77 and is subject to penalties under SDCL 34A-2-75.

3. In addition to a jail sentence authorized by SDCL 22-6-2, you can be subject to a criminal fine not to exceed $10,000 per day per violation. You are also subject to a civil penalty not to exceed $10,000 per day per violation, or for damages to the environment of this state.

Appendix A

NOTICE OF INTENT
(NOI) FORM

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
NOTICE OF INTENT (NOI)
to Obtain Coverage Under the SWD General Permit for Stormwater Discharges Associated with Construction Activities

Submit form to:
SD Department of Environment and Natural Resources
Surface Water Quality Program
523 East Capitol Avenue
Pierre, South Dakota 57501
stormwater@state.sd.us
Telephone: 1-800-SDSTORM

ALL QUESTIONS MUST BE ANSWERED COMPLETELY FOR THIS FORM TO BE VALID

I. Site Owner Contact Information:

Company Name: ____________________

Primary Contact Person: ____________________

Mailing Address: ____________________

City: ____________________ State: ________ Zip Code: ____________________

Phone Number: ____________________ Email Address: ____________________

Type of Ownership: ☐ Private ☐ Federal ☐ State ☐ Other (Municipal, County, etc.) (any type not listed previously)

II. Contractor Information:

Will any contractors be responsible for erosion and sediment control practices: ☐ Yes ☐ No

(A contractor certification form must be submitted for each contractor that will have day to day responsibility for erosion and sediment control practices. If these contractors have not been identified at the time this NOI is submitted, the contractor certification form may be submitted after they have been identified, but before they begin construction work.)

III. Engineering Firm Contact Information (if applicable):

Contact Person: ____________________

Contact's Email Address: ____________________

IV. Construction Project Information:

Project Name: ____________________

Physical Project Address or Description of Construction Site Location: ____________________

____

City: ____________________ State: ____________________ Zip Code: ____________________

On-Site Contact Person: ____________________

Contact's Email Address: ____________________

Contact's Mailing Address: ____________________

City: ____________________ State: ____________________ Zip Code: ____________________

Phone Number: ____________________ County of Construction Site: ____________________

Latitude: ____________________ Longitude: ____________________ Source (GPS, Google, etc.): ____________________

Quarter(s): ____________ Section(s): ______________ Township(s): ______________ Range(s): ______________

FOR DENR USE ONLY

Permit Number: ____________________ Date Approved: ____________________ Approved by: ______________

Construction Project Information (Continued):

Is this project on Tribal Lands? ☐ Yes ☐ No

Total area disturbed by the project (in acres): ___________________

Will this project encroach, damage, or destroy one of the historic sites identified at the following wesites:

http://history.sd.gov/Preservation/nationalregisterofhistoricplaces.aspx ☐ Yes ☐ No

http://www.nps.gov/nhl/find/statelists/sd/SD.pdf ☐ Yes ☐ No

V. Stormwater Pollution Prevent Plan (SWPPP):

Has the SWPPP been developed as required? ☐ Yes ☐ No

(The plan must be developed **before** the NOI is submitted. DENR will not issue coverage before this has been developed.)

VI. Receiving Waters:

Please list all possible waters that may receive a discharge from this site. If discharging to a Municipal Storm Sewer System, indicate which municipality and the ultimate receiving water.

____

____

VII. Nature of Discharge:

Please include a brief description of the construction project:

____

____

Will construction dewatering be required? ☐ Yes ☐ No If yes, please complete section IX also.

VIII. Construction Dates:

Project Start Date (MM/DD/YYYY): _________________________________

Estimated Completion Date (MM/DD/YYYY): ________________________

IX. Dewatering Activities (Complete this section if you answered yes in VII):

Date dewatering will commence (MM/DD/YYYY): ____

Date dewatering will end (MM/DD/YYYY): ____

Total volume of dewatering (gallons): _________________ Average flow rate (gallons per minute): __________________

Source of water to be discharged: ____

Receiving water: ____

Brief description of water treatment processes to be employed, if any: ____

____

Will the dewatering discharge contain anything other than uncontaminated groundwater and stormwater: ☐ Yes ☐ No

NOTE: If there will be dewatering activities, please place points of withdrawal and discharge on a topographic map, or other map if a topographic map is unavailable. This map should extend to one (1) square mile beyond the property boundaries of the facility and each of its discharge facilities, and those wells, springs, and other surface water bodies, drinking water wells, and surface water intake structures listed in public records, or otherwise known to the applicant in the map area.

X. Other Information

List other information you feel should be brought to the attention of the SDDENR regarding coverage under this general permit. Attach additional sheets if necessary.

____

____

____

STATE OF SOUTH DAKOTA

BEFORE THE SECRETARY OF

THE DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

IN THE MATTER OF THE)
APPLICATION OF)
) **CERTIFICATION OF**
____)
) **APPLICANT**
STATE OF ____________________________________)
)
COUNTY OF __________________________________)

I, ___________________________________, the applicant in the above matter after being duly sworn upon oath hereby certify the following information in regard to this application:

I have read and understand South Dakota Codified Law Section 1-40-27 which provides:

"The secretary may reject an application for any permit filed pursuant to Titles 34A or 45, including any application by any concentrated swine feeding operation for authorization to operate under a general permit, upon making a specific finding that:

- *(1) The applicant is unsuited or unqualified to perform the obligations of a permit holder based upon a finding that the applicant, any officer, director, partner, or resident general manager of the facility for which application has been made:*
  - *(a) Has intentionally misrepresented a material fact in applying for a permit;*
  - *(b) Has been convicted of a felony or other crime involving moral turpitude;*
  - *(c) Has habitually and intentionally violated environmental laws of any state or the United States which have caused significant and material environmental damage;*
  - *(d) Has had any permit revoked under the environmental laws of any state or the United States; or*
  - *(e) Has otherwise demonstrated through clear and convincing evidence of previous actions that the applicant lacks the necessary good character and competency to reliably carry out the obligations imposed by law upon the permit holder; or*
- *(2) The application substantially duplicates an application by the same applicant denied within the past five years which denial has not been reversed by a court of competent jurisdiction. Nothing in this subdivision may be construed to prohibit an applicant from submitting a new application for a permit previously denied, if the new application represents a good faith attempt by the applicant to correct the deficiencies that served as the basis for the denial in the original application.*

All applications filed pursuant to Titles 34A and 45 shall include a certification, sworn to under oath and signed by the applicant, that he is not disqualified by reason of this section from obtaining a permit. In the absence of evidence to the contrary, that certification shall constitute a prima facie showing of the suitability and qualification of the applicant. If at any point in the application review, recommendation or hearing process, the secretary finds the applicant has intentionally made any material misrepresentation of fact in regard to this certification, *consideration of the application may be suspended and the application may be rejected as provided for under this section.*

Applications rejected pursuant to this section constitute final agency action upon that application and may be appealed to circuit court as provided for under chapter 1-26."

I certify pursuant to 1-40-27, that as an applicant, officer, director, partner, or resident general manager of the activity or facility for which the application has been made that I; a) have not intentionally misrepresented a material fact in applying for a permit; b) have not been convicted of a felony or other crime of moral turpitude; c) have not habitually and intentionally violated environmental laws of any state or the United States which have caused significant and material environmental damage; (d) have not had any permit revoked under the environmental laws of any state or the United States; or e) have not otherwise demonstrated through clear and convincing evidence of previous actions that I lack the necessary good character and competency to reliably carry out the obligations imposed by law upon me. I also certify that this application does not substantially duplicate an application by the same applicant denied within the past five years which denial has not been reversed by a court of competent jurisdiction. Further;

"I declare and affirm under the penalties of perjury that this claim (petition, application, information) has been examined by me, and to the best of my knowledge and belief, is in all things true and correct."

Dated this ______ day of ___________________________ , 20____ .

____
Applicant (print)

____
Applicant (signature)

Subscribed and sworn before me this _____ day of ___________________________ , 20_____ .

____
Notary Public (signature)

My commission expires: ___________________________________

(SEAL)

PLEASE ATTACH ANY ADDITIONAL INFORMATION NECESSARY TO DISCLOSE ALL FACTS AND DOCUMENTS PERTAINING TO SDCL 1-40-27 (1) (a) THROUGH (e).
ALL VIOLATIONS MUST BE DISCLOSED, BUT WILL NOT AUTOMATICALLY RESULT IN THE REJECTION OF AN APPLICATION

Appendix B

NOTICE OF TERMINATION
(NOT) FORM

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
NOTICE OF TERMINATION (NOT)
of Coverage Under the SWD General Permit for Stormwater Discharges Associated with Construction Activities

This form is required to be submitted when a discharge permit is no longer required or necessary. Submission of this form shall in no way relieve the permittee of permit obligations required prior to submission of this form. Please submit this form to the following address:

Submit form to:
SD Department of Environment and Natural Resources
Surface Water Quality Program
523 East Capitol Avenue
Pierre, South Dakota 57501
stormwater@state.sd.us
Telephone: 1-800-SDSTORM

I. Permit Number: ______________________________

II. Primary Contact Information:

Company Name: ______________________________

Primary Contact Person: ______________________________

Mailing Address: ______________________________

City: ______________________ State: ____________ Zip Code: ____________

Phone Number: ____________________ Email Address: ______________________

III. Mailing Address for Facility/Site Location:

Project Name: ______________________________

Primary Contact Person: ______________________________

Contact's Email Address: ______________________________

Contact's Mailing Address: ______________________________

City: ______________________ State: ____________ Zip Code: ____________

I certify under penalty of law that all stormwater discharges associated with construction activity from the identified facility that are authorized by a SWD general permit have been eliminated. I understand that by submitting the Notice of Termination, I am no longer authorized to discharge stormwater associated with construction activity under this general permit, and that discharging pollutants in stormwater associated with construction activity to waters of the state is unlawful under the federal Clean Water Act and the South Dakota Water Pollution Control Act if the discharge is not authorized by a SWD permit. I also understand that the submittal of this Notice of Termination does not release an operator from liability for any violations of this permit or the South Dakota Water Pollution Control Act. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NOTE: Notice of Termination shall be signed by the authorized chief elective or executive officer of the applicant, or by the applicant, if an individual.

Name: ______________________________ Title: ______________________

Signature: ______________________________ Date: ______________

FOR DENR USE ONLY

Permit Number: ______________ Date Approved: ______________ Letter Date: ____________ Approved by: ____________

Appendix C

CONTRACTOR AUTHORIZATION FORM

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
CONTRACTOR AUTHORIZATION FORM
for Coverage Under the SWD General Permit for Stormwater Discharges Associated with Construction Activities

This form is required to be submitted when a contractor will act as an operator and have day to day responsibility for erosion and sediment control measures. Submission of this form shall in no way relieve the permittee of permit obligations. Please submit this form to the following address:

Submit form to: SD Department of Environment and Natural Resources
Surface Water Quality Program
523 East Capitol Avenue
Pierre, South Dakota 57501
stormwater@state.sd.us
Telephone: 1-800-SDSTORM

ALL QUESTIONS MUST BE ANSWERED COMPLETELY FOR THIS FORM TO BE VALID

Project Name: ____ Permit Number (if available): ___________________

Project Site Legal Location: ____

Contractor Company Name: ____

Responsible Contact Person: ____

Contact's Email Address: ____

Contractor Mailing Address: ____

City: ________________________ State: _____ Zip Code: ___________ Phone Number: _________________________

The contractor(s) responsible for the day to day operation of the construction site shall certify the following:

> "I certify under penalty of law that I understand and will comply with the terms and conditions of the Surface Water Discharge General Permit for Stormwater Discharges Associated with Construction Activities for the project identified above."

South Dakota Codified Laws Section 1-40-27 provides:

> *"The secretary may reject an application for any permit filed pursuant to Titles 34A or 45, including any application by any concentrated swine feeding operation for authorization to operate under a general permit, upon making a specific finding that:*
>
> *(1) The applicant is unsuited or unqualified to perform the obligations of a permit holder based upon a finding that the applicant, any officer, director, partner or resident general manager of the facility for which application has been made:*
> - *(a) Has intentionally misrepresented a material fact in applying for a permit;*
> - *(b) Has been convicted of a felony or other crime involving moral turpitude;*
> - *(c) Has habitually and intentionally violated environmental laws of any state or the United States which have caused significant and material environmental damage;*
> - *(d) Has had any permit revoked under the environmental laws of any state or the United States; or*

FOR DENR USE ONLY

Permit Number: ______________________ Date Approved: _____________________ Approved by: ______________

(e) Has otherwise demonstrated through clear and convincing evidence of previous actions that the applicant lacks the necessary good character and competency to reliably carry out the obligations imposed by law upon the permit holder; or

(2) The application substantially duplicates an application by the same applicant denied within the past five years which denial has not been reversed by a court of competent jurisdiction. Nothing in this subdivision may be construed to prohibit an applicant from submitting a new application for a permit previously denied, if the new application represents a good faith attempt by the applicant to correct the deficiencies that served as the basis for the denial in the original application.

All applications filed pursuant to Titles 34A and 45 shall include a certification, sworn to under oath and signed by the applicant, that he is not disqualified by reason of this section from obtaining a permit. In the absence of evidence to the contrary, that certification shall constitute a prima facie showing of the suitability and qualification of the applicant. If at any point in the application review, recommendation or hearing process, the secretary finds the applicant has intentionally made any material misrepresentation of fact in regard to this certification, consideration of the application may be suspended and the application may be rejected as provided for under this section.

Applications rejected pursuant to this section constitute final agency action upon that application and may be appealed to circuit court as provided for under chapter 1-26."

I certify pursuant to SDCL 1-40-27, that as an applicant, officer, partner, or resident general manager of the activity or facility for which the application has been made that I; a) have not intentionally misrepresented a material fact in applying for a permit; b) have not been convicted of a felony or other crime of moral turpitude; c) have not habitually and intentionally violated environmental laws of any state or the United States which have caused significant and material environmental damage; d) have not had any permit revoked under the environmental laws of any state or the United States; or e) have not otherwise demonstrated through clear and convincing evidence of previous actions that I lack the necessary good character and competency to reliably carry out the obligations imposed by law upon me. I also certify that this application does not substantially duplicate an application by the same applicant denied within the past five years which denial has not been reversed by a court of competent jurisdiction. Further;

> *"I declare and affirm under the penalties of perjury that this claim (petition, application, information) has been examined by me, and to the best of my knowledge and belief, is in all things true and correct."*

Dated this __________ day of ________________________, 20____.

____
Applicant (print)

____
Applicant (signature)

Subscribed and sworn before me this ___________ day of ________________________, 20____.

____
Notary Public (signature)

My commission expires: ____________________________________

(SEAL)

PLEASE ATTACH A SHEET DISCLOSING ALL FACTS PERTAINING TO SDCL 1-40-27 (1) (a) THROUGH (e). ALL VIOLATIONS MUST BE DISCLOSED, BUT WILL NOT AUTOMATICALLY RESULT IN THE REJECTION OF AN APPLICATION.

Appendix D

TRANSFER OF PERMIT COVERAGE FORM

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
TRANSFER OF PERMIT COVERAGE FORM
for Coverage Under the SWD General Permit for Stormwater Discharges Associated with Construction Activities

This form is required to be submitted when ownership of a construction project or an individual lot in a larger common plan of development has been transferred to a different owner. Please submit this form to the following address:

Submit form to:
SD Department of Environment and Natural Resources
Surface Water Quality Program
523 East Capitol Avenue
Pierre, South Dakota 57501
stormwater@state.sd.us
Telephone: 1-800-SDSTORM

Project Name: ______________________________ Permit Number: ______________________

Site (Lot) Legal Location: ____

Site (Lot) Description: ____

Previous Owner's Name: ____

New Owner's Name: ____

New Owner's Mailing Information:

City: ______________________________ State: ________ Zip Code: ______________

Phone Number: ________________________ Email: ______________________________

Stabilization measures implemented prior to transfer: ______________________________

____

Date transfer of property responsibility and liability becomes effective: ______________________

****NOTE: Any change in location, operation, and/or coverage area requires that the Stormwater Pollution Prevention Plan be updated and revised to reflect all changes.**

The site (lot) described about is covered under the General Permit for Stormwater Discharges Associated with Construction Activity. Temporary or permanent stabilization has been established on the site, which has now transferred ownership/responsibility as indicated above. The new owners, or operators, have been made aware of the importance of site stabilization in an effort to control pollutant runoff and/or sedimentation.

The new owner assumes responsibility for implementing best management practices to reduce or eliminate a discharge of pollutants to waters of the state. The new owner is aware that permit coverage for the site is required until all soil-disturbing activities at the site have been completed and one of the following conditions have been met:

- **all portions of the site not covered by pavement or permanent structures have a uniform perennial vegetative cover over at least 70% of the site; or**
- **equivalent permanent stabilization measure have been employed, such as the use of riprap, gabions, or geotextiles.**

New Owner/Operator Signature: ____

Date: ______________________________

Previous Owner/Operator Signature: ____

Date: ______________________________

FOR DENR USE ONLY

Permit Number: ________________ Date Approved: ________________ Approved by: ____________

Appendix E

NOTICE OF INTENT
FOR
REAUTHORIZATION FORM

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
NOTICE OF INTENT (NOI) for REAUTHORIZATION
of Coverage Under the SWD General Permit for Stormwater Discharges Associated with Construction Activities

The following facility currently has coverage under the General Permit for Stormwater Discharges Associated with Construction Activities. ***This form must be submitted if you wish to continue coverage under the General Permit.*** Submission of this form shall in no way relieve the permittee of permit obligations required prior to submission of this form. Please submit this form to the following address:

Submit form to: SD Department of Environment and Natural Resources
Surface Water Quality Program
523 East Capitol Avenue
Pierre, South Dakota 57501
stormwater@state.sd.us
Telephone: 1-800-SDSTORM

Update information below as needed. Please print or type information.

I. Permit Number: ____________________

II. Owner Information:

Company Name: ____________________

Primary Contact Person: ____________________

Mailing Address: ____________________

City: ____________________ State: ________ Zip Code: ____________________

Phone Number: ____________________ Email Address: ____________________

III. Construction Project Information:

Project Name: ____________________

Project Description: ____________________

On-Site Contact Person: ____________________

Mailing Address: ____________________

City: ____________________ County: ____________ State: ________ Zip Code: ____________________

Phone Number: ____________________ Total area disturbed by the project (in acres): ____________________

Project Start Date: ____________________ Estimated Completion Date: ____________________

IV. Signature of Applicant

By signing this form, you are requesting to continue permit coverage under the reissued General Permit. You are certifying you will comply with the new General Permit and update your Stormwater Pollution Prevention Plan if necessary to meet the reissued General Permit conditions.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including revocation of the permit and the possibility of fine and imprisonment for knowing violations. In addition, I certify that I am aware of the terms and conditions of the General Stormwater permit and I agree to comply with those requirements.

NOTE: The NOI for Reauthorization must be signed by the authorized chief elective or executive offier of the applicant, or by the applicant, if an individual project.

Name (print): ____________________ Title: ____________________

Signature: ____________________ Date: ____________________

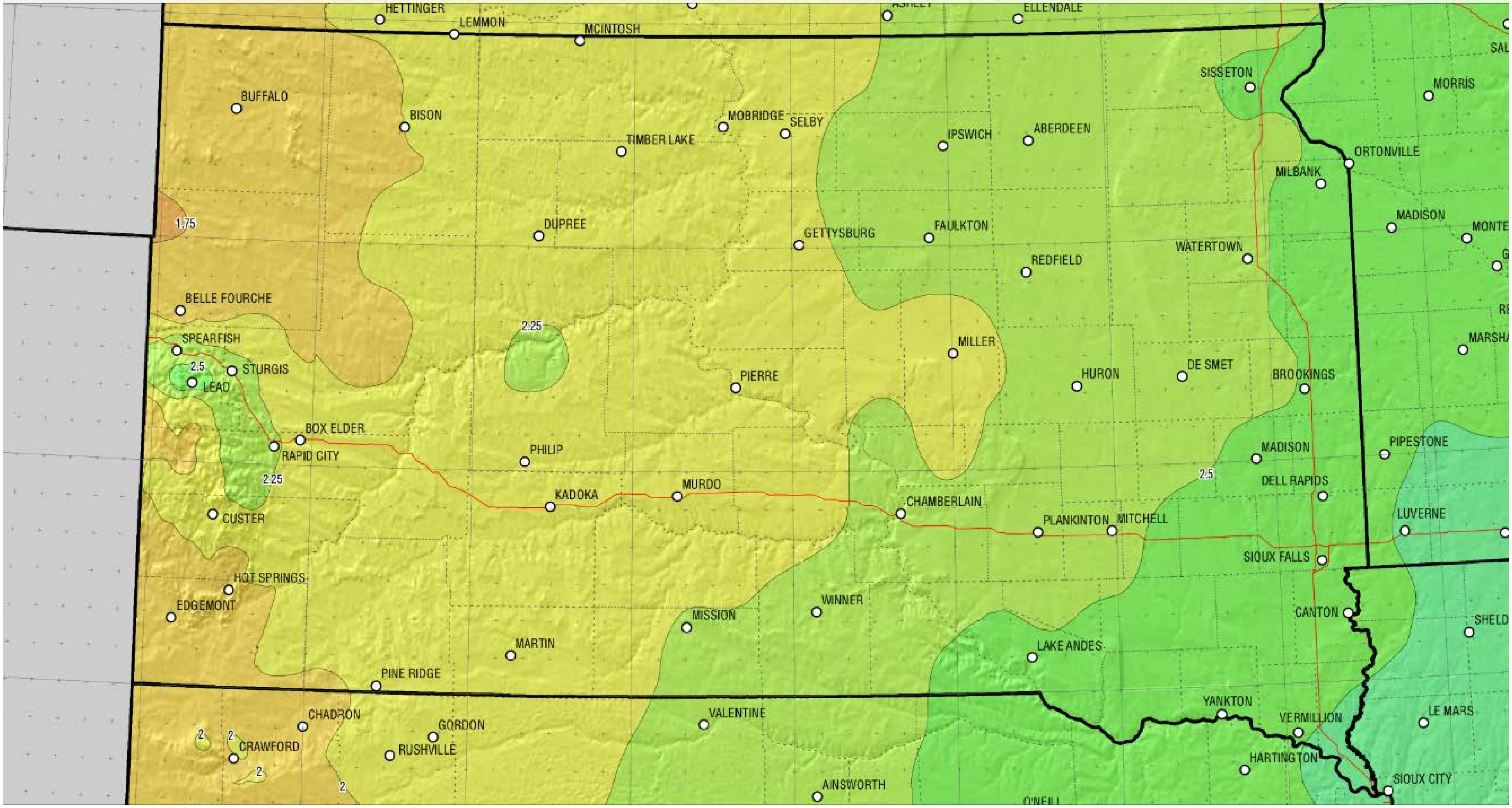
FOR DENR USE ONLY

Permit Number: ____________________ Date Reauthorized: ________________ Approved by: ____________

Appendix F

TWO YEAR, TWENTY-FOUR HOUR PRECIPITATION EVENT MAP

ftp://hdsc.nws.noaa.gov/pub/hdsc/data/mw/nd2y24h.pdf



NOAA Atlas 14, Volume 8, Version 2
Midwestern States

SOUTH DAKOTA

2-year 24-hour precipitation in inches

- 🟫 0.88 - 1.00
- 🟫 1.01 - 1.25
- 🟧 1.26 - 1.50
- 🟧 1.51 - 1.75
- 🟨 1.76 - 2.00
- 🟨 2.01 - 2.25
- 🟩 2.26 - 2.50
- 🟩 2.51 - 2.75
- 🟩 2.76 - 3.00
- 🟩 3.01 - 3.25
- 🟦 3.26 - 3.50
- 🟦 3.51 - 3.75
- 🟦 3.76 - 4.00
- 🟪 4.01 - 4.25
- 🟪 4.26 - 4.50
- 🟪 4.51 - 4.75
- 🟪 4.76 - 5.00
- ☐ 5.01 - 5.19

Legend based on entire Volume 8 project area.

Prepared by U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
OFFICE OF HYDROLOGIC DEVELOPMENT
HYDROMETEOROLOGICAL DESIGN STUDIES CENTER
April 2013

APPENDIX B

SOIL REPORT

Geotechnical Exploration and Testing Report

Astoria Station
19333 482nd Avenue
Astoria, South Dakota

Prepared for

Otter Tail Power Company

Professional Certification:
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of South Dakota.

EZRA BALLINGER
#PE.13500

Ezra Ballinger, PE
Principal/Senior Engineer
License Number: 13500
September 5, 2018

Project B1806731

Braun Intertec Corporation

BRAUN
INTERTEC
The Science You Build On.

Braun Intertec Corporation
526 10th Street NE, Suite 300
P.O. Box 485
West Fargo, ND 58078

Phone: 701.232.8701
Fax: 701.232.7817
Web: braunintertec.com

September 5, 2018

Project B1806731

Mr. Kirk Phinney
Otter Tail Power Company
Astoria Station
19333 482nd Avenue
Astoria, SD 57213

Re: Geotechnical Exploration and Testing Report
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

Dear Mr. Phinney:

We are pleased to present this Geotechnical Exploration and Testing Report for the Astoria Station project. The purpose of our work was to characterize subsurface geologic conditions at selected locations through field exploration and laboratory testing. The following pages:

- Summarize of our scope of services.
- Describe the subsurface geologic and hydrologic conditions encountered.
- Summarize the material properties determined through laboratory testing.

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please contact Ezra Ballinger at 701.205.2515 (eballinger@braunintertec.com)

Sincerely,

BRAUN INTERTEC CORPORATION

Cody Mathiason, EIT
Staff Engineer

Ezra Ballinger, PE
Principal/Senior Engineer

c: Adam Redd, Sargent & Lundy, L.L.C.
Roger Wu, Sargent & Lundy, L.L.C.

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Description **Page**

Appendix

A. Introduction

A.1. Project Description

Otter Tail Power Company is designing a new facility called Astoria Station on the east side of 482nd Avenue about ½ mile north of County Road 28 (also known as 194th Street). It is our understanding that the project includes a combustion turbine generator, stack, standard equipment enclosures, and associated balance of plant equipment. The primary fuel will be natural gas with layout consideration for future fuel oil. The net electrical output of the station will be in the range of 240 Megawatts (MW) to 265 MW at summer ambient conditions, depending on the selected combustion turbine. The engineering for the project is being performed by Sargent & Lundy, L.L.C.

A.2. Site Conditions and History

Currently, the site exists as an agricultural field with a farmstead on the east side near the center of the area. At the time of our exploration the site had recently had alfalfa cut and was a stubble field. Cattle grazed in the farmstead area that was surrounded by an electrical fence. Current grades at our boring locations range from about 1815 to 1840 feet above sea level.

Photograph 1. Aerial Photograph of the Site in 2015

Photograph taken from Google Earth™, image dated September 1, 2015.

A.3. Purpose

The purpose of our geotechnical exploration and testing is to characterize subsurface geologic conditions at selected exploration locations and present the results of our field and laboratory evaluation to Otter Tail Power Company.

A.4. Organization of this Report

The body of this report summarizes our scope of services, describes the subsurface geologic and hydrologic conditions encountered at our borings, and summarizes the physical properties of the materials encountered at our exploration locations and tested in our laboratory. The text is complimented with the following appendices:

- The Exploration Location Sketch shows the location and coordinates of the exploration locations on an aerial photograph.
- The Log of Boring sheets are the logs of penetration test borings performed at the locations shown in the aerial photograph.
- The Grain Size Accumulation Curves, Unconfined Compressive Strength Test Reports, Consolidation Test Reports and Modified Proctor Reports contain the sample specific graphic results for those tests, which were performed on standard penetration test, thin-walled tube, or bulk samples obtained from the borings.
- The Soil Resistivity Survey Results provide results of the electrical resistivity tests performed at the site.
- The Soil Thermal Conductivity Laboratory Testing Results summarize the laboratory testing performed on thin-walled tube samples from thermal testing locations.
- The Soil Corrosivity Testing Results and Seismic Surface Wave Survey Results provide the results of subcontracted testing.
- The Drill Rig Hammer Energy Results provides calibration data for the hammers used in to perform our standard penetration testing.

A.5. Scope of Services

We performed our scope of services for the project in accordance with our Proposal QTB079404 to Otter Tail Power Company, dated June 19, 2018. We received Notice to Proceed from Otter Tail Power

Company on July 5, 2018 and a signed contract on July 10, 2018. The following list describes the geotechnical tasks completed in accordance with our authorized scope of services.

- Staking and clearing the exploration location of underground utilities. We subcontracted with Short Elliot Hendrickson, Inc. to stake the exploration locations provided in the contract documents and provide us the elevations at each location. The Exploration Location Sketch included in the Appendix shows the approximate locations of the borings. The exploration locations were not offset from the staked locations.
- Performing 20 standard penetration test (SPT) borings, denoted as B-01 to B-20, to nominal depths of 10 to 100 feet below grade across the site.
- Performing electrical resistivity testing using the Wenner array at 13 locations and using the Schlumberger array at 2 locations.
- Performing a seismic surface wave survey, subcontracted to Zonge International, Inc.
- Performing thermal conductivity testing on undisturbed samples recovered from depths of 2 feet and 5 feet at the eight identified locations.
- Performing laboratory testing on samples identified by Roger Wu of Sargent & Lundy, L.L.C.
- Preparing this report containing:
    - A description of the exploration procedures used and estimated SPT hammer energy.
    - Logs of the borings describing the materials encountered and presenting the results of our groundwater measurements and laboratory tests.
    - The estimated SPT hammer energy.
    - Soil resistivity survey, seismic surface wave survey results, and soil thermal conductivity laboratory testing results.
    - A CAD sketch showing the as-built boring, thermal conductivity test, electrical resistivity test and seismic surface wave survey test locations.
    - A description of any unusual occurrences or non-conformances with the applicable ASTM Standards that may affect the quality of the data obtained.

Our scope of services did not include environmental services or testing, and we did not train the personnel performing this evaluation to provide environmental services or testing. We can provide these services or testing at your request.

B. Results

B.1. Geologic Overview

The eastern side of South Dakota is underlain by a mix of glacial till and glacial outwash soils created as glaciers advanced and retreated over the area repeatedly during the last ice age. The glacial till and outwash soils are locally overlain by more recent alluvial deposits along the current or historic paths of rivers. The predominant formations identified near the project site on the *Geologic Map of South Dakota (Martin, Sawyer, Fahrenbach, Tomhave, Schulz, 2004)* are described as follows:

- Alluvium (Qal) – Clay- to boulder-sized clasts with locally abundant organic material. Thickness up to 75 feet.
- Outwash, undifferentiated (Qlo) – Heterogeneous sand and gravel with minor clay and silt, of glaciofluvial origin, including autwas plans, kames, kame terraces, and other undifferentiated deposits. Thickness up to 30 feet.
- Till, ground moraine (Qltg) – Compact, silty, clay-rich matrix with sand- to boulder-sized clasts of glacial origin. A geomorphic feature characterized by elevated linear ridges including minor, washboard, or recessional moraines. Composite thickness of all Upper Wisconsonian till may be up to 300 feet.

We based the geologic origins used in this report on the soil types, in-situ and laboratory testing, and available common knowledge of the geological history of the site. Because of the complex depositional history, geologic origins can be difficult to ascertain. We did not perform a detailed investigation of the geologic history for the site.

B.2. Boring Results

The types of soils encountered in the borings are described below. The soils are generally described in the order they were encountered; i.e., beginning at the ground surface. Please reference the Logs of Borings attached in the Appendix for additional details.

B.2.a. Fill

The borings encountered fill from the surface at 4 of 28 boring locations to depths of 2 to 5 1/2 feet below the surface. The only borings that encountered fill were the ones performed on 482nd Avenue. The fill encountered in the borings consisted of poorly graded sand with silt, clayey sand, sandy lean clay, lean clay with sand and lean clay. While most of the fill appears to have been placed with some compactive effort or to have undergone some settlement, there are some pockets of fill are loose. The upper, approximately 1/2 foot thick, layer of poorly graded sand is presumed to be an aggregate surfacing course, though testing was not performed to evaluate its conformance to the requirements of South Dakota Department of Transportation Standard Specifications for Roads and Bridges Section 882 or any other criteria.

B.2.b. Topsoil

Topsoil was encountered at 24 of 28 boring locations with thicknesses of about 1 to 4 feet of topsoil. The topsoil encountered by our soil borings consisted of sandy lean clay, lean clay with sand, and lean clay.

B.2.c. Organic Deposits

In Boring B-19 we encountered a layer of organic silt swamp deposit from beneath the fill to a depth of 10 1/2 feet. We did not encounter swamp deposits in any other borings.

B.2.d. Alluvial Deposits

Beneath the fill, topsoil or organic deposits we encountered alluvium in 26 of 28 borings at thicknesses ranging from 1 1/2 to 12 feet where the borings did not terminate in it. One of the roadway borings (B-16) and all of the thermal resistivity sampling borings (T-01 through T-08) terminated in alluvial deposits. Only Borings B-18 and B-19 on the roadway did not encounter alluvium. The alluvial deposits consisted of poorly graded sand with silt, silty sand, clayey sand, sandy silt, silt with sand, silt, silty clay, sandy lean clay and lean clay.

B.2.e. Glacial Till and Outwash Deposits

All the borings that did not terminate in alluvium encountered glacial till and outwash deposits to the termination depths of the borings. The glacial deposits consisted of poorly graded gravel with sand, poorly graded gravel with silt and sand, poorly graded sand, poorly graded sand with gravel, poorly graded sand with silt and gravel, poorly graded sand with silt, silty sand, clayey sand, sandy silt, silt with sand, silt, sandy lean clay with gravel, sandy lean clay and lean clay with sand.

The upper elevation of the glacial deposits ranged from about 1808 1/2 to 1828 1/2 with an average of about 1816 1/2 feet. The two glacial deposits were layered throughout the profile and across the site though glacial outwash was more common at shallower depths and glacial till at deeper depths. In the borings at least 60 feet deep, the elevation at which the soils transitioned to only glacial till soils with no more layering ranged from 1763 to 1809 feet.

B.2.f. Soil Boring Penetration Resistances

Results of the penetration resistance tests from the standard penetration test borings are summarized in Table 1 below. The penetration resistances include the number of hammer blows (BPF = blows per foot) required to drive the split-spoon sampler over the last 12 of the 18 inches of penetration. The blows reported have not been modified from those counted in the field. The hammer energy efficiencies are discussed in Section C. Interpretive comments are provided to illustrate the engineering implications of the penetration resistances.

Table 1. Soil Boring Penetration Resistances

Deposition	Classifications	Penetration Resistances (BPF)	Comments
Alluvium	SP, SP-SM, SM, SC, ML, CL-ML, CL	Range: 2 – 8 Average: 5 # Samples: 42	The alluvial soils were generally in a very loose to loose (cohesionless soils) or very soft to soft (cohesive soils) relative density and exhibited low strength and high compressibility's.
Glacial Outwash	GP, SP, SP-SM, SM, ML	Range: 1 – 31 Average: 8 # Samples: 87	The penetration resistances indicate a loose to medium dense relative density with loose being more common. The lowest values were encountered near the surface in a few of the borings or immediately after the boring penetrated the groundwater table. The highest blow counts were generally at deeper depths and in the gravel deposits.
Glacial Till	CL	Range: 2 – 81 Average: 22 # Samples: 141	The penetration resistances indicate relative densities ranging from soft to hard. Some of the higher blow counts in the upper 40 to 50 feet are likely due to gravel and cobbles. In all the borings that were extended to at least 60 feet, with the exception of Boring B-11, we encountered a transition to stiffer materials. Below depths ranging from 45 to 65 feet (elevations of 1761 to 1778 feet) blow counts were consistently above the average of 22 BPF. Above this transition the blow counts were generally below the average.

B.3. Groundwater

Table 2 summarizes the depths where we observed groundwater; the attached Log of Boring sheets in the Appendix also include this information and additional details.

Table 2. Groundwater Summary

Location	Surface Elevation	Estimated Depth to Groundwater (feet)	Corresponding Groundwater Elevation (ft)
B-01	1822 1/2	8 1/2	1814
B-02	1823	10	1813
B-03	1826	9	1817
B-04	1826 1/2	10	1816 1/2
B-05	1822 1/2	6 1/2	1816
B-07	1822 1/2	9	1813
B-08	1822	8	1814
B-09	1828	9 1/2	1818 1/2
B-11	1826	13	1813
B-12	1829	8	1821
B-13	1823	9	1814
B-14	1821	9	1812
B-15	1840	17	1823
B-19	1819	7	1812
B-20	1828	9 1/2	1818 1/2
T-02	1822	5	1817

At the time of our observation, the groundwater surface elevation appeared to be about elevation 1812 to 1823 feet. The soil borings indicate a layered soil profile that is conducive for encountering perched water conditions. Project planning should expect seasonal and annual fluctuations in groundwater elevations.

B.4. Field Testing Results

B.4.a. In-Situ Electrical Resistivity Testing

Electrical resistivity testing was conducted at the project site on July 26 and July 27, 2018 at the locations shown on the Exploration Location Sketch in the Appendix. We conducted testing at 13 locations using a

Wenner array with electrode spacing's of 1 1/2, 3, 5, 10, 15 and 20 feet. The results of the electrical resistivity tests are presented in the Appendix.

B.4.b. Seismic Testing

Seismic testing was performed by Zonge Geosciences at 5 turbines. The results of their testing are provided in the Appendix.

B.5. Laboratory Test Results

We performed laboratory testing on samples selected by Roger Wu, PE of Sargent & Lundy, L.L.C. The following paragraphs summarize the results of our tests.

B.5.a. Moisture Contents

We performed 85 moisture content (MC) tests per ASTM D2216. The moisture contents for the soils overall ranged from 5 to 51 percent, with an average moisture content of about 19 percent. The Log of Boring Sheets attached in the Appendix present the results of the moisture content tests in the "MC" column.

B.5.b. Moisture Contents and Unit Weights

We performed 20 unit weight tests. The results of the tests indicate the materials have wet densities (WD) ranging from 126 to 138 pounds per cubic foot (pcf), and dry densities (DD) ranging from 103 to 120 pcf. The Log of Boring Sheets list the results of the unit weight tests in the "Tests or Notes" column.

B.5.c. Organic Contents

We performed 9 organic content (OC) tests per ASTM D2974. The organic contents of the materials tested ranged from 2 to 11 percent. The Log of Boring sheets in the Appendix show the results of the organic content tests in the "Tests or Notes" column.

B.5.d. Atterberg Limits

We performed Atterberg limits tests (per ASTM D4318) on 36 samples for classification. Two samples tested were non-plastic. The results of the remaining Atterberg limits tests indicated the soils tested had liquid limits (LL) ranging from 22 to 56 percent, plastic limits (PL) ranging from 10 to 34 percent, and plasticity indices (PI) ranging from 5 to 27 percent. The samples tested were classified as silt, silty clay, lean clay, and elastic silt. The Log of Boring sheets list the results of Atterberg limits tests in the "Tests or Notes" column.

B.5.e. Percent Passing the #200 Sieve Tests

We performed 20 tests to evaluate the percent of particles passing the #200 sieve (P200) (per ASTM D1140). The results of these tests indicated the soils encountered had P200s ranging from 19 to 84 percent. The Log of Boring sheets list the results of P200 tests in the “Tests or Notes” column.

B.5.f. Mechanical-Sieve Analysis Tests

We performed mechanical-sieve analyses with a #200 wash (per ASTM D6913) on 22 samples to assist in classification. The tests indicated the samples classified as poorly graded gravel with silt and sand (GP-GM), poorly graded sand (SP), poorly graded sand with silt (SP-SM), silty sand (SM), clayey sand (SC), sandy silt (ML), silt with sand (ML), sandy lean clay (CL), and lean clay with sand (CL). The Appendix includes graphical representations of the grain size analyses.

B.5.g. Sieve-Hydrometer Analysis Tests

We performed 9 sieve-hydrometer analyses (per ASTM D422) to assist in classification. The tests indicated the samples tested classified as silty sand (SM), clayey sand (SC), sandy silt (ML), silt (ML), and sandy lean clay (CL). The Appendix includes graphs presenting the results of the mechanical sieve-hydrometer grain size analyses.

B.5.h. Unconfined Compressive Strength Tests

We performed unconfined compressive strength (qu) tests (per ASTM D2166) on 21 samples. The results of the tests indicated the soils had unconfined compressive strengths ranging from 830 to 9020 pounds per square foot (psf), indicating undrained shear strengths ranging from 415 to 4510 psf. The attached Log of Boring sheets list the results of the unconfined compressive tests in the “Tests or Notes” column and the Appendix also includes the individual data sheets and graphs.

We performed pocket penetrometer tests (qp) on selected penetration test samples to provide an additional estimation of the soil’s unconfined compressive strength. Penetrometer tests performed on the materials ranged from 1/4 to 4 1/2+ tons per square foot (tsf), indicating estimated undrained shear strengths ranging from about 250 to 4500 psf.

B.5.i. Time-Rate Consolidation Tests

We performed 6 time-rate consolidation test (per ASTM D2435). The test results are provided graphically in the Appendix. Tables 3 and 4 summarize the results.

Table 3. Summary of Consolidation Test Results

Boring / Depth	Soil Type	Preconsolidation Pressure (psf)	Compression Index (C_c)	Recompression Index (C_r)	Initial Void Ratio
B-04 (42 to 44 feet)	Sandy Lean Clay (CL)	2,880	0.14	0.01	0.525
B-05 (32 to 34 feet)	Sandy Lean Clay (CL)	3,820	0.11	0.02	0.457
B-08 (17 to 19 feet)	Sandy Silt (ML)	4,700	0.04	0.00	0.523
B-10 (32 to 34 feet)	Sandy Lean Clay (CL)	3,660	0.11	0.02	0.447
B-11 (3 to 5 feet)	Sandy Lean Clay (CL)	4,540	0.11	0.01	0.539
B-12 (29 ½ to 31 ½ feet)	Sandy, Silty Clay (CL-ML)	3,760	0.11	0.01	0.474

The time-rate curves for the time-rate consolidation tests provided the following coefficient of consolidation (c_V) values at the indicated confining pressure:

Table 4. Time-Rate Consolidation Test Results

Boring / Depth	Soil Type	Confining Pressure (psf)	Coefficient of Consolidation (C_V) (ft^2/day)
B-04 (42 to 44 feet)	Sandy Lean Clay (CL)	1,000	0.94
		2,000	1.39
		4,000	0.86
		8,000	0.49
B-04 (42 to 44 feet)	Sandy Lean Clay (CL)	16,000	0.29
		32,000	0.21
B-05 (32 to 34 feet)	Sandy Lean Clay (CL)	1,000	0.26
		2,000	0.12
		4,000	0.14
		8,000	0.40
		16,000	0.10
		32,000	0.09

Boring / Depth	Soil Type	Confining Pressure (psf)	Coefficient of Consolidation (C_V) (ft²/day)
B-08 (17 to 19 feet)	Sandy Silt (ML)	1,000	0.39
		2,000	0.13
		4,000	0.45
		8,000	0.26
		16,000	0.12
		32,000	0.49
B-10 (32 to 34 feet)	Sandy Lean Clay (CL)	1,000	0.38
		2,000	0.28
		4,000	1.16
		8,000	1.52
		16,000	0.15
		32,000	0.11
B-11 (3 to 5 feet)	Sandy Lean Clay (CL)	1,000	0.34
		2,000	1.76
		4,000	1.20
		8,000	0.82
		16,000	0.57
		32,000	0.76
B-12 (29 ½ to 31 ½ feet)	Sandy Silty Clay (CL-ML)	500	0.77
		1,000	0.38
		2,000	0.46
		4,000	1.29
		8,000	0.38
		16,000	0.23
		32,000	0.20

B.5.j. Moisture-Density Relationship (Proctor Tests)

We performed modified Proctor tests (per ASTM D1557) on 6 selected bulk samples. The results indicated maximum dry densities of 115.1 to 124.7 pounds per cubic foot (pcf) with optimum moisture contents of 10.5 to 12.9 percent. The Proctor test results are provided graphically in the Appendix.

B.5.k. Corrosion Potential Tests

We performed corrosion potential tests including pH determinations, chloride and water soluble sulfate on 15 samples. The Appendix includes all of the test results on composite sheets and the results are also listed in the “Tests or Notes” column of the Log of Boring sheets.

B.5.l. Thermal Conductivity Tests

We performed 19 thermal conductivity tests on samples obtained from the locations shown on the Exploration Location Sketch in the Appendix. The thermal conductivity results are presented graphically in the Appendix.

C. Procedures

C.1. Penetration Test Borings

We drilled the penetration test borings with truck and ATV-mounted core and auger drill equipped with hollow-stem auger. We performed the borings in general accordance with ASTM D6151 taking penetration test samples at 2 1/2- or 5-foot intervals in general accordance to ASTM D1586. We collected thin-walled tube samples in general accordance with ASTM D1587 at selected depths. The boring logs show the actual sample intervals and corresponding depths. We also collected bulk samples of auger cuttings at selected locations for laboratory testing.

On July 25 and July 26, 2018 we performed calibrations on the autohammers for each rig. The results of the calibrations are presented in the Appendix.

C.2. Exploration Logs

C.2.a. Log of Boring Sheets

The Appendix includes Log of Boring sheets for our penetration test borings. The logs identify and describe the penetrated geologic materials, and present the results of penetration resistance tests performed. The logs also present the results of laboratory tests performed on samples, and groundwater measurements.

We inferred strata boundaries from changes in the penetration test samples and the auger cuttings. Because we did not perform continuous sampling, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may occur as gradual rather than abrupt transitions.

C.2.b. Geologic Origins

We assigned geologic origins to the materials shown on the logs and referenced within this report, based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance testing performed for the project, (4) laboratory test results, and (5) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

C.3. Material Classification and Testing

C.3.a. Visual and Manual Classification

We visually and manually classified the geologic materials encountered based on ASTM D2488. When we performed laboratory classification tests, we used the results to classify the geologic materials in accordance with ASTM D2487. The Appendix includes a chart explaining the classification system we used.

C.3.b. Laboratory Testing

The exploration logs in the Appendix note most of the results of the laboratory tests performed on geologic material samples. The remaining laboratory test results follow the exploration logs. We performed the tests in general accordance with ASTM procedures.

C.4. Groundwater Measurements

The drillers checked for groundwater while advancing the penetration test borings, and again after auger withdrawal. We then filled the boreholes or allowed them to remain open for an extended period of observation, as noted on the boring logs.

D. Qualifications

D.1. Variations in Subsurface Conditions

D.1.a. Material Strata

We developed our evaluation, analyses and recommendations from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth. Therefore, we must infer strata boundaries and thicknesses to some extent. Strata boundaries may also be gradual transitions, and project planning should expect the strata to vary in depth, elevation and thickness, away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until performing additional exploration work, or starting construction. If future activity for this project reveals any such variations, you should notify us so that we may reevaluate our recommendations. Such variations could increase construction costs, and we recommend including a contingency to accommodate them.

D.1.b. Groundwater Levels

We made groundwater measurements under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. Note that the observation periods were relatively short, and project planning can expect groundwater levels to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

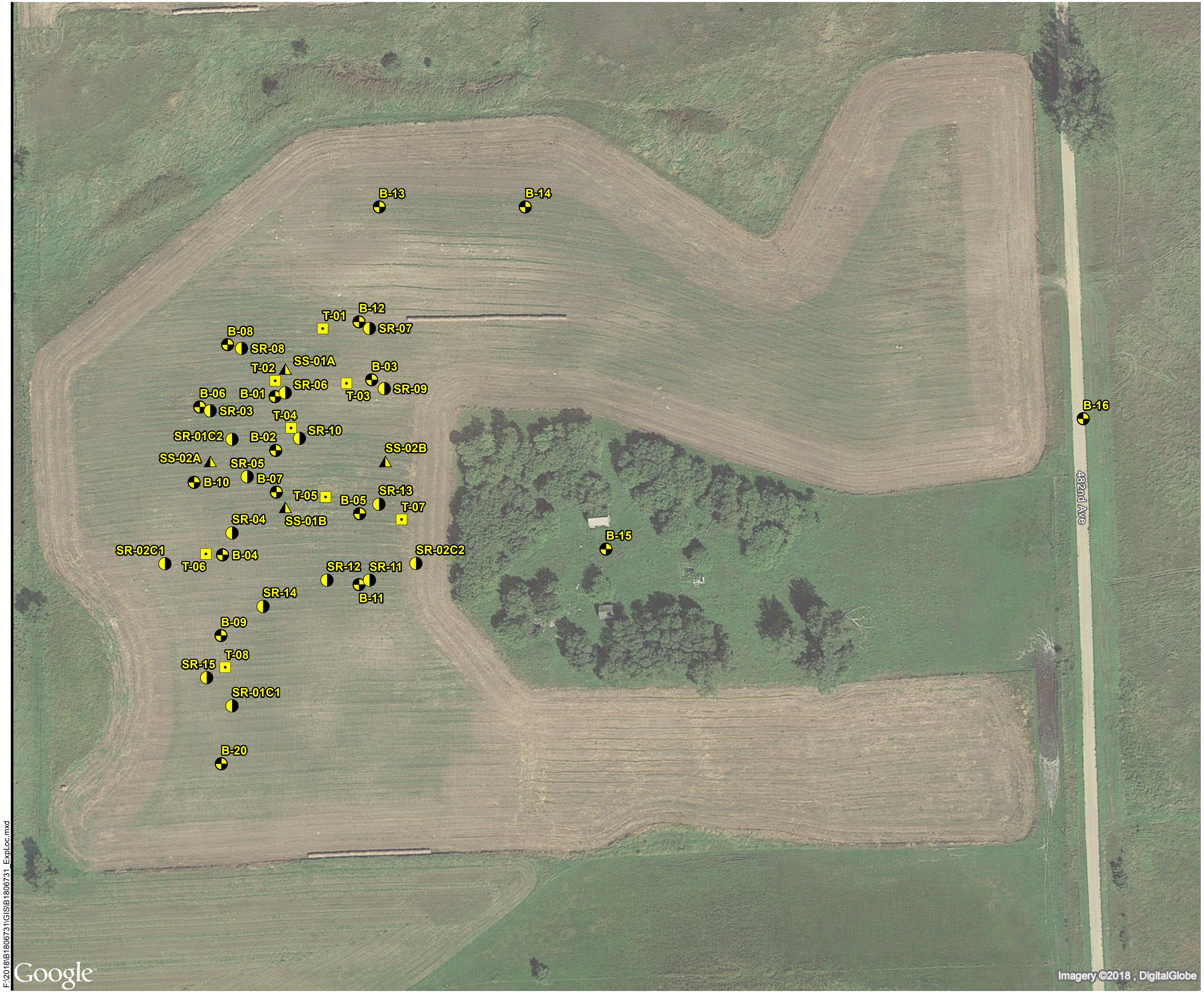
D.2. Use of Report

This report is for the exclusive use of the addressed parties. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

D.3. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix



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APPROXIMATE LOCATION OF

◐ ELECTRICAL RESISTIVITY (17)

▲ SIESMIC TESTING (4)

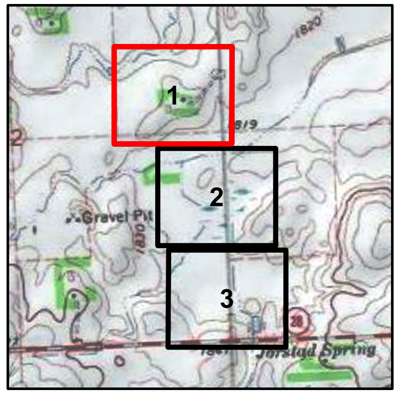
⊕ SOIL BORING (20)

▣ THERMAL TESTING (8)

N

0 60 120 Feet

1 inch = 120 feet



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West Fargo, ND 58078
701.232.8701
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Drawing Information

Project No:
B1806731

Drawing No:
B1806731_ExpLoc

Drawn By:	CMF
Drawn Drawn:	8/22/2018
Checked By:	EB
Last Modified:	8/22/2018

Project Information

Astoria Station

Geotechnical
Exploration & Testing

19333 482nd Avenue

Astoria, South Dakota

Exploration Location Sketch

Sheet:
1 of 3

Figure 1

APPROXIMATE LOCATION OF

◐ ELECTRICAL RESISTIVITY (17)

▲ SIESMIC TESTING (4)

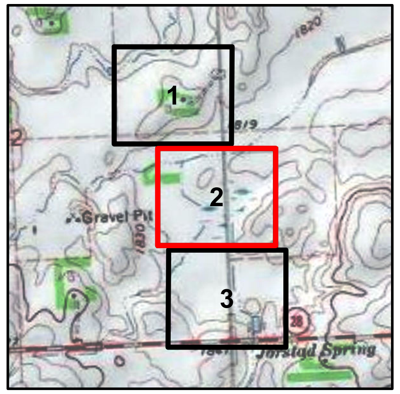
⊕ SOIL BORING (20)

▣ THERMAL TESTING (8)

N

0 60 120 Feet

1 inch = 120 feet



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Drawn Drawn:	8/22/2018
Checked By:	EB
Last Modified:	8/22/2018

Project Information

Astoria Station

Geotechnical
Exploration & Testing

19333 482nd Avenue

Astoria, South Dakota

Exploration Location Sketch

Sheet:
2 of 3

Figure 1

F:\2018\B1806731\GIS\B1806731_ExpLoc.mxd

APPROXIMATE LOCATION OF

◐ ELECTRICAL RESISTIVITY (17)

▲ SIESMIC TESTING (4)

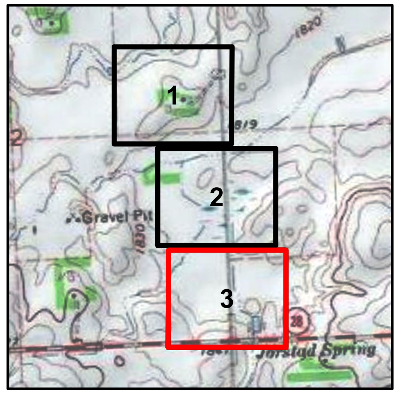
⊕ SOIL BORING (20)

▣ THERMAL TESTING (8)

N

0 60 120 Feet

1 inch = 120 feet



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Drawn By: CMF
Drawn Drawn: 8/22/2018
Checked By: EB
Last Modified: 8/22/2018

Project Information

Astoria Station

Geotechnical
Exploration & Testing

19333 482nd Avenue

Astoria, South Dakota

Exploration Location Sketch

Sheet:
3 of 3

Figure 1

F:\2018\B1806731\GIS\B1806731_ExpLoc.mxd

BRAUN℠ INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-01**
LOCATION: See sketch.

DRILLER: G. Bevre
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/26/18**
SCALE: **1" = 4'**

Elev. feet 1822.4	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		CL	LEAN CLAY, trace Sand and roots, black, moist. (Topsoil)	4				
			-trace Gravel and roots at 3 feet.	3		24		P200=84%
1818.4	4.0							
		SM	SILTY SAND, trace Gravel, fine-grained, brown and gray, moist, loose. (Alluvium)	TW*		10		*12 inch recovery. LL=NP, PL=NP, PI=NP
					▽			
			-gray and wet below 10 feet.	7				Mud rotary methods used below 10 feet.
1810.9	11.5							
		SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, wet, loose. (Glacial Outwash)					
				6		23		
			-Silty Sand seams at 20 feet.	8				
1799.4	23.0							
		CL	SANDY LEAN CLAY, trace Gravel, gray, moist, medium to stiff. (Glacial Till)					
			- SILTY SAND layer at 25 feet.	10			1 1/4	pH=7.8, WSS=470mg/Kg, Chloride=<5mg/Kg
				TW*		14	1	*24 inch recovery. WD=133pcf, DD=117pcf, Qu=3240psf; LL=26, PL=12, PI=14
				7			1	

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/23/18 12:11

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-01 (cont.)**
LOCATION: See sketch.

DRILLER: G. Bevre
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/26/18**
SCALE: **1" = 4'**

Elev. feet 1790.4	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			SANDY LEAN CLAY, trace Gravel, gray, moist, medium to stiff. (Glacial Till) *(continued)*					
			-with Silty Sand seams at 35 feet.	8				
				TW*		21	1	*Full recovery. WD=130pcf, DD=108pcf, Qu=1240psf; P200=53%
				13			1 1/2	
1779.4	43.0	CL	-driller noted what felt like Sand and Gravel at 42 1/2 feet (1 foot long). SANDY LEAN CLAY, a little Gravel, gray, moist, very stiff to hard. (Glacial Till)					
				18			2	
			-with Silty Sand seams at 50 feet.	67				
				21		16	2 3/4	LL=29, PL=10, PI=19
				27			3 1/4	

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/23/18 12:11

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-01 (cont.)**
LOCATION: See sketch.

DRILLER: G. Bevre
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/26/18**
SCALE: **1" = 4'**

Elev. feet 1758.4	Depth feet 64.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		▨	SANDY LEAN CLAY, a little Gravel, gray, moist, very stiff to hard. (Glacial Till) *(continued)*	36			4	
			-SILTY SAND layer at 70 feet.	29				
				31			3 1/2	
				35			3 1/2	
				32			3	
				22			2 1/2	
				38			4	

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/23/18 12:11

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-01 (cont.)**

LOCATION: See sketch.

DRILLER: G. Bevre

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/26/18**

SCALE: **1" = 4'**

Elev. feet 1726.4	Depth feet 96.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1721.4	101.0	▨	SANDY LEAN CLAY, a little Gravel, gray, moist, very stiff to hard. (Glacial Till) *(continued)*	21			2	
			END OF BORING. Water observed at a depth of 8 1/2 feet while drilling. Water level not determined at termination due to the use of mud rotary drilling fluids. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/23/18 12:11

BRAUN℠
INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-02**

LOCATION: See sketch.

DRILLER: G. Bevre

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/25/18**

SCALE: **1" = 4'**

Elev. feet 1823.0	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1822.0	1.0	CL	LEAN CLAY, trace Sand and roots, black, moist.					
		ML	SANDy SILT, with Lean Clay layers, brown and gray with iron-staining, moist, very loose to loose. (Alluvium)	6				
				3		22		OC=3%
				5				
1816.5	6.5							
		SP-SM	POORLY GRADED SAND with SILT, fine-grained, gray, wet, very loose to loose. (Glacial Outwash)	5				
			-brown at 10 feet.	2	▽	28		Mud rotary methods used below 11 feet.
				4				pH=8.3, WSS=27mg/Kg, Chloride=<5mg/Kg
			-Silty Sand seams at 15 feet.	4				
			-trace Gravel at 20 feet.	7				
				5				
			-layer of SILT at 30 feet.	10		24		P200=60%

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/23/18 12:11

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-02 (cont.)**

LOCATION: See sketch.

DRILLER: G. Bevre | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/25/18** | SCALE: **1" = 4'**

Elev. feet 1791.0	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			POORLY GRADED SAND with SILT, fine-grained, gray, wet, very loose to loose. (Glacial Outwash) *(continued)*					
			-with GRAVEL, medium dense at 35 feet.	16				
1785.0	38.0	CL	SANDY LEAN CLAY, trace Gravel, gray, moist, very stiff to hard. (Glacial Till)					
				18		14	1 3/4	LL=29, PL=12, PI=17
				20				
			-with GRAVEL at 50 feet.	44				
				26			3 1/4	
				32		17	3 1/2	P200=68%; LL=35, PL=13, PI=22

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/23/18 12:11

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-02 (cont.)**

LOCATION: See sketch.

DRILLER: G. Bevre	METHOD: 3 1/4" HSA, Autohammer	DATE: **7/25/18**	SCALE: **1" = 4'**

Elev. feet 1759.0	Depth feet 64.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		▨	SANDY LEAN CLAY, trace Gravel, gray, moist, very stiff to hard. (Glacial Till) *(continued)*	32				
				35			3 1/2	
				32				
				36		15		
				30				
				36			2 3/4	
				30			2 3/4	

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-02 (cont.)**

LOCATION: See sketch.

DRILLER: G. Bevre | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/25/18** | SCALE: **1" = 4'**

Elev. feet 1727.0	Depth feet 96.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1722.0	101.0	▨	SANDY LEAN CLAY, trace Gravel, gray, moist, very stiff to hard. (Glacial Till) *(continued)*	37			3 1/4	
			END OF BORING. Water observed at a depth of 10 feet while drilling. Water level not determined at termination due to the use of mud rotary drilling fluids. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/23/18 12:12

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-03**

LOCATION: See sketch.

DRILLER: G. Bevre

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/27/18**

SCALE: **1" = 4'**

Elev. feet 1826.0	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1825.2	0.8	CL	SANDY LEAN CLAY, trace roots and organics, black, moist.	FA				
1819.5	6.5	SM	SILTY SAND, fine-grained, brown, moist to wet, very loose to loose. (Alluvium)	4				
				5		10		
				6				pH=8.5, WSS=26mg/Kg, Chloride=<5mg/Kg
1817.0	9.0	ML	SILT with SAND, brown, moist, very loose. (Alluvium)	4				
					▽			
1803.0	23.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, brown and gray, moist, loose to medium dense. (Glacial Outwash) -layer of SILTY SAND at 10 feet.	8				Mud rotary methods used below 11 feet.
				9				
				10				
				15				
		CL	SANDY LEAN CLAY, gray, wet, medium to stiff. (Glacial Till)					
				6			1/2	
				TW*		14	1	*16 inch recovery. WD=137pcf, DD=120pcf, Qu=2440psf;

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/23/18 12:12

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-03 (cont.)**
LOCATION: See sketch.

DRILLER: G. Bevre
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/27/18**
SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 1794.0	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			SANDY LEAN CLAY, gray, wet, medium to stiff. (Glacial Till) *(continued)*					LL=30, PL=13, PI=17; P200=50%
			-layer of SILTY SAND at 35 feet.	6			1/2	
				7			1	
			-Unconfined compressive strength test attempted on sample at 45 feet, but sample had not peaked at the movement limit of the machine (1 inch). Qu at 17.8% strain was 1560psf.	TW*		17	1	*24 inch recovery. WD=134pcf, DD=114pcf; LL=24, PL=14, PI=10
				11*				*No recovery.
				10			1 1/4	
1768.0	58.0							
		CL	SANDY LEAN CLAY, a little Gravel, gray, moist, medium dense to hard. (Glacial Till)					
				TW*		15	3 3/4	*13 inch recovery. WD=133pcf, DD=115pcf, Qu=6360psf

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BRAUN℠ INTERTEC

LOG OF BORING

Braun Project B1806731 **Geotechnical Evaluation** **Astoria Station** **19333 482nd Avenue** **Astoria, South Dakota**	BORING: **B-03 (cont.)** LOCATION: See sketch.

DRILLER: G. Bevre | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/27/18** | SCALE: **1" = 4'**

Elev. feet 1762.0	Depth feet 64.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		▨	SANDY LEAN CLAY, a little Gravel, gray, moist, medium dense to hard. (Glacial Till) *(continued)*	29			3 1/2	
				30			3	
				49				
			-layer of POORLY GRADED SAND with SILT at 80 feet.	59				
				30			3	
				36			3	
				16			1 1/2	

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-03 (cont.)**

LOCATION: See sketch.

DRILLER: G. Bevre

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/27/18**

SCALE: **1" = 4'**

Elev. feet 1730.0	Depth feet 96.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1725.0	101.0	▨	SANDY LEAN CLAY, a little Gravel, gray, moist, medium dense to hard. (Glacial Till) *(continued)*	☒ 22			2	
			END OF BORING. Water observed at a depth of 9 feet while drilling. Water level not determined at termination due to the use of mud rotary drilling fluids. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-04**
LOCATION: See sketch.

DRILLER: K. Miller
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/25/18**
SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 1826.7	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		CL	LEAN CLAY, with roots and organics, black, moist. (Topsoil)	5		15		OC=4%
1824.7	2.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, brown, moist, loose to very loose. (Alluvium)	5				pH=8.6, WSS=9mg/Kg, Chloride=<5mg/Kg
				4		5		
1818.7	8.0	SM	SILTY SAND, fine-grained, brown, wet, loose. (Alluvium)	5				
				7	▽	30		P200=35% Mud rotary methods used below 11 feet.
1813.7	13.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, gray, wet, very loose to loose. (Glacial Outwash)					
			-brown and gray at 15 feet.	1				
				4		23		
			-layer of SILT at 25 feet.	8				
			-fine- to medium-grained below 30 feet.	8				

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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-04 (cont.)**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/25/18**

SCALE: **1" = 4'**

Elev. feet 1794.7	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			POORLY GRADED SAND with SILT, fine- to medium-grained, gray, wet, very loose to loose. (Glacial Outwash) *(continued)*					
				10			1	
1788.7	38.0							
		CL	SANDY LEAN CLAY, trace Gravel, gray, moist, medium. (Glacial Till)					
				6			1/2	
				TW*		16		*23 inch recovery. WD=136pcf, DD=117pcf; Qu=3580psf; LL=32, PL=12, PI=20; P200=59%; SG=2.686
			-SILTY SAND layers at 43 feet.					
				5		18	1/2	LL=29, PL=13, PI=16
1776.7	50.0							
		SP-SM	POORLY GRADED SAND with SILT, fine-grained, gray, wet, loose. (Glacial Outwash)	9				
			-drillers noted what felt like Gravel at 53-54 feet.					
1771.7	55.0							
		CL	SANDY LEAN CLAY, trace Gravel, gray, moist, soft. (Glacial Till)	5			1/2	
				*				*Thinwall attempted at 57 feet. No recovery.
				3			1/4	
				TW*		16	2 3/4	*18 inch recovery. Drillers noted upper 1 foot pushed
1763.7	63.0							
		CL						

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-04 (cont.)**
LOCATION: See sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/25/18** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 1762.7	Depth feet 64.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		▨	SANDY LEAN CLAY, a little Gravel, gray, moist, stiff to very stiff. (Glacial Till) *(continued)*					significantly easier than bottom 1 foot.
				30			4	WD=133pcf, DD=115pcf, Qu=2800psf; P200=65%
				28			3 1/2	
				27		17	3 1/2	LL=31, PL=13, PI=18
				28			3 1/4	
				23			3	
				11				
				TW*		18	1 1/2	*24 inch recovery. WD=132pcf, DD=112pcf, Qu=2020psf
				13			1 1/2	

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Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-04 (cont.)**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/25/18**

SCALE: **1" = 4'**

Elev. feet 1730.7	Depth feet 96.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1725.7	101.0	▨	SANDY LEAN CLAY, a little Gravel, gray, moist, stiff to very stiff. (Glacial Till) *(continued)*	17			1 3/4	
			END OF BORING. Water observed at a depth of 10 feet while drilling. Water level not determined at termination due to the use of mud rotary drilling fluids. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-05**
LOCATION: See sketch.

DRILLER: K. Miller
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/27/18**
SCALE: **1" = 4'**

Elev. feet 1822.7	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		CL	LEAN CLAY, trace Sand, organics and roots, black, moist. (Topsoil)	5				
1819.2	3.5			6		20		OC=4%; LL=44, PL=20, PI=24
		CL	LEAN CLAY, brown, moist, soft. (Alluvium)	3				pH=8.2, WSS=<2mg/Kg, Chloride=<5mg/Kg
1816.2	6.5				▽			
		SM	SILTY SAND, fine- to medium-grained, brown, wet, very loose to loose. (Glacial Outwash)	1				Mud rotary methods used below 8 feet.
				5				
1809.7	13.0							
		SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, trace Gravel, brown, wet. (Glacial Outwash)	8				
			-gray below 20 feet.	8		21		
				8				
1794.7	28.0							
		ML	SILT with SAND, with Lean Clay seams, gray, wet, loose. (Glacial Outwash)					
1792.2	30.5							
		CL	SANDY LEAN CLAY, trace Gravel, gray, moist, medium to stiff.	8				

(See Descriptive Terminology sheet for explanation of abbreviations)

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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-05 (cont.)**
LOCATION: See sketch.

DRILLER: K. Miller
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/27/18**
SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 1790.7	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			SANDY LEAN CLAY, trace Gravel, gray, moist, medium to stiff. *(continued)*	TW*		15	1 1/2	*24 inch recovery. WD=138pcf, DD=120pcf; Qu=3230psf; LL=30, PL=12, PI=18; SG=2.705
				10			2	
				11		17	1 1/2	P200=57%; LL=28, PL=12, PI=16
				13			1 1/2	
				TW*		15	1 1/2	*16 inch recovery. WD=133pcf, DD=116pcf, Qu=3680psf; LL=29, PL=12, PI=17
1772.7	50.0	SM	SILTY SAND, fine- to coarse-grained, trace Gravel, gray, wet, medium dense. (Glacial Outwash)	15				
1769.7	53.0	GP	POORLY GRADED GRAVEL with SAND, fine- to coarse-grained, gray, wet, dense. (Glacial Outwash)	31*				*Limited recovery.
1763.2	59.5	CL	SANDY LEAN CLAY, a little Gravel, gray, moist, very stiff to hard. (Glacial Till)	34			3	

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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-05 (cont.)**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/27/18**

SCALE: **1" = 4'**

Elev. feet 1758.7	Depth feet 64.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		▨	SANDY LEAN CLAY, a little Gravel, gray, moist, very stiff to hard. (Glacial Till) *(continued)*	59				
				39			3	
				39			3	
			-lenses of Sand at 80 feet.	41				
				25			2 1/2	
				24			2 34	
				27			2 3/4	

(See Descriptive Terminology sheet for explanation of abbreviations)

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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-05 (cont.)**

LOCATION: See sketch.

DRILLER:	K. Miller	METHOD:	3 1/4" HSA, Autohammer	DATE:	**7/27/18**	SCALE:	**1" = 4'**

Elev. feet 1726.7	Depth feet 96.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1721.7	101.0	▨	SANDY LEAN CLAY, a little Gravel, gray, moist, very stiff to hard. (Glacial Till) *(continued)*	26			2 1/2	
			END OF BORING. Water observed at a depth of 6 1/2 feet while drilling. Water level not determined at termination due to the use of mud rotary drilling fluids. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-06**
LOCATION: See sketch.

DRILLER: K. Miller
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/26/18**
SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 1821.5	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1819.5	2.0	CL	LEAN CLAY, trace Sand and roots, black, moist. (Topsoil)	5		24		OC=8%
1817.5	4.0	CL	LEAN CLAY, trace Sand, brown, moist, soft. (Alluvium)	4				
1813.5	8.0	SC	CLAYEY SAND, fine-grained, brown and gray with iron-staining, moist, very loose. (Alluvium)	4 4		16		Mud rotary methods used below 6 feet. P200=25%; LL=27, L=13, PI=14
1811.0	10.5	SM	SILTY SAND, fine-grained, brown, moist, very loose. (Glacial Outwash)	5			3/4	
1803.0	18.5	CL	SANDY LEAN CLAY, trace Gravel, brown, moist, medium to stiff. (Glacial Till) -CLAYEY SAND layers at 15 feet.	10		12		P200=19%; LL=22, PL=13, PI=9
1798.5	23.0	GP	POORLY GRADED GRAVEL with SILT and SAND, fine- to coarse-grained, gray, wet, medium dense. (Glacial Outwash)	13		10		
1794.0	27.5	SP	POORLY GRADED SAND, fine- to coarse-grained, trace Gravel, gray, wet, loose. (Glacial Outwash)	8				
1789.5	32.0	CL	SANDY LEAN CLAY, gray, wet, stiff. (Glacial Till)	9			1 /2	

BRAUN INTERTEC

LOG OF BORING

Braun Project B1806731 **Geotechnical Evaluation** **Astoria Station** **19333 482nd Avenue** **Astoria, South Dakota**	BORING: **B-06 (cont.)** LOCATION: See sketch.

DRILLER: K. Miller	METHOD: 3 1/4" HSA, Autohammer	DATE: **7/26/18**	SCALE: **1" = 4'**

Elev. feet 1789.5	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		SP	POORLY GRADED SAND with GRAVEL, fine- to coarse-grained, gray, wet, medium dense. (Glacial Outwash)	TW*				*No recovery.
				11				
1783.5	38.0	CL	SANDY LEAN CLAY, trace Gravel, gray, wet, very stiff to hard. (Glacial Till)					
			-stiff consistency at 40 feet.	10		18	1 1/2	
				TW*				*No recovery.
				18*				*Very little recovery.
				TW*		19		*9 inch recovery. Tube bent. LL=35, PL=14, PI=21
				22			2 3/4	
				23		22		LL=35, PL=14, PI=21
				37			3 3/4	

(See Descriptive Terminology sheet for explanation of abbreviations)

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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-06 (cont.)**
LOCATION: See sketch.

DRILLER: K. Miller
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/26/18**
SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 1757.5	Depth feet 64.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		▨	SANDY LEAN CLAY, trace Gravel, gray, wet, very stiff to hard. (Glacial Till) *(continued)*	39			3	
				41			3 1/2	
				40				
				29			2 1/2	
			POORLY GRADED SAND with GRAVEL layer at 85 feet.	81				
				25			2 1/2	
				28			2 1/2	

BRAUN℠ INTERTEC

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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-06 (cont.)**
LOCATION: See sketch.

DRILLER: K. Miller
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/26/18**
SCALE: **1" = 4'**

Elev. feet 1725.5	Depth feet 96.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1720.5	101.0	▨	SANDY LEAN CLAY, trace Gravel, gray, wet, very stiff to hard. (Glacial Till) *(continued)*	28				
			END OF BORING. Water not observed with 4 1/2 feet of hollow stem auger in the ground. Water level not determined at termination due to the use of mud rotary drilling fluids. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-07**

LOCATION: See sketch.

DRILLER: G. Bevre

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/24/18**

SCALE: **1" = 4'**

Elev. feet 1822.5	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		CL	LEAN CLAY with SAND, trace roots and organics, black, moist. (Topsoil)	3				
				2		25		OC=6%
1818.5	4.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, brown, moist, very loose. (Alluvium)	3				
			-with Silt seams at 8 feet.	3	▽			
			-layer of SILT at 10 feet.	3				Mud rotary methods used below 11 feet.
			-fine- to coarse-grained at 13 feet.	4				
1808.5	14.0	SM	SILTY SAND, a little Gravel, fine-grained, gray, wet, loose. (Glacial Outwash)	7		22		
				9				
1799.5	23.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, gray, wet, loose to medium dense. (Glacial Outwash)	9				
				12				

(See Descriptive Terminology sheet for explanation of abbreviations)

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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-07 (cont.)**

LOCATION: See sketch.

DRILLER: G. Bevre

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/24/18**

SCALE: **1" = 4'**

Elev. feet 1790.5	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			POORLY GRADED SAND with SILT, fine- to coarse-grained, gray, wet, loose to medium dense. (Glacial Outwash) *(continued)*					
				7				
			-drillers noted what felt like Gravel, hard drilling and grinding at 36 1/2 feet.					
1784.5	38.0	CL	SANDY LEAN CLAY, trace Gravel, gray, moist, stiff. (Glacial Till)					
				10			1 1/2	
			-SILTY SAND layers at 44 feet. -Cobbles at 45 feet.	TW*		18		pH=7.9, WSS=270mg/Kg, Chloride=<5mg/Kg *12 inch recovery. Bottom 2 inches of tube bent. WD=138pcf, DD=117pcf, Qu=1180psf
1774.5	48.0	CL	SANDY LEAN CLAY, a little Gravel, gray, moist, very stiff to hard. (Glacial Till)					
				40			3 1/2	
				50				
				31		18	3 1/4	

(See Descriptive Terminology sheet for explanation of abbreviations)

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-07 (cont.)**

LOCATION: See sketch.

DRILLER: G. Bevre	METHOD: 3 1/4" HSA, Autohammer	DATE: **7/24/18**	SCALE: **1" = 4'**

Elev. feet 1758.5	Depth feet 64.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		▨	SANDY LEAN CLAY, a little Gravel, gray, moist, very stiff to hard. (Glacial Till) *(continued)*	42				
				28			3 1/2	
			-SILT with SAND layer at 75 feet, with 2" Clay lenses in it.	TW*		22		*8 inch recovery. Bottom 1 inch of tube bent. LL=29, PL=14, PI=15
				26			2 3/4	
				29			3 1/4	
				21				
				27				

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-07 (cont.)**

LOCATION: See sketch.

DRILLER: G. Bevre

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/24/18**

SCALE: **1" = 4'**

Elev. feet 1726.5	Depth feet 96.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1721.5	101.0	▨	SANDY LEAN CLAY, a little Gravel, gray, moist, very stiff to hard. (Glacial Till) *(continued)*	30			3	
			END OF BORING. Water observed at a depth of 9 feet while drilling. Water level not determined at termination due to the use of mud rotary drilling fluids. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN℠ INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-08**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/31/18**

SCALE: **1" = 4'**

Elev. feet 1822.0	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1821.3	0.7	CL	LEAN CLAY, trace Sand, roots and organics, black, moist.					
		CL	LEAN CLAY, brown, moist, soft. (Alluvium)	6				
				3			1/4	
1817.0	5.0			TW*		20		*20 inch recovery.
		SM	SILTY SAND, fine- to coarse-grained, a little Gravel, brown, moist. (Alluvium)					
1815.0	7.0							
		CL	SANDY LEAN CLAY, trace Gravel, with lenses of Sand, brown, wet, medium. (Glacial Till)	8	▽	19	1 1/4	LL=25, PL=14, PI=11
1812.0	10.0							
		SM	SILTY SAND, fine-grained, brown, wet, loose. (Glacial Outwash)	10		24		
1809.0	13.0							
		CL	SANDY LEAN CLAY, trace Gravel, gray, moist, medium to stiff. (Glacial Till)					
				8			1 1/4	
				TW*		18	1 3/4	*24 inch recovery. WD=134pcf, DD=114pcf; Qu=830psf; LL=NP, PL=NP, PI=NP; SG=2.702
			-SANDY SILT layer at 17 feet.					
			-Silty Sand seams from 20 to 28 feet.	8			1 1/2	
				7				
				9			1 1/2	

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-08 (cont.)**

LOCATION: See sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/31/18** | SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 1790.0	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		▨	SANDY LEAN CLAY, trace Gravel, gray, moist, medium to stiff. (Glacial Till) *(continued)*					
		▨	-3- to 8-inch thick layers of SILTY SAND at 35 feet.	TW*		15	1 1/4	*24 inch recovery. WD=133pcf, DD=116pcf, Qu=2960psf; LL=29, PL=12, PI=17
		▨		5			3/4	
1779.0	43.0	▨						
		CL ▨	SANDY LEAN CLAY, a little Gravel, gray, moist, very stiff to hard.	18			2	
		▨		TW*		15	4.5+	*12 inch recovery. Drillers noted the tube was pushed very hard and short recovery is due to not being able to push any further. WD=135pcf, DD=118pcf, Qu=9020psf
		▨		33			4.5+	
		▨		38				
1761.0	61.0	▨						
			END OF BORING. Water on 7 1/2 foot sample tube. No measurable water collected in base of hole after removal of auger. Boring then backfilled with bentonite grout.					

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Geotechnical Evaluation
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BORING: **B-09**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/24/18**

SCALE: **1" = 4'**

Elev. feet 1827.9	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1826.9	1.0	CL	LEAN CLAY, trace Sand and roots, dark brown, moist. (Topsoil)	4			1	
1825.4	2.5	CL	LEAN CLAY, brown, moist, soft. (Alluvium)					
1823.9	4.0	ML	SILT with SAND, brown, moist, very loose. (Alluvium)	3				pH=8.8, WSS=<2mg/Kg, Chloride=<5mg/Kg
1814.9	13.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, brown, moist to wet, loose. (Alluvium)	5 5 5	∇	 6 		Mud rotary methods used below 11 feet.
1809.9	18.0	SM	SILTY SAND, fine- to medium-grained, gray, wet, very loose to loose. (Glacial Outwash)	1				
1799.9	28.0	SP-SM	POORLY GRADED SAND with SILT, fine- to medium-grained, wet, very loose to loose. (Glacial Outwash)	4 6				
1795.9	32.0	SM	SILTY SAND, fine-grained, trace Gravel, gray, wet, loose. (Glacial Outwash)	7		27		

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
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BORING: **B-09 (cont.)**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/24/18**

SCALE: **1" = 4'**

Elev. feet 1795.9	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		ML	SANDY SILT, gray, wet, loose. (Glacial Outwash)					
				6		23		P200=57%
1789.9	38.0	CL	SANDY LEAN CLAY, trace Gravel, gray, wet, stiff to very stiff. (Glacial Till)					
				11		17	1	LL=30, PL=13, PI=17
				11			1	
			-SILTY SAND layers at 50 feet.	6			1/2	
				10			3/4	
				28			3	
1766.9	61.0		END OF BORING. Water observed at a depth of 9 1/2 feet while drilling. Water level not determined at termination due to the use					

(See Descriptive Terminology sheet for explanation of abbreviations)

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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
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BORING: **B-09 (cont.)**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/24/18**

SCALE: **1" = 4'**

Elev. feet 1763.9	Depth feet 64.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			of mud rotary drilling fluids. Boring then backfilled with bentonite grout.					

BRAUN℠
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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-10**
LOCATION: See sketch.

DRILLER: K. Miller
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/25/18**
SCALE: **1" = 4'**

Elev. feet 1824.8	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1823.8	1.0	CL	LEAN CLAY, trace Sand, roots and organics, black, moist. (Topsoil)	4		18		LL=34, PL=18, PI=16
1820.3	4.5	CL	LEAN CLAY, trace Sand, brown and gray, moist, soft. (Alluvium)	4			3/4	pH=8.9, WSS=10mg/Kg, Chloride=<5mg/Kg
1799.8	25.0	SM	SILTY SAND, fine-grained, brown, wet, very loose to loose. (Glacial Outwash)	4				Mud rotary methods used below 6 feet.
				6		21		
				6				
			-gray below 15 feet.	4				
				8				
1794.8	30.0	ML	SILT with SAND, gray, wet, loose. (Glacial Outwash)	7		27		P200=75%
		CL	SANDY LEAN CLAY, trace Gravel, gray, moist, medium. (Glacial Till)	7			1 1/4	

(See Descriptive Terminology sheet for explanation of abbreviations)

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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-10 (cont.)**

LOCATION: See sketch.

DRILLER: K. Miller
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/25/18**
SCALE: **1" = 4'**

Elev. feet 1792.8	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			SANDY LEAN CLAY, trace Gravel, gray, moist, medium. (Glacial Till) *(continued)*	TW*		16		*21 inch recovery. Rock in tip. WD=137pcf, DD=118pcf; Qu=2960psf; LL=30, PL=12, PI=18; P200=54%; SG=2.693
				7			1 1/4	
				7		24	1 1/2	
				13			2	
				TW*		18	2 1/2	*24 inch recovery. WD=134pcf, DD=114pcf, Qu=7140psf
1775.8	49.0	CL	SANDY LEAN CLAY, trace Gravel, gray, moist, very stiff to hard. (Glacial Till)	30			3	
				44			4.5+	
				65				
1763.8	61.0		END OF BORING. Water not observed with 4 1/2 feet of hollow stem auger in the ground.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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Braun Project B1806731 **Geotechnical Evaluation** **Astoria Station** **19333 482nd Avenue** **Astoria, South Dakota**	BORING: **B-10 (cont.)** LOCATION: See sketch.

DRILLER: K. Miller	METHOD: 3 1/4" HSA, Autohammer	DATE: **7/25/18**	SCALE: **1" = 4'**

Elev. feet 1760.8	Depth feet 64.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			Water level not determined at termination due to the use of mud rotary drilling fluids. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

LOG OF BORING

Braun Project B1806731

Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-11**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/30/18**

SCALE: **1" = 4'**

Elev. feet 1825.8	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1823.3	2.5	CL	LEAN CLAY, trace Sand, roots and organics, black, moist. (Topsoil)	4				
1821.8	4.0	CL	SANDY LEAN CLAY, brown, moist, soft. (Alluvium)	4		20		pH=8.2, WSS=<2mg/Kg, Chloride=<5mg/Kg A thinwall was taken in a sister hole from 3 to 5 feet with 17" recovery (WD=129pcf, DD=107pcf; Qu=2430psf; LL=28, PL=16, PI=12; SG=2.715). LL=22, PL=16, PI=6 P200=83%; LL=39, PL=15, PI=24
1819.3	6.5	CL-ML	SILTY CLAY, trace Gravel, brown, moist, medium. (Alluvium)	7		13		
1816.8	9.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, trace Gravel, brown, moist, medium. (Glacial Outwash)	17				
1812.8	13.0	CL	LEAN CLAY with SAND, brown, moist, medium. (Glacial Till)	6	∇	31	1/2	
1807.8	18.0	GP	POORLY GRADED GRAVEL with SAND, fine-grained, brown, wet, loose. (Glacial Outwash)	6				Mud rotary methods used below 13 feet.
		SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, trace Gravel, gray, wet, loose to medium loose. (Glacial Outwash)	9 9 8				

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-11 (cont.)**

LOCATION: See sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/30/18** | SCALE: **1" = 4'**

Elev. feet 1793.8	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			POORLY GRADED SAND with SILT, fine- to coarse-grained, trace Gravel, gray, wet, loose to medium loose. (Glacial Outwash) *(continued)*					
				12				
				12				
1782.8	43.0							
		ML	SANDY SILT, trace Gravel, gray, wet, medium dense. (Glacial Outwash)					
				16		20		
1777.8	48.0							
		CL	SANDY LEAN CLAY, trace Gravel, gray, moist, medium to stiff. (Glacial Till)					
				10*				*Limited recovery.
				8			3/4	
				TW*		17	3/4	*19 inch recovery. WD=129pcf, DD=110pcf, Qu=2720psf; LL=30, PL=13, PI=17
				7			1/2	
1764.8	61.0							
			END OF BORING. Water observed at a depth of 13 feet while drilling. Water level not determined at termination due to the use					

(See Descriptive Terminology sheet for explanation of abbreviations)

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Geotechnical Evaluation
Astoria Station
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BORING: **B-11 (cont.)**

LOCATION: See sketch.

DRILLER: K. Miller	METHOD: 3 1/4" HSA, Autohammer	DATE: **7/30/18**	SCALE: **1" = 4'**

Elev. feet 1761.8	Depth feet 64.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			of mud rotary drilling fluids. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-12**

LOCATION: See sketch.

DRILLER: G. Bevre

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/30/18**

SCALE: **1" = 4'**

Elev. feet 1829.1	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		CL	LEAN CLAY, trace Sand and roots, brown, moist. (Topsoil)	2				
1828.1	1.0	CL	LEAN CLAY, trace Sand, moist, soft. (Alluvium)	4				
1826.1	3.0	SM	SILTY SAND, fine-grained, brown, moist, very loose. (Glacial Outwash)	4				pH=8.6, WSS=28mg/Kg, Chloride=<5mg/Kg
				4	▽	25		
1820.1	9.0	ML	SILT with SAND, brown and gray, wet, very loose. (Glacial Outwash)	4				Mud rotary methods used below 11 feet.
1817.6	11.5	SP-SM	POORLY GRADED SAND with SILT, gray, wet, loose. (Glacial Outwash)	6				
				7				
				10				
1806.1	23.0	CL	SANDY LEAN CLAY, trace Gravel, gray, wet, medium to very stiff. (Glacial Till)	8		16	1 1/2	
			-SILTY CLAY layer at 20 feet.	TW*		19	1 1/2	*20 inch recovery. Bottom 1 inch of tube was bent. WD=132pcf,

LOG OF BORING

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BORING: **B-12 (cont.)**
LOCATION: See sketch.

DRILLER: G. Bevre	METHOD: 3 1/4" HSA, Autohammer	DATE: **7/30/18**	SCALE: **1" = 4'**

Elev. feet 1797.1	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
		▨	SANDY LEAN CLAY, trace Gravel, gray, wet, medium to very stiff. (Glacial Till) *(continued)*					DD=111pcf; Qu=1340psf; LL=23, PL=18, PI=5; SG=2.695
		▨		11			1 1/2	
		▨		TW*		15	1 1/2	*12 inch recovery. WD=136pcf, DD=118pcf, Qu=2140psf; P200=52%; LL=27, PL=13, PI=14
		▨		12			1 1/2	
		▨		12			1 1/2	
		▨	-layer of SILTY SAND at 55 feet.	17				
		▨		30				
1768.1	61.0		END OF BORING. Water observed at a depth of 8 feet while drilling. Water level not determined at termination due to the use					

(See Descriptive Terminology sheet for explanation of abbreviations)

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Astoria Station
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BORING: **B-12 (cont.)**

LOCATION: See sketch.

DRILLER: G. Bevre

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/30/18**

SCALE: **1" = 4'**

Elev. feet 1765.1	Depth feet 64.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			of mud rotary drilling fluids. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-13**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/31/18**

SCALE: **1" = 4'**

Elev. feet 1823.1	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1822.1	1.0	CL	LEAN CLAY, trace Sand roots, black, moist. (Topsoil)	6				
1821.1	2.0	CL	LEAN CLAY, brown, moist, medium. (Alluvium)					
1819.1	4.0	SC	CLAYEY SAND, fine-grained, brown, moist, loose. (Alluvium)	5		19		Bulk sample collected from 1 to 5 feet deep (pH=8.1, WSS=9mg/Kg, Chloride=<5mg/Kg; LL=29, PL=15, PI=14; P200=45%). *23 inch recovery. WD=126pcf, DD=103pcf, Qu=1740psf; P200=30%; LL=30, PL=23, PI=7 pH=8.1, WSS=28mg/Kg, Chloride=<5mg/Kg Mud rotary methods used below 11 feet.
1816.1	7.0	CL	LEAN CLAY, brown, and gray with iron-staining, moist, medium. (Alluvium)	5 TW*		22	3/4	
1810.1	13.0	ML	SILT, with Silty Sand seams, gray, wet, loose. (Alluvium)	4	▽			
1800.1	23.0	CL	SANDY LEAN CLAY, trace Gravel, gray, moist, medium to stiff. (Glacial Till) -Silty Sand seams at 15 feet.	6 15		22		P200=62%
1794.1	29.0	SP-SM	POORLY GRADED SAND with SILT, fine-grained, gray, wet, loose. (Glacial Outwash)	9				
1792.1	31.0	CL	SANDY LEAN CLAY, trace Gravel, gray, moist, very stiff. (Glacial Till)	17			1 1/4	
			END OF BORING.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-13 (cont.)**

LOCATION: See sketch.

DRILLER: K. Miller | METHOD: 3 1/4" HSA, Autohammer | DATE: **7/31/18** | SCALE: **1" = 4'**

Elev. feet 1791.1	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			Water observed at a depth of 9 feet while drilling. Water level not determined at termination due to the use of mud rotary drilling fluids. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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Geotechnical Evaluation
Astoria Station
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Astoria, South Dakota

BORING: **B-14**

LOCATION: See sketch.

DRILLER: G. Bevre	METHOD: 3 1/4" HSA, Autohammer	DATE: **7/30/18**	SCALE: **1" = 4'**

Elev. feet 1821.0	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1819.5	1.5	CL	LEAN CLAY, trace Sand, roots and organics, black, moist. (Topsoil)	4				Bulk sample collected from 1 to 5 feet deep (pH=8.2, WSS=9mg/Kg, Chloride=<5mg/Kg) P200=84%
1817.0	4.0	CL	LEAN CLAY, brown and gray, moist, soft. (Alluvium)	4		26	1/4	
1814.5	6.5	CL	SANDY LEAN CLAY, trace Gravel, with Silty Sand seams, brown and gray with iron-staining, moist, soft. (Glacial Till)	3			1/4	
1807.0	14.0	SM	SILTY SAND, fine-grained, brown, moist, loose to medium dense. (Glacial Outwash)	9		24		
					▽			
			-gray and wet below 10 feet.	13				
				12				
1798.0	23.0	ML	SILT, trace Sand and Gravel, gray, wet, medium dense. (Glacial Outwash)	11				
				16		20		
1790.0	31.0	CL	SANDY LEAN CLAY, trace Gravel, wet, medium to stiff. (Glacial Till)		▼			
			-layer of SILTY SAND at 25 feet.	13				
				8			1 1/4	
			END OF BORING.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF BORING

Braun Project B1806731 **Geotechnical Evaluation** **Astoria Station** **19333 482nd Avenue** **Astoria, South Dakota**	BORING: **B-14 (cont.)** LOCATION: See sketch.

DRILLER: G. Bevre	METHOD: 3 1/4" HSA, Autohammer	DATE: **7/30/18**	SCALE: **1" = 4'**

Elev. feet 1789.0	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			Water observed at a depth of 9 feet while drilling. Water observed at a depth of 24 feet immediately after withdrawal of auger. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-15**
LOCATION: See sketch.

DRILLER: G. Bevre
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/30/18**
SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 1839.8	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1839.0	0.8	CL	LEAN CLAY, trace Sand and roots, black, moist. (Topsoil)	4				
1833.3	6.5	CL	SANDY LEAN CLAY, a little Gravel, brown, moist, medium. (Alluvium)	8		14	1 1/4	
			-with Silt seams at 5 feet.	7			1 1/4	
1830.8	9.0	SP	POORLY GRADED SAND, fine-grained, brown, moist, loose. (Alluvium)	6				
1828.3	11.5	CL	LEAN CLAY, with Silt seams, brown, moist, medium. (Alluvium)	7			3/4	
1821.8	18.0	SP	POORLY GRADED SAND, fine- to coarse-grained, moist to wet, loose. (Glacial Outwash)	8				
				10				
					▼			
1816.8	23.0	SM	SILTY SAND, fine-grained, brown, wet, medium dense. (Glacial Outwash)		▽			
				12				
1811.8	28.0	ML	SILT with SAND, brown, wet, loose. (Glacial Outwash)	6				
1808.8	31.0	SP-SM	POORLY GRADED SAND with SILT, fine- to coarse-grained, wet, loose. (Glacial Outwash)	10				
			END OF BORING.					

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-15 (cont.)**

LOCATION: See sketch.

DRILLER: G. Bevre

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/30/18**

SCALE: **1" = 4'**

Elev. feet 1807.8	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			Water observed at a depth of 19 feet while drilling. Water observed at a depth of 17 feet with a cave-in depth of 22 feet immediately after withdrawal of auger. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-16**

LOCATION: See sketch.

DRILLER: K. Miller
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/24/18**
SCALE: **1" = 4'**

Elev. feet 1825.1	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	Tests or Notes
1825.0	0.1	FILL	FILL: Poorly Graded Sand with Silt, a little Gravel, fine- to medium-grained, brown, moist.	10		14	OC=2%; LL=27, PL=15, PI=12
1820.1	5.0	FILL	FILL: Clayey Sand, fine- to medium-grained, trace Gravel, brown, moist.	7			
1819.6	5.5	CL	LEAN CLAY, brown, moist, soft. (Alluvium)	3		12	
1818.6	6.5	SM	SILTY SAND, fine- to medium-grained, brown, moist, very loose. (Alluvium)				
1814.6	10.5	ML	SILT, trace Sand, brown, moist, loose. (Alluvium)	6 8		37	
1814.1	11.0	CL	LEAN CLAY, brown, wet, medium. (Alluvium)				

END OF BORING.

Water not observed with 10 1/2 feet of hollow stem auger in the ground.

Boring then backfilled with bentonite grout.

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-17**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/24/18**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 1817.0	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1816.3	0.7	FILL	FILL: Poorly Graded Sand with Silt, fine- to coarse-grained, trace Gravel, brown, moist.					
1814.5	2.5	FILL	FILL: Lean Clay, trace Sand, a little organics, black, moist.	9		27		OC=9%
1813.0	4.0	CL	LEAN CLAY, trace Sand, gray, moist, soft. (Alluvium)	4*		25		*6 inch recovery. LL=41, PL=14, PI=27
1806.0	11.0	CL	SANDY LEAN CLAY, trace Gravel, brown and gray with iron-staining, moist, soft to medium. (Glacial Till)	2 5 6			1/4 1 1/4 1 1/4	

END OF BORING.

Water not observed with 9 1/2 feet of hollow stem auger in the ground.

Boring then backfilled with bentonite grout.

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BRAUN℠ INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-18**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/24/18**

SCALE: **1" = 4'**

Elev. feet 1814.4	Depth feet 0.0	Symbol		Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1813.6	0.8	FILL	▩	FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel, brown, moist.	8		8 18		P200=24% OC=5%
1808.9	5.5	FILL	▩	FILL: Lean Clay with Sand, trace Gravel, a little organics, dark brown to black, moist.	2		30		LL=50, PL=25, PI=25
					2			1/2	
1803.4	11.0	CL	▨	SANDY LEAN CLAY, trace Gravel, brown and gray with iron-staining, moist, medium. (Glacial Till)	5		17	3/4	
					5			1 1/4	
				END OF BORING. Water not observed with 9 1/2 feet of hollow stem auger in the ground. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-19**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/24/18**

SCALE: **1" = 4'**

Elev. feet 1819.2	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1818.7	0.5	FILL	FILL: Poorly Graded Sand with Silt, fine- to medium-grained, trace Gravel, brown, moist.	13				
1817.2	2.0	FILL	FILL: Sandy Lean Clay, dark brown, moist.					
		OL	ORGANIC SILT, trace Sand, shells and fibers, dark brown, moist to wet, soft to medium. (Swamp Deposit)	5		51	3/4	OC=11%; LL=56, PL=34, PI=22
			-lenses of fine-grained Sand at 5 feet.	3			<1/4	pH=8.0, WSS=51mg/Kg, Chloride=<5mg/Kg
					▽			
			-gray below 7 1/2 feet.	2			<1/4	
1808.7	10.5			2			<1/4	
		CL	SANDY LEAN CLAY, brown and gray, wet, soft. (Glacial Till)					
1805.7	13.5			3			1/2	
			END OF BORING. Water observed at a depth of 7 feet while drilling. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-20**
LOCATION: See sketch.

DRILLER: G. Bevre
METHOD: 3 1/4" HSA, Autohammer
DATE: **7/24/18**
SCALE: **1" = 4'**

Elev. feet 1827.8	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
1826.8	1.0	CL	LEAN CLAY, trace Sand, organics and Gravel, brown, moist. (Topsoil)	14				
1823.8	4.0	SM	SILTY SAND, fine-grained, brown, moist, loose. (Alluvium)	6				
		SP-SM	POORLY GRADED SAND with SILT, fine-grained, brown, moist, loose to medium dense. (Glacial Outwash) -SANDY SILT layer at 5 feet.	6		10		
				7				
			-wet below 9 1/2 feet.	7	∇			
			-fine- to medium-grained below 13 feet.	4				
			-gray below 15 feet.	11		21		
				6				Mud rotary methods used below 21 feet.
1799.8	28.0		-lenses of Lean Clay with Gravel at 25 feet.	7				
		CL	SANDY LEAN CLAY, trace Gravel, gray, moist, medium to stiff. (Glacial Till)	12			1 3/4	

(See Descriptive Terminology sheet for explanation of abbreviations)

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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-20 (cont.)**

LOCATION: See sketch.

DRILLER: G. Bevre

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/24/18**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 1795.8	Depth feet 32.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			SANDY LEAN CLAY, trace Gravel, gray, moist, medium to stiff. (Glacial Till) *(continued)*					
				5		17	1/2	
				9		17	1 1/4	P200=56%; LL=28, PL=13, PI=15
1784.8	43.0	SP-SM	POORLY GRADED SAND with SILT and GRAVEL, fine- to coarse-grained, wet, medium dense.	*				*Attempted thinwall at 44 feet but was unable to push it.
				15				
1779.8	48.0	CL	SANDY LEAN CLAY, trace Gravel, gray, moist, stiff. (Glacial Till)					
				10			1 1/4	
			-drillers noted 'grinding' an apparent rock at 53 feet.					
			-Sand seams at 55 feet.	13			1 1/2	
				11			1 1/4	
1766.8	61.0		END OF BORING. Water observed at a depth of 9 1/2 feet with 9 1/2 feet of hollow-stem auger in the ground.					

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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **B-20 (cont.)**

LOCATION: See sketch.

DRILLER: G. Bevre

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/24/18**

SCALE: **1" = 4'**

Elev. feet 1763.8	Depth feet 64.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	MC %	qp tsf	Tests or Notes
			Water level not determined at termination due to the use of mud rotary drilling fluids. Boring then backfilled with bentonite grout.					

(See Descriptive Terminology sheet for explanation of abbreviations)

BRAUN INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **T-01**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/27/18**

SCALE: **1" = 4'**

Elev. feet 1822.9	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
1821.9	1.0	CL ▨	LEAN CLAY, trace Sand and roots, black, moist. (Topsoil)	FA		
1816.9	6.0	CL ▨	SANDY LEAN CLAY, brown, moist. (Alluvium)	TW* TW*		*18 inch recovery. *18 inch recovery, tip of tube was Silty Sand.
			END OF BORING. Water not observed with 4 feet of hollow stem auger in the ground. Boring then backfilled with bentonite grout.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN℠ INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **T-02**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/27/18**

SCALE: **1" = 4'**

Elev. feet 1822.2	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
1820.2	2.0	CL ▨	LEAN CLAY, trace Sand and roots, black, moist. (Topsoil)	FA		
1816.2	6.0	CL ▨	SANDY LEAN CLAY, with layers of fine-grained sand, brown, moist. (Alluvium)	TW* TW*	▽	*14 inch recovery. *14 inch recovery.

END OF BORING.

Water observed at a depth of 5 feet while drilling.

Boring then backfilled with bentonite grout.

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **T-03**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/27/18**

SCALE: **1" = 4'**

Elev. feet 1824.6	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
1823.6	1.0	CL	LEAN CLAY, trace Sand and roots, black, moist. (Topsoil)	FA		
1820.6	4.0	CL	SANDY LEAN CLAY, brown, moist. (Alluvium)	TW*		*24 inch recovery.
1818.6	6.0	SM	SILTY SAND, fine- to medium-grained, brown, moist. (Alluvium)	TW*		*16 inch recovery.
			END OF BORING. Water not observed with 4 feet of hollow stem auger in the ground. Boring then backfilled with bentonite grout.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **T-04**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/27/18**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 1823.5	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
1822.5	1.0	CL ▨	LEAN CLAY, trace Sand and roots, black, moist. (Topsoil)	FA		
1817.5	6.0	CL ▨	SANDY LEAN CLAY, with lenses and seams of Silty Sand, brown, moist. (Alluvium)	TW* TW*		*24 inch recovery. *24 inch recovery.
			END OF BORING. Water not observed with 4 feet of hollow stem auger in the ground. Boring then backfilled with bentonite grout.			

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LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **T-05**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/27/18**

SCALE: **1" = 4'**

Elev. feet 1821.9	Depth feet 0.0	Symbol		Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
1820.4	1.5	CL	▨	LEAN CLAY, trace Sand and roots, black, moist. (Topsoil)	FA		
		CL	▨	SANDY LEAN CLAY, brown, moist. (Alluvium)	TW*		*16 inch recovery.
1815.9	6.0				TW*		*13 inch recovery.
				END OF BORING. Water not observed with 4 feet of hollow stem auger in the ground. Boring then backfilled with bentonite grout.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN℠
INTERTEC

LOG OF BORING

Braun Project B1806731 **Geotechnical Evaluation** **Astoria Station** **19333 482nd Avenue** **Astoria, South Dakota**	BORING: **T-06** LOCATION: See sketch.

DRILLER: K. Miller	METHOD: 3 1/4" HSA, Autohammer	DATE: **7/27/18**	SCALE: **1" = 4'**

Elev. feet 1827.6	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
1826.6	1.0	CL	LEAN CLAY, trace Sand and roots, black, moist. (Topsoil)	FA		
		SM	SILTY SAND, fine- to medium-grained, brown, moist. (Alluvium)	TW*		*23 inch recovery.
				TW*		*24 inch recovery.
1821.6	6.0		END OF BORING. Water not observed with 4 feet of hollow stem auger in the ground. Boring then backfilled with bentonite grout.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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INTERTEC

LOG OF BORING

Braun Project B1806731 **Geotechnical Evaluation** **Astoria Station** **19333 482nd Avenue** **Astoria, South Dakota**	BORING: **T-07** LOCATION: See sketch.

DRILLER: K. Miller	METHOD: 3 1/4" HSA, Autohammer	DATE: **7/27/18**	SCALE: **1" = 4'**

Elev. feet 1825.3	Depth feet 0.0	Symbol		Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
1823.3	2.0	CL	▨	LEAN CLAY, trace Sand and roots, black, moist. (Topsoil)	FA		
1819.3	6.0	CL	▨	SANDY LEAN CLAY, brown, moist. (Alluvium)	TW* TW*		*17 inch recovery. *16 inch recovery, tip of tube was Silty Sand.
				END OF BORING. Water not observed with 4 feet of hollow stem auger in the ground. Boring then backfilled with bentonite grout.			

(See Descriptive Terminology sheet for explanation of abbreviations)

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BRAUN INTERTEC

LOG OF BORING

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: **T-08**

LOCATION: See sketch.

DRILLER: K. Miller

METHOD: 3 1/4" HSA, Autohammer

DATE: **7/27/18**

SCALE: **1" = 4'**

(See Descriptive Terminology sheet for explanation of abbreviations)

Elev. feet 1827.4	Depth feet 0.0	Symbol	Description of Materials (Soil-ASTM D2488 or D2487, Rock-USACE EM1110-1-2908)	BPF	WL	Tests or Notes
1826.4	1.0	CL	LEAN CLAY, trace Sand and roots, black, moist. (Topsoil)	FA		
1823.4	4.0	SM	SILTY SAND, fine- to medium-grained, brown, moist. (Alluvium)	TW*		*22 inch recovery.
1821.4	6.0	CL	SANDY LEAN CLAY, brown, moist. (Alluvium)	TW*		*23 inch recovery, tip of tube was Silty Sand.
			END OF BORING. Water not observed with 4 feet of hollow stem auger in the ground. Boring then backfilled with bentonite grout.			

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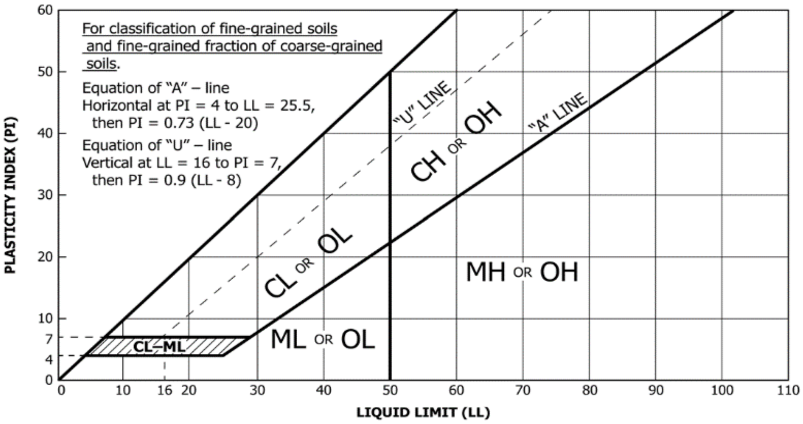
The Science You Build On.

Descriptive Terminology of Soil

Based on Standards ASTM D 2487-11/2488-09a
(Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
Coarse-grained Soils (more than 50% retained on No. 200 sieve)	**Gravels** (More than 50% of coarse fraction retained on No. 4 sieve)	**Clean Gravels** (Less than 5% fines[C])	$C_u \geq 4$ and $1 \leq C_c \leq 3$[D]	GW	Well-graded gravel[E]
			$C_u < 4$ and/or ($C_c < 1$ or $C_c > 3$)[D]	GP	Poorly graded gravel[E]
		Gravels with Fines (More than 12% fines[C])	Fines classify as ML or MH	GM	Silty gravel[E F G]
			Fines Classify as CL or CH	GC	Clayey gravel[E F G]
	Sands (50% or more coarse fraction passes No. 4 sieve)	**Clean Sands** (Less than 5% fines[H])	$C_u \geq 6$ and $1 \leq C_c \leq 3$[D]	SW	Well-graded sand[I]
			$C_u < 6$ and/or ($C_c < 1$ or $C_c > 3$)[D]	SP	Poorly graded sand[I]
		Sands with Fines (More than 12% fines[H])	Fines classify as ML or MH	SM	Silty sand[F G I]
			Fines classify as CL or CH	SC	Clayey sand[F G I]
Fine-grained Soils (50% or more passes the No. 200 sieve)	**Silts and Clays** (Liquid limit less than 50)	Inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K L M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K L M]
		Organic	$\frac{\text{Liquid Limit – oven dried}}{\text{Liquid Limit – not dried}} < 0.75$	OL	Organic clay[K L M N] Organic silt[K L M O]
	Silts and Clays (Liquid limit 50 or more)	Inorganic	PI plots on or above "A" line	CH	Fat clay[K L M]
			PI plots below "A" line	MH	Elastic silt[K L M]
		Organic	$\frac{\text{Liquid Limit – oven dried}}{\text{Liquid Limit – not dried}} < 0.75$	OH	Organic clay[K L M P] Organic silt[K L M Q]
Highly Organic Soils		Primarily organic matter, dark in color, and organic odor		PT	Peat

A. Based on the material passing the 3-inch (75-mm) sieve.
B. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
C. Gravels with 5 to 12% fines require dual symbols:
  GW-GM well-graded gravel with silt
  GW-GC well-graded gravel with clay
  GP-GM poorly graded gravel with silt
  GP-GC poorly graded gravel with clay
D. $C_u = D_{60} / D_{10}$ $\quad C_c = (D_{30})^2 / \ (D_{10}\ x\ D_{60})$
E. If soil contains ≥ 15% sand, add "with sand" to group name.
F. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
G. If fines are organic, add "with organic fines" to group name.
H. Sands with 5 to 12% fines require dual symbols:
  SW-SM well-graded sand with silt
  SW-SC well-graded sand with clay
  SP-SM poorly graded sand with silt
  SP-SC poorly graded sand with clay
I. If soil contains ≥ 15% gravel, add "with gravel" to group name.
J. If Atterberg limits plot in hatched area, soil is CL-ML, silty clay.
K. If soil contains 15 to < 30% plus No. 200, add "with sand" or "with gravel", whichever is predominant.
L. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
M. If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
N. PI ≥ 4 and plots on or above "A" line.
O. PI < 4 or plots below "A" line.
P. PI plots on or above "A" line.
Q. PI plots below "A" line.



Particle Size Identification

Boulders	over 12"
Cobbles	3" to 12"
Gravel	
Coarse	3/4" to 3" (19.00 mm to 75.00 mm)
Fine	No. 4 to 3/4" (4.75 mm to 19.00 mm)
Sand	
Coarse	No. 10 to No. 4 (2.00 mm to 4.75 mm)
Medium	No. 40 to No. 10 (0.425 mm to 2.00 mm)
Fine	No. 200 to No. 40 (0.075 mm to 0.425 mm)
Silt	No. 200 (0.075 mm) to .005 mm
Clay	< .005 mm

Relative Proportions[L, M]

trace	0 to 5%
little	6 to 14%
with	≥ 15%

Inclusion Thicknesses

lens	0 to 1/8"
seam	1/8" to 1"
layer	over 1"

Apparent Relative Density of Cohesionless Soils

Very loose	0 to 4 BPF
Loose	5 to 10 BPF
Medium dense	11 to 30 BPF
Dense	31 to 50 BPF
Very dense	over 50 BPF

Consistency of Cohesive Soils	Blows Per Foot	Approximate Unconfined Compressive Strength
Very soft	0 to 1 BPF	< 1/4 tsf
Soft	2 to 4 BPF	1/4 to 1/2 tsf
Medium	5 to 8 BPF	1/2 to 1 tsf
Stiff	9 to 15 BPF	1 to 2 tsf
Very Stiff	16 to 30 BPF	2 to 4 tsf
Hard	over 30 BPF	> 4 tsf

Moisture Content:

Dry: Absence of moisture, dusty, dry to the touch.
Moist: Damp but no visible water.
Wet: Visible free water, usually soil is below water table.

Drilling Notes:

BPF: Numbers indicate blows per foot recorded in standard penetration test, also known as "N" value. The sampler was set 6 inches into undisturbed soil below the hollow-stem auger. Driving resistances were then counted for second and third 6-inch increments, and added to get BPF.

Partial Penetration: If the sampler cannot be driven the full 12 inches beyond the initial 6-inch set, the number of blows for that partial penetration is shown as "No./X" (i.e., 50/2"). If the sampler cannot be advanced beyond the initial 6-inch set, the depth of penetration will be recorded in the Notes column as "No. to set X" (i.e., 50 to set 4").

WH: WH indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

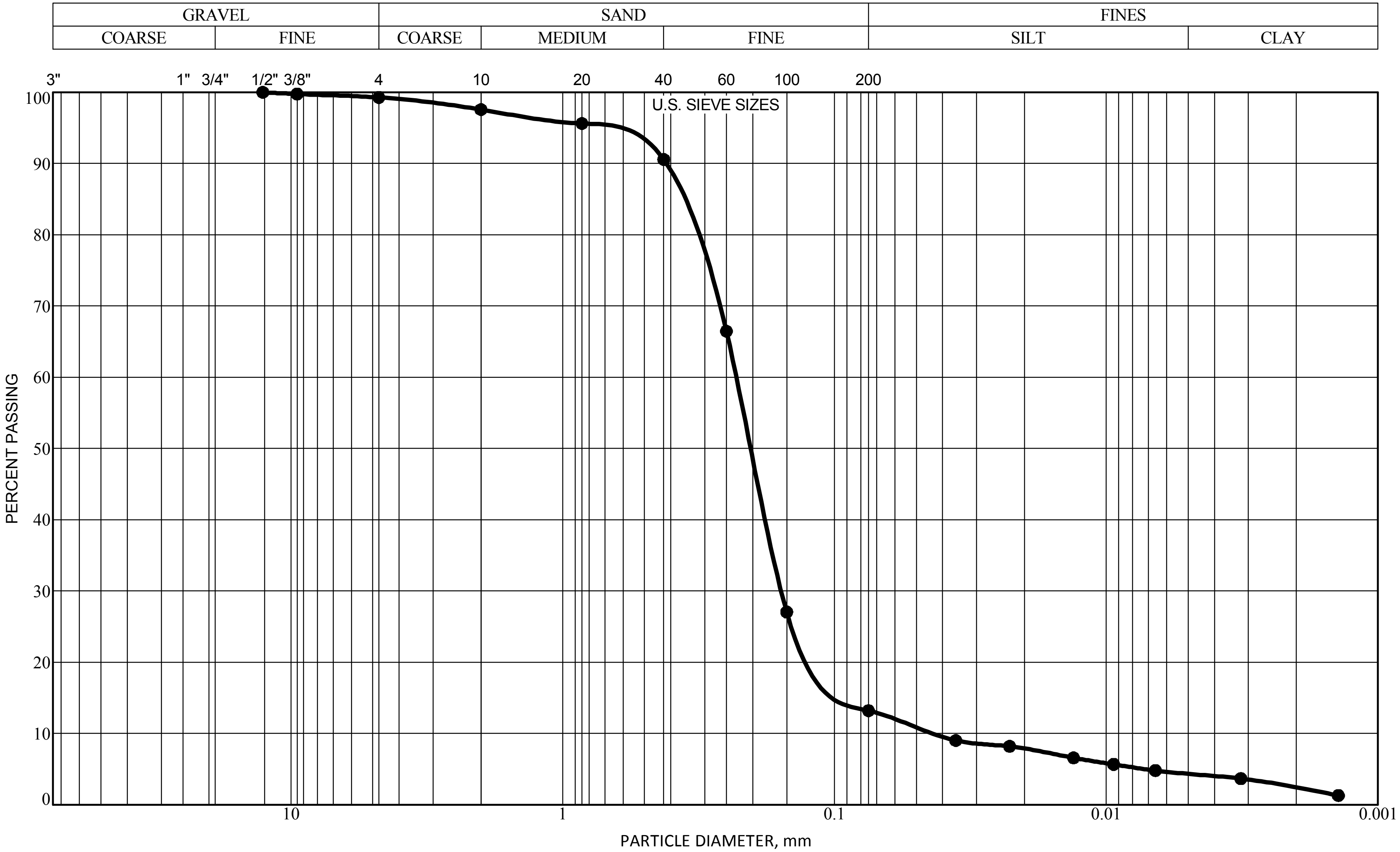
WR: WR indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

WL: WL indicates the water level measured by the drillers either while drilling or following drilling.

Laboratory Tests

DD	Dry Density, pcf	**OC**	Organic content, %	**PL**	Plastic limit
WD	Wet Density, pcf	**q_p**	Pocket penetrometer strength, tsf	**LL**	Liquid limit
P200	% Passing #200 sieve	**MC**	Moisture conent, %	**PI**	Plasticity Index

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

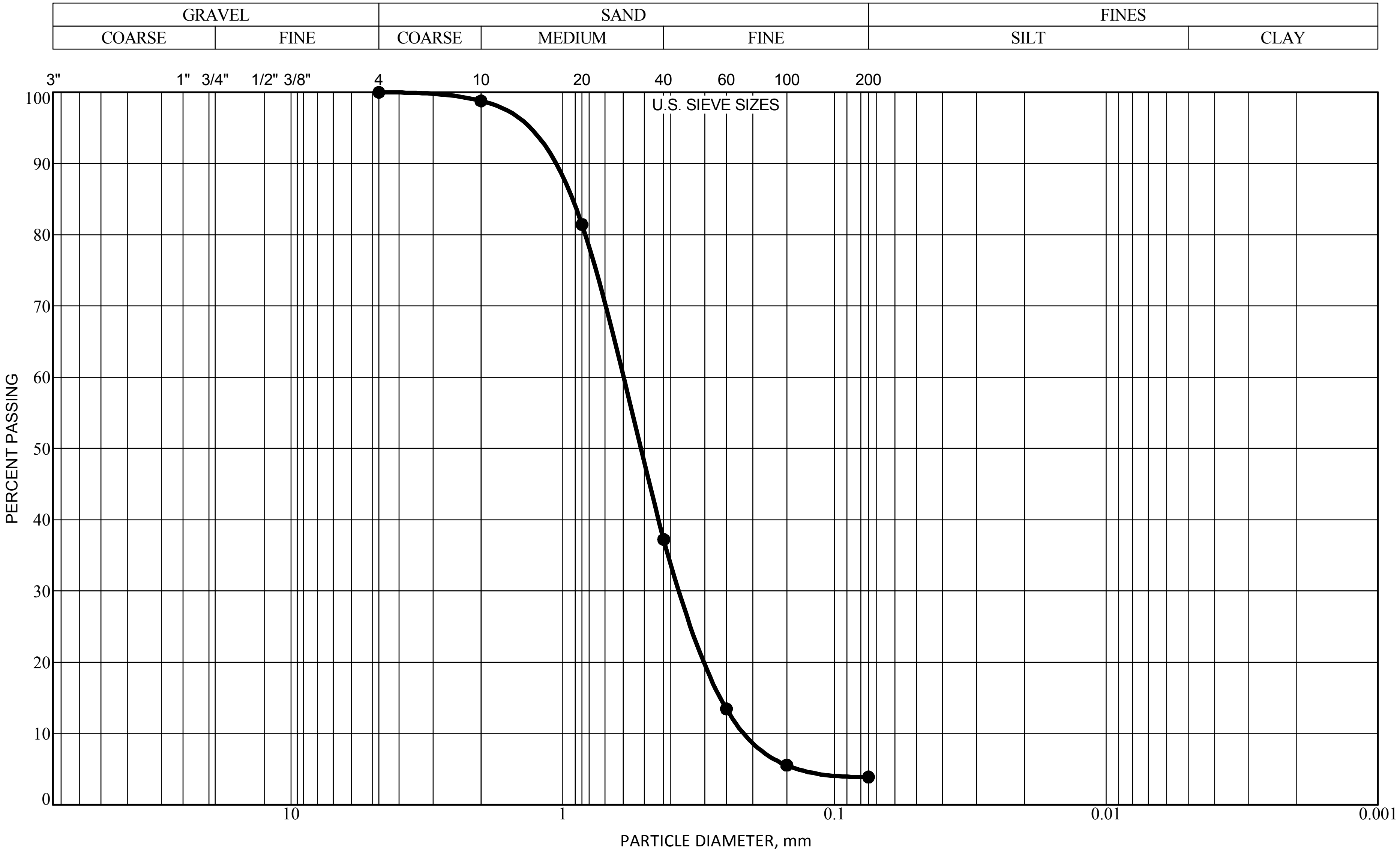
BORING: B-01 DEPTH: 4.0'-6.0'

GRAVEL	0.7%
SAND	86.1%
SILT	8.8%
CLAY	4.4%
D60=0.230 D30=0.156 D10=0.043	Cu=5.4 Cc=2.5

CLASSIFICATION:
SILTY SAND(SM)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-01 DEPTH: 15.0'-16.0'

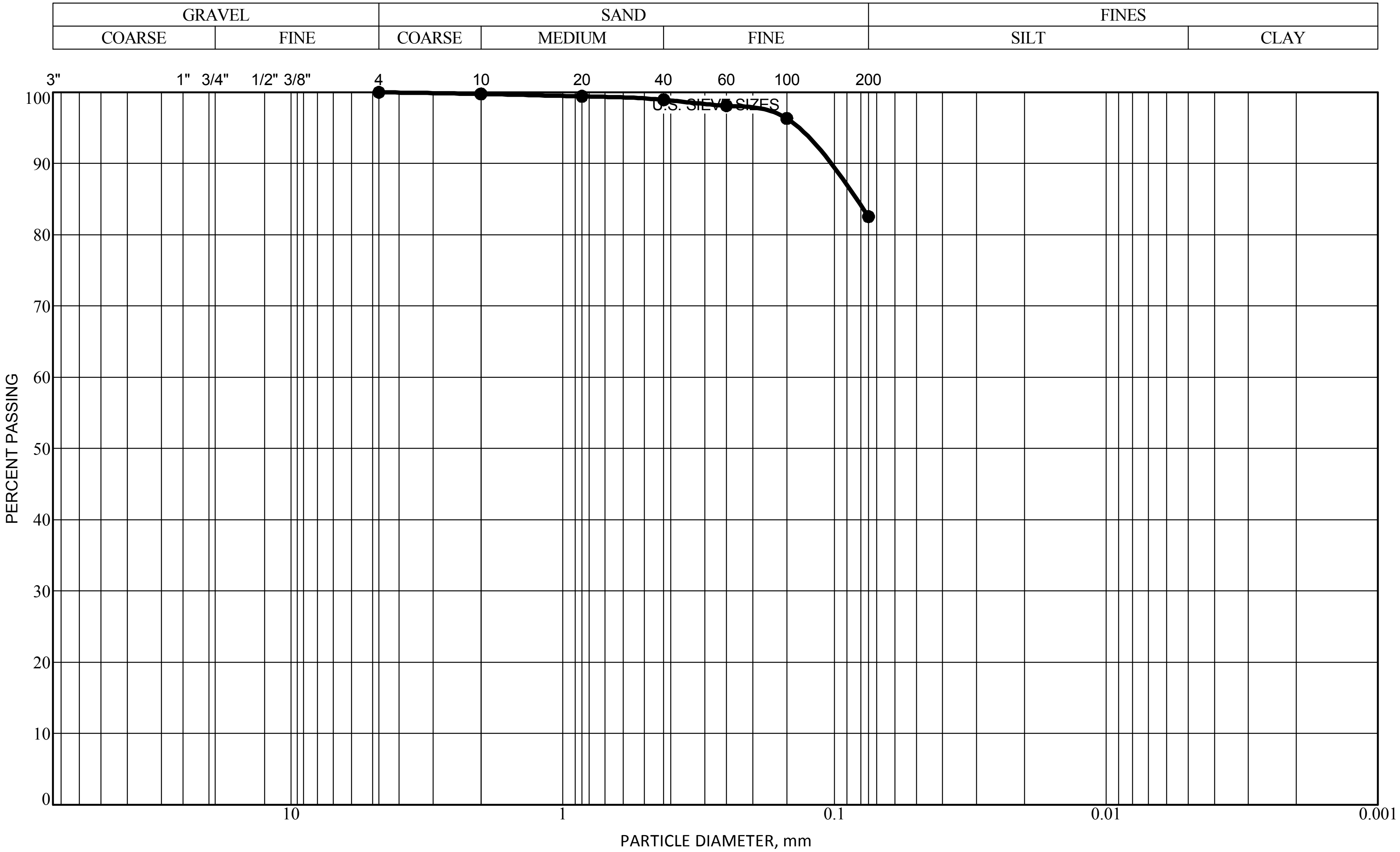
GRAVEL	0.0%
SAND	96.1%
FINES	3.9%

D60=0.607
D30=0.362
D10=0.200

Cu=3.0
Cc=1.1

CLASSIFICATION:
POORLY GRADED SAND(SP)

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project B1806731
Geotechnical Exploration and Testing
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-02 DEPTH: 1.0'-5.0'

GRAVEL	0.0%
SAND	17.5%
FINES	82.5%

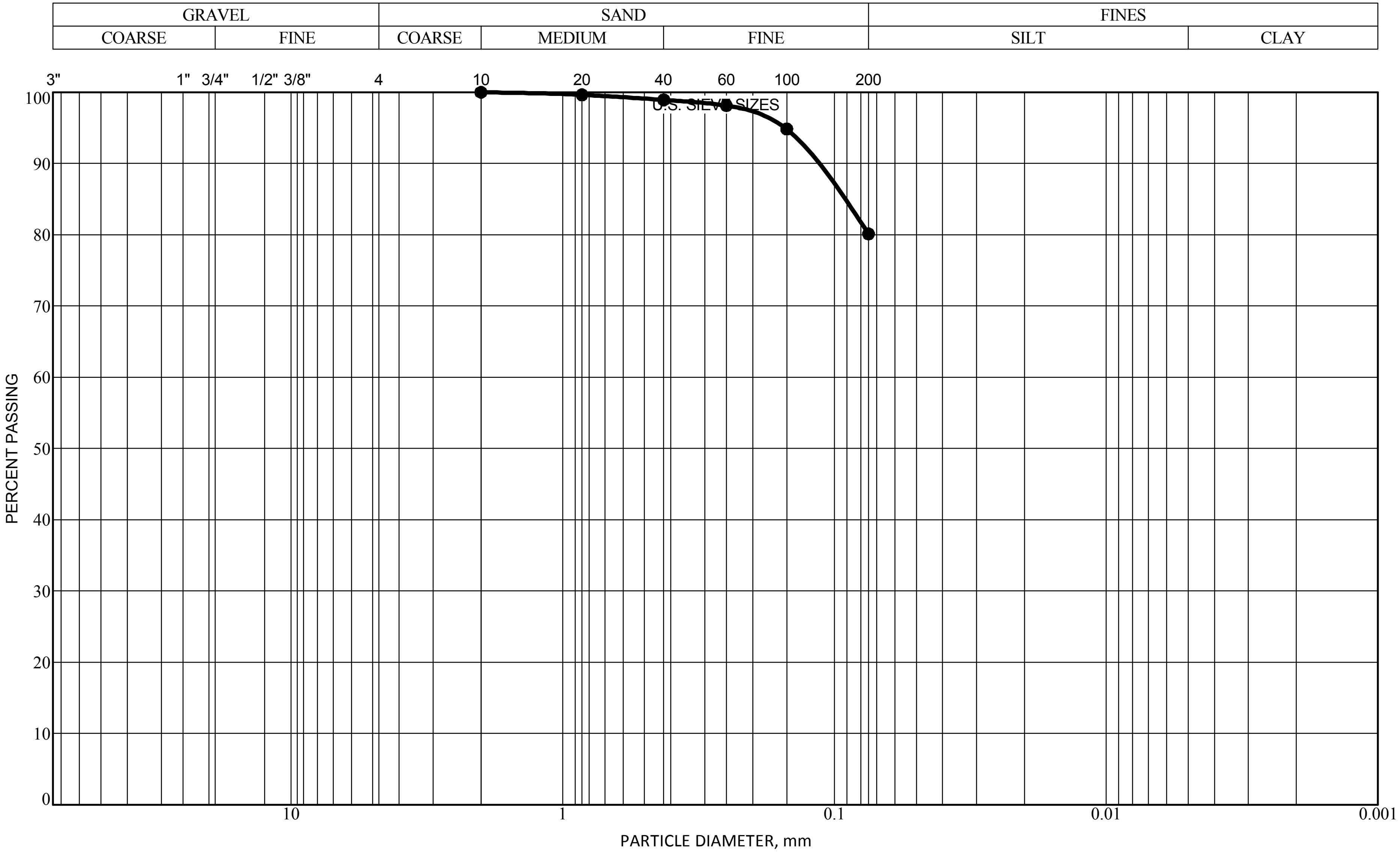
D60=
D30=
D10=

Cu=
Cc=

CLASSIFICATION:
SANDY SILT (ML)

GS ASTM N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\AX PROJECTS GEO LAB\2018\B1806731.GPJ BRAUN_V8_CURRENT.GDT 8/23/18 10:44

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-02 DEPTH: 2.5'-3.5'

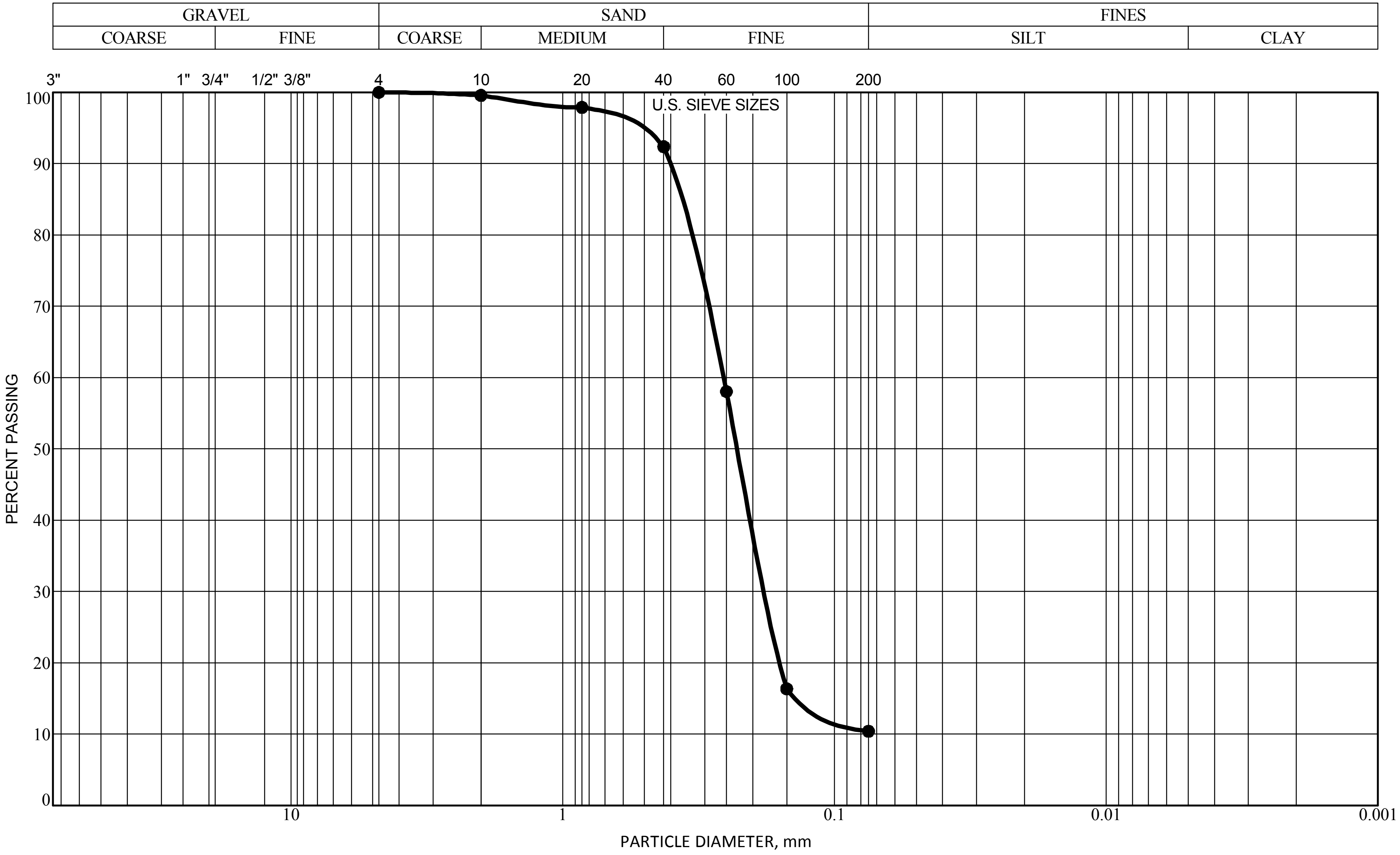
GRAVEL	0.0%
SAND	19.9%
FINES	80.1%

D60=
D30=
D10=

Cu=
Cc=

CLASSIFICATION:
SILT with SAND(ML)

GRAIN SIZE ACCUMULATION CURVE (ASTM)



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Braun Project B1806731

Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: B-02 DEPTH: 10.0'-11.0'

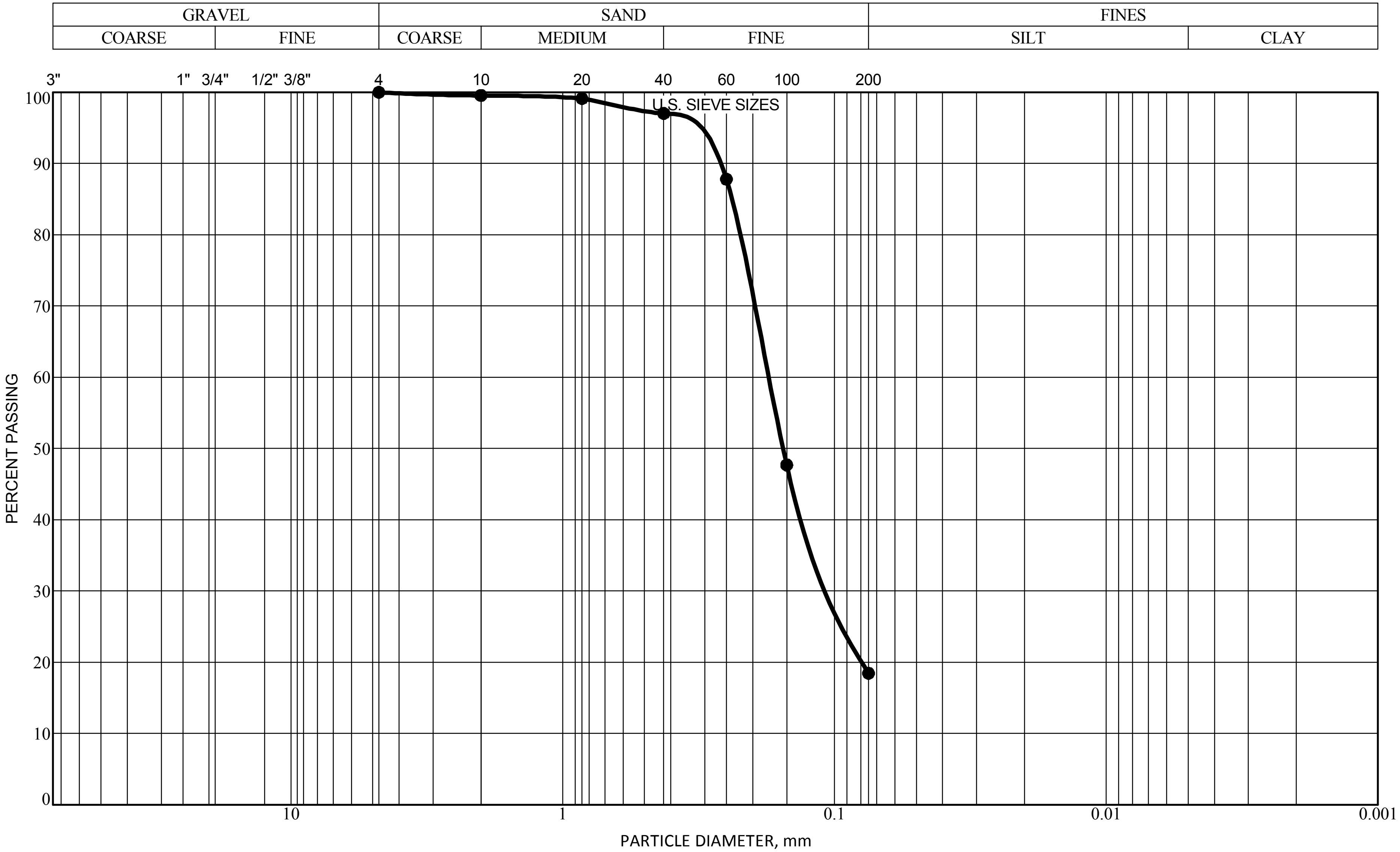
GRAVEL	0.0%
SAND	89.6%
FINES	10.4%

D60=0.258
D30=0.177
D10=

Cu=3.6
Cc=1.7

CLASSIFICATION:
POORLY GRADED SAND with SILT(SP-SM)

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project B1806731

Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: B-03 DEPTH: 2.5'-3.5'

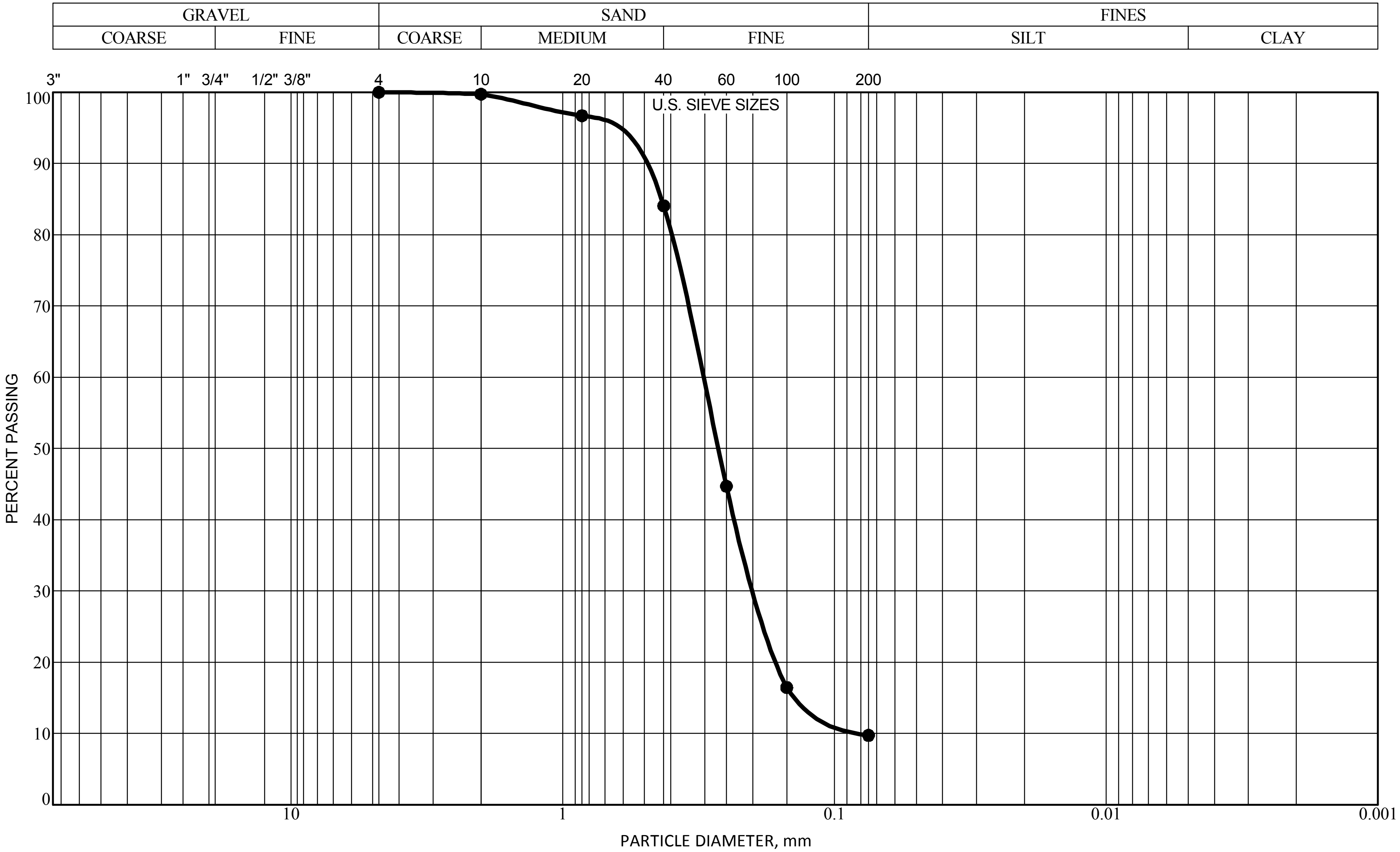
GRAVEL	0.0%
SAND	81.5%
FINES	18.5%

D60=0.175
D30=0.099
D10=

Cu=
Cc=

CLASSIFICATION:
SILTY SAND(SM)

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-04 DEPTH: 5.0'-6.0'

GRAVEL	0.0%
SAND	90.3%
FINES	9.7%

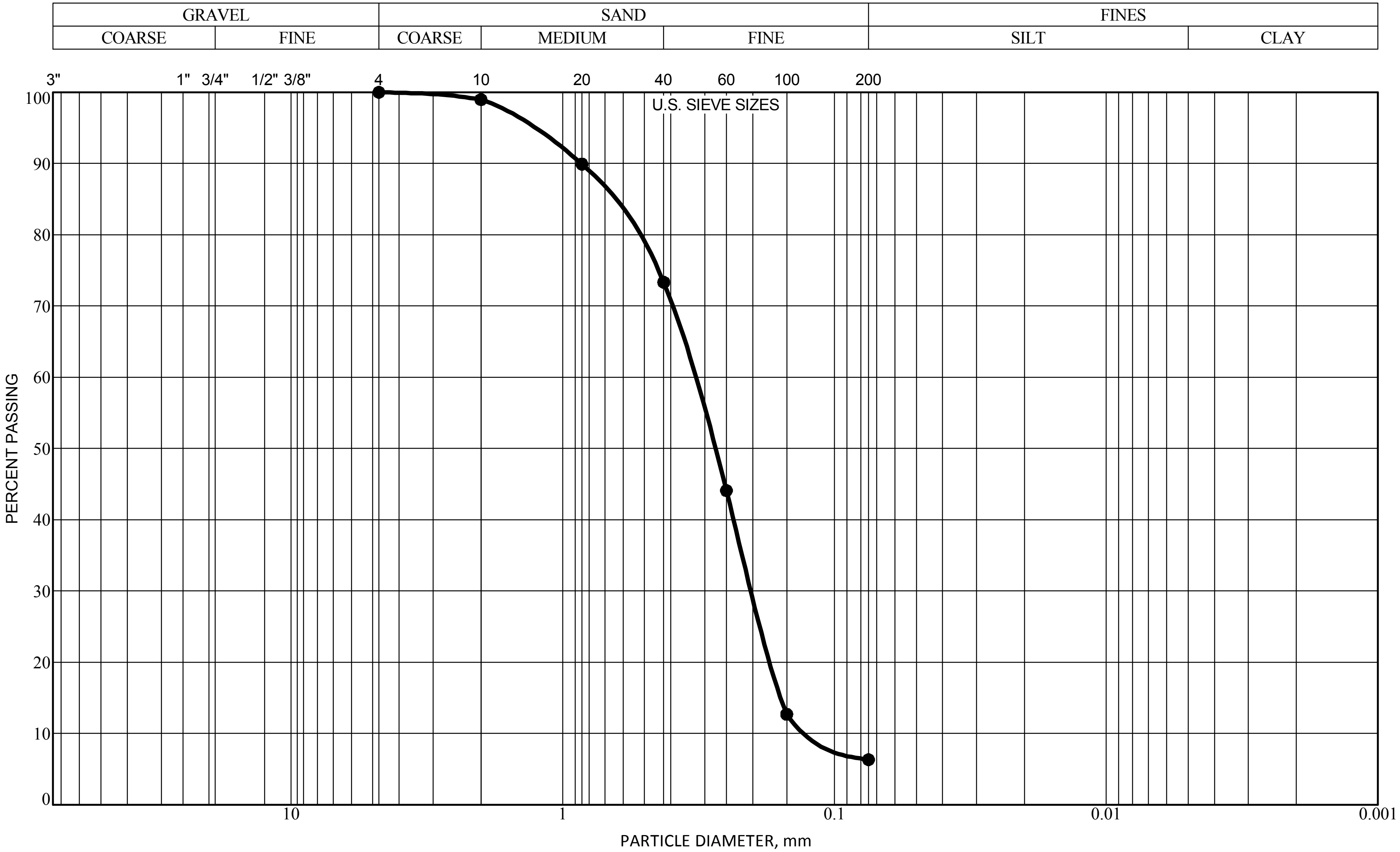
D60=0.307
D30=0.192
D10=0.077

Cu=4.0
Cc=1.6

CLASSIFICATION:
POORLY GRADED SAND with SILT(SP-SM)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



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Braun Project B1806731

Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

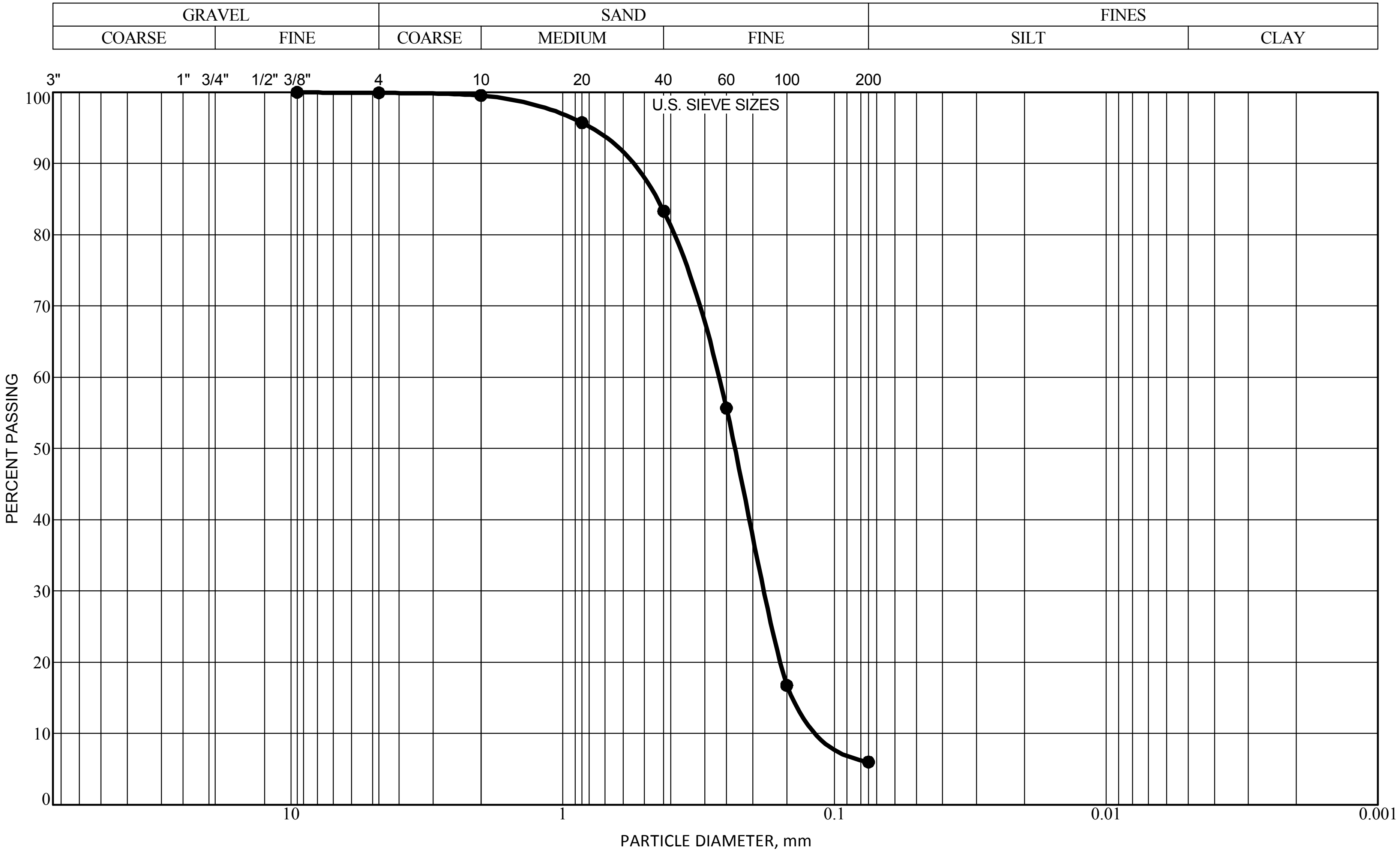
BORING: B-04 DEPTH: 20.0'-21.0'

GRAVEL	0.0%
SAND	93.7%
FINES	6.3%
D60=0.334 D30=0.199 D10=0.112	Cu=3.0 Cc=1.1

CLASSIFICATION:
POORLY GRADED SAND with SILT(SP-SM)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: B-05 DEPTH: 20.0'-21.0'

GRAVEL	0.1%
SAND	93.9%
FINES	6.0%

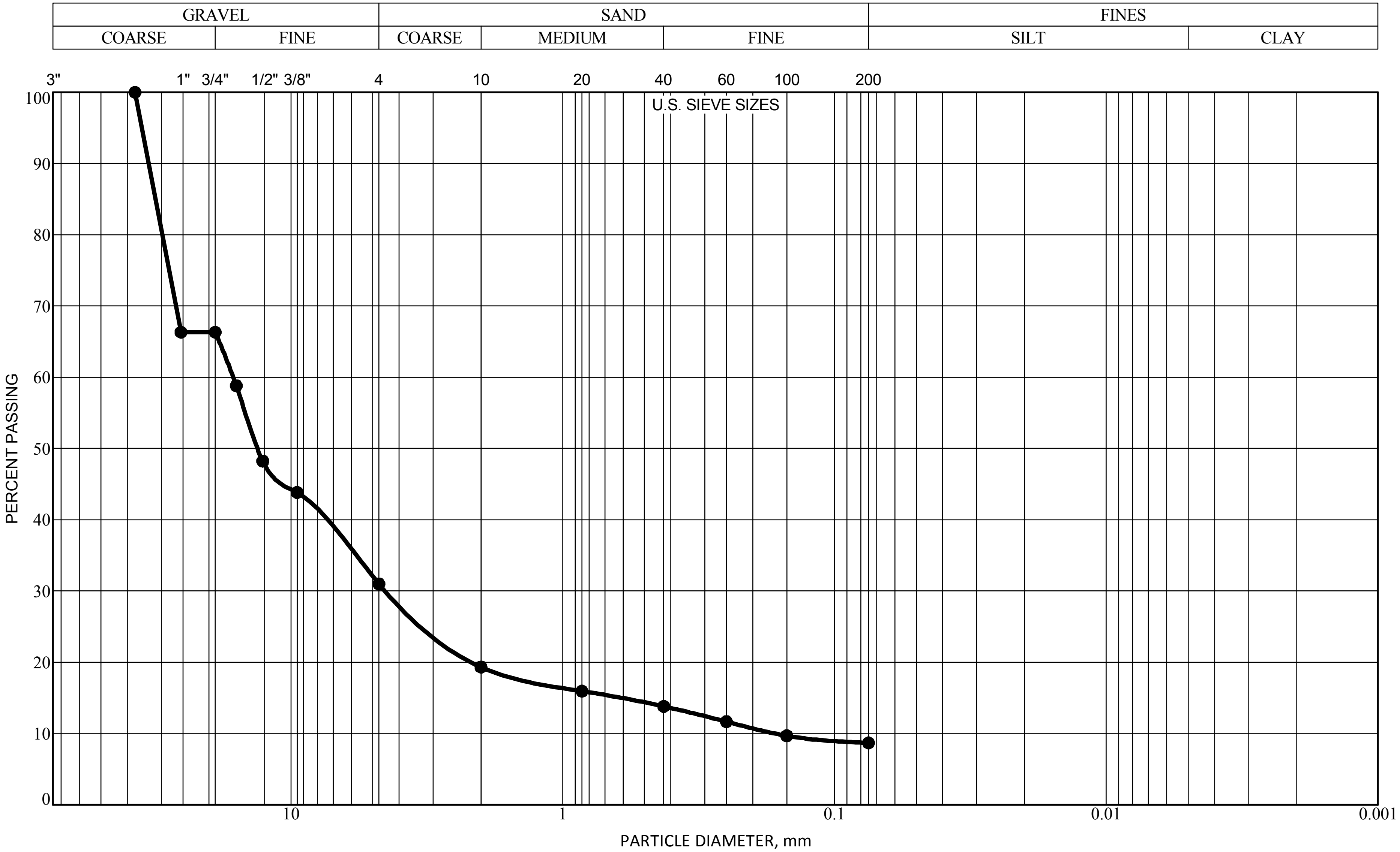
D60=0.272
D30=0.178
D10=0.097

Cu=2.8
Cc=1.2

CLASSIFICATION:
POORLY GRADED SAND with SILT(SP-SM)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project B1806731

Geotechnical Evaluation

Astoria Station

19333 482nd Avenue

Astoria, South Dakota

BORING: B-06 DEPTH: 20.0'-21.0'

GRAVEL	69.0%
SAND	22.3%
FINES	8.7%

D60=16.351
D30=4.409
D10=0.163

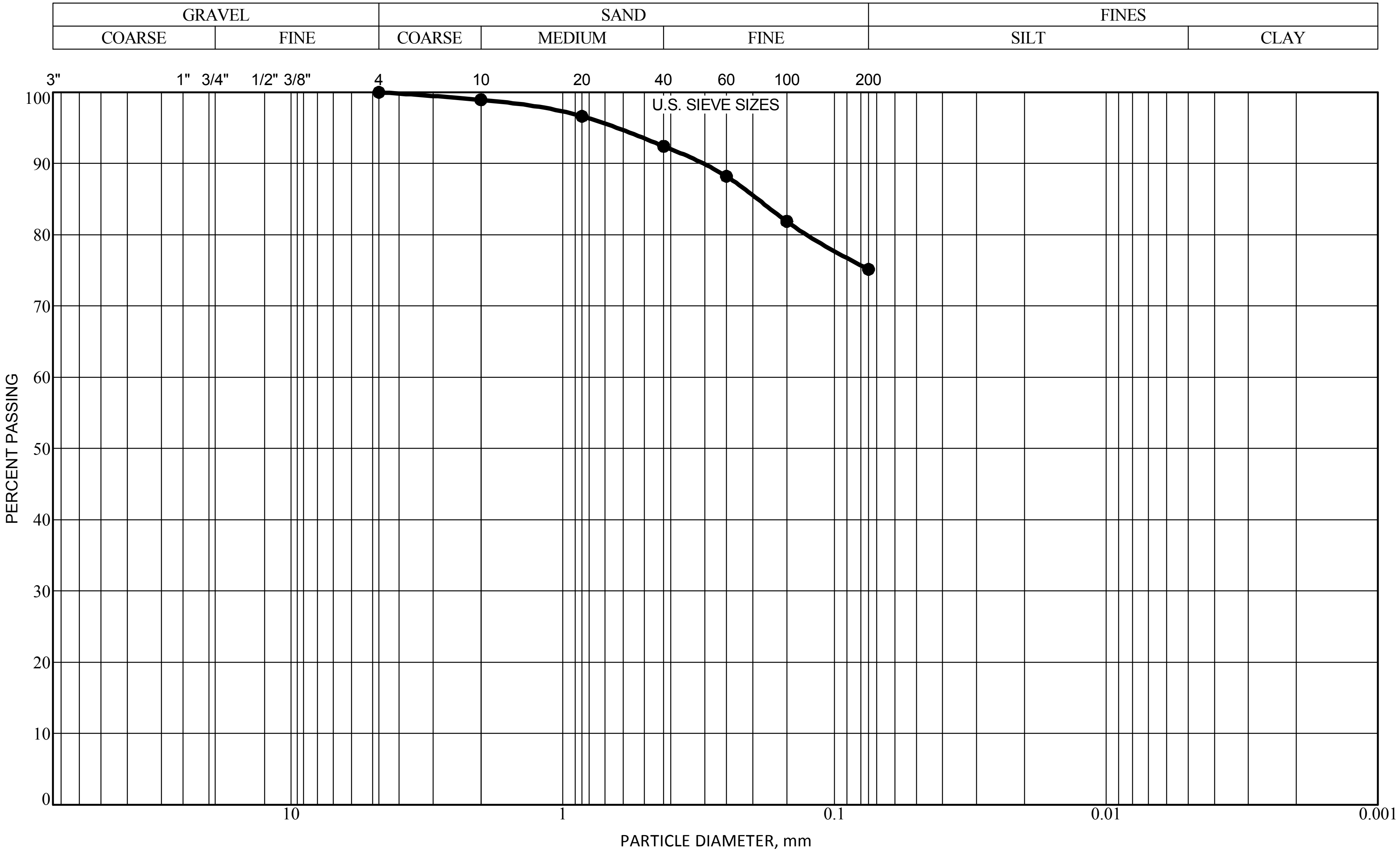
Cu=100.6
Cc=7.3

CLASSIFICATION:

POORLY GRADED GRAVEL with SILT and SAND(GP-GM)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-07 DEPTH: 2.5'-3.5'

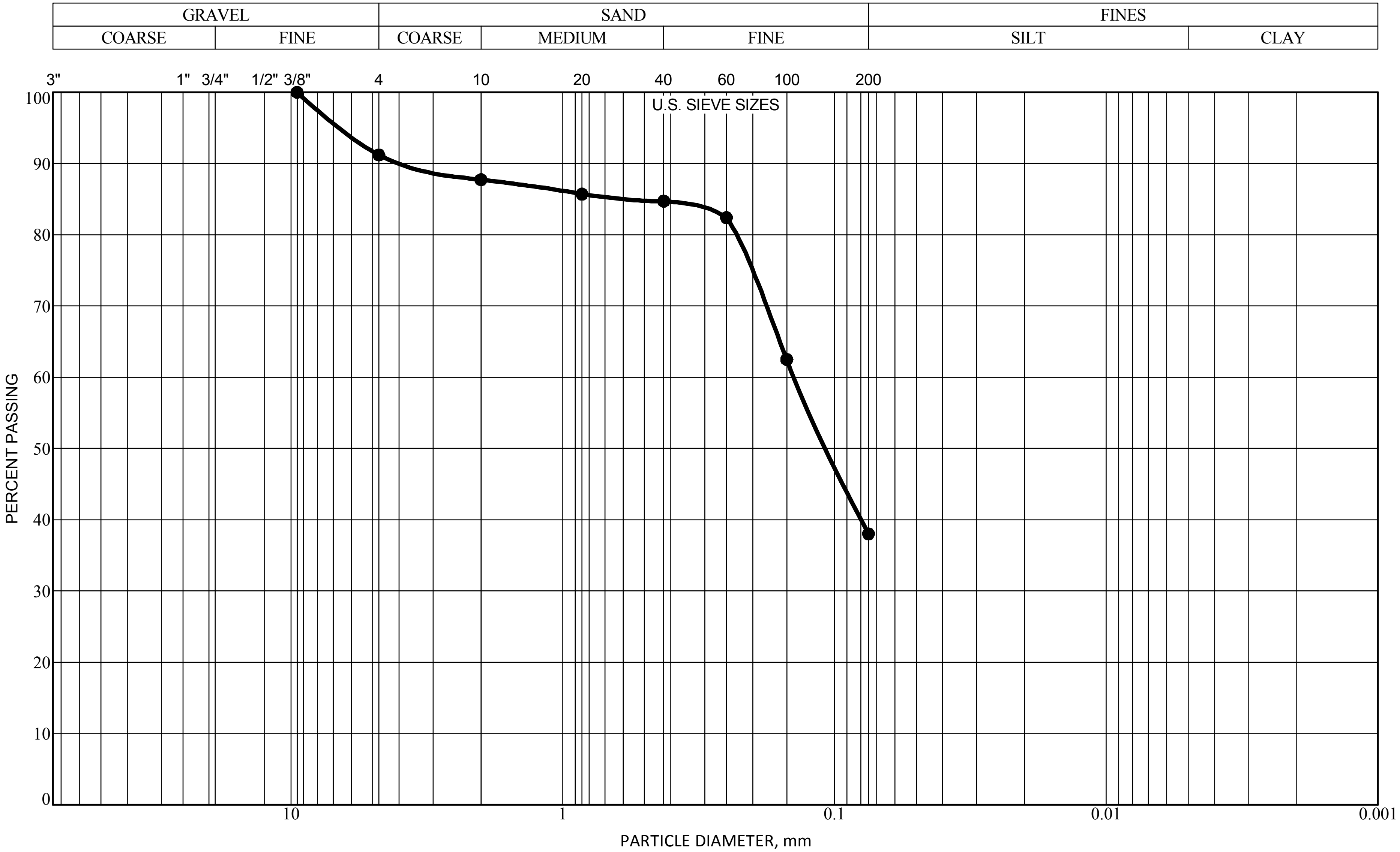
GRAVEL	0.0%
SAND	24.8%
FINES	75.2%

D60=
D30=
D10=

Cu=
Cc=

CLASSIFICATION:
LEAN CLAY with SAND(CL)

GRAIN SIZE ACCUMULATION CURVE (ASTM)



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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-07 DEPTH: 15.0'-16.0'

GRAVEL	8.8%
SAND	53.2%
FINES	38.0%

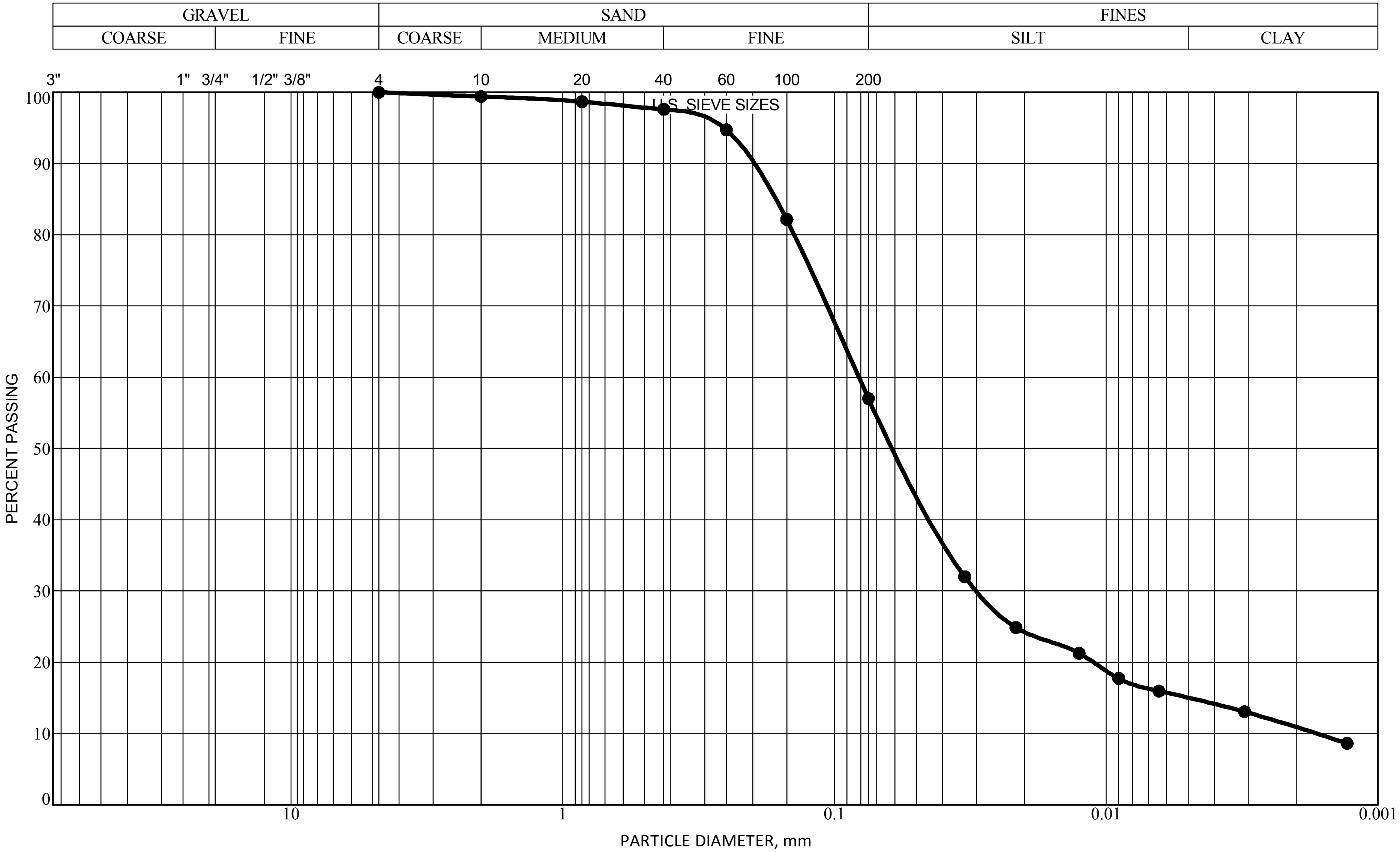
D60=0.140
D30=
D10=

Cu=
Cc=

CLASSIFICATION:
SILTY SAND(SM)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



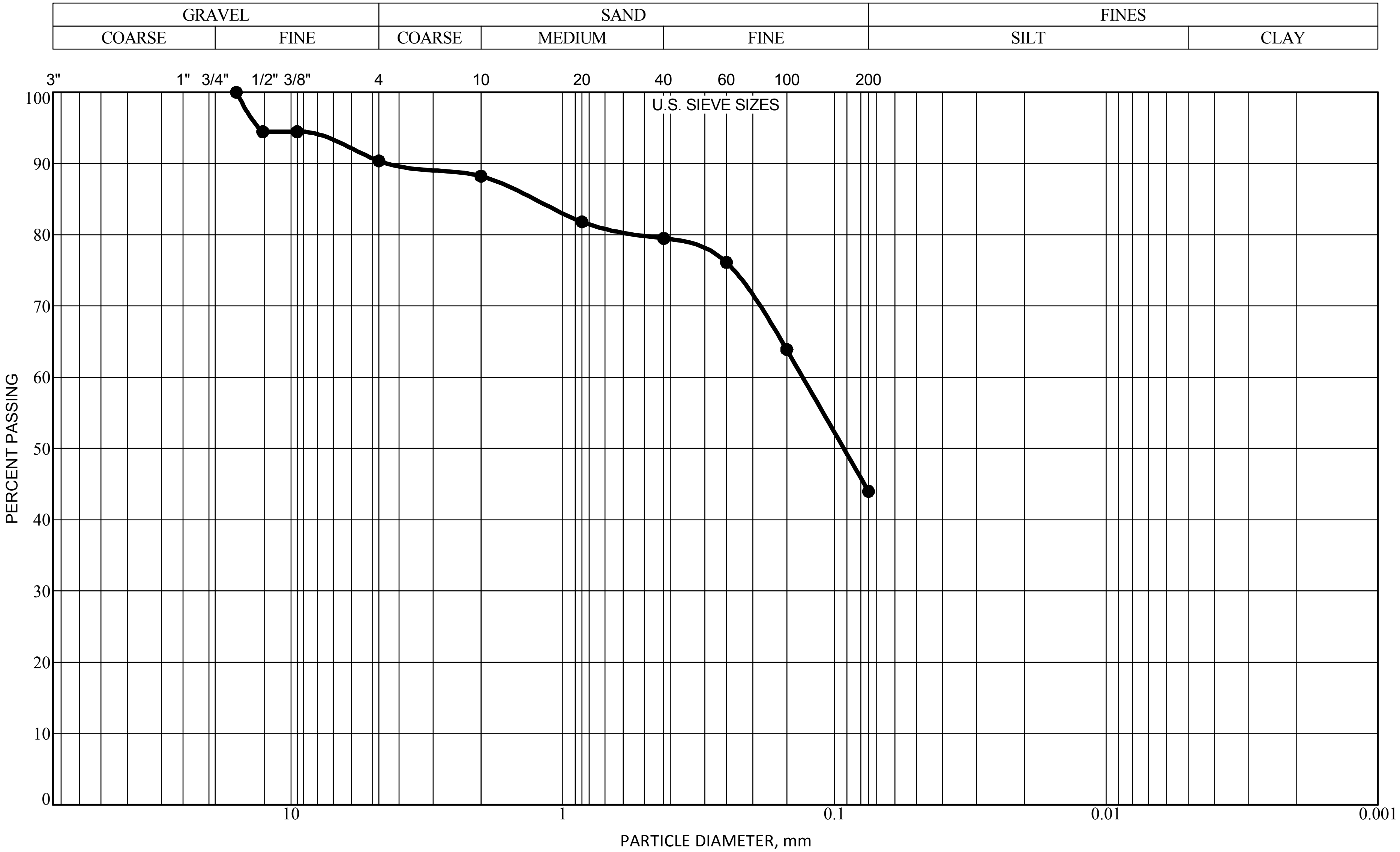
Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-07 DEPTH: 44.0'-46.0'

GRAVEL	0.0%
SAND	43.0%
SILT	42.0%
CLAY	15.0%
D60=0.081 D30=0.029 D10=0.002	Cu=47.9 Cc=6.2

CLASSIFICATION:
SANDY LEAN CLAY(CL)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: B-08 DEPTH: 4.5'-6.5'

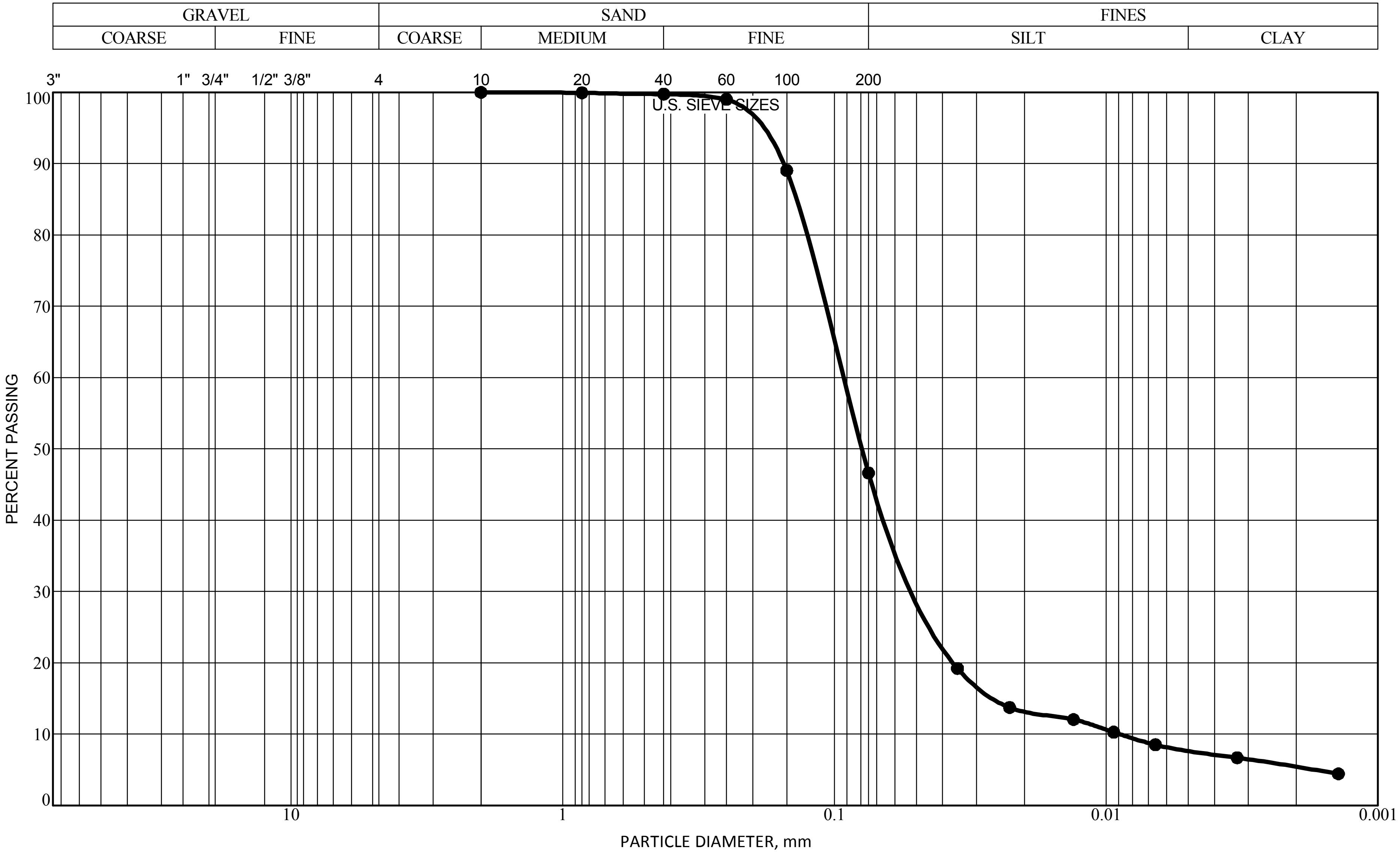
GRAVEL	9.6%
SAND	46.4%
FINES	44.0%

D60=0.131
D30=
D10=

Cu=
Cc=

CLASSIFICATION:
SILTY SAND(SM)

GRAIN SIZE ACCUMULATION CURVE (ASTM)



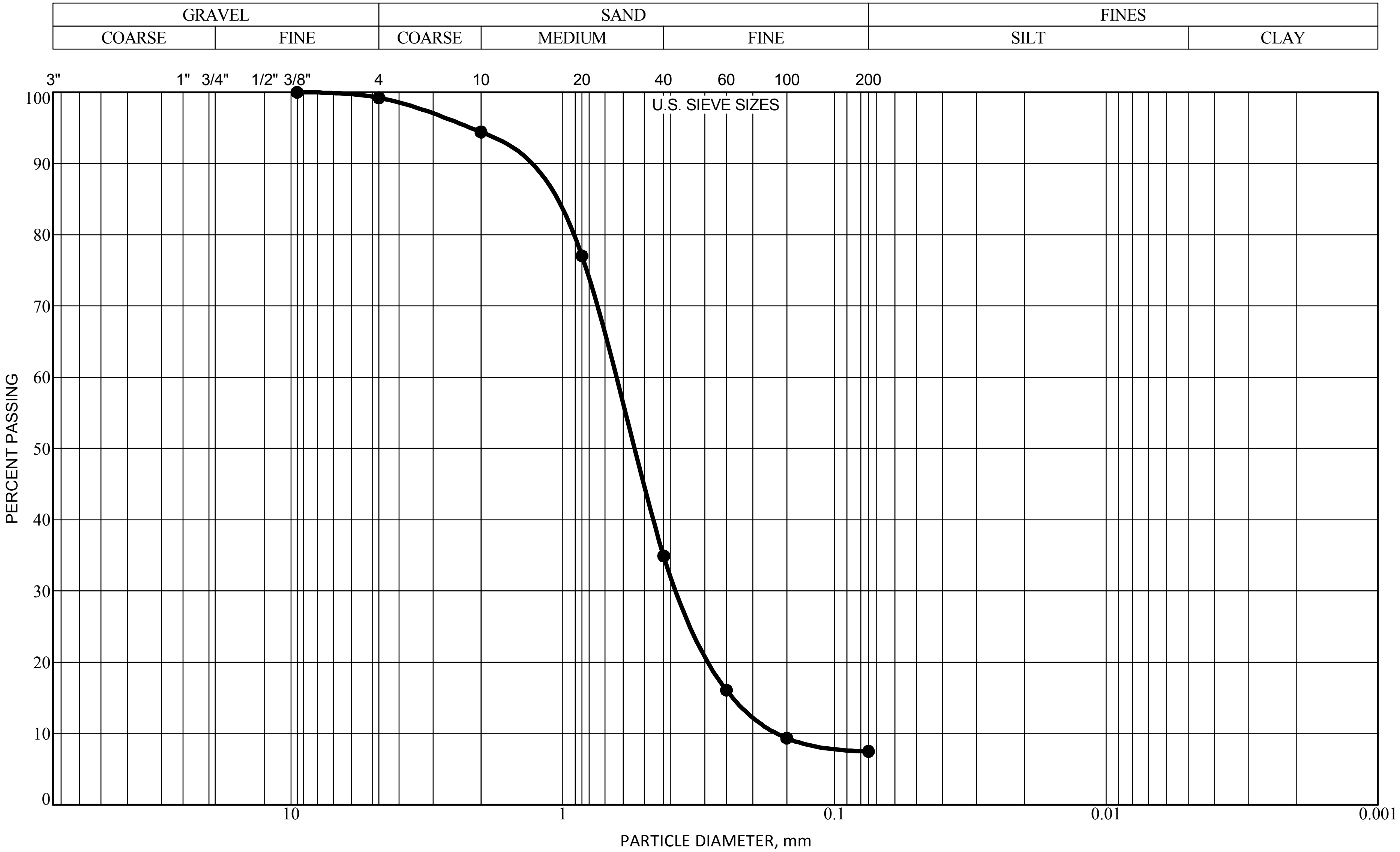
Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-08 DEPTH: 10.0'-11.0'

GRAVEL	0.0%
SAND	53.4%
SILT	38.8%
CLAY	7.8%
D60=0.093 D30=0.047 D10=0.009	Cu=10.5 Cc=2.7

CLASSIFICATION:
SILTY SAND(SM)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



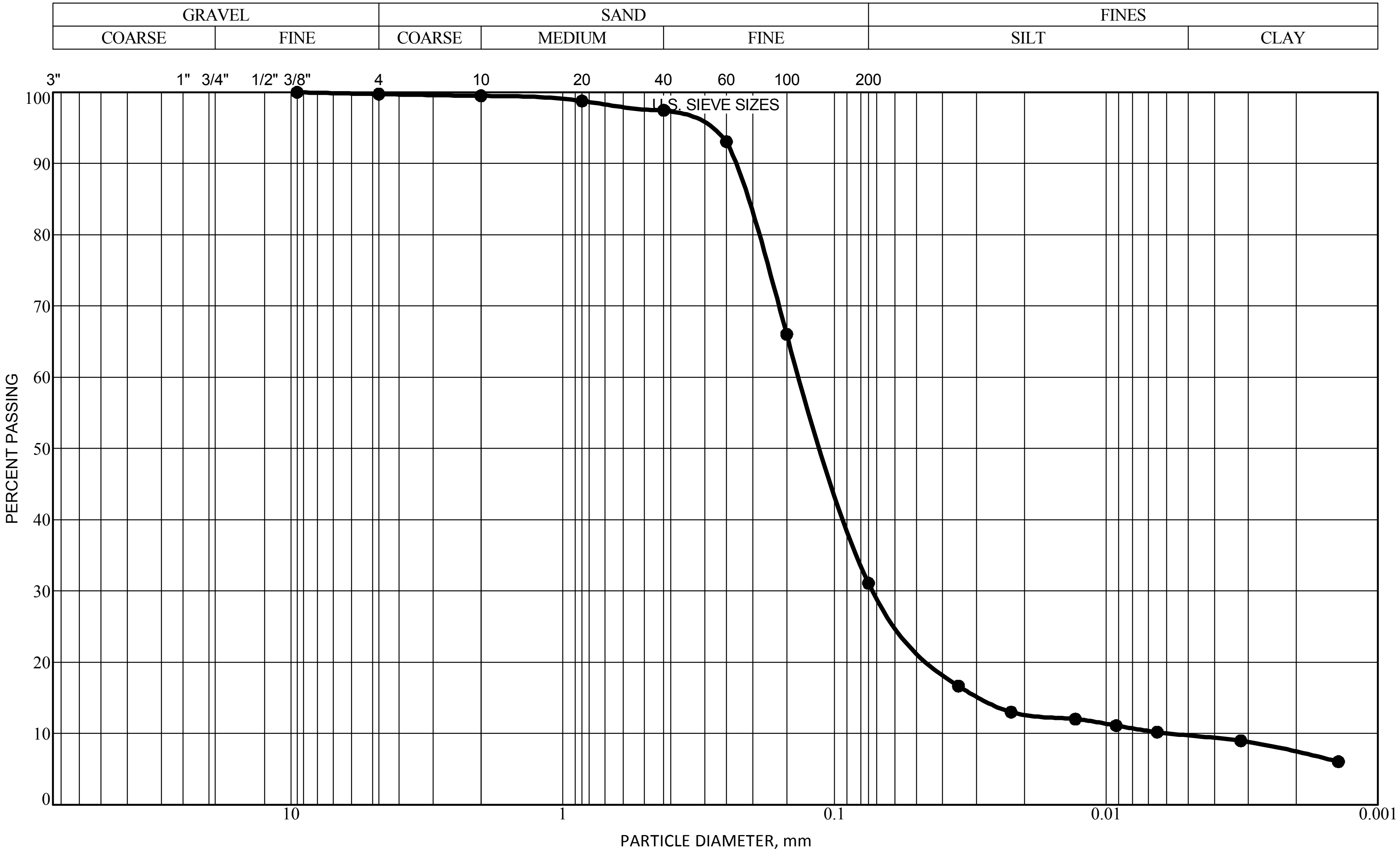
Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-09 DEPTH: 7.5'-8.5'

GRAVEL	0.8%	
SAND	91.7%	
FINES	7.5%	
D60=0.642		
D30=0.370	Cu=4.1	
D10=0.157	Cc=1.4	

CLASSIFICATION:
POORLY GRADED SAND with SILT(SP-SM)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



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Braun Project B1806731

Geotechnical Evaluation

Astoria Station

19333 482nd Avenue

Astoria, South Dakota

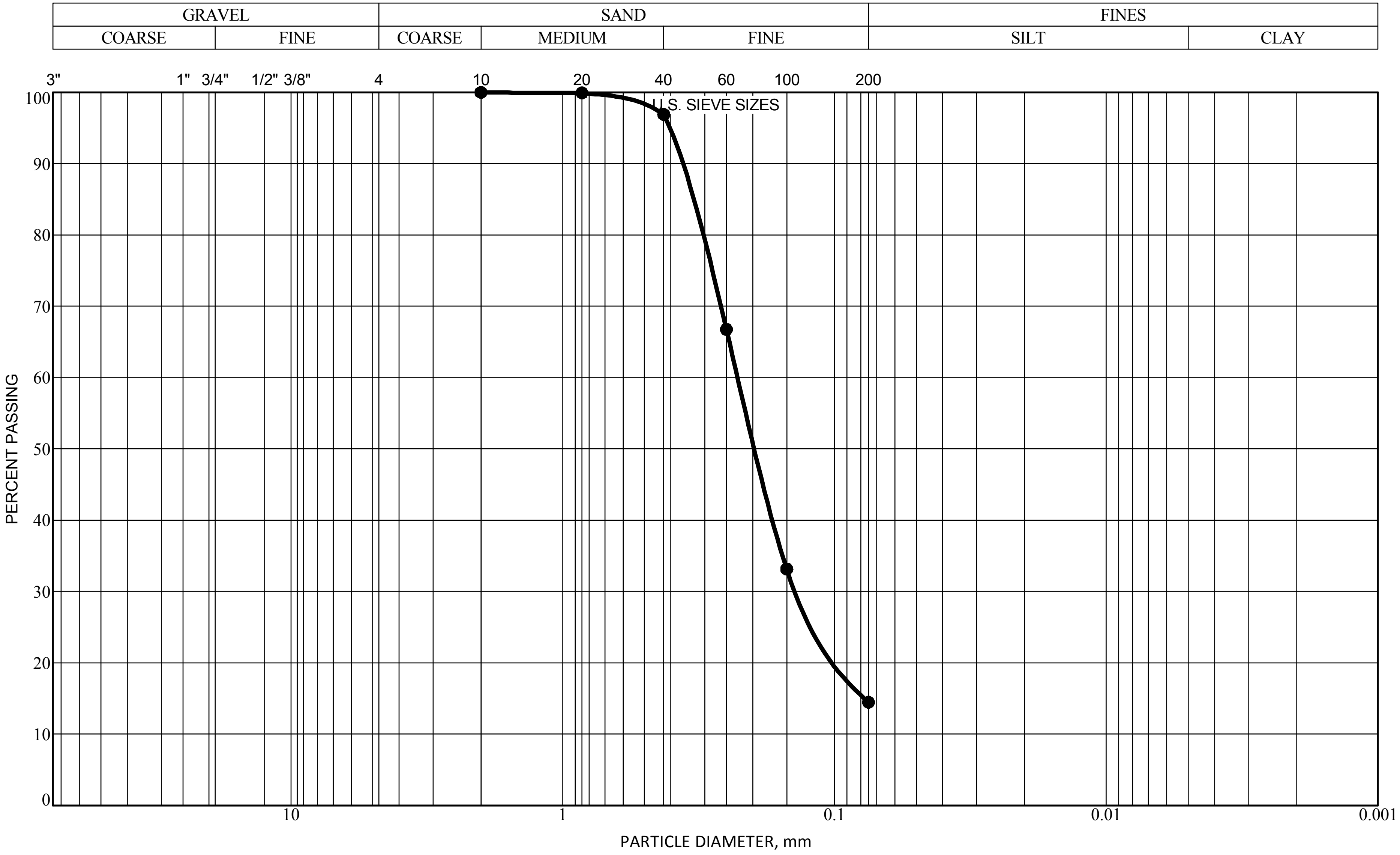
BORING: B-09 DEPTH: 30.0'-31.0'

GRAVEL	0.3%
SAND	68.7%
SILT	21.3%
CLAY	9.7%
D60=0.133 D30=0.071 D10=0.006	Cu=23.0 Cc=6.5

CLASSIFICATION:
SILTY SAND(SM)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



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Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-10 DEPTH: 7.5'-8.5'

GRAVEL	0.0%
SAND	85.5%
FINES	14.5%

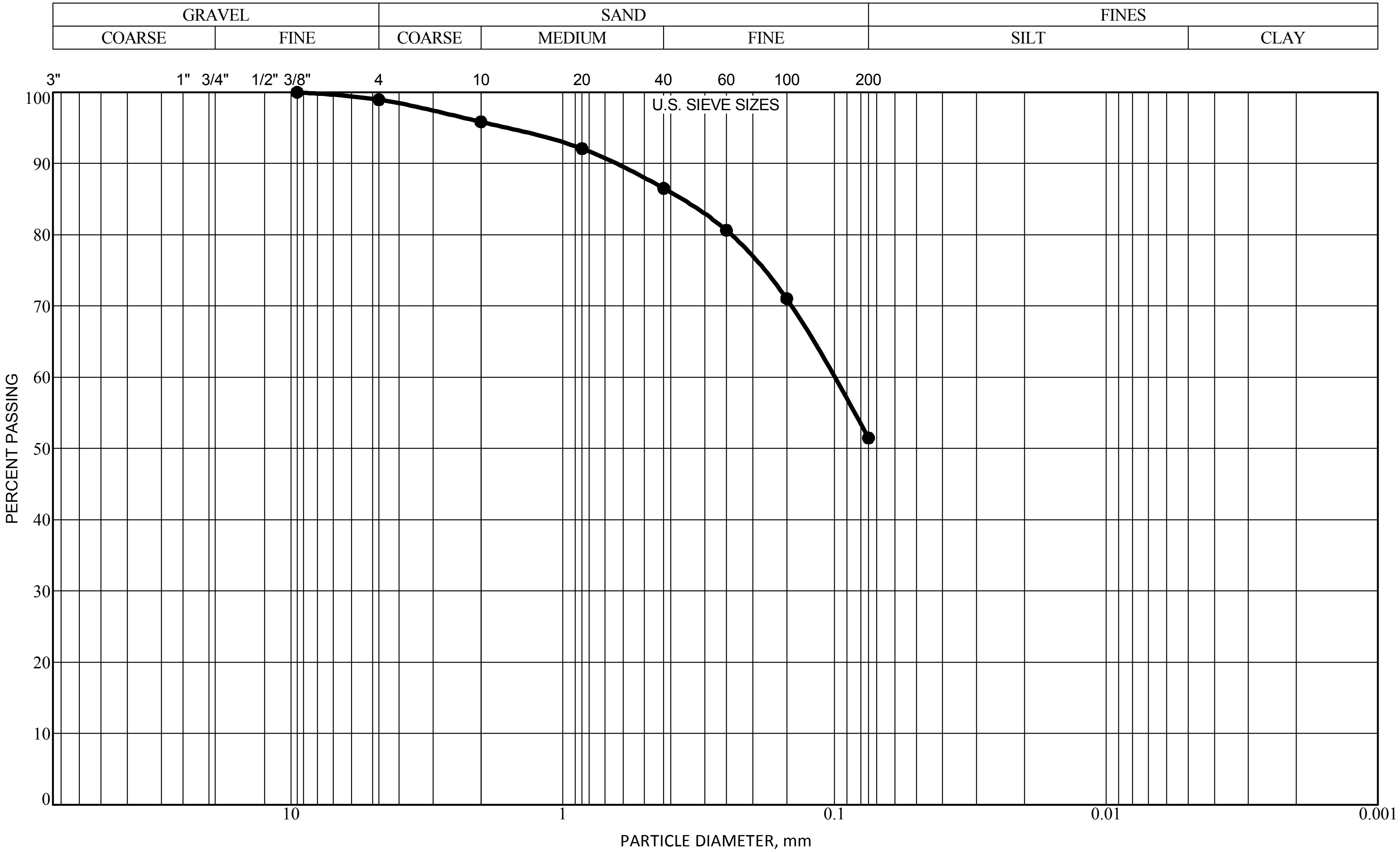
D60=0.226
D30=0.133
D10=

Cu=
Cc=

CLASSIFICATION:
SILTY SAND(SM)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-11 DEPTH: 45.0'-46.0'

GRAVEL	1.0%
SAND	47.5%
FINES	51.5%

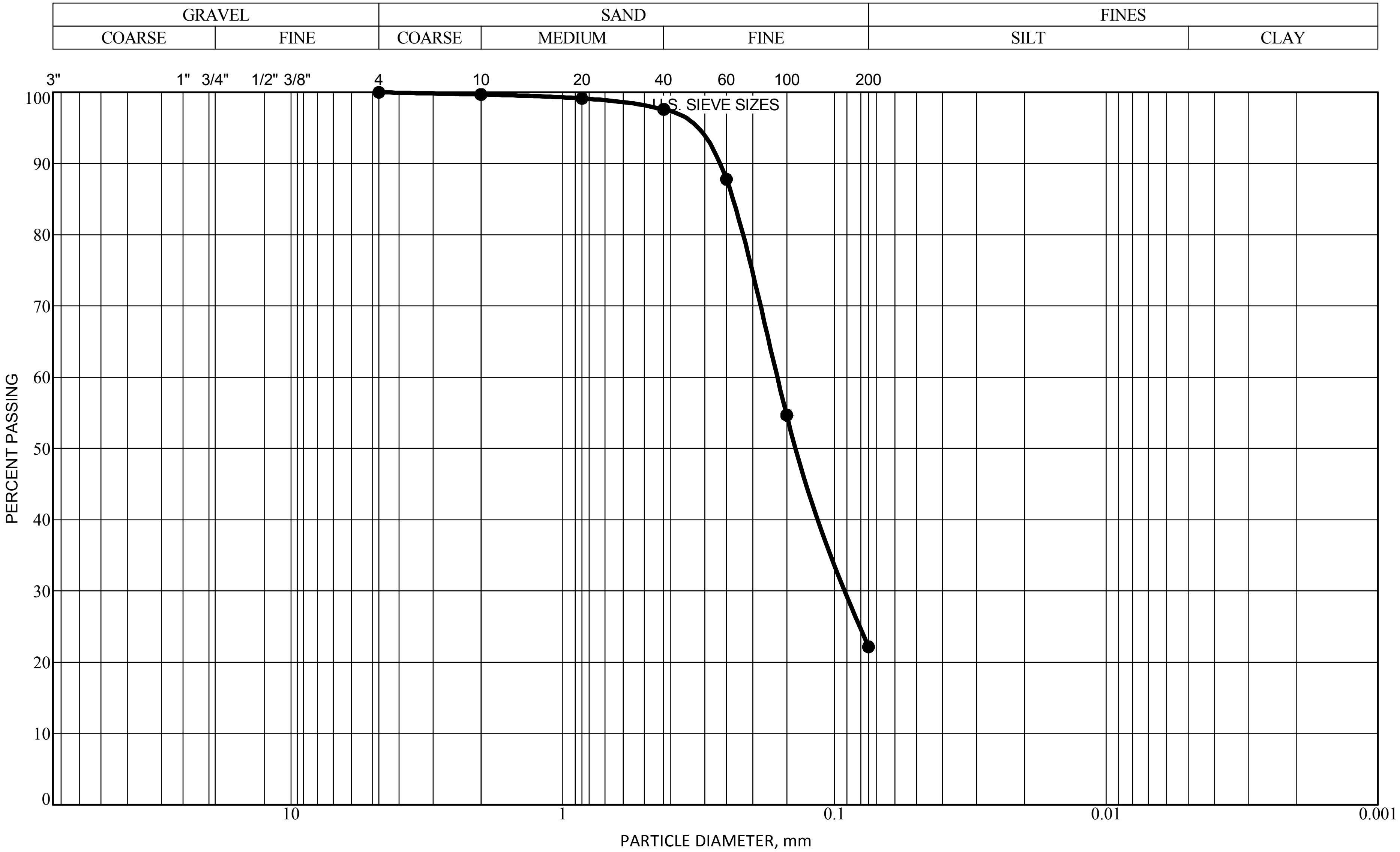
D60=0.101
D30=
D10=

Cu=
Cc=

CLASSIFICATION:
SANDY SILT(ML)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)

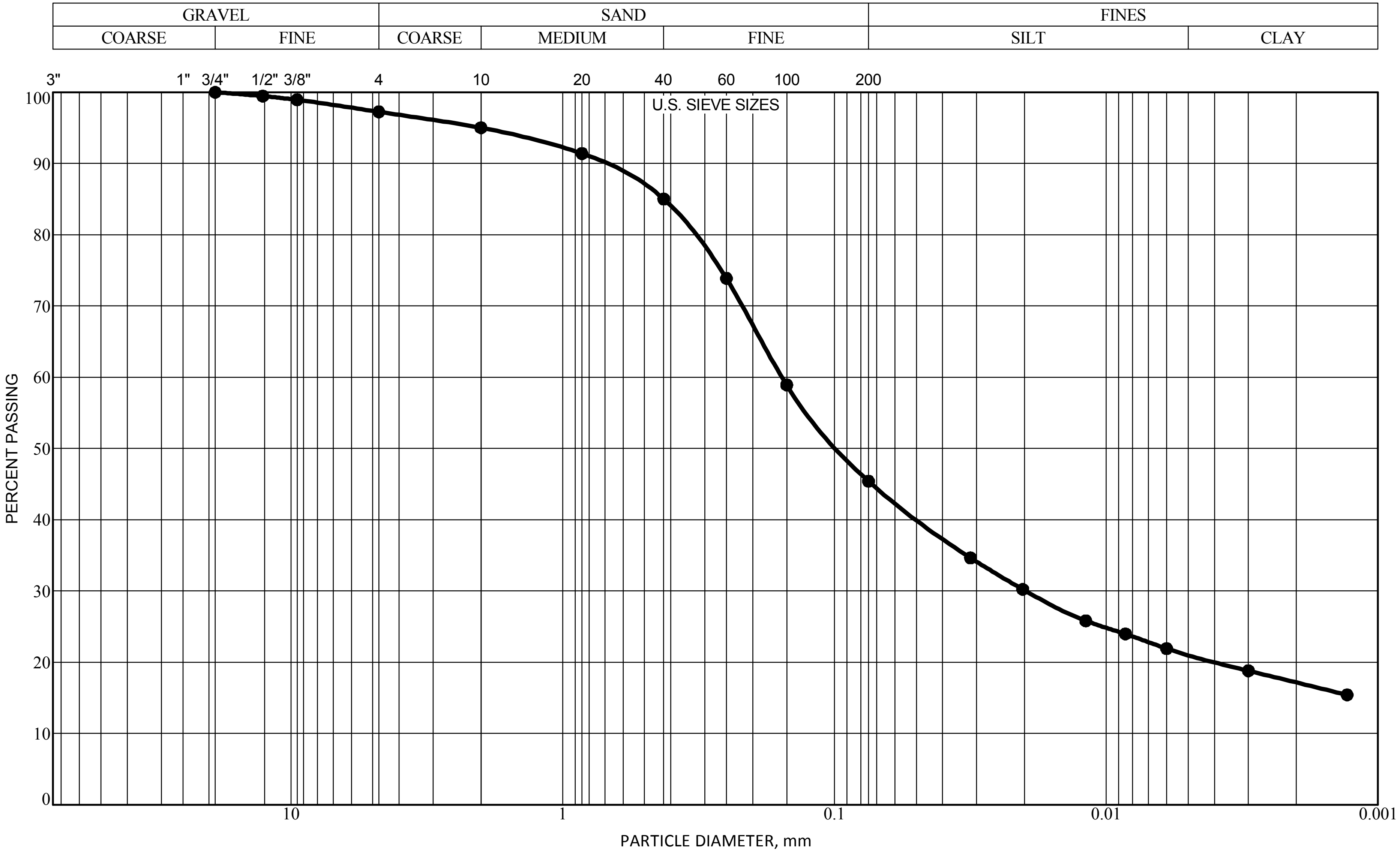


Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-12 DEPTH: 7.5'-8.5'

GRAVEL	0.0%
SAND	77.8%
FINES	22.2%
D60=0.163	Cu=
D30=0.089	Cc=
D10=	

CLASSIFICATION:
SILTY SAND(SM)

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN INTERTEC

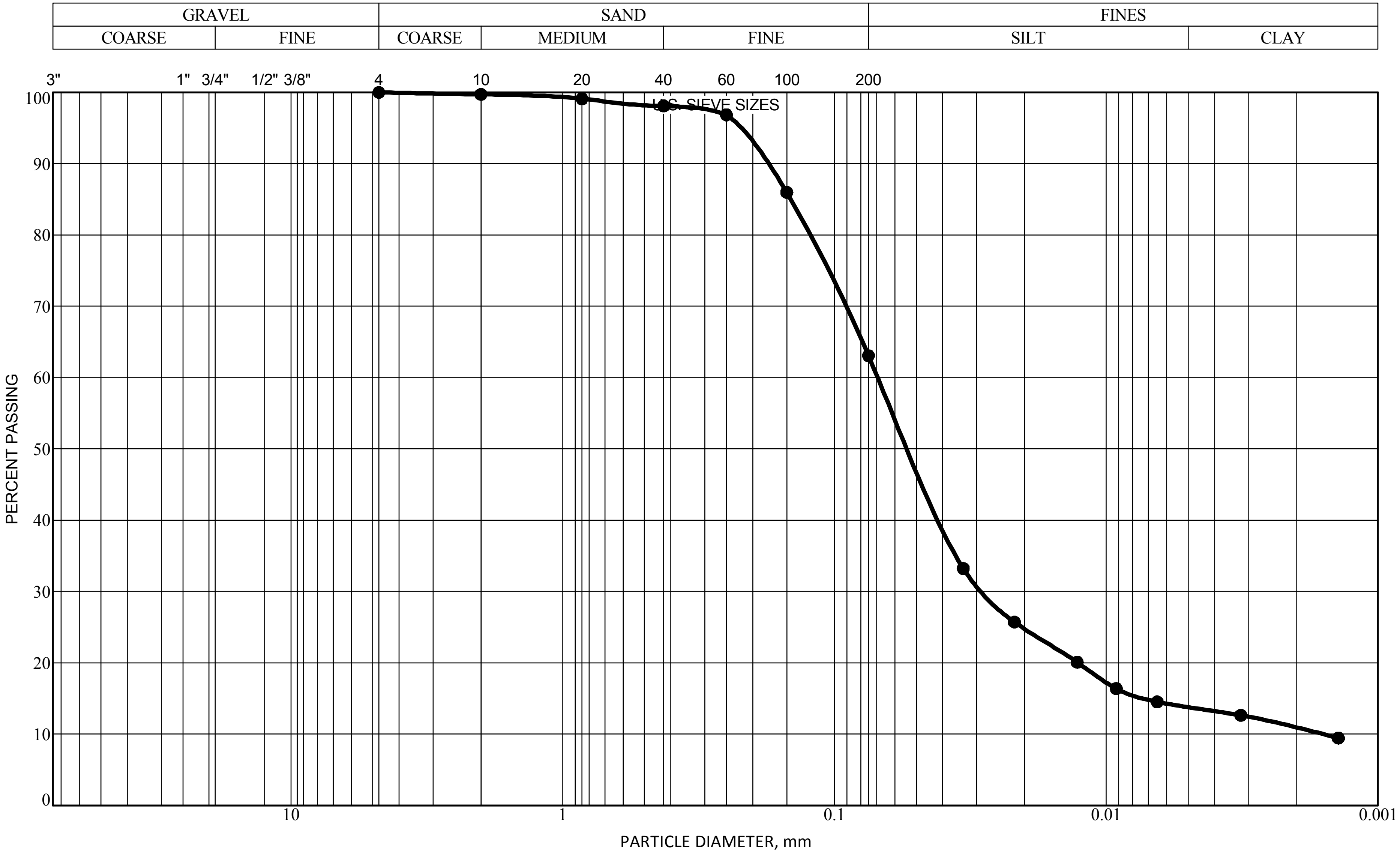
Braun Project B1806731
Geotechnical Exploration and Testing
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-13 DEPTH: 1.0'-5.0'

GRAVEL	2.7%
SAND	51.8%
SILT	24.3%
CLAY	21.1%
D60=0.156	
D30=0.020	Cu=
D10=	Cc=

CLASSIFICATION:
CLAYEY SAND(SC)

GS ASTM N:\GINT\PROJECTS\X-GEOLAB\1-GINT FILES\AX PROJECTS GEO LAB\2018\B1806731.GPJ BRAUN_V8_CURRENT.GDT 8/23/18 10:44

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

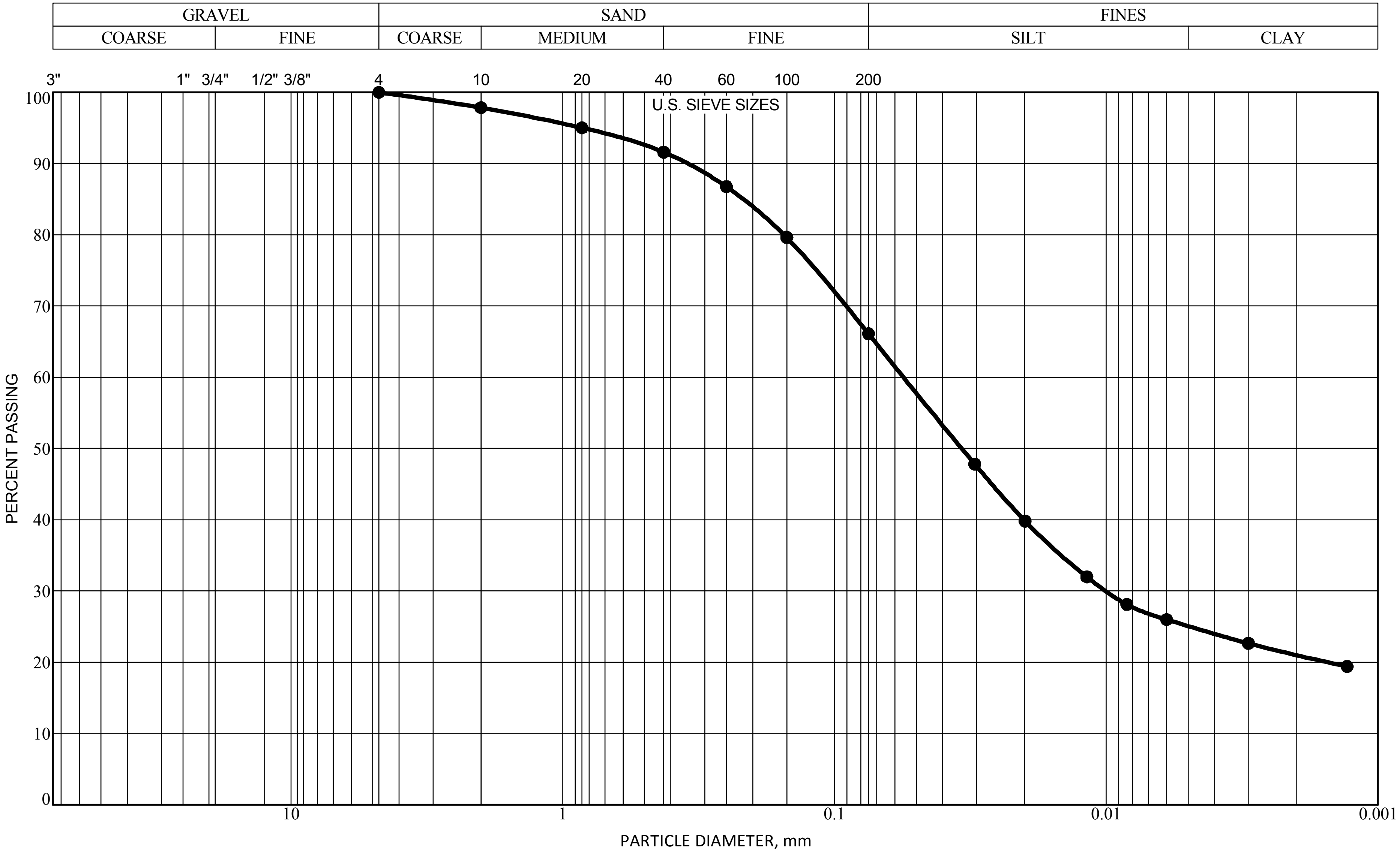
BORING: B-13 DEPTH: 2.5'-3.5'

GRAVEL	0.0%
SAND	36.9%
SILT	49.2%
CLAY	13.8%
D60=0.069 D30=0.028 D10=0.002	Cu=42.8 Cc=7.0

CLASSIFICATION:
SANDY SILT(ML)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



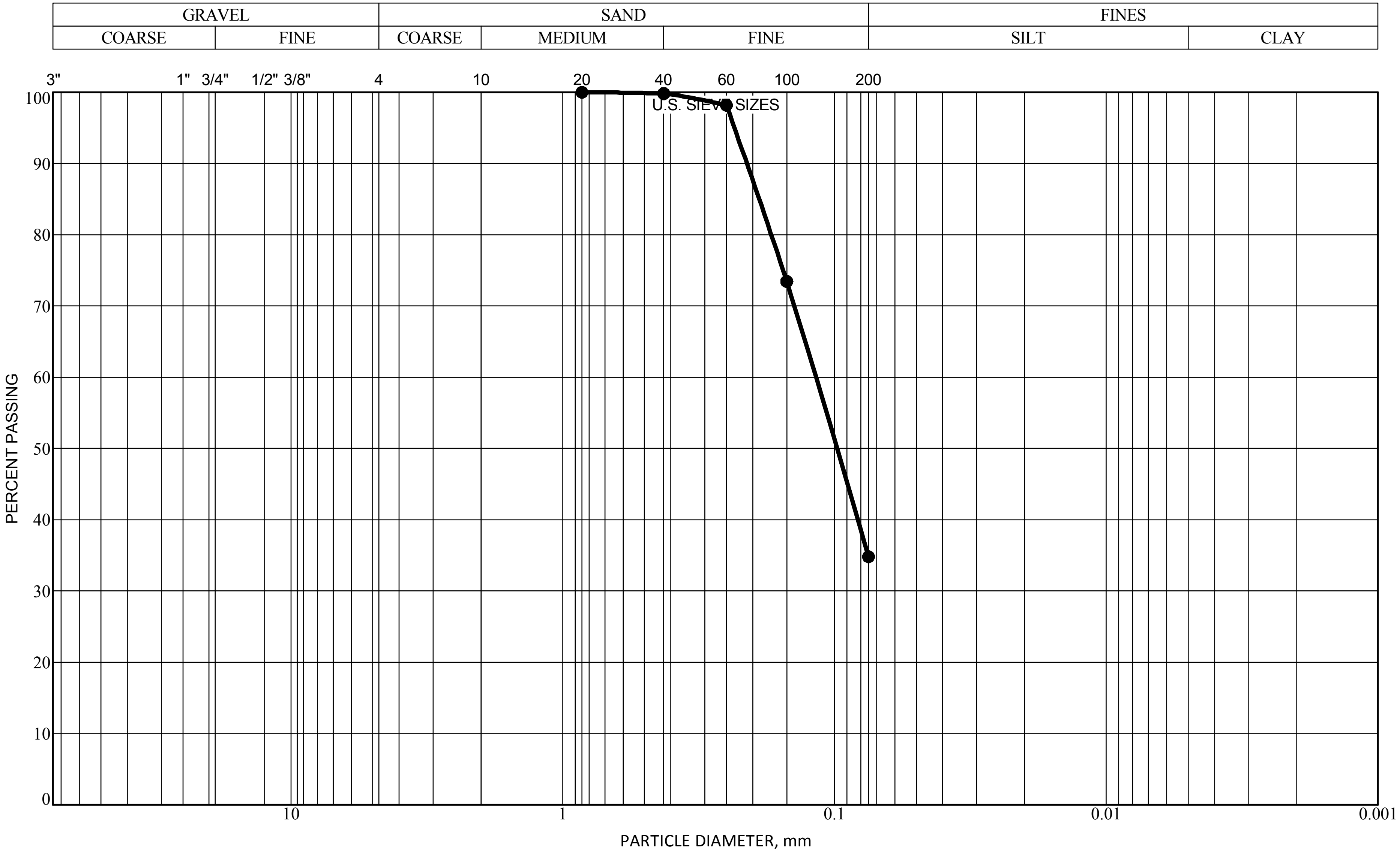
BRAUN℠ INTERTEC

Braun Project B1806731
Geotechnical Exploration and Testing
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-14 DEPTH: 1.0'-5.0'

GRAVEL	0.0%
SAND	33.9%
SILT	41.0%
CLAY	25.1%
D60=0.056	Cu=
D30=0.010	Cc=
D10=	

CLASSIFICATION:
SANDY LEAN CLAY(CL)

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

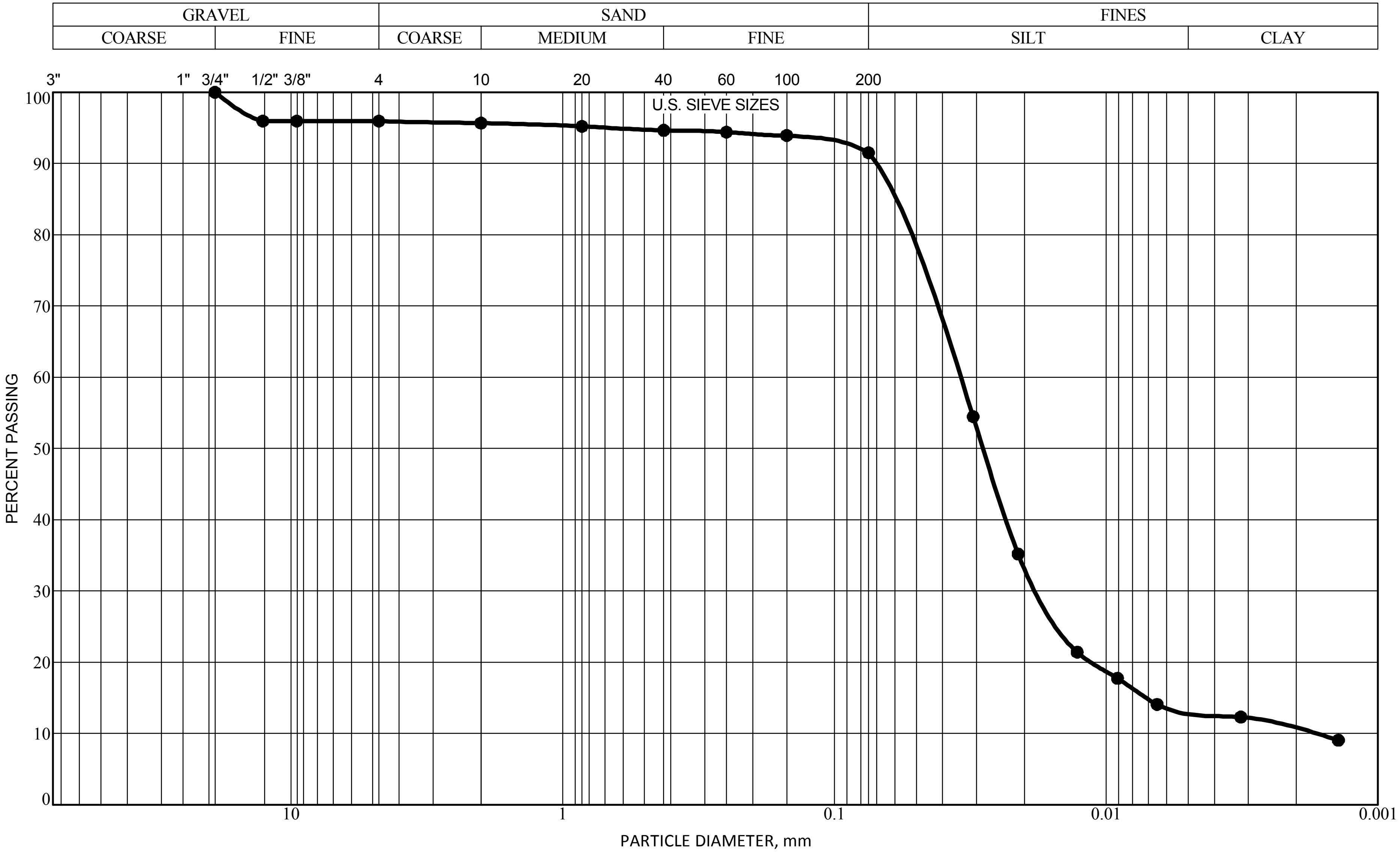
BORING: B-14 DEPTH: 7.5'-8.5'

GRAVEL	0.0%
SAND	65.2%
FINES	34.8%
D60=0.118	Cu=
D30=	Cc=
D10=	

CLASSIFICATION:
SILTY SAND(SM)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



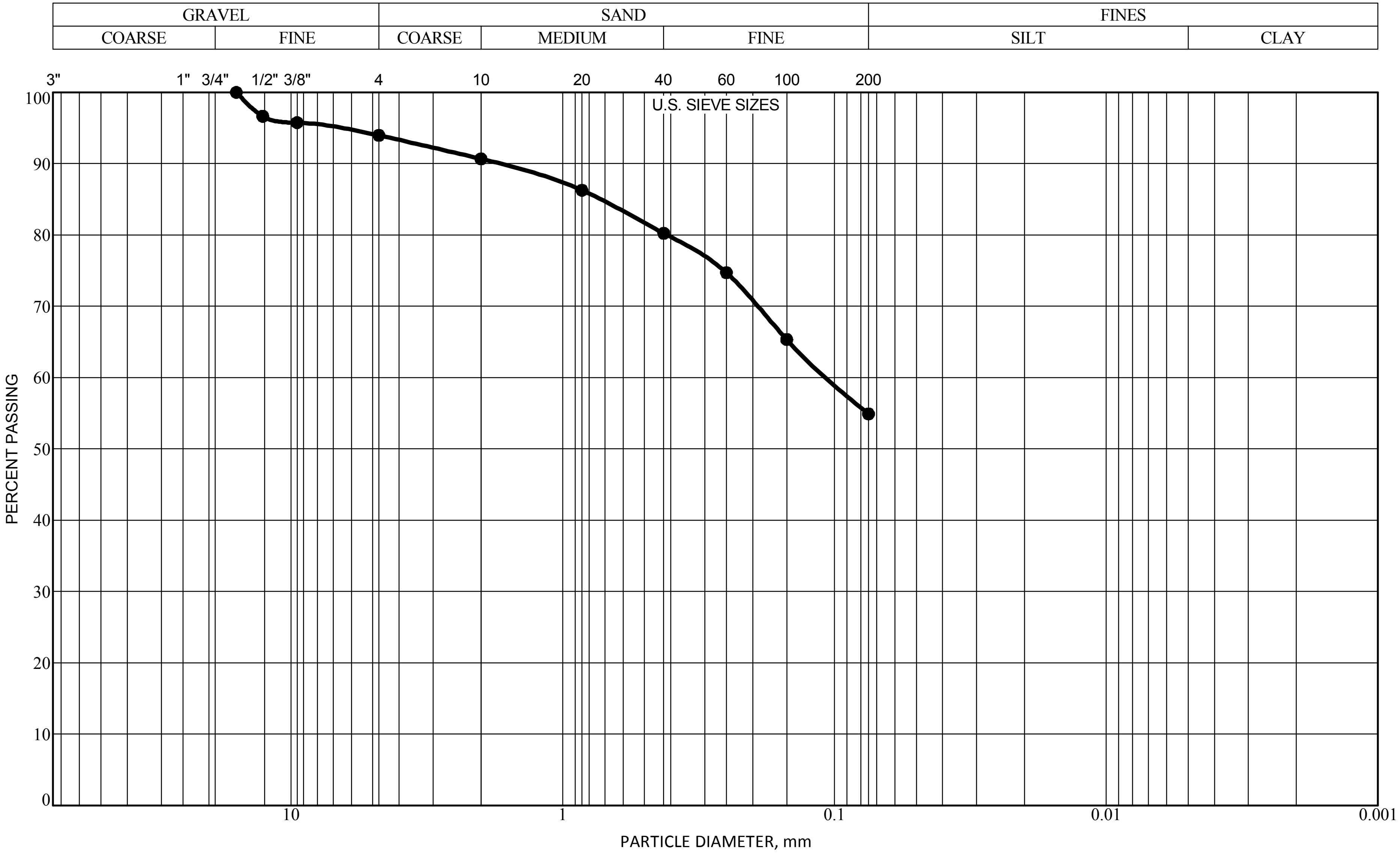
BRAUN℠ INTERTEC

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-14 DEPTH: 20.0'-21.0'

GRAVEL	4.0%
SAND	4.4%
SILT	78.1%
CLAY	13.4%
D60=0.035 D30=0.017 D10=0.002	Cu=19.8 Cc=4.9

CLASSIFICATION:
SILT(ML)

GRAIN SIZE ACCUMULATION CURVE (ASTM)



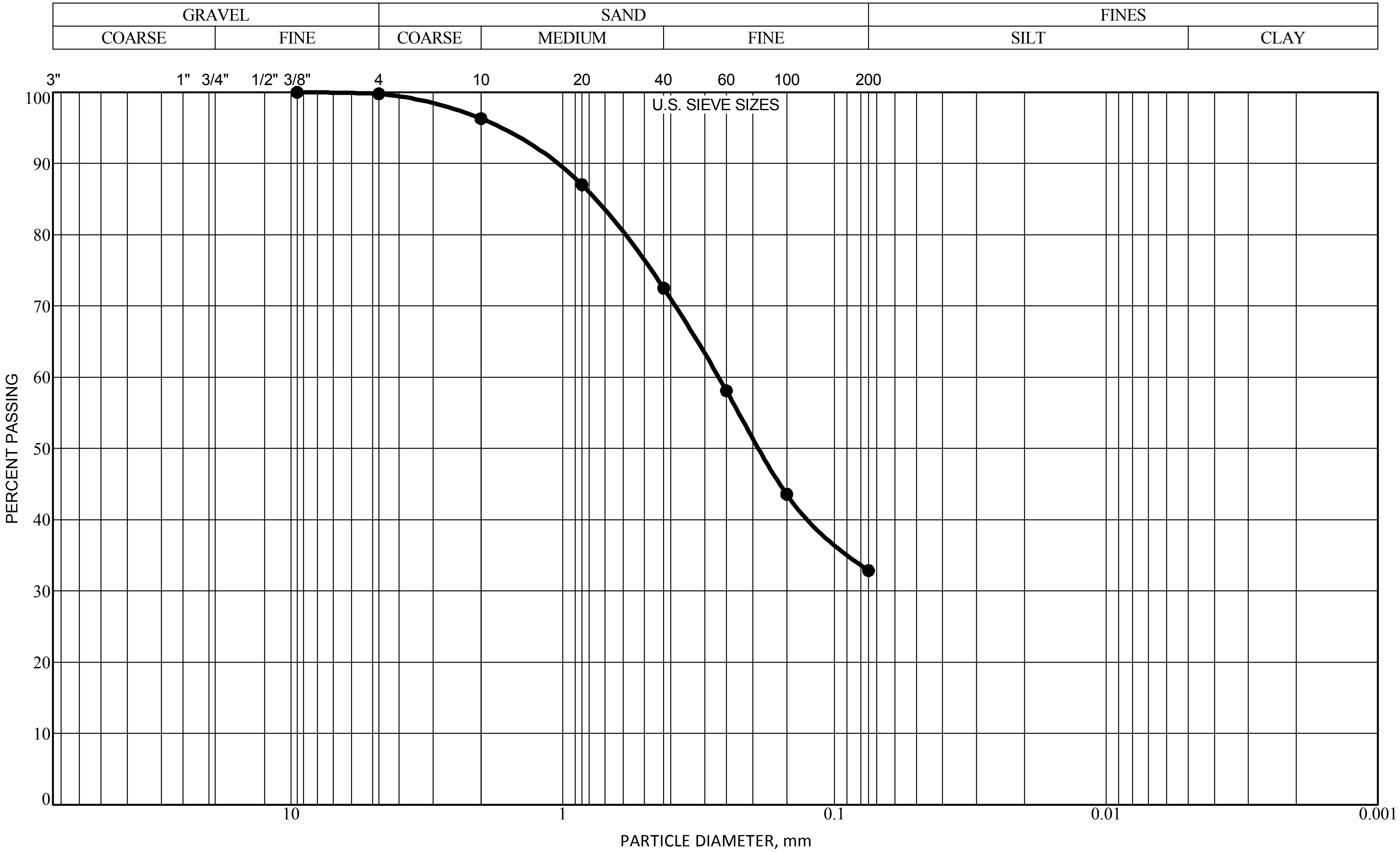
Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-15 DEPTH: 2.5'-3.5'

GRAVEL	6.0%
SAND	39.1%
FINES	54.9%
D60=0.105	Cu=
D30=	Cc=
D10=	

<u>CLASSIFICATION:</u>
SANDY LEAN CLAY(CL)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN SM
INTERTEC

Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-16 DEPTH: 5.0'-6.0'

GRAVEL	0.2%
SAND	66.9%
FINES	32.9%

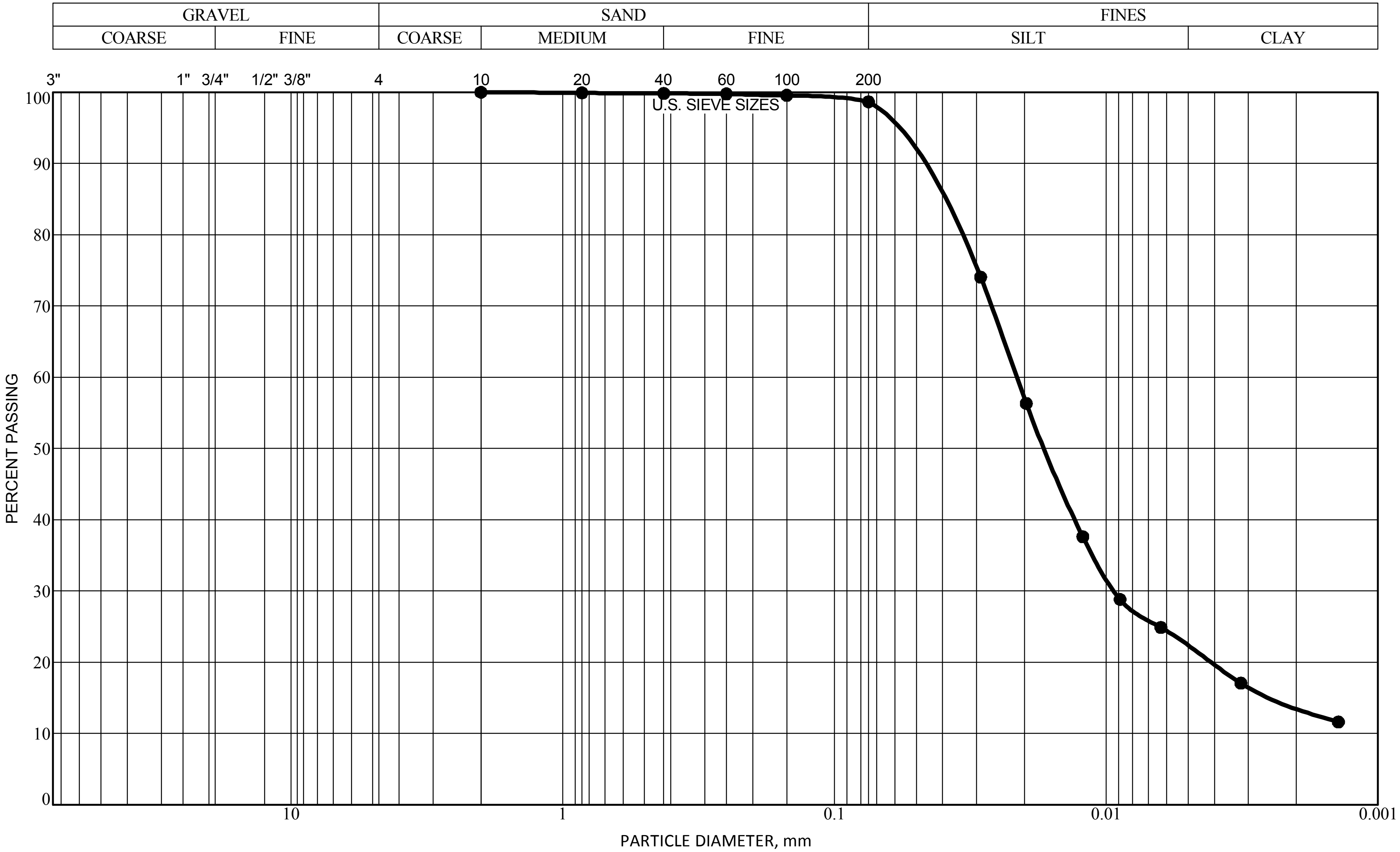
D60=0.268
D30=
D10=

Cu=
Cc=

CLASSIFICATION:
CLAYEY SAND(SC)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



BRAUN℠ INTERTEC

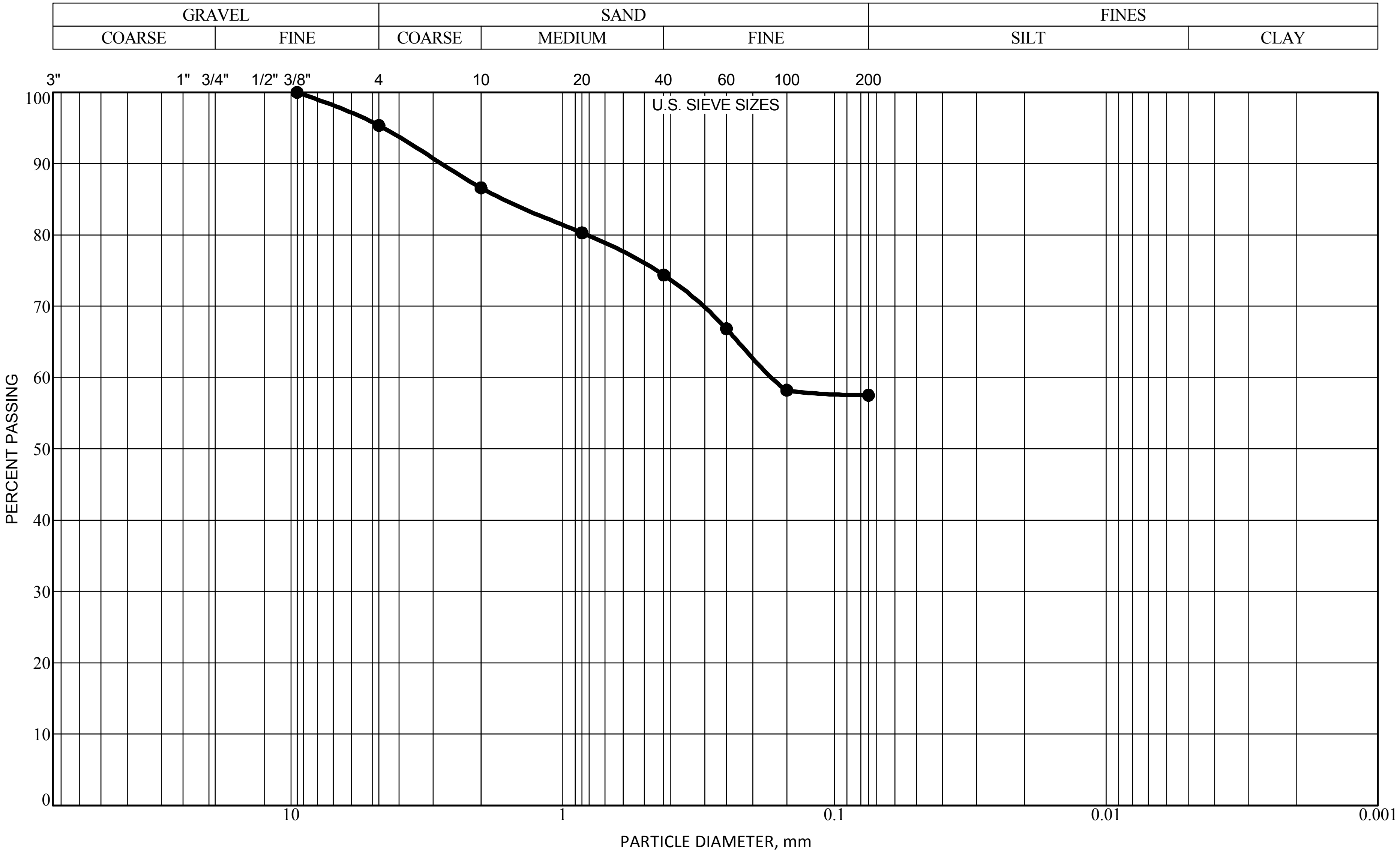
Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota

BORING: B-16 DEPTH: 7.5'-8.5'

GRAVEL	0.0%
SAND	1.3%
SILT	76.4%
CLAY	22.2%
D60=0.021	Cu=
D30=0.009	Cc=
D10=	

CLASSIFICATION:
SILT(ML)

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-18 DEPTH: 7.5'-8.5'

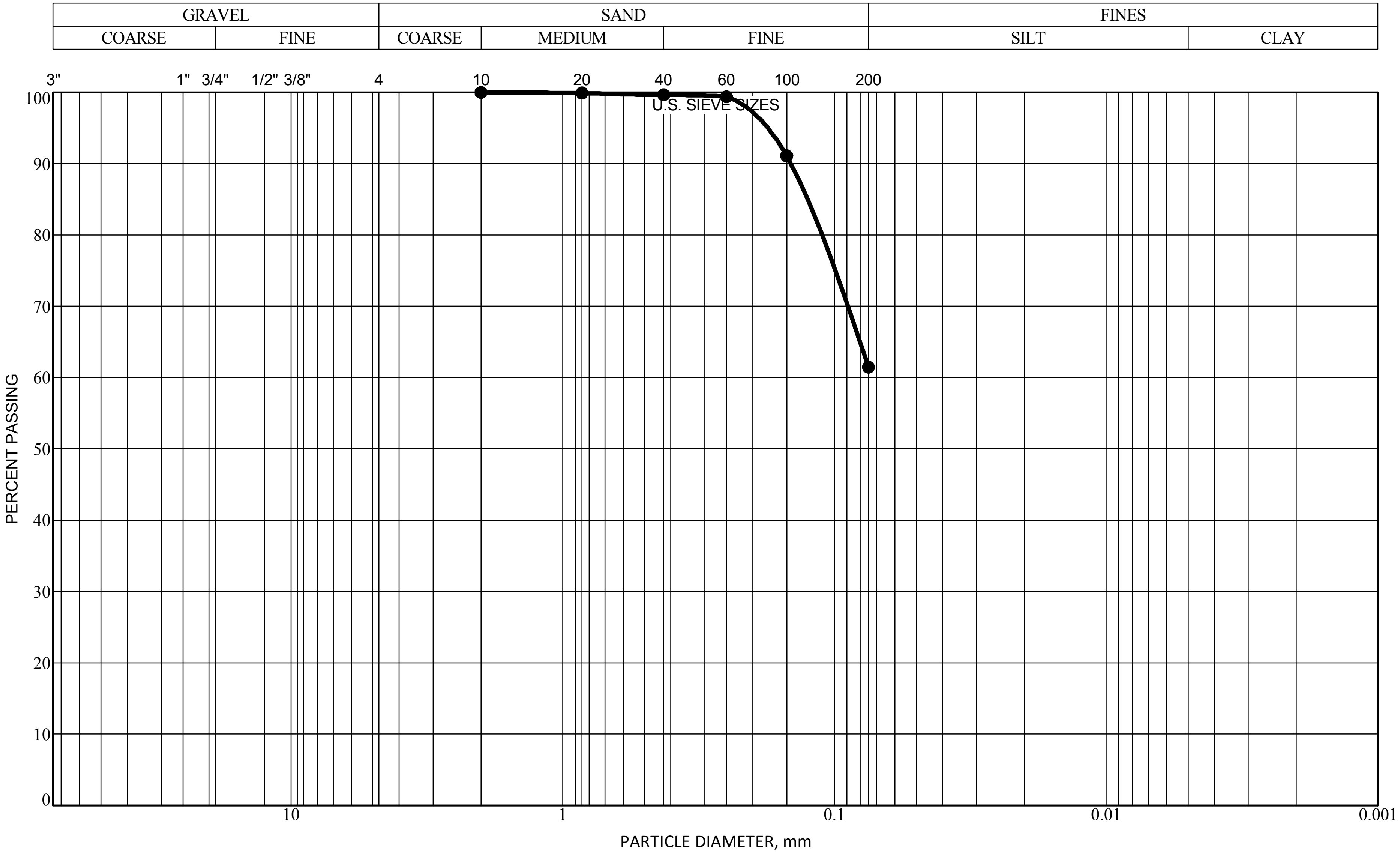
GRAVEL	4.6%
SAND	37.8%
FINES	57.5%
D60=0.167	
D30=	Cu=
D10=	Cc=

CLASSIFICATION:
SANDY LEAN CLAY(CL)

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GS ASTM N:\GINT\PROJECTS\AX PROJECTS\2018\06731.GPJ BRAUN_V8_CURRENT.GDT 8/21/18 10:55

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project B1806731
Geotechnical Evaluation
Astoria Station
19333 482nd Avenue
Astoria, South Dakota
BORING: B-20 DEPTH: 5.0'-6.0'

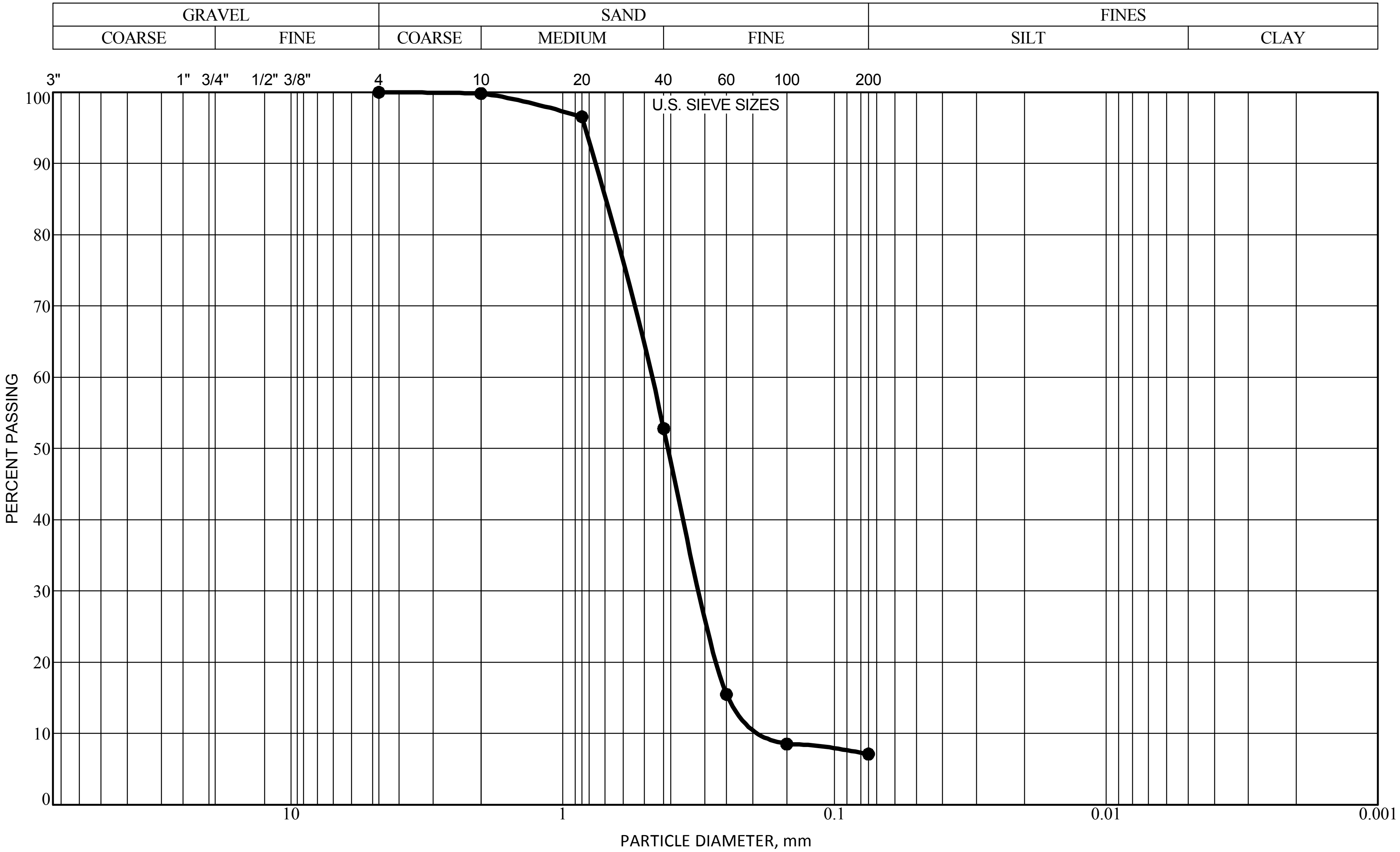
GRAVEL	0.0%
SAND	38.5%
FINES	61.5%

D60=
D30=
D10=

Cu=
Cc=

CLASSIFICATION:
SANDY SILT(ML)

GRAIN SIZE ACCUMULATION CURVE (ASTM)



Braun Project B1806731

Geotechnical Evaluation

Astoria Station

19333 482nd Avenue

Astoria, South Dakota

BORING: B-20 DEPTH: 15.0'-16.0'

GRAVEL	0.0%
SAND	92.9%
FINES	7.1%

D60=0.476
D30=0.307
D10=0.167

Cu=2.8
Cc=1.2

CLASSIFICATION:

POORLY GRADED SAND with SILT(SP-SM)

BRAUN INTERTEC
The Science You Build On.

Unconfined Compression

ASTM D2166

Sample 202962
8/21/2018

526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Client:	**Project:**
Otter Tail Power Company 215 S CascadeP.O. Box 496 Fergus Falls, MN 56538	B1806731 Astoria Station 19333 482nd Avenue Astoria, SD 57213

Sample Information

Sample Number: 202962

Sample From: Splitspoon

Sampling Method: Auger Boring ASTM D1452

Sampled By: Miller, Kevin

Location Details: B-01 27'-29'

Sample Date: 07/26/2018

Received Date: 07/27/2018

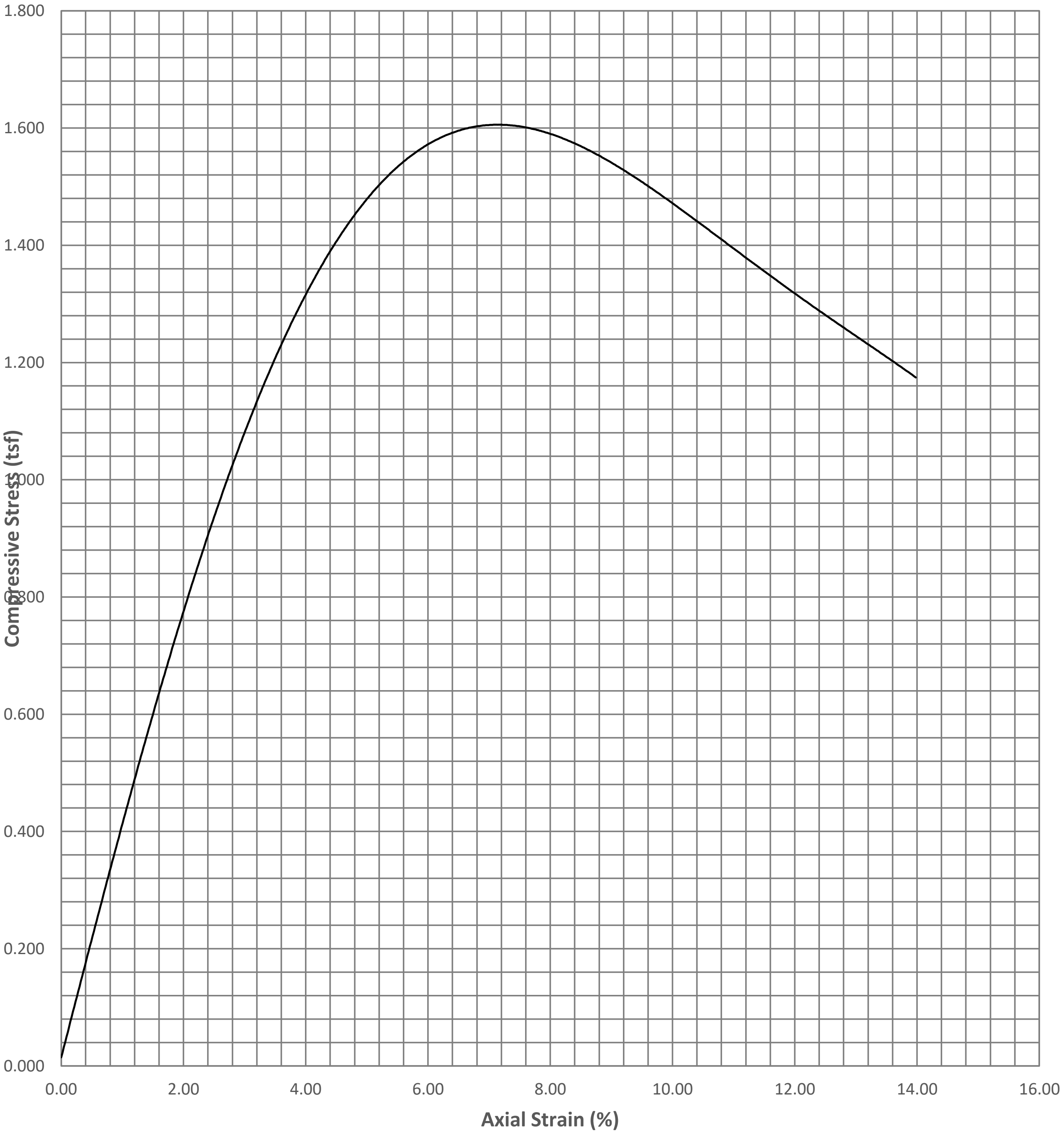
Lab: 526 10th Street NE, Suite 300, West Fargo, ND, 58078

Tested Date: 08/09/2018

Laboratory Data

Average Diameter (in):	1.907	**Average Length (in):**	3.755
Height to Diameter Ratio:	1.97	**Specimen Type:**	Intact
Wet Density (pcf):	132.7	**Dry Density (pcf):**	116.5
Moisture Content (%):	13.9	**Moisture Specimen:**	Entire sample after shear
Unconfined Compressive Strength (tsf):	1.62	**Shear Strength (tsf):**	0.81
Strain At Failure (%):	7.32	**Average Strain Rate (%/min):**	3.69
Soil Classification:	CL SANDY LEAN CLAY		

General



Project B1806731

Sample B-01 27'-29'

Date 8/9/2018

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Unconfined Compression

ASTM D2166

Sample 202969
8/21/2018

526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Client:	**Project:**
Otter Tail Power Company 215 S CascadeP.O. Box 496 Fergus Falls, MN 56538	B1806731 Astoria Station 19333 482nd Avenue Astoria, SD 57213

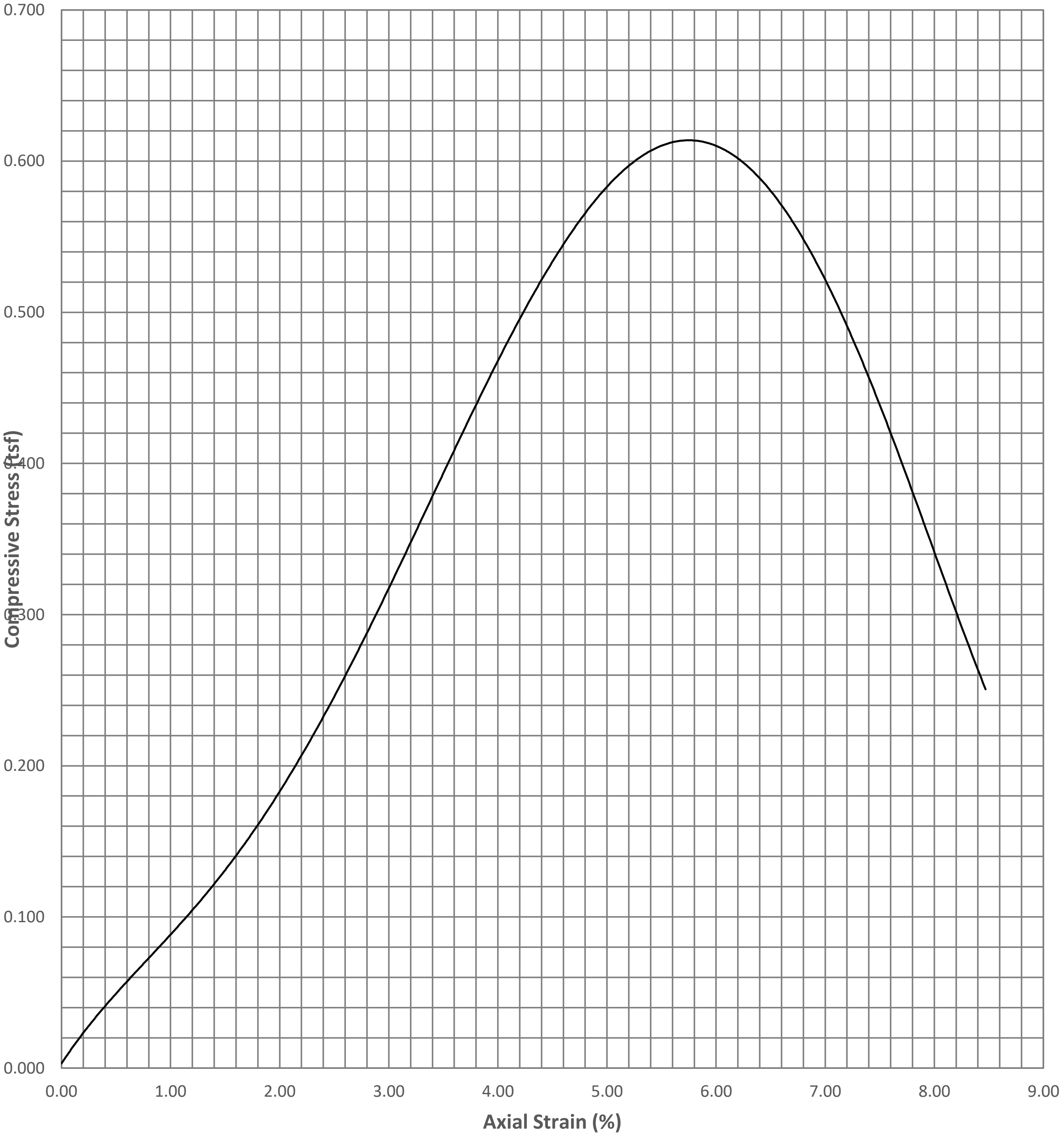
Sample Information

Sample Number:	202969	**Sample From:**	Boring
Sampling Method:	Thinwall Tube ASTM D1587	**Sampled By:**	Miller, Kevin
Location Details:	B-01 37'-39'		
Sample Date:	07/25/2018		
Received Date:	07/26/2018	**Lab:**	526 10th Street NE, Suite 300, West Fargo, ND, 58078
Tested Date:	08/10/2018		

Laboratory Data

Average Diameter (in):	2.854	**Average Length (in):**	5.608
Height to Diameter Ratio:	1.96	**Specimen Type:**	Intact
Wet Density (pcf):	129.6	**Dry Density (pcf):**	107.5
Moisture Content (%):	20.6	**Moisture Specimen:**	Entire sample after shear
Unconfined Compressive Strength (tsf):	0.62	**Shear Strength (tsf):**	0.31
Strain At Failure (%):	5.35	**Average Strain Rate (%/min):**	2.41
Soil Classification:	CL SANDY LEAN CLAY		

General



Project B1806731

Sample B-01 37'-39'

Date 8/9/2018

BRAUN INTERTEC
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Unconfined Compression

ASTM D2166

Sample 202970
8/21/2018

526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Client:

Otter Tail Power Company
215 S CascadeP.O. Box 496
Fergus Falls, MN 56538

Project:

B1806731
Astoria Station
19333 482nd Avenue
Astoria, SD 57213

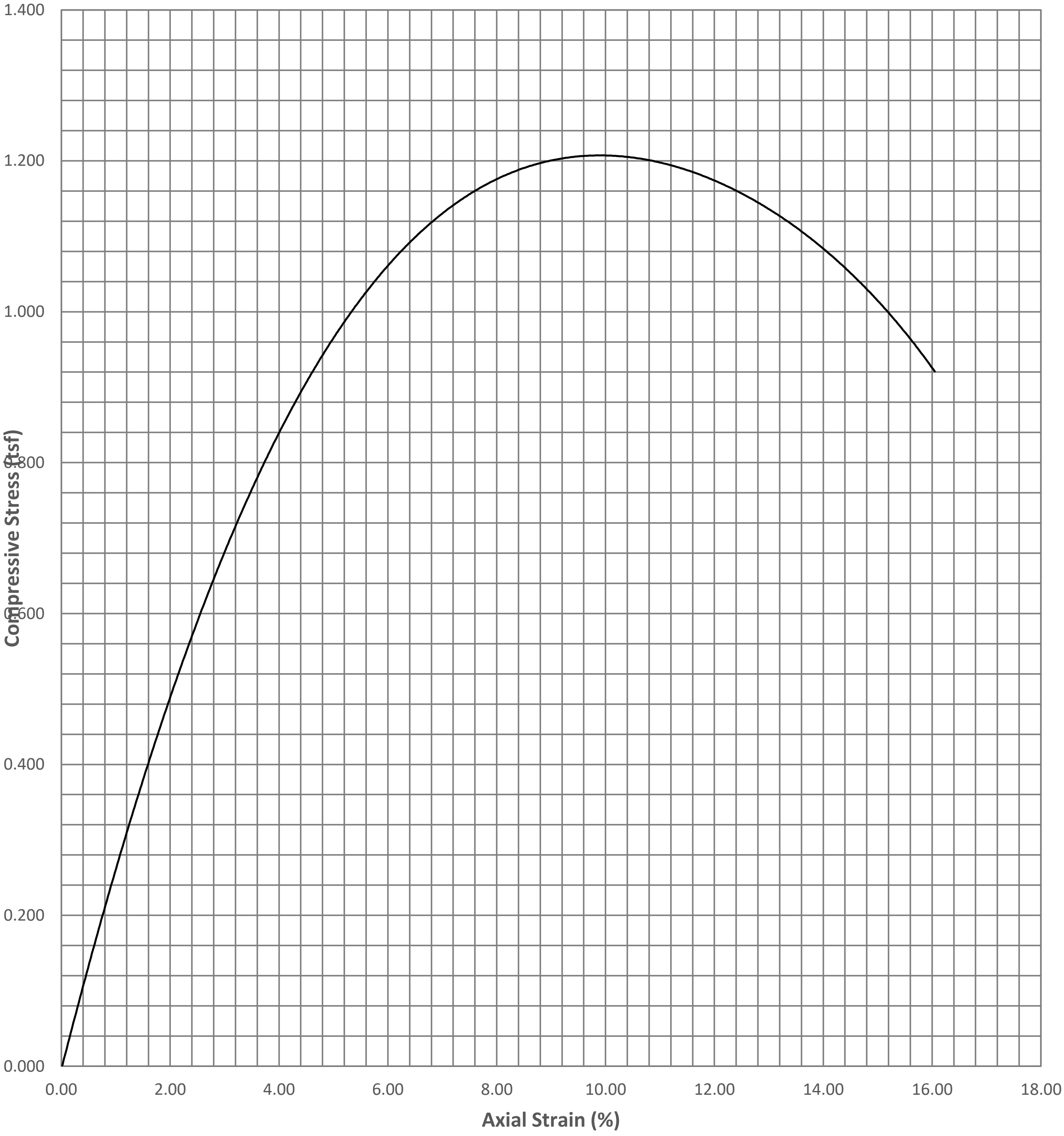
Sample Information

Sample Number:	202970	**Sample From:**	Boring
Sampling Method:	Thinwall Tube ASTM D1587	**Sampled By:**	Miller, Kevin
Location Details:	B-03 29.5'-31.5'		
Sample Date:	07/30/2018		
Received Date:	07/31/2018	**Lab:**	526 10th Street NE, Suite 300, West Fargo, ND, 58078
Tested Date:	08/10/2018		

Laboratory Data

Average Diameter (in):	2.861	**Average Length (in):**	5.609
Height to Diameter Ratio:	1.96	**Specimen Type:**	Intact
Wet Density (pcf):	137.2	**Dry Density (pcf):**	120.1
Moisture Content (%):	14.2	**Moisture Specimen:**	Entire sample after shear
Unconfined Compressive Strength (tsf):	1.22	**Shear Strength (tsf):**	0.61
Strain At Failure (%):	9.81	**Average Strain Rate (%/min):**	2.61
Soil Classification:	CL SANDY LEAN CLAY		

General



Project B1806731

Sample B-03 29.5'-31.5'

Date 8/9/2018

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526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Unconfined Compression

ASTM D2166

Sample 202972
8/21/2018

Client:

Otter Tail Power Company
215 S CascadeP.O. Box 496
Fergus Falls, MN 56538

Project:

B1806731
Astoria Station
19333 482nd Avenue
Astoria, SD 57213

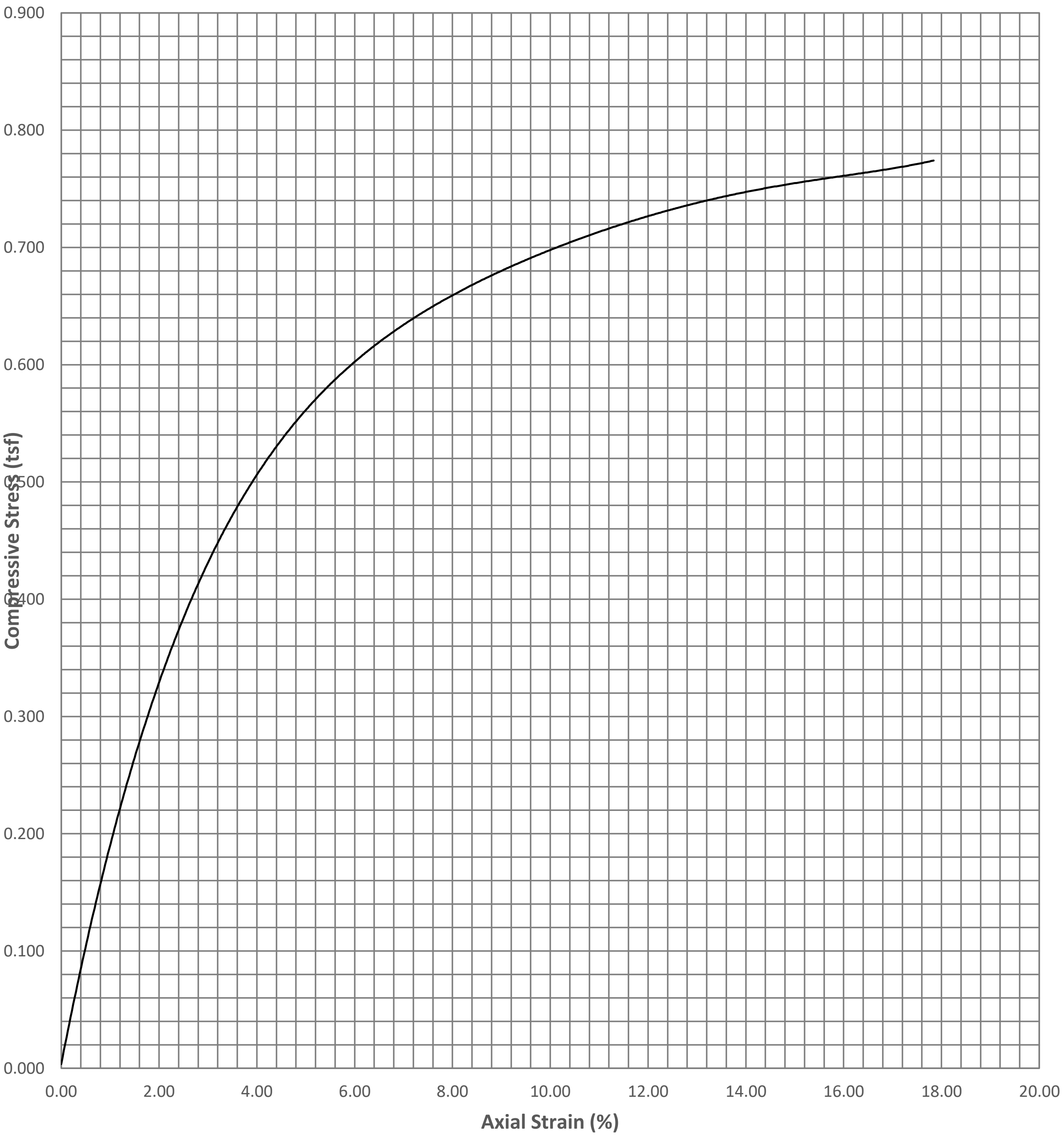
Sample Information

Sample Number:	202972	**Sample From:**	Boring
Sampling Method:	Thinwall Tube ASTM D1587	**Sampled By:**	Miller, Kevin
Location Details:	B-03 44.5'-46.5'		
Sample Date:	07/30/2018		
Received Date:	07/31/2018	**Lab:**	526 10th Street NE, Suite 300, West Fargo, ND, 58078
Tested Date:	08/09/2018		

Laboratory Data

Average Diameter (in):	2.866	**Average Length (in):**	5.605
Height to Diameter Ratio:	1.96	**Specimen Type:**	Intact
Wet Density (pcf):	133.5	**Dry Density (pcf):**	114.4
Moisture Content (%):	16.7	**Moisture Specimen:**	Entire sample after shear
Unconfined Compressive Strength (tsf):	0.78	**Shear Strength (tsf):**	0.39
Strain At Failure (%):	17.84	**Average Strain Rate (%/min):**	2.44
Soil Classification:	CL SANDY LEAN CLAY		

General



Project
B1806731

Sample
B-03 44.5'-46.5'

Date
8/9/2018

BRAUN INTERTEC
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Unconfined Compression

ASTM D2166

526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Client:	**Project:**
Otter Tail Power Company 215 S CascadeP.O. Box 496 Fergus Falls, MN 56538	B1806731 Astoria Station 19333 482nd Avenue Astoria, SD 57213

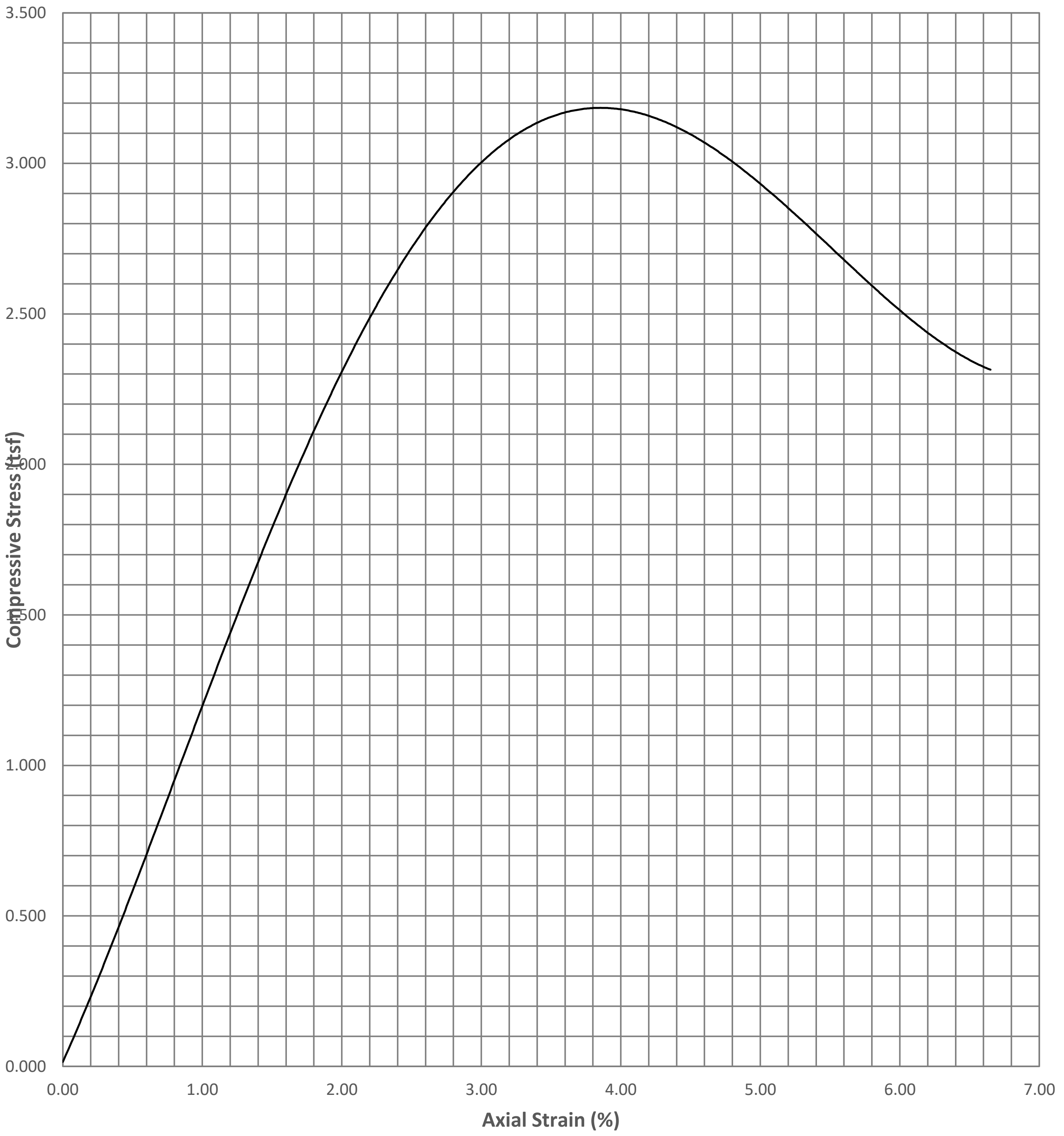
Sample Information

Sample Number:	203145	**Sample From:**	Boring
Sampling Method:	Thinwall Tube ASTM D1587	**Sampled By:**	Miller, Kevin
Location Details:	B-03 59.5'-61.5'		
Sample Date:	07/30/2018		
Received Date:	07/31/2018	**Lab:**	526 10th Street NE, Suite 300, West Fargo, ND, 58078
Tested Date:	08/11/2018		

Laboratory Data

Average Diameter (in):	1.910	**Average Length (in):**	3.757
Height to Diameter Ratio:	1.97	**Specimen Type:**	Intact
Wet Density (pcf):	132.5	**Dry Density (pcf):**	115.3
Moisture Content (%):	14.9	**Moisture Specimen:**	Entire sample after shear
Unconfined Compressive Strength (tsf):	3.18	**Shear Strength (tsf):**	1.59
Strain At Failure (%):	3.99	**Average Strain Rate (%/min):**	2.22
Soil Classification:	CL SANDY LEAN CLAY		

General

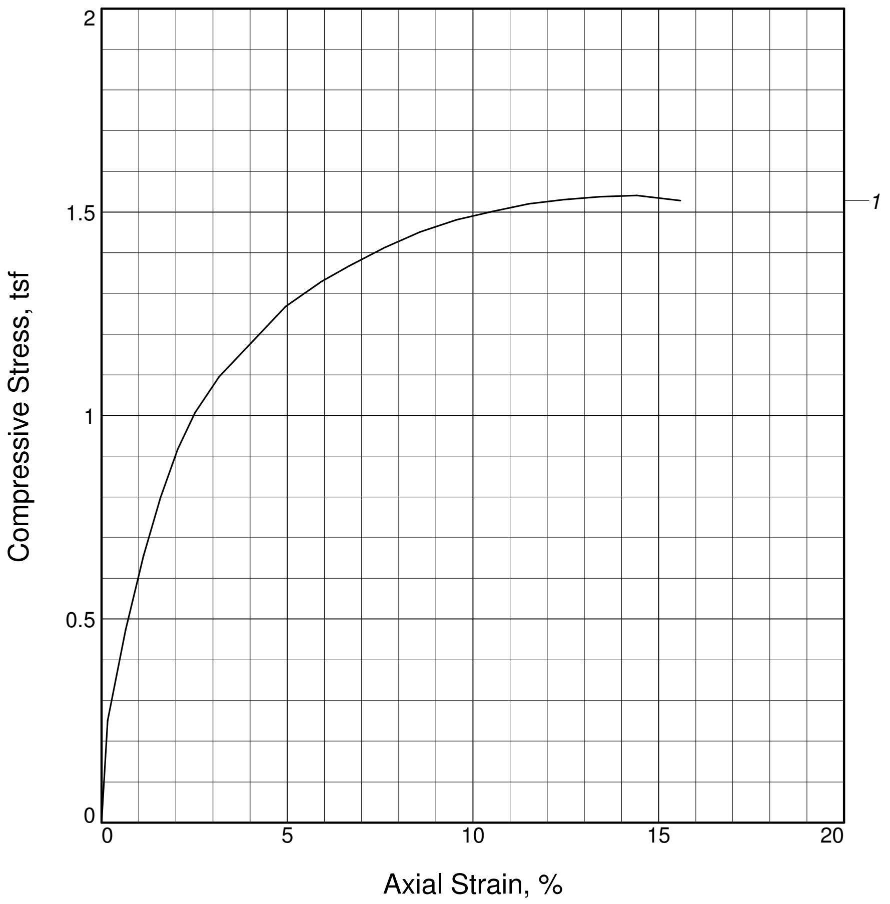


Project
B1806731

Sample
B-03 59.5'-61.5'

Date
8/11/2018

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.541			
Undrained shear strength, tsf	0.771			
Failure strain, %	14.4			
Strain rate, %/min.	1.00			
Water content, %	16.3			
Wet density, pcf	135.6			
Dry density, pcf	116.6			
Saturation, %	99.8			
Void ratio	0.4386			
Specimen diameter, in.	2.844			
Specimen height, in.	5.605			
Height/diameter ratio	1.97			

Description: SANDY LEAN CLAY, brown (CL)

LL = 32	**PL =** 12	**PI =** 20	**Assumed GS=** 2.686	**Type:** Thinwall

Project No.: B1806731

Date Sampled:

Remarks:
ASTM D 2166

Figure _______

Client: Otter Tail Power Company

Project: Astoria Station
19333 482nd Ave, Astoria, SD

Sample Number: B-04 **Depth:** 42-44'

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Unconfined Compression

ASTM D2166

Sample 202974
8/21/2018

526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Client:	Project:
Otter Tail Power Company 215 S CascadeP.O. Box 496 Fergus Falls, MN 56538	B1806731 Astoria Station 19333 482nd Avenue Astoria, SD 57213

Sample Information

Sample Number: 202974

Sample From: Boring

Sampling Method: Thinwall Tube ASTM D1587

Sampled By: Miller, Kevin

Location Details: B-04 62'-64'

Sample Date: 07/25/2018

Received Date: 07/26/2018

Lab: 526 10th Street NE, Suite 300, West Fargo, ND, 58078

Tested Date: 08/10/2018

Laboratory Data

Average Diameter (in): 2.870

Average Length (in): 5.617

Height to Diameter Ratio: 1.96

Specimen Type: Intact

Wet Density (pcf): 133.1

Dry Density (pcf): 114.7

Moisture Content (%): 16.0

Moisture Specimen: Entire sample after shear

Unconfined Compressive Strength (tsf): 1.40

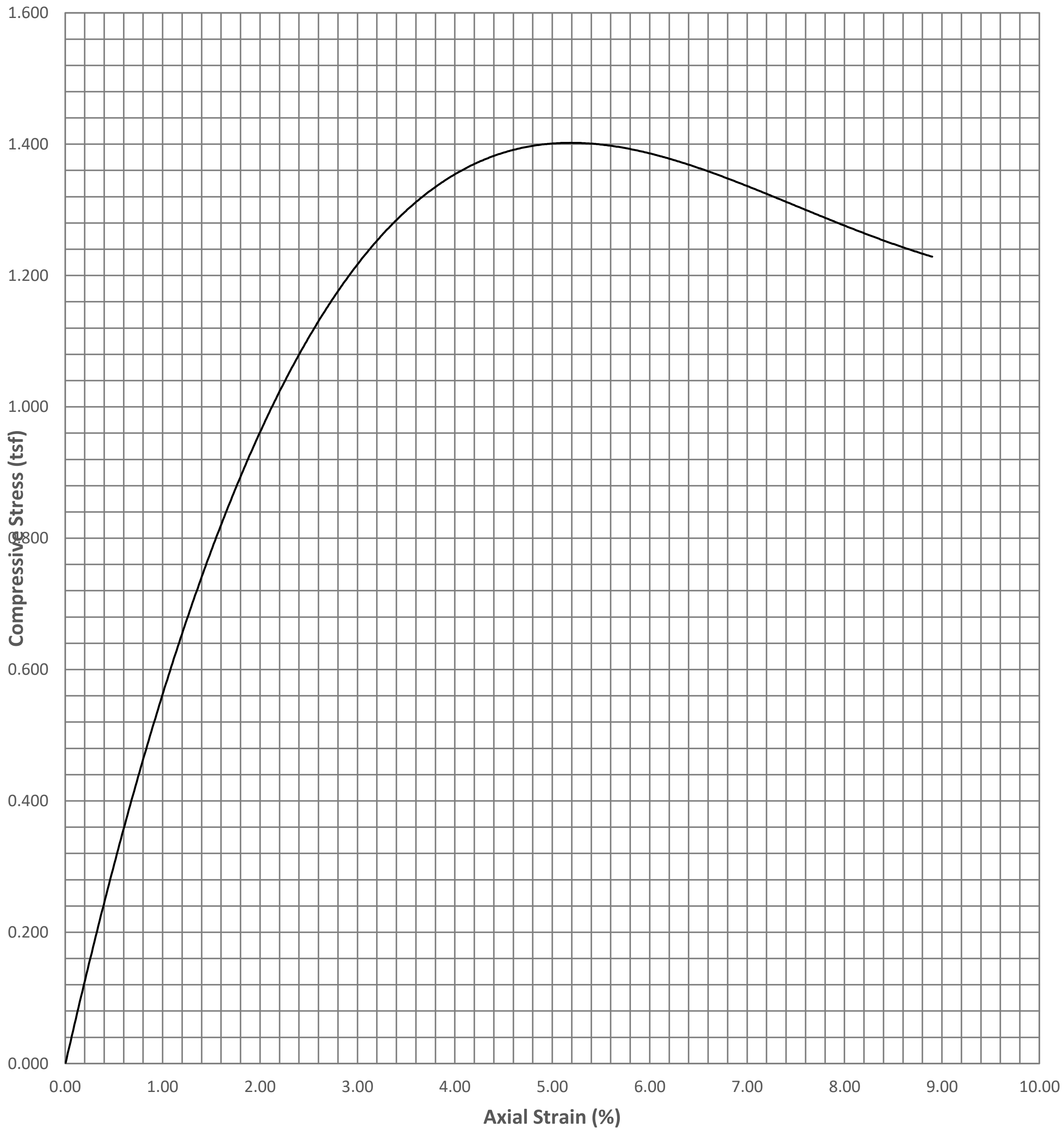
Shear Strength (tsf): 0.70

Average Strain Rate (%/min): 3.11

Strain At Failure (%): 5.34

Soil Classification: CL SANDY LEAN CLAY

General



Project
B1806731

Sample
B-04 62'-64'

Date
8/10/2018

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The Science You Build On.

Unconfined Compression

ASTM D2166

Sample 202975
8/14/2018

526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Client:

Otter Tail Power Company
215 S CascadeP.O. Box 496
Fergus Falls, MN 56538

Project:

B1806731
Astoria Station
19333 482nd Avenue
Astoria, SD 57213

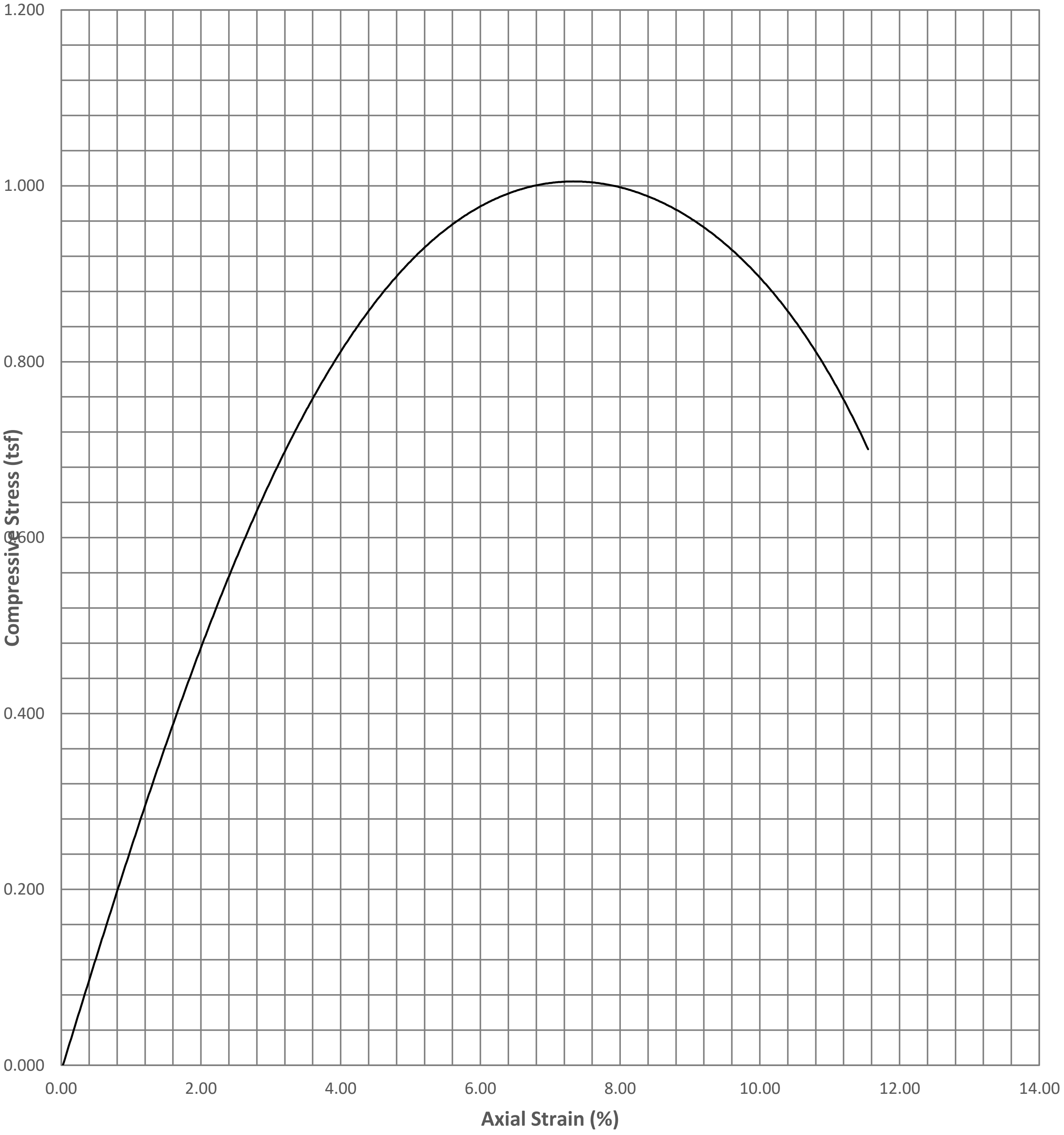
Sample Information

Sample Number:	202975	**Sample From:**	Boring
Sampling Method:	Thinwall Tube ASTM D1587	**Sampled By:**	Miller, Kevin
Location Details:	B-04 91'-93'		
Sample Date:	07/25/2018		
Received Date:	07/26/2018	**Lab:**	526 10th Street NE, Suite 300, West Fargo, ND, 58078
Tested Date:	08/11/2018		

Laboratory Data

Average Diameter (in):	1.877	**Average Length (in):**	3.680
Height to Diameter Ratio:	1.96	**Specimen Type:**	Intact
Wet Density (pcf):	132.0	**Dry Density (pcf):**	112.2
Moisture Content (%):	17.6	**Moisture Specimen:**	Entire sample after shear
Unconfined Compressive Strength (tsf):	1.01	**Shear Strength (tsf):**	0.51
Strain At Failure (%):	8.15	**Average Strain Rate (%/min):**	2.21
Soil Classification:	CL SANDY LEAN CLAY		

General

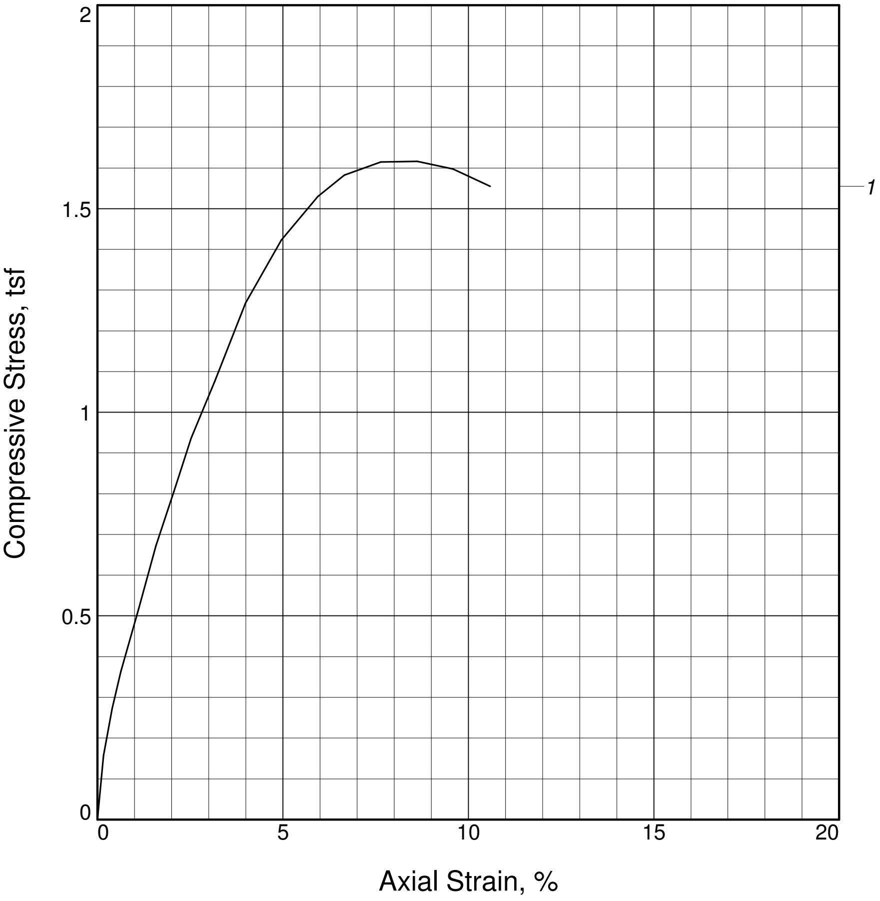


Project
B1806731

Sample
B-04 91'-93'

Date
8/11/2018

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.616			
Undrained shear strength, tsf	0.808			
Failure strain, %	8.6			
Strain rate, %/min.	1.00			
Water content, %	15.2			
Wet density, pcf	137.9			
Dry density, pcf	119.8			
Saturation, %	100.0			
Void ratio	0.4098			
Specimen diameter, in.	2.853			
Specimen height, in.	5.591			
Height/diameter ratio	1.96			

Description: SANDY LEAN CLAY, brown (CL)

LL = 30	**PL =** 12	**PI =** 18	**Assumed GS=** 2.705	**Type:** Thinwall

Project No.: B1806731

Date Sampled:

Remarks:
ASTM D 2166

Figure _______

Client: Otter Tail Power Company

Project: Astoria Station
19333 482nd Ave, Astoria, SD

Sample Number: B-05 **Depth:** 32-34'

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Unconfined Compression

ASTM D2166

Sample 202977
8/21/2018

526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Client:

Otter Tail Power Company
215 S CascadeP.O. Box 496
Fergus Falls, MN 56538

Project:

B1806731
Astoria Station
19333 482nd Avenue
Astoria, SD 57213

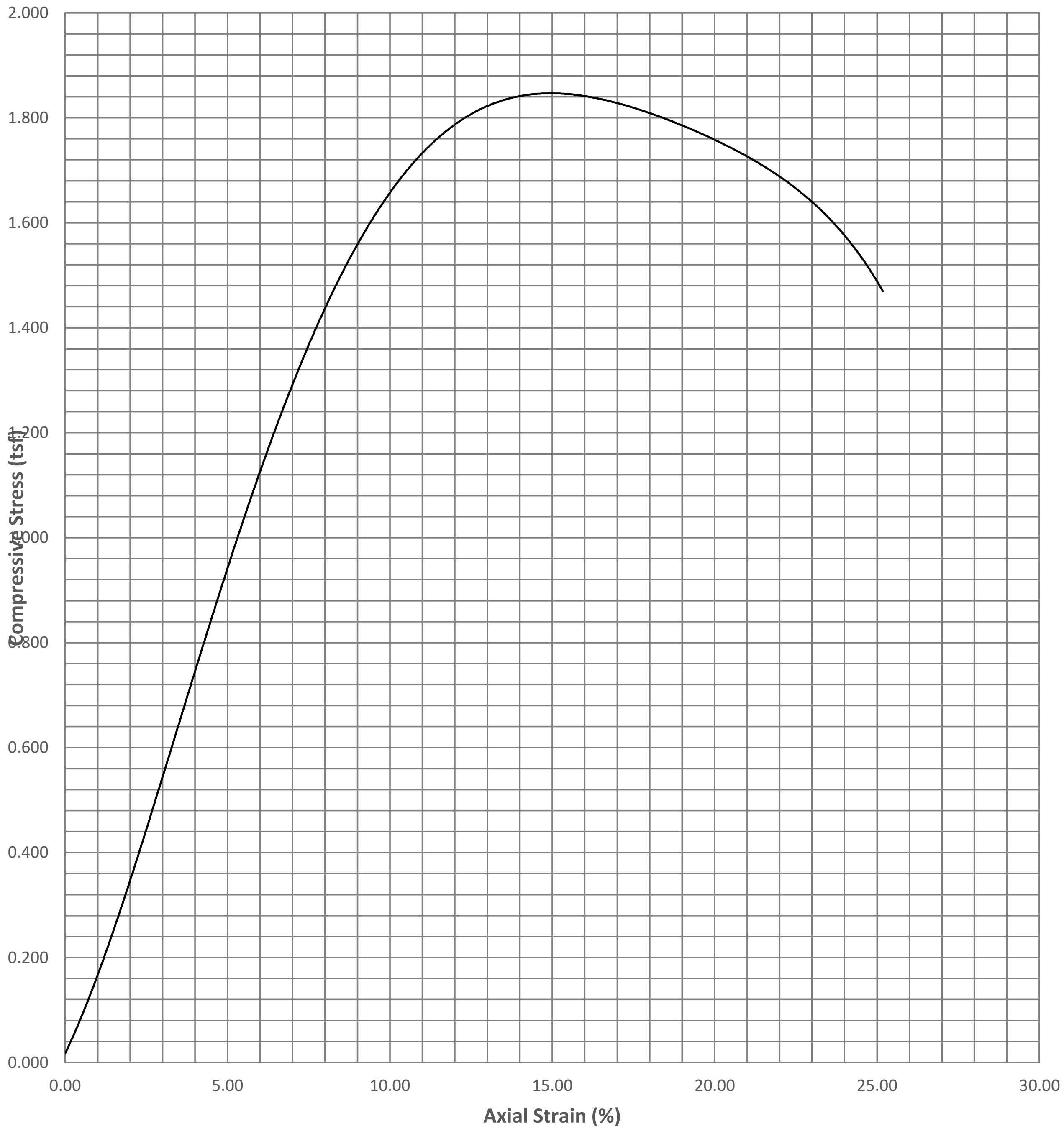
Sample Information

Sample Number:	202977	**Sample From:**	Boring
Sampling Method:	Thinwall Tube ASTM D1587	**Sampled By:**	Miller, Kevin
Location Details:	B-05 47'-49'		
Sample Date:	07/30/2018		
Received Date:	07/31/2018	**Lab:**	526 10th Street NE, Suite 300, West Fargo, ND, 58078
Tested Date:	08/09/2018		

Laboratory Data

Average Diameter (in):	1.930	**Average Length (in):**	3.972
Height to Diameter Ratio:	2.06	**Specimen Type:**	Intact
Wet Density (pcf):	132.7	**Dry Density (pcf):**	115.5
Moisture Content (%):	14.9	**Moisture Specimen:**	Entire sample after shear
Unconfined Compressive Strength (tsf):	1.84	**Shear Strength (tsf):**	0.92
Strain At Failure (%):	17.62	**Average Strain Rate (%/min):**	3.75
Soil Classification:	CL SANDY LEAN CLAY		

General



Project
B1806731

Sample
B-05 47'-49'

Date
8/9/2018

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Unconfined Compression

ASTM D2166

526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Client:

Otter Tail Power Company
215 S CascadeP.O. Box 496
Fergus Falls, MN 56538

Project:

B1806731
Astoria Station
19333 482nd Avenue
Astoria, SD 57213

Sample Information

Sample Number: 202978

Sample From: Boring

Sampling Method: Thinwall Tube ASTM D1587

Sampled By: Bevre, Gabriel

Location Details: B-07 44'-46'

Sample Date: 07/25/2018

Received Date: 07/26/2018

Lab: 526 10th Street NE, Suite 300, West Fargo, ND, 58078

Tested Date: 08/10/2018

Laboratory Data

Average Diameter (in): 1.876

Average Length (in): 3.649

Height to Diameter Ratio: 1.95

Specimen Type: Intact

Wet Density (pcf): 137.8

Dry Density (pcf): 116.6

Moisture Content (%): 18.2

Moisture Specimen: Entire sample after shear

Unconfined Compressive Strength (tsf): 0.59

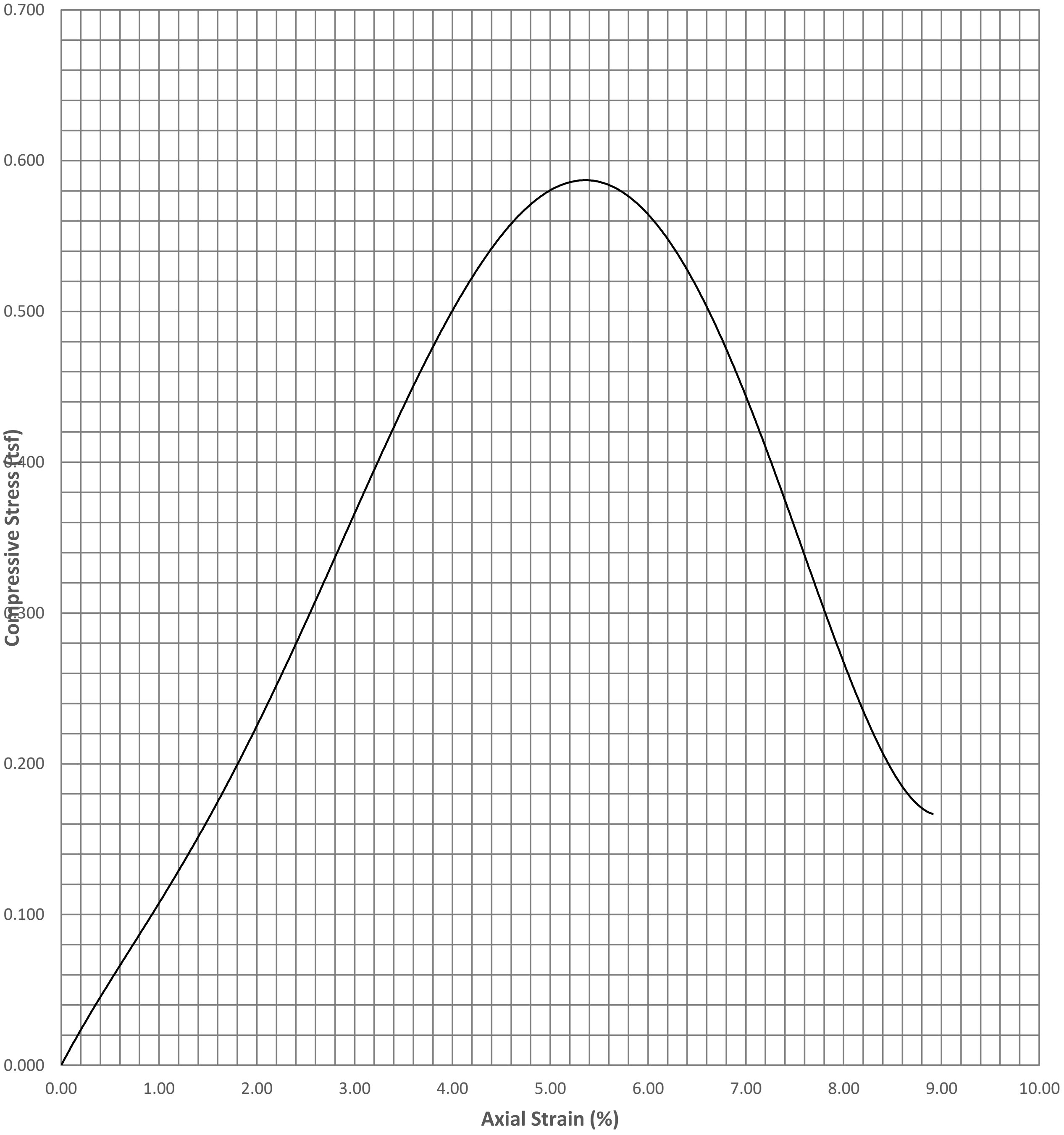
Shear Strength (tsf): 0.29

Average Strain Rate (%/min): 5.32

Strain At Failure (%): 5.48

Soil Classification: CL SANDY LEAN CLAY with layers of Silty Sand

General

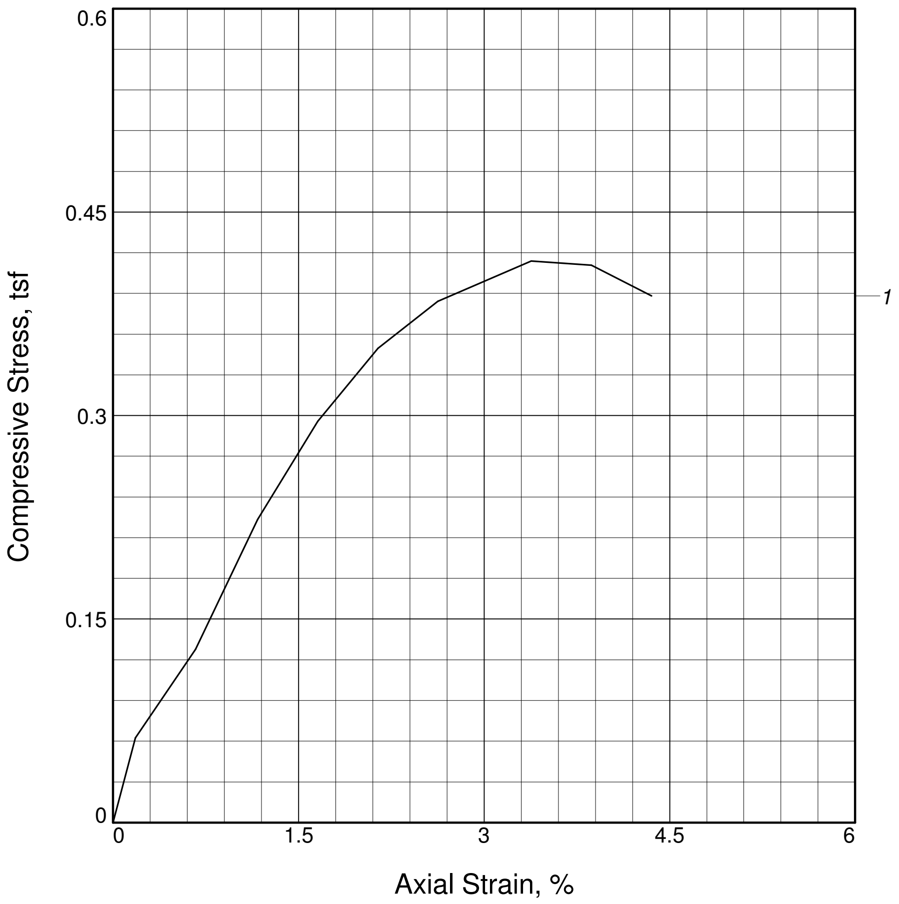


Project
B1806731

Sample
B-07 44'-46'

Date
8/10/2018

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.414			
Undrained shear strength, tsf	0.207			
Failure strain, %	3.4			
Strain rate, %/min.	1.00			
Water content, %	17.6			
Wet density, pcf	134.4			
Dry density, pcf	114.3			
Saturation, %	99.8			
Void ratio	0.4752			
Specimen diameter, in.	2.819			
Specimen height, in.	5.560			
Height/diameter ratio	1.97			

Description: SANDY SILT, brown (ML)

LL = 21	**PL =** 21	**PI =** 0	**Assumed GS=** 2.702	**Type:** Thinwall

Project No.: B1806731
Date Sampled:

Remarks:
ASTM D 2166

Figure _______

Client: Otter Tail Power Company

Project: Astoria Station
19333 482nd Ave, Astoria, SD
Sample Number: B-08 **Depth:** 17-19'

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Unconfined Compression
ASTM D2166

Sample 202979
8/21/2018

526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Client:

Otter Tail Power Company
215 S CascadeP.O. Box 496
Fergus Falls, MN 56538

Project:

B1806731
Astoria Station
19333 482nd Avenue
Astoria, SD 57213

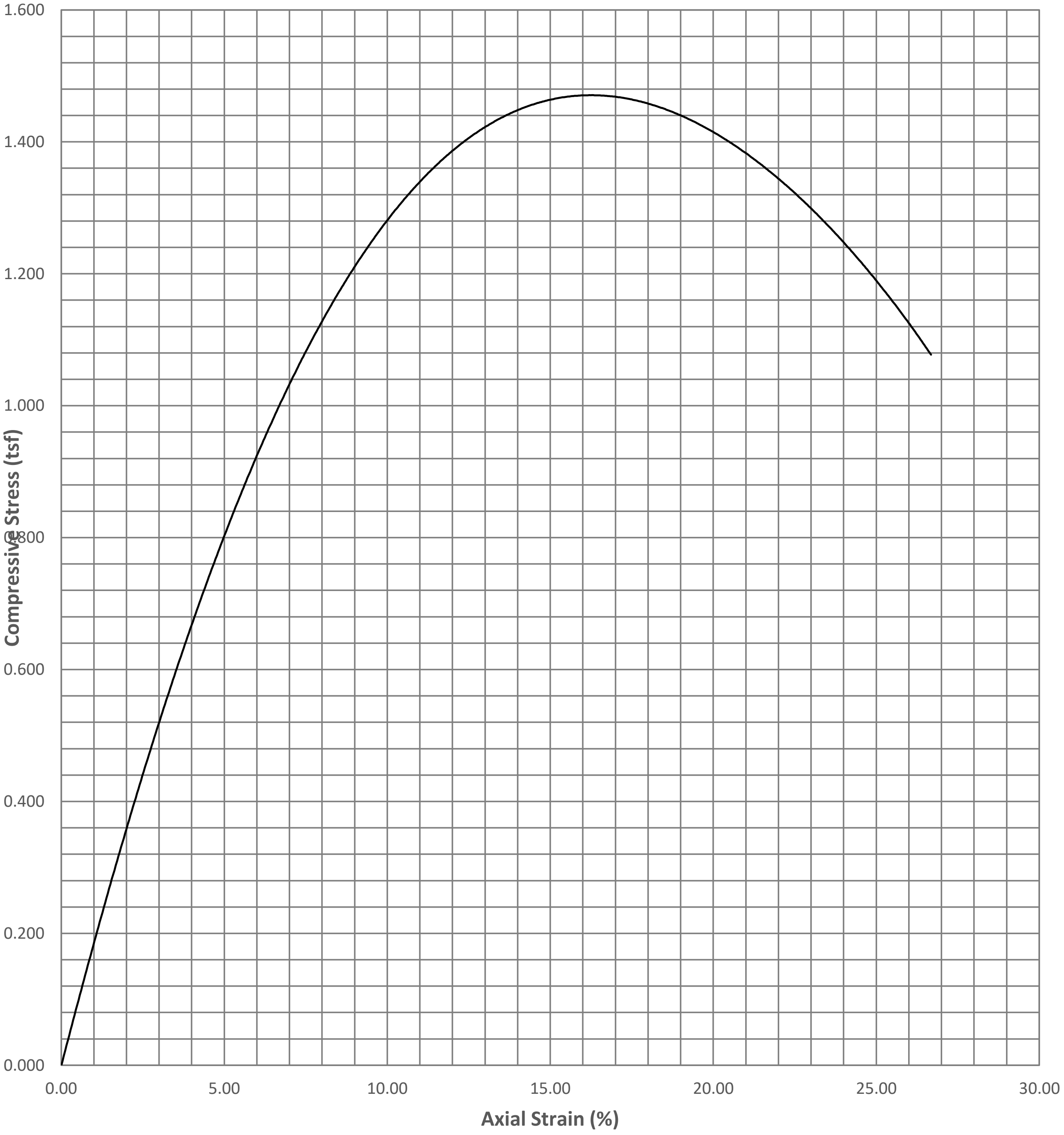
Sample Information

Sample Number:	202979	**Sample From:**	Boring
Sampling Method:	Thinwall Tube ASTM D1587	**Sampled By:**	Miller, Kevin
Location Details:	B-08 34.5'-36.5'		
Sample Date:	07/31/2018		
Received Date:	08/01/2018	**Lab:**	526 10th Street NE, Suite 300, West Fargo, ND, 58078
Tested Date:	08/10/2018		

Laboratory Data

Average Diameter (in):	1.893	**Average Length (in):**	3.748
Height to Diameter Ratio:	1.98	**Specimen Type:**	Intact
Wet Density (pcf):	133.0	**Dry Density (pcf):**	115.6
Moisture Content (%):	15.1	**Moisture Specimen:**	Entire sample after shear
Unconfined Compressive Strength (tsf):	1.48	**Shear Strength (tsf):**	0.74
Strain At Failure (%):	17.34	**Average Strain Rate (%/min):**	4.34
Soil Classification:	CL SANDY LEAN CLAY		

General



Project
B1806731

Sample
B-08 34.5'-36.5'

Date
8/10/2018

Unconfined Compression

ASTM D2166

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526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Client:	**Project:**
Otter Tail Power Company 215 S CascadeP.O. Box 496 Fergus Falls, MN 56538	B1806731 Astoria Station 19333 482nd Avenue Astoria, SD 57213

Sample Information

Sample Number: 202980

Sample From: Boring

Sampling Method: Thinwall Tube ASTM D1587

Sampled By: Miller, Kevin

Location Details: B-08 49.5'-50.5'

Sample Date: 07/31/2018

Received Date: 08/01/2018

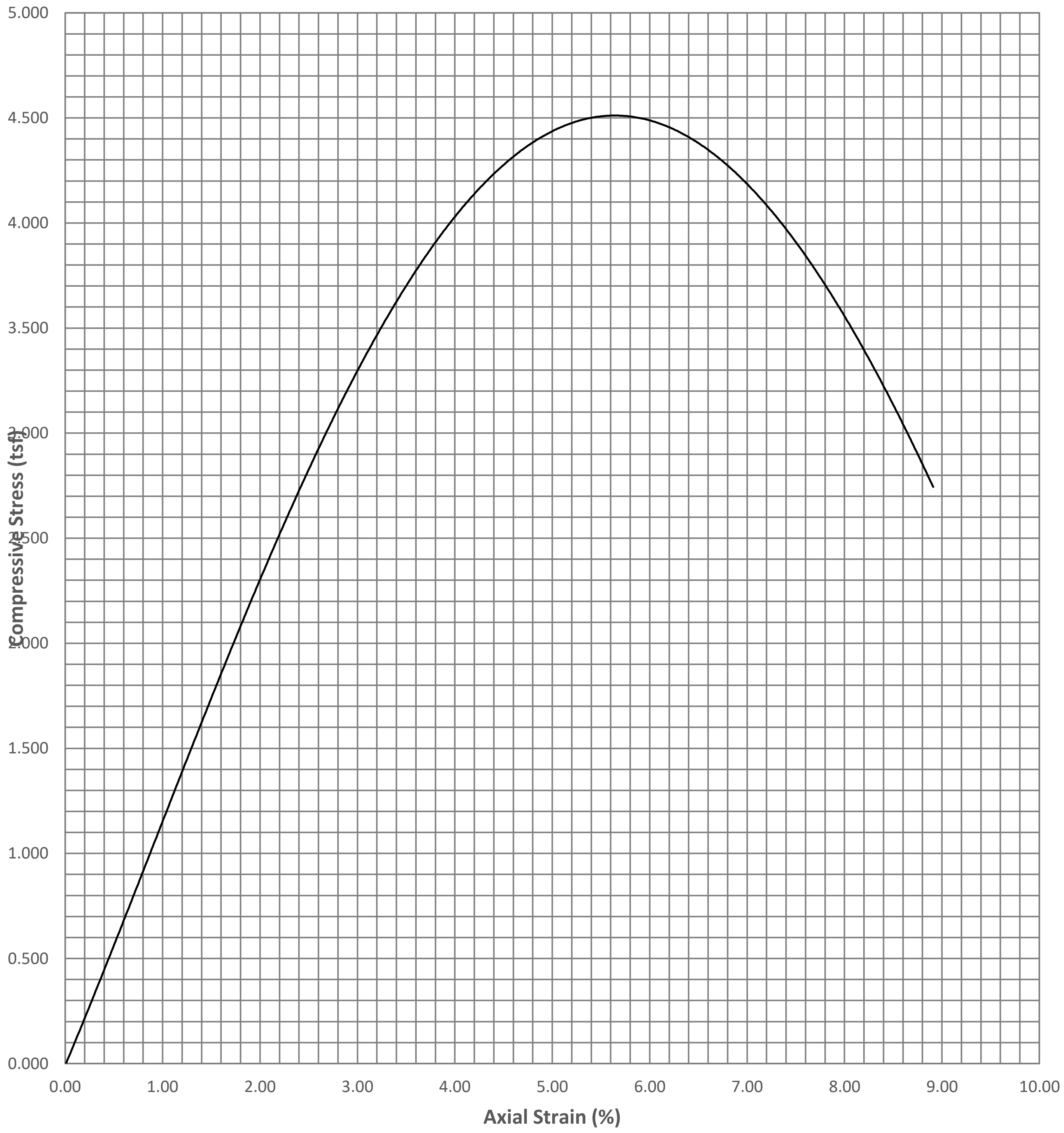
Lab: 526 10th Street NE, Suite 300, West Fargo, ND, 58078

Tested Date: 08/11/2018

Laboratory Data

Average Diameter (in):	2.880	**Average Length (in):**	5.613
Height to Diameter Ratio:	1.95	**Specimen Type:**	Intact
Wet Density (pcf):	135.1	**Dry Density (pcf):**	117.6
Moisture Content (%):	14.9	**Moisture Specimen:**	Entire sample after shear
Unconfined Compressive Strength (tsf):	4.51	**Shear Strength (tsf):**	2.25
Strain At Failure (%):	5.34	**Average Strain Rate (%/min):**	1.20
Soil Classification:	CL SANDY LEAN CLAY		

General

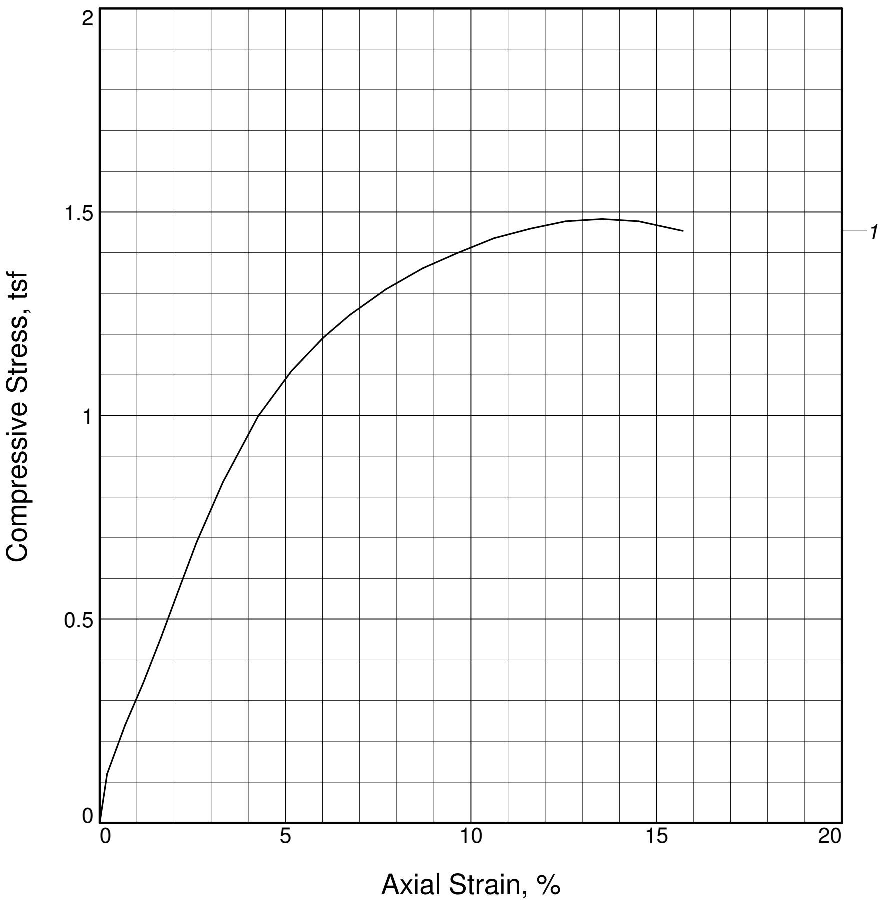


Project
B1806731

Sample
B-08 49.5'-50.5'

Date
8/11/2018

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.483			
Undrained shear strength, tsf	0.741			
Failure strain, %	13.5			
Strain rate, %/min.	1.00			
Water content, %	15.7			
Wet density, pcf	136.8			
Dry density, pcf	118.2			
Saturation, %	100.0			
Void ratio	0.4218			
Specimen diameter, in.	2.855			
Specimen height, in.	5.600			
Height/diameter ratio	1.96			

Description: SANDY LEAN CLAY, brown (CL)

LL = 30	**PL =** 12	**PI =** 18	**Assumed GS=** 2.693	**Type:** Thinwall

Project No.: B1806731

Date Sampled:

Remarks:

Client: Otter Tail Power Company

Project: Astoria Station
19333 482nd Ave, Astoria, SD

Sample Number: B-10 **Depth:** 32-34'

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Figure _______

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Unconfined Compression

ASTM D2166

Sample 202981
8/21/2018

526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Client:	**Project:**
Otter Tail Power Company 215 S CascadeP.O. Box 496 Fergus Falls, MN 56538	B1806731 Astoria Station 19333 482nd Avenue Astoria, SD 57213

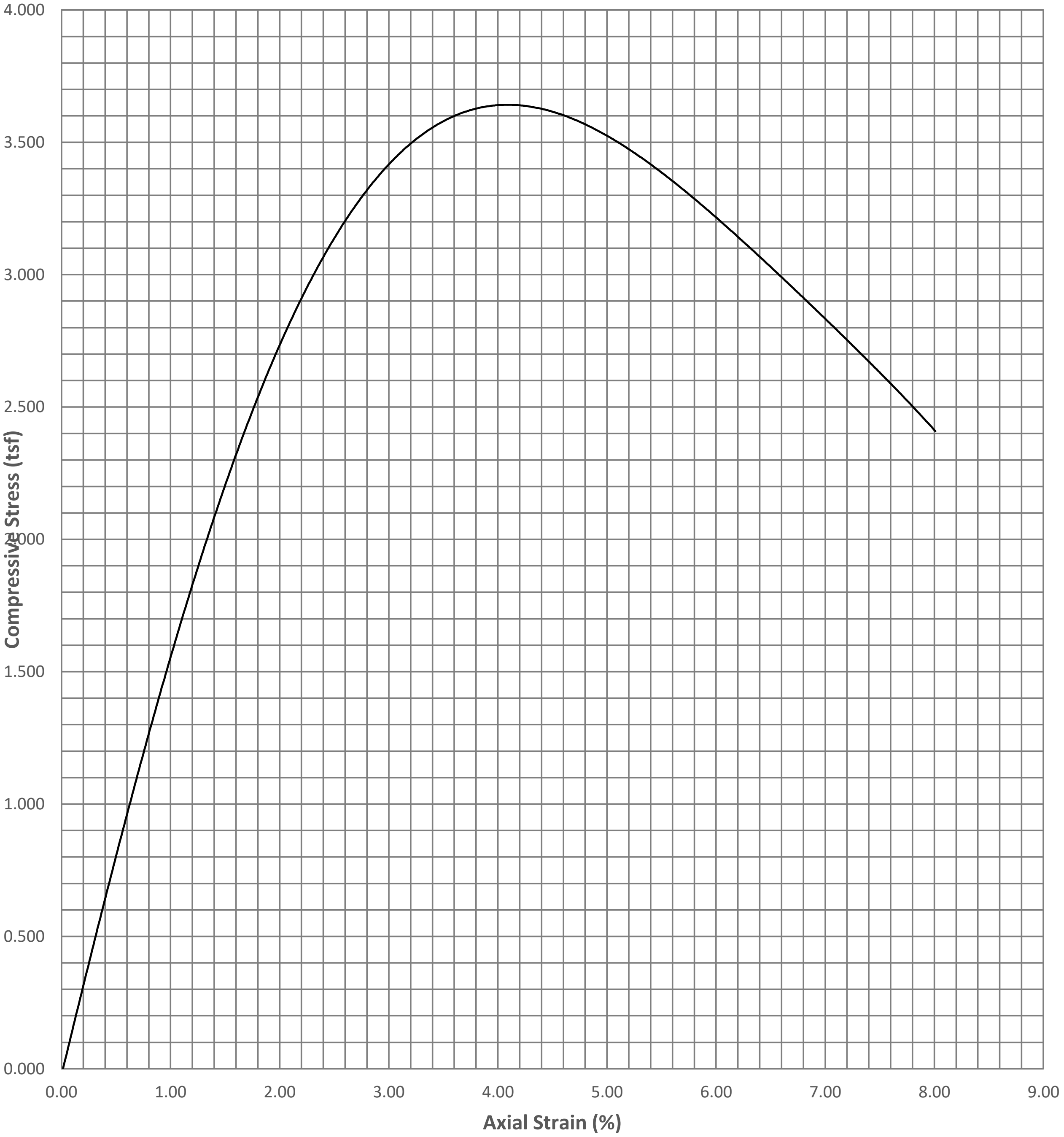
Sample Information

Sample Number:	202981	**Sample From:**	Boring
Sampling Method:	Thinwall Tube ASTM D1587	**Sampled By:**	Miller, Kevin
Location Details:	B-10 47'-49'		
Sample Date:	07/25/2018		
Received Date:	07/26/2018	**Lab:**	526 10th Street NE, Suite 300, West Fargo, ND, 58078
Tested Date:	08/11/2018		

Laboratory Data

Average Diameter (in):	2.870	**Average Length (in):**	5.620
Height to Diameter Ratio:	1.96	**Specimen Type:**	Intact
Wet Density (pcf):	133.9	**Dry Density (pcf):**	114.0
Moisture Content (%):	17.5	**Moisture Specimen:**	Entire sample after shear
Unconfined Compressive Strength (tsf):	3.57	**Shear Strength (tsf):**	1.78
Strain At Failure (%):	4.45	**Average Strain Rate (%/min):**	1.19
Soil Classification:	CL SANDY LEAN CLAY		

General

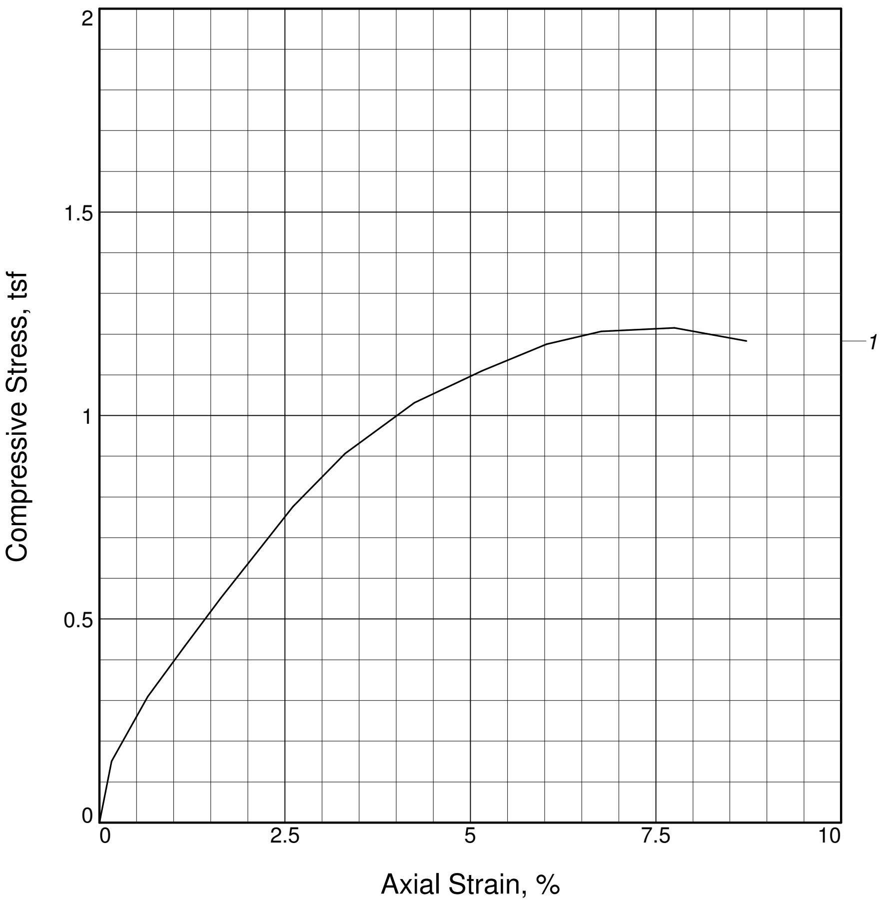


Project B1806731

Sample B-10 47'-49'

Date 8/11/2018

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	1.216			
Undrained shear strength, tsf	0.608			
Failure strain, %	7.8			
Strain rate, %/min.	1.00			
Water content, %	20.2			
Wet density, pcf	128.5			
Dry density, pcf	106.9			
Saturation, %	93.8			
Void ratio	0.5853			
Specimen diameter, in.	2.840			
Specimen height, in.	5.560			
Height/diameter ratio	1.96			

Description: SANDY LEAN CLAY, brown (CL)

LL = 28 | **PL =** 16 | **PI =** 12 | **Assumed GS=** 2.715 | **Type:** Thinwall

Project No.: B1806731

Date Sampled:

Remarks:
ASTM D 2166

Figure _______

Client: Otter Tail Power Company

Project: Astoria Station
19333 482nd Ave, Astoria, SD

Sample Number: B-11 **Depth:** 3-5'

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526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Unconfined Compression
ASTM D2166

Sample 202982
8/23/2018

Client:	**Project:**
Otter Tail Power Company 215 S CascadeP.O. Box 496 Fergus Falls, MN 56538	B1806731 Astoria Station 19333 482nd Avenue Astoria, SD 57213

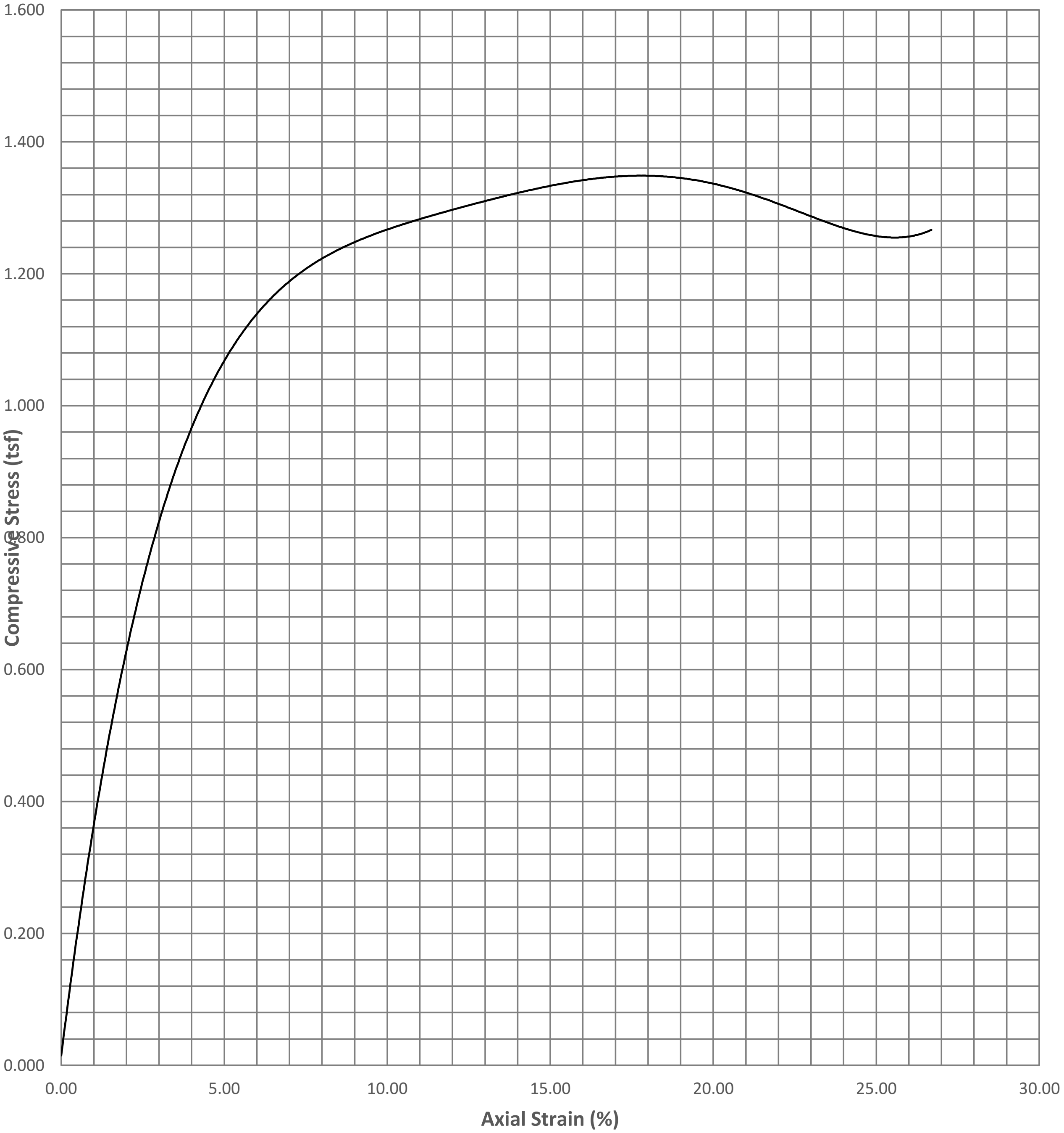
Sample Information

Sample Number:	202982	**Sample From:**	Boring
Sampling Method:	Thinwall Tube ASTM D1587	**Sampled By:**	Miller, Kevin
Location Details:	B-11 58'-59'		
Sample Date:	07/31/2018		
Received Date:	08/01/2018	**Lab:**	526 10th Street NE, Suite 300, West Fargo, ND, 58078
Tested Date:	08/10/2018		

Laboratory Data

Average Diameter (in):	1.895	**Average Length (in):**	3.747
Height to Diameter Ratio:	1.98	**Specimen Type:**	Intact
Wet Density (pcf):	128.8	**Dry Density (pcf):**	110.2
Moisture Content (%):	16.9	**Moisture Specimen:**	Entire sample after shear
Unconfined Compressive Strength (tsf):	1.36	**Shear Strength (tsf):**	0.68
Strain At Failure (%):	20.02	**Average Strain Rate (%/min):**	5.05
Soil Classification:	CL LEAN CLAY		

General

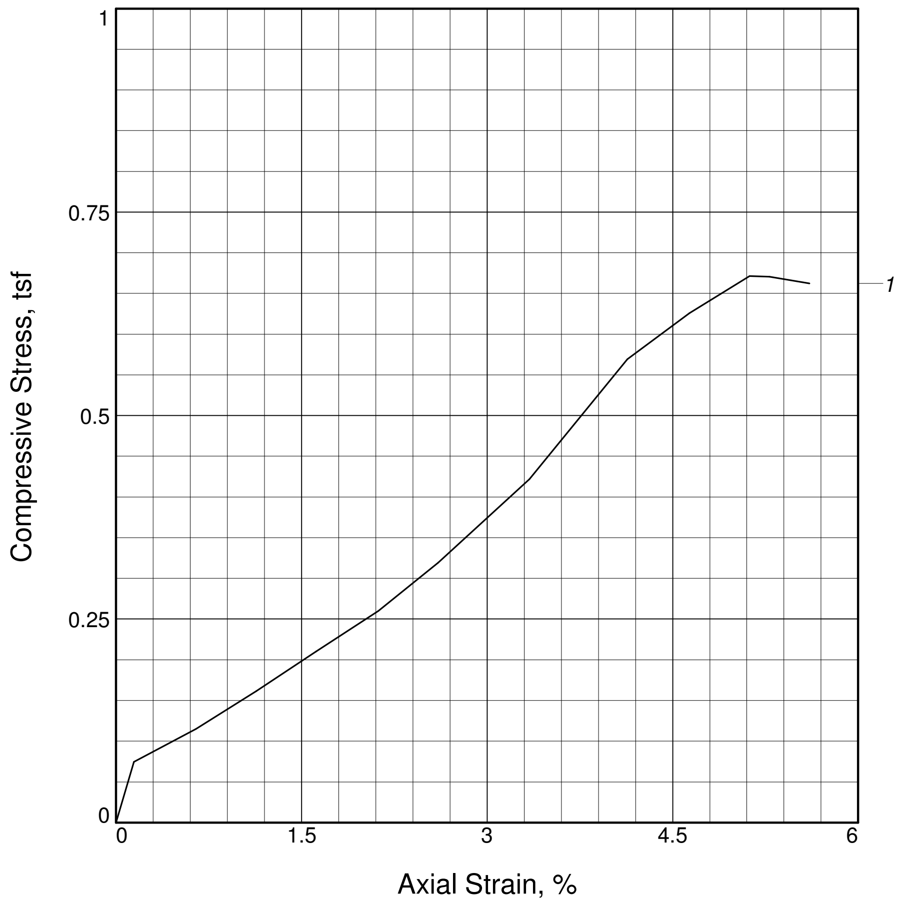


Project
B1806731

Sample
B-11 58'-59'

Date
8/10/2018

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, tsf	0.671			
Undrained shear strength, tsf	0.336			
Failure strain, %	5.1			
Strain rate, %/min.	1.00			
Water content, %	19.3			
Wet density, pcf	131.9			
Dry density, pcf	110.6			
Saturation, %	99.8			
Void ratio	0.5214			
Specimen diameter, in.	2.817			
Specimen height, in.	5.565			
Height/diameter ratio	1.98			

Description: SANDY, SILTY CLAY, brown (CL-ML)

LL = 23	**PL =** 18	**PI =** 5	**Assumed GS=** 2.695	**Type:** Thinwall

Project No.: B1806731

Date Sampled:

Remarks:
ASTM D 2166

Figure _______

Client: Otter Tail Power Company

Project: Astoria Station
19333 482nd Ave, Astoria, SD

Sample Number: B-12 **Depth:** 29.5-31.5'

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Unconfined Compression

ASTM D2166

526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Client:	**Project:**
Otter Tail Power Company 215 S CascadeP.O. Box 496 Fergus Falls, MN 56538	B1806731 Astoria Station 19333 482nd Avenue Astoria, SD 57213

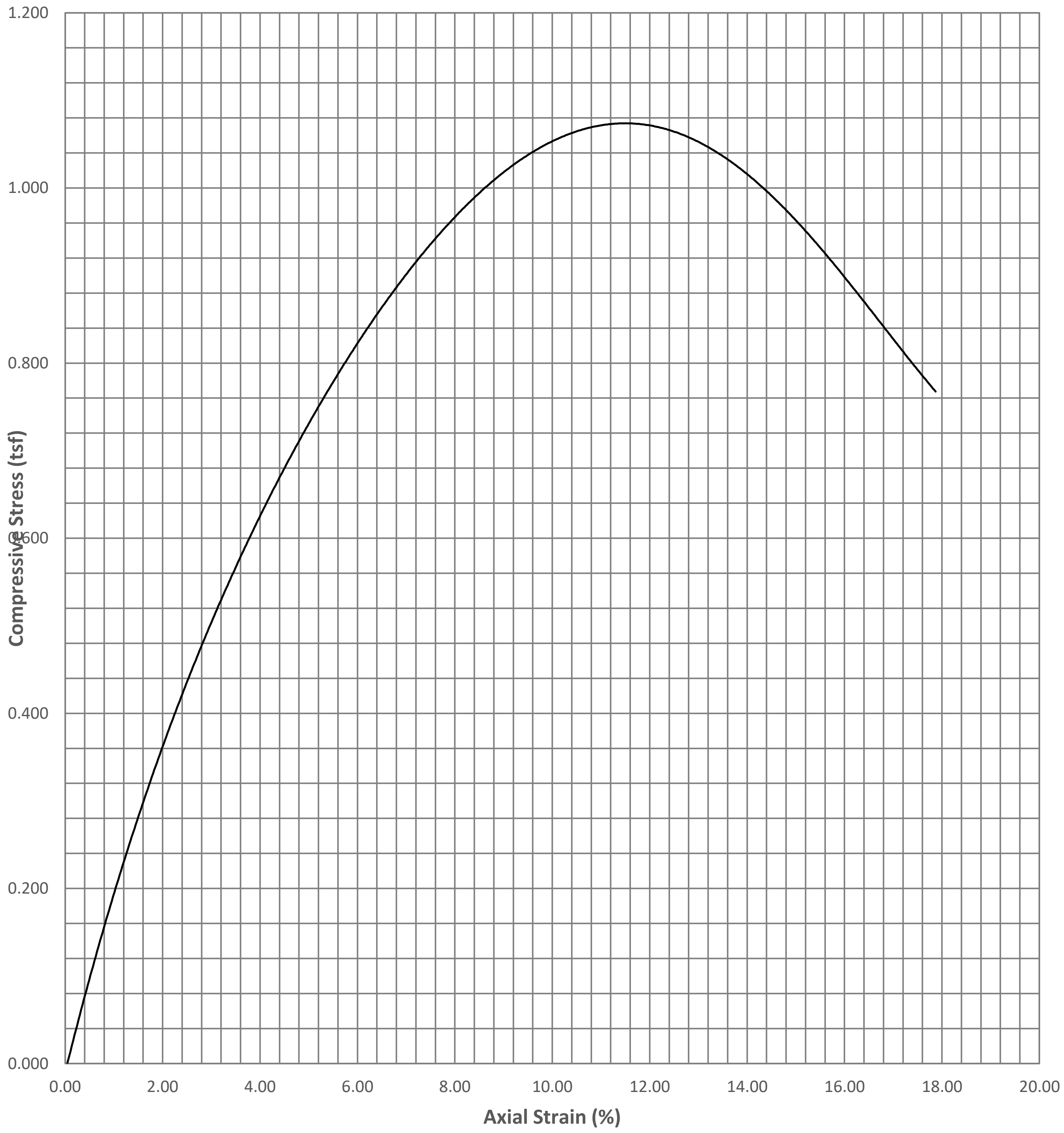
Sample Information

Sample Number:	202983	**Sample From:**	Boring
Sampling Method:	Thinwall Tube ASTM D1587	**Sampled By:**	Miller, Kevin
Location Details:	B-12 39.5'-41.5'		
Sample Date:	07/31/2018		
Received Date:	08/01/2018	**Lab:**	526 10th Street NE, Suite 300, West Fargo, ND, 58078
Tested Date:	08/10/2018		

Laboratory Data

Average Diameter (in):	2.863	**Average Length (in):**	5.595
Height to Diameter Ratio:	1.95	**Specimen Type:**	Intact
Wet Density (pcf):	135.5	**Dry Density (pcf):**	117.9
Moisture Content (%):	14.9	**Moisture Specimen:**	Entire sample after shear
Unconfined Compressive Strength (tsf):	1.07	**Shear Strength (tsf):**	0.54
Strain At Failure (%):	11.62	**Average Strain Rate (%/min):**	2.38
Soil Classification:	CL SANDY LEAN CLAY		

General



Project	B1806731	**Sample**	B-12 39.5'-41.5'	**Date**	8/10/2018

Unconfined Compression

ASTM D2166

526 10th Street NE, Suite 300
PO Box 485
West Fargo, ND 58078
Phone: 701-232-8701

Client:

Otter Tail Power Company
215 S CascadeP.O. Box 496
Fergus Falls, MN 56538

Project:

B1806731
Astoria Station
19333 482nd Avenue
Astoria, SD 57213

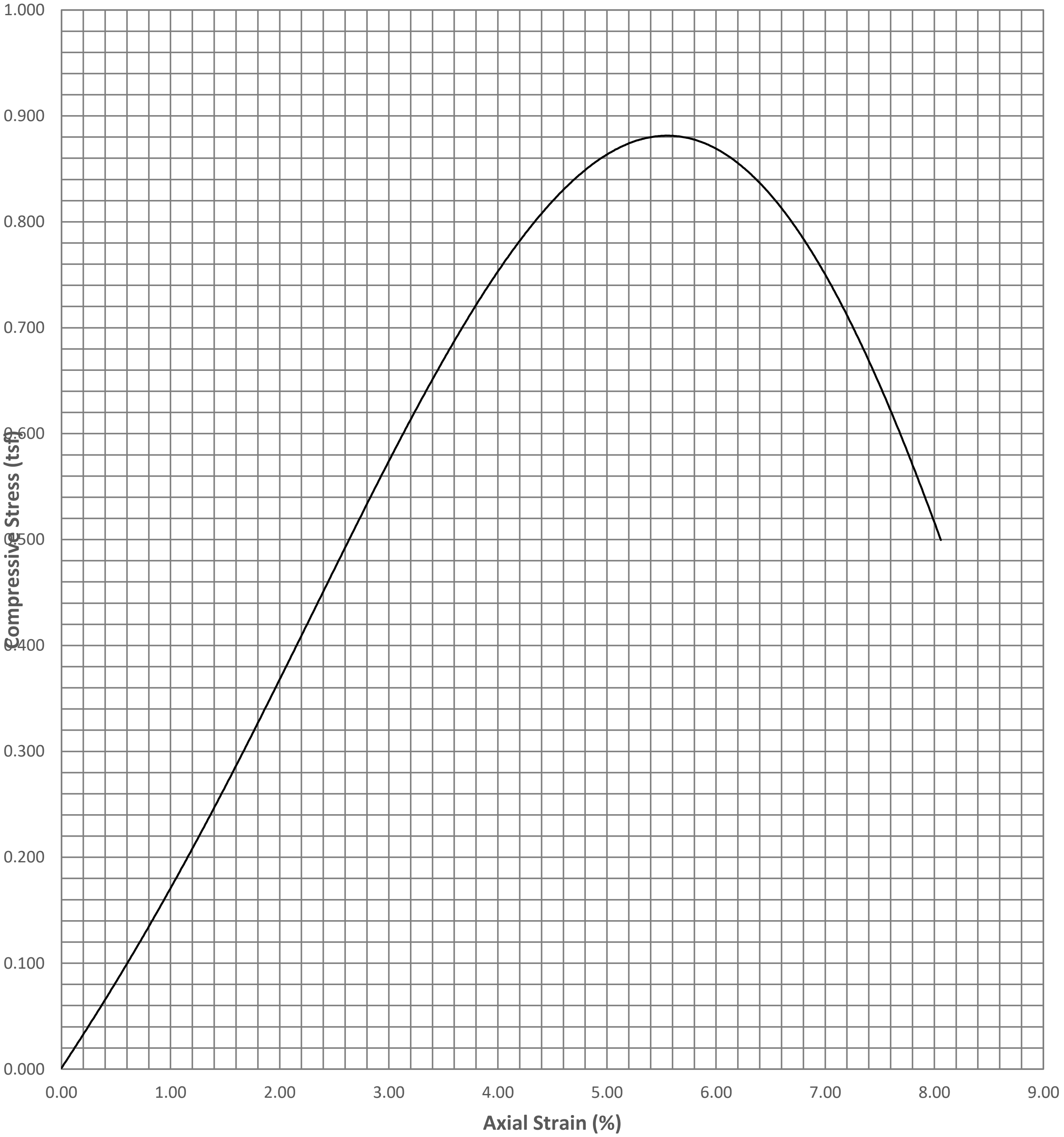
Sample Information

Sample Number:	202984	**Sample From:**	Boring
Sampling Method:	Thinwall Tube ASTM D1587	**Sampled By:**	Miller, Kevin
Location Details:	B-13 6'-8'		
Sample Date:	07/31/2018		
Received Date:	08/01/2018	**Lab:**	526 10th Street NE, Suite 300, West Fargo, ND, 58078
Tested Date:	08/10/2018		

Laboratory Data

Average Diameter (in):	2.866	**Average Length (in):**	5.581
Height to Diameter Ratio:	1.95	**Specimen Type:**	Intact
Wet Density (pcf):	126.3	**Dry Density (pcf):**	103.4
Moisture Content (%):	22.2	**Moisture Specimen:**	Entire sample after shear
Unconfined Compressive Strength (tsf):	0.87	**Shear Strength (tsf):**	0.44
Strain At Failure (%):	5.38	**Average Strain Rate (%/min):**	2.86
Soil Classification:	CL LEAN CLAY		

General

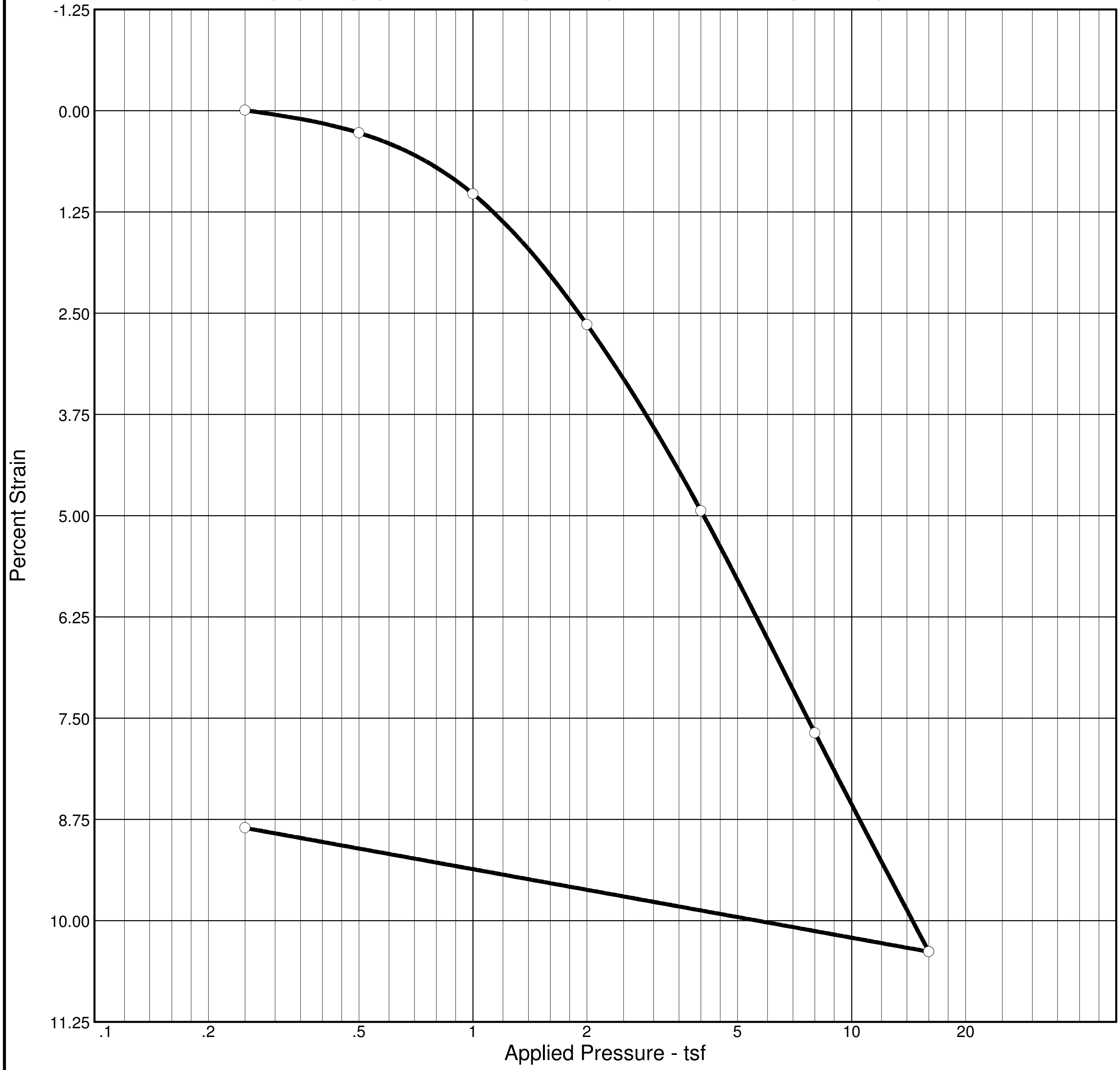


Project
B1806731

Sample
B-13 6'-8'

Date
8/10/2018

CONSOLIDATION / SWELL TESTING



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Swell Press. (tsf)	Swell %	e_o
Sat.	Moist.											
95.8 %	18.8 %	109.9	32	20	2.686		1.44	0.14	0.01			0.525

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY LEAN CLAY, brown (CL)	CL	

Project No. B1806731 **Client:** Otter Tail Power Company

Project: Astoria Station
19333 482nd Ave, Astoria, SD

Source: **Sample No.:** B-04 **Elev./Depth:** 42-44'

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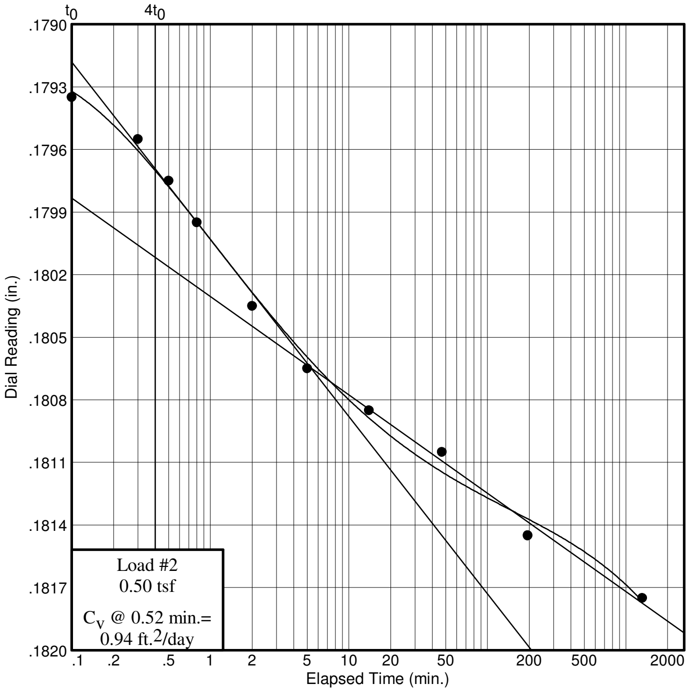
Remarks:

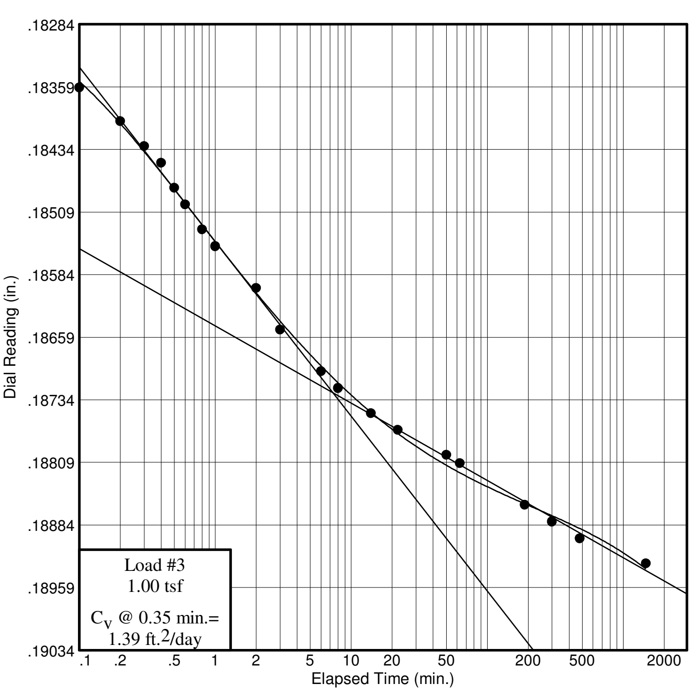
ASTM D 2435

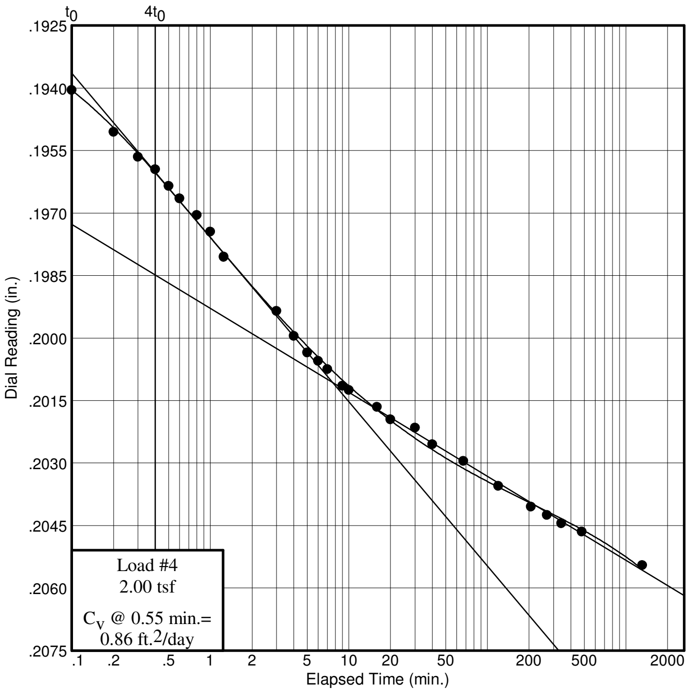
Figure

Dial Reading vs. Time

Project No.: B1806731
Project: Astoria Station
19333 482nd Ave, Astoria, SD
Source:
Sample No.: B-04
Elev./Depth: 42-44'







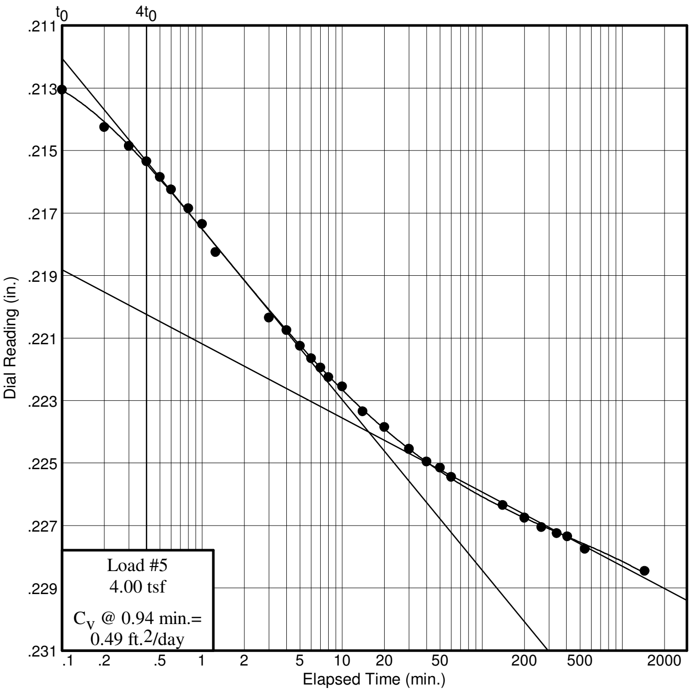


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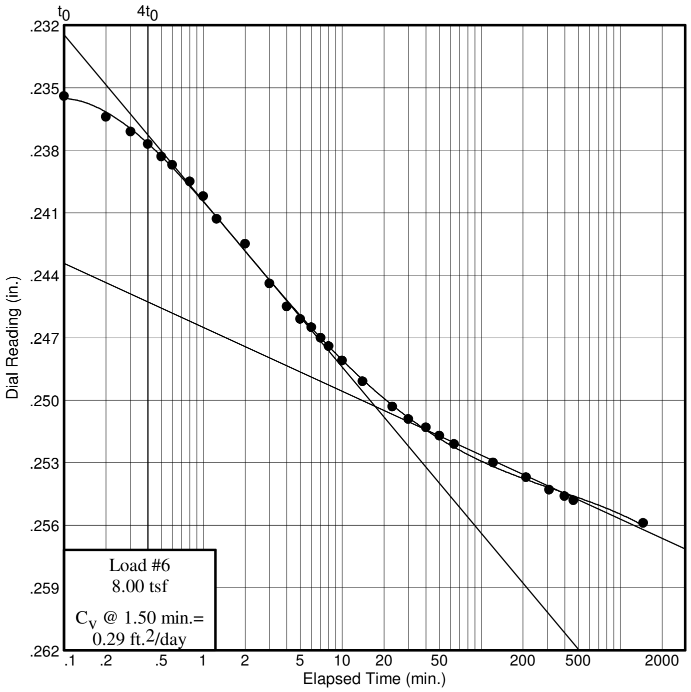
Figure

Dial Reading vs. Time

Project No.: B1806731
Project: Astoria Station
19333 482nd Ave, Astoria, SD
Source: Sample No.: B-04 Elev./Depth: 42-44'



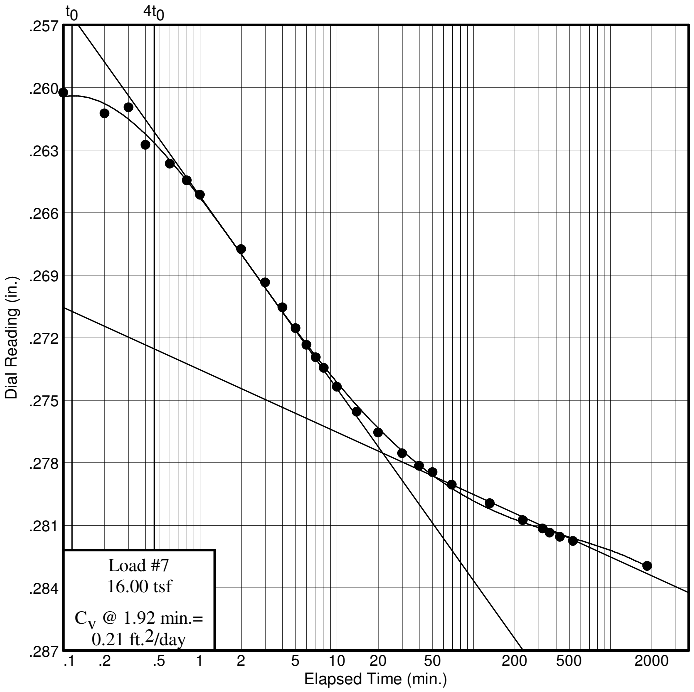


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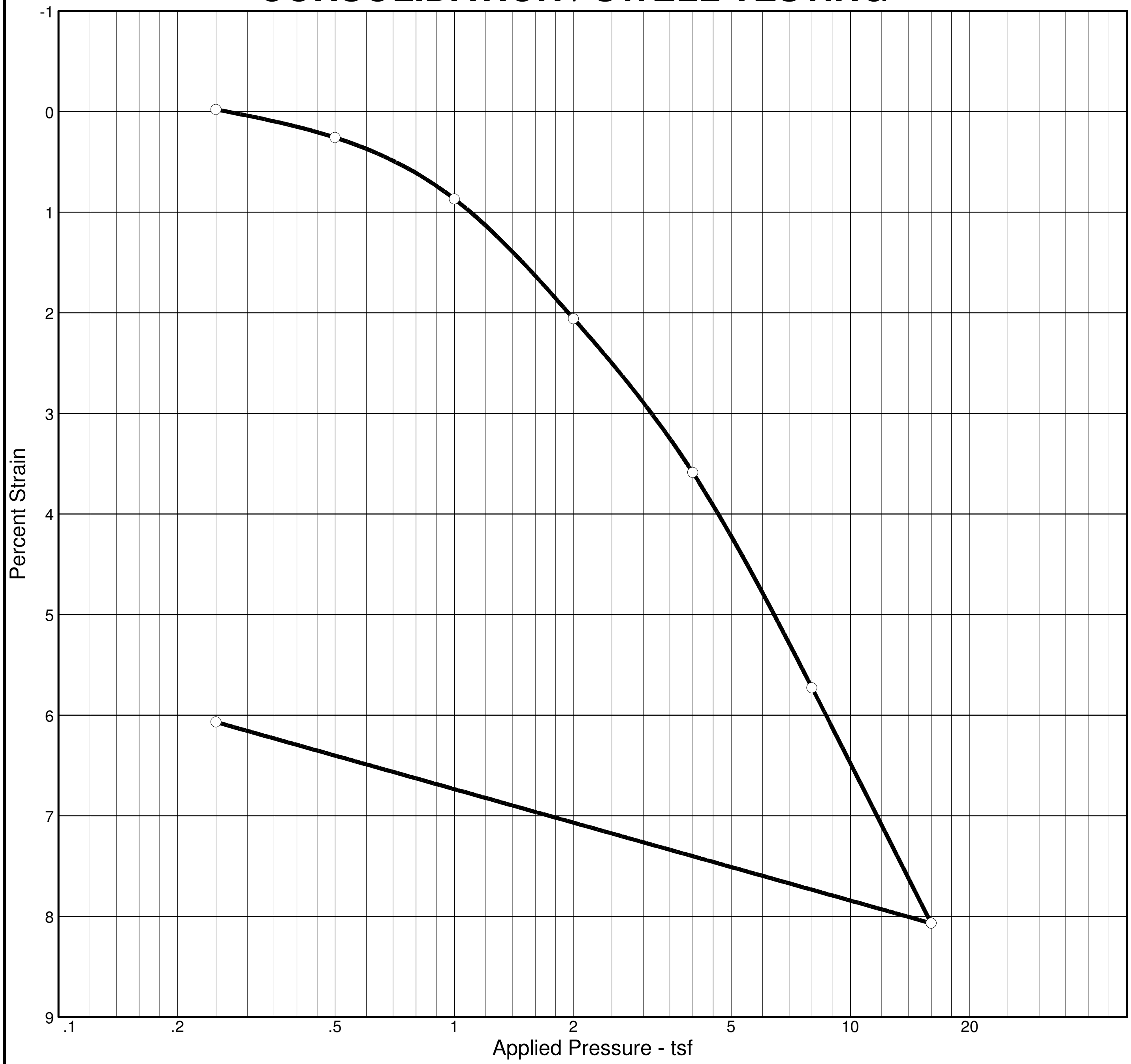
Figure

CONSOLIDATION / SWELL TESTING



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Swell Press. (tsf)	Swell %	e_o
Sat.	Moist.											
95.9 %	16.2 %	115.9	30	18	2.705		1.91	0.11	0.02			0.457

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY LEAN CLAY, brown (CL)	CL	

Project No. B1806731 **Client:** Otter Tail Power Company

Project: Astoria Station
19333 482nd Ave, Astoria, SD

Source: **Sample No.:** B-05 **Elev./Depth:** 32-34'

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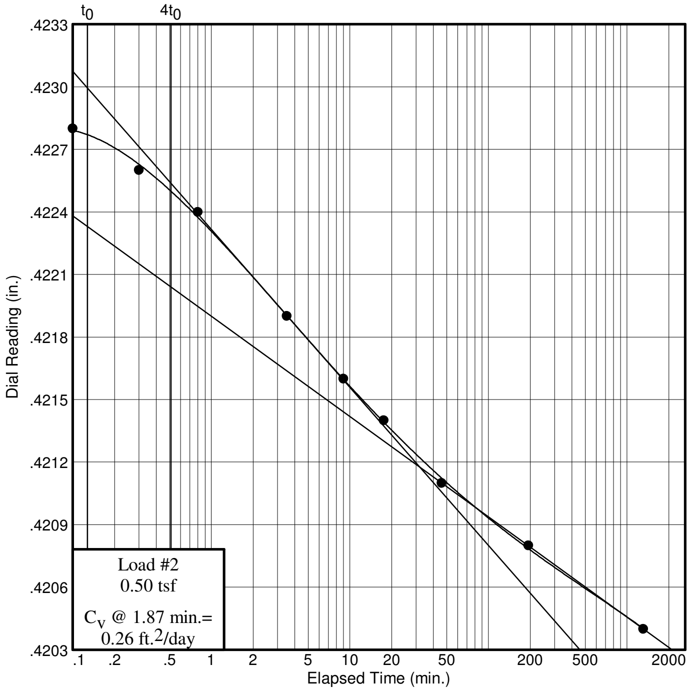
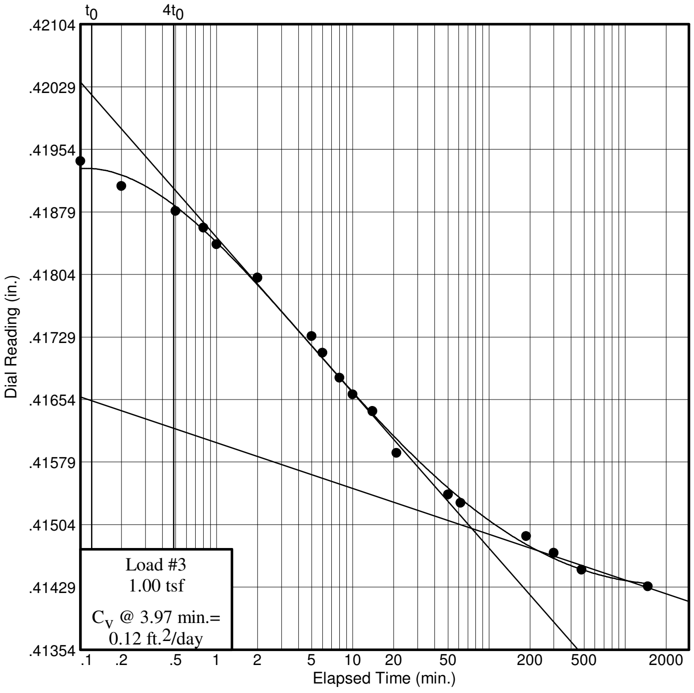
Remarks:
ASTM D 2435

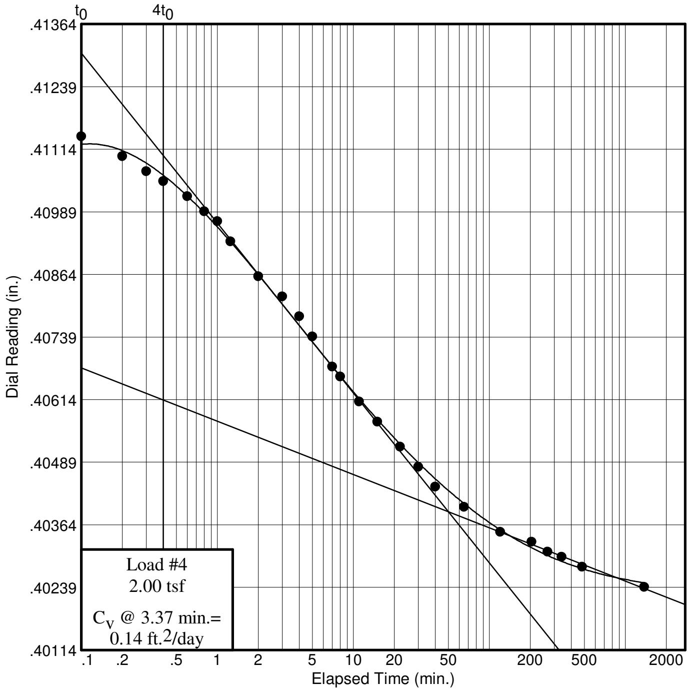
Figure

Dial Reading vs. Time

Project No.: B1806731
Project: Astoria Station
19333 482nd Ave, Astoria, SD
Source:
Sample No.: B-05
Elev./Depth: 32-34'







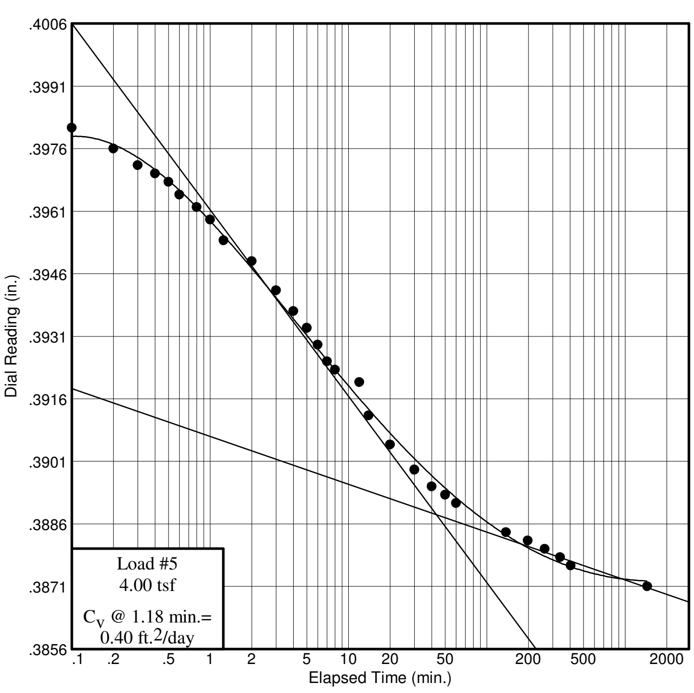


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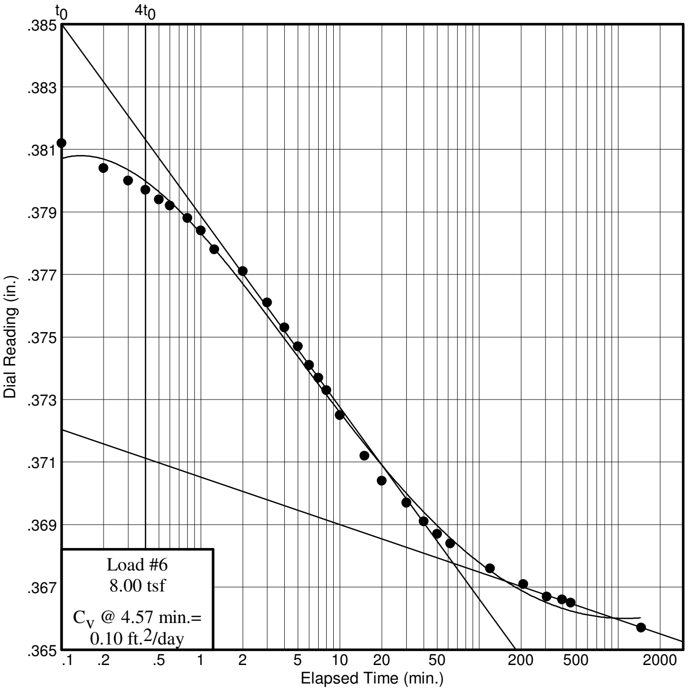
Figure

Dial Reading vs. Time

Project No.: B1806731
Project: Astoria Station
19333 482nd Ave, Astoria, SD
Source:
Sample No.: B-05
Elev./Depth: 32-34'



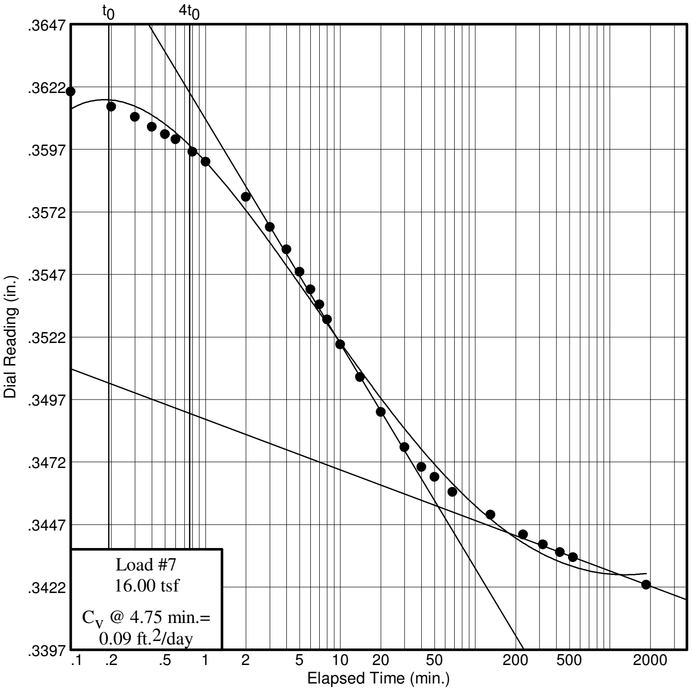


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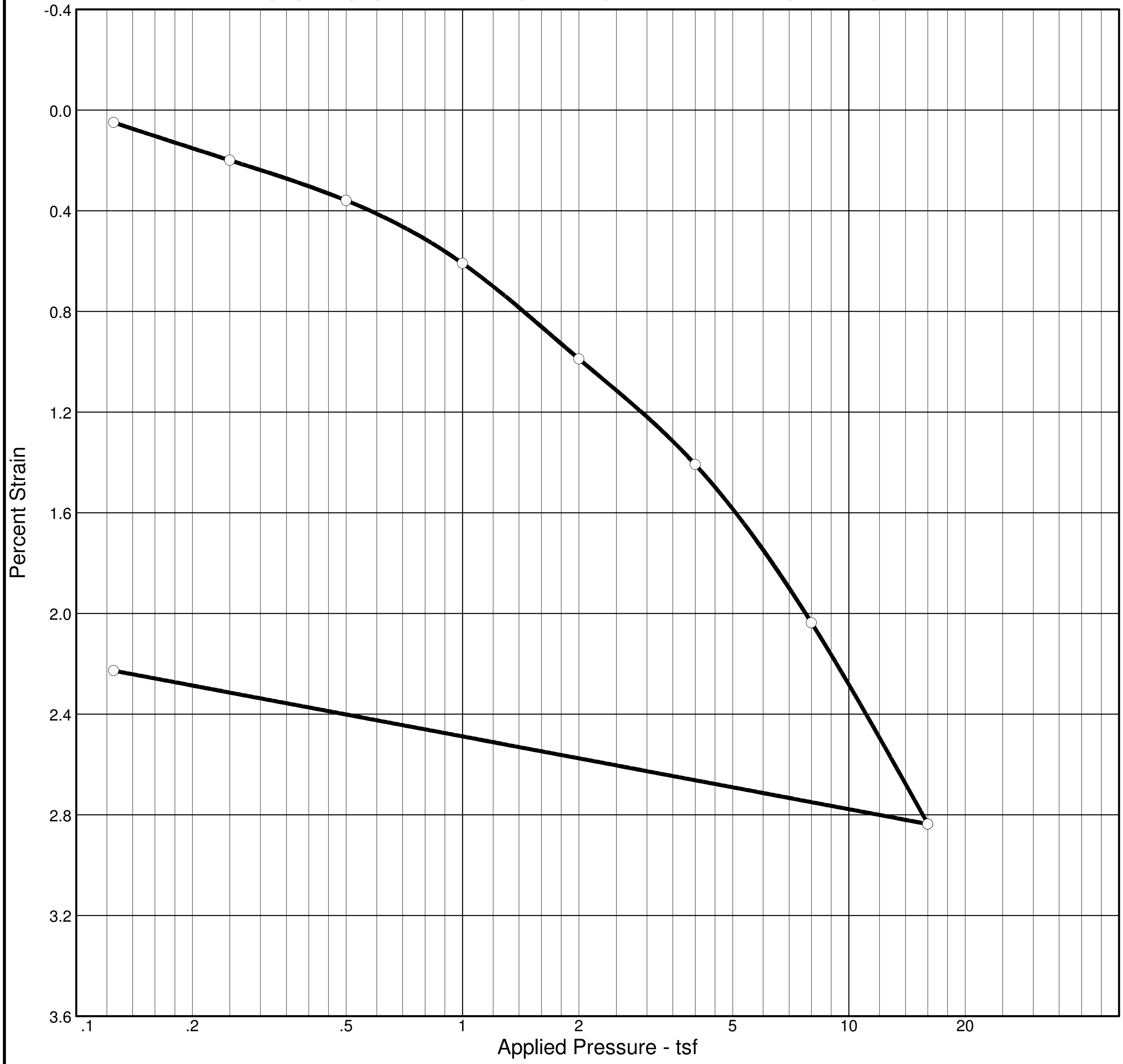
Figure

CONSOLIDATION / SWELL TESTING



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Swell Press. (tsf)	Swell %	e_o
Sat.	Moist.											
99.8 %	19.3 %	110.8	21	0	2.702		2.35	0.04	0.00			0.523

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY SILT, brown (ML)	ML	

Project No. B1806731 **Client:** Otter Tail Power Company

Project: Astoria Station
19333 482nd Ave, Astoria, SD

Source: **Sample No.:** B-08 **Elev./Depth:** 17-19'

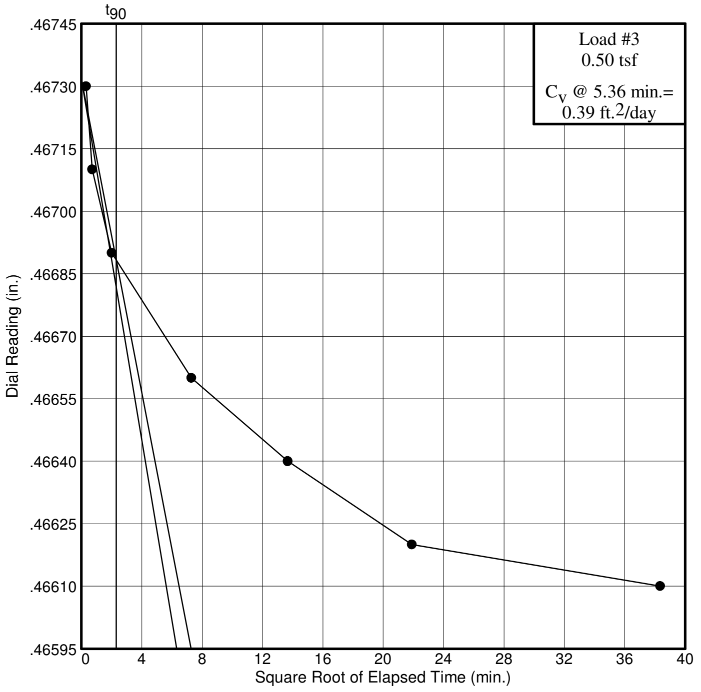
BRAUN℠
INTERTEC

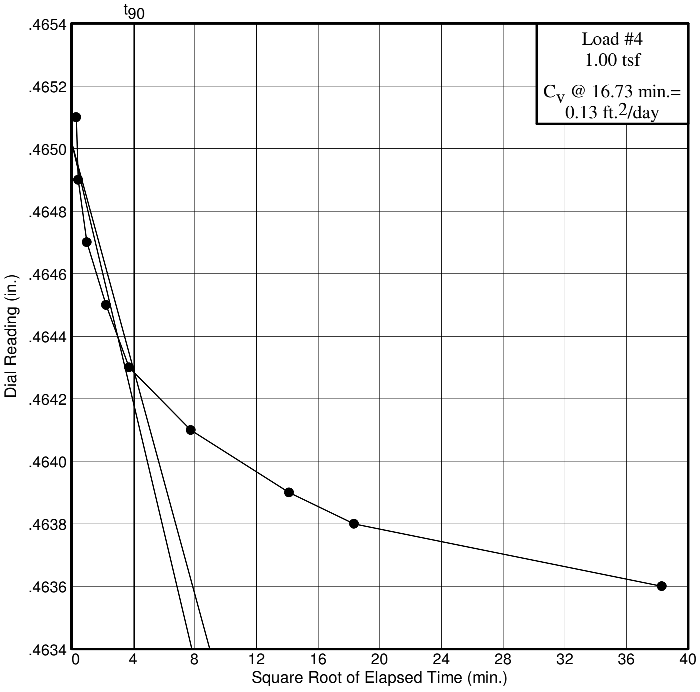
Remarks:
ASTM D 2435

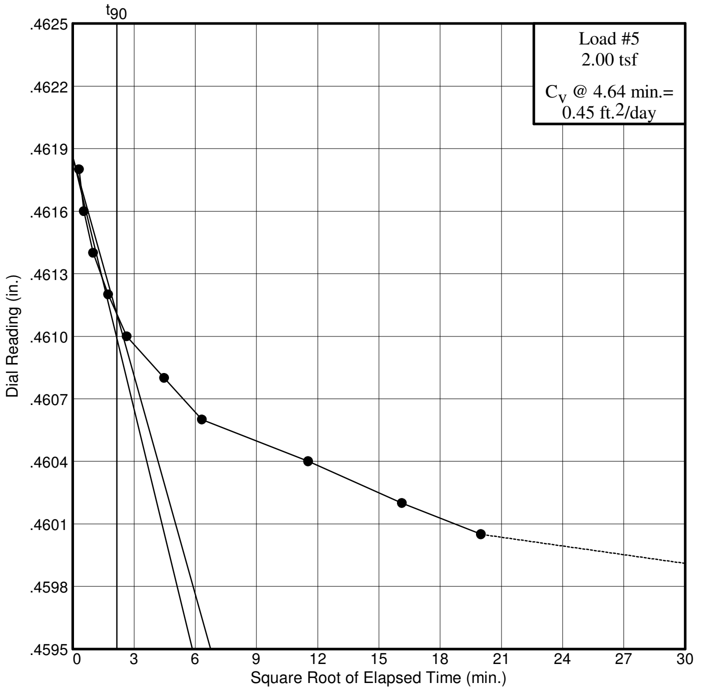
Figure

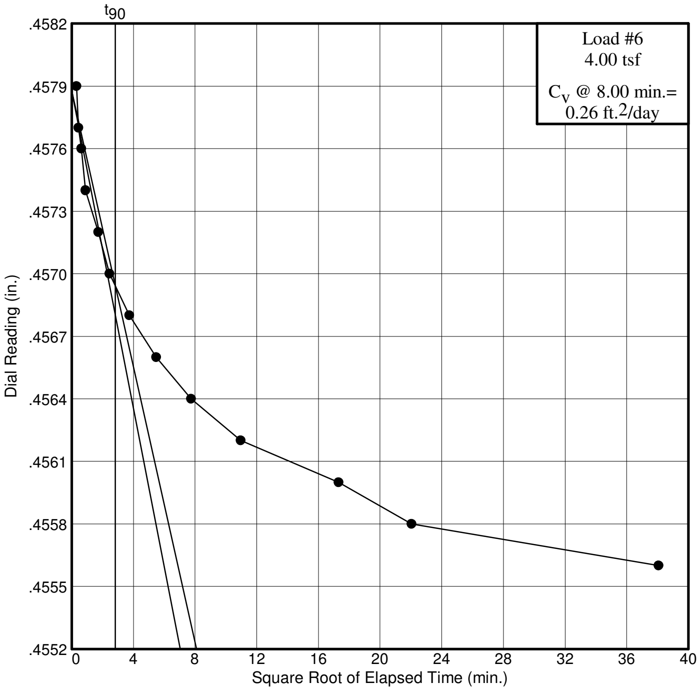
Dial Reading vs. Time

Project No.: B1806731
Project: Astoria Station
19333 482nd Ave, Astoria, SD
Source:
Sample No.: B-08
Elev./Depth: 17-19'







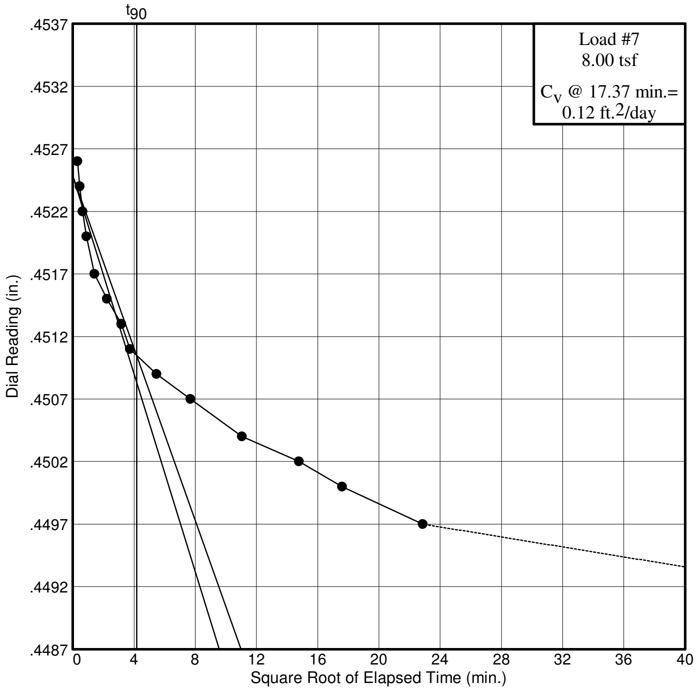


BRAUN℠
INTERTEC

Figure

Dial Reading vs. Time

Project No.: B1806731
Project: Astoria Station
19333 482nd Ave, Astoria, SD
Source: Sample No.: B-08 Elev./Depth: 17-19'



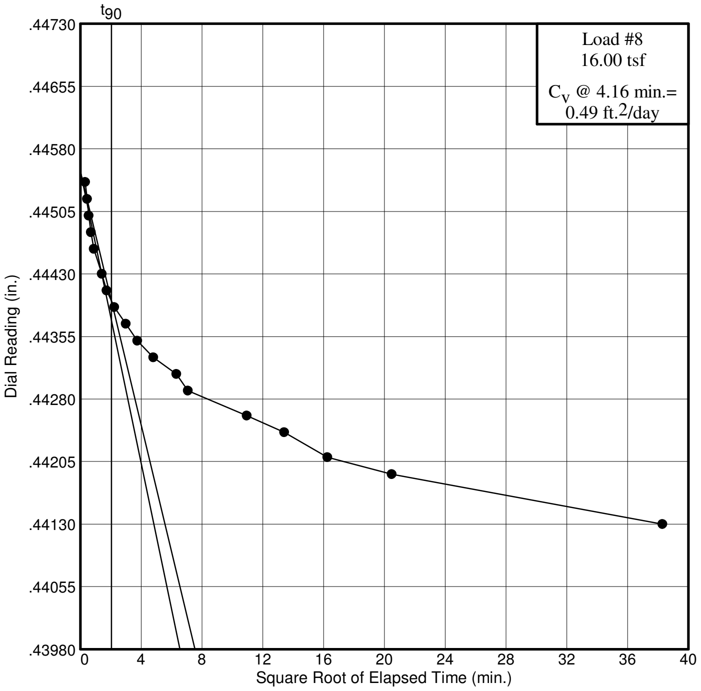


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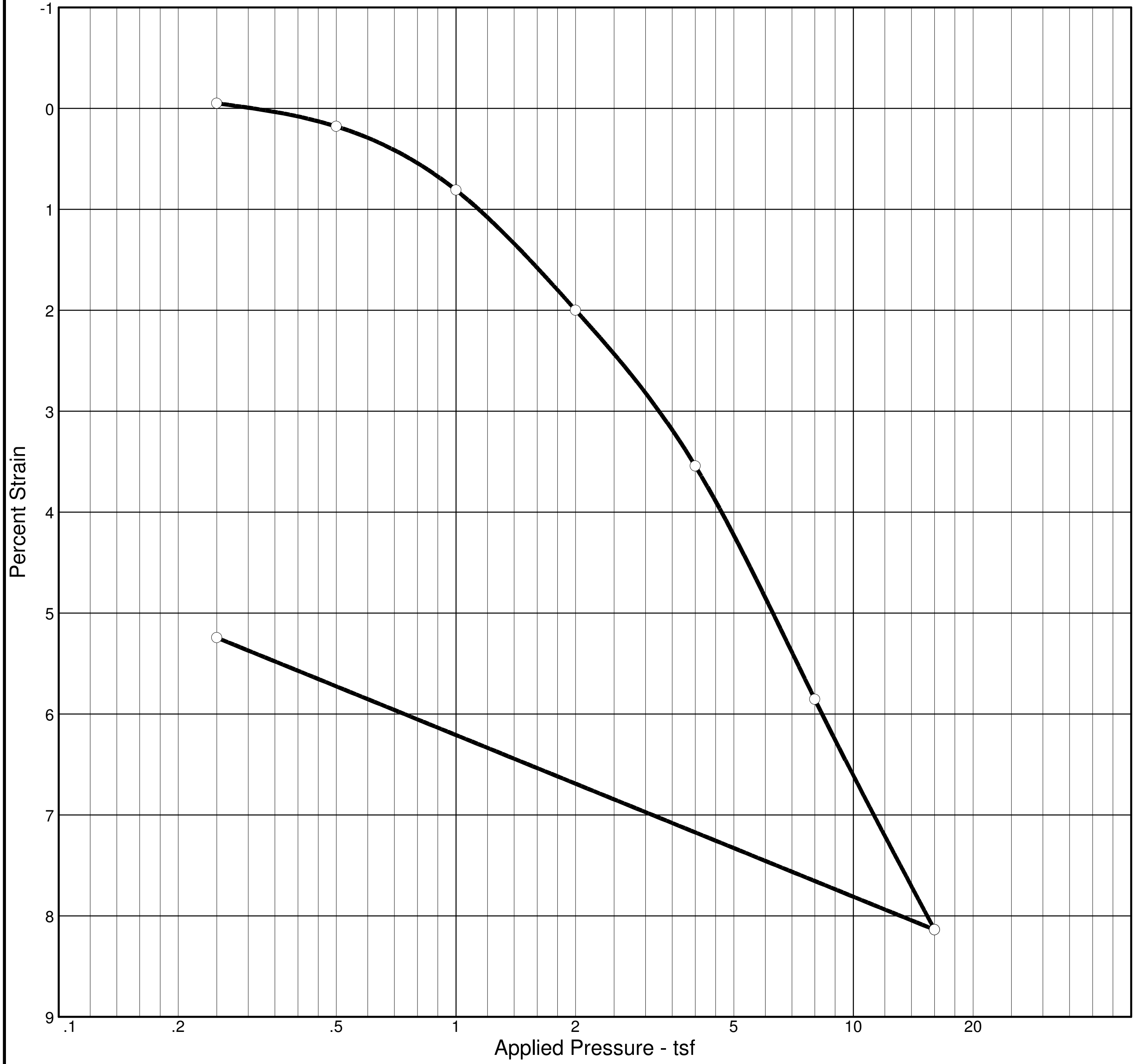
Figure

CONSOLIDATION / SWELL TESTING



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Swell Press. (tsf)	Swell %	e_o
Sat.	Moist.											
93.1 %	15.5 %	116.2	30	18	2.693		1.83	0.11	0.02			0.447

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY LEAN CLAY, brown (CL)	CL	

Project No. B1806731 **Client:** Otter Tail Power Company

Project: Astoria Station
19333 482nd Ave, Astoria, SD

Source: **Sample No.:** B-10 **Elev./Depth:** 32-34'

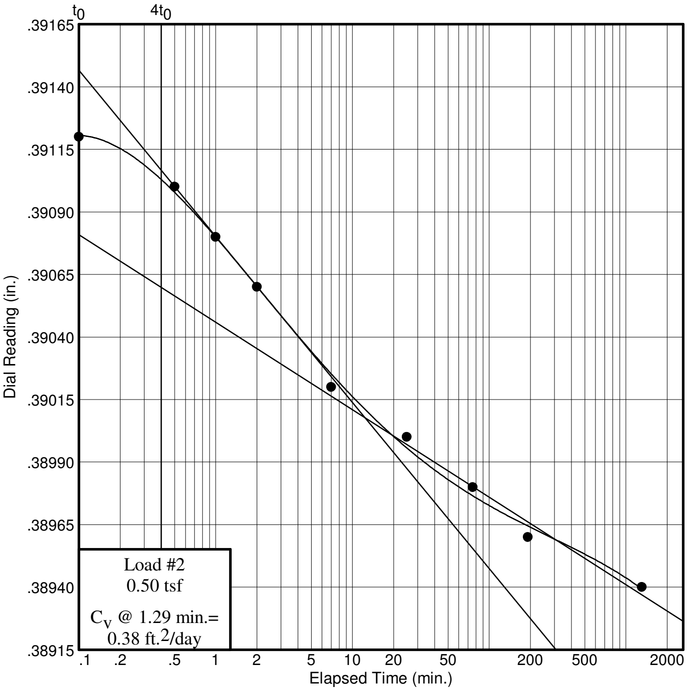
BRAUN INTERTEC

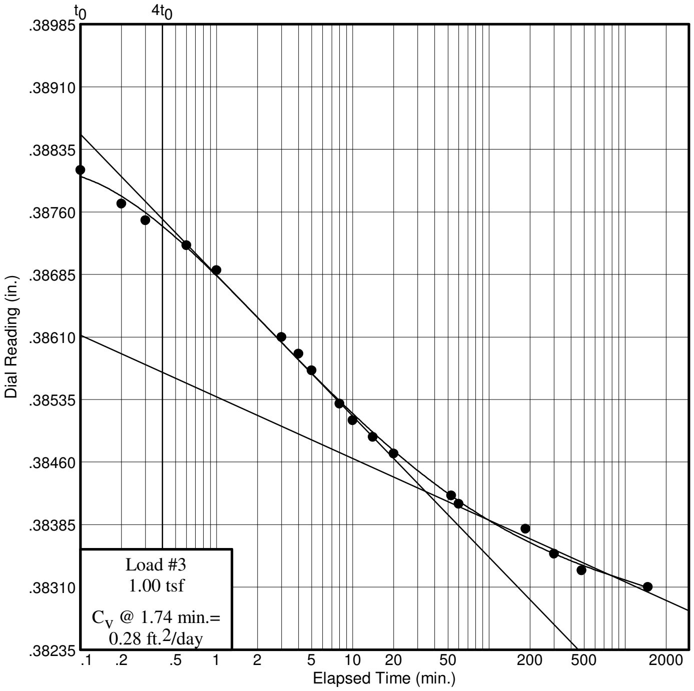
Remarks:
ASTM D 2435

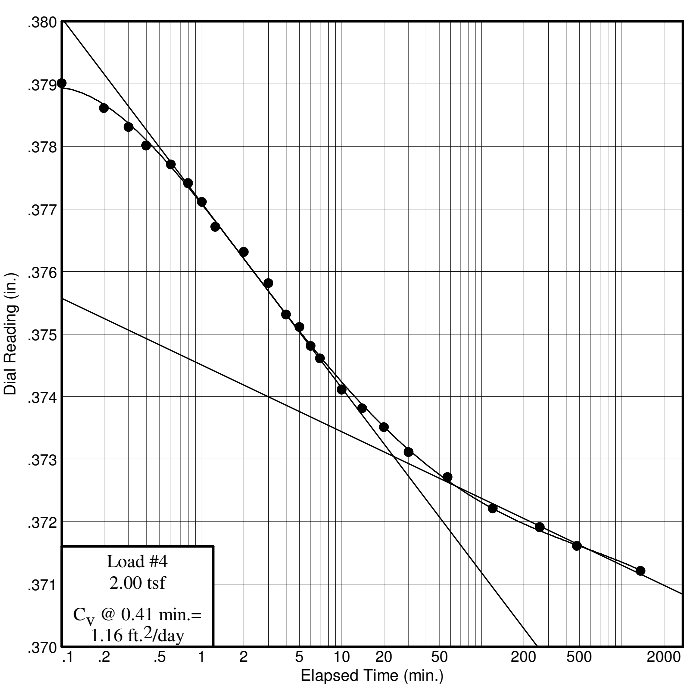
Figure

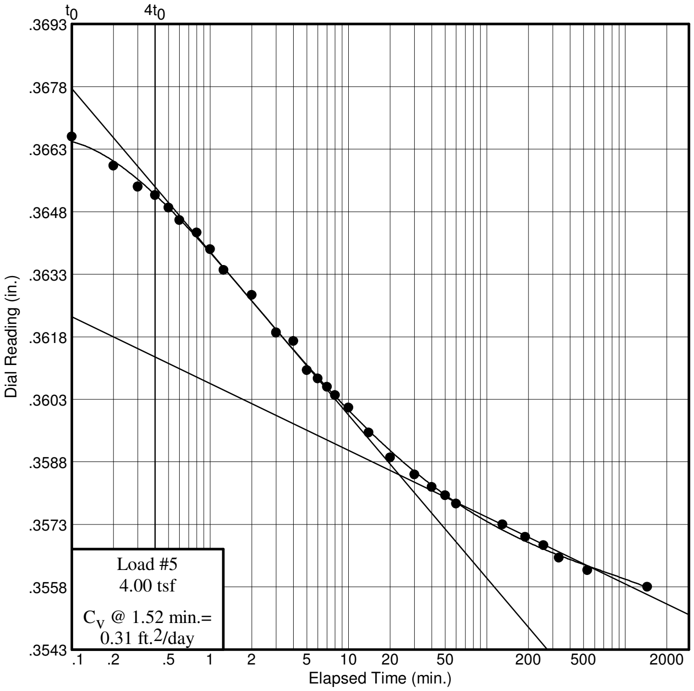
Dial Reading vs. Time

Project No.: B1806731
Project: Astoria Station
19333 482nd Ave, Astoria, SD
Source:
Sample No.: B-10
Elev./Depth: 32-34'







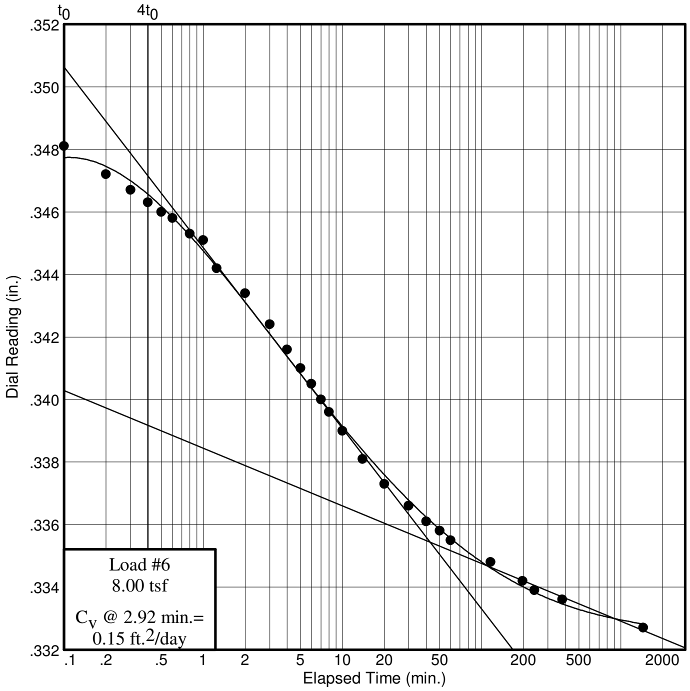


BRAUN℠
INTERTEC

Figure

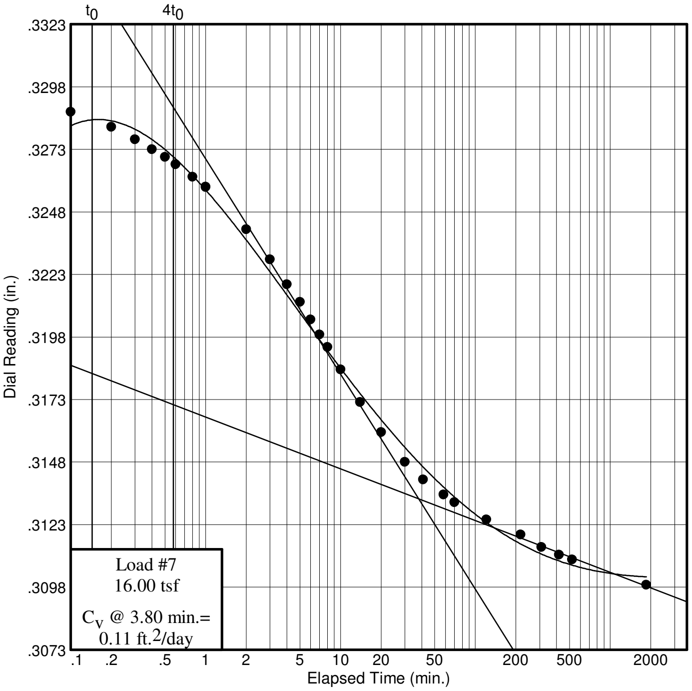
Dial Reading vs. Time

Project No.: B1806731
Project: Astoria Station
19333 482nd Ave, Astoria, SD
Source:
Sample No.: B-10
Elev./Depth: 32-34'



Load #6
8.00 tsf

C_v @ 2.92 min.=
0.15 ft.^{2}/day



Load #7
16.00 tsf

C_v @ 3.80 min.=
0.11 ft.^{2}/day

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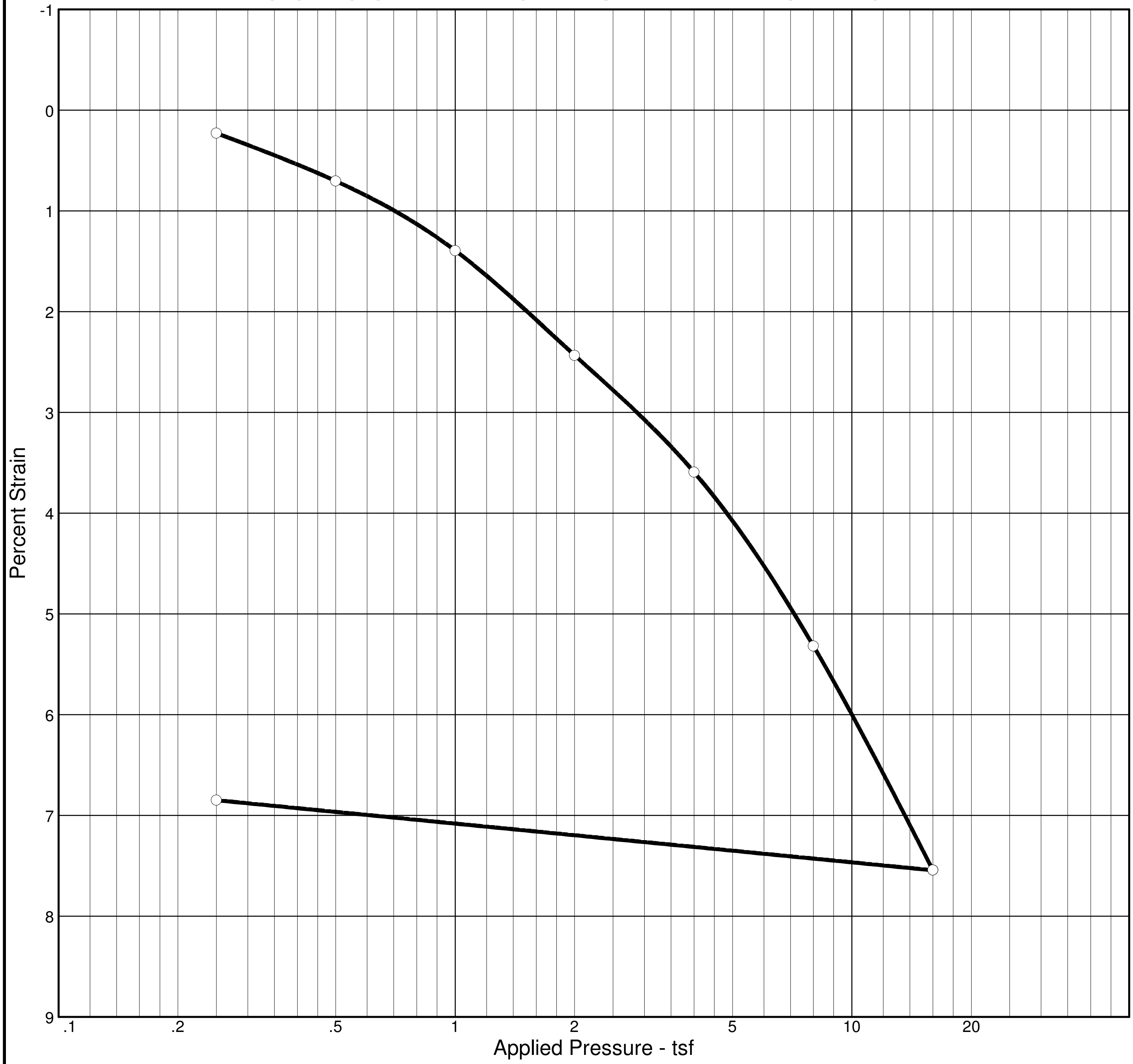
INTERTEC

Figure

CONSOLIDATION / SWELL TESTING



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Swell Press. (tsf)	Swell %	e_o
Sat.	Moist.											
88.6 %	17.6 %	110.1	28	12	2.715		2.27	0.11	0.01			0.539

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY LEAN CLAY, brown (CL)	CL	

Project No. B1806731 **Client:** Otter Tail Power Company

Project: Astoria Station
19333 482nd Ave, Astoria, SD

Source: **Sample No.:** B-11 **Elev./Depth:** 3-5'

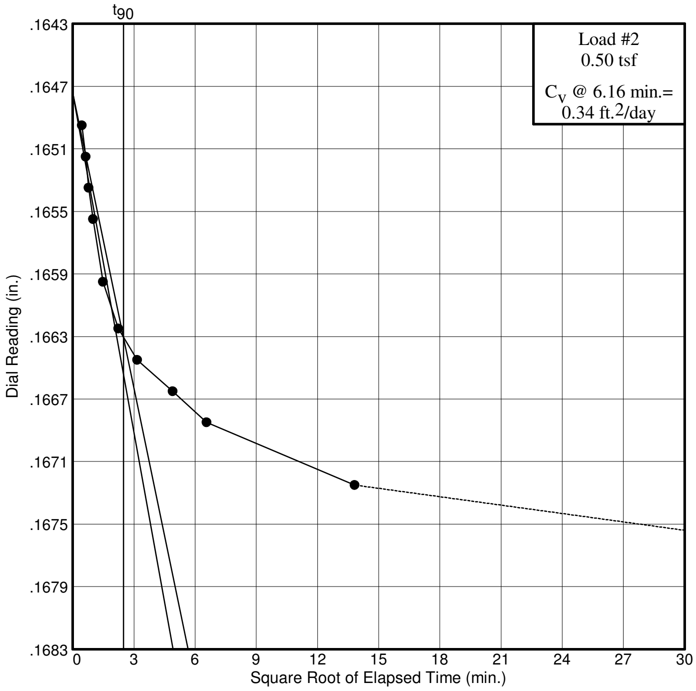
BRAUN℠
INTERTEC

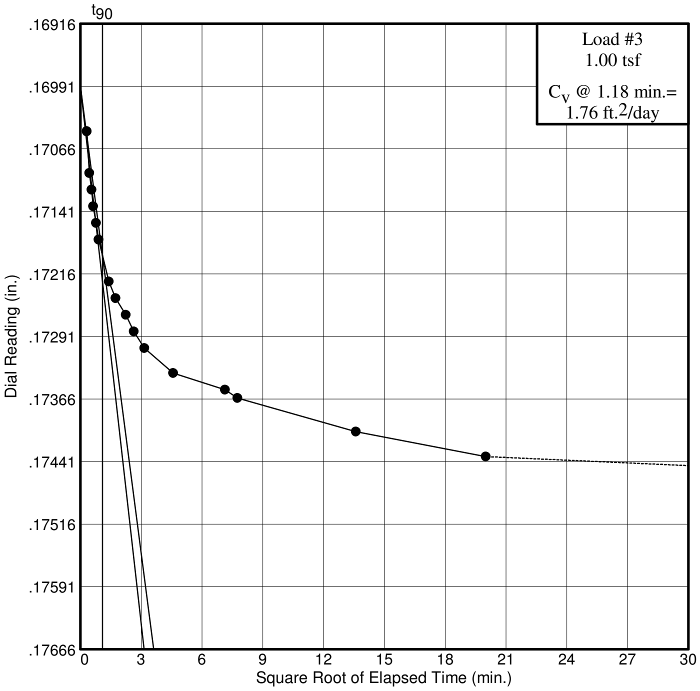
Remarks:
ASTM D 2435

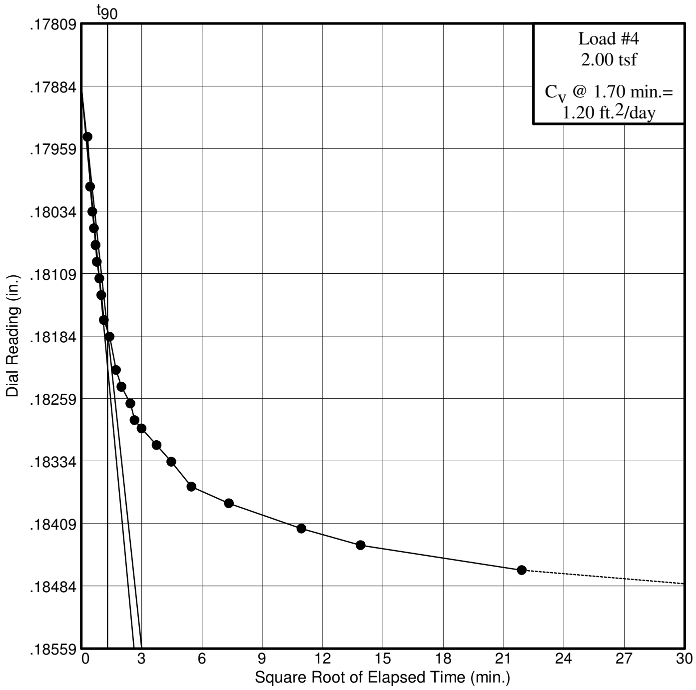
Figure

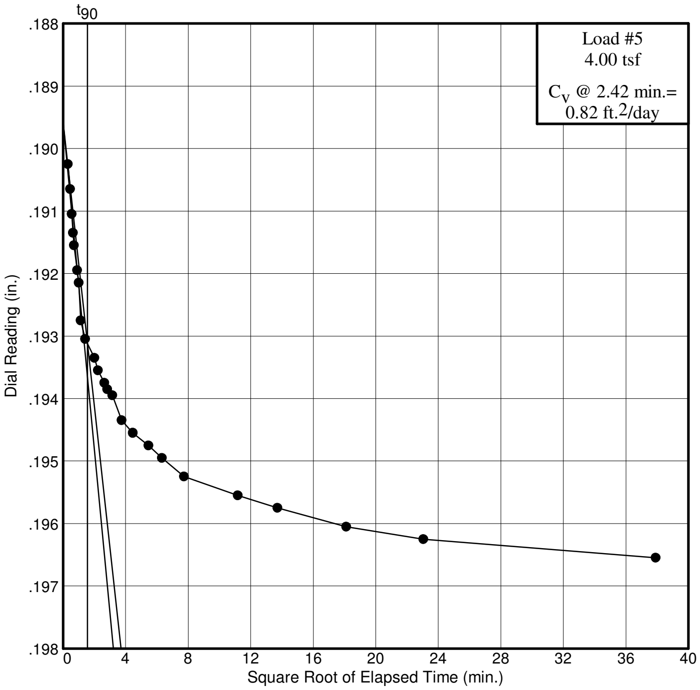
Dial Reading vs. Time

Project No.: B1806731
Project: Astoria Station
19333 482nd Ave, Astoria, SD
Source: **Sample No.:** B-11 **Elev./Depth:** 3-5'



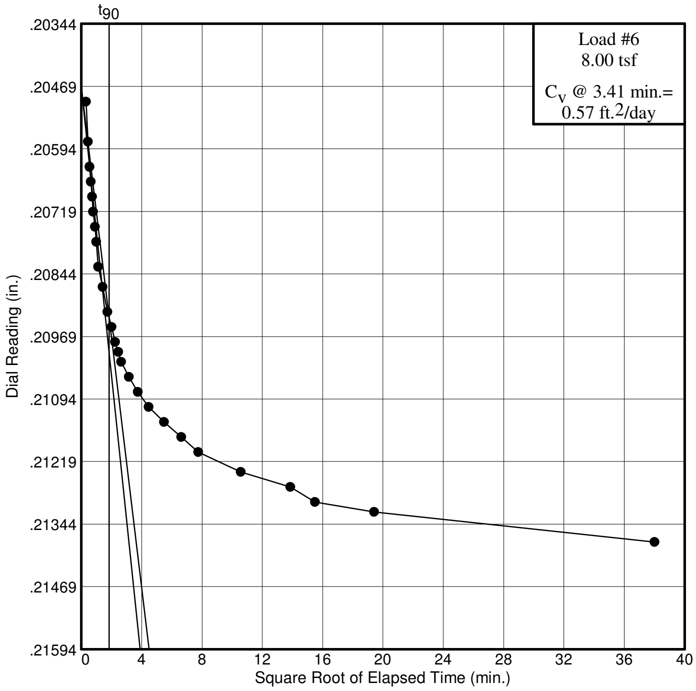






Dial Reading vs. Time

Project No.: B1806731
Project: Astoria Station
19333 482nd Ave, Astoria, SD
Source: Sample No.: B-11 Elev./Depth: 3-5'



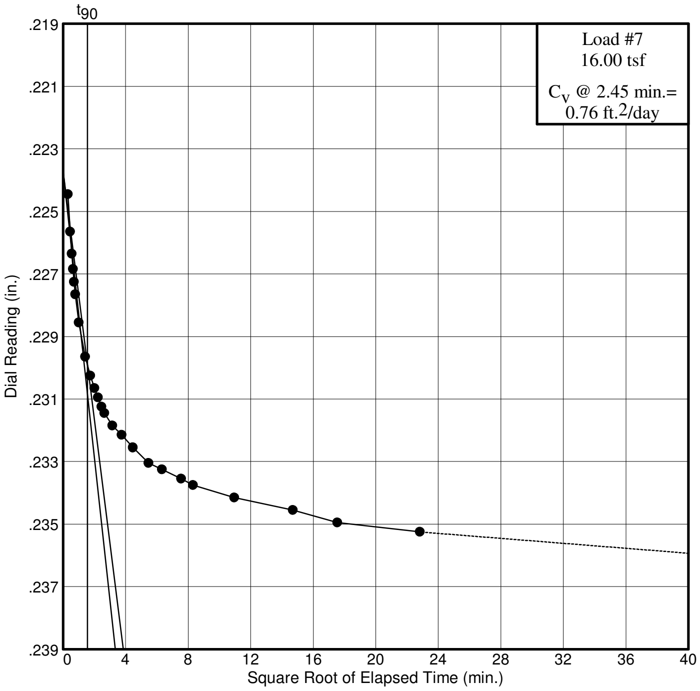


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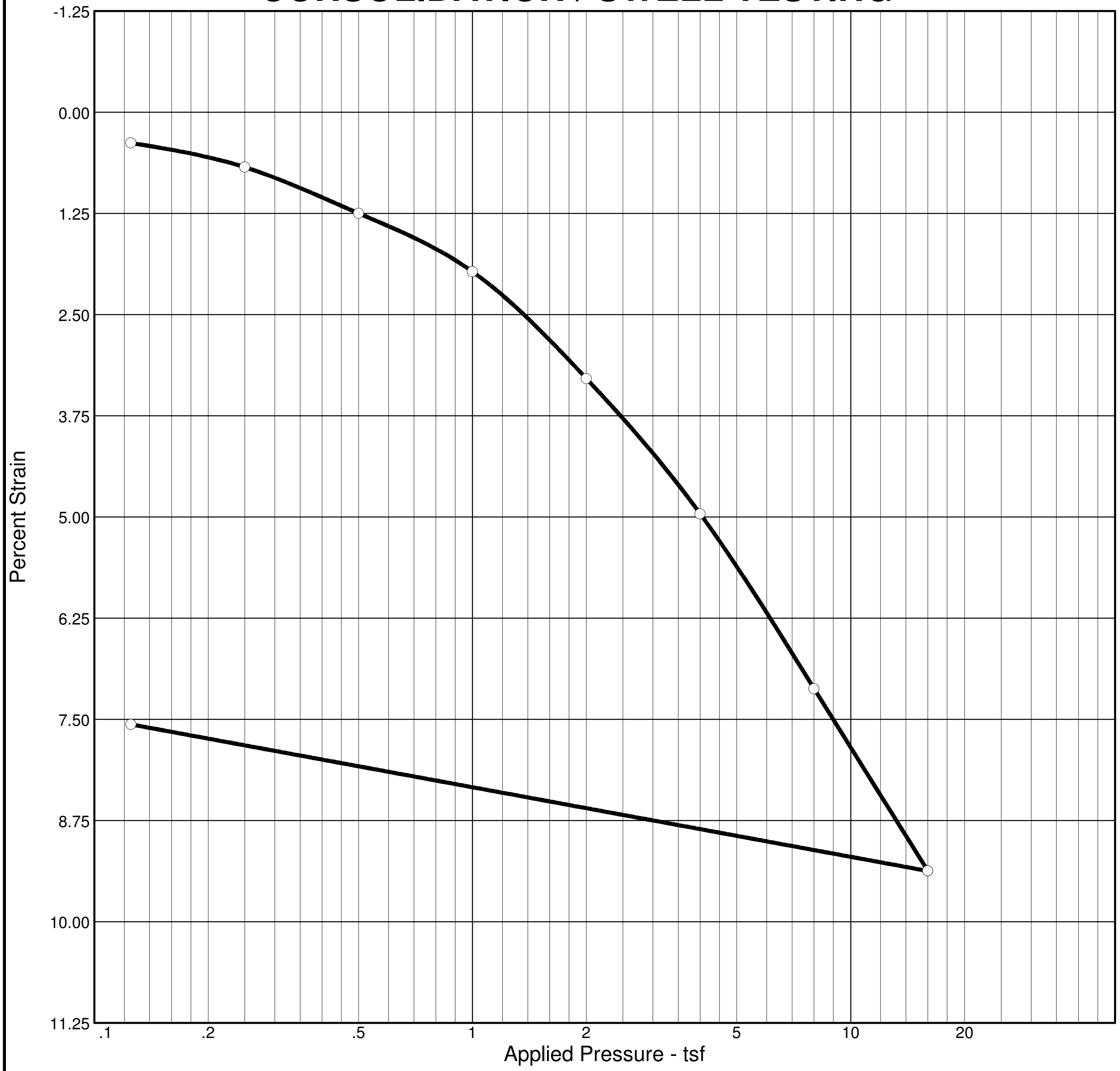
Figure

CONSOLIDATION / SWELL TESTING



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Swell Press. (tsf)	Swell %	e_o
Sat.	Moist.											
95.1 %	16.7 %	114.4	23	5	2.70		1.88	0.11	0.01			0.474

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY, SILTY CLAY, brown (CL-ML)	CL-ML	

Project No. B1806731 **Client:** Otter Tail Power Company

Project: Astoria Station
19333 482nd Ave, Astoria, SD

Source: **Sample No.:** B-12 **Elev./Depth:** 29.5-31.5'

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Remarks:
ASTM D 2435

Figure

Dial Reading vs. Time

Project No.: B1806731
Project: Astoria Station
19333 482nd Ave, Astoria, SD
Source: Sample No.: B-12 Elev./Depth: 29.5-31.5'

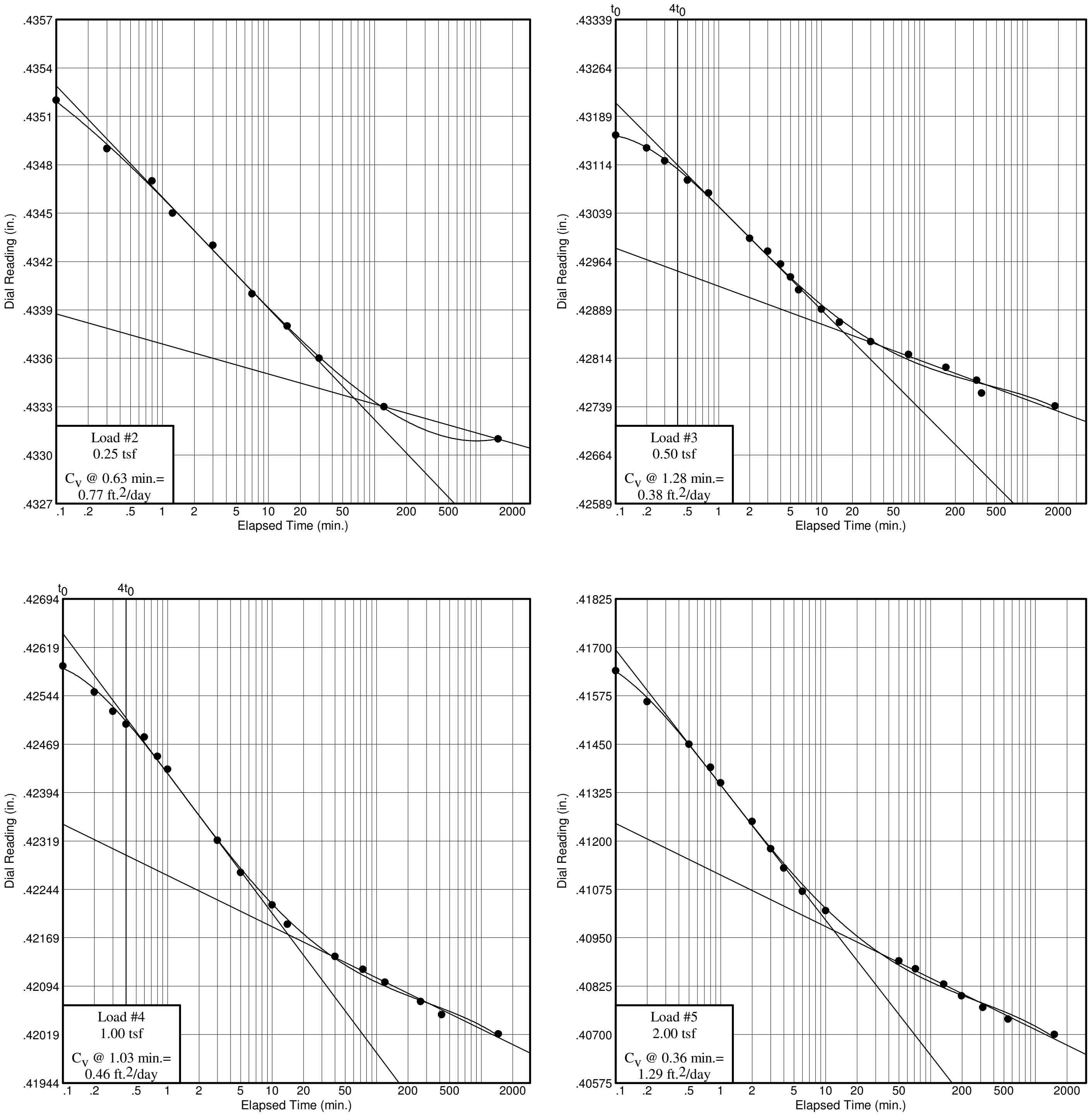

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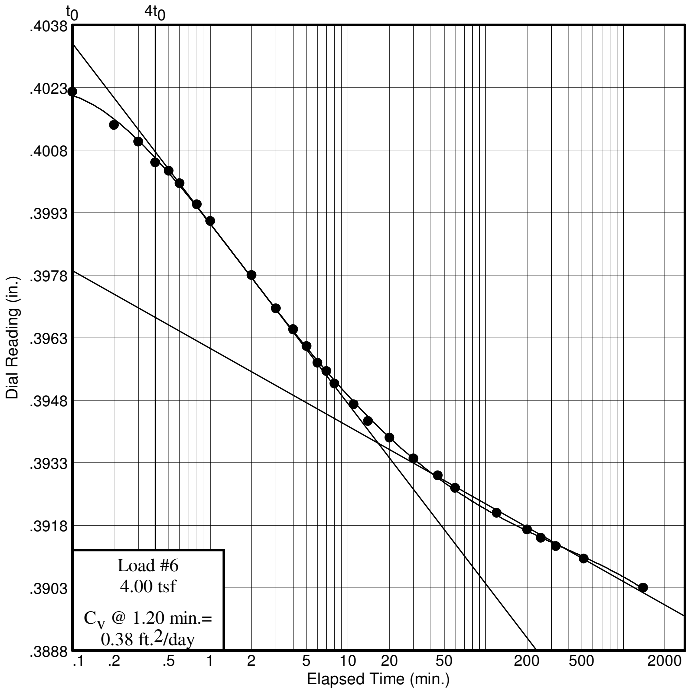
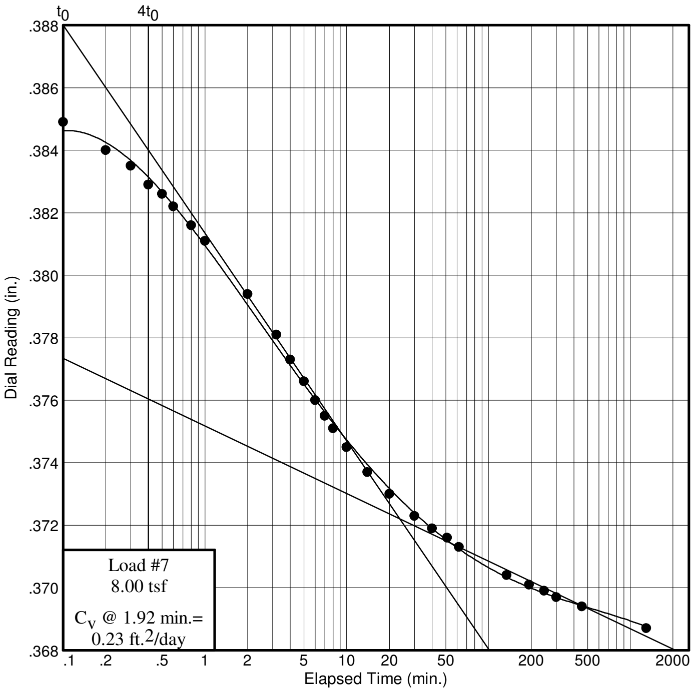
Figure

Dial Reading vs. Time

Project No.: B1806731
Project: Astoria Station
19333 482nd Ave, Astoria, SD
Source: Sample No.: B-12 Elev./Depth: 29.5-31.5'





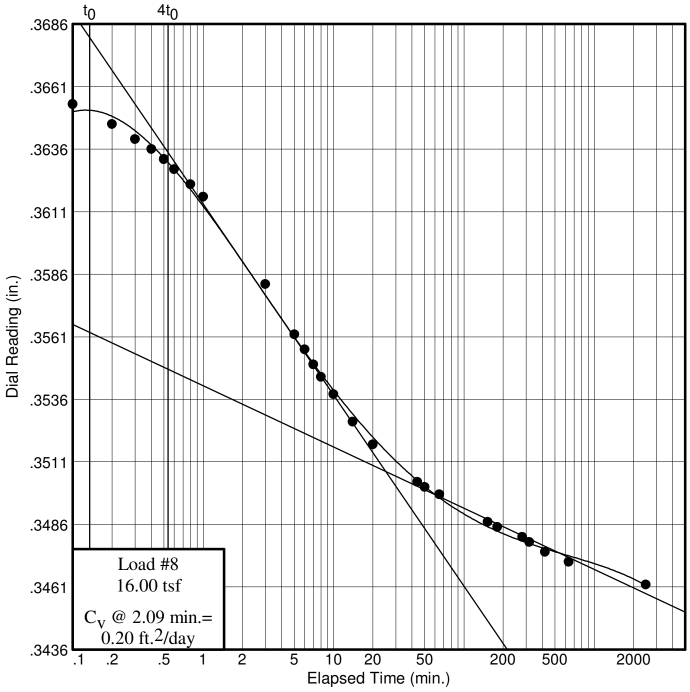


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Figure

BRAUN INTERTEC

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

Proctor Report

Report No: PTR:W18-004609-S1
Issue No: 1

Client:	Kirk Phinney Otter Tail Power Company 215 S Cascade Fergus Falls, MN, 56538
Project:	B1806731 Astoria Station 19333 482nd Avenue Astoria, SD, 57213
TR:	Ezra Ballinger, eballinger@braunintertec.com

Laboratory Results Reviewed by:

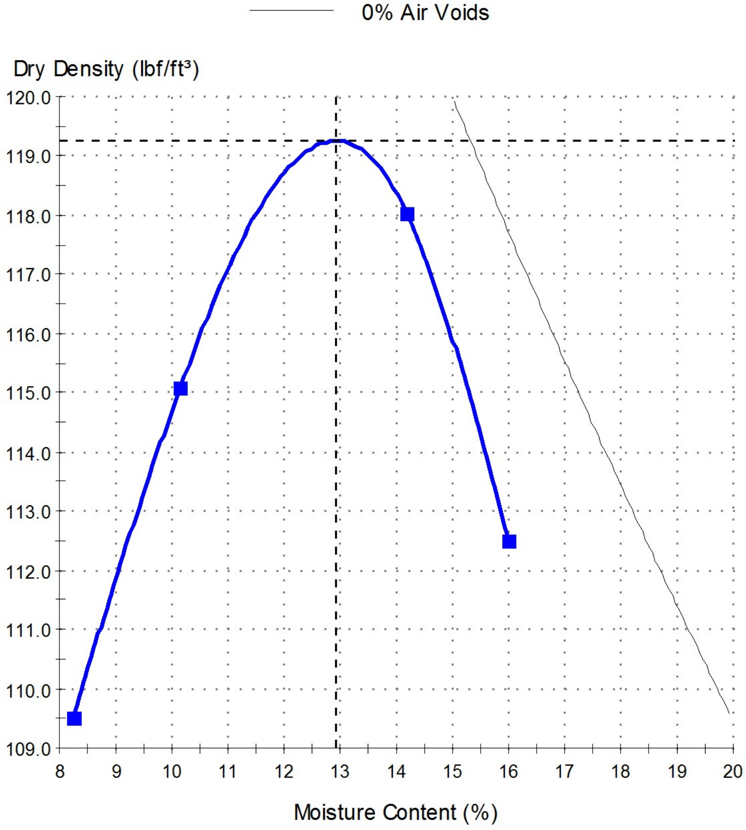
ISO/IEC 17025

Kanhai Seokaran
Engineering Technician II
Date of Issue: 8/21/2018

Sample Details

Sample ID:	W18-004609-S1	Alternate Sample ID:	P-04
Date Sampled:	7/25/2018	Date Submitted:	8/2/2018
Sampled By:	Drill Crew	Sampling Method:	Soil Boring Auger
Source:	Soil Boring		
Material:	Silt with Sand		
Specification:	For Informational Purposes Only		
Location:	B-02, Depth 1-5'		
Date Tested:	8/13/2018		

Dry Density - Moisture Content Relationship



Test Results

ASTM D 1557 - 07

Maximum Dry Density (lbf/ft³):	119.3
Corrected Maximum Dry Density (lbf/ft³):	119.3
Optimum Moisture Content (%):	12.9
Corrected Optimum Moisture Content (%):	12.9
Method:	A
Preparation Method:	Moist
Rammer Type:	Mechanical round
Specific Gravity (Fines):	2.70
Specific Gravity Method:	Assumed
Retained Sieve No 4 (4.75mm) (%):	0
Passing Sieve No 4 (4.75mm) (%):	100
Visual Description:	ML Silt with Sand, brown

Comments

P200=83%

BRAUN
INTERTEC

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

Proctor Report

Report No: PTR:W18-004620-S1
Issue No: 1

Client:	Kirk Phinney Otter Tail Power Company 215 S Cascade Fergus Falls, MN, 56538
Project:	B1806731 Astoria Station 19333 482nd Avenue Astoria, SD, 57213
TR:	Ezra Ballinger, eballinger@braunintertec.com

Laboratory Results Reviewed by:

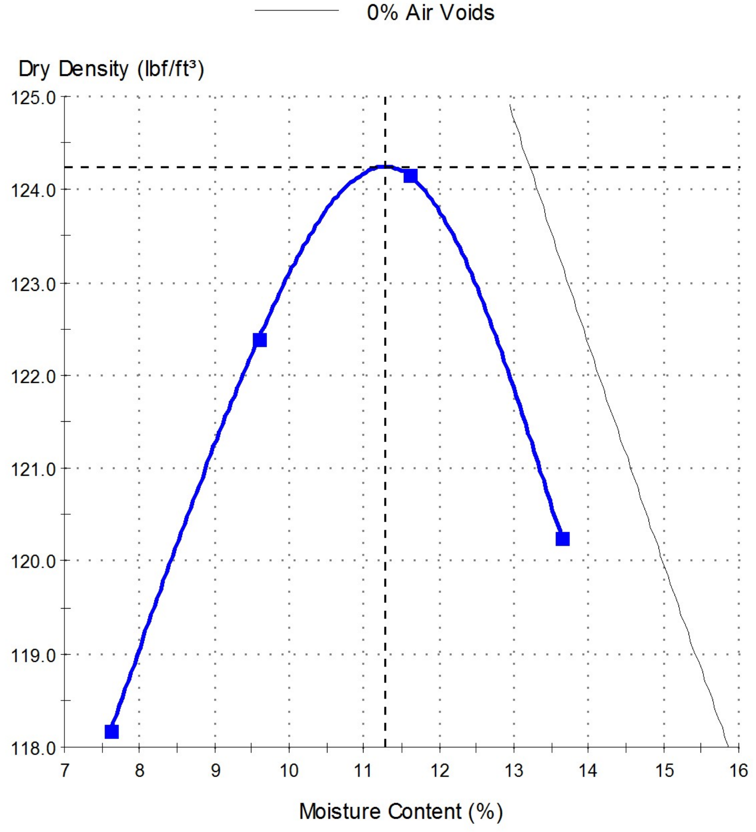
ISO/IEC
17025

Kanhai Seokaran
Engineering Technician II
Date of Issue: 8/21/2018

Sample Details

Sample ID:	W18-004620-S1	Alternate Sample ID:	P-05
Date Sampled:	7/31/2018	Date Submitted:	8/2/2018
Sampled By:	Drill Crew	Sampling Method:	Soil Boring Auger
Source:	Soil Boring		
Material:	Silty Sand		
Specification:	For Informational Purposes Only		
Location:	B-13, Depth 1-5'		
Date Tested:	8/13/2018		

Dry Density - Moisture Content Relationship



Test Results

ASTM D 1557 - 07

Maximum Dry Density (lbf/ft³):	124.2
Corrected Maximum Dry Density (lbf/ft³):	124.2
Optimum Moisture Content (%):	11.3
Corrected Optimum Moisture Content (%):	11.3
Method:	A
Preparation Method:	Moist
Rammer Type:	Mechanical round
Specific Gravity (Fines):	2.70
Specific Gravity Method:	Assumed
Retained Sieve No 4 (4.75mm) (%):	3
Passing Sieve No 4 (4.75mm) (%):	97
Visual Description:	SM Silty Sand, fine grained, brown

Comments

P200=46%

BRAUN
INTERTEC

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

Proctor Report

Report No: PTR:W18-004626-S1
Issue No: 1

Client:	Kirk Phinney Otter Tail Power Company 215 S Cascade Fergus Falls, MN, 56538
Project:	B1806731 Astoria Station 19333 482nd Avenue Astoria, SD, 57213
TR:	Ezra Ballinger, eballinger@braunintertec.com

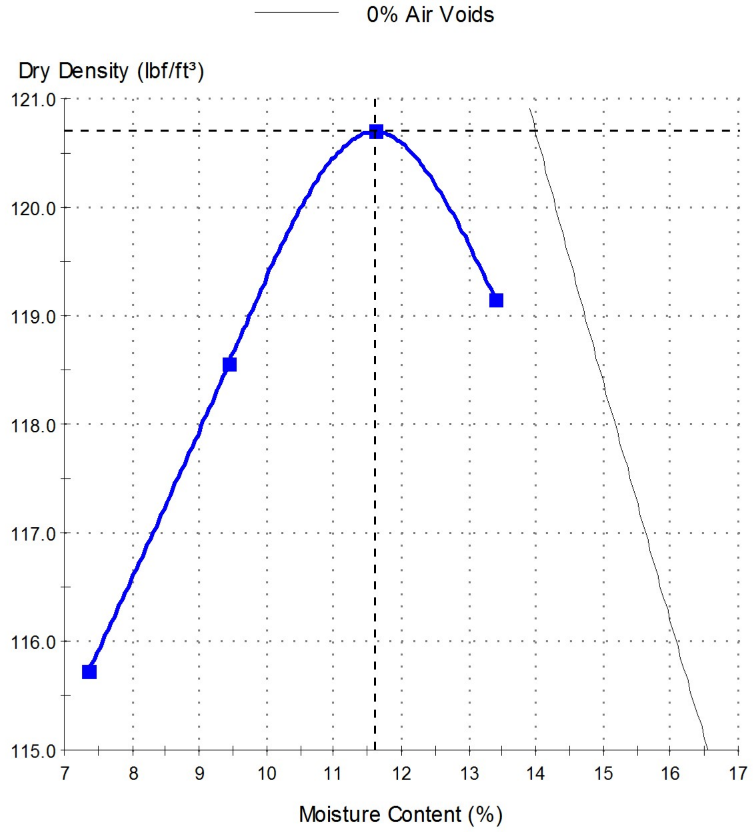
Laboratory Results Reviewed by:

Kanhai Seokaran
Engineering Technician II
Date of Issue: 8/21/2018

Sample Details

Sample ID:	W18-004626-S1	Alternate Sample ID:	P-06
Date Sampled:	7/30/2018	Date Submitted:	8/2/2018
Sampled By:	Drill Crew	Sampling Method:	Soil Boring Auger
Source:	Soil Boring		
Material:	Sandy Lean Clay		
Specification:	For Informational Purposes Only		
Location:	B-14, Depth 1-5'		
Date Tested:	8/13/2018		

Dry Density - Moisture Content Relationship



Test Results

ASTM D 1557 - 07

Maximum Dry Density (lbf/ft³):	120.7
Corrected Maximum Dry Density (lbf/ft³):	120.7
Optimum Moisture Content (%):	11.6
Corrected Optimum Moisture Content (%):	11.6
Method:	A
Preparation Method:	Moist
Rammer Type:	Mechanical round
Specific Gravity (Fines):	2.65
Specific Gravity Method:	Assumed
Retained Sieve No 4 (4.75mm) (%):	0
Passing Sieve No 4 (4.75mm) (%):	100
Visual Description:	CL Sandy Lean Clay, brown

Comments

P200=65%

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

Proctor Report

Report No: PTR:W18-004161-S1
Issue No: 1

Client: Kirk Phinney
Otter Tail Power Company
215 S Cascade
Fergus Falls, MN, 56538
Project: B1806731
Astoria Station
19333 482nd Avenue
Astoria, SD, 57213
TR: Ezra Ballinger, eballinger@braunintertec.com

Laboratory Results Reviewed by:

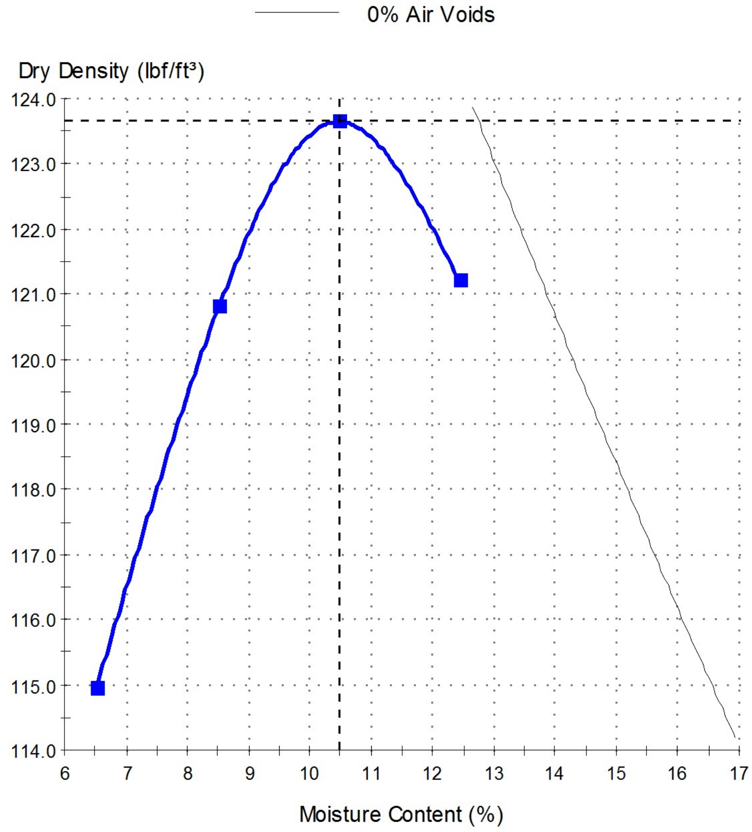
ISO/IEC 17025

Kanhai Seokaran
Engineering Technician II
Date of Issue: 8/21/2018

Sample Details

Sample ID:	W18-004161-S1	Alternate Sample ID:	P-01
Date Sampled:	7/27/2018	Date Submitted:	7/30/2018
Sampled By:	Drill Crew	Sampling Method:	Soil Boring Auger
Source:	Soil Boring		
Material:	Sandy Lean Clay		
Specification:	For Informational Purposes Only		
Location:	Boring T-4, Depth 1.5-4'		
Date Tested:	8/2/2018		

Dry Density - Moisture Content Relationship



Test Results

ASTM D 1557 - 07

Maximum Dry Density (lbf/ft³):	123.6
Corrected Maximum Dry Density (lbf/ft³):	123.6
Optimum Moisture Content (%):	10.5
Corrected Optimum Moisture Content (%):	10.5
Method:	A
Preparation Method:	Moist
Rammer Type:	Mechanical round
Specific Gravity (Fines):	2.65
Specific Gravity Method:	Assumed
Retained Sieve No 4 (4.75mm) (%):	3
Passing Sieve No 4 (4.75mm) (%):	97
Visual Description:	CL Sandy Lean Clay, brown

Comments

P200=65%

BRAUN
INTERTEC

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

Proctor Report

Report No: PTR:W18-004161-S2
Issue No: 1

Client:	Kirk Phinney Otter Tail Power Company 215 S Cascade Fergus Falls, MN, 56538
Project:	B1806731 Astoria Station 19333 482nd Avenue Astoria, SD, 57213
TR:	Ezra Ballinger, eballinger@braunintertec.com

Laboratory Results Reviewed by:

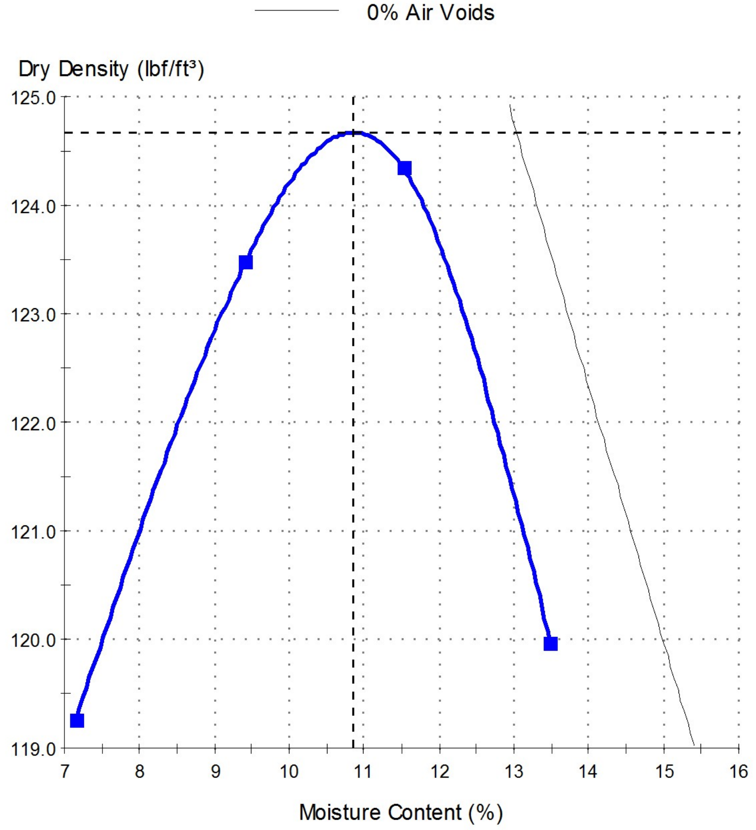
ISO/IEC 17025

Kanhai Seokaran
Engineering Technician II
Date of Issue: 8/21/2018

Sample Details

Sample ID:	W18-004161-S2	Alternate Sample ID:	P-02
Date Sampled:	7/27/2018	Date Submitted:	7/30/2018
Sampled By:	Drill Crew	Sampling Method:	Soil Boring Auger
Source:	Soil Boring		
Material:	Silty Sand		
Specification:	For Informational Purposes Only		
Location:	Boring T-8, Depth 2-4'		
Date Tested:	8/2/2018		

Dry Density - Moisture Content Relationship



Test Results

ASTM D 1557 - 07

Maximum Dry Density (lbf/ft³):	124.7
Corrected Maximum Dry Density (lbf/ft³):	124.7
Optimum Moisture Content (%):	10.9
Corrected Optimum Moisture Content (%):	10.9
Method:	A
Preparation Method:	Moist
Rammer Type:	Mechanical round
Specific Gravity (Fines):	2.70
Specific Gravity Method:	Assumed
Retained Sieve No 4 (4.75mm) (%):	0
Passing Sieve No 4 (4.75mm) (%):	100
Visual Description:	SM Silty Sand, fine grained, brown

Comments

P200=39%

BRAUN INTERTEC

Braun Intertec Corporation
11001 Hampshire Avenue South
Minneapolis, MN 55438
Phone: 952.995.2000

Report No: PTR:W18-004161-S3
Issue No: 1

Proctor Report

Client: Kirk Phinney
Otter Tail Power Company
215 S Cascade
Fergus Falls, MN, 56538
Project: B1806731
Astoria Station
19333 482nd Avenue
Astoria, SD, 57213
TR: Ezra Ballinger, eballinger@braunintertec.com

Laboratory Results Reviewed by:

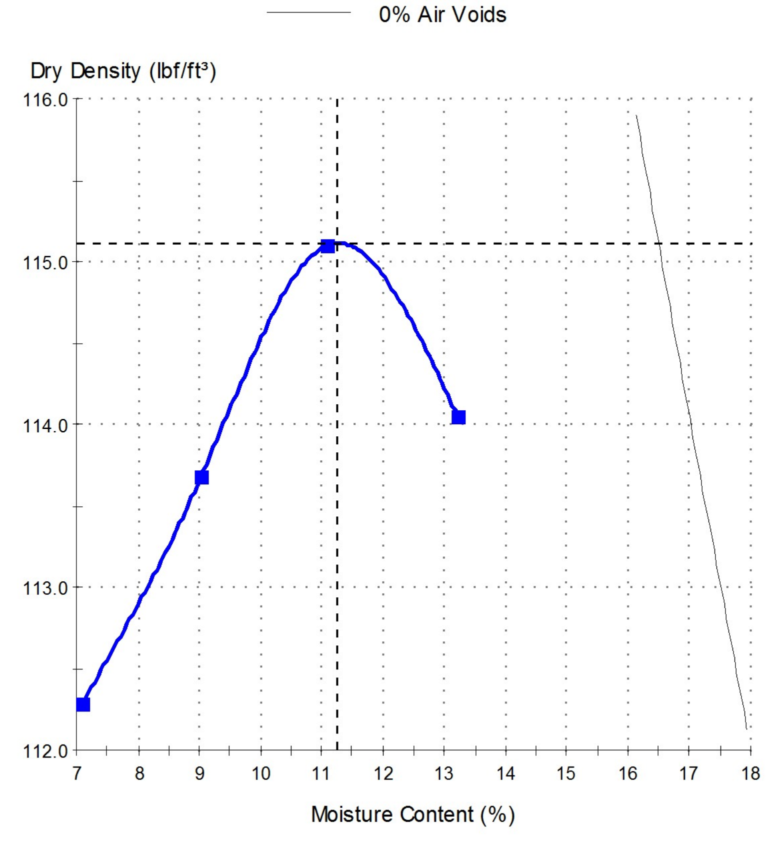
ISO/IEC 17025

Kanhai Seokaran
Engineering Technician II
Date of Issue: 8/21/2018

Sample Details

Sample ID:	W18-004161-S3	Alternate Sample ID:	P-03
Date Sampled:	7/27/2018	Date Submitted:	7/30/2018
Sampled By:	Drill Crew	Sampling Method:	Soil Boring Auger
Source:	Soil Boring		
Material:	Silty Sand		
Specification:	For Informational Purposes Only		
Location:	Boring T-8, Depth 4-6'		
Date Tested:	8/2/2018		

Dry Density - Moisture Content Relationship



Test Results

ASTM D 1557 - 07

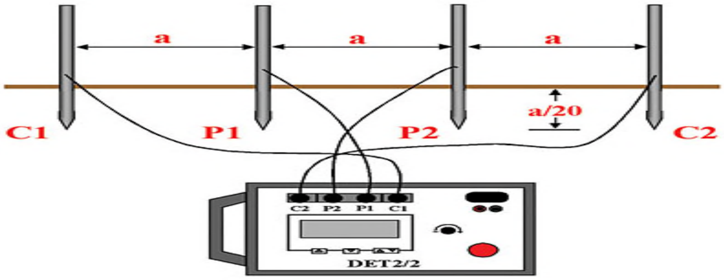
Maximum Dry Density (lbf/ft³):	115.1
Corrected Maximum Dry Density (lbf/ft³):	115.1
Optimum Moisture Content (%):	11.3
Corrected Optimum Moisture Content (%):	11.3
Method:	A
Preparation Method:	Moist
Rammer Type:	Mechanical round
Specific Gravity (Fines):	2.65
Specific Gravity Method:	Assumed
Retained Sieve No 4 (4.75mm) (%):	1
Passing Sieve No 4 (4.75mm) (%):	99
Visual Description:	SM Silty Sand, fine grained, brown

Comments

P200=30%

Project No. B1806731
Electrical Resistivity Testing (Wenner 4 pin Method)
Date: 7/26/2018

Site: Astoria Station
Weather: Partly Cloudy 60 to 65 Degrees F
Technician: Cody Mathiason



Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-07 (N-S)	1.5	200	11.0000
	3	200	5.6380
	5	200	3.5070
	10	200	1.8277
	15	200	1.1870
	20	200	0.8153

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-07 (E-W)	1.5	200	10.9100
	3	200	5.5560
	5	200	3.3790
	10	200	1.9270
	15	200	1.2760
	20	200	0.9002

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-06 (N-S)	1.5	200	9.2810
	3	200	4.6970
	5	200	2.8990
	10	200	1.9370
	15	200	1.0890
	20	200	0.7912

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-06 (E-W)	1.5	200	9.1870
	3	200	4.8370
	5	200	2.9910
	10	200	1.8902
	15	200	1.0120
	20	200	0.7249

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-05 (N-S)	1.5	200	11.5400
	3	200	5.7470
	5	200	3.5760
	10	200	1.9230
	15	200	1.3800
	20	200	1.0290

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-05 (E-W)	1.5	200	11.4160
	3	200	5.8130
	5	200	3.6953
	10	200	2.1560
	15	200	1.5930
	20	200	1.0390

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-04 (N-S)	1.5	200	11.8100
	3	200	6.0350
	5	200	3.8510
	10	200	2.4870
	15	200	1.4920
	20	200	0.9941

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-04 (E-W)	1.5	200	11.7400
	3	200	5.9950
	5	200	3.9120
	10	200	2.5140
	15	200	1.3810
	20	200	0.9812

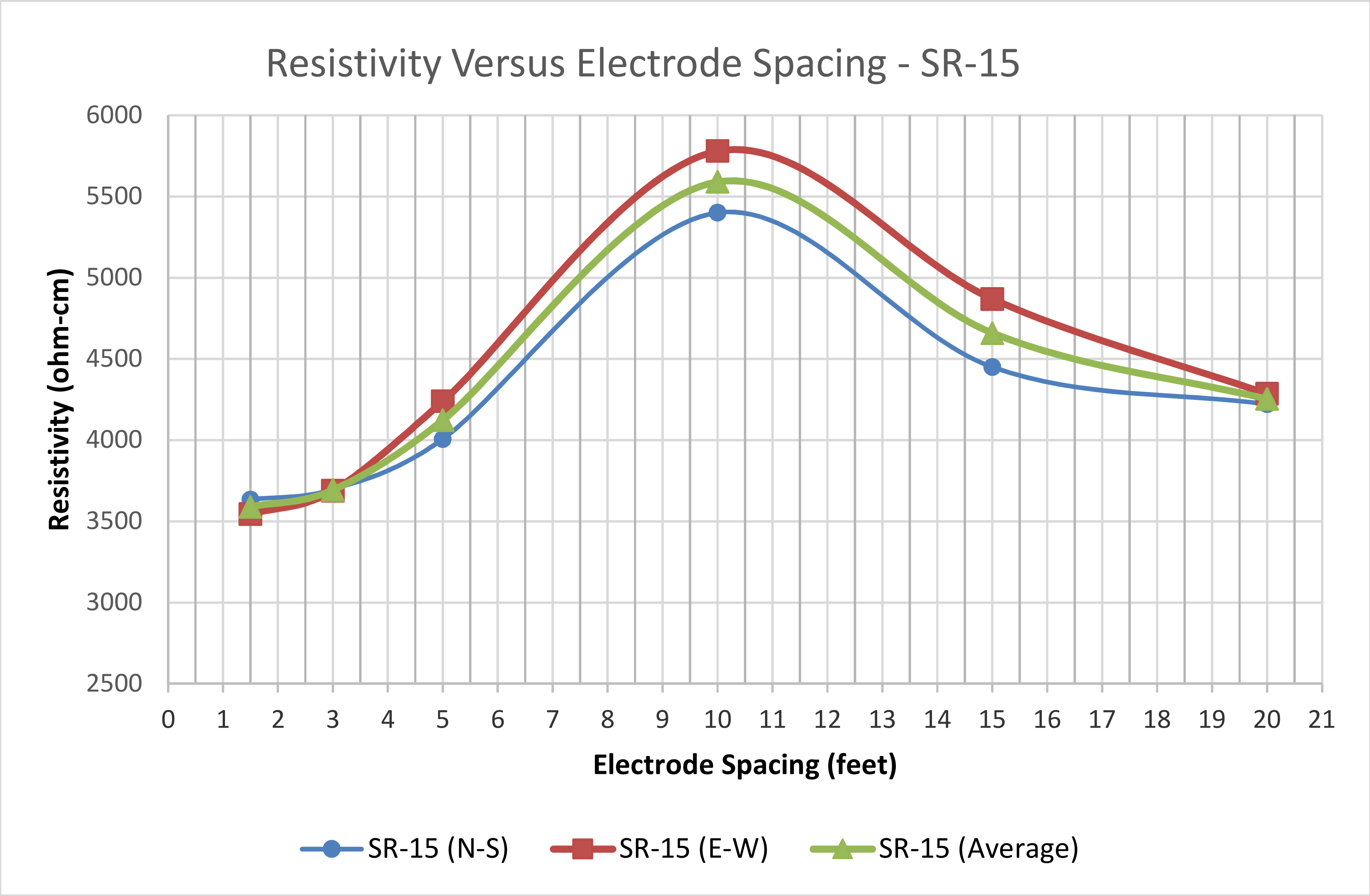
Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-03 (N-S)	1.5	200	9.6750
	3	200	4.9120
	5	200	2.9970
	10	200	1.7830
	15	200	1.0980
	20	200	0.7194

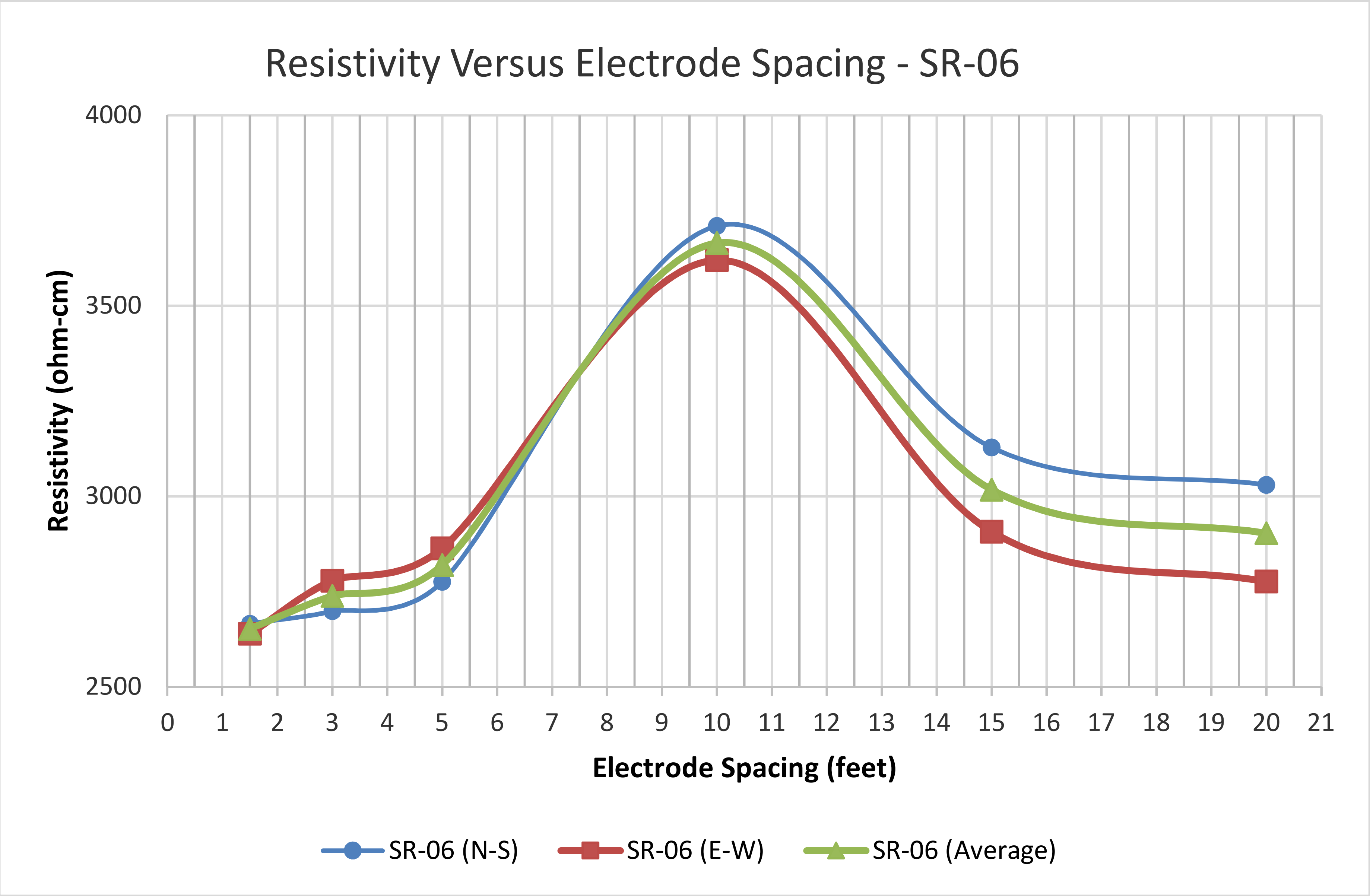
Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-03 (E-W)	1.5	200	9.4520
	3	200	4.8920
	5	200	3.0150
	10	200	1.6780
	15	200	1.0290
	20	200	0.7421

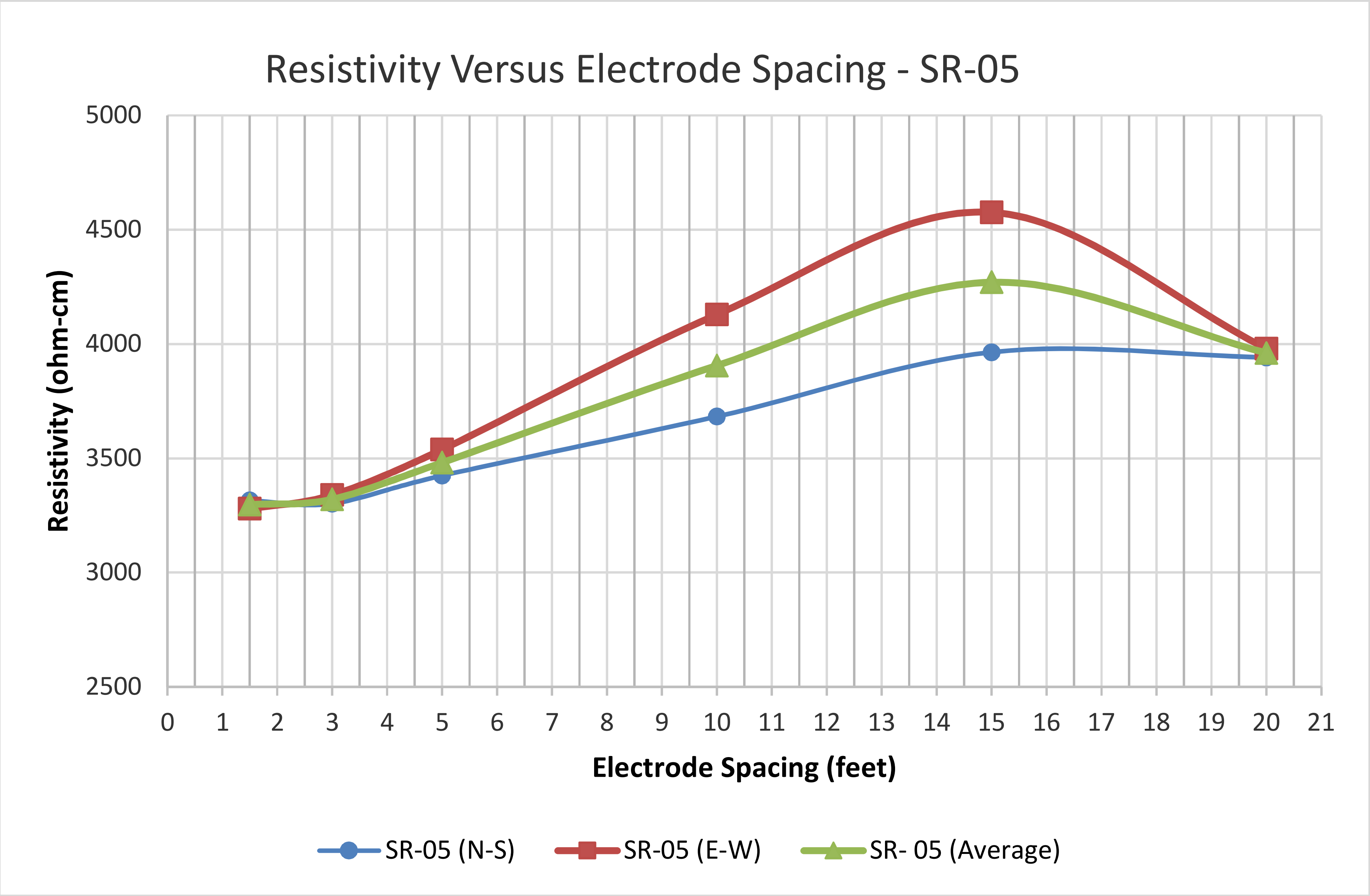
Project No. B1806731
Electrical Resistivity Testing (Wenner 4 pin Method - ASTM G57)

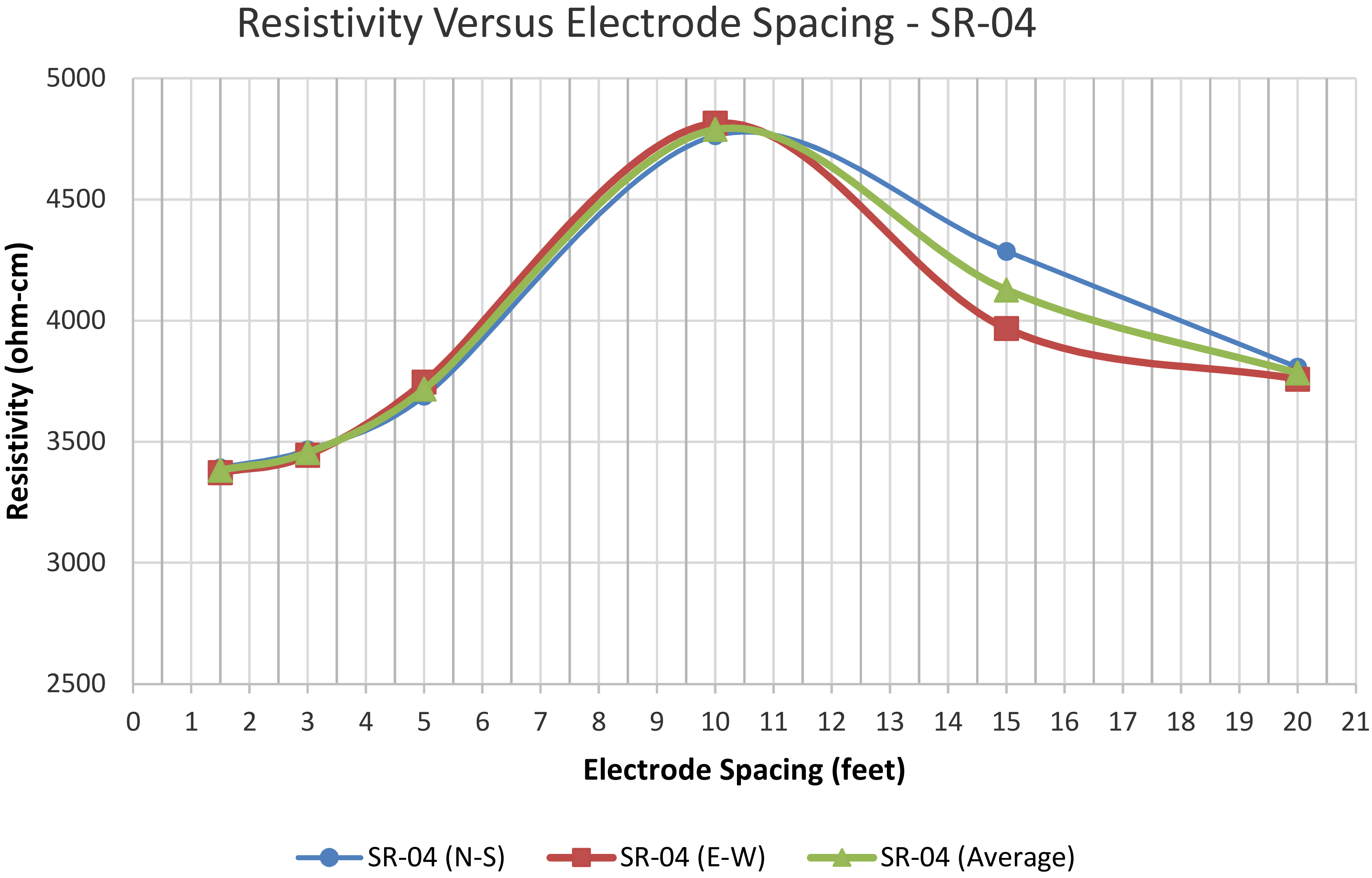
Site: Astoria Station
Weather: Partly Cloudy 60 to 65 Degrees F
Technician: Cody Mathiason **Date:** 7/26/2018

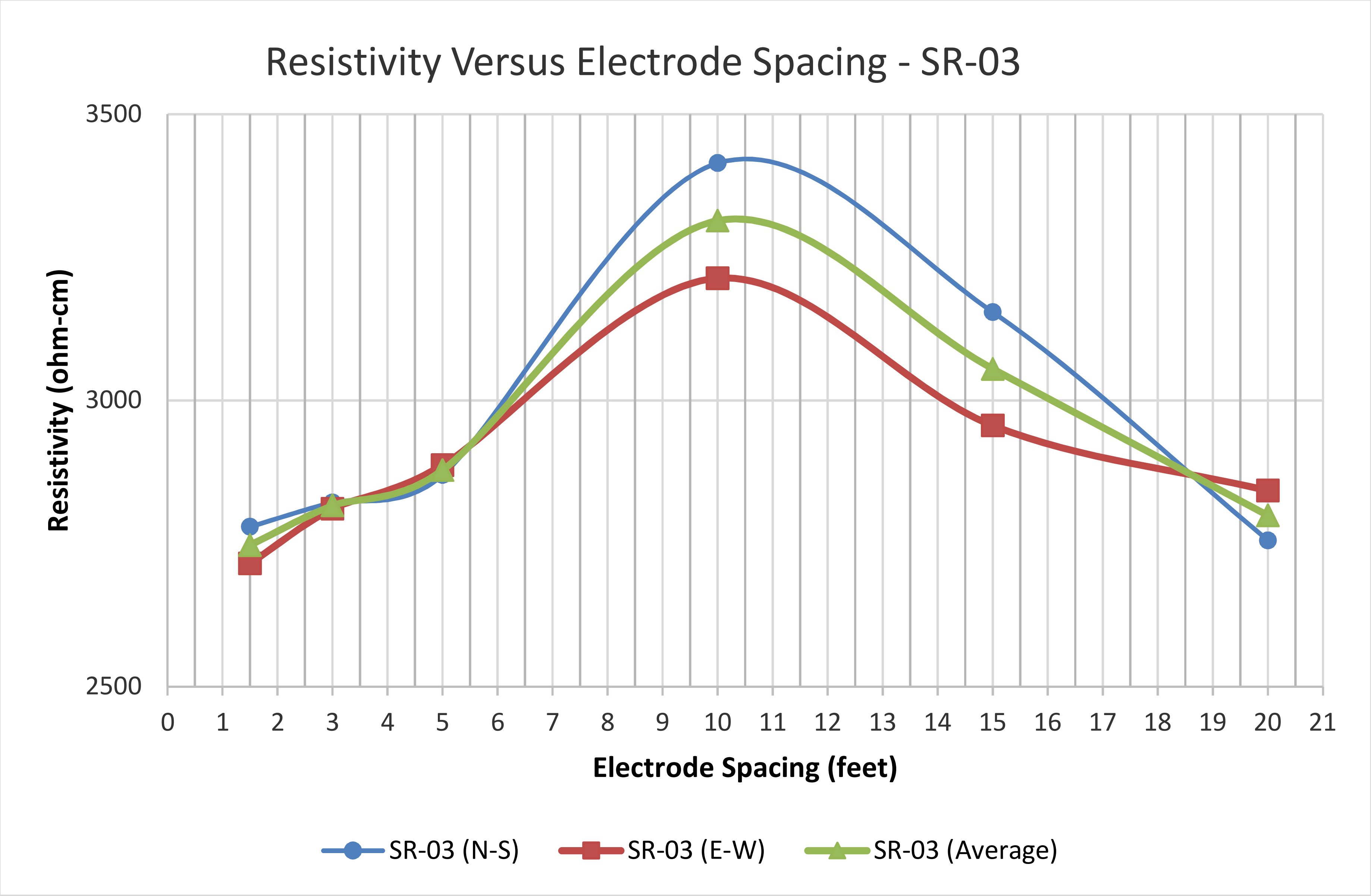
Points	Electrode Spacing (ft)	I (mA)	Voltage (V)	Resistance (ohm)	Resistivity (ohm-cm)	Points	Electrode Spacing (ft)	I (mA)	Voltage (V)	Resistance (ohm)	Resistivity (ohm-cm)	Average Resistivtity
SR-15 (N-S)	1.5	100	1.265	12.6500	3634	SR-15 (E-W)	1.5	100	1.234	12.3400	3545	3589
	3	100	0.644	6.4370	3698		3	100	0.642	6.4200	3689	3693
	5	100	0.419	4.1850	4007		5	100	0.443	4.4270	4239	4123
	10	100	0.282	2.8200	5401		10	100	0.302	3.0180	5780	5590
	15	100	0.155	1.5490	4450		15	100	0.170	1.6950	4869	4659
	20	100	0.110	1.1020	4221		20	100	0.112	1.1187	4285	4253
SR-14 (N-S)	1.5	200	2.446	12.2300	3513	SR-14 (E-W)	1.5	200	2.472	12.3580	3550	3532
	3	200	1.269	6.3460	3646		3	200	1.284	6.4210	3689	3668
	5	200	0.818	4.0890	3915		5	200	0.799	3.9950	3825	3870
	10	200	0.471	2.3570	4514		10	200	0.481	2.4050	4606	4560
	15	200	0.349	1.7450	5013		15	200	0.332	1.6590	4766	4889
	20	200	0.223	1.1150	4271		20	200	0.212	1.0580	4052	4162
SR-13 (N-S)	1.5	200	2.276	11.3810	3269	SR-13 (E-W)	1.5	200	2.283	11.4160	3279	3274
	3	200	1.196	5.9820	3437		3	200	1.163	5.8130	3340	3388
	5	200	0.744	3.7190	3561		5	200	0.739	3.6953	3538	3550
	10	200	0.486	2.4320	4658		10	200	0.512	2.5610	4905	4781
	15	200	0.310	1.5490	4450		15	200	0.319	1.5930	4576	4513
	20	200	0.205	1.0270	3934		20	200	0.208	1.0390	3980	3957
SR-12 (N-S)	1.5	200	2.431	12.1560	3492	SR-12 (E-W)	1.5	200	2.413	12.0630	3465	3479
	3	200	1.225	6.1230	3518		3	200	1.199	5.9930	3443	3481
	5	200	0.799	3.9970	3827		5	200	0.800	4.0010	3831	3829
	10	200	0.507	2.5370	4859		10	200	0.488	2.4392	4671	4765
	15	200	0.318	1.5910	4570		15	200	0.297	1.4870	4272	4421
	20	200	0.220	1.0990	4209		20	200	0.199	0.9940	3807	4008


Resistivity Versus Electrode Spacing - SR-15
Resistivity (ohm-cm)
6000
5500
5000
4500
4000
3500
3000
2500
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Electrode Spacing (feet)
SR-15 (N-S)
SR-15 (E-W)
SR-15 (Average)


Resistivity Versus Electrode Spacing - SR-06
4000
3500
3000
2500
Resistivity (ohm-cm)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Electrode Spacing (feet)
SR-06 (N-S)
SR-06 (E-W)
SR-06 (Average)

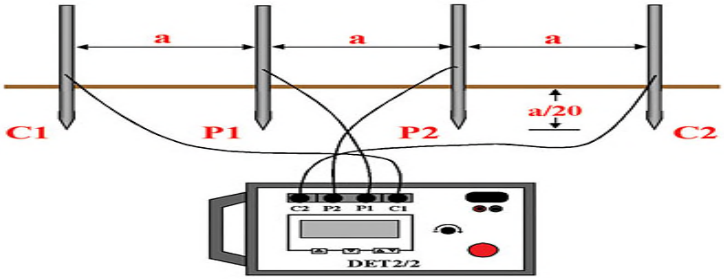

Resistivity Versus Electrode Spacing - SR-05
Resistivity (ohm-cm)
5000
4500
4000
3500
3000
2500
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Electrode Spacing (feet)
SR-05 (N-S)
SR-05 (E-W)
SR- 05 (Average)

Resistivity Versus Electrode Spacing - SR-04
Resistivity (ohm-cm)
5000
4500
4000
3500
3000
2500
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Electrode Spacing (feet)
SR-04 (N-S)
SR-04 (E-W)
SR-04 (Average)


Resistivity Versus Electrode Spacing - SR-03
Resistivity (ohm-cm)
3500
3000
2500
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Electrode Spacing (feet)
SR-03 (N-S)
SR-03 (E-W)
SR-03 (Average)

Project No. B1806731
Electrical Resistivity Testing (Wenner 4 pin Method)
Date: 7/26/2018

Site: Astoria Station
Weather: Partly Cloudy 60 to 65 Degrees F
Technician: Cody Mathiason



Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-11 (N-S)	1.5	200	11.7800
	3	200	5.9190
	5	200	3.7290
	10	200	2.3790
	15	200	1.4830
	20	200	1.0680

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-11 (E-W)	1.5	200	11.5300
	3	200	5.8290
	5	200	3.6390
	10	200	2.4190
	15	200	1.3950
	20	200	1.1290

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-10 (N-S)	1.5	200	10.2400
	3	200	5.2470
	5	200	3.2780
	10	200	1.8990
	15	200	1.2070
	20	200	0.8120

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-10 (E-W)	1.5	200	10.3500
	3	200	5.3190
	5	200	3.3730
	10	200	1.9910
	15	200	1.1920
	20	200	0.8041

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-09 (N-S)	1.5	200	11.6500
	3	200	5.9120
	5	200	3.6190
	10	200	2.0180
	15	200	1.3490
	20	200	0.9513

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-09 (E-W)	1.5	200	11.6200
	3	200	5.8250
	5	200	3.5170
	10	200	2.0070
	15	200	1.3710
	20	200	0.9841

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-08 (N-S)	1.5	200	8.3820
	3	200	4.3280
	5	200	2.8070
	10	200	1.5980
	15	200	0.9241
	20	200	0.6160

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-08 (E-W)	1.5	200	8.4230
	3	200	4.6280
	5	200	2.9190
	10	200	1.4870
	15	200	0.9010
	20	200	0.6271

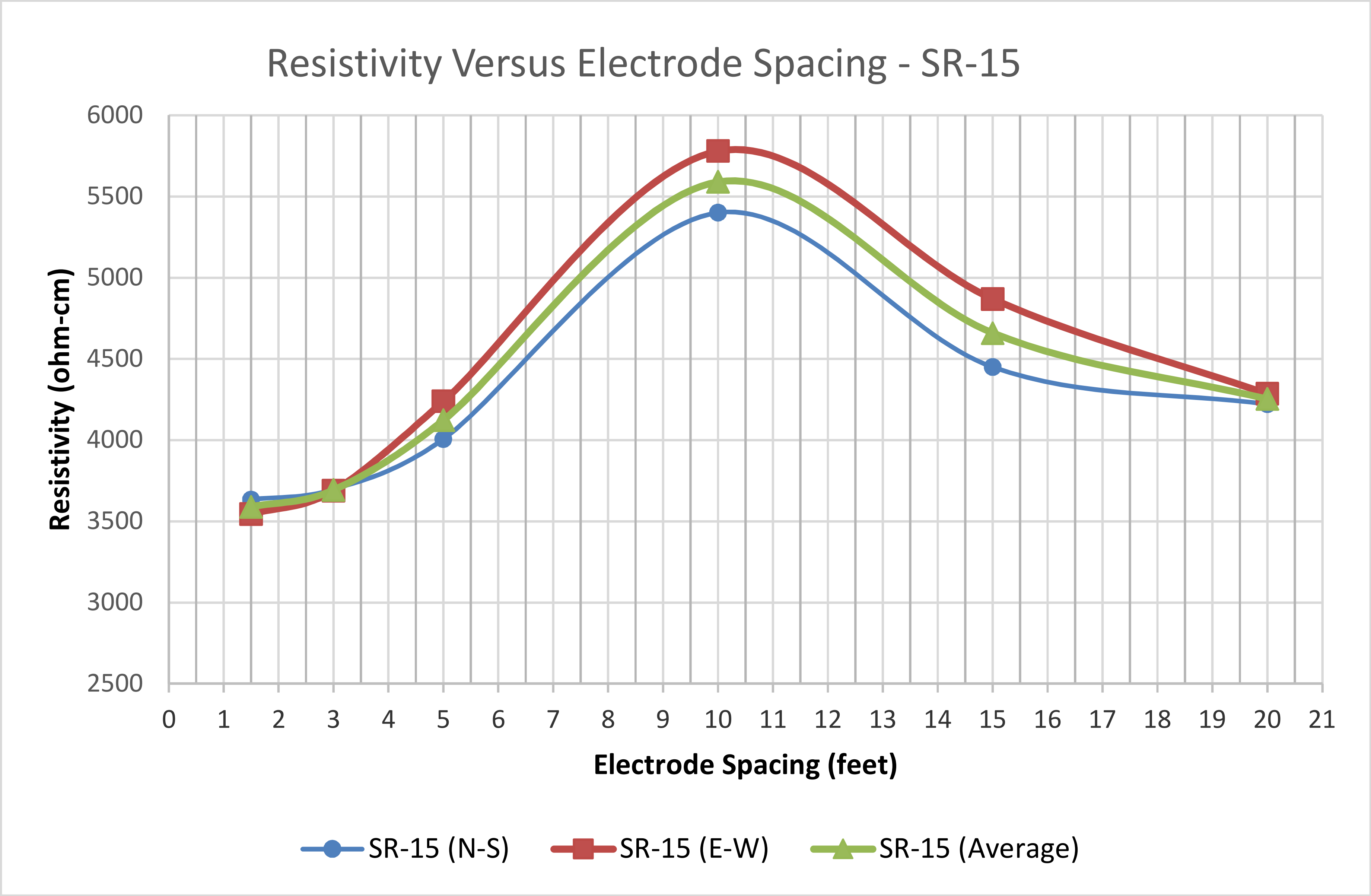
Project No. B1806731
Electrical Resistivity Testing (Wenner 4 pin Method - ASTM G57)

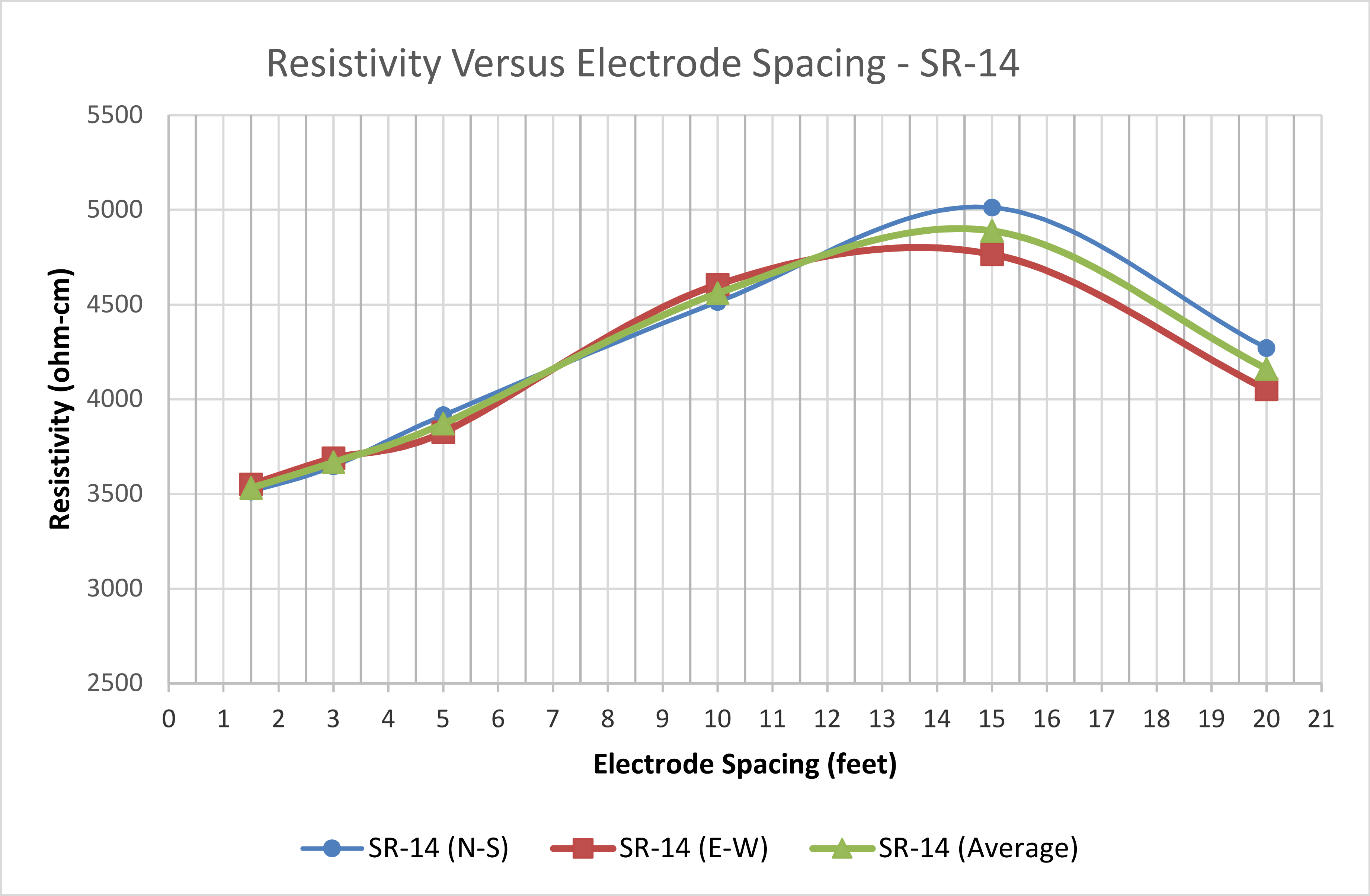
Site: Astoria Station
Weather: Partly Cloudy 60 to 65 Degrees F
Technician: Cody Mathiason **Date:** 7/26/2018

Points	Electrode Spacing (ft)	I (mA)	Voltage (V)	Resistance (ohm)	Resistivity (ohm-cm)
SR-15 (N-S)	1.5	100	1.265	12.6500	3634
	3	100	0.644	6.4370	3698
	5	100	0.419	4.1850	4007
	10	100	0.282	2.8200	5401
	15	100	0.155	1.5490	4450
	20	100	0.110	1.1020	4221
SR-14 (N-S)	1.5	200	2.446	12.2300	3513
	3	200	1.269	6.3460	3646
	5	200	0.818	4.0890	3915
	10	200	0.471	2.3570	4514
	15	200	0.349	1.7450	5013
	20	200	0.223	1.1150	4271
SR-13 (N-S)	1.5	200	2.276	11.3810	3269
	3	200	1.196	5.9820	3437
	5	200	0.744	3.7190	3561
	10	200	0.486	2.4320	4658
	15	200	0.310	1.5490	4450
	20	200	0.205	1.0270	3934
SR-12 (N-S)	1.5	200	2.431	12.1560	3492
	3	200	1.225	6.1230	3518
	5	200	0.799	3.9970	3827
	10	200	0.507	2.5370	4859
	15	200	0.318	1.5910	4570
	20	200	0.220	1.0990	4209

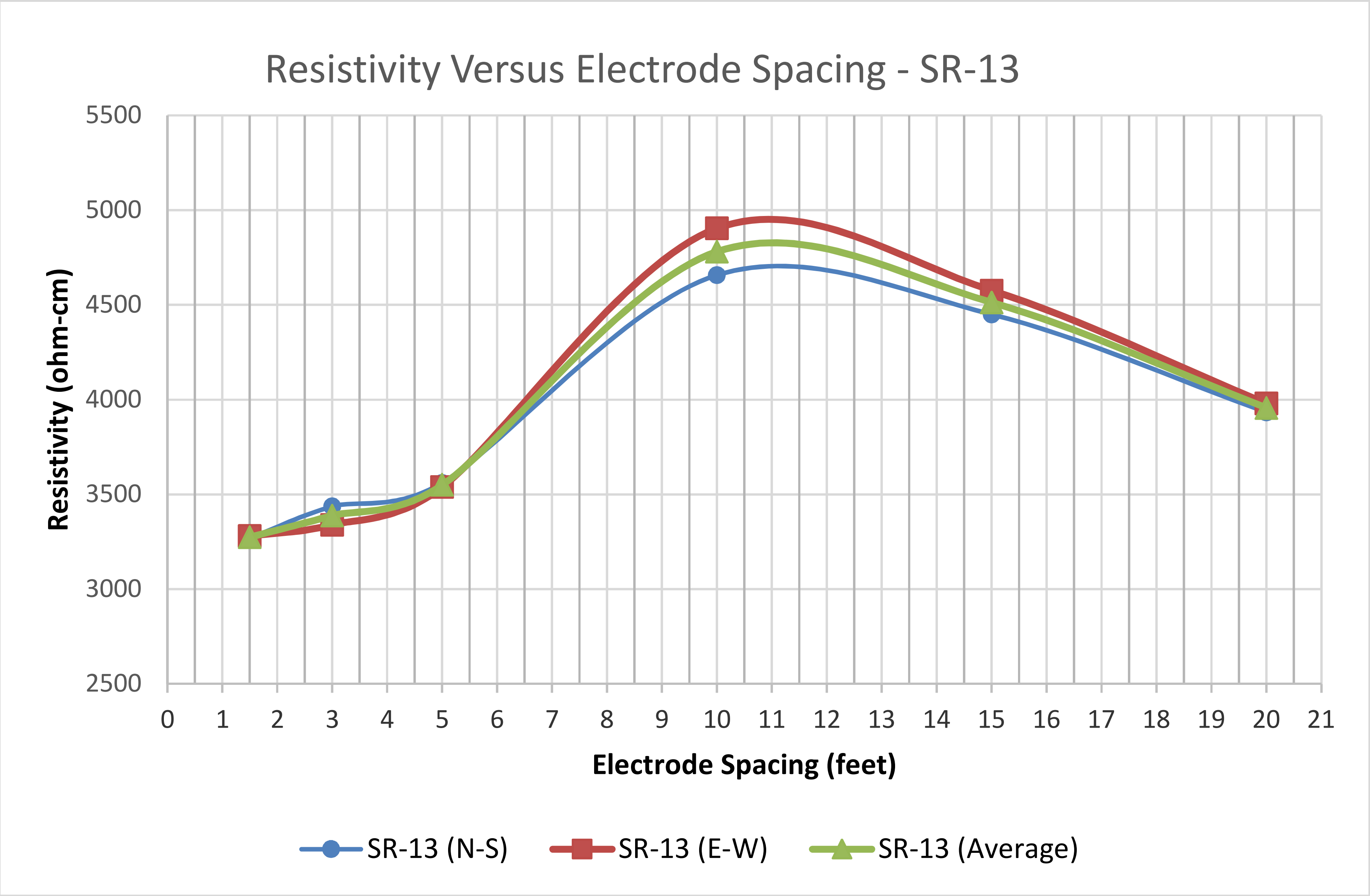
Points	Electrode Spacing (ft)	I (mA)	Voltage (V)	Resistance (ohm)	Resistivity (ohm-cm)
SR-15 (E-W)	1.5	100	1.234	12.3400	3545
	3	100	0.642	6.4200	3689
	5	100	0.443	4.4270	4239
	10	100	0.302	3.0180	5780
	15	100	0.170	1.6950	4869
	20	100	0.112	1.1187	4285
SR-14 (E-W)	1.5	200	2.472	12.3580	3550
	3	200	1.284	6.4210	3689
	5	200	0.799	3.9950	3825
	10	200	0.481	2.4050	4606
	15	200	0.332	1.6590	4766
	20	200	0.212	1.0580	4052
SR-13 (E-W)	1.5	200	2.283	11.4160	3279
	3	200	1.163	5.8130	3340
	5	200	0.739	3.6953	3538
	10	200	0.512	2.5610	4905
	15	200	0.319	1.5930	4576
	20	200	0.208	1.0390	3980
SR-12 (E-W)	1.5	200	2.413	12.0630	3465
	3	200	1.199	5.9930	3443
	5	200	0.800	4.0010	3831
	10	200	0.488	2.4392	4671
	15	200	0.297	1.4870	4272
	20	200	0.199	0.9940	3807

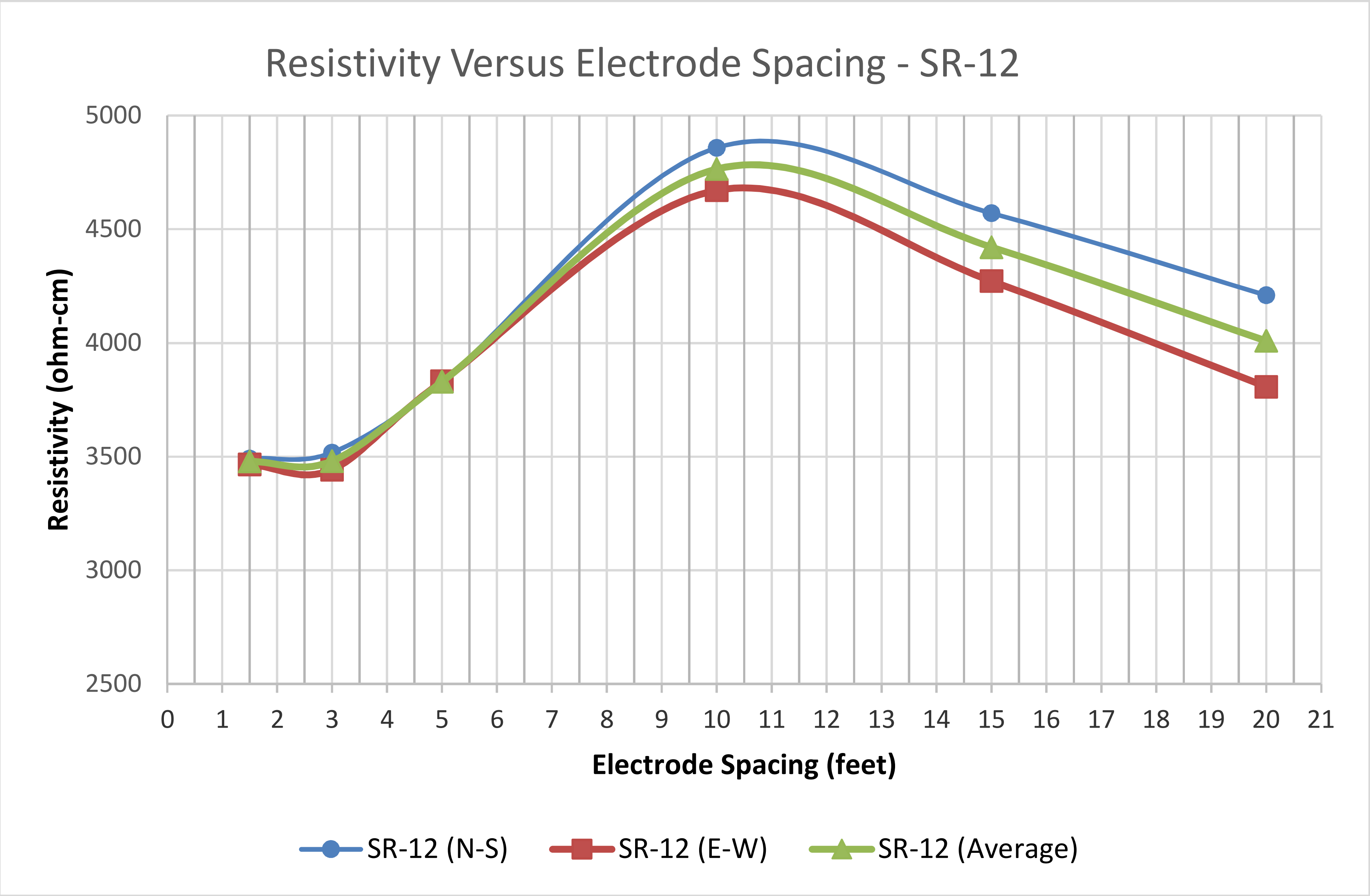
Average Resistivtity
3589
3693
4123
5590
4659
4253
3532
3668
3870
4560
4889
4162
3274
3388
3550
4781
4513
3957
3479
3481
3829
4765
4421
4008


Resistivity Versus Electrode Spacing - SR-15
Resistivity (ohm-cm)
6000
5500
5000
4500
4000
3500
3000
2500
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Electrode Spacing (feet)
SR-15 (N-S)
SR-15 (E-W)
SR-15 (Average)



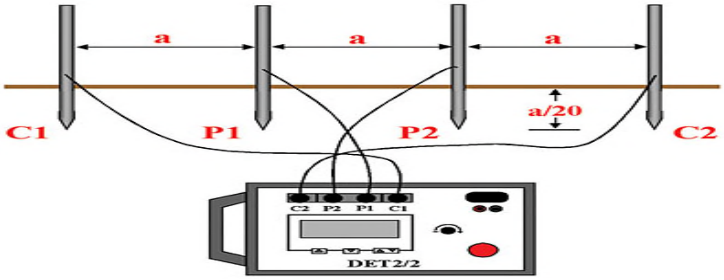
Resistivity Versus Electrode Spacing - SR-14


Resistivity Versus Electrode Spacing - SR-13
Resistivity (ohm-cm)
5500
5000
4500
4000
3500
3000
2500
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Electrode Spacing (feet)
SR-13 (N-S)
SR-13 (E-W)
SR-13 (Average)


Resistivity Versus Electrode Spacing - SR-12
Resistivity (ohm-cm)
5000
4500
4000
3500
3000
2500
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Electrode Spacing (feet)
SR-12 (N-S)
SR-12 (E-W)
SR-12 (Average)

Project No. B1806731
Electrical Resistivity Testing (Wenner 4 pin Method)
Date: 7/26/2018

Site: Astoria Station
Weather: Partly Cloudy 60 to 65 Degrees F
Technician: Cody Mathiason



Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-11 (N-S)	1.5	200	11.7800
	3	200	5.9190
	5	200	3.7290
	10	200	2.3790
	15	200	1.4830
	20	200	1.0680

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-11 (E-W)	1.5	200	11.5300
	3	200	5.8290
	5	200	3.6390
	10	200	2.4190
	15	200	1.3950
	20	200	1.1290

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-10 (N-S)	1.5	200	10.2400
	3	200	5.2470
	5	200	3.2780
	10	200	1.8990
	15	200	1.2070
	20	200	0.8120

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-10 (E-W)	1.5	200	10.3500
	3	200	5.3190
	5	200	3.3730
	10	200	1.9910
	15	200	1.1920
	20	200	0.8041

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-09 (N-S)	1.5	200	11.6500
	3	200	5.9120
	5	200	3.6190
	10	200	2.0180
	15	200	1.3490
	20	200	0.9513

Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-09 (E-W)	1.5	200	11.6200
	3	200	5.8250
	5	200	3.5170
	10	200	2.0070
	15	200	1.3710
	20	200	0.9841

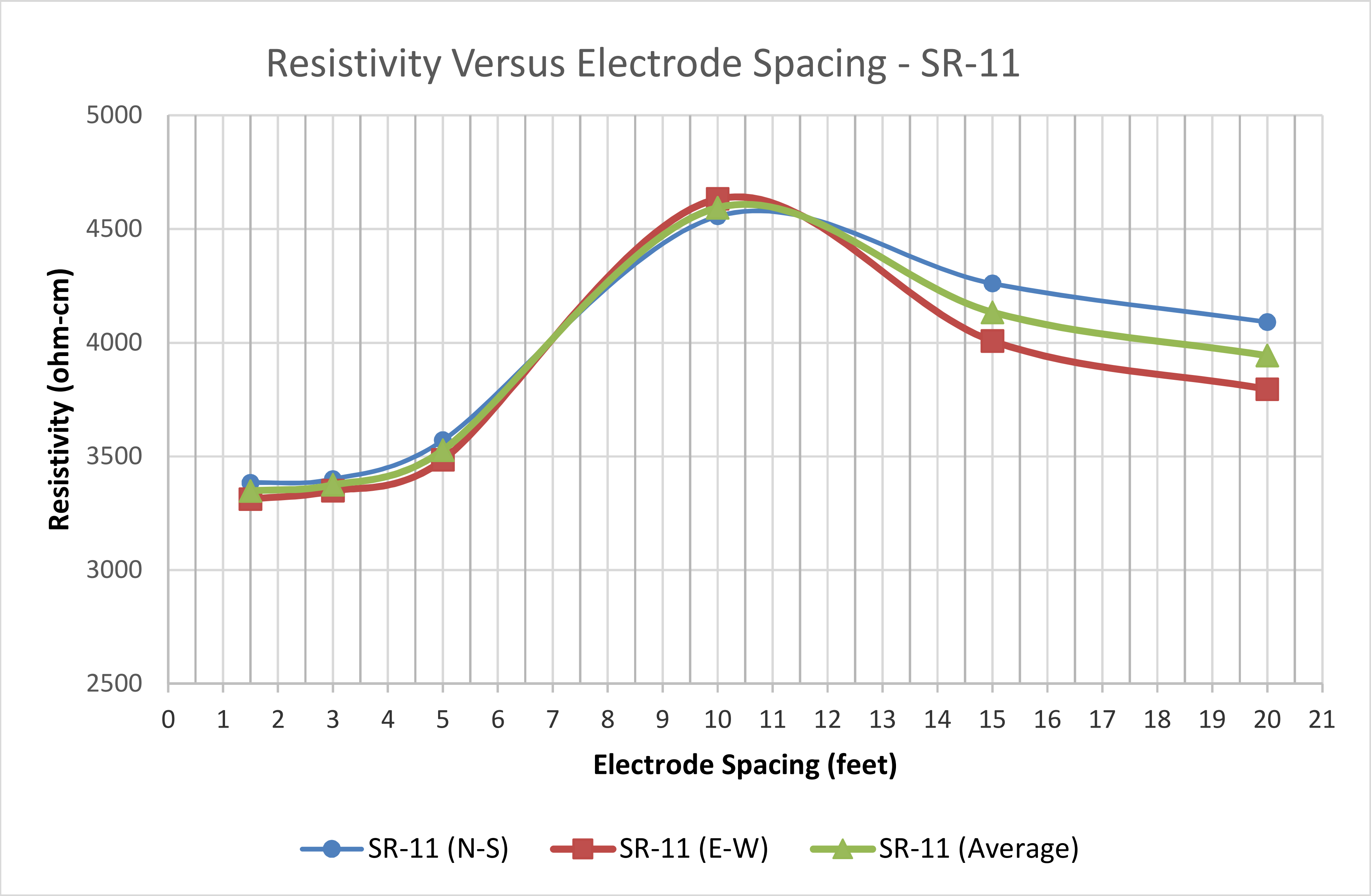
Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-08 (N-S)	1.5	200	8.3820
	3	200	4.3280
	5	200	2.8070
	10	200	1.5980
	15	200	0.9241
	20	200	0.6160

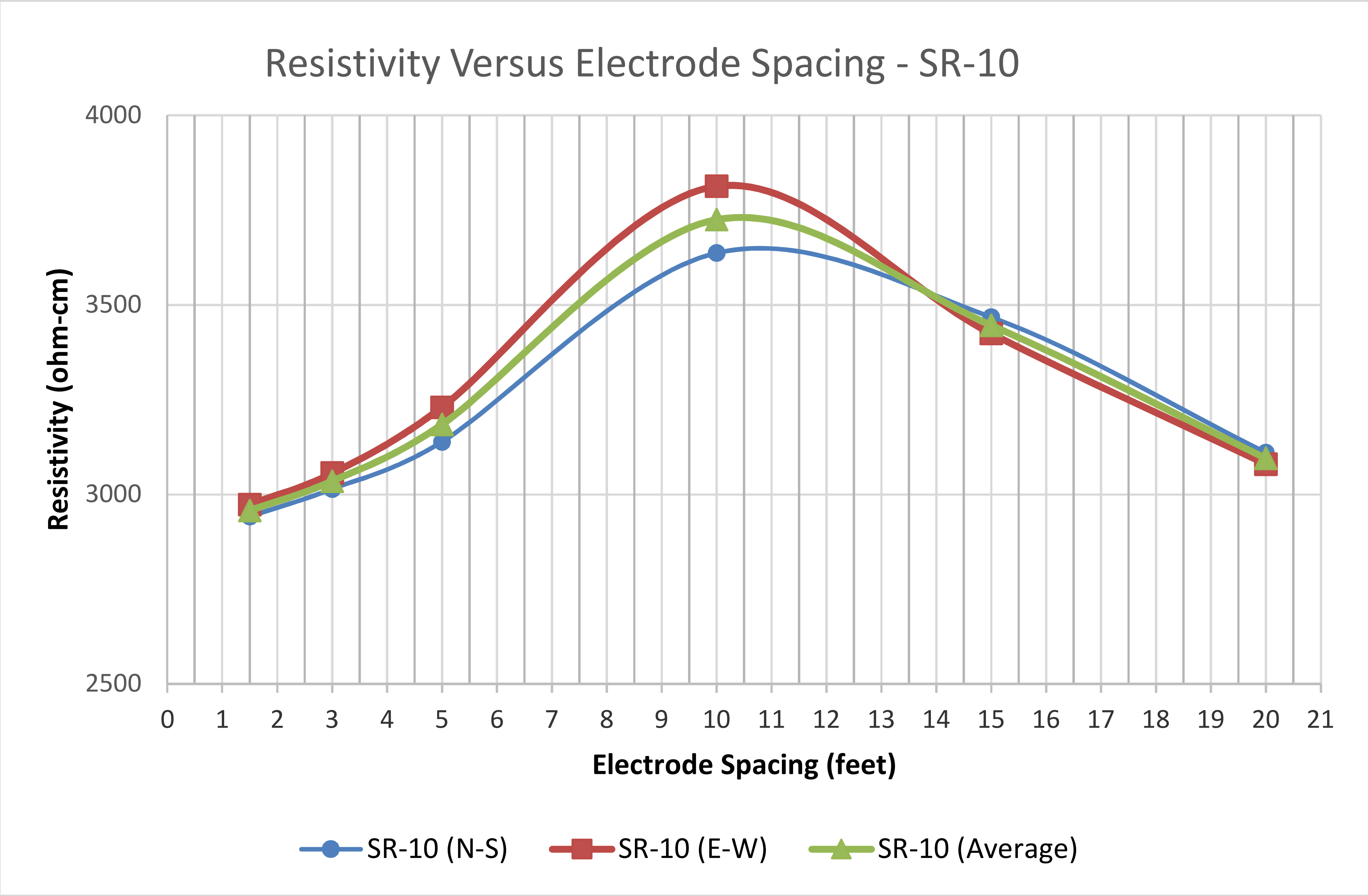
Points	Electrode Spacing (ft)	I (mA)	Resistance (ohm)
SR-08 (E-W)	1.5	200	8.4230
	3	200	4.6280
	5	200	2.9190
	10	200	1.4870
	15	200	0.9010
	20	200	0.6271

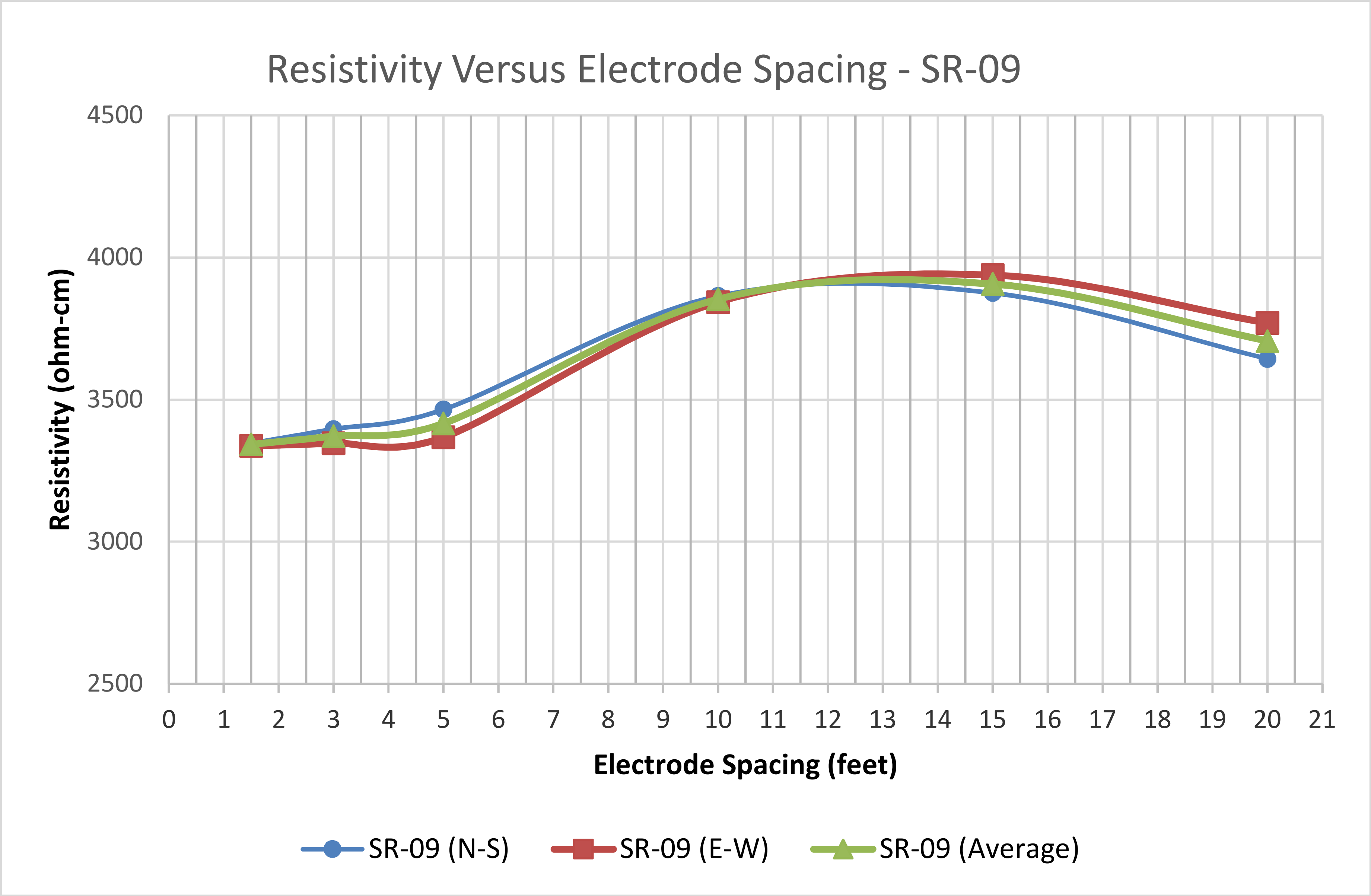
Project No. B1806731
Electrical Resistivity Testing (Wenner 4 pin Method - ASTM G57)

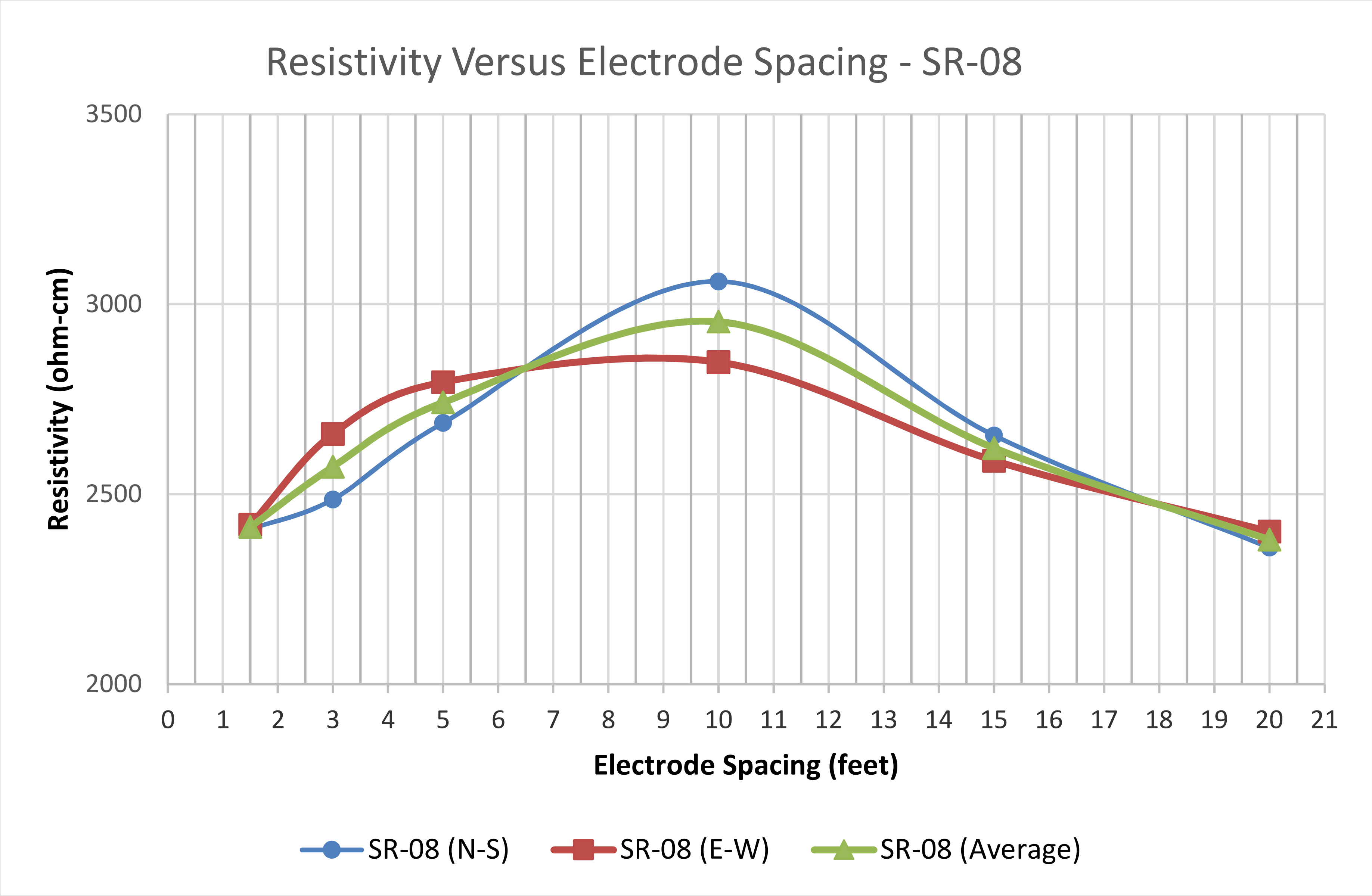
Site: Astoria Station
Weather: Partly Cloudy 60 to 65 Degrees F
Technician: Cody Mathiason **Date:** 7/26/2018

Points	Electrode Spacing (ft)	I (mA)	Voltage (V)	Resistance (ohm)	Resistivity (ohm-cm)	Points	Electrode Spacing (ft)	I (mA)	Voltage (V)	Resistance (ohm)	Resistivity (ohm-cm)	Average Resistivtity
SR-11 (N-S)	1.5	200	2.356	11.7800	3384	SR-11 (E-W)	1.5	200	2.306	11.5300	3312	3348
	3	200	1.184	5.9190	3401		3	200	1.166	5.8290	3349	3375
	5	200	0.746	3.7290	3571		5	200	0.728	3.6390	3485	3528
	10	200	0.476	2.3790	4556		10	200	0.484	2.4190	4633	4594
	15	200	0.297	1.4830	4260		15	200	0.279	1.3950	4007	4134
	20	200	0.214	1.0680	4091		20	200	0.198	0.9910	3796	3943
SR-10 (N-S)	1.5	200	2.048	10.2400	2942	SR-10 (E-W)	1.5	200	2.070	10.3500	2973	2957
	3	200	1.049	5.2470	3015		3	200	1.064	5.3190	3056	3035
	5	200	0.656	3.2780	3139		5	200	0.675	3.3730	3230	3184
	10	200	0.380	1.8990	3637		10	200	0.398	1.9910	3813	3725
	15	200	0.241	1.2070	3467		15	200	0.238	1.1920	3424	3446
	20	200	0.162	0.8120	3110		20	200	0.161	0.8041	3080	3095
SR-09 (N-S)	1.5	200	2.330	11.6500	3347	SR-09 (E-W)	1.5	200	2.324	11.6200	3338	3342
	3	200	1.182	5.9120	3397		3	200	1.165	5.8250	3347	3372
	5	200	0.724	3.6190	3465		5	200	0.703	3.5170	3368	3417
	10	200	0.404	2.0180	3865		10	200	0.401	2.0070	3844	3854
	15	200	0.270	1.3490	3875		15	200	0.274	1.3710	3938	3907
	20	200	0.190	0.9513	3644		20	200	0.197	0.9841	3769	3707
SR-08 (N-S)	1.5	200	1.676	8.3820	2408	SR-08 (E-W)	1.5	200	1.685	8.4230	2420	2414
	3	200	0.866	4.3280	2487		3	200	0.926	4.6280	2659	2573
	5	200	0.561	2.8070	2688		5	200	0.584	2.9190	2795	2741
	10	200	0.320	1.5980	3060		10	200	0.297	1.4870	2848	2954
	15	200	0.185	0.9241	2655		15	200	0.180	0.9010	2588	2621
	20	200	0.123	0.6160	2359		20	200	0.125	0.6271	2402	2381


Resistivity Versus Electrode Spacing - SR-11
Resistivity (ohm-cm)
5000
4500
4000
3500
3000
2500
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Electrode Spacing (feet)
SR-11 (N-S)
SR-11 (E-W)
SR-11 (Average)


Resistivity Versus Electrode Spacing - SR-10
Resistivity (ohm-cm)
4000
3500
3000
2500
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Electrode Spacing (feet)
SR-10 (N-S)
SR-10 (E-W)
SR-10 (Average)


Resistivity Versus Electrode Spacing - SR-09
4500
4000
3500
3000
2500
Resistivity (ohm-cm)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Electrode Spacing (feet)
SR-09 (N-S)
SR-09 (E-W)
SR-09 (Average)


Resistivity Versus Electrode Spacing - SR-08
Resistivity (ohm-cm)
3500
3000
2500
2000
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
Electrode Spacing (feet)
SR-08 (N-S)
SR-08 (E-W)
SR-08 (Average)

Project No. B1806731
Electrical Resistivity Testing (Schlumberger Four Pin Method)

Site: Astoria Station
Weather: Partly Cloudy 60 to 65 Degrees F
Technician: Cody Mathiason **Date:** 7/27/2018

Points	Electrode Spacing (a) (cm)	Electrode Spacing (α) (cm)	I (mA)	Voltage (V)	Resistance (ohm)	Resistivity (ohm-cm)
SR-1C1 (Centered at Staked Location and Ran (N-S)	5135.88	0.602373887	200	0.060	0.2989	2551
SR-1C2 (Centered at Staked Location and Ran (N-S)	5135.88	0.602373887	200	0.056	0.2796	2386
SR-2C1 (Centered at Staked Location at Ran (E-W)	4831.08	0.602523659	200	0.059	0.2974	2386
SR-2C2 (Ran to the West from the Staked Location	4831.08	0.602523659	200	0.056	0.2819	2262

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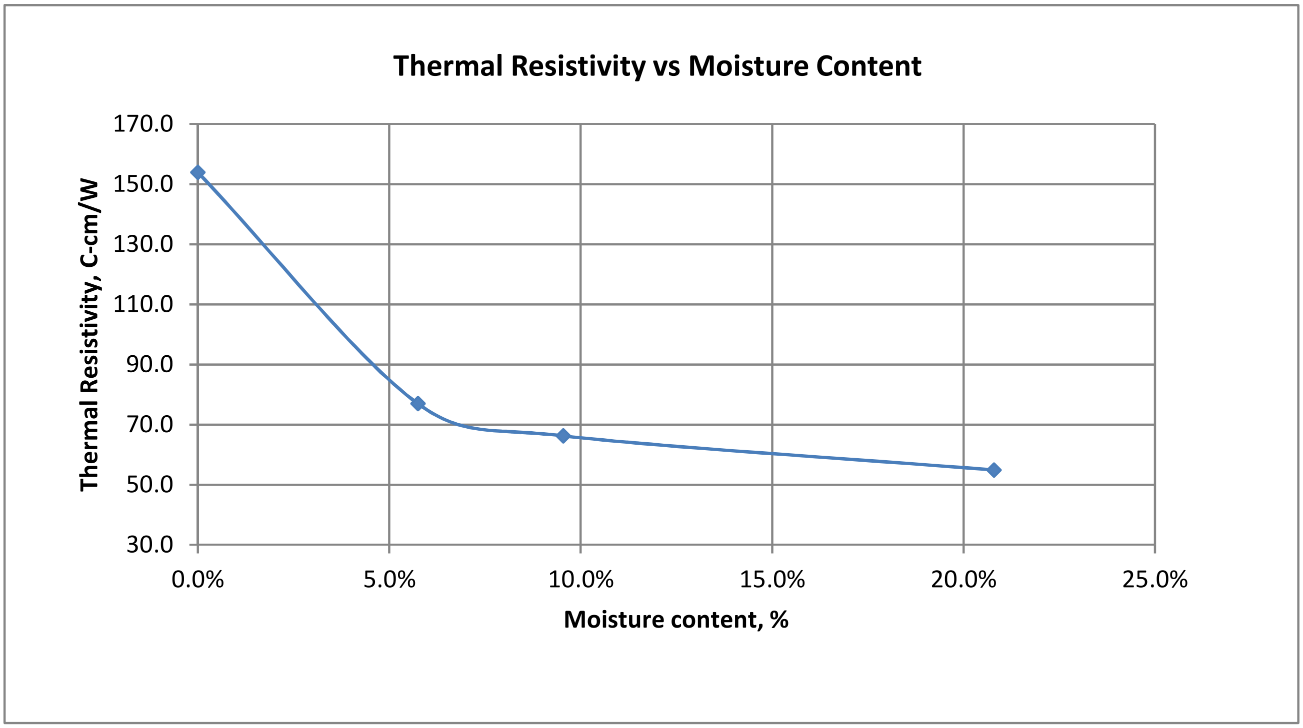
Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe
ASTM D 5334-08

Date:	August 21, 2018	**Project Number:**	B1806731
Client:	Kirk Phinney Otter Tail Power Company 215 S Cascade, P.O. Box 496 Fergus Falls, MN 56538	**Project Description:**	Astoria Station 19333 482nd Ave Astoria, SD

Location:	T-1, 2-4'	Needle Type:	TR-1
Description:	Sandy Lean Clay	Measurement Time:	10 min
Date Received:	7/30/18	Maximum Density:	NA
Date Tested:	8/21/18	Optimum Moisture:	NA

Moisture Content %	**Thermal Resistivity** C-cm/W	**Temperature** °C	**Err Value**
0.0%	154.0	24.7	0.0032
5.8%	77.0	23.7	0.0036
9.5%	66.3	23.5	0.0051
20.8%	54.9	23.3	0.0041



Remarks:

James Streier

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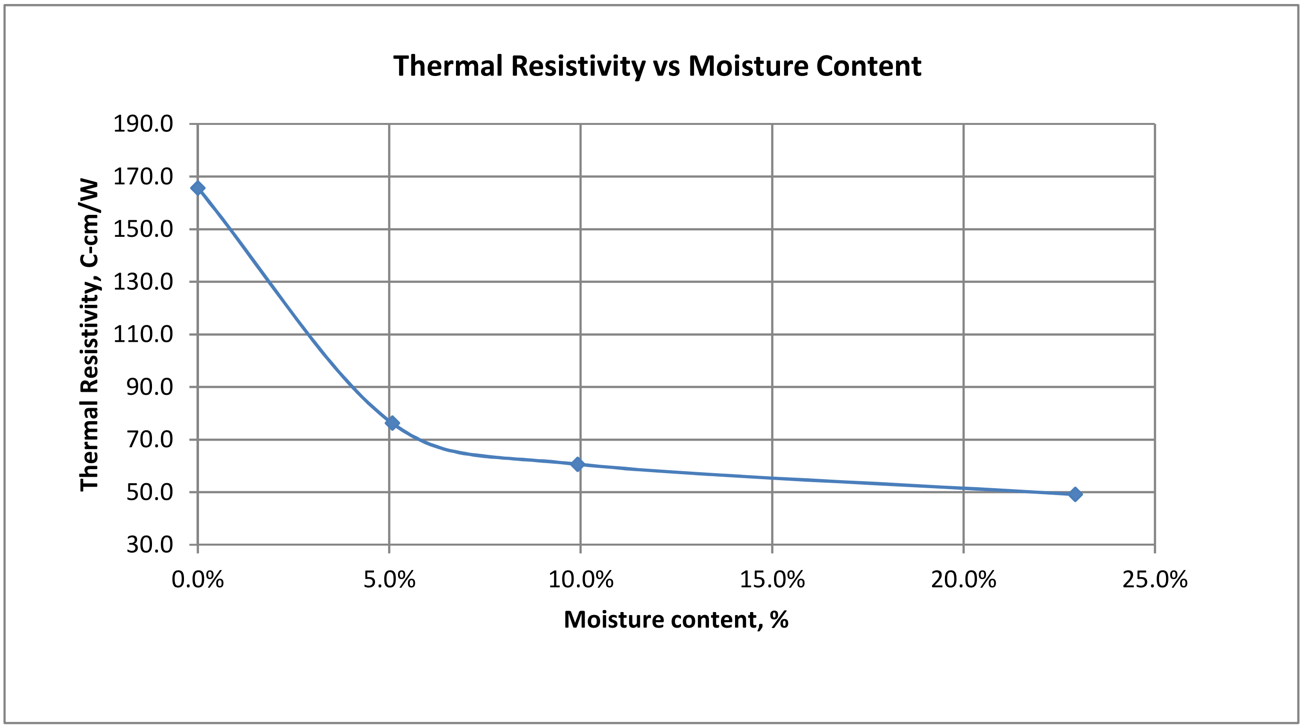
ASTM D 5334-08

Date:	August 21, 2018	**Project Number:**	B1806731
Client:	Kirk Phinney Otter Tail Power Company 215 S Cascade, P.O. Box 496 Fergus Falls, MN 56538	**Project Description:**	Astoria Station 19333 482nd Ave Astoria, SD

Location:	T-1, 4-6'	Needle Type:	TR-1
Description:	Sandy Lean Clay	Measurement Time:	10 min
Date Received:	7/30/18	Maximum Density:	NA
Date Tested:	8/21/18	Optimum Moisture:	NA

Moisture Content **%**	**Thermal Resistivity** **C-cm/W**	**Temperature** **°C**	**Err Value**
0.0%	165.7	24.8	0.0053
5.1%	76.3	23.7	0.0048
9.9%	60.7	23.6	0.0062
22.9%	49.2	23.3	0.0055



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ASTM D 5334-08

Date: August 21, 2018

Project Number: B1806731

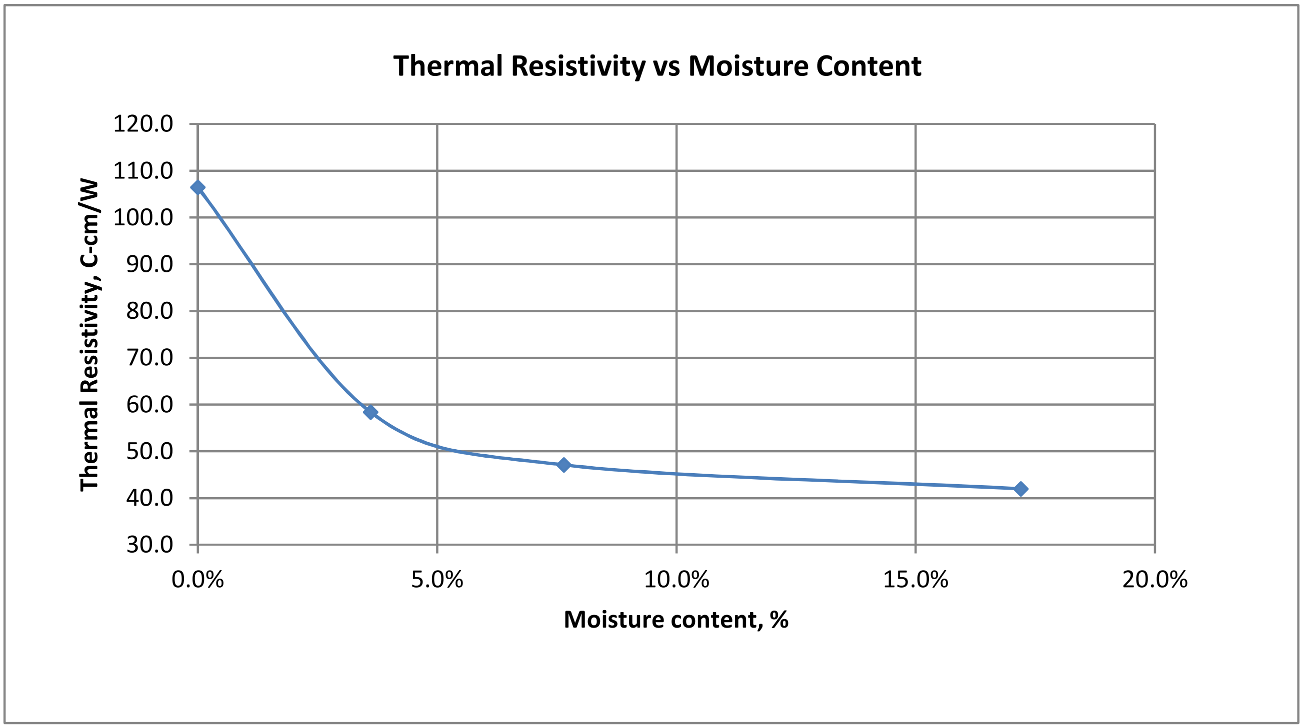
Client:
Kirk Phinney
Otter Tail Power Company
215 S Cascade, P.O. Box 496
Fergus Falls, MN 56538

Project Description:
Astoria Station
19333 482nd Ave
Astoria, SD

Location: T-2, 2-4'
Description: Sandy Lean Clay
Date Received: 7/30/18
Date Tested: 8/21/18

Needle Type: TR-1
Measurement Time: 10 min
Maximum Density: NA
Optimum Moisture: NA

Moisture Content %	**Thermal Resistivity** C-cm/W	**Temperature** °C	**Err Value**
0.0%	106.5	24.6	0.0064
3.6%	58.4	23.6	0.0052
7.7%	47.1	23.7	0.0055
17.2%	42.0	23.3	0.0073



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ASTM D 5334-08

Date: August 21, 2018

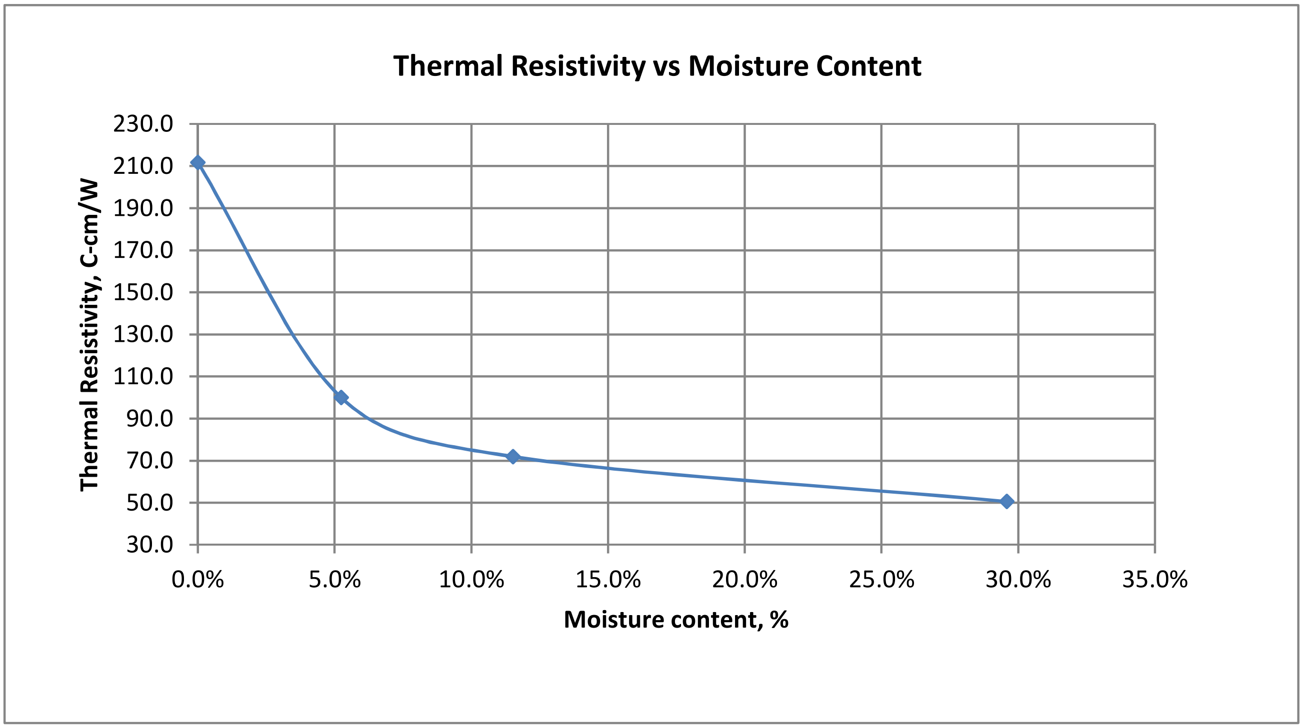
Project Number: B1806731

Client:
Kirk Phinney
Otter Tail Power Company
215 S Cascade, P.O. Box 496
Fergus Falls, MN 56538

Project Description:
Astoria Station
19333 482nd Ave
Astoria, SD

Location:	T-2, 4-6'	Needle Type:	TR-1
Description:	Sandy Lean Clay	Measurement Time:	10 min
Date Received:	7/30/18	Maximum Density:	NA
Date Tested:	8/21/18	Optimum Moisture:	NA

Moisture Content %	**Thermal Resistivity** C-cm/W	**Temperature** °C	**Err Value**
0.0%	211.8	24.6	0.0271
5.2%	100.0	23.6	0.0110
11.5%	71.9	23.6	0.0094
29.6%	50.6	23.1	0.0046



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ASTM D 5334-08

Date: August 21, 2018

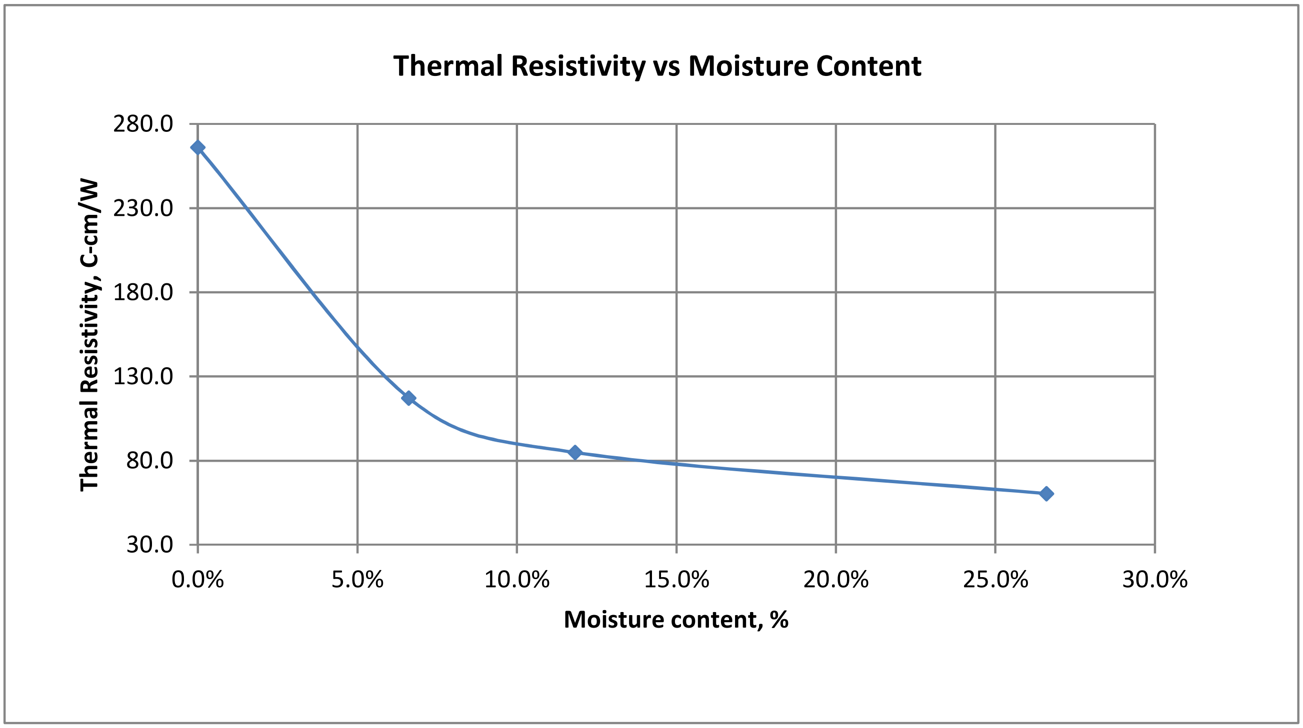
Project Number: B1806731

Client:
Kirk Phinney
Otter Tail Power Company
215 S Cascade, P.O. Box 496
Fergus Falls, MN 56538

Project Description:
Astoria Station
19333 482nd Ave
Astoria, SD

Location:	T-3, 2-4'	Needle Type:	TR-1
Description:	Sandy Lean Clay	Measurement Time:	10 min
Date Received:	7/30/18	Maximum Density:	NA
Date Tested:	8/21/18	Optimum Moisture:	NA

Moisture Content %	**Thermal Resistivity** C-cm/W	**Temperature** °C	**Err Value**
0.0%	266.1	24.9	0.0029
6.6%	117.3	23.6	0.0022
11.8%	84.9	23.7	0.0043
26.6%	60.4	23.2	0.0111



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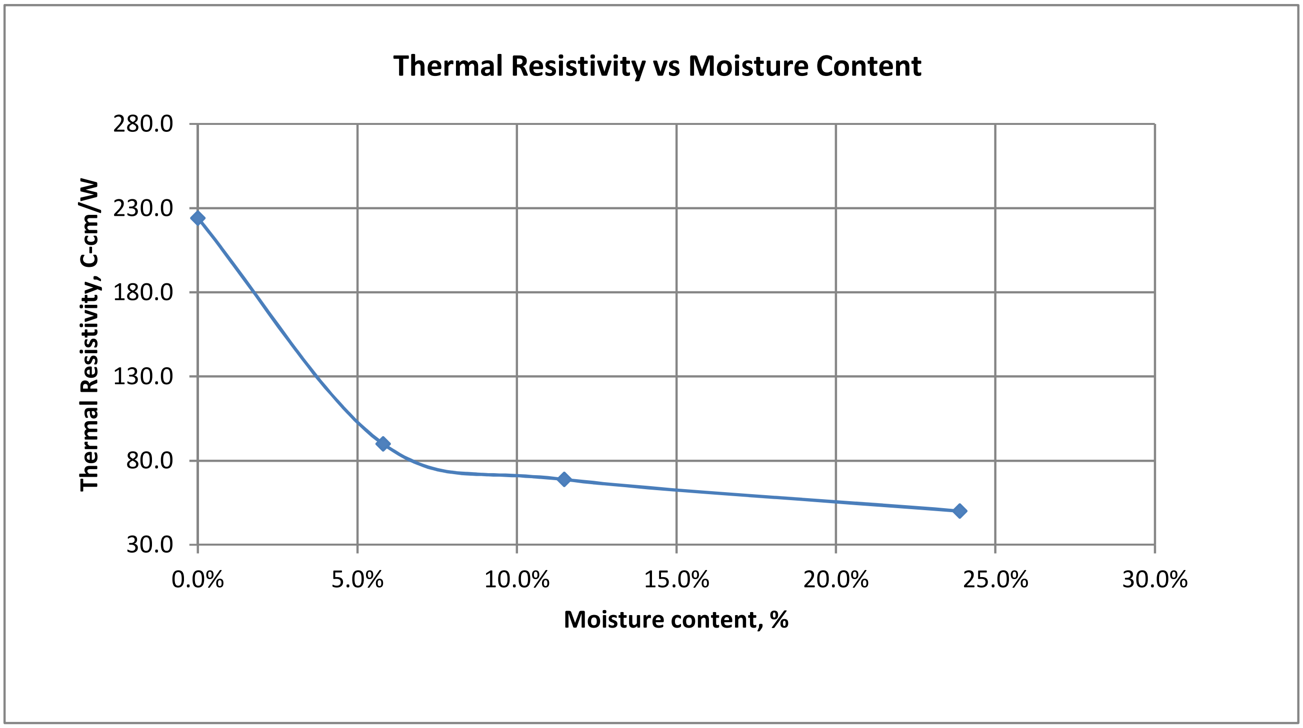
Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe
ASTM D 5334-08

Date:	August 21, 2018	**Project Number:**	B1806731
Client:	Kirk Phinney Otter Tail Power Company 215 S Cascade, P.O. Box 496 Fergus Falls, MN 56538	**Project Description:**	Astoria Station 19333 482nd Ave Astoria, SD

Location:	T-3, 4-6'	Needle Type:	TR-1
Description:	Silty Sand	Measurement Time:	10 min
Date Received:	7/30/18	Maximum Density:	NA
Date Tested:	8/21/18	Optimum Moisture:	NA

Moisture Content %	**Thermal Resistivity** C-cm/W	**Temperature** °C	**Err Value**
0.0%	224.1	24.8	0.0014
5.8%	90.0	23.6	0.0014
11.5%	68.8	23.6	0.0027
23.9%	50.1	23.0	0.0053



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ASTM D 5334-08

Date: August 21, 2018

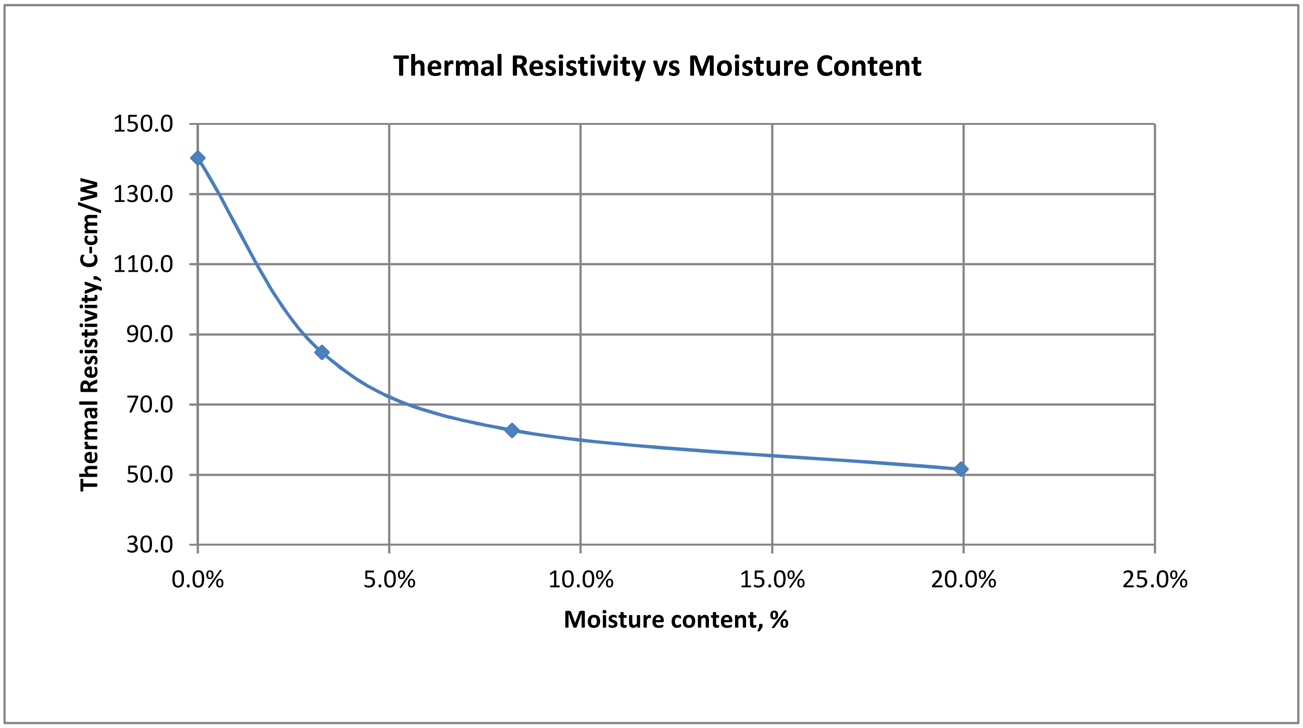
Project Number: B1806731

Client:
Kirk Phinney
Otter Tail Power Company
215 S Cascade, P.O. Box 496
Fergus Falls, MN 56538

Project Description:
Astoria Station
19333 482nd Ave
Astoria, SD

Location:	T-4, 2-4'	Needle Type:	TR-1
Description:	Sandy Lean Clay	Measurement Time:	10 min
Date Received:	7/30/18	Maximum Density:	NA
Date Tested:	8/21/18	Optimum Moisture:	NA

Moisture Content %	**Thermal Resistivity** C-cm/W	**Temperature** °C	**Err Value**
0.0%	140.3	24.7	0.0046
3.2%	84.9	23.4	0.0025
8.2%	62.7	22.5	0.0050
19.9%	51.6	23.8	0.0055



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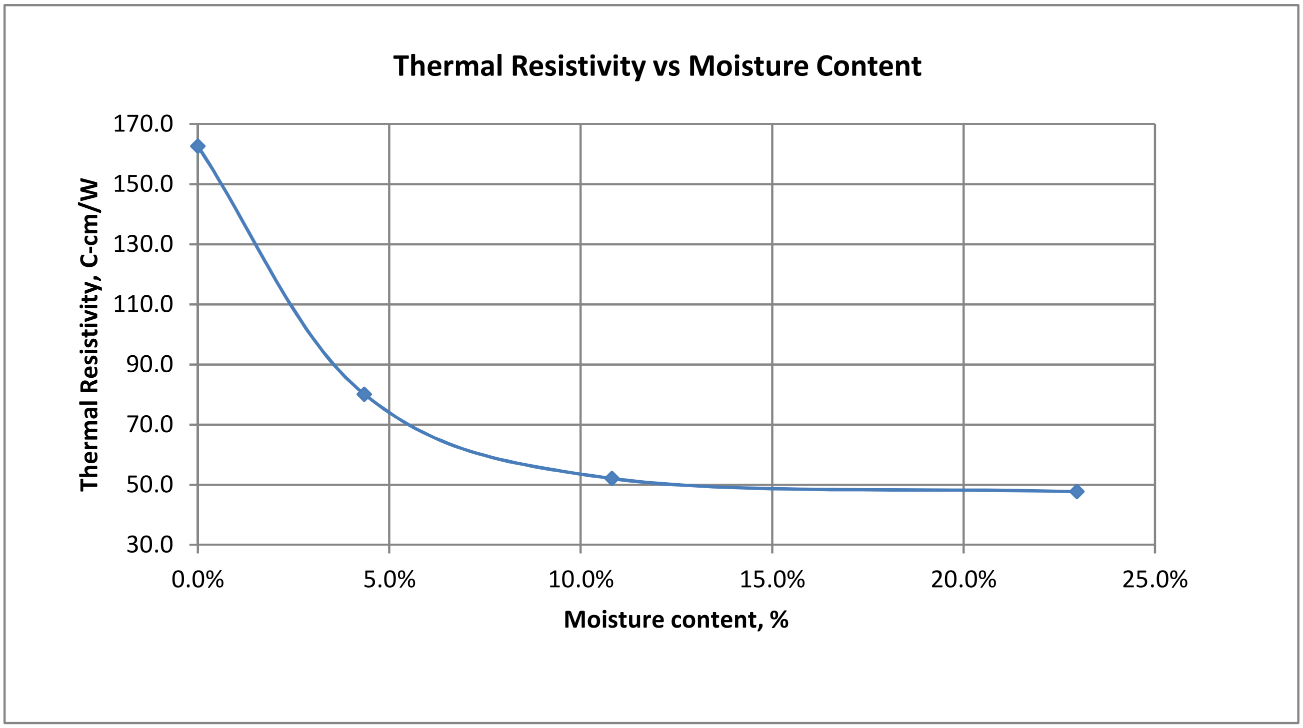
ASTM D 5334-08

Date:	August 21, 2018	**Project Number:**	B1806731
Client:	Kirk Phinney Otter Tail Power Company 215 S Cascade, P.O. Box 496 Fergus Falls, MN 56538	**Project Description:**	Astoria Station 19333 482nd Ave Astoria, SD

Location:	T-4, 4-6'	Needle Type:	TR-1
Description:	Sandy Lean Clay	Measurement Time:	10 min
Date Received:	7/30/18	Maximum Density:	NA
Date Tested:	8/21/18	Optimum Moisture:	NA

Moisture Content %	**Thermal Resistivity** C-cm/W	**Temperature** °C	**Err Value**
0.0%	162.6	24.2	0.0086
4.3%	80.1	23.6	0.1149
10.8%	52.1	21.7	0.0086
23.0%	47.7	23.7	0.0060



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Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe
ASTM D 5334-08

Date: August 22, 2018

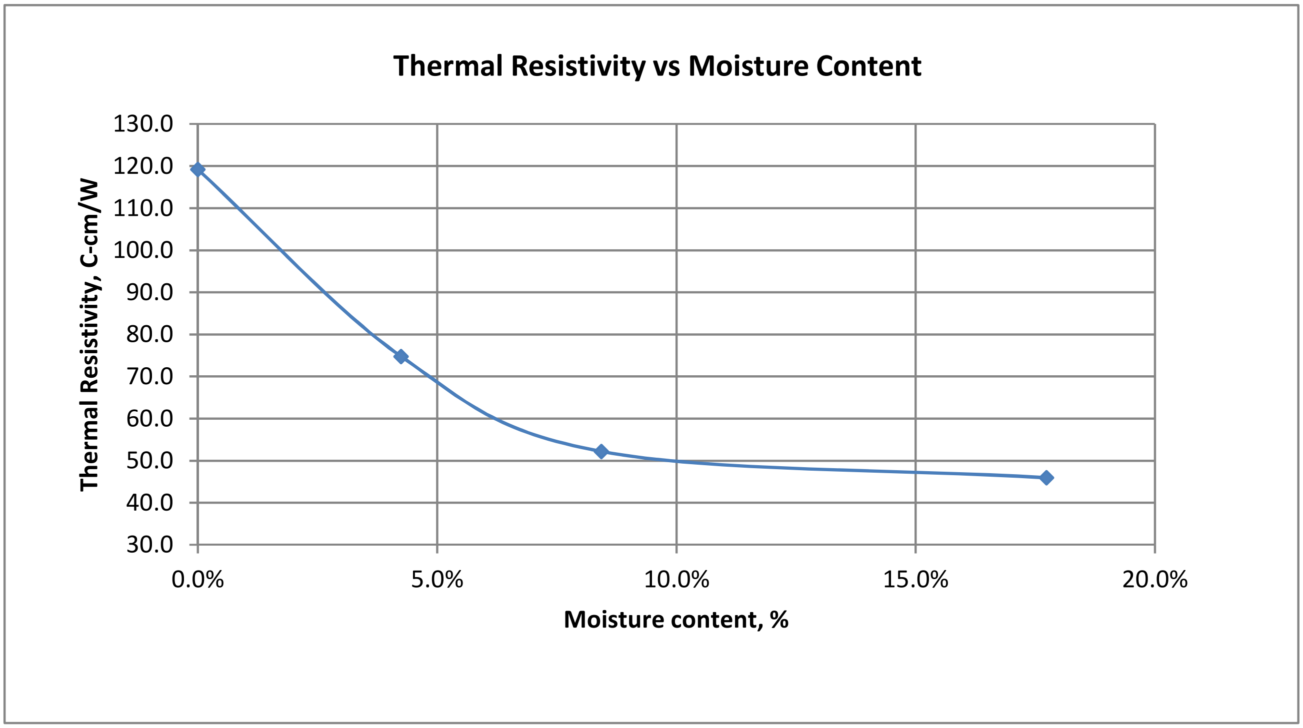
Project Number: B1806731

Client:
Kirk Phinney
Otter Tail Power Company
215 S Cascade, P.O. Box 496
Fergus Falls, MN 56538

Project Description:
Astoria Station
19333 482nd Ave
Astoria, SD

Location:	T-5, 2-4'	Needle Type:	TR-1
Description:	Sandy Lean Clay	Measurement Time:	10 min
Date Received:	7/30/18	Maximum Density:	NA
Date Tested:	8/22/18	Optimum Moisture:	NA

Moisture Content **%**	**Thermal Resistivity** **C-cm/W**	**Temperature** **°C**	**Err Value**
0.0%	119.2	24.3	0.0071
4.2%	74.8	23.6	0.0061
8.4%	52.2	23.6	0.0054
17.7%	46.0	23.8	0.0044



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Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe
ASTM D 5334-08

Date: August 22, 2018

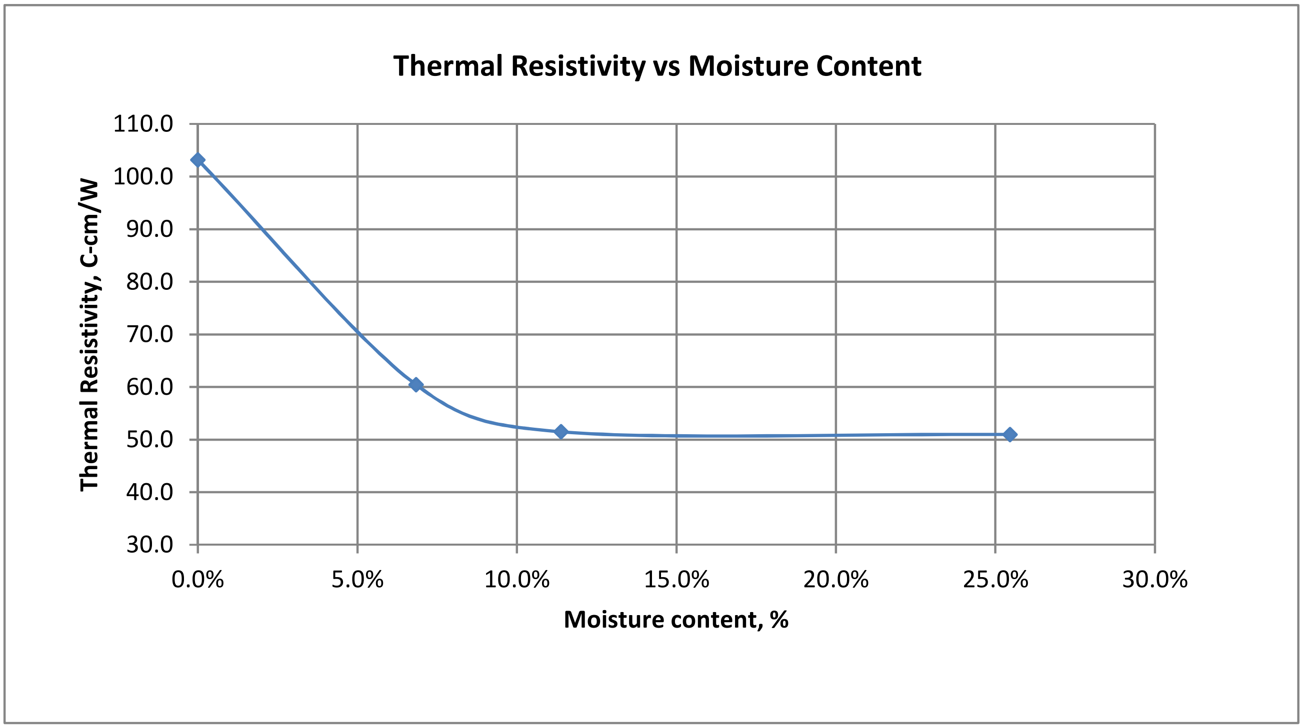
Project Number: B1806731

Client:
Kirk Phinney
Otter Tail Power Company
215 S Cascade, P.O. Box 496
Fergus Falls, MN 56538

Project Description:
Astoria Station
19333 482nd Ave
Astoria, SD

Location:	T-5, 4-6'	Needle Type:	TR-1
Description:	Sandy Lean Clay	Measurement Time:	10 min
Date Received:	7/30/18	Maximum Density:	NA
Date Tested:	8/22/18	Optimum Moisture:	NA

Moisture Content %	**Thermal Resistivity** C-cm/W	**Temperature** °C	**Err Value**
0.0%	103.2	24.3	0.0052
6.8%	60.5	23.6	0.0047
11.4%	51.5	23.6	0.0058
25.5%	51.0	23.7	0.0038



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Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe
ASTM D 5334-08

Date: August 24, 2018

Project Number: B1806731

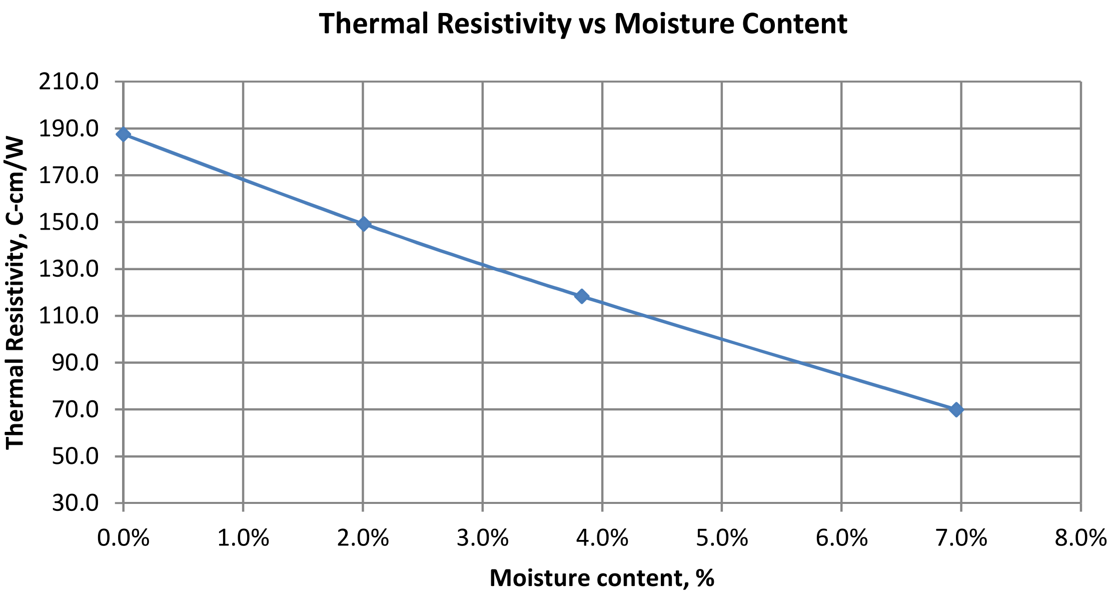
Client:
Kirk Phinney
Otter Tail Power Company
215 S Cascade, P.O. Box 496
Fergus Falls, MN 56538

Project Description:
Astoria Station
19333 482nd Ave
Astoria, SD

Location: T-6, 2-4'
Description: Silty Sand
Date Received: 7/30/18
Date Tested: 8/24/18

Needle Type: TR-1
Measurement Time: 10 min
Maximum Density: NA
Optimum Moisture: NA

Moisture Content %	Thermal Resistivity C-cm/W	Temperature °C	Err Value
0.0%	187.6	23.8	0.0017
2.0%	149.2	24.1	0.0027
3.8%	118.3	23.6	0.0011
7.0%	70.0	23.9	0.0019



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Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe
ASTM D 5334-08

Date: August 24, 2018

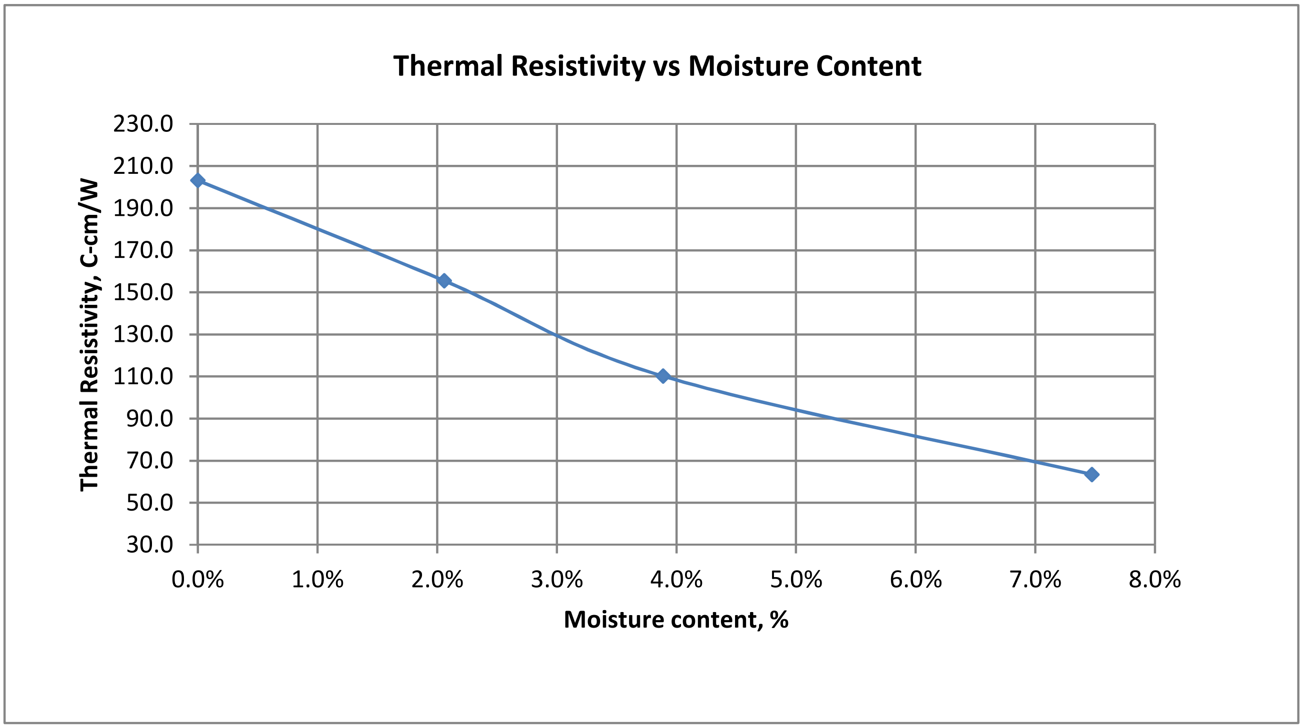
Project Number: B1806731

Client:
Kirk Phinney
Otter Tail Power Company
215 S Cascade, P.O. Box 496
Fergus Falls, MN 56538

Project Description:
Astoria Station
19333 482nd Ave
Astoria, SD

Location:	T-6, 4-6'	Needle Type:	TR-1
Description:	Silty Sand	Measurement Time:	10 min
Date Received:	7/30/18	Maximum Density:	NA
Date Tested:	8/24/18	Optimum Moisture:	NA

Moisture Content %	**Thermal Resistivity** C-cm/W	**Temperature** °C	**Err Value**
0.0%	203.2	23.9	0.0027
2.1%	155.5	24.2	0.0023
3.9%	110.2	23.7	0.0011
7.5%	63.5	23.4	0.0022



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ASTM D 5334-08

Date: August 21, 2018

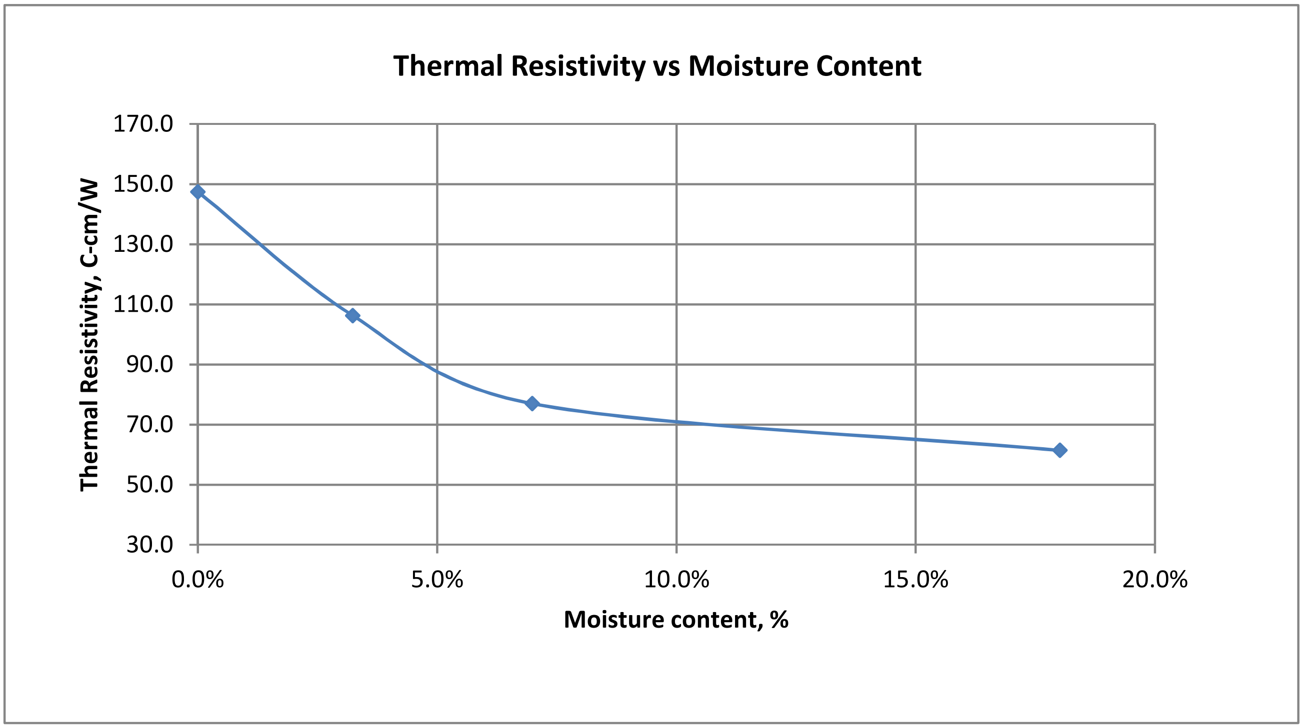
Project Number: B1806731

Client:
Kirk Phinney
Otter Tail Power Company
215 S Cascade, P.O. Box 496
Fergus Falls, MN 56538

Project Description:
Astoria Station
19333 482nd Ave
Astoria, SD

Location:	T-7, 2-4'	Needle Type:	TR-1
Description:	Sandy Lean Clay	Measurement Time:	10 min
Date Received:	7/30/18	Maximum Density:	NA
Date Tested:	8/21/18	Optimum Moisture:	NA

Moisture Content %	**Thermal Resistivity** C-cm/W	**Temperature** °C	**Err Value**
0.0%	147.5	24.3	0.0010
3.2%	106.3	23.6	0.0006
7.0%	77.0	21.5	0.0023
18.0%	61.4	23.8	0.0018



Remarks:

James Streier

James Streier
Soil Lab Technician

AA/EOE

BRAUN INTERTEC
The Science You Build On.

Braun Intertec Corporation
11001 Hampshire Avenue S
Minneapolis, MN 55438

Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe
ASTM D 5334-08

Date: August 21, 2018

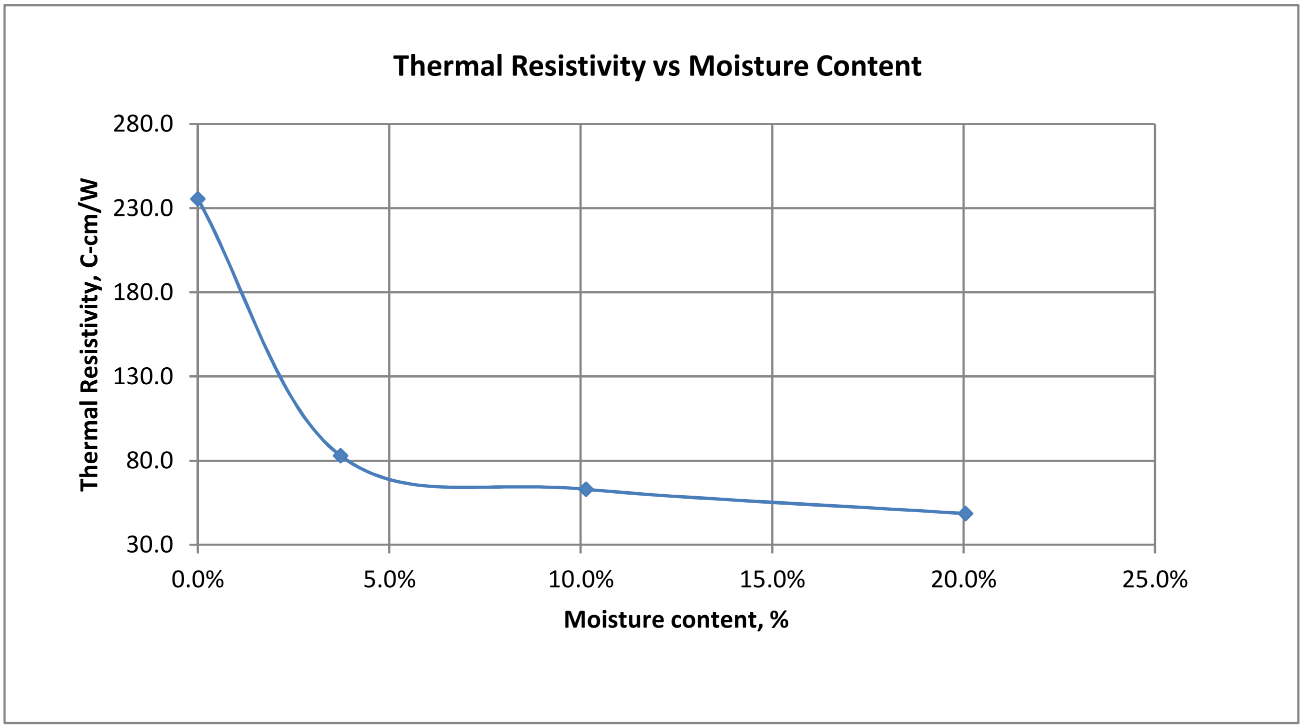
Project Number: B1806731

Client:
Kirk Phinney
Otter Tail Power Company
215 S Cascade, P.O. Box 496
Fergus Falls, MN 56538

Project Description:
Astoria Station
19333 482nd Ave
Astoria, SD

Location:	T-7, 4-6'	Needle Type:	TR-1
Description:	Sandy Lean Clay	Measurement Time:	10 min
Date Received:	7/30/18	Maximum Density:	NA
Date Tested:	8/21/18	Optimum Moisture:	NA

Moisture Content %	**Thermal Resistivity** C-cm/W	**Temperature** °C	**Err Value**
0.0%	235.6	24.6	0.0032
3.7%	82.9	23.6	0.0039
10.1%	63.0	22.9	0.0063
20.1%	48.6	23.7	0.0065



Remarks:

James Streier

James Streier
Soil Lab Technician

AA/EOE

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11001 Hampshire Avenue S
Minneapolis, MN 55438

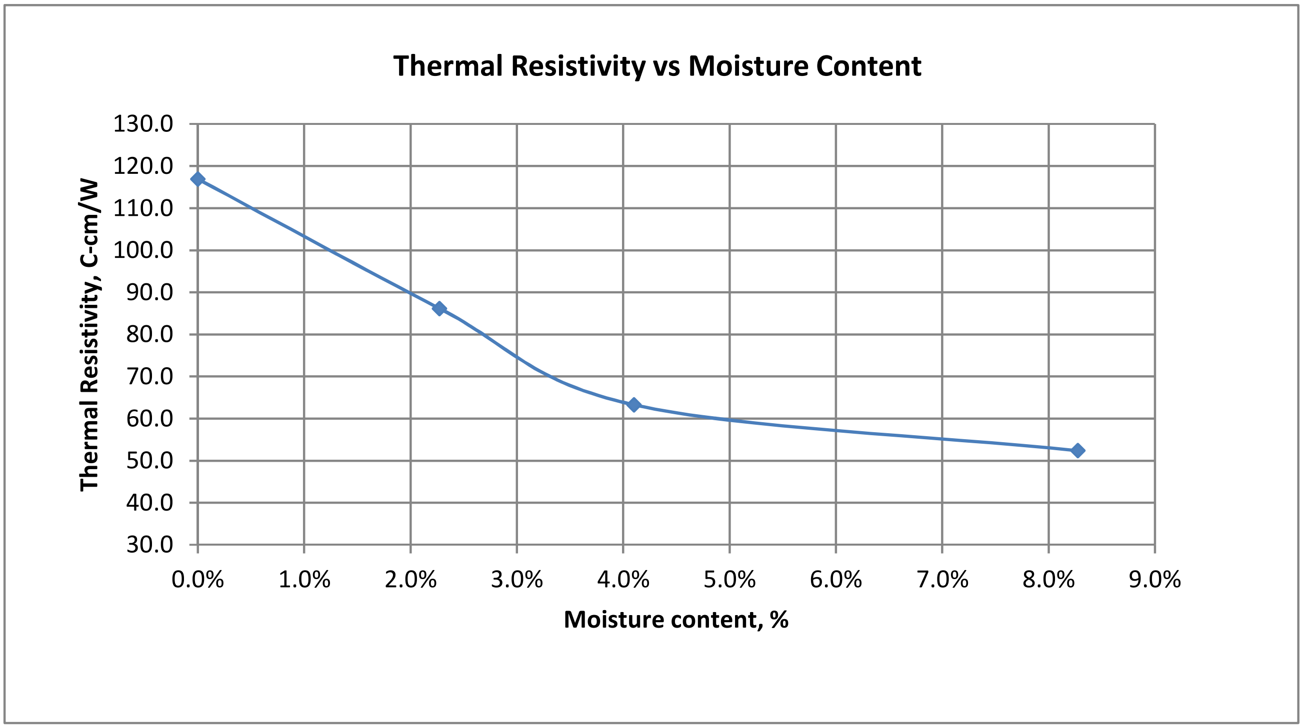
Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe
ASTM D 5334-08

Date:	August 24, 2018	**Project Number:**	B1806731
Client:	Kirk Phinney Otter Tail Power Company 215 S Cascade, P.O. Box 496 Fergus Falls, MN 56538	**Project Description:**	Astoria Station 19333 482nd Ave Astoria, SD

Location:	T-8, 2-4'	Needle Type:	TR-1
Description:	Silty Sand	Measurement Time:	10 min
Date Received:	7/30/18	Maximum Density:	NA
Date Tested:	8/24/18	Optimum Moisture:	NA

Moisture Content %	**Thermal Resistivity** C-cm/W	**Temperature** °C	**Err Value**
0.0%	116.9	23.7	0.0029
2.3%	86.2	24.0	0.0060
4.1%	63.3	23.7	0.0278
8.3%	52.4	23.3	0.0019



Remarks:

James Streier

James Streier
Soil Lab Technician

AA/EOE

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11001 Hampshire Avenue S
Minneapolis, MN 55438

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Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe
ASTM D 5334-08

Date: August 23, 2018

Project Number: B1806731

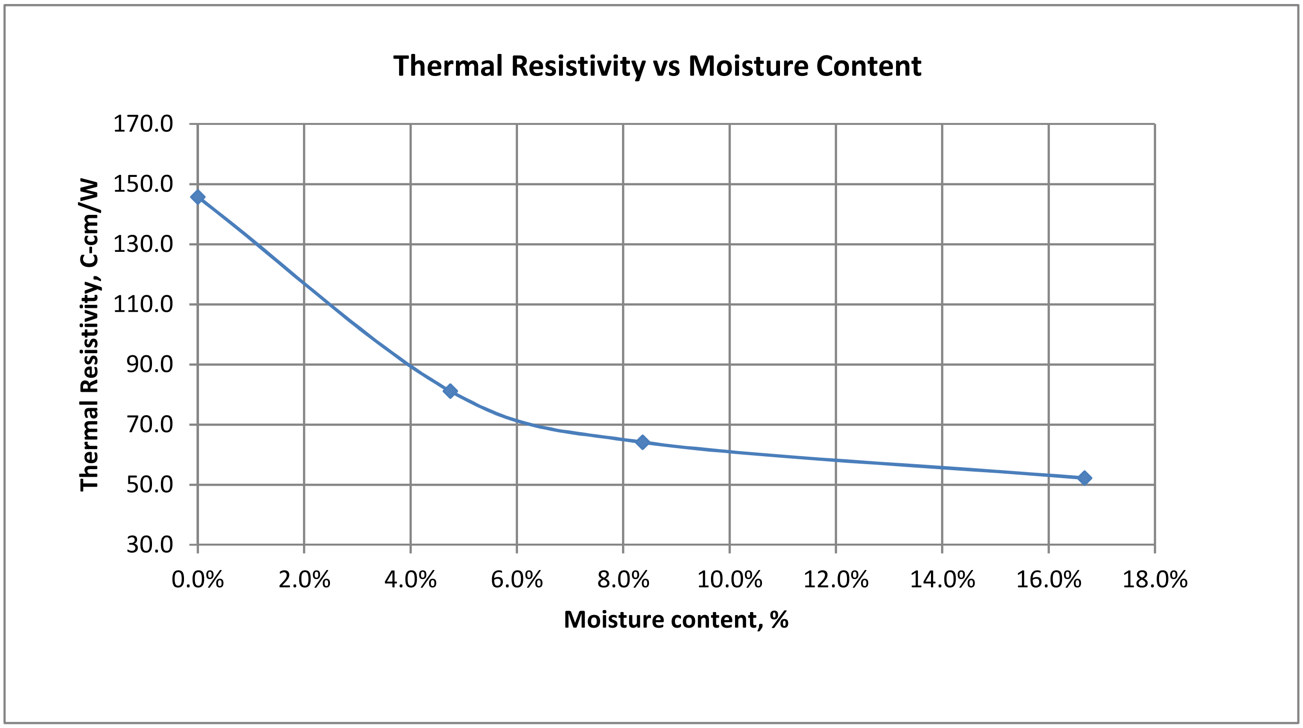
Client:
Kirk Phinney
Otter Tail Power Company
215 S Cascade, P.O. Box 496
Fergus Falls, MN 56538

Project Description:
Astoria Station
19333 482nd Ave
Astoria, SD

Location: T-8, 4-6'
Description: Sandy Lean Clay
Date Received: 7/30/18
Date Tested: 8/23/18

Needle Type: TR-1
Measurement Time: 10 min
Maximum Density: NA
Optimum Moisture: NA

Moisture Content %	Thermal Resistivity C-cm/W	Temperature °C	Err Value
0.0%	145.8	24.6	0.0023
4.7%	81.2	23.4	0.0021
8.4%	64.1	23.6	0.0030
16.7%	52.2	23.6	0.0041



Remarks:

James Streier
Soil Lab Technician

BRAUN INTERTEC
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Braun Intertec Corporation
11001 Hampshire Avenue S
Minneapolis, MN 55438

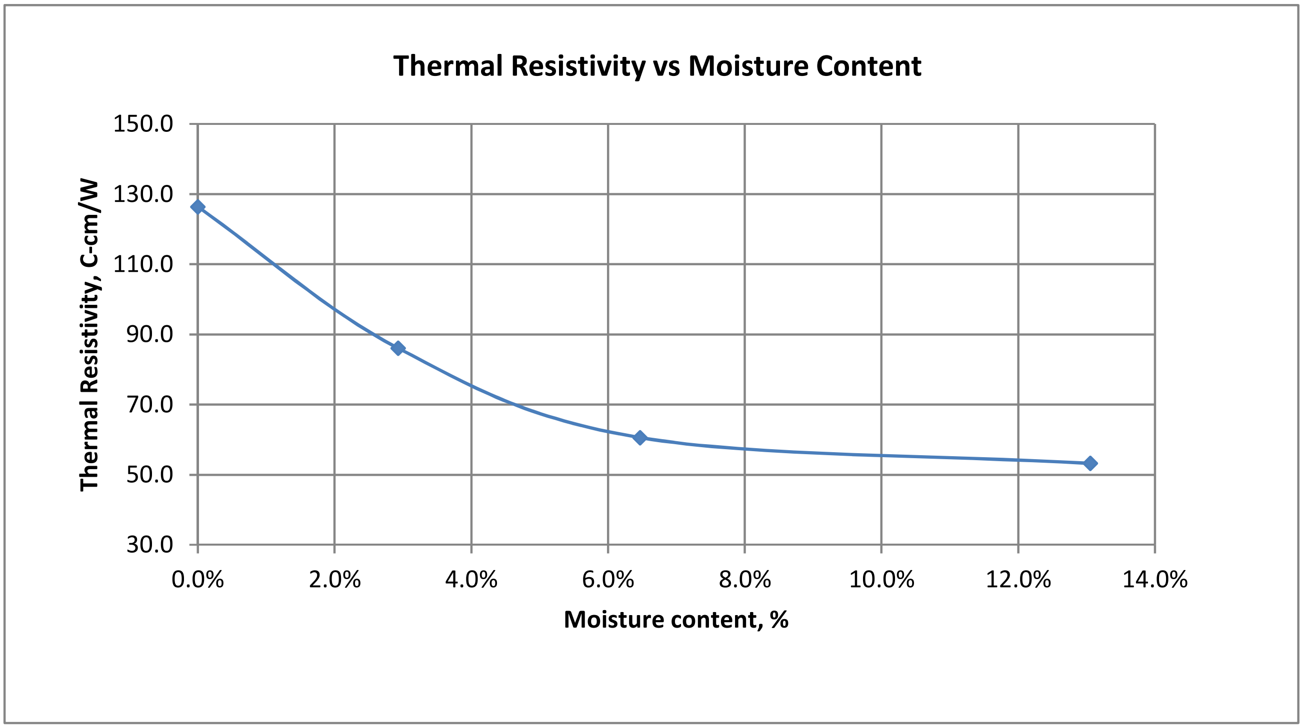
Phone: 952.995.2000
Fax: 952.995.2020
Web: braunintertec.com

Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe
ASTM D 5334-08

Date:	September 5, 2018	**Project Number:**	B1806731
Client:	Kirk Phinney Otter Tail Power Company 215 S Cascade Fergus Falls, MN 56538	**Project Description:**	Astoria Station 19333 482nd Avenue Astoria, SD

Location:	B-02, 1-5'	Needle Type:	TR-1
Description:	Silt with Sand	Measurement Time:	10 min
Date Received:	8/2/18	Maximum Density:	119.3 pcf
Date Tested:	8/28/18	Optimum Moisture:	12.9%

Moisture Content %	**Thermal Resistivity** C-cm/W	**Temperature** °C	**Err Value**
0.0%	126.4	24.2	0.0027
2.9%	86.1	22.9	0.0035
6.5%	60.6	23.5	0.0043
13.1%	53.2	23.9	0.0048



Remarks: Tested at 90% compaction and at optimum moisture content.

James Streier

James Streier
Soil Lab Technician

BRAUN INTERTEC
The Science You Build On.

Braun Intertec Corporation
11001 Hampshire Avenue S
Minneapolis, MN 55438

Phone: 952.995.2000
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Web: braunintertec.com

Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe
ASTM D 5334-08

Date: September 5, 2018

Project Number: B1806731

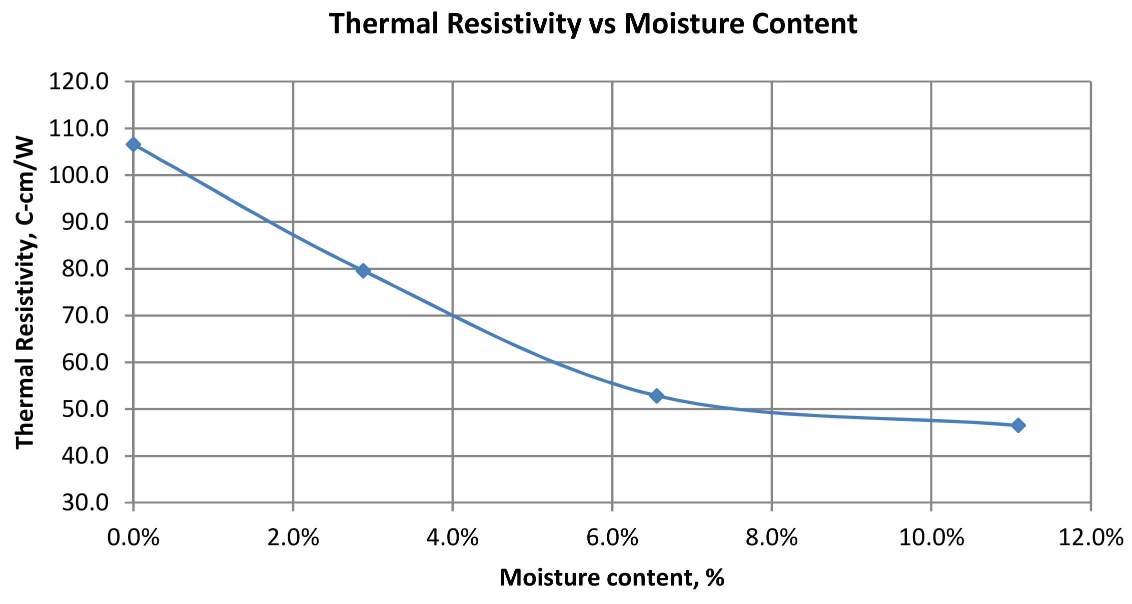
Client:
Kirk Phinney
Otter Tail Power Company
215 S Cascade
Fergus Falls, MN 56538

Project Description:
Astoria Station
19333 482nd Avenue
Astoria, SD

Location: B-13, 1-5'
Description: Clayey Sand
Date Received: 8/2/18
Date Tested: 8/28/18

Needle Type: TR-1
Measurement Time: 10 min
Maximum Density: 124.2 pcf
Optimum Moisture: 11.3%

Moisture Content **%**	**Thermal Resistivity** **C-cm/W**	**Temperature** **°C**	**Err Value**
0.0%	106.6	24.1	0.0042
2.9%	79.6	23.1	0.0037
6.6%	52.9	23.6	0.0045
11.1%	46.5	23.9	0.0061



Remarks: Tested at 90% compaction and at optimum moisture content.

James Streier

James Streier
Soil Lab Technician

AA/EOE

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Minneapolis, MN 55438

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Web: braunintertec.com

Thermal Conductivity of Soil and Soft Rock by Thermal Needle Probe
ASTM D 5334-08

Date: September 5, 2018

Project Number: B1806731

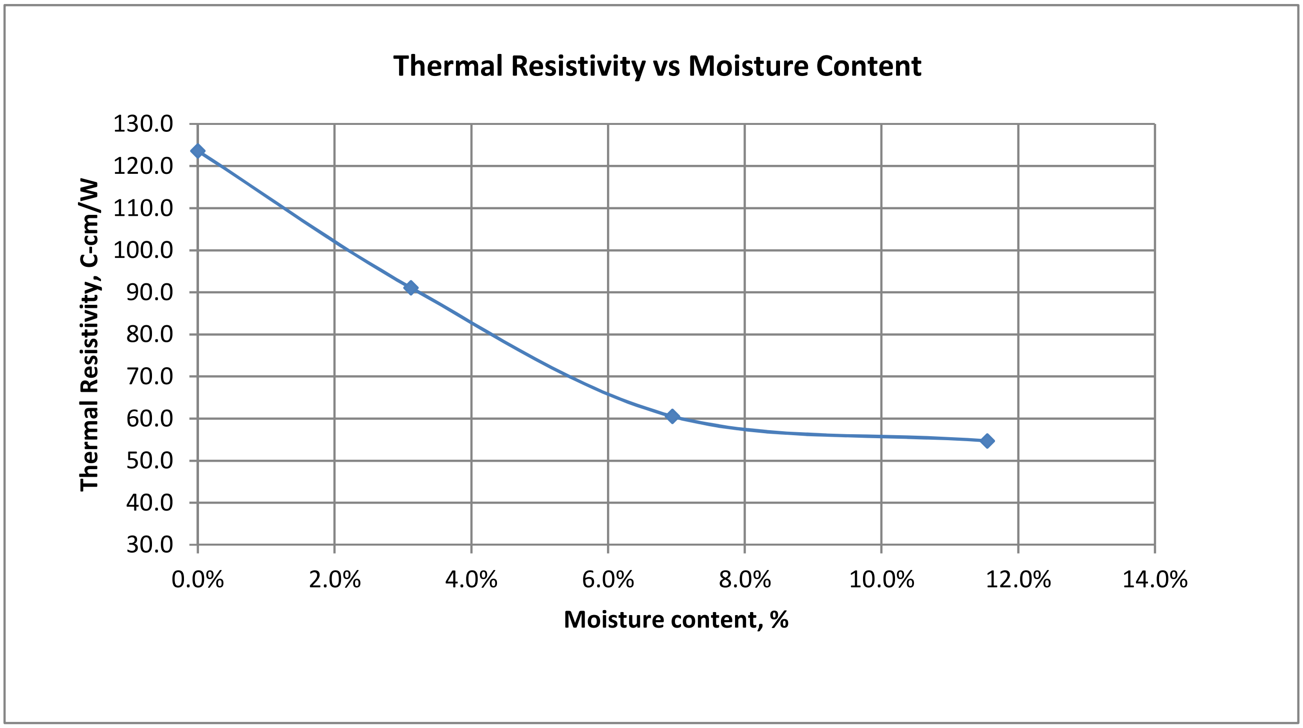
Client:
Kirk Phinney
Otter Tail Power Company
215 S Cascade
Fergus Falls, MN 56538

Project Description:
Astoria Station
19333 482nd Avenue
Astoria, SD

Location: B-14, 1-5'
Description: Sandy Lean Clay
Date Received: 8/2/18
Date Tested: 8/28/18

Needle Type: TR-1
Measurement Time: 10 min
Maximum Density: 120.7 pcf
Optimum Moisture: 11.6%

Moisture Content	**Thermal Resistivity**	**Temperature**	**Err Value**
%	**C-cm/W**	**°C**	
0.0%	123.6	24.4	0.0043
3.1%	91.1	23.1	0.0041
6.9%	60.5	23.5	0.0032
11.5%	54.7	23.8	0.0042



Remarks: Tested at 90% compaction and at optimum moisture content.

James Streier
James Streier
Soil Lab Technician

Silver State Labs-Reno
1135 Financial Blvd
Reno, NV 89502
(775) 857-2400 FAX: (888) 398-7002
www.ssalabs.com

August 17, 2018
Workorder **18080626**

Ezra Ballinger
Braun Intertec
P.O. Box 485
West Fargo, ND 58078

Project: B1806731

Dear Ezra Ballinger:

It is the policy of Silver State Analytical Laboratory - Reno to strictly adhere to a comprehensive Quality Assurance Plan that ensures the data presented in this report are both accurate and precise. Silver State Analytical Laboratory - Reno maintains accreditation in the State of Nevada (NV-00015) and the State of California (ELAP 2990).

The data presented in this report was obtained from the analysis of samples received under a chain of custody. Unless otherwise noted below, samples were received in good condition, properly preserved and within the hold time for the requested analyses. Any anomalies associated with the analysis of the samples have been flagged with an appropriate explanation in the Analysis Report section of the Laboratory Report.

Note: Sample #446 arrived broken, could not analyze.

Sincerely,

Carly Wood
Laboratory Director
1135 Financial Blvd
Reno, NV 89502

Analytical Report

Workorder#: **18080626**
Date Reported: **8/17/2018**

Client: Braun Intertec
Project Name: B1806731
PO #: B1806731
Sampled By: K. Miller

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
18080626-01	Sample#73, Proj No B1806731,Boring No.	07/26/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/14/2018 20:51	
pH	SW-846 9045D	7.84	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	23.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	470	mg/Kg	2	JF	08/14/2018 20:51	

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
18080626-02	Sample #46, Proj No B1806731, Boring N	07/25/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/14/2018 21:19	
pH	SW-846 9045D	8.34	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	23.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	27	mg/Kg	2	JF	08/14/2018 21:19	

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
18080626-03	Sample #91, Proj No B1806731, Boring N	07/27/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/14/2018 21:46	
pH	SW-846 9045D	8.54	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	23.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	26	mg/Kg	2	JF	08/14/2018 21:46	

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
18080626-04	Sample #38, Proj No B1806731, Boring N	07/25/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/14/2018 22:13	
pH	SW-846 9045D	8.61	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	23.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	9	mg/Kg	2	JF	08/14/2018 22:13	

Client: Braun Intertec
Project Name: B1806731
PO #: B1806731

Sampled By: K. Miller

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
18080626-05	Sample #100, Proj No B1806731, Boring	07/27/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/14/2018 22:40	
pH	SW-846 9045D	8.26	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	24.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	<2	mg/Kg	2	JF	08/14/2018 22:40	

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
18080626-06	Sample #76, Proj No B1806731, Boring N	07/26/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/14/2018 23:07	
pH	SW-846 9045D	7.89	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	23.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	13	mg/Kg	2	JF	08/14/2018 23:07	

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
18080626-07	Sample #23, Proj No B1806731, Boring N	07/24/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/14/2018 23:35	
pH	SW-846 9045D	8.82	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	23.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	<2	mg/Kg	2	JF	08/14/2018 23:35	

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
18080626-08	Sample #61, Proj No B1806731, Boring N	07/25/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/15/2018 0:02	
pH	SW-846 9045D	8.90	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	23.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	10	mg/Kg	2	JF	08/15/2018 0:02	

Client: Braun Intertec
Project Name: B1806731
PO #: B1806731

Sampled By: K. Miller

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	**Client Sample ID**	**Date/Time Sampled**	**Date Received**
18080626-09	Sample #122, Proj No B1806731, Boring	07/30/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/15/2018 2:18	
pH	SW-846 9045D	8.21	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	23.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	<2	mg/Kg	2	JF	08/15/2018 2:18	

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	**Client Sample ID**	**Date/Time Sampled**	**Date Received**
18080626-10	Sample #115, Proj No B1806731, Boring	07/30/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/15/2018 2:45	
pH	SW-846 9045D	8.60	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	23.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	7	mg/Kg	2	JF	08/15/2018 2:45	

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	**Client Sample ID**	**Date/Time Sampled**	**Date Received**
18080626-11	Sample #140, Proj No B1806731, Boring	07/31/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/15/2018 3:12	
pH	SW-846 9045D	8.12	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	24.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	28	mg/Kg	2	JF	08/15/2018 3:12	

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	**Client Sample ID**	**Date/Time Sampled**	**Date Received**
18080626-12	Sample #3, Proj No B1806731, Boring No	07/24/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/15/2018 3:40	
pH	SW-846 9045D	7.99	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	23.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	51	mg/Kg	2	JF	08/15/2018 3:40	

Client: Braun Intertec
Project Name: B1806731
PO #: B1806731

Sampled By: K. Miller

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
18080626-13	Sampled from TW tube, Proj No B180673	07/25/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/15/2018 4:07	
pH	SW-846 9045D	7.92	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	23.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	270	mg/Kg	2	JF	08/15/2018 4:07	

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
18080626-14	Sampled from Bulk Sample, Proj No B180	07/31/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/15/2018 4:34	
pH	SW-846 9045D	8.14	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	23.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	10	mg/Kg	2	JF	08/15/2018 4:34	

Laboratory Accreditation Number: NV015/CA2990

Laboratory ID	Client Sample ID	Date/Time Sampled	Date Received
18080626-15	Sampled from Bulk Sample, Proj No B180	07/30/2018 0:00	8/13/2018

Parameter	Method	Result	Units	PQL	Analyst	Date/Time Analyzed	Data Flag
Chloride	EPA 9056	<5	mg/Kg	5	JF	08/15/2018 5:01	
pH	SW-846 9045D	8.18	pH Units		LRB	08/16/2018 11:18	
pH Temperature	SW-846 9045D	23.0	°C		LRB	08/16/2018 11:18	
Sulfate	EPA 9056	9	mg/Kg	2	JF	08/15/2018 5:01	

Analysis: Anions 300.0 Solid
Method: EPA 9056 **Batch ID:** R20760

Laboratory Control Sample (LCS)

RunID: 20760 SeqNo 444709 Units: mg/L

Analysis Date: 7/24/2018 3:57:47 PM Analyst: JF

Analyte	LCS Spike Added	LCS Result	LCS % Recovery	LCSD Spike Added	LCSD Result	LCSD % Recovery	RPD	RPD Limit	Low Limit	High Limit	Qual
Chloride	8.000	7.3	90.7								
Sulfate	8.000	7.5	93.2								

Matrix Spike (MS) / Matrix Spike Duplicate (MSD)

Sample Spiked: 18080626-08A

RunID: 20760 SeqNo 444736 Units: mg/Kg

Analysis Date: 8/15/2018 12:29:32 AM Analyst: JF

Analyte	Sample Result	MS Spike Added	MS Result	MS % Recovery	MSD Spike Added	MSD Result	MSD % Recovery	RPD	RPD Limit	Low Limit	High Limit	Qual
Chloride	4.382	100.0	100	95.7	100.0	100	97.1	1.43	20	90	110	
Sulfate	9.935	99.00	99	90.2	99.00	100	93.8	3.51	20	90	110	

Analysis: PASTE pH
Method: SW-846 9045D **Batch ID:** R20796

Laboratory Control Sample (LCS)

RunID: 20796 SeqNo 445466 Units: pH Units

Analysis Date: 8/16/2018 11:18:00 AM Analyst: LRB

Analyte	LCS Spike Added	LCS Result	LCS % Recovery	LCSD Spike Added	LCSD Result	LCSD % Recovery	RPD	RPD Limit	Low Limit	High Limit	Qual
pH	7.020	7.05	100								

SilverState Analytical Laboratories Sierra Environmental Monitoring EnviroTech

ssalabs.com sem-analytical.com envirotechonline.com

☐ 3626 E. SUNSET RD., STE 100, LAS VEGAS, NV 89120
Phone (702) 873-4478 Fax: (702) 873-7967 (EPA#: NV00930, CA2885)

18080626

☒ 1135 FINANCIAL BOULEVARD, RENO, NV 89502
Phone (775) 857-2400 Fax: (888) 398-7002 (EPA#: NV00015, CA2526)

CHAIN-OF-CUSTODY-RECORD

Page 1 of 2

Report Results To:

Report Attention: Ezra Ballinger, PE
Project Number: B1806731
Company: Braun Intertec
Mailing Address: 526 10th Street NE, Suite 300
City, State, Zip: West Fargo, ND 58078
Phone: 701-232-8701
Email / Fax: Eballinger@braunintertec.com

Send Invoice To:

Invoice Attention: Ezra Ballinger
PO# B1806731
Quote #
Company: Braun Intertec
Mailing Address: 526 10th Street NE, Suite 300
City, State, Zip: West Fargo, ND 58078
Phone: 701-232-8701
Email / Fax: Eballinger@braunintertec.com

COMPLIANCE MONITORING? Yes ☐ [✓ No]

NEW ADDRESS? Results: ☐ Invoice: ☐

Applicable Program
SDWA ☐ CWA ☐ RCRA ☐
Mining ☐ Other ____

QC Level Report [✓ I] II III IV
NOTE: Surcharges apply to Level II, III and IV reports

Send Results Via: Mail: ☐ Email: ☒ Fax: ☐

Send Invoice Via: Mail: ☐ Email: ☒ Fax: ☐

Field Measurements
On-Site pH: NA Chlorine: NA
Temperature: NA Other: NA

Metals* —

COMMENTS: —

Sampled by: KEVIN MILLER Signature:

I attest to the validity and authenticity of the sample. I am aware that tampering with or intentionally mislabeling the sample location, date or time is considered fraud and may be grounds for legal action.

Standard: ☒ Standard TAT 7-10 Business Days. Note that some tests vary.
Rush
Same Day: ☐ 3 Day: ☐ Other (specify): ________
1 Day: ☐ 4 Day: ☐ **Rush results will be issued after 4:00 p.m.**
2 Day: ☐ 5 Day: ☐

NOTE: A Rush Surcharge is applied for rush samples

Other Pertinent Information / Special Instructions
—
26°

ANALYSES REQUESTED

Date Sampled	Time Sampled	Sample Identification	SSAL - SEM Lab No.	Comp Grab	Matrix*	Preservative**	Number / Type of Containers ***	Water Soluble Sulfates (EPA 9056)	Water Soluble Chlorides (EPA 9056)	pH (ASTM G51/equivalent that lab offers
7/26/2018	NA	Sample# 73, Proj. No. B1806731, Boring No. B-1, Depth - 24.5-26'	135 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X
7/25/2018	NA	Sample# 46, Proj. No. B1806731, Boring No. B-2, Depth - 12-13.5'	136 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X
7/27/2018	NA	Sample# 91, Proj. No. B1806731, Boring No. B-3, Depth - 4.5-6'	137 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X
7/25/2018	NA	Sample# 38, Proj. No. B1806731, Boring No. B-4, Depth - 2-3.5'	138 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X
7/27/2018	NA	Sample# 100, Proj. No. B1806731, Boring No. B-5, Depth - 4.5-6'	139 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X
7/26/2018	NA	Sample# 76, Proj. No. B1806731, Boring No. B-6, Depth - 2-3'	140 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X
7/24/2018	NA	Sample# 23, Proj. No. B1806731, Boring No. B-9, Depth - 2-3.5'	141 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X
7/25/2018	NA	Sample# 61, Proj. No. B1806731, Boring No. B-10, Depth - 2-3.5'	142 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X

	Signature	Print Name	Company	Date	Time
Relinquished By:		Eddy Mathiason	Braun Intertec	8-9-18	2:30
Received By:		K. Groven	SSAL	8/13/18	10:20
Relinquished By:			Fed Ex Tr # 7729	4036 65	46
Received By:					
Relinquished By:					
Received By:					
Authorized By:					

Authorization is required to process samples. This obligates your organization for service fees. SSAL Standard T & C's or other written agreement applies. If collections or legal services are required to recover said fees, your organization will be responsible for all fees and costs in addition to service fees.

Samples are discarded 30 days after results are reported unless other arrangements are made and storage fees may apply.
The analytical results associated with this COC apply only to these samples as they are received by the laboratory.
The liability of the laboratory is limited to the amount paid for the report.

Matrix* DW-Drinking Water, WW-Waste Water, GW-Ground Water, SW-Surface Water, SS-Soil, S-Solid, OT-Other

Container*** P-Plastic, G-Glass, V-Voa Vial, OT-Other

SilverState Analytical Laboratories Sierra Environmental Monitoring EnviroTech

ssalabs.com sem-analytical.com envirotechonline.com

☐ 3626 E. SUNSET RD., STE 100, LAS VEGAS, NV 89120
Phone (702) 873-4478 Fax: (702) 873-7967 (EPA#: NV00930, CA2885)

☒ 1135 FINANCIAL BOULEVARD, RENO, NV 89502
Phone (775) 857-2400 Fax: (888) 398-7002 (EPA#: NV00015, CA2526)

CHAIN-OF-CUSTODY-RECORD

Page 2 of 2

Report Results To:

Report Attention: Ezra Ballinger, PE Project Number: B1806731
Company: Braun Intertec
Mailing Address: 526 10th Street NE, Suite 300
City, State, Zip: West Fargo, ND 58078
Phone: 701-232-8701 Email / Fax: Eballinger@braunintertec.com

Send Invoice To:

Invoice Attention: Ezra Ballinger PO# B1806731 Quote #
Company: Braun Intertec
Mailing Address: 526 10th Street NE, Suite 300
City, State, Zip: West Fargo, ND 58078
Phone: 701-232-8701 Email / Fax: Eballinger@braunintertec.com

COMPLIANCE MONITORING? Yes ☐ No ☒
NEW ADDRESS? Results: ☐ Invoice: ☐

Applicable Program
SDWA ☐ CWA ☐ RCRA ☐
Mining ☐ Other ____________

QC Level Report
[✓ I] II III IV
NOTE: Surcharges apply to Level II, III and IV reports

Sampled by: KEVIN MILLER Signature:

I attest to the validity and authenticity of the sample. I am aware that tampering with or intentionally mislabeling the sample location, date or time is considered fraud and may be grounds for legal action.

Standard: ☒ Standard TAT 7-10 Business Days. Note that some tests vary.
Rush
Same Day: ☐ 3 Day: ☐ Other (specify): ____________
1 Day: ☐ 4 Day: ☐ **Rush results will be issued after 4:00 p.m.**
2 Day: ☐ 5 Day: ☐
NOTE: A Rush Surcharge is applied for rush samples

Other Pertinent Information / Special Instructions
—

ANALYSES REQUESTED

Send Results Via: Mail: ☐ Email: ☒ Fax: ☐

Send Invoice Via: Mail: ☐ Email: ☒ Fax: ☐

Field Measurements
On-Site pH: NA Chlorine: NA
Temperature: NA Other: NA

Date Sampled	Time Sampled	Sample Identification	SSAL - SEM Lab No.	Comp Grab	Matrix*	Preservative**	Number / Type of Containers ***	Water Soluble Sulfates (EPA 9056)	Water Soluble Chlorides (EPA 9056)	pH (ASTM G51/equivalent that lab offers									
7/30/2018	NA	Sample# 122, Proj. No. B1806731, Boring No. B-11, Depth - 2-3.5'	135 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X									Metals* —
7/30/2018	NA	Sample# 115, Proj. No. B1806731, Boring No. B-12, Depth - 4.5-6'	136 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X									
7/31/2018	NA	Sample# 140, Proj. No. B1806731, Boring No. B-13, Depth - 9.5-11'	137 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X									
7/24/2018	NA	Sample# 3, Proj. No. B1806731, Boring No. B-19, Depth - 4.5-6'	138 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X									
7/24/2018	NA	Sample# 2, Proj. No. B1806731, Boring No. B-20, Depth - 2-3.5'	139 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X									COMMENTS: *#2 ARrived broken.
7/25/2018	NA	Sampled from TW tube, Proj. No. B1806731, Boring No. B-7, Depth - 44-46'	140 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X									
7/31/2018	NA	Sampled from bulk sample, Proj. No. B1806731, Boring No. B-13, Depth - 1-5'	141 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X									
7/30/2018	NA	Sampled from bulk sample, Proj. No. B1806731, Boring No. B-14, Depth - 1-5'	142 FINANCIAL BOULEVARD, RENO, NV		SS	6	1/G	X	X	X									

	Signature	Print Name	Company	Date	Time
Relinquished By:		Cody Mathiason	Braun Intertec	8-9-18	2:30
Received By:		K-Grover	SSAL	8/13/18	10:20
Relinquished By:					
Received By:					
Relinquished By:					
Received By:					
Authorized By:					

Authorization is required to process samples. This obligates your organization for service fees. SSAL Standard T & C's or other written agreement applies. If collections or legal services are required to recover said fees, your organization will be responsible for all fees and costs in addition to service fees.

Samples are discarded 30 days after results are reported unless other arrangements are made and storage fees may apply. The analytical results associated with this COC apply only to these samples as they are received by the laboratory. The liability of the laboratory is limited to the amount paid for the report.

Matrix* DW-Drinking Water, WW-Waste Water, GW-Ground Water, SW-Surface Water, SS-Soil, S-Solid, OT-Other

Container*** P-Plastic, G-Glass, V-Voa Vial, OT-Other

Definitions & Qualifiers

Definitions:

LCS: Laboratory Control Sample; prepared by adding a known mass of target analytes to a specified amount of de-ionized water and prepared with the batch of samples, used to calculate Accuracy (%REC).

LCSD: LCS Duplicate; used to calculate both Accuracy (%REC) and Precision (%RPD)

MBLK: Method Blank; a sample of similar matrix that is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedure, and in which no target analytes
or interferences are present at concentrations that impact the analytical results for sample analyses.

MS: Matrix Spike; prepared by adding a known mass of target analytes to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available, used to calculate Accuracy (%REC)

MSD: Matrix Spike Duplicate; used to calculate both Accuracy (%REC) and Precision (%RPD)

RPD: Relative Percent Difference; comparison between sample and duplicate and/or MS and MSD.

PQL: Practical Quantitation Limit; the limit to which data is quantitated for reporting.

MDL: Method Detection Limit; the limit to which the instrument can reliably detect.

MCL: Maximum Contaminant Level; value set according to EPA guidelines.

Qualifiers:

* - Analyte exceeds Safe Drinking Water Act MCL, does not meet drinking water standards.
C - Analyte value below Safe Drinking Water Act MCL, does not meet drinking water standards.
B - Analyte found above the PQL in associated method blank.
G - Calibration blank analyte detected above PQL.
H - Sample analyzed beyond holding time for this parameter.
J - Estimated Value; Analyte found between MDL and PQL limits.
L - Sample concentration is at least 5 times greater than spike contribution. Spike recovery criteria do not apply.
R - RPD between sample and duplicate sample outside the RPD acceptance limits.
S - Batch MS and/or MSD were outside acceptance limits, batch LCS was acceptable.
W - Sample temperature when recieved was out of limit as specified by method.

Zonge

Zonge International, Inc.
9595 Prototype Court
Reno, Nevada 89521
775-355-7707

August 9, 2018
Ref: 18047

Ezra Ballinger, PE
Braun Intertec
526 10th Street NE
West Fargo, ND 58078

Re: Geophysical Report for Shallow Seismic Survey, Astoria Station

Mr. Ballinger:

Zonge International, Inc. (Zonge) presents this report summarizing the findings of a geophysical survey conducted at the Astoria Station Project in eastern South Dakota. This report provides an overview of the methods, field procedures, data processing, modeling, and a discussion of the results and interpretations.

Fieldwork was conducted on August 1, 2018. The purpose of this investigation was to provide compressional (P-wave) and shear wave (S-wave) velocity profiles to a depth of 100 feet or more at four test locations. A list of proposed test locations with the survey coordinates is given in Table 1 below. Geophysical methods used during this investigation were compressional wave seismic refraction tomography and seismic surface wave analysis techniques.

A geo-referenced aerial photograph with the test locations is presented as Figure 1. Coordinates shown reference South Dakota (North) State Plane Coordinate System, North American Datum of 1983, Imperial units of measure.

Test ID	**Easting** *South Dakota (North), NAD83* *feet*	**Northing** *South Dakota (North), NAD83* *feet*
SS-1A	291815	2863143
SS-1B	291640	2863143
SS-2A	291698	2863048
SS-2B	291698	2863269

Table 1 – Coordinates of Staked Test Locations

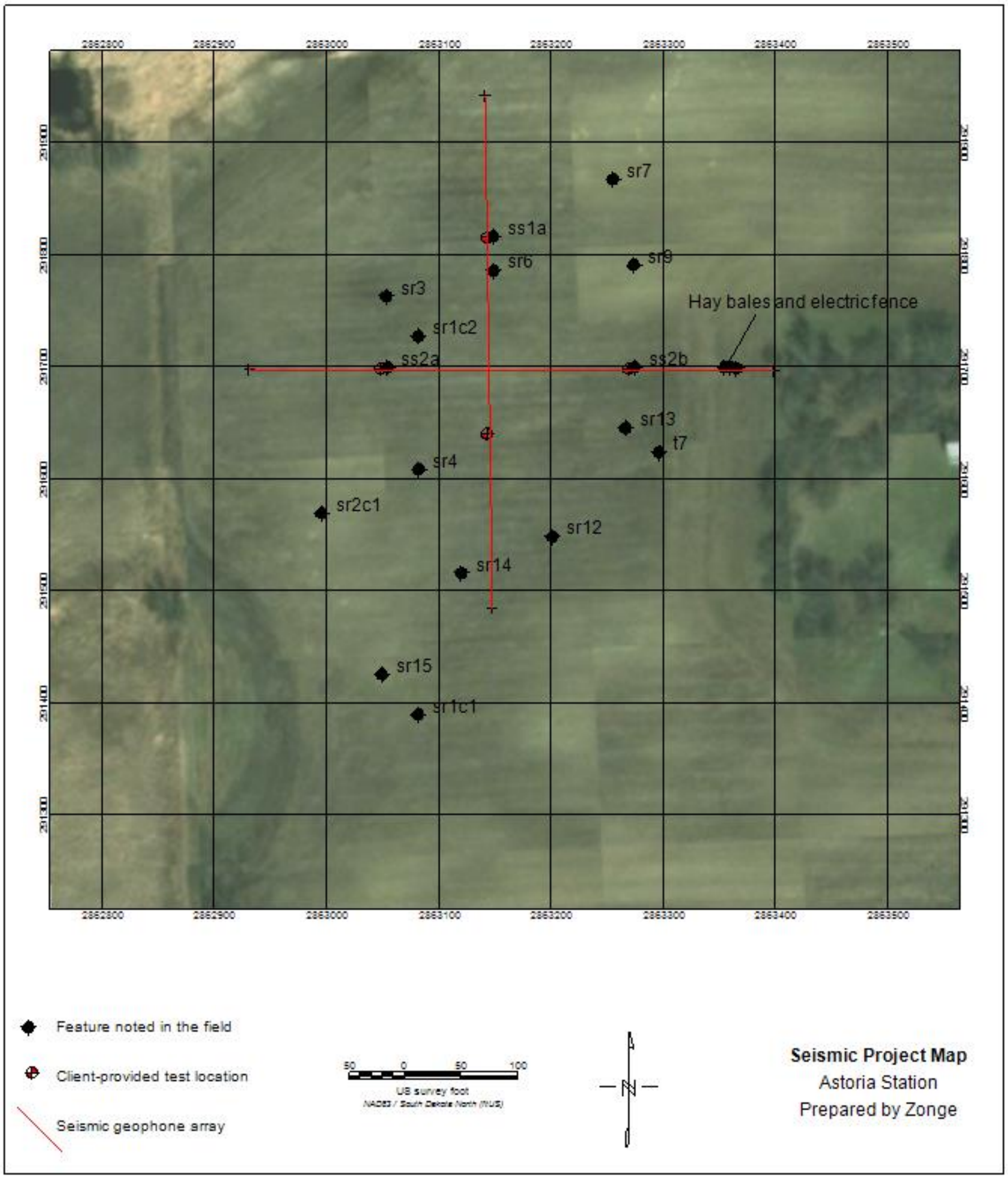


Figure 1 - Project Map

Methods Overview

Seismic Refraction

During seismic refraction surveys, acoustic energy is input to the subsurface by an energy source such as a sledgehammer impacted on a metal plate. The acoustic waves generated by the impulse travel into the subsurface at a velocity dependent on the elastic properties of the ground through which it travels. In accordance with Snell’s Law, as the energy encounters a change in velocity, its path of travel will change. Eventually, as velocity increases with depth the path of the acoustic energy changes enough to return a portion of the energy to the surface, where it can be detected by geophones.

The seismic refraction method involves analysis of the travel times of the first energy to arrive at the geophones (Palmer, 1981). These first arrivals are from energy that has traveled directly along the surface to the geophones (for geophones close to the source), or refracted subsurface waves (at geophones further from the source). The travel time data is inverted for a velocity model by iteratively changing the velocity model to best fit the observed travel times.

Depth of investigation for all seismic methods is a complex function involving receiver array length, the velocity distribution of the subsurface materials, and the source type and offset distance. Depths to underlying layers will be overestimated if a velocity inversion, such as a gravel layer over soft clay over bedrock, is present. Depths to underlying layers will be underestimated if a hidden layer (a geologic layer with a velocity increase, but too thin to be sufficiently imaged) is present. Velocity inversions are rare, but hidden layers occur more frequently when the water table is present within sedimentary units. Both inaccuracies can be detected and may be corrected with the aid of borehole data. These are concerns that must be evaluated based on initial testing of source-receiver geometry, ground truth data (if available) and experience.

Seismic Surface Waves

Surface wave techniques are non-invasive and non-destructive, with all testing occurring at elastic strain levels (Martin et. al 2005). The basis of surface wave methods is the dispersive characteristic of Rayleigh waves when propagating in a layered medium. The phase velocity depends primarily on the material properties (shear-wave velocity, mass density, and Poisson’s ratio) over a depth of approximately one wavelength. Waves of different wavelengths sample different depths. As a result of the variance in the shear stiffness of the layers, waves with different wavelengths travel at different phase velocities. A surface wave dispersion curve displays the observed variation of velocity with frequency. A velocity model is created by inverting that observed dispersion curve and iteratively calculating a model that creates a best fit to the observed dispersion.

The field procedure for multi-channel analysis of surface waves (MASW) used in this survey consists of placing a shot (hammer strike) off the end a line of geophones. The inverted 1D velocity structure corresponds to average properties across the spread, but is often plotted at the center of the geophone spread. Tighter geophone intervals give better horizontal resolution while a longer total spread length can provide better depth penetration.

The linear-array microtremor method was evaluated at this project to supplement the MASW tests. This method relies on an uncontrolled seismic source such as earthquake microtremors, traffic, tidal energy, etc. instead of a hammer or explosive source. Microtremor measurements typically record longer wavelength (lower frequency) ground vibrations, which correspond to deeper sampling depths.

Survey Methodology

Seismic refraction equipment used during this investigation consisted of two linked Geometrics, Geode 24-bit digital seismograph, 4.5 Hz vertical geophones at 10-foot spacing, seismic cables, a 16-lb sledge hammer with a strike plate and a truck-mounted weight drop with a 50-lb hammer accelerated via four elastomer bands.

Given the close proximity and orientation of the test locations, one long N-S line and one long W-E line were used to obtain the seismic data, rather than a short geophone array at each of the four test locations. The geophone arrays are shown on Figure 1. This required additional equipment but allowed for more efficient data acquisition and aided in reaching the desired depths of 100 feet below the ground surface (BGS).

Endpoints of the seismic lines were established using the provided survey markers and submeter-grade GPS. Geophones were located using the fixed 10-ft cable takeouts and measuring tape, and off-end shots were located using a 100-foot measuring tape. Interior shot points were located adjacent to a geophone.

Fifteen shot point locations were occupied for seismic Line 1 (oriented North-to-South, through SS-1A and SS-1B) and fourteen shot point locations were occupied for Line 2 (oriented West-to-East through SS-2A and SS-2B). The weight drop and sledgehammer sources were used as the energy source for all refraction and MASW shot locations. The final seismic record at each shot point was the result of stacking 7-10 individual shots to increase the signal to noise ratio. Ten passive microtremor measurements were collected per geophone array.

Data Processing Methodology

Seismic Refraction

Seismic refraction data processing begins with "picking" the first arrival time (the time associated with the source energy first being recorded at each geophone) for a refraction shot record. The SeisImager software by Geometrics, Inc. was used to make first break picks and seismic models. Travel times, along with source and receiver positions (X, Y, and Z - elevation) were formatted into master files for input into the modeling software. The travel time curves (provided in Appendix B) indicated that layer-based processing would be more appropriate for these data than tomographic modeling. Two layers were observed in the travel time data, and the time term analysis method was used to convert first-picked travel times to velocity-depth models. That two-layer model was used to generate the seismic tomograms shown in Figures 2 and 3, but tomographic modeling "smooths" contacts between subsurface units, even when no gradational contact exists. P-wave velocity values reported in Tables 2 - 5 represent results from the layer-based modeling analysis.

Seismic Surface Wave

Surface wave analysis consists of creating a frequency-velocity transform (provided in Appendix B), picking the transformed data to derive a dispersion curve, and inverting this dispersion curve to a layered model of shear wave velocity (Vs) versus depth (Xia, et. al 1999). SeisImager software was used for this processing sequence. As a long 2D profile was used to collect the MASW data along each profile, rather than four individual geophone arrays corresponding to each test location, the data from each geophone was sorted into "common midpoint gathers." These CMP gathers were used as the basis for the dispersion analysis at each of the four requested test locations.

Without ground truth data to guide the surface wave data modeling, the same number of layers and interpreted interfaces were used as input parameters for the starting model before surface wave inversion for all of the test locations (French et. al 2013). This was adjusted based on the layers observed in the P-wave refraction data.

Results and Interpretation

Results are presented in tables and velocity plots which follow the text of this report. Data quality for this investigation was fair. The only source of noise encountered during the field investigation was moderate wind activity; data collection was paused during a brief rain shower. Traffic noise was not present, and the project was conducted after drilling activities had been completed.

In general, the P-wave velocity of the shallowest subsurface layer is modeled as being approximately 1,100 feet per second, which is consistent with the speed of sound in air. There is some subtle indication that the shallowest materials may have a P-wave velocity of less than 1,100 ft/s, but this is difficult to accurately measure with any degree of confidence as this represents an example of the "thin hidden layer" problem described in the methodology section above. The method requires velocity to increase with depth, and the air-wave velocity, if faster than soil velocity, will be modeled based on the travel time analysis. The fastest modeled refractor may not be a different lithologic unit, but instead a function of soil saturation. The P-wave velocity at depths of 11.5-12 feet BGS was similar to that expected for saturated sediments (~ 5,800 feet per second). No P-wave velocity models show evidence of hard, non-rippable bedrock in the upper 100 feet of the subsurface.

The shear-wave velocities modeled from the MASW data indicate stiff soils. No hard rock velocities were observed in the MASW data. No easily distinguishable layers are observed (such as distinct geologic contacts). Rather, a general increase of seismic velocity with depth is observed. This is typical for glacial environments. The modeled shear-wave data associated with SS-2B is slower than the other three tests (~720 ft/s as opposed to 810-860 ft/s). However, the data is a bulk representation of an array that is over 200 feet in length, a portion of this line was located beyond a fence, and is expected to be less compacted than the soils located within the agricultural field. The P-wave refraction data also indicates a slightly thicker zone of slower-velocity materials east of SS-2B, which would impact the MASW and microtremor measurements.

Closure

This geophysical investigation was conducted under Zonge International protocols and procedures using industry standard methods and equipment. Professional quality control standards were observed during each phase of this project, from field activities through data processing and reporting.

If you have any questions regarding the field procedures, analysis techniques, or the results and interpretations presented herein, please do not hesitate to contact us. We appreciate working with you and look forward to providing you with geophysical services in the future.

Respectfully submitted by

JB Shawver,

Zonge International

Technical References

French, R., J. Shawver, & M. Douglas, 2013, *Pitfalls of Seismic Surface Wave Analysis for Shear-wave Velocity Determination*: Abstract from the 2013 AEG Annual Meeting

Martin, A. Diehl, J., & J. Shawver, 2005, *Combined Use of Active and Passive Surface-wave Techniques for Cost-effective UBC/IBC Site Classification*: Abstract from the 2005 AEG Annual Meeting

Palmer, D., 1981, *An Introduction to the generalized reciprocal method of seismic refraction interpretation*: Geophysics, 46(11), 1508–1518.

Park, C. & J. Shawver, 2009, *MASW Survey using Multiple Source Offsets*: Proceedings of the 2009 Symposium on the Application of Geophysics to Environmental and Engineering Problems (SAGEEP)

Xia, J., R. Miller, & C. Park, 1999, *Estimation of near-surface shear-wave velocity by inversion of Rayleigh wave*: Geophysics, v. 64, p.691-700.

Appendix A - Velocity Plots & Tables

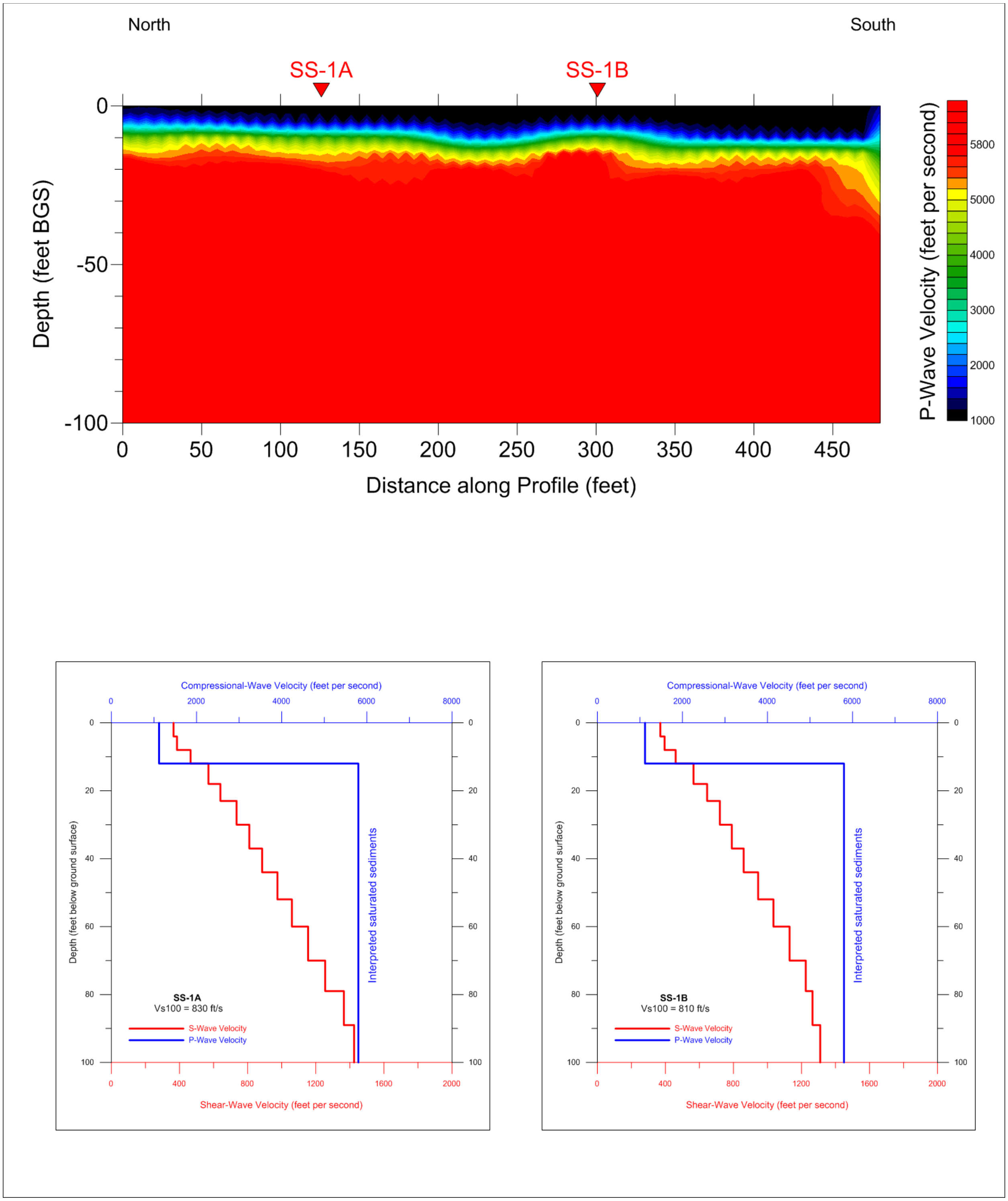


Figure 2 – Seismic Velocity Plots for SS-1A & SS-1B

P-wave refraction tomogram (top) and S-wave from surface wave methods (bottom, with P-wave overlain in blue)

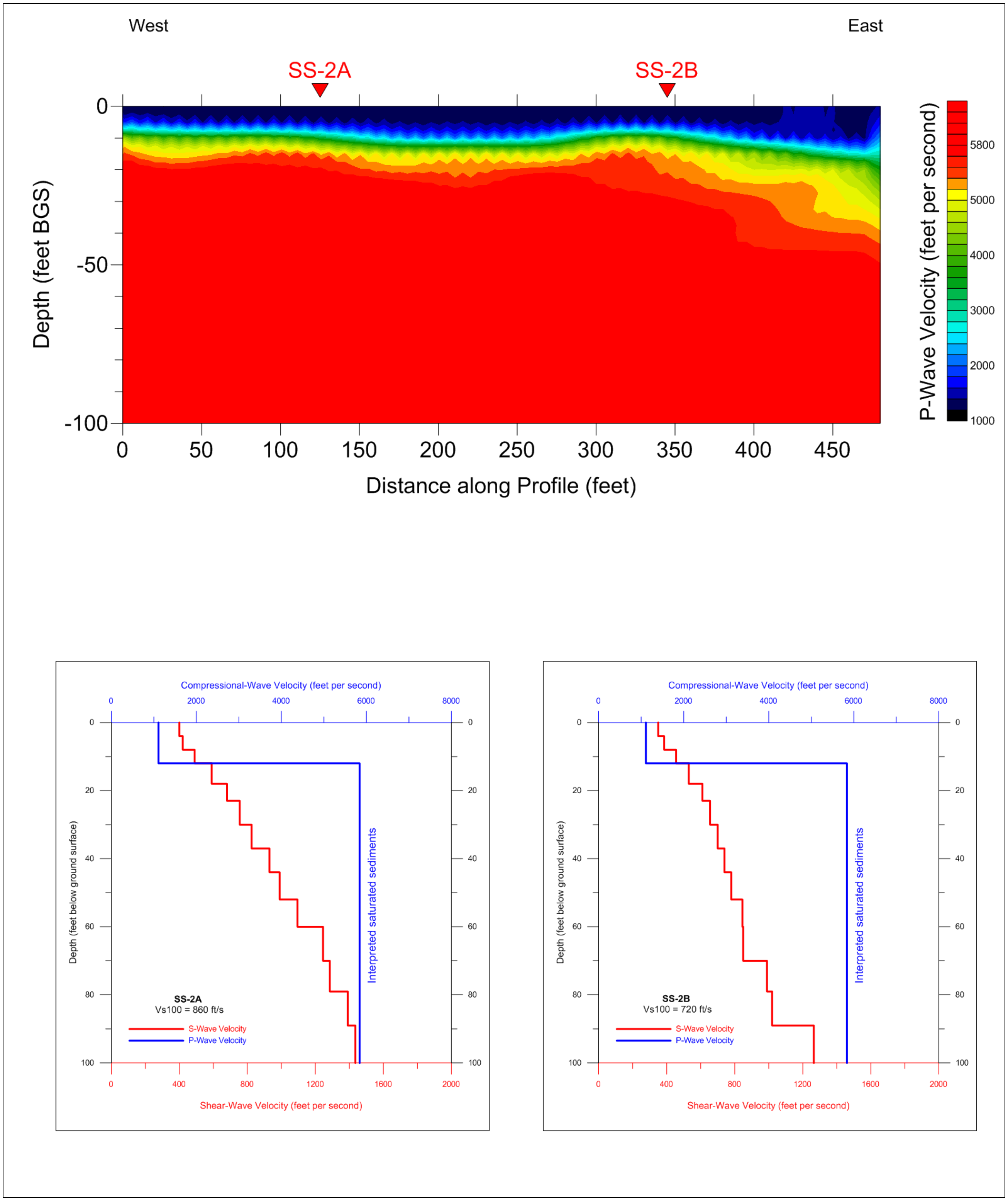


Figure 3 – Seismic Velocity Plots for SS-2A & SS-2B

P-wave refraction tomogram (top) and S-wave from surface wave methods (bottom, with P-wave overlain in blue)

SS-1A		
Depth (ft)	S-wave velocity (ft/s)	P-wave velocity (ft/s)
0	365	1120
4	385	1120
8	465	1120
12	570	5800
18	640	5800
23	735	5800
30	810	5800
37	885	5800
44	975	5800
52	1060	5800
60	1155	5800
70	1255	5800
79	1365	5800
89	1425	5800
121	1465	5800

SS-1A
Vs100 = 830 ft/s
Saturated Sediments = 11ft BGS

Table 2 – Velocity Summary SS-1A

SS-1B		
Depth (ft)	S-wave velocity (ft/s)	P-wave velocity (ft/s)
0	370	1120
4	395	1120
8	460	1120
12	565	5800
18	645	5800
23	720	5800
30	790	5800
37	860	5800
44	945	5800
52	1035	5800
60	1130	5800
70	1225	5800
79	1265	5800
89	1310	5800
121	1345	5800

SS-1B
Vs100 = 810 ft/s
Saturated Sediments = 11ft BGS

Table 3 – Velocity Summary SS-1B

SS-2A		
Depth(ft) (ft)	**S-wave velocity(ft/s) (ft/s)**	**P-wave velocity(ft/s) (ft/s)**
0	400	1110
4	420	1110
8	490	1110
12	590	5840
18	680	5840
23	755	5840
30	825	5840
37	930	5840
44	990	5840
52	1095	5840
60	1245	5840
70	1285	5840
79	1390	5840
89	1435	5840
121	1470	5840

SS-2A
Vs100 = 860 ft/s
Saturated Sediments = 12ft BGS

Table 4 – Velocity Summary SS-2A

SS-2B		
Depth(ft) (ft)	**S-wave velocity(ft/s) (ft/s)**	**P-wave velocity(ft/s) (ft/s)**
0	350	1110
4	385	1110
8	455	1110
12	530	5840
18	610	5840
23	655	5840
30	700	5840
37	740	5840
44	780	5840
52	845	5840
60	850	5840
70	990	5840
79	1020	5840
89	1265	5840
121	1355	5840

SS-2B
Vs100 = 720 ft/s
Saturated Sediments = 11.5ft BGS

Table 5 – Velocity Summary SS-2B

Appendix B – Seismic Travel Time Curves and Phase Velocity Spectra

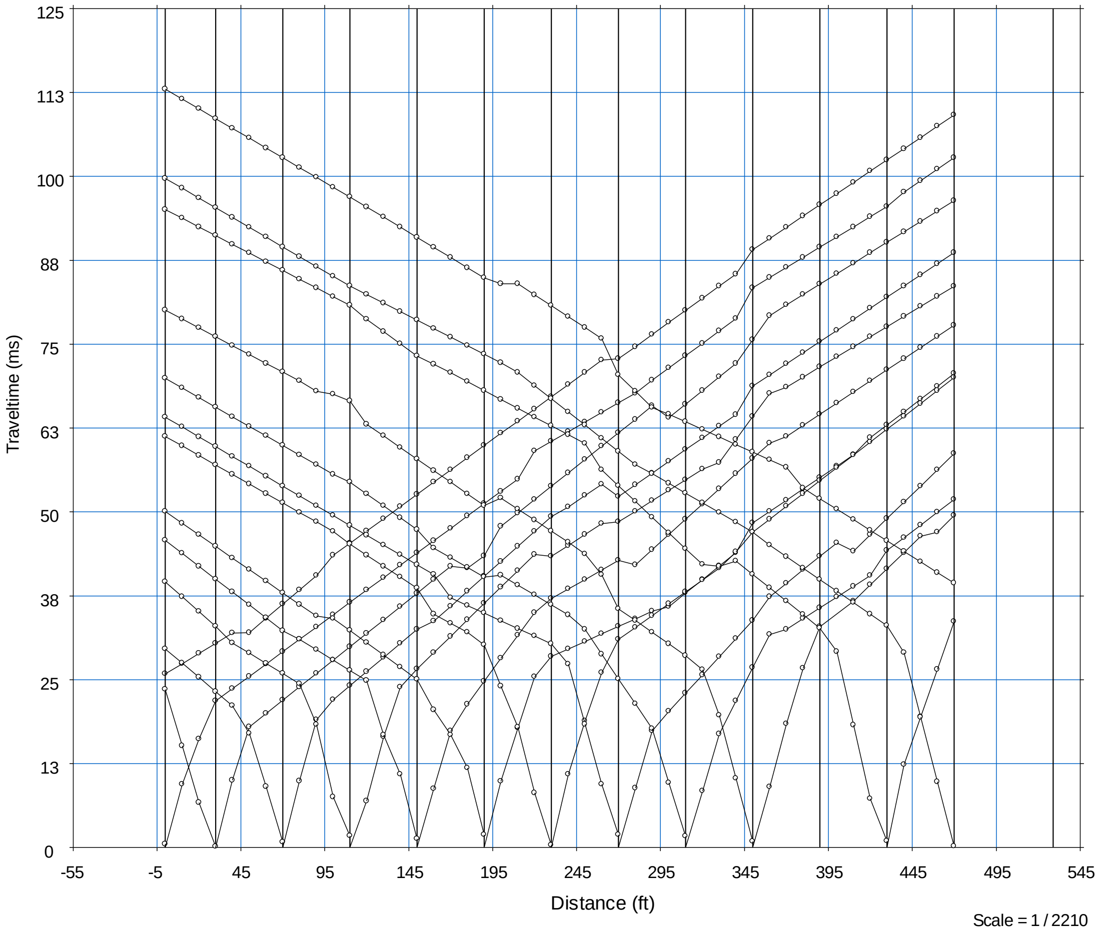


Figure 4 - Traveltime Curve for Seismic Refraction Line 1

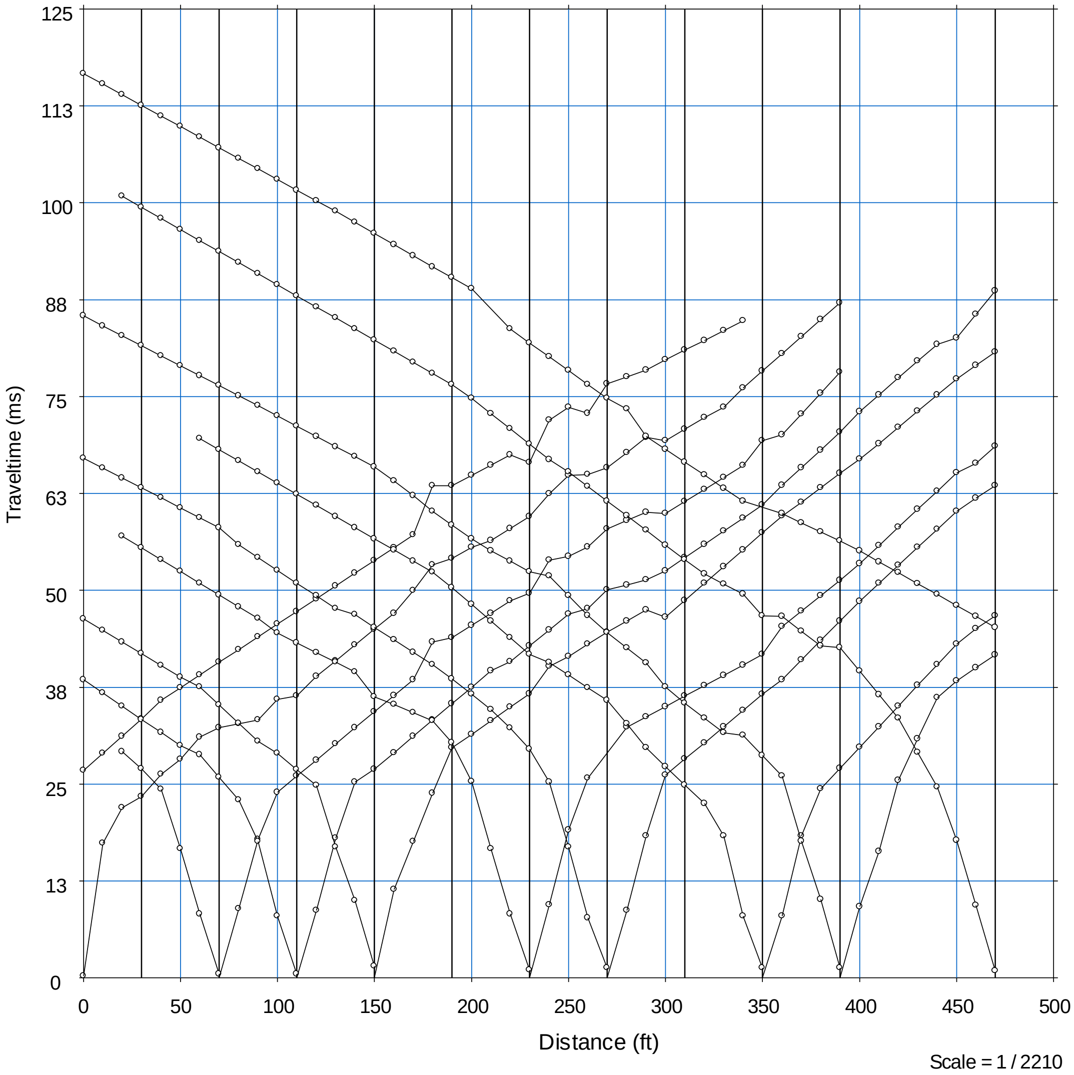


Figure 5 - Traveltime Curve for Seismic Refraction Line 2

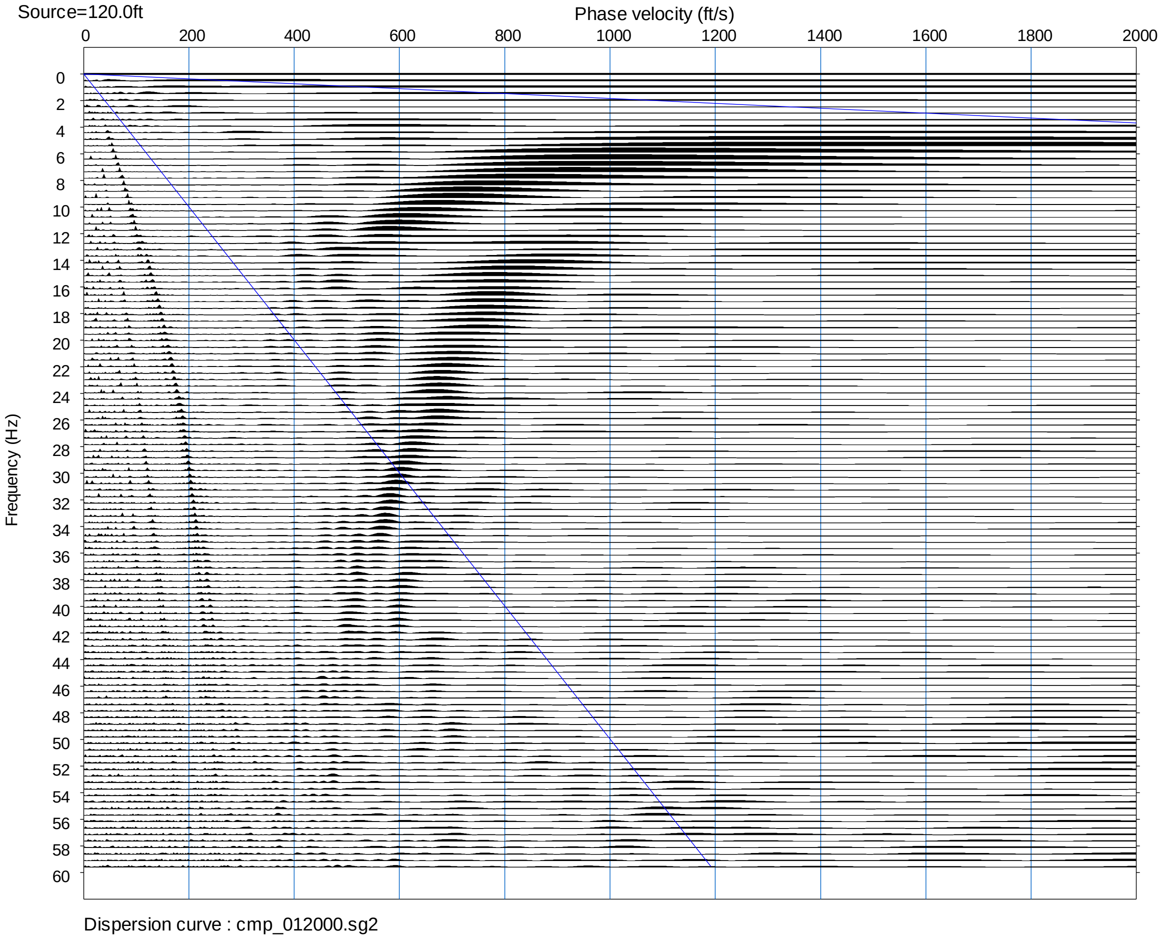


Figure 6 – Phase Velocity Spectra for MASW file centered on SS-1A

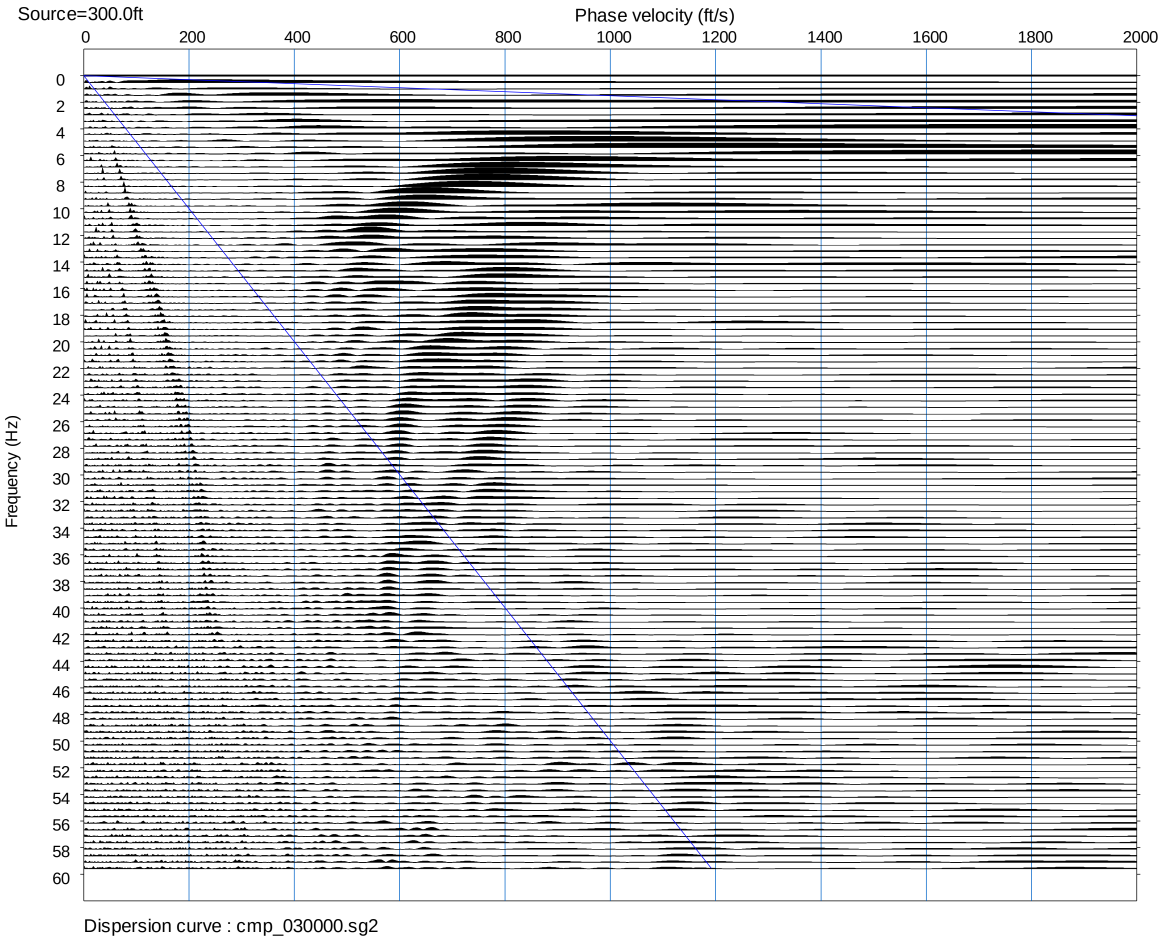


Figure 7 – Phase Velocity Spectra for MASW file centered on SS-1B

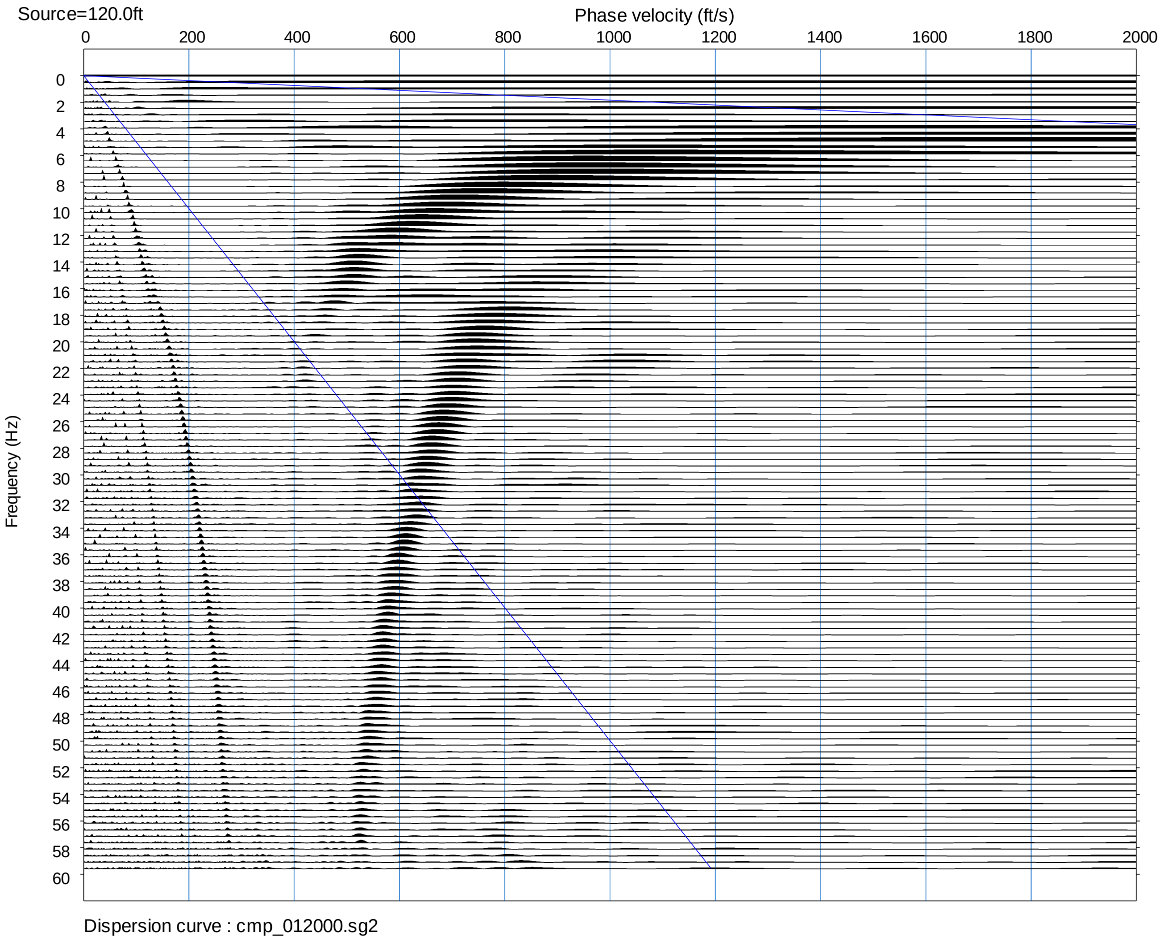


Figure 8 – Phase Velocity Spectra for MASW file centered on SS-2A

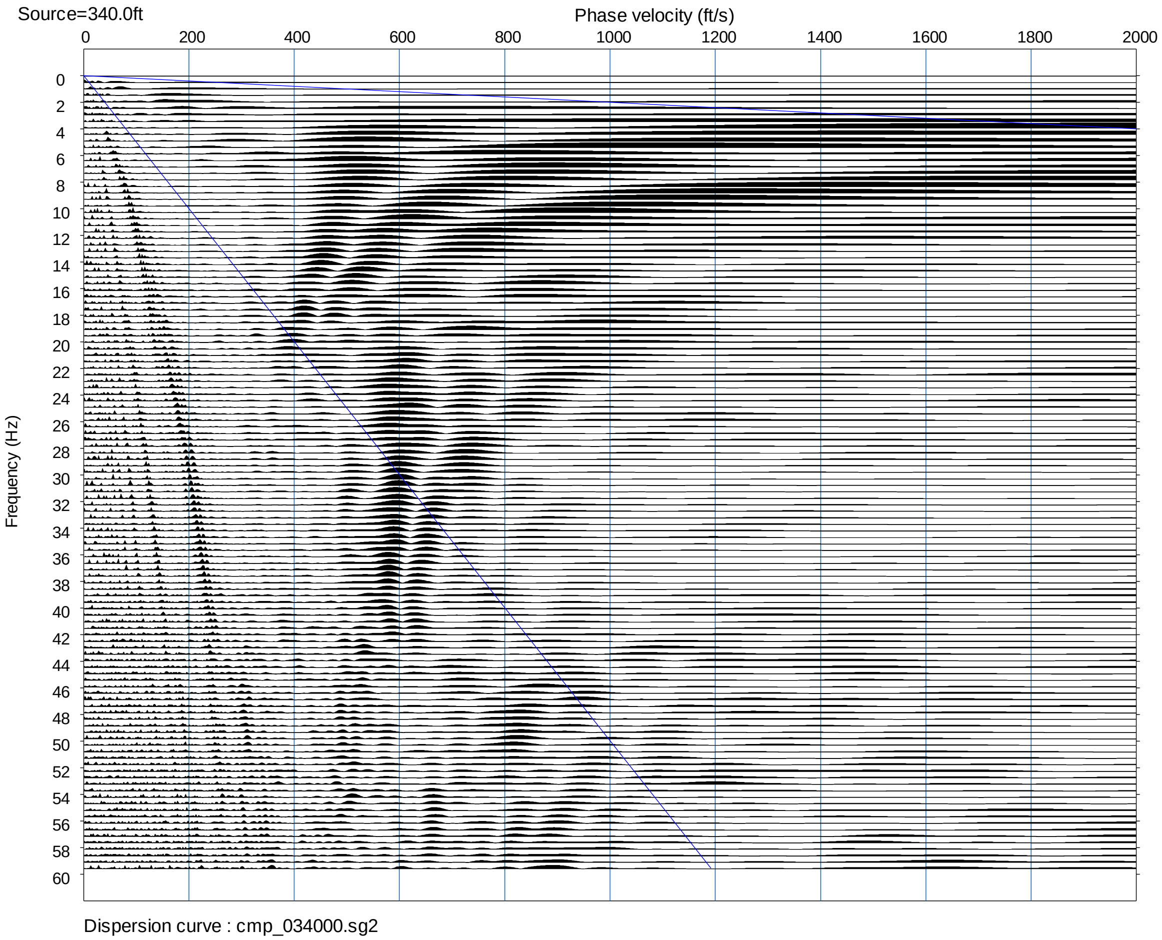


Figure 9 – Phase Velocity Spectra for MASW file centered on SS-2B

BRAUN
INTERTEC

Standard Penetration Test, Energy Measurement Results Summary
Braun Intertec Rig 7512 SPT Calibration, 140-lb Ram
Test Performed on July 25, 2018

Boring Number	Sample Depth (feet)	Blows Per Set			N	Sampled Material	Average Rate (BPM)	Weighted Average Measured Energy (ft-lbs) **	Hammer Energy Efficiency *	Conversion Factor To N_{60}	N_{60}	General Remarks
		Set 1	Set 2	Set 3								
B-10	25	3	4	6	10	Sandy Lean Clay	56	261	74.7%	1.24	12	
		EMX	0.263	0.261								
B-10	30	1	2	5	7	Sandy Lean Clay	56	262	74.8%	1.25	9	
		EMX	0.268	0.260								
B-10	35	2	3	5	8	Sandy Lean Clay	52	253	72.4%	1.21	10	
		EMX	0.250	0.256								
B-10	40	2	5	8	13	Sandy Lean Clay	53	255	72.8%	1.21	16	
		EMX	0.257	0.253								
B-10	45	7	9	9	18	Sandy Lean Clay	50	254	72.4%	1.21	22	
		EMX	0.254	0.253								

Weighted Average of Efficiency and Conversion Factor	74.0%	1.22

* Based on a standard penetration test energy of 140 pounds falling 30 inches or 350 foot-pounds (ft-lbs).

** ASTM D4633 specification for SPT energy measurement. Weighted Average of final two 6-inch sets.

BRAUN
INTERTEC

Standard Penetration Test, Energy Measurement Results Summary
Braun Intertec Rig 7508 SPT Calibration, 140-lb Ram
Test Performed on July 26, 2018

Boring Number	Sample Depth (feet)	Blows Per Set			N	Sampled Material	Average Rate (BPM)	Weighted Average Measured Energy (ft-lbs) **	Hammer Energy Efficiency *	Conversion Factor To N_{60}	N_{60}	General Remarks
		Set 1	Set 2	Set 3								
B-01	30	2	3	4	7	Sandy Lean Clay	56	260	74.4%	1.24	9	
		EMX	0.258	0.262								
B-01	35	1	3	4	7	Sandy Lean Clay	56	264	75.5%	1.26	9	
		EMX	0.267	0.263								
B-01	40	2	2	5	7	Sandy Lean Clay	53	267	76.4%	1.27	9	
		EMX	0.267	0.268								
B-01	45	3	5	8	13	Sandy Lean Clay	51	266	75.9%	1.27	16	
		EMX	0.257	0.271								
B-01	50	7	12	18	30	Sandy Lean Clay	53	263	75.3%	1.25	38	
		EMX	0.265	0.263								

Weighted Average of Efficiency and Conversion Factor	75.4%	1.26

* Based on a standard penetration test energy of 140 pounds falling 30 inches or 350 foot-pounds (ft-lbs).

** ASTM D4633 specification for SPT energy measurement. Weighted Average of final two 6-inch sets.

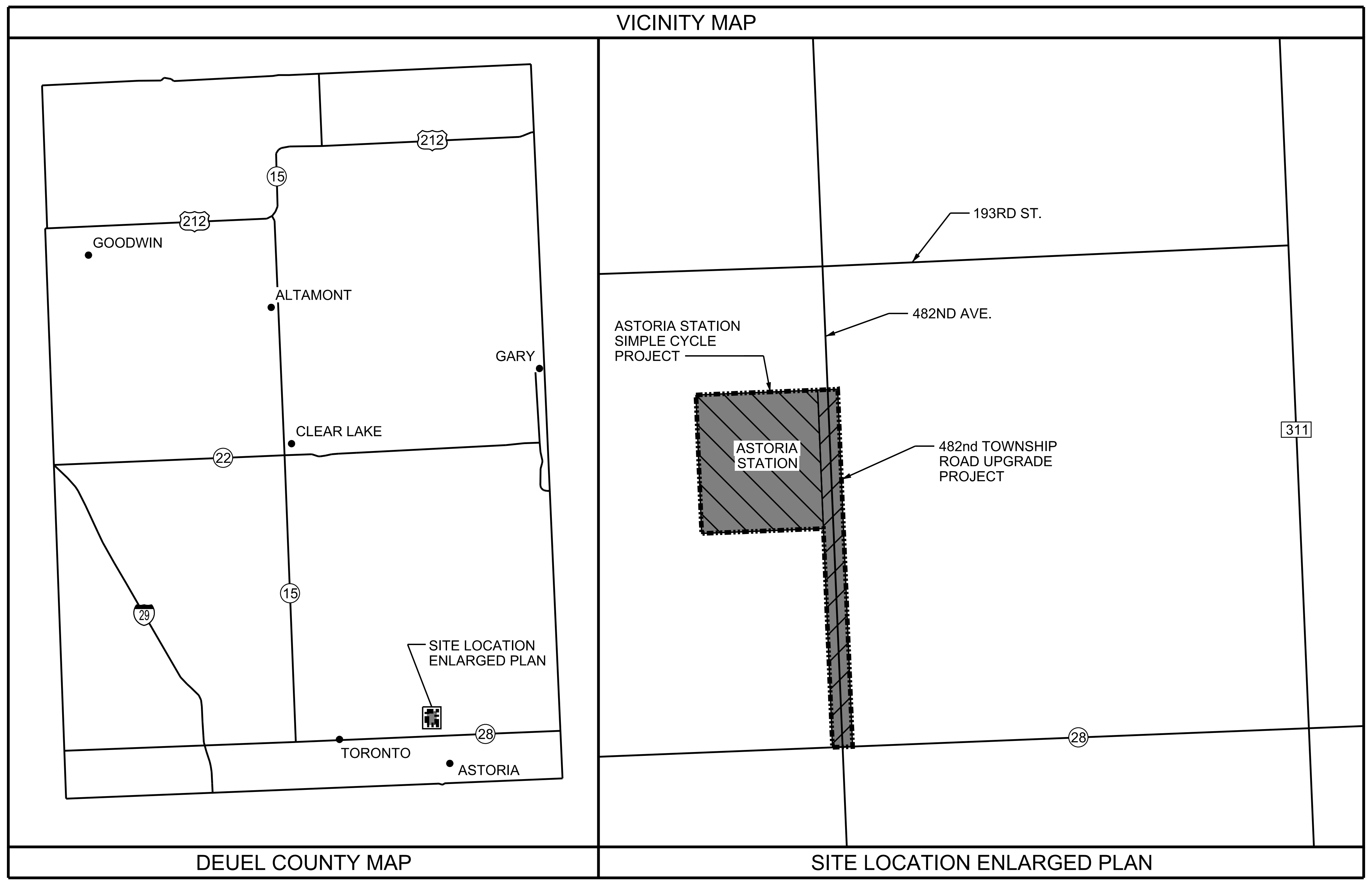
ASTORIA STATION
SIMPLE CYCLE PROJECT
STORMWATER POLLUTION PREVENTION PLAN

APPENDIX C

SITE MAPS

ASTORIA STATION SIMPLE CYCLE PROJECT
AND 482nd TOWNSHIP ROAD UPGRADE PROJECT
DEUEL COUNTY, SOUTH DAKOTA

VICINITY MAP



DEUEL COUNTY MAP

SITE LOCATION ENLARGED PLAN

DRAWING LIST

C1-0001	CIVIL COVER SHEET AND DRAWING LIST
C1-0002	CIVIL GENERAL NOTES, LEGEND, SYMBOLS AND ABBREVIATIONS
C1-0010	TEMPORARY EROSION CONTROL PLAN
C1-0011	TEMPORARY EROSION CONTROL DETAILS
C1-0030	CLEARING AND GRUBBING AND SITE DEMOLITION PLAN
C1-0031	INITIAL GRADING PLAN - SHEET 1
C1-0032	INITIAL GRADING PLAN - SHEET 2
C1-0033	INITIAL GRADING PLAN - SHEET 3
C1-0034	INITIAL GRADING PLAN - SHEET 4
C1-0035	INITIAL GRADING DETAILS - SHEET 1
C1-0050	482nd TOWNSHIP ROAD TEMPORARY EROSION CONTROL PLAN
C1-0051	482nd TOWNSHIP ROAD PLAN AND PROFILE - SHEET 1
C1-0052	482nd TOWNSHIP ROAD PLAN AND PROFILE - SHEET 2
C1-0053	482nd TOWNSHIP ROAD PLAN AND PROFILE - SHEET 3
C1-0054	482nd TOWNSHIP ROAD PLAN AND PROFILE - SHEET 4
C1-0065	PERMANENT FENCING PLAN
C1-0066	FENCING DETAILS - SHEET 1
C1-0067	FENCING DETAILS - SHEET 2
C1-0075	STORMWATER SEWER PLAN
C1-0076	STORM SEWER SECTIONS AND DETAILS - SHEET 1
C1-0078	OILY WATER AND SANITARY SEWER PLAN
C1-0079	OILY WATER PIPING SECTIONS AND DETAILS - SHEET 1
C1-0080	OILY WATER PIPING SECTIONS AND DETAILS - SHEET 2
C1-0081	SANITARY SEWER MANHOLE DETAILS

HOLD INFORMATION

NO.	DESCRIPTION

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUB-CONTRACTOR(S)) PERFORMING THE WORK.

RELEASE INFORMATION

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0	01-11-2019	FOR COMMENT
1	02-08-2019	FOR COMMENT

ISSUE PURPOSE: COMMENT

SPECIFICATION: A-8808

PROJECT NO.: 12715-010

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ENTER DATE

MY LICENSE RENEWAL DATE
IS: ENTER DATE
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CERTIFICATE OF AUTHORIZATION

CAD FILE NAME: C1-0001.DGN

PREPARED BY: A. PAAPE

REVIEWED BY: M. TURNER

APPROVED BY: ---

ANY MODIFICATION OR ADDITION TO THIS DRAWING BY AN ORGANIZATION OTHER THAN SARGENT & LUNDY IS NOT THE RESPONSIBILITY OF SARGENT & LUNDY.

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SARGENT & LUNDY LLC
55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603-5780

OTTER TAIL
POWER COMPANY

PROJECT

ASTORIA STATION
SIMPLE CYCLE PROJECT AND
482nd TOWNSHIP ROAD UPGRADE

SOUTH DAKOTA

DRAWING TITLE

CIVIL COVER SHEET AND DRAWING LIST

DRAWING NUMBER	REVISION
C1-0001	1

SHEET 1 OF 1

ZD11185/0p2962/D:\ASTORIA\checkout\c1-0001.dgn
Form GDG-0401-01-08, ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 10, Revision Date: 10-16-2009

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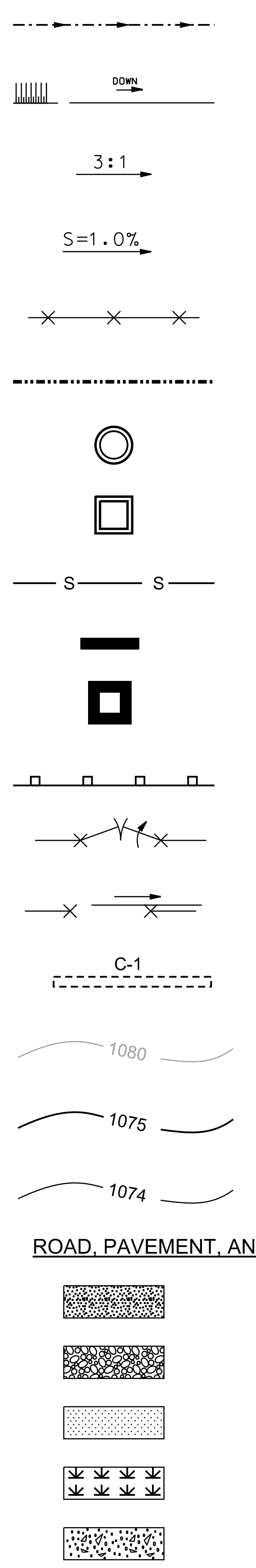
ABBREVIATIONS

AC	ACRE
APPROX	APPROXIMATE
BOT.	BOTTOM
BVCS	BEGINNING OF VERTICAL CURVE STATION
BVCE	BEGINNING OF VERTICAL CURVE ELEVATION
CL OR ℄	CENTERLINE
CB	CATCH BASIN
CO	CLEANOUT
CONC	CONCRETE
DIA	DIAMETER
DS	DOWNSTREAM
EL. OR ELEV.	GRADE ELEVATION
EQ	EQUAL
EXIST.	EXISTING
GALV.	GALVANIZED
HORIZ	HORIZONTAL
HP	HIGH POINT
HPFS	HIGH POINT FINISHED SURFACE
I.D.	INNER DIAMETER
INV.	INVERT ELEVATION
LP	LOW POINT
LS	LIFT STATION
LVC	LENGTH OF VERTICAL CURVE
MAX	MAXIMUM
MH	MANHOLE
MIN	MINIMUM
N.T.S.	NOT TO SCALE
O.C.	ON CENTER
O.D.	OUTER DIAMETER
OHL	OVERHEAD LINE
PC	POINT OF CURVE
PI	POINT OF INTERSECTION
PIV	POST INDICATOR VALVE
PROP	PROPOSED
PT	POINT OF TANGENT
PVI	INTERSECTION POINT OF VERTICAL CURVE
R	RADIUS
RE	RIM ELEVATION
ROW	RIGHT OF WAY
S	SLOPE
SIM	SIMILAR
STA.	STATION
T/	TOP OF
T/RD	TOP OF ROAD ELEVATION
TYP	TYPICAL
UN	UNLESS NOTED
US	UPSTREAM

SYMBOLS



SWALE

TOP OF EMBANKMENT SLOPE OR DITCH SIDE SLOPE AND DIRECTION OF SLOPE

HORIZONTAL TO VERTICAL SLOPE WHEN SLOPE IS CONSTANT

DIRECTION OF ROAD OR AREA SLOPE. PERCENT OF SLOPE SHOWN WHERE APPLICABLE

CHAIN LINK FENCE

PROPERTY LINE

PRECAST CONCRETE MANHOLE WITH GRATED COVER

PRECAST CONCRETE CATCH BASIN WITH GRATED COVER

SILT FENCE

CHECK DAM

INLET PROTECTION

GUARDRAIL

SWING GATE - DIRECTION OF SWING

SLIDE GATE - DIRECTION OF SLIDE

CULVERT

EXISTING CONTOURS

PROPOSED MAJOR CONTOURS

PROPOSED MINOR CONTOURS

ROAD, PAVEMENT, AND SURFACING SYMBOLS

8" AGGREGATE SURFACING

AGGREGATE ROAD

ASPHALT PAVEMENT

4" SEEDED TOPSOIL

CONCRETE PAVEMENT

CIVIL GENERAL NOTES

1. PROPERTY:

   THE PROJECT IS LOCATED IN DEUEL COUNTY, SOUTH DAKOTA, JUST NORTH OF THE CITY OF ASTORIA.

2. HORIZONTAL AND VERTICAL CONTROL:

   A. PERMANENT MONUMENTS FOR HORIZONTAL AND VERTICAL CONTROL HAVE BEEN ESTABLISHED BY THE OWNER. THE LOCATION OF EACH MONUMENT ARE IDENTIFIED BELOW.

MONUMENT NO.	NORTHING	EASTING	ELEVATION
M1	(LATER)	(LATER)	(LATER)
M2	(LATER)	(LATER)	(LATER)
M3	(LATER)	(LATER)	(LATER)
M4	(LATER)	(LATER)	(LATER)
M5	(LATER)	(LATER)	(LATER)
M6	(LATER)	(LATER)	(LATER)

   B. THE BASIS FOR HORIZONTAL CONTROL IS THE PLANT COORDINATE SYSTEM. THE TIE BETWEEN PLANT COORDINATE SYSTEM AND THE SOUTH DAKOTA STATE PLANE COORDINATE SYSTEM NORTH ZONE (NAD 83) IS:

   PLANT NORTH 7400.00= STATE PLANE NORTH 291765.00
   PLANT EAST 5200.00 = STATE PLANE EAST 2863125.00

   C. PLANT NORTH IS ROTATED 2 DEGREES COUNTER CLOCKWISE FROM STATE PLANE NORTH.

   D. THE BASIS FOR VERTICAL CONTROL IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).

   E. CONTRACTOR IS RESPONSIBLE FOR SETTING ADDITIONAL MONUMENTS AND CONTROL POINTS THAT THEY MAY DEEM NECESSARY FOR COMPLETION OF WORK.

   F. CONTRACTOR SHALL VERIFY COORDINATES PROVIDED FROM THE ESTABLISHED CONTROL MONUMENTS PRIOR TO SETTING ADDITIONAL MONUMENTS AND PRIOR TO PERFORMING SURVEYING FOR CONSTRUCTION LAYOUT WORK. THE CONTRACTOR SHALL RERUN COORDINATES TO EACH MONUMENT IN ORDER TO VERIFY ACCURACY OF MONUMENT LOCATIONS.

3. TOPOGRAPHIC MAPS:

   A. THE TOPOGRAPHIC MAP OF THE PLANT SITE WAS PREPARED BY BANNER ASSOCIATES AND IS DATED AUGUST 2018.

4. GEOTECHNICAL REPORT:

   A. "GEOTECHNICAL EXPLORATION AND TESTING REPORT" WAS PREPARED BY BRAUN INTERTEC CORPORATION, AND IS DATED SEPTEMBER 5, 2018.

5. ALL WORK DONE BY CONTRACTOR/INSTALLER PURSUANT TO THIS DRAWING SHALL: (A) CONFORM TO THE GOVERNING CONTRACT DOCUMENTS; (B) BE PERFORMED EXCLUSIVELY BY ITS TRAINED, COMPETENT PERSONNEL OR, WHERE PERMITTED, THAT OF ITS SUBCONTRACTOR(S); AND (C) COMPLY WITH ALL APPLICABLE SAFETY LAWS, REGULATIONS, PROGRAMS AND PRACTICES TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING THE CONTRACTOR'S /INSTALLER'S PERSONNEL (OR THAT OF ITS SUBCONTRACTOR(S)) PERFORMING THE WORK.

6. UNDERGROUND OR EMBEDDED UTILITIES MAY EXIST WITHIN THE AREA OF AND ADJACENT TO THE LIMITS OF THE WORK. THE LOCATION OR IDENTIFICATION OF SUCH UTILITIES HAS NOT BEEN VERIFIED BY THE OWNER OR BY S&L. CONTRACTOR/INSTALLER IS RESPONSIBLE FOR FIELD LOCATING AND IDENTIFYING UNDERGROUND OR EMBEDDED UTILITIES AND ANY OTHER UNDERGROUND OR EMBEDDED UTILITY DIMENSIONS.

7. REFERENCES USED HAVE BEEN IDENTIFIED ON EXCAVATION/FOUNDATION/DEMOLITION DRAWINGS AND HAVE BEEN PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING EXISTING UTILITIES AND OTHER POTENTIAL UNDERGROUND OR EMBEDDED INTERFERENCES. THESE REFERENCES ONLY SHOW THE APPROXIMATE LOCATION OF POTENTIAL UNDERGROUND OR EMBEDDED UTILITIES AND MAY NOT INDICATE OR REFLECT ALL EXISTING UNDERGROUND OR EMBEDDED UTILITIES OR THEIR ACTUAL LOCATIONS.

8. REFERENCES IDENTIFIED SHALL NOT SUBSTITUTE FOR THE CONTRACTOR'S/INSTALLER'S OBLIGATION TO FIELD LOCATE ANY UNDERGROUND OR EMBEDDED UTILITIES OR INTERFERENCES THAT MAY AFFECT THE WORK.

9. DUE CAUTION SHALL BE TAKEN DURING ANY EXCAVATION/FOUNDATION/DEMOLITION WORK WITHIN THE AREA OF AND ADJACENT TO THE LIMITS OF THE WORK DUE TO POSSIBLE INTERFERENCES THAT MAY NOT BE REFLECTED ON THE REFERENCES IDENTIFIED.

10. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF FEDERAL, STATE, OR LOCAL CODES, STANDARDS, AND SPECIFICATION (LATER), UNLESS NOTED OTHERWISE.

11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PRESERVATION AND RESTORATION OF THE EXISTING UTILITIES, IF DAMAGED DURING CONSTRUCTION, AT NO ADDITIONAL COST TO THE OWNER.

12. CONTRACTOR SHALL SEQUENCE ALL CONSTRUCTION TO ALLOW FOR CONSTANT PROGRESS OF THE WORK. ANY DAMAGE TO COMPLETED WORK AS A RESULT OF CONSTRUCTION ACTIVITIES SHALL BE REPAIRED AT NO ADDITIONAL COST TO THE OWNER.

13. GRADING AND DRAINAGE:

   A. FINISHED GRADE OF ALL AREAS SHALL PROVIDE PROPER DRAINAGE AT ALL TIMES AND PREVENT PONDING OF WATER.

   B. THE MINIMUM SLOPE OF ALL ROADS, AREA PAVING, AND SURFACING SHALL BE AS SHOWN ON PLAN AND SHALL NOT BE LESS THAN 0.5% UNLESS NOTED.

   C. THE MAXIMUM SLOPE OF ALL SURFACING SHALL BE 3H:1V UNLESS NOTED.

HOLD INFORMATION

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PROJECT NO.: 12715-010

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CAD FILE NAME: C1-0002.DGN
PREPARED BY: A. PAAPE
REVIEWED BY: M. TURNER
APPROVED BY: ---

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CHICAGO, ILLINOIS 60603-5780

OTTER TAIL POWER COMPANY

PROJECT

ASTORIA STATION
SIMPLE CYCLE

SOUTH DAKOTA

DRAWING TITLE

CIVIL GENERAL NOTES, LEGEND, SYMBOLS AND ABBREVIATIONS

DRAWING NUMBER	REVISION
C1-0002	1
SHEET 1 OF 1	

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Form GDG-0401-01-08, ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 10, Revision Date: 10-16-2009

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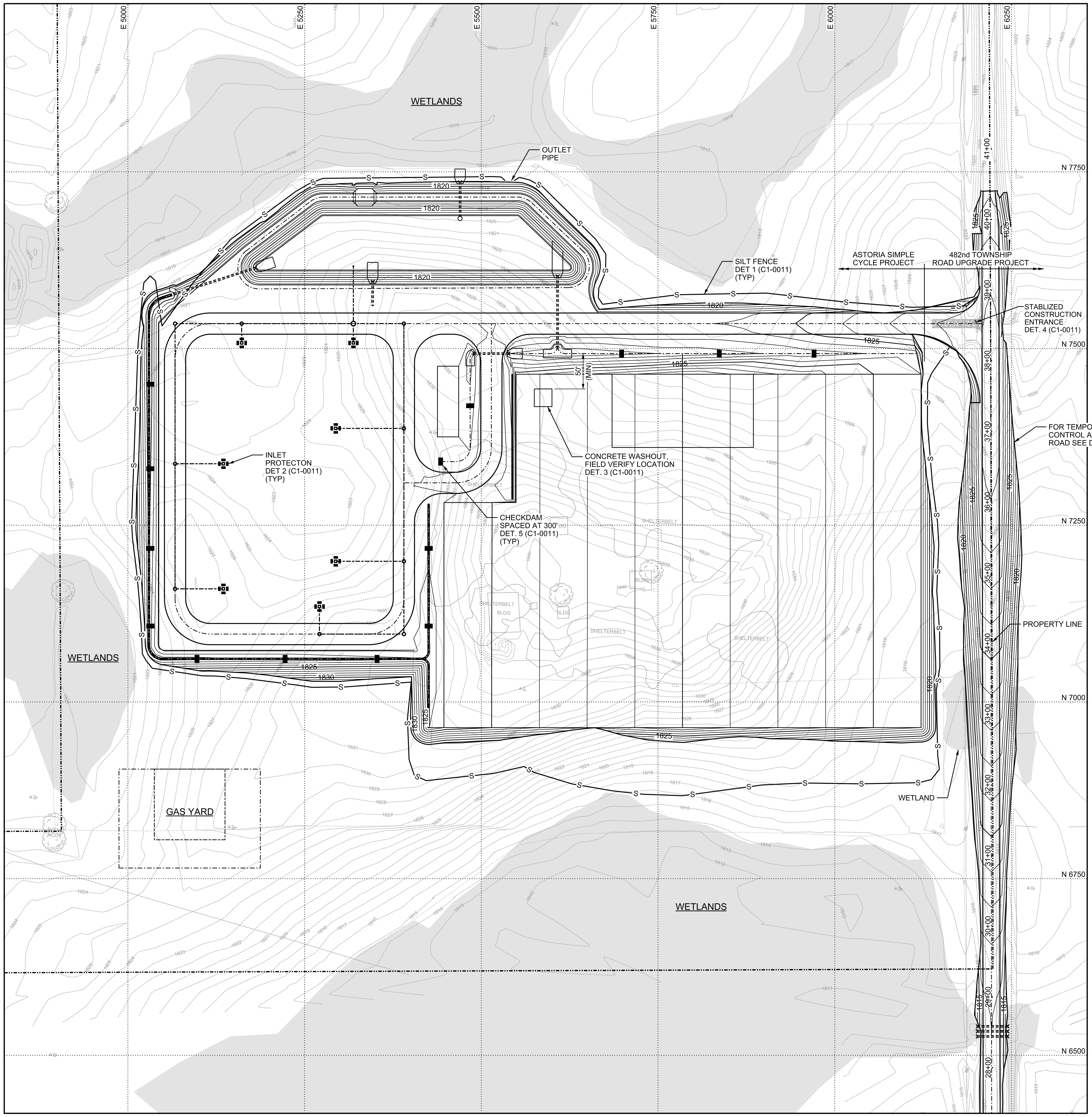

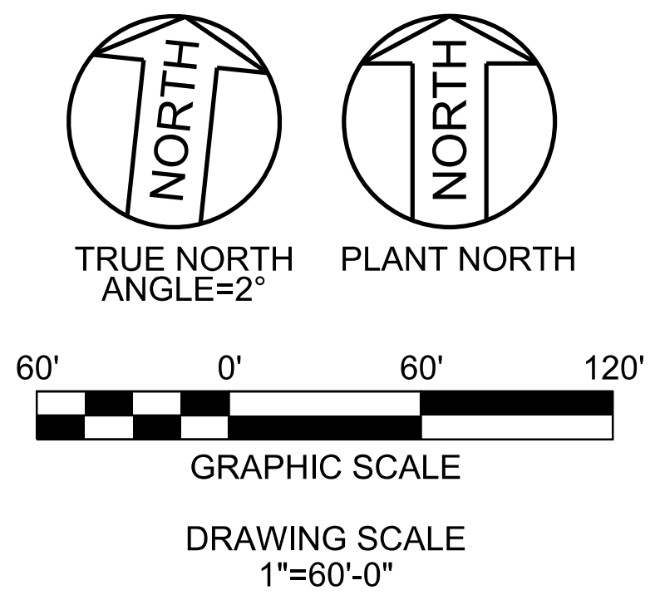

DRAWING SCALE
1"=60'-0"

HOLD INFORMATION	
NO.	DESCRIPTION

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CAD FILE NAME: C1-0010.DGN
PREPARED BY: A. PAAPE
REVIEWED BY: M. TURNER
APPROVED BY: ---

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CHICAGO, ILLINOIS 60603-5780

OTTER TAIL
POWER COMPANY

PROJECT

ASTORIA STATION
SIMPLE CYCLE PROJECT AND
482nd TOWNSHIP ROAD UPGRADE

SOUTH DAKOTA

DRAWING TITLE

TEMPORARY EROSION CONTROL PLAN

DRAWING NUMBER	REVISION
C1-0010	1

SHEET 1 OF 1

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE PERFORMED BY SPECIFICATION A-8808 UNLESS NOTED OTHERWISE.
2. FOR CIVIL GENERAL NOTES SEE DRAWING C1-0002.
3. FOR TEMPORARY EROSION CONTROL DETAILS, SEE DRAWING C1-0011.

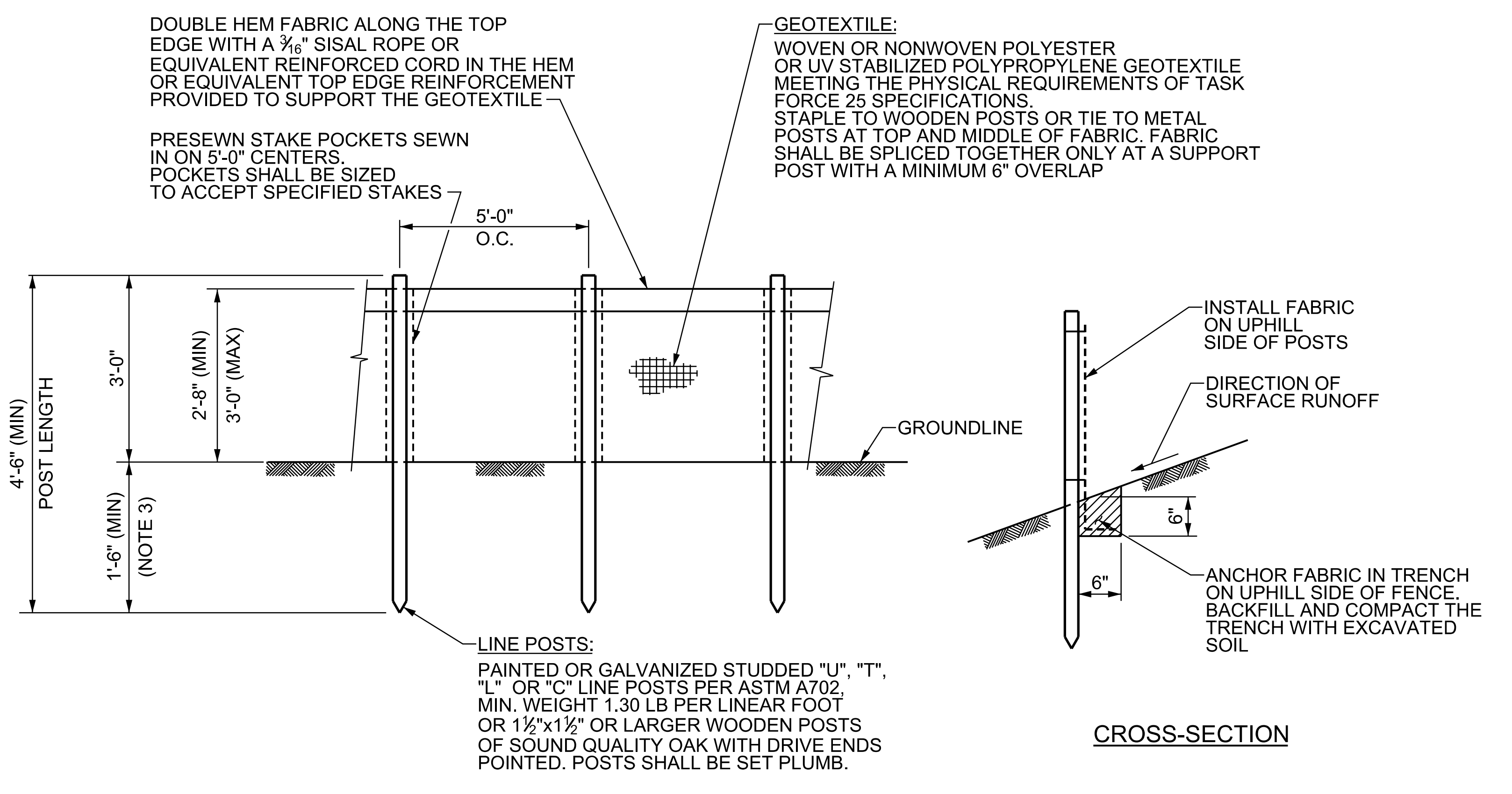
REFERENCE DRAWINGS

C1-0011	TEMPORARY EROSION CONTROL DETAILS

UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED.

REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK.

THE CONTRACTOR/INSTALLER SHALL EXERCISE DUE CAUTION DURING ALL EXCAVATION/FOUNDATION/DEMOLITION WORK.



FRONT ELEVATION

CROSS-SECTION

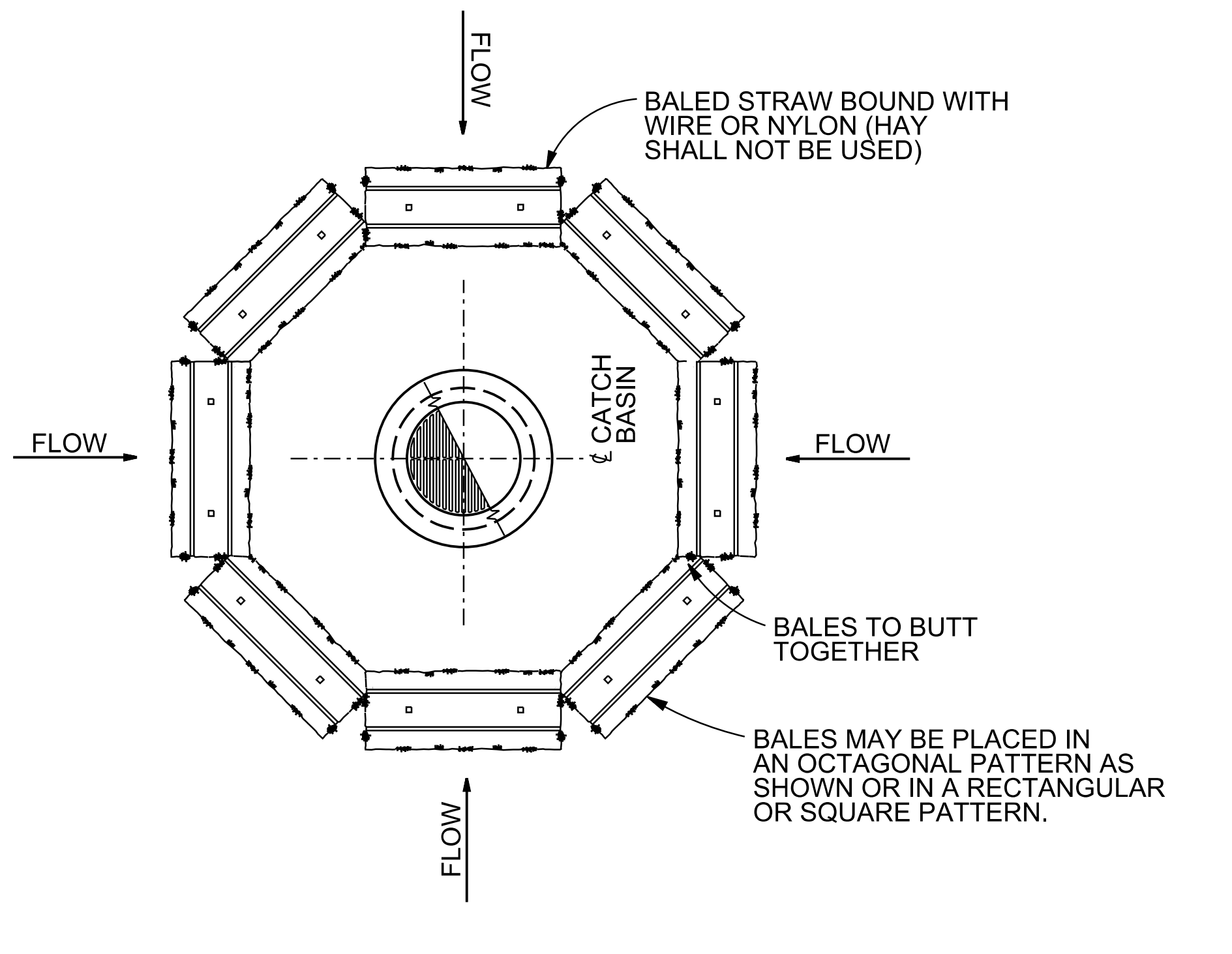
NOTES:

1. AFTER INSTALLATION, THE CONTRACTOR SHALL BE RESPONSIBLE FOR SATISFACTORILY MAINTAINING THE FENCE. THE CONTRACTOR SHALL INSPECT FENCES AFTER EACH RAINFALL AND AT LEAST DAILY DURING PROLONGED RAINFALL. CONTRACTOR IS RESPONSIBLE FOR REMOVING AND REPLACING SILT FENCING NOT FUNCTIONING DUE TO CLOGGING, DAMAGE OR DETERIORATION.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVAL AND DISPOSAL OF FENCING WHEN, AS DETERMINED BY THE PURCHASER, THE FENCING IS NO LONGER NEEDED.
3. WHERE 18" DEPTH IS IMPOSSIBLE TO ACHIEVE THE POSTS SHALL BE SECURED TO PREVENT OVERTURNING OF THE FENCE DUE TO SEDIMENT LOAD.

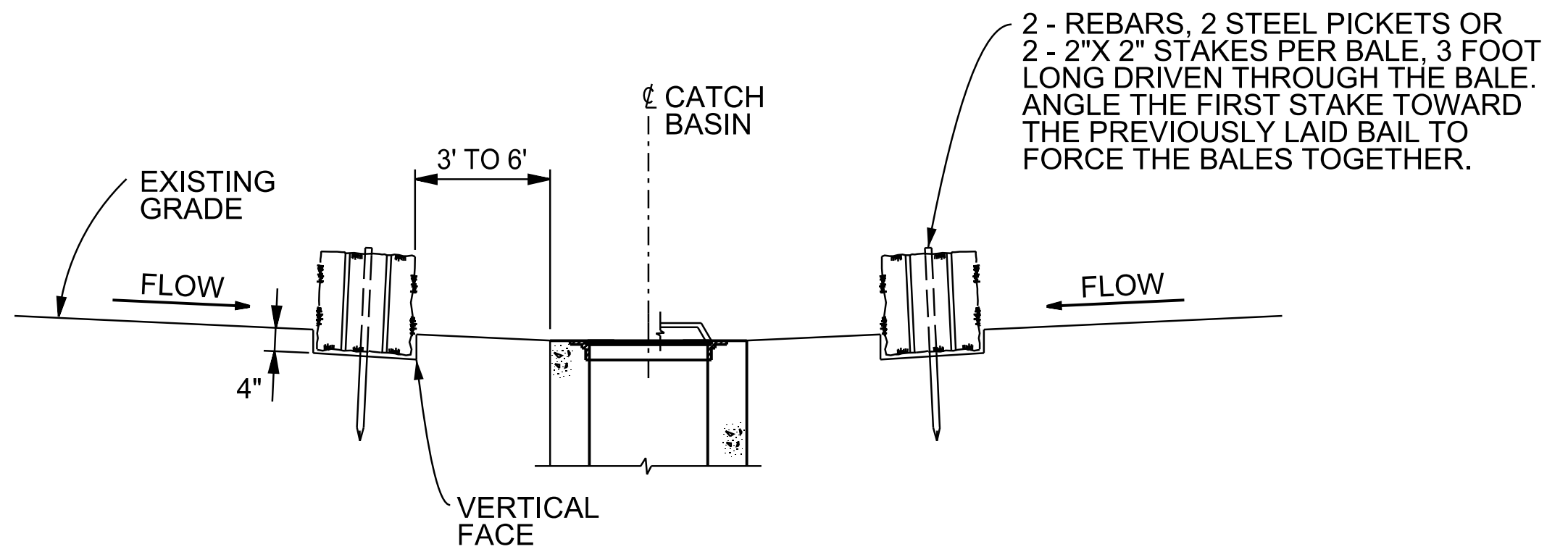
SELF-SUPPORTING SILT FENCE

DETAIL 1

N.T.S.



PLAN

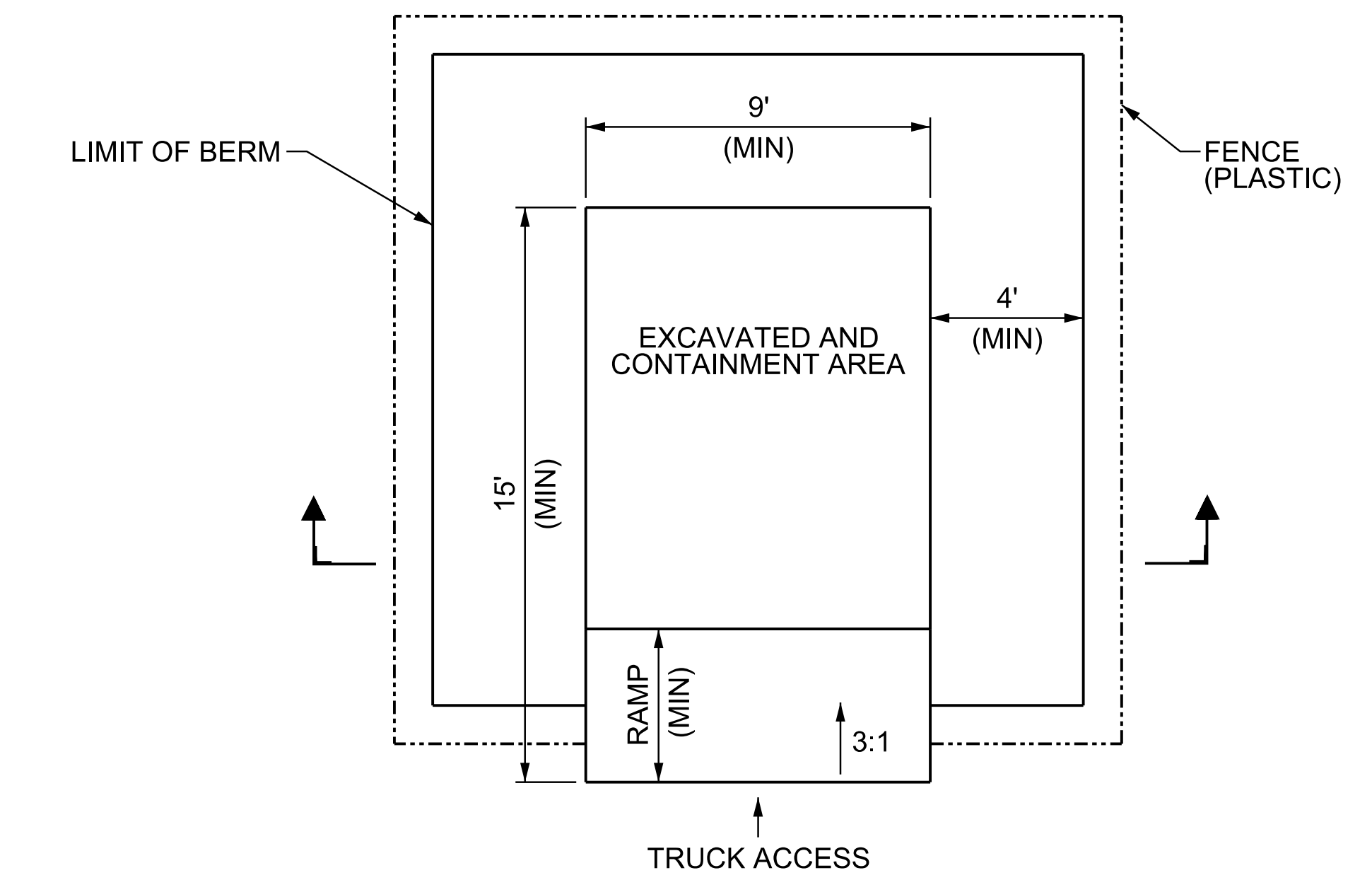


ELEVATION

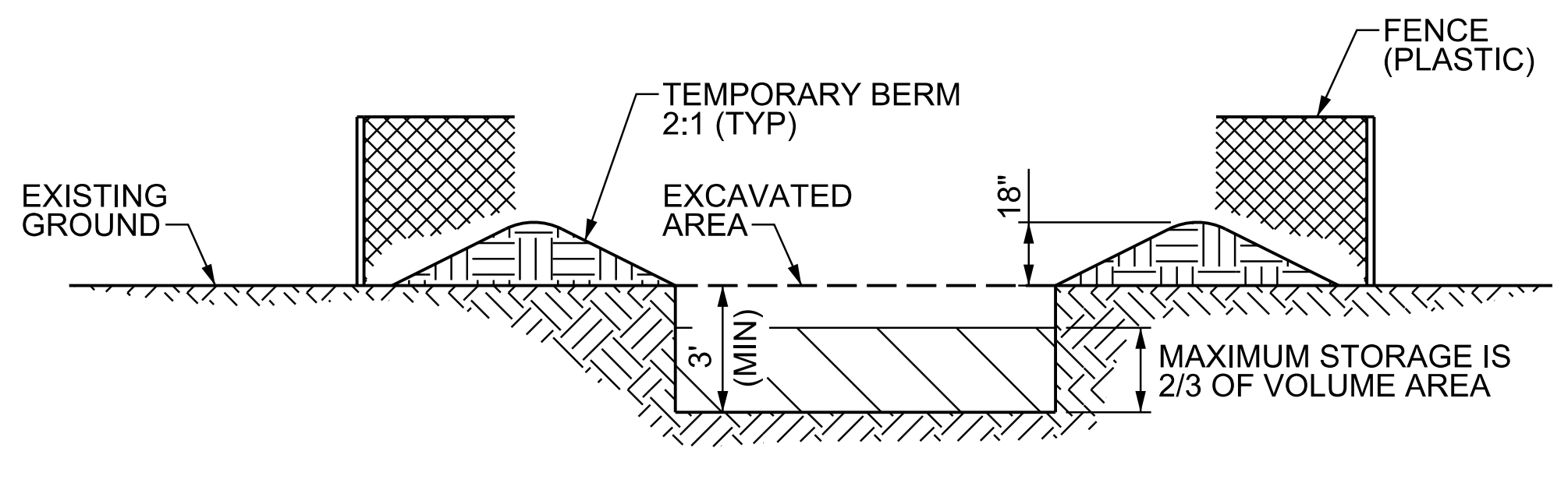
SINGLE ROW STRAW BALE EROSION CHECK FOR CATCH BASINS ON SOIL, GRAVEL OR GRASS SURFACE

DETAIL 2

N.T.S.



PLAN VIEW



SECTION

CONCRETE WASHOUT

DETAIL 3

N.T.S.

CONCRETE WASHOUT NOTES:

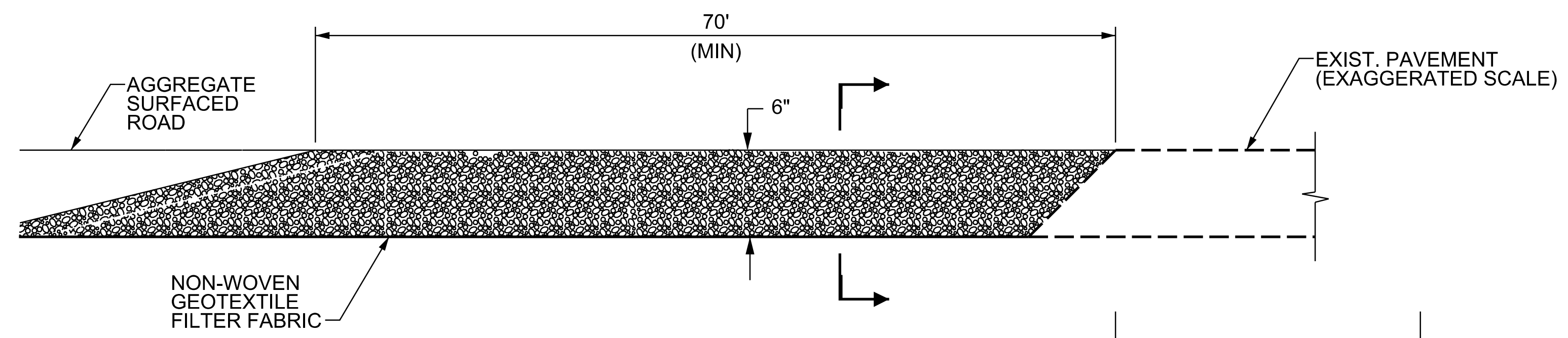
1. EROSION BALES MAY BE USED AS AN ALTERNATIVE FOR THE BERM.
2. A FENCE (PLASTIC) SHALL BE INSTALLED AROUND THE CONCRETE WASHOUT AREA, EXCEPT AT THE OPENING.

INSTALLATION NOTES:

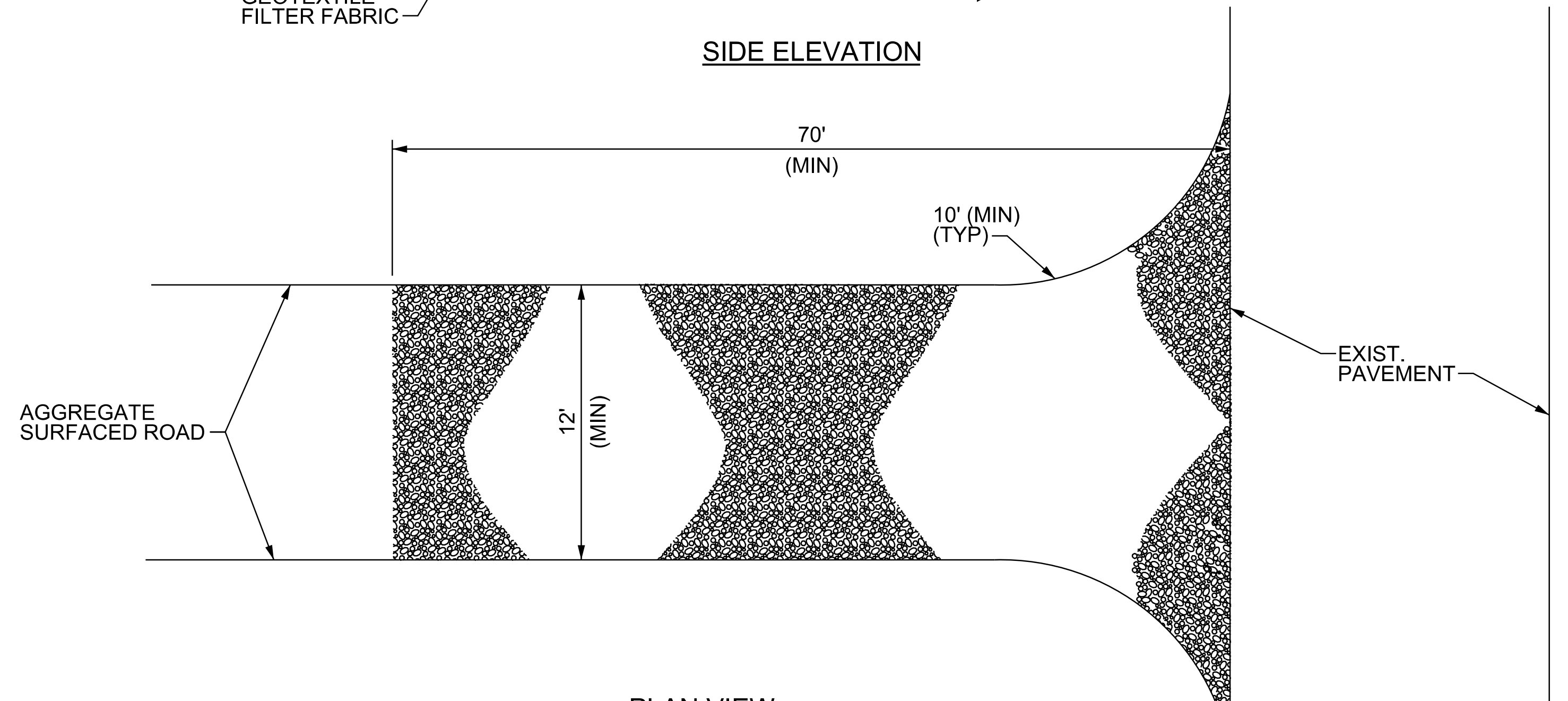
1. THE CONCRETE WASHOUT AREA SHALL BE INSTALLED PRIOR TO ANY CONCRETE PLACEMENT ON SITE.
2. VEHICLE TRACKING CONTROL IS REQUIRED AT THE ACCESS POINT.
3. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE WASHOUT AREA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CONCRETE WASHOUT AREA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.
4. PROVIDE PLASTIC LINING FREE OF TEARS AND HOLES ON BASE OF WASHOUT TO CONTAIN ALL WASH WATER.

MAINTENANCE NOTES:

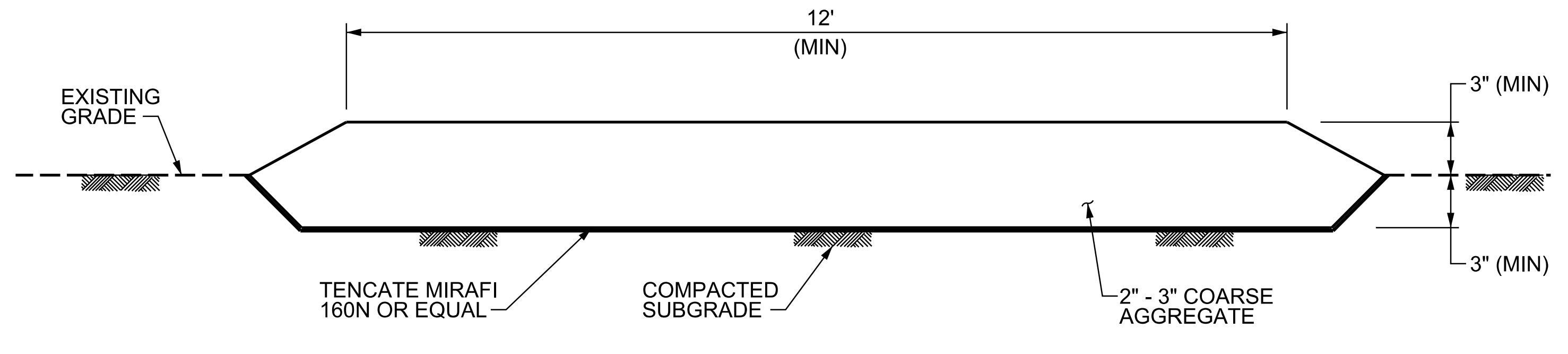
1. THE CONCRETE WASHOUT AREA SHALL BE REPAIRED AND ENLARGED OR CLEANED OUT AS NECESSARY TO MAINTAIN CAPACITY FOR WASTED CONCRETE.
2. REPLACE OR REPAIR DAMAGED PLASTIC LINING AS SOON AS DAMAGE OCCURS.
3. AT THE END OF CONSTRUCTION, ALL CONCRETE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT AN APPROVED WASTE SITE.
4. WHEN THE CONCRETE WASHOUT AREA IS REMOVED, COVER THE DISTURBED AREA WITH TOPSOIL, DRILL SEED AND CRIMP MULCH OR OTHERWISE STABILIZE IN A MANNER APPROVED BY THE LOCATION JURISDICTION.
5. INSPECT WEEKLY, DURING AND AFTER ANY STORM EVENT.



SIDE ELEVATION



PLAN VIEW

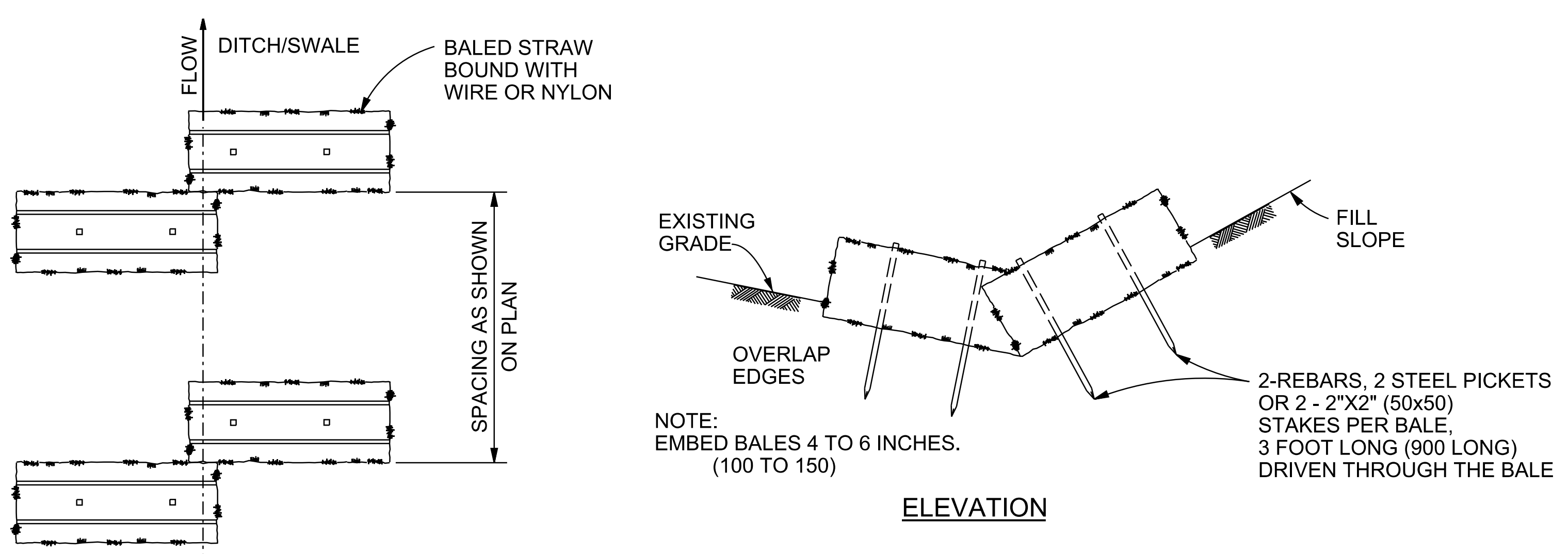


SECTION

ROCK CONSTRUCTION ENTRANCE

DETAIL 4

N.T.S.



ELEVATION

PLAN

USE: TO BE USED AS A SEDIMENT TRAP IN A SWALE.

STRAW BALE EROSION CHECK FOR DITCH/SWALE

DETAIL 5

N.T.S.

PRELIMINARY
NOT FOR CONSTRUCTION

UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED.

REFERENCES RELATING TO THE UNDERGROUND OR EMBEDDED UTILITIES ARE PROVIDED TO ASSIST THE CONTRACTOR/INSTALLER IN THE FIELD LOCATING THOSE UTILITIES AND OTHER POSSIBLE UNDERGROUND OR EMBEDDED INTERFERENCES WITH THE WORK.

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NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE PERFORMED BY SPECIFICATION A-8808 UNLESS NOTED OTHERWISE.
2. FOR CIVIL GENERAL NOTES SEE DRAWING C1-0002.

REFERENCE DRAWINGS

C1-0010	TEMPORARY EROSION CONTROL PLAN

HOLD INFORMATION

NO.	DESCRIPTION

CONTRACTOR/INSTALLER SHALL TAKE ALL APPROPRIATE PRECAUTIONS TO ENSURE THE SAFETY OF ALL PEOPLE LOCATED ON THE WORK SITE, INCLUDING CONTRACTOR'S/INSTALLER'S PERSONNEL (OR THAT OF ITS SUB-CONTRACTOR(S)) PERFORMING THE WORK.

RELEASE INFORMATION

REV.	DATE	DESCRIPTION
0	01-11-2019	FOR COMMENT
1	02-08-2019	FOR COMMENT

ISSUE PURPOSE: COMMENT
SPECIFICATION: A-8808
PROJECT NO.: 12715-010

I HEREBY CERTIFY THAT THIS ENGINEERING DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT PERSONAL SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF SOUTH DAKOTA.

ENTER NAME
ENTER DATE

MY LICENSE RENEWAL DATE IS: ENTER DATE
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CERTIFICATE OF AUTHORIZATION

CAD FILE NAME: C1-0011.DGN
PREPARED BY: A. PAAPE
REVIEWED BY: M. TURNER
APPROVED BY: ---

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Sargent & Lundy LLC

SARGENT & LUNDY LLC
55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603-5780

OTTER TAIL
POWER COMPANY

PROJECT

ASTORIA STATION
SIMPLE CYCLE PROJECT AND
482nd TOWNSHIP ROAD UPGRADE

SOUTH DAKOTA

DRAWING TITLE

TEMPORARY EROSION CONTROL DETAILS

DRAWING NUMBER	REVISION
C1-0011	1

SHEET 1 OF 1

ZD11185/0p2962/D:\ASTORIA\checkout\c1-0011.dgn
Form GDG-0401-01-08, ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 10, Revision Date: 10-16-2009

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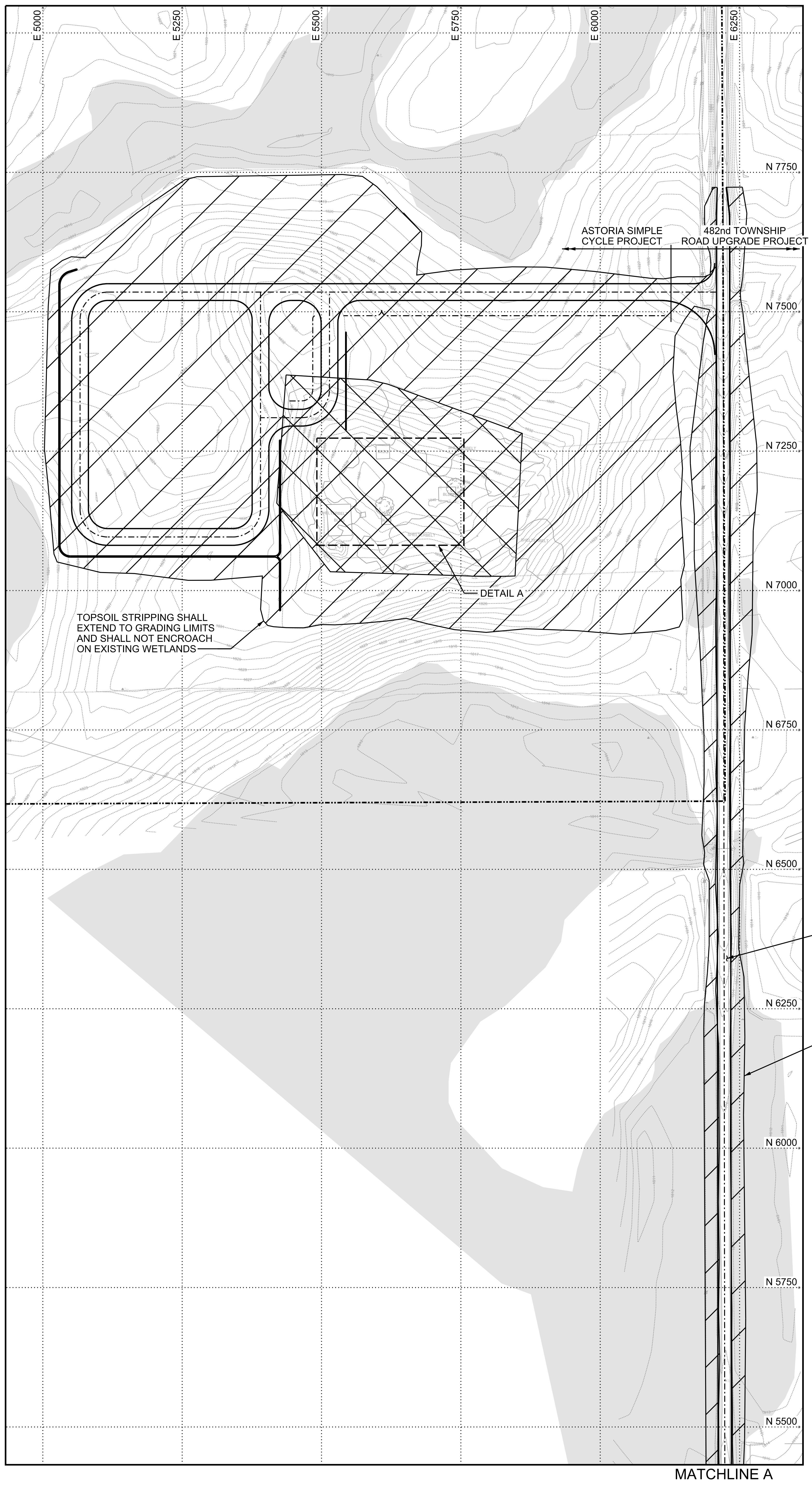
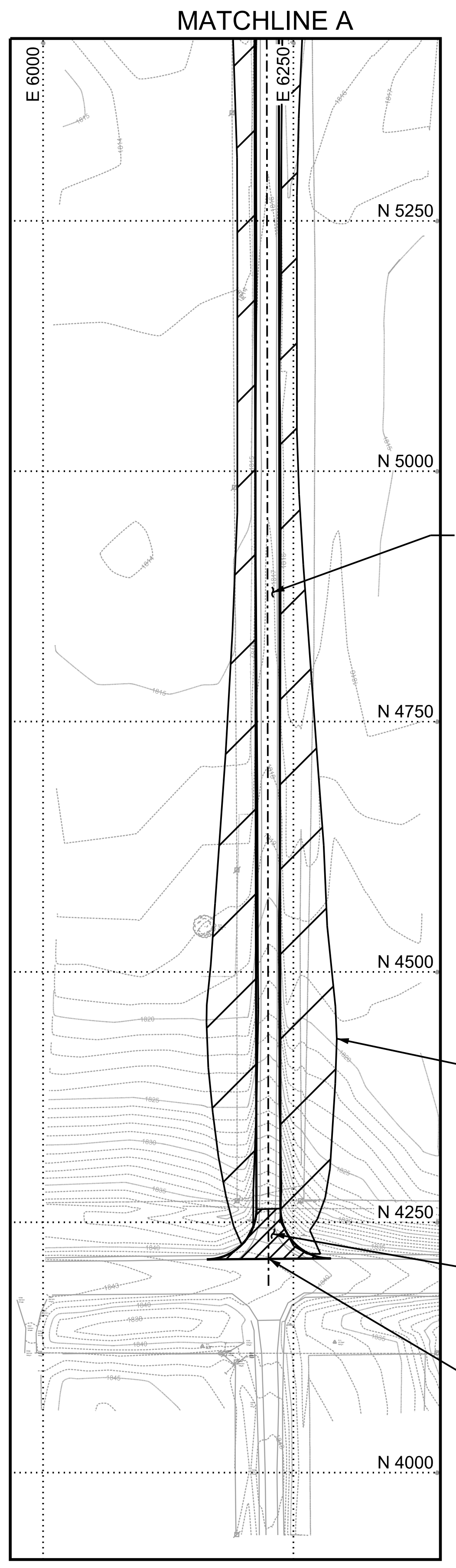
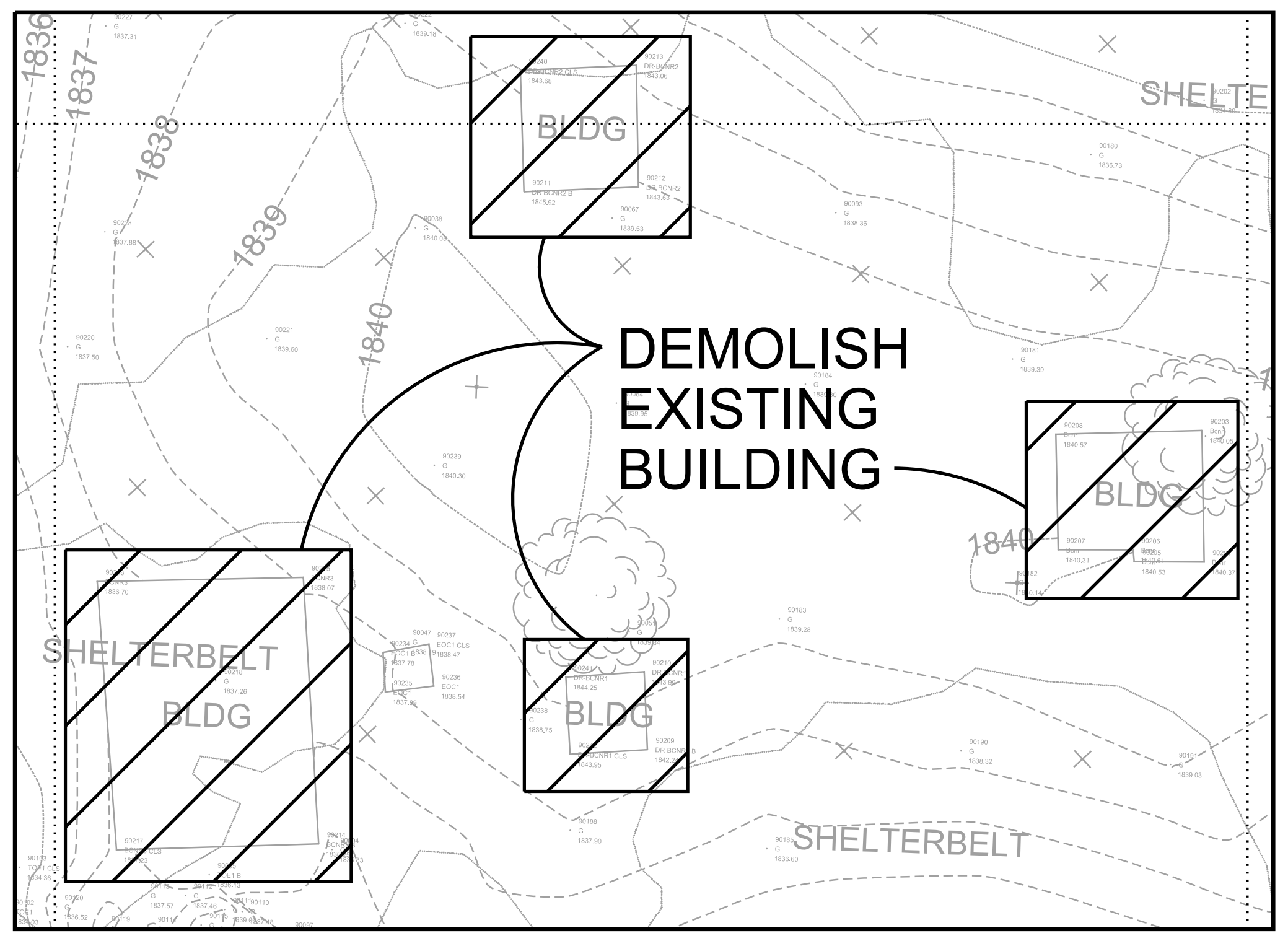
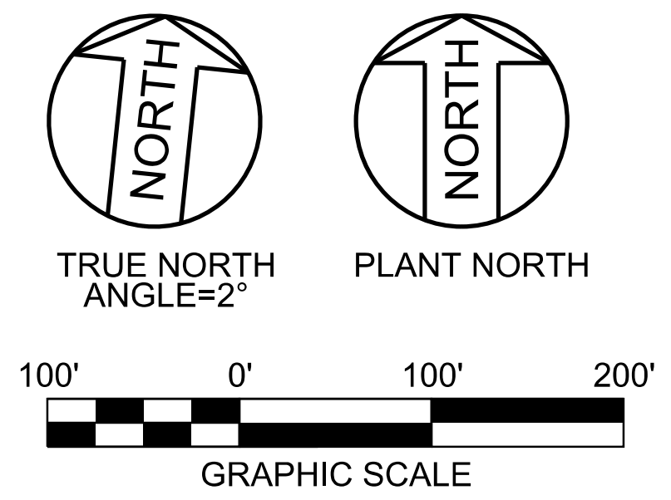






DETAIL A
SCALE: 1"=30'



GRAPHIC SCALE

DRAWING SCALE
1"=100'-0"

LEGEND

▨	TOPSOIL STRIPPING LIMITS (NOTE 3)
▩	CLEARING AND GRUBBING AND TOPSOIL STRIPPING (NOTE 3)

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE PERFORMED BY SPECIFICATION A-8808 UNLESS NOTED OTHERWISE.
2. FOR CIVIL GENERAL NOTES SEE DRAWING C1-0002.
3. STRIP TOPSOIL, REMOVING ALL ROOTS AND ORGANIC MATERIAL, AS SHOWN ON PLAN. DEPTH OF TOPSOIL STRIPPING ANTICIPATED TO BE 10" IN EXISTING GRASS AREAS AND 20" IN FARM FIELD. ALL TREES WILL BE CUT OFF AND REMOVED FROM THE SITE BY OTHERS. TREE REMOVAL BY OTHERS INCLUDES TREES AND SMALL DIAMETER TREES TO BE CUT OFF AT 3" OR LESS FROM GROUND AND LARGE DIAMETER TREES TO BE CUT AT A MANAGABLE HEIGHT FOR STUMP REMOVAL,
4. NO MACHINERY OR EQUIPMENT SHALL DRIVE THROUGH OR BE STORED WITHIN LIMITS OF WETLANDS TO REMAIN.

REFERENCE DRAWINGS

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PROJECT NO.: 12715-010

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CERTIFICATE OF AUTHORIZATION

CAD FILE NAME: C1-0030.DGN
PREPARED BY: A. PAAPE
REVIEWED BY: M. TURNER
APPROVED BY: ---

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OTTERTAIL
POWER COMPANY

PROJECT

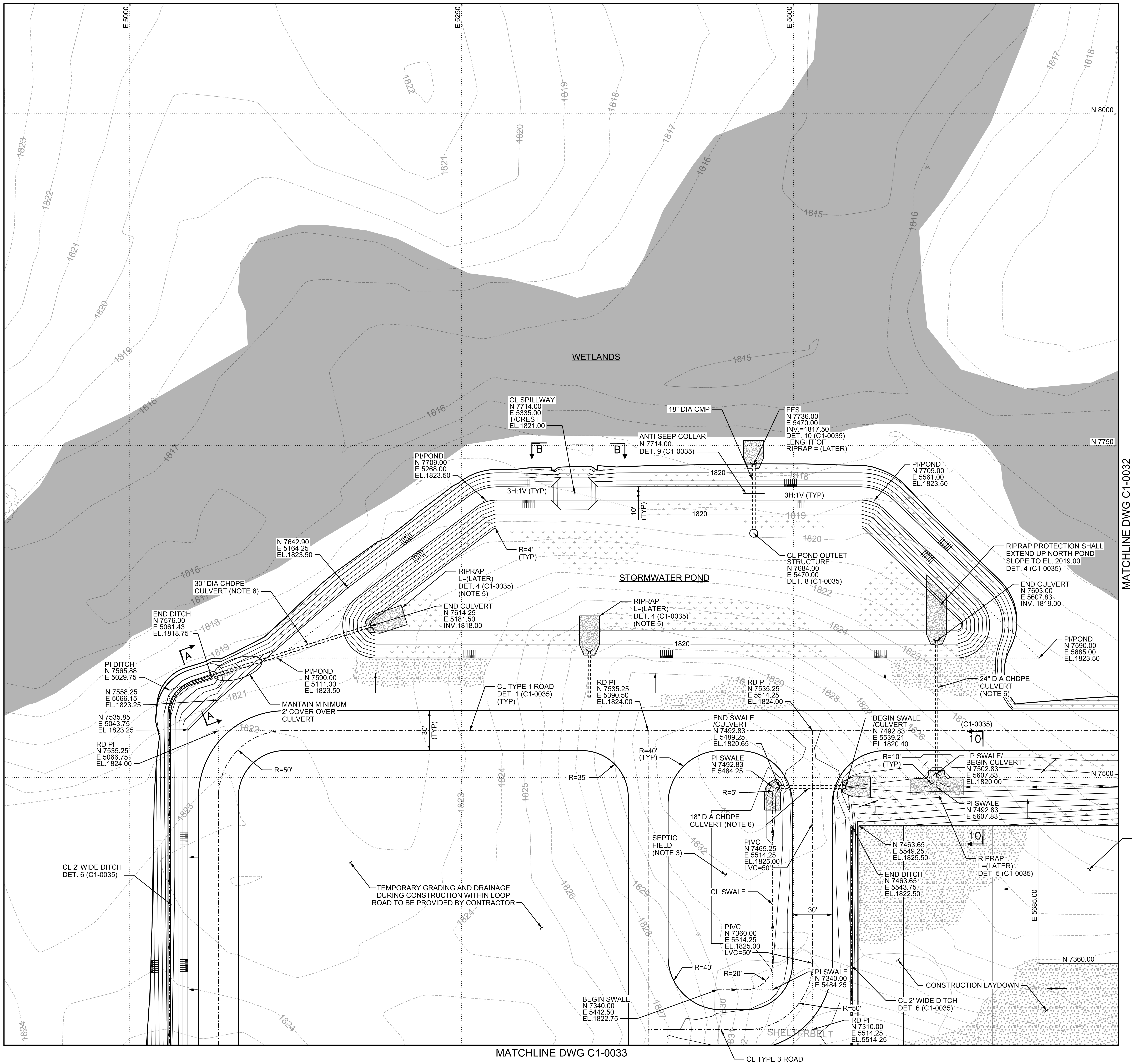
ASTORIA STATION
SIMPLE CYCLE PROJECT AND
482nd TOWNSHIP ROAD UPGRADE

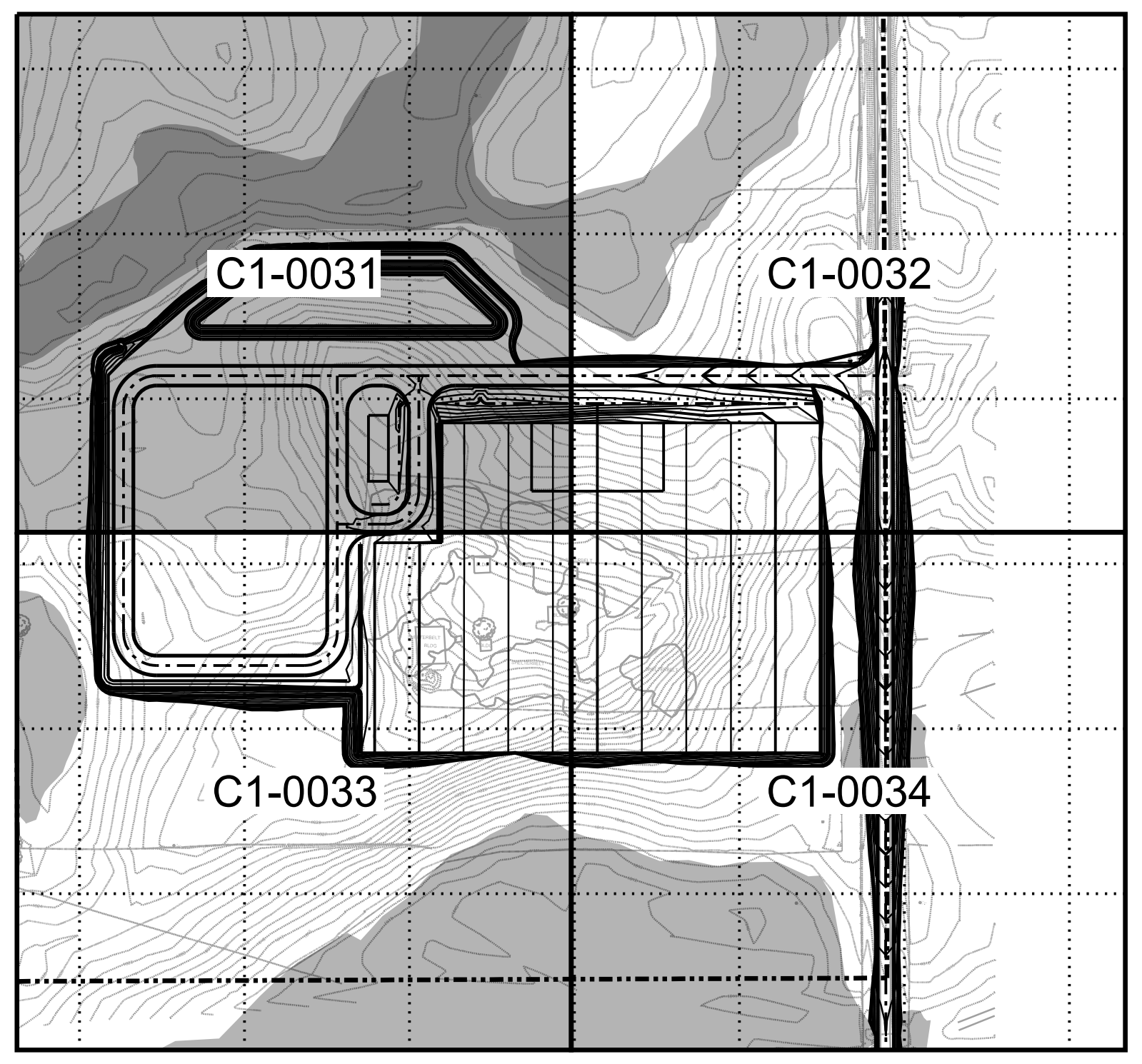
SOUTH DAKOTA

DRAWING TITLE

CLEARING AND GRUBBING AND
SITE DEMOLITION PLAN

DRAWING NUMBER: C1-0030
REVISION: 1
SHEET 1 OF 1





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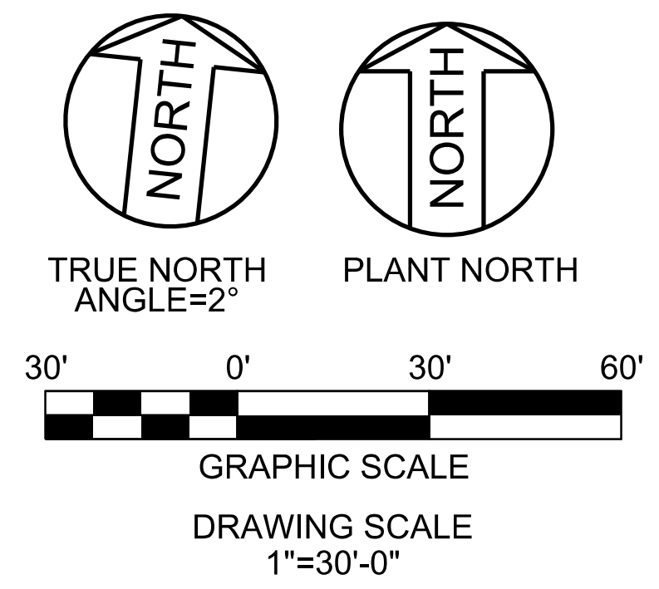


GRAPHIC SCALE

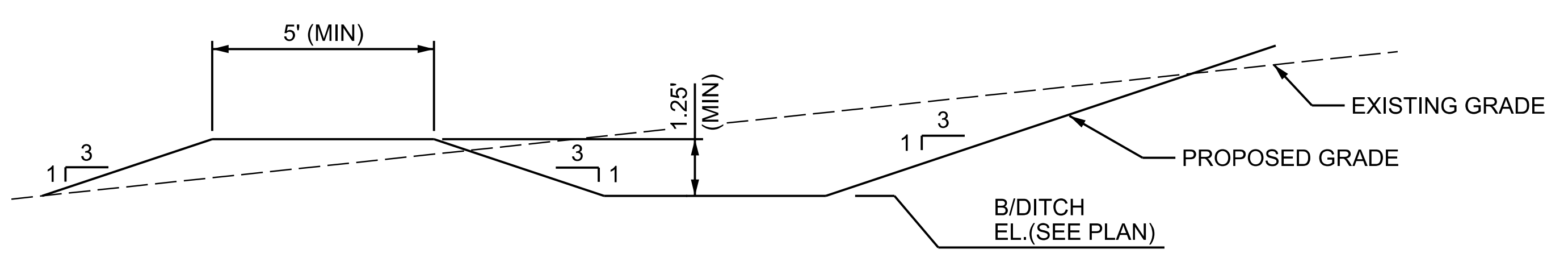
DRAWING SCALE
1"=30'-0"

LEGEND

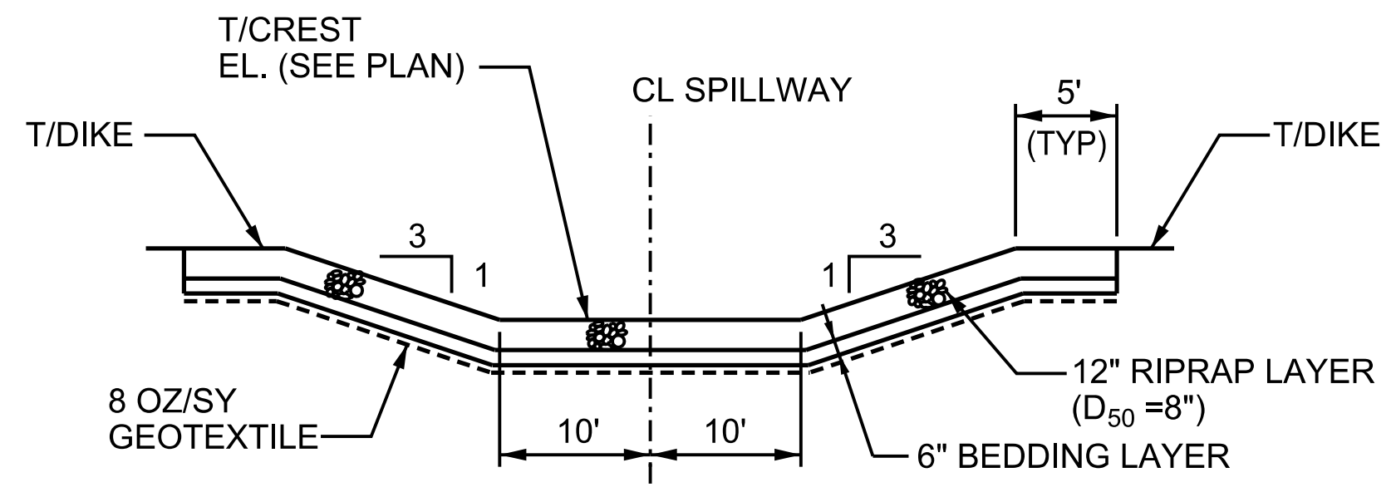
▨	8" THICK AGGREGATE SURFACING DETAIL 2 (C1-0035)
▨	4" SEEDED TOPSOIL DETAIL 3 (C1-0035)

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE PERFORMED BY SPECIFICATION A-8808 UNLESS NOTED OTHERWISE.
2. FOR CIVIL GENERAL NOTES SEE DRAWING C1-0002.
3. CONTRACTOR SHALL PROTECT AREA FROM VEHICULAR LOADING, MATERIAL STORAGE, AND OTHER LOADING TO PREVENT SOIL COMPACTION IN SEPTIC FIELD AREA.
4. CONTRACTOR SHALL STOCKPILE SUFFICIENT TOPSOIL TO RECLAIM ENTIRE LAYDOWN AREA (APPROXIMATELY 5000 CY) AND OTHER SEEDED TOPSOIL AREAS. MODIFY STOCKPILE DIMENSIONS AS REQUIRED.
5. FOR STORM SEWER LOCATIONS SEE DRAWING C1-0075.
6. INSTALL PRECAST HEADWALLS AT ENDS OF CULVERT.



SECTION A
N.T.S.



SPILLWAY RIPRAP

SECTION B
N.T.S.

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REFERENCE DRAWINGS

C1-0002	CIVIL GENERAL NOTES, LEGEND, SYMBOLS AND ABBREVIATIONS
C1-0010	TEMPORARY EROSION CONTROL PLAN
C1-0032	INITIAL GRADING PLAN SHEET 2
C1-0033	INITIAL GRADING PLAN SHEET 3
C1-0035	INITIAL GRADING DETAILS SHEET 1

HOLD INFORMATION

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IS: ENTER DATE
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CERTIFICATE OF AUTHORIZATION

CAD FILE NAME: C1-0031.DGN
PREPARED BY: A. PAAPE
REVIEWED BY: M. TURNER
APPROVED BY: ---

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55 EAST MONROE STREET
CHICAGO, ILLINOIS 60603-5780

OTTER TAIL
POWER COMPANY

PROJECT

ASTORIA STATION
SIMPLE CYCLE

SOUTH DAKOTA

DRAWING TITLE

INITIAL GRADING PLAN
SHEET 1

DRAWING NUMBER	REVISION
C1-0031	1

SHEET 1 OF 1

ZD11185/0p2962/D:\ASTORIA\checkout\c1-0031.dgn
Form GDG-0401-01-08, ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 10, Revision Date: 10-16-2009

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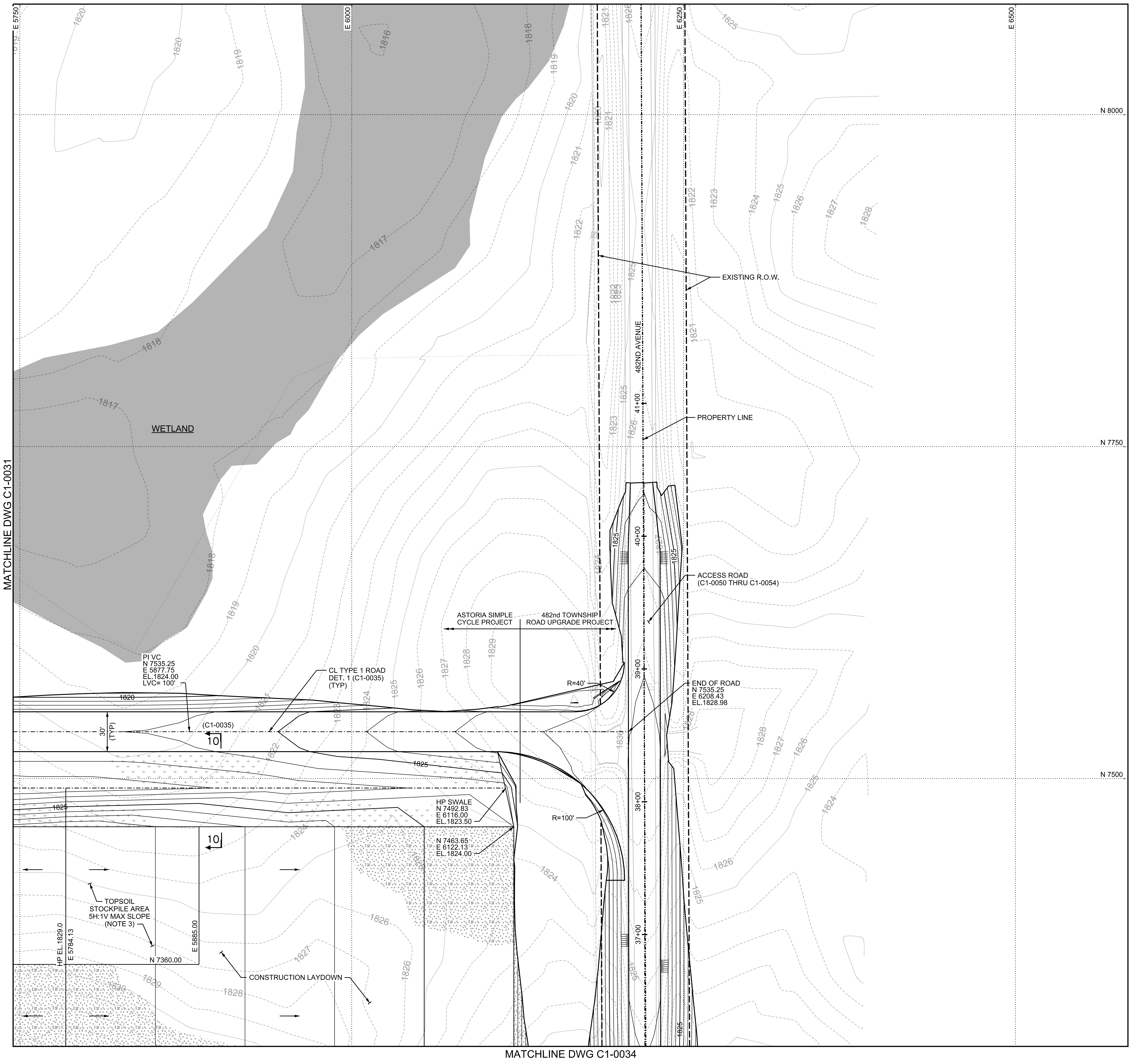

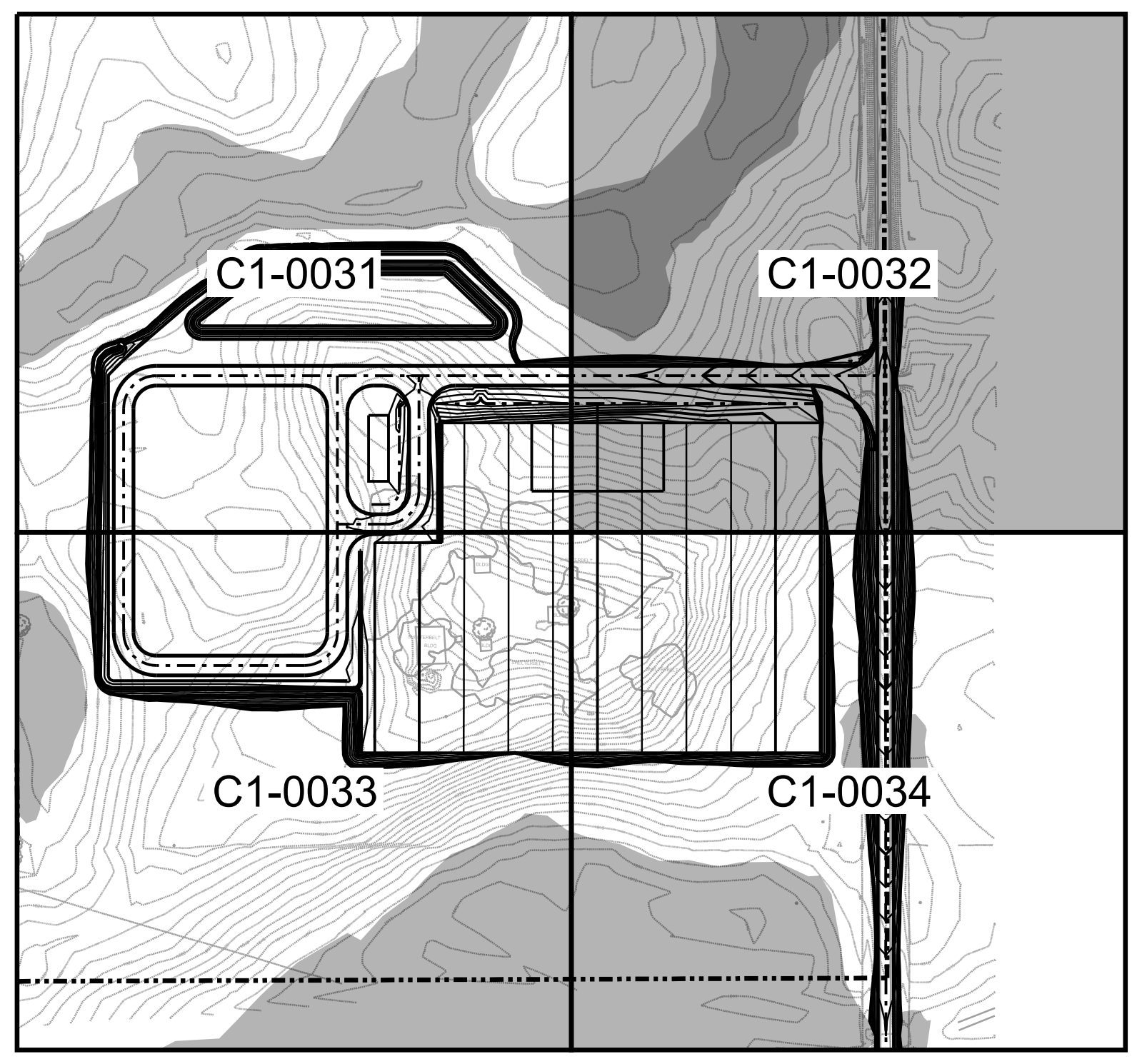

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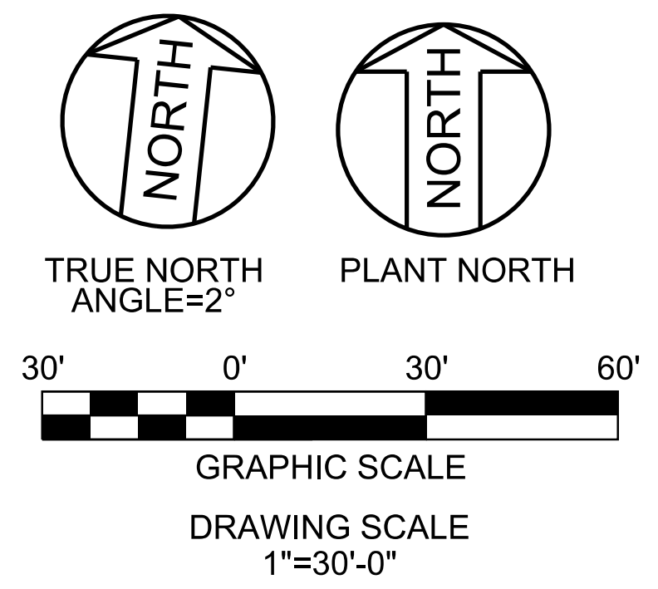

GRAPHIC SCALE

DRAWING SCALE
1"=30'-0"

LEGEND

▨	8" THICK AGGREGATE SURFACING DETAIL 2 (C1-0035)
▨	4" SEEDED TOPSOIL DETAIL 3 (C1-0035)

NOTES

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3. CONTRACTOR SHALL STOCKPILE SUFFICIENT TOPSOIL TO RECLAIM ENTIRE LAYDOWN AREA (APPROXIMATELY 5000 CY) AND OTHER SEEDED TOPSOIL AREAS. MODIFY STOCKPILE DIMENSIONS AS REQUIRED.

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C1-0010	TEMPORARY EROSION CONTROL PLAN
C1-0031	INITIAL GRADING PLAN SHEET 1
C1-0034	INITIAL GRADING PLAN SHEET 4
C1-0035	INITIAL GRADING DETAILS SHEET 1

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PROJECT NO.: 12715-010

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CERTIFICATE OF AUTHORIZATION

CAD FILE NAME: C1-0032.DGN
PREPARED BY: A. PAAPE
REVIEWED BY: M. TURNER
APPROVED BY: ---

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SARGENT & LUNDY LLC
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CHICAGO, ILLINOIS 60603-5780

OTTER TAIL POWER COMPANY

PROJECT

ASTORIA STATION
SIMPLE CYCLE PROJECT AND
482nd TOWNSHIP ROAD UPGRADE

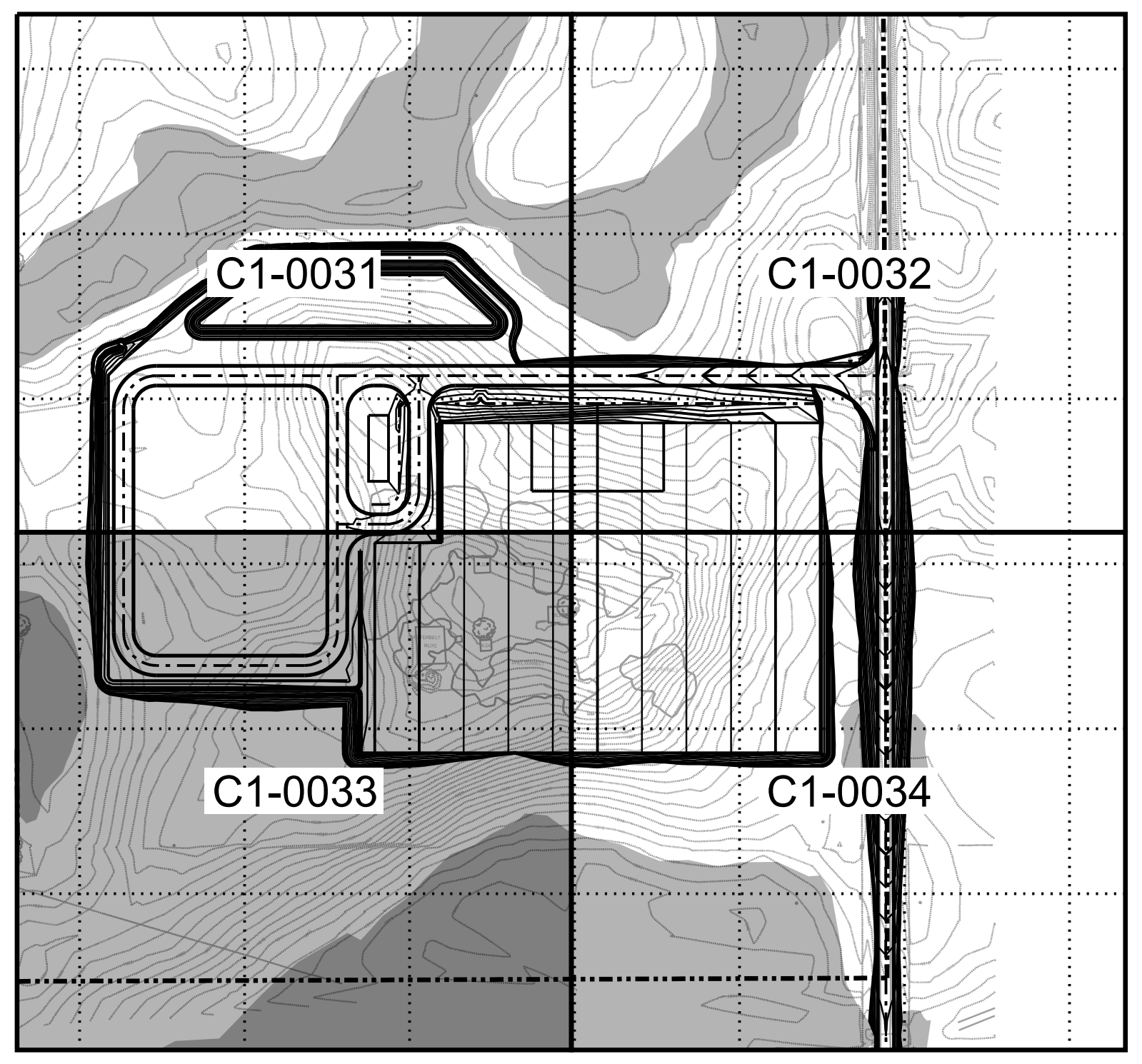
SOUTH DAKOTA

DRAWING TITLE

INITIAL GRADING PLAN
SHEET 2

DRAWING NUMBER	REVISION
C1-0032	1

SHEET 1 OF 1



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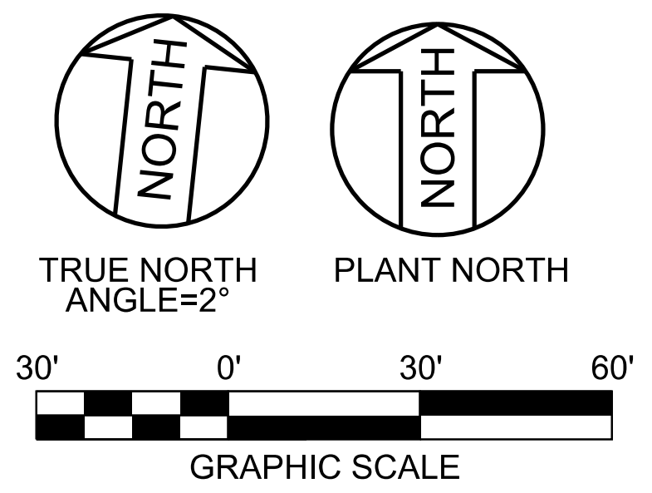

GRAPHIC SCALE

DRAWING SCALE
1"=30'-0"

HOLD INFORMATION	
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RELEASE INFORMATION		
REV.	DATE	DESCRIPTION
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ISSUE PURPOSE: COMMENT

SPECIFICATION: A-8808

PROJECT NO.: 12715-010

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CAD FILE NAME: C1-0033.DGN

PREPARED BY: A. PAAPE

REVIEWED BY: M. TURNER

APPROVED BY: ---

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CHICAGO, ILLINOIS 60603-5780

OTTER TAIL
POWER COMPANY

LEGEND

▨	8" THICK AGGREGATE SURFACING DETAIL 2 (C1-0035)
▨	4" SEEDED TOPSOIL DETAIL 3 (C1-0035)

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE PERFORMED BY SPECIFICATION A-8808 UNLESS NOTED OTHERWISE.
2. FOR CIVIL GENERAL NOTES SEE DRAWING C1-0002.

REFERENCE DRAWINGS

C1-0002	CIVIL GENERAL NOTES, LEGEND, SYMBOLS AND ABBREVIATIONS
C1-0010	TEMPORARY EROSION CONTROL PLAN
C1-0031	INITIAL GRADING PLAN SHEET 1
C1-0034	INITIAL GRADING PLAN SHEET 4
C1-0035	INITIAL GRADING DETAILS SHEET 1

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PROJECT

ASTORIA STATION
SIMPLE CYCLE PROJECT AND
482nd TOWNSHIP ROAD UPGRADE

SOUTH DAKOTA

DRAWING TITLE

INITIAL GRADING PLAN
SHEET 3

DRAWING NUMBER	REVISION
C1-0033	1
SHEET 1 OF 1	

ZD11185/0p2962/D:\ASTORIA\checkout\c1-0033.dgn
Form GDG-0401-01-08, ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 10, Revision Date: 10-16-2009

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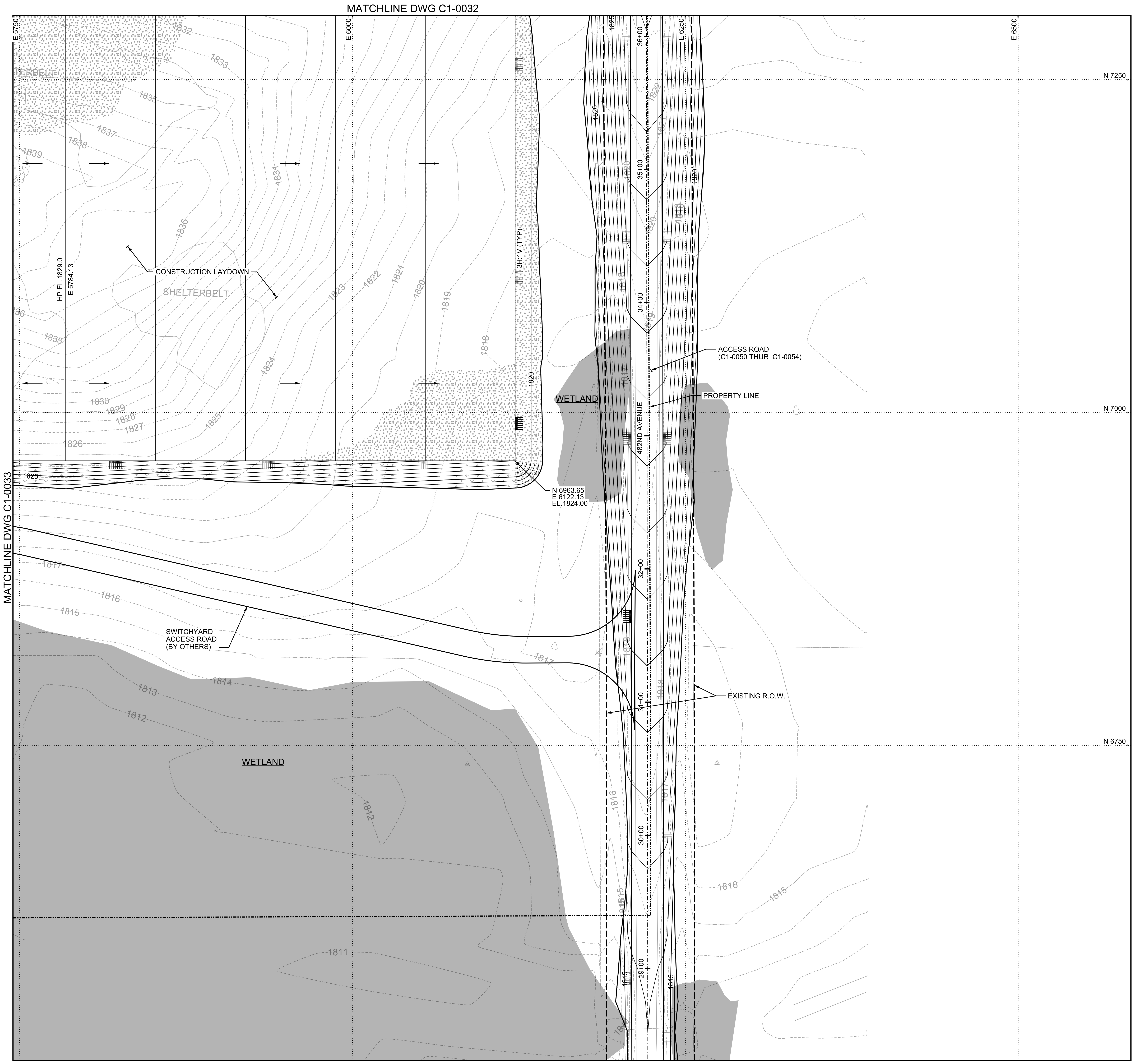

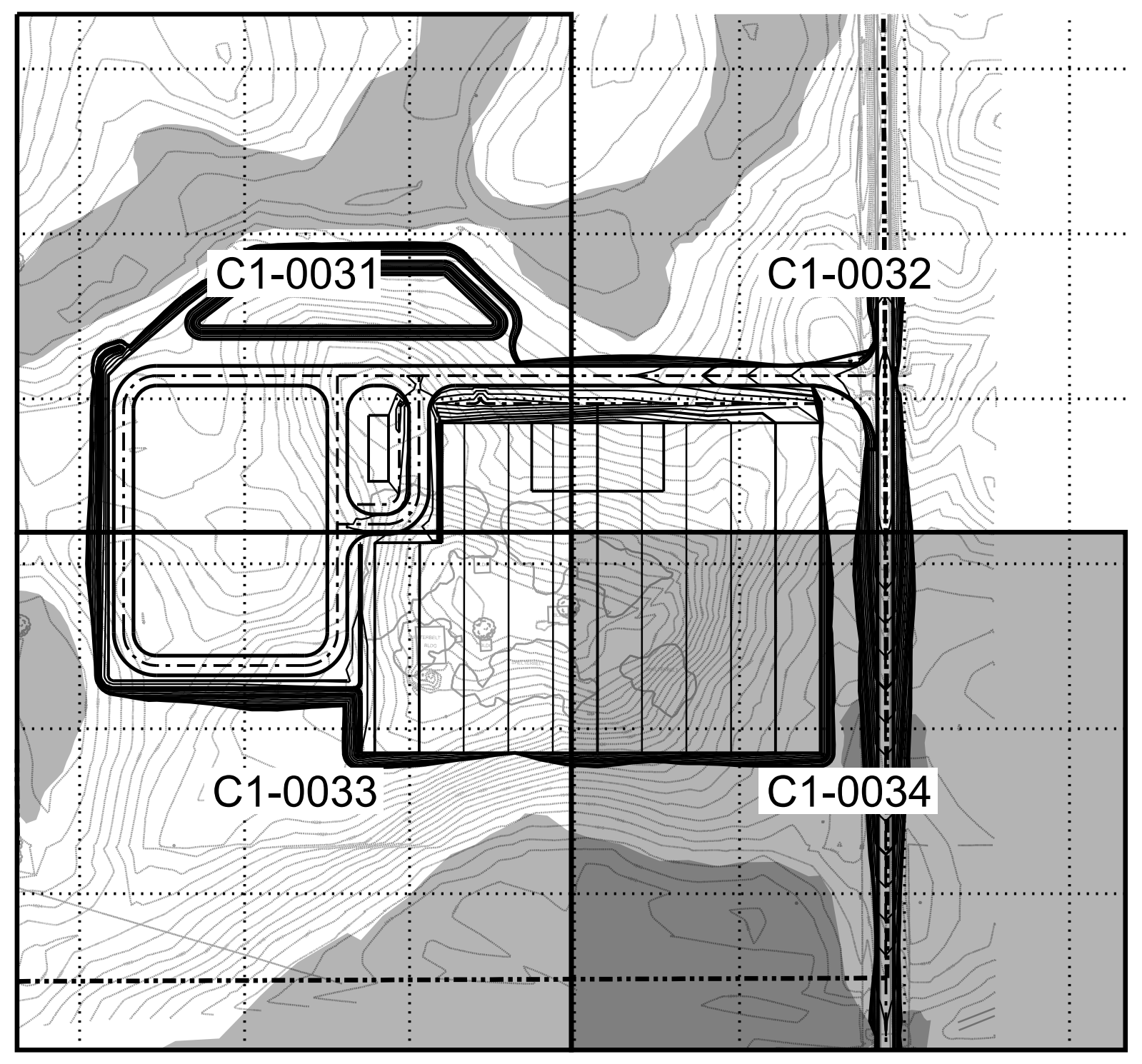

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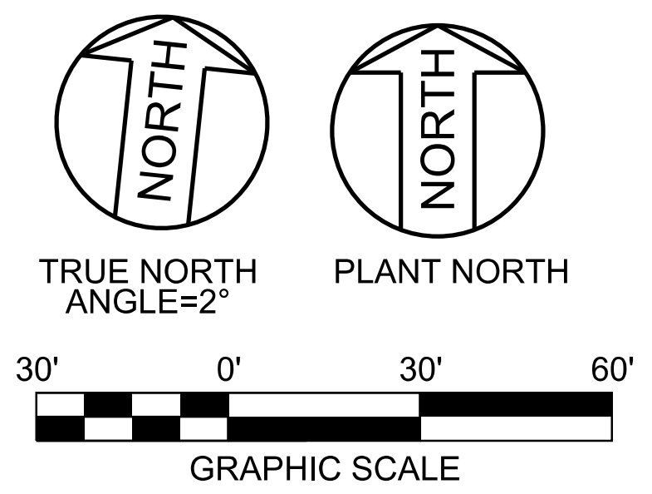

GRAPHIC SCALE

DRAWING SCALE
1"=30'-0"

LEGEND

▨	8" THICK AGGREGATE SURFACING DETAIL 2 (C1-0035)
▨	4" SEEDED TOPSOIL DETAIL 3 (C1-0035)

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C1-0033	INITIAL GRADING PLAN SHEET 3
C1-0035	INITIAL GRADING DETAILS SHEET 1

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CERTIFICATE OF AUTHORIZATION

CAD FILE NAME: C1-0034.DGN
PREPARED BY: A. PAAPE
REVIEWED BY: M. TURNER
APPROVED BY: ---

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PROJECT

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SIMPLE CYCLE PROJECT AND
482nd TOWNSHIP ROAD UPGRADE

SOUTH DAKOTA

DRAWING TITLE

INITIAL GRADING PLAN
SHEET 4

DRAWING NUMBER	REVISION
C1-0034	1

SHEET 1 OF 1

ZD11185/0p2962/D:\ASTORIA\checkout\c1-0034.dgn
Form GDG-0401-01-08, ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 10, Revision Date: 10-16-2009

2/8/2019 9:34:18 AM
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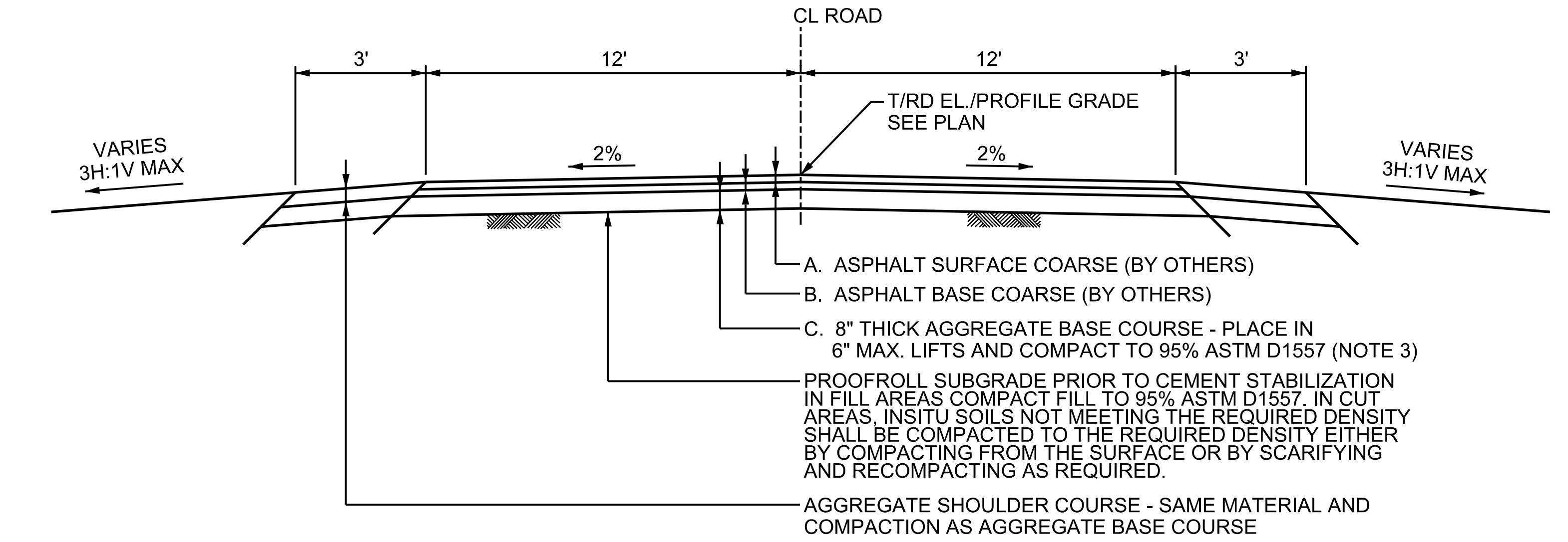


A. ASPHALT SURFACE COARSE (BY OTHERS)

B. ASPHALT BASE COARSE (BY OTHERS)

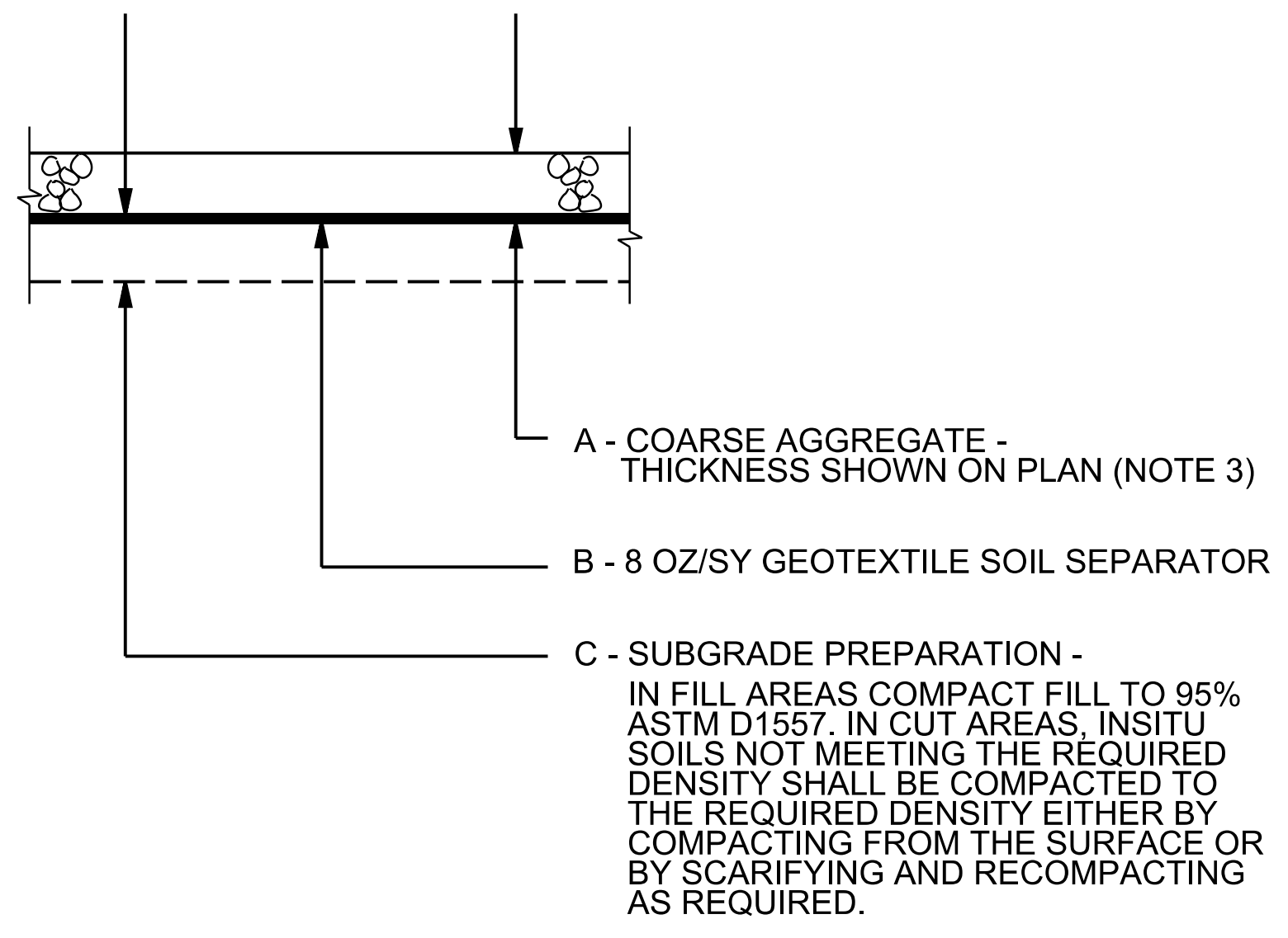
C. 8" THICK AGGREGATE BASE COURSE - PLACE IN 6" MAX. LIFTS AND COMPACT TO 95% ASTM D1557 (NOTE 3)

PROOFROLL SUBGRADE PRIOR TO CEMENT STABILIZATION IN FILL AREAS COMPACT FILL TO 95% ASTM D1557. IN CUT AREAS, INSITU SOILS NOT MEETING THE REQUIRED DENSITY SHALL BE COMPACTED TO THE REQUIRED DENSITY EITHER BY COMPACTING FROM THE SURFACE OR BY SCARIFYING AND RECOMPACTING AS REQUIRED.

AGGREGATE SHOULDER COURSE - SAME MATERIAL AND COMPACTION AS AGGREGATE BASE COURSE

DESCRIPTION		GEOMETRIC DATA			STRUCTURAL DATA				REMARKS
		W	L	S	A	B	C	E	
TYPE	TITLE	OVERALL WIDTH FT.	LANE WIDTH FT.	SHOULDER WIDTH FT.	SURFACE COURSE (NOTES A & B) IN.	ASPHALT BINDER COURSE (NOTE C) IN.	AGGREGATE BASE COURSE IN.	SUBBASE COURSE IN.	
1	ASPHALT PLANT ROAD	30	12	3	LATER	LATER	LATER	12	
2	ASPHALT PARKING LOT	N/A	N/A	N/A	LATER	LATER	LATER	12	
3	AGGREGATE ROAD	30	12	3	N/A	N/A	12	12	

TYPICAL ROAD SECTION
DETAIL 1
N.T.S.

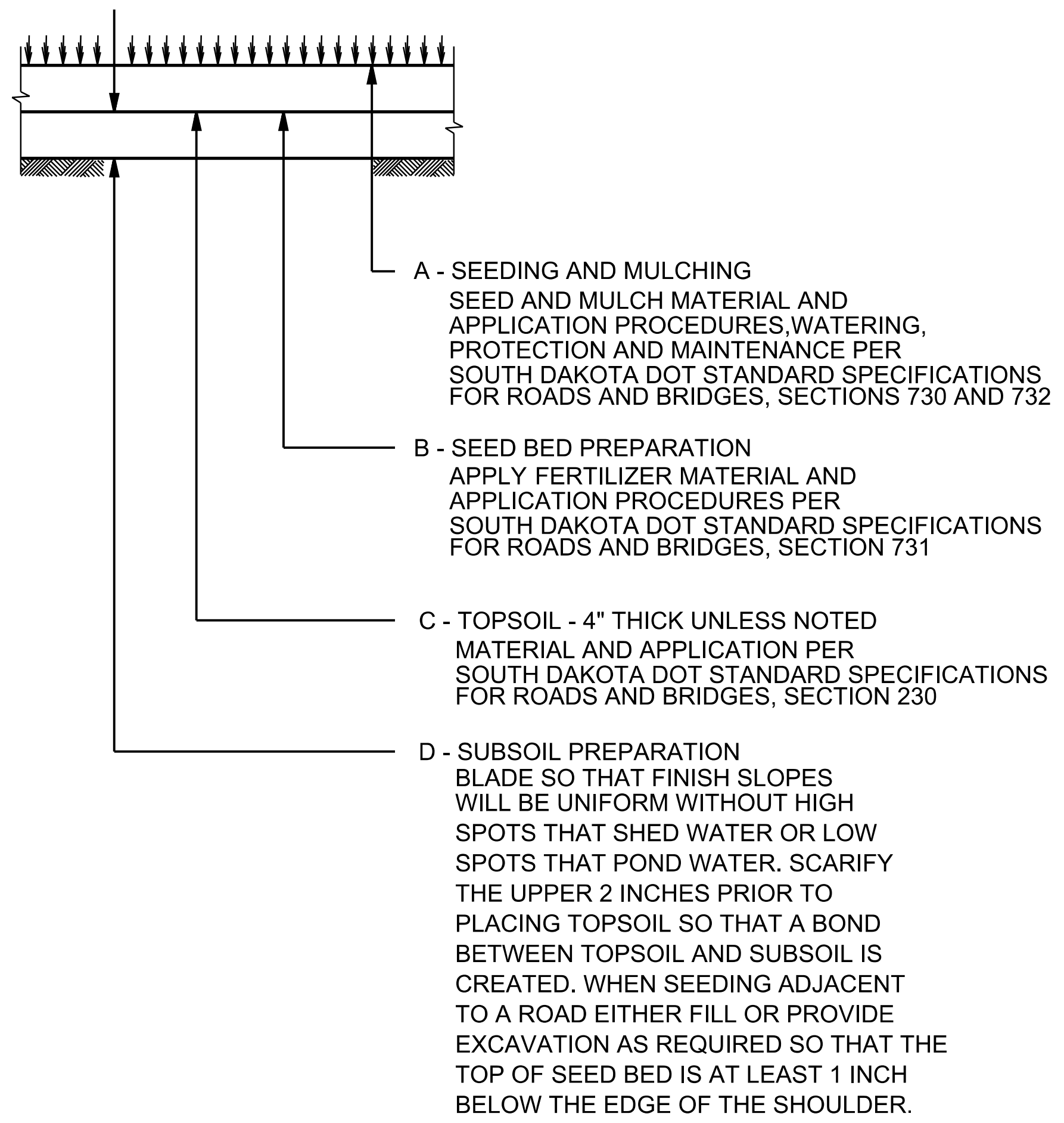


A - COARSE AGGREGATE - THICKNESS SHOWN ON PLAN (NOTE 3)

B - 8 OZ/SY GEOTEXTILE SOIL SEPARATOR

C - SUBGRADE PREPARATION - IN FILL AREAS COMPACT FILL TO 95% ASTM D1557. IN CUT AREAS, INSITU SOILS NOT MEETING THE REQUIRED DENSITY SHALL BE COMPACTED TO THE REQUIRED DENSITY EITHER BY COMPACTING FROM THE SURFACE OR BY SCARIFYING AND RECOMPACTING AS REQUIRED.

AGGREGATE SURFACING
DETAIL 2
N.T.S.



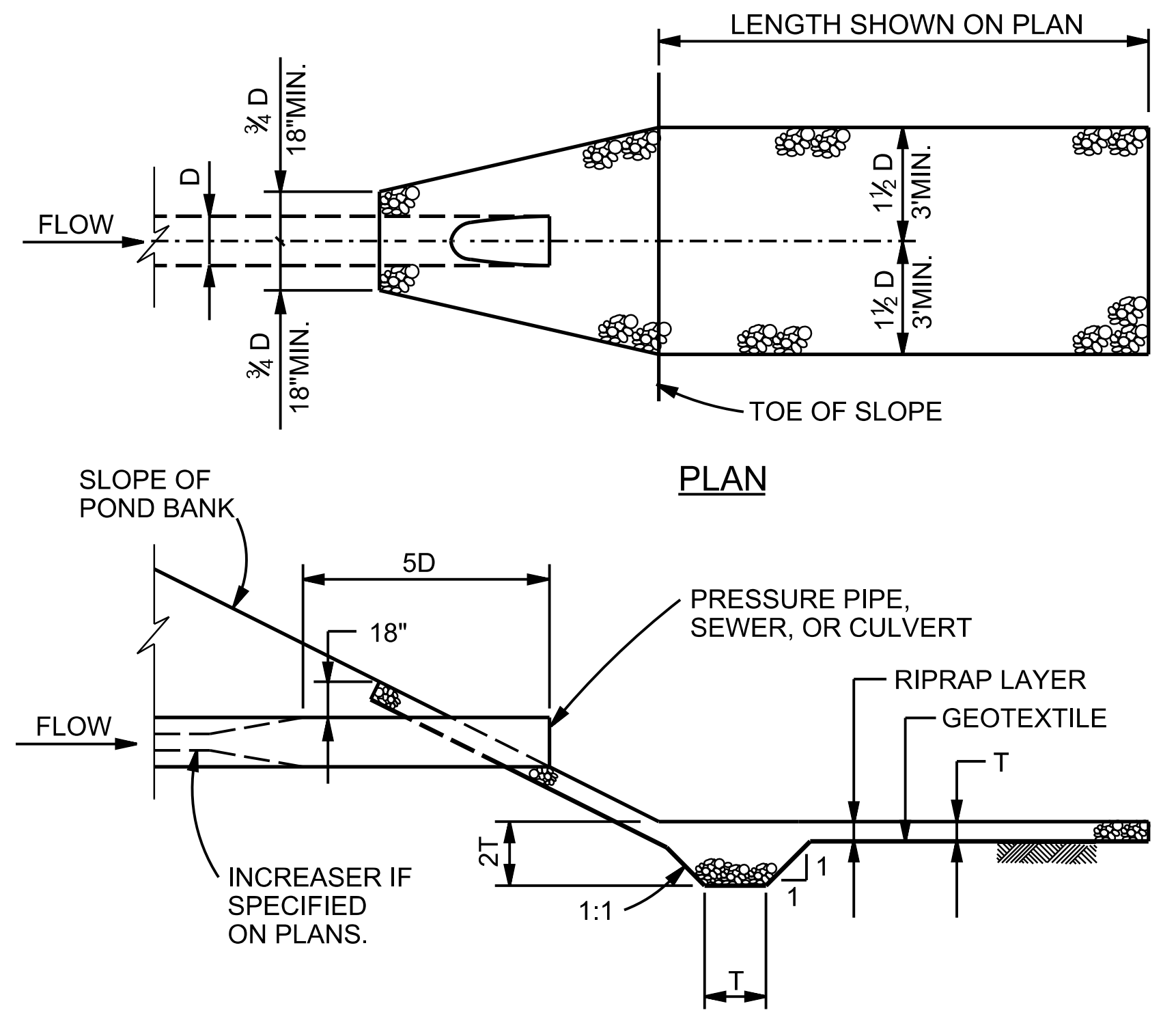
A - SEEDING AND MULCHING
SEED AND MULCH MATERIAL AND APPLICATION PROCEDURES,WATERING, PROTECTION AND MAINTENANCE PER SOUTH DAKOTA DOT STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES, SECTIONS 730 AND 732

B - SEED BED PREPARATION
APPLY FERTILIZER MATERIAL AND APPLICATION PROCEDURES PER SOUTH DAKOTA DOT STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES, SECTION 731

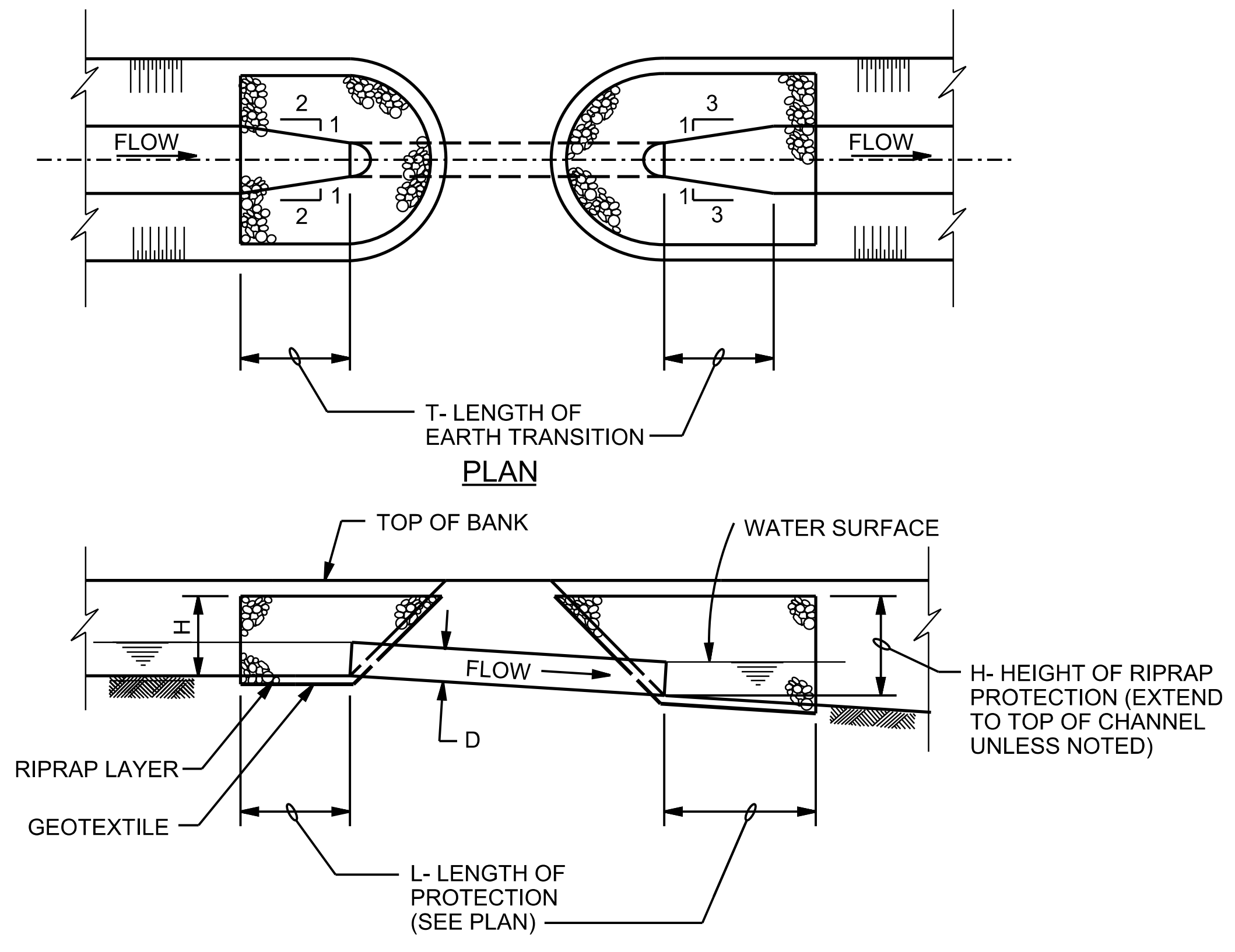
C - TOPSOIL - 4" THICK UNLESS NOTED
MATERIAL AND APPLICATION PER SOUTH DAKOTA DOT STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES, SECTION 230

D - SUBSOIL PREPARATION
BLADE SO THAT FINISH SLOPES WILL BE UNIFORM WITHOUT HIGH SPOTS THAT SHED WATER OR LOW SPOTS THAT POND WATER. SCARIFY THE UPPER 2 INCHES PRIOR TO PLACING TOPSOIL SO THAT A BOND BETWEEN TOPSOIL AND SUBSOIL IS CREATED. WHEN SEEDING ADJACENT TO A ROAD EITHER FILL OR PROVIDE EXCAVATION AS REQUIRED SO THAT THE TOP OF SEED BED IS AT LEAST 1 INCH BELOW THE EDGE OF THE SHOULDER.

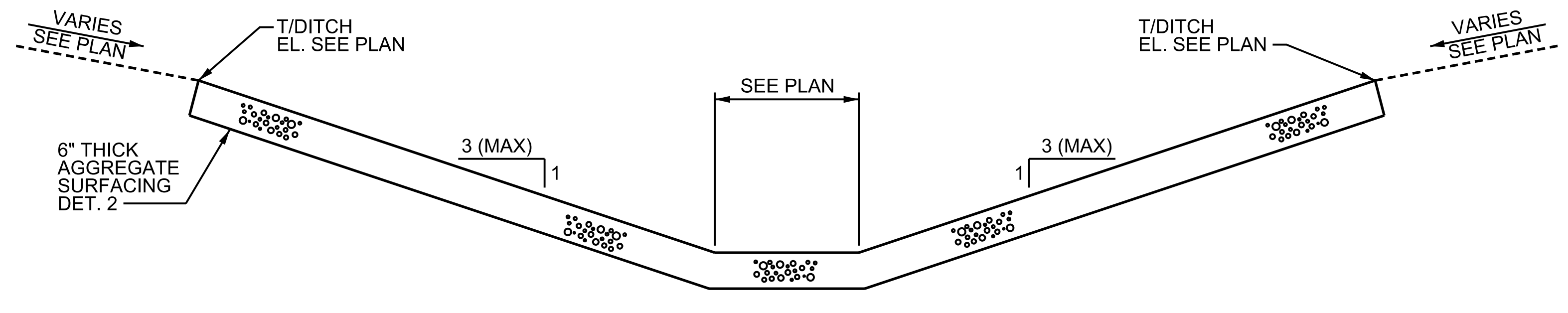
4" SEEDED TOPSOIL
DETAIL 3
N.T.S.



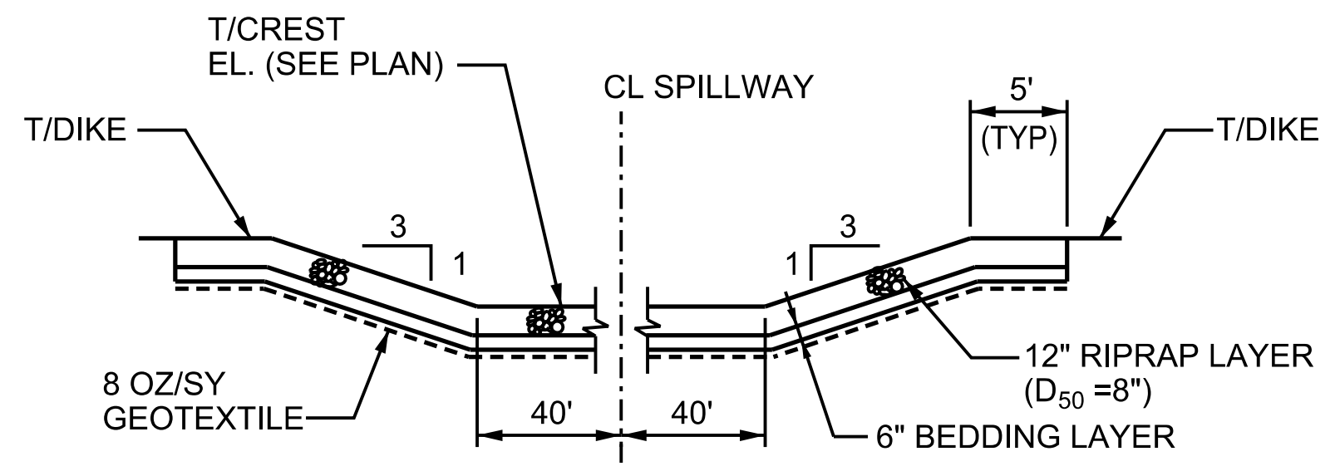
LONGITUDINAL SECTION
PROTECTION AT PIPE INLET INTO POND
DETAIL 4
N.T.S.



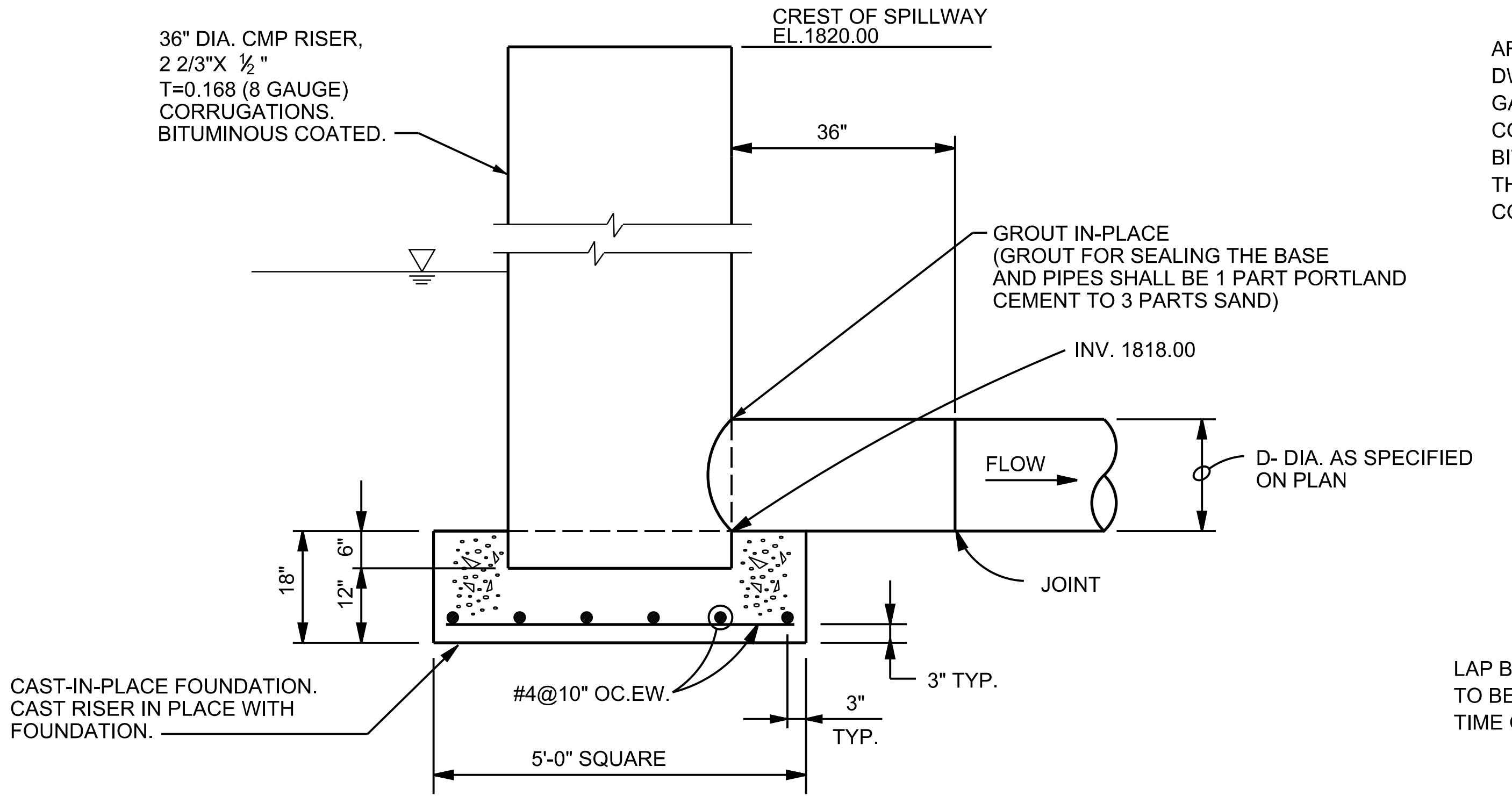
LONGITUDINAL SECTION
PROTECTION AT CULVERT IN A DEFINED CHANNEL
SINGLE CULVERT
DETAIL 5
N.T.S.



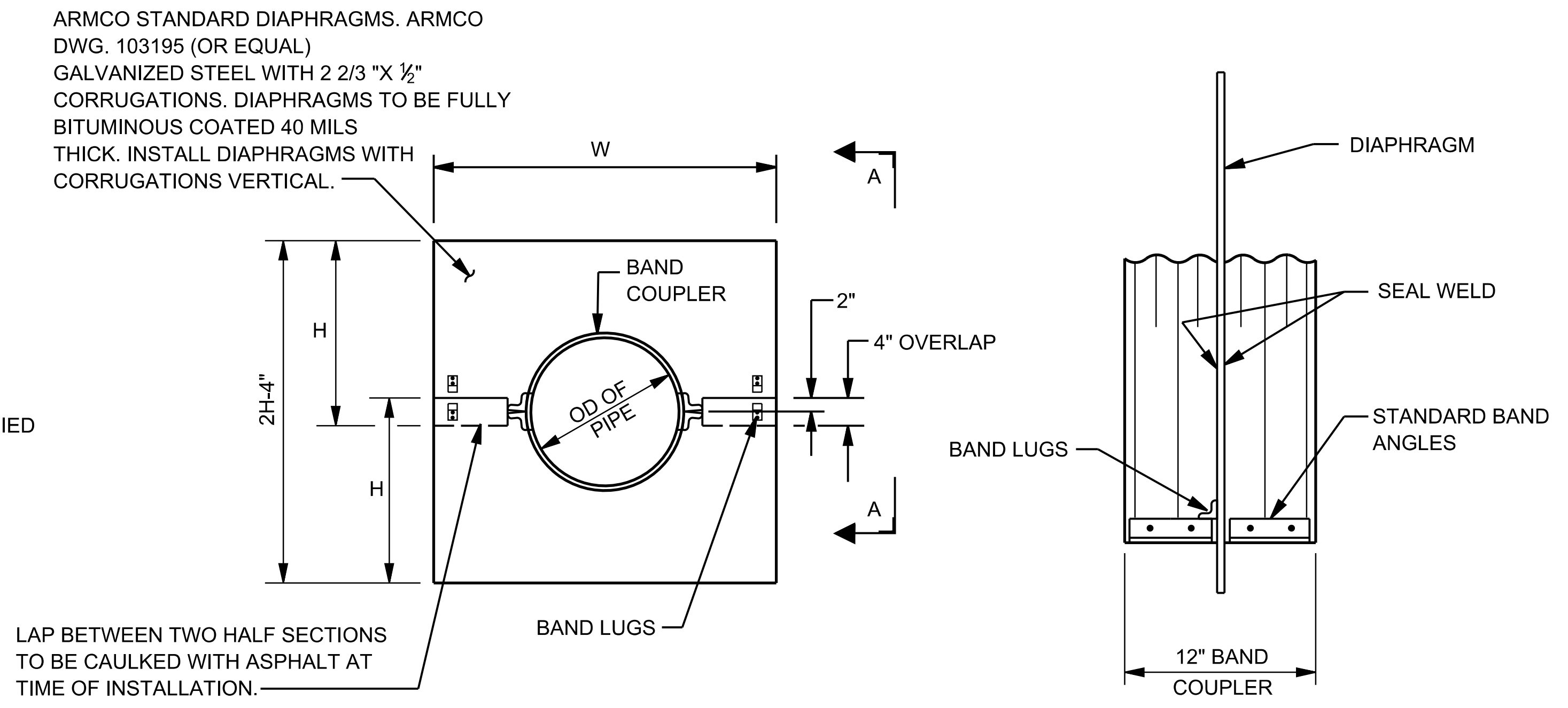
DRAINAGE DITCH
DETAIL 6
N.T.S



SPILLWAY RIPRAP
DETAIL 7
N.T.S



TYPICAL DETAIL
DEBRIS BASIN PIPE SPILLWAY DROP INLET STRUCTURE
DETAIL 8
N.T.S



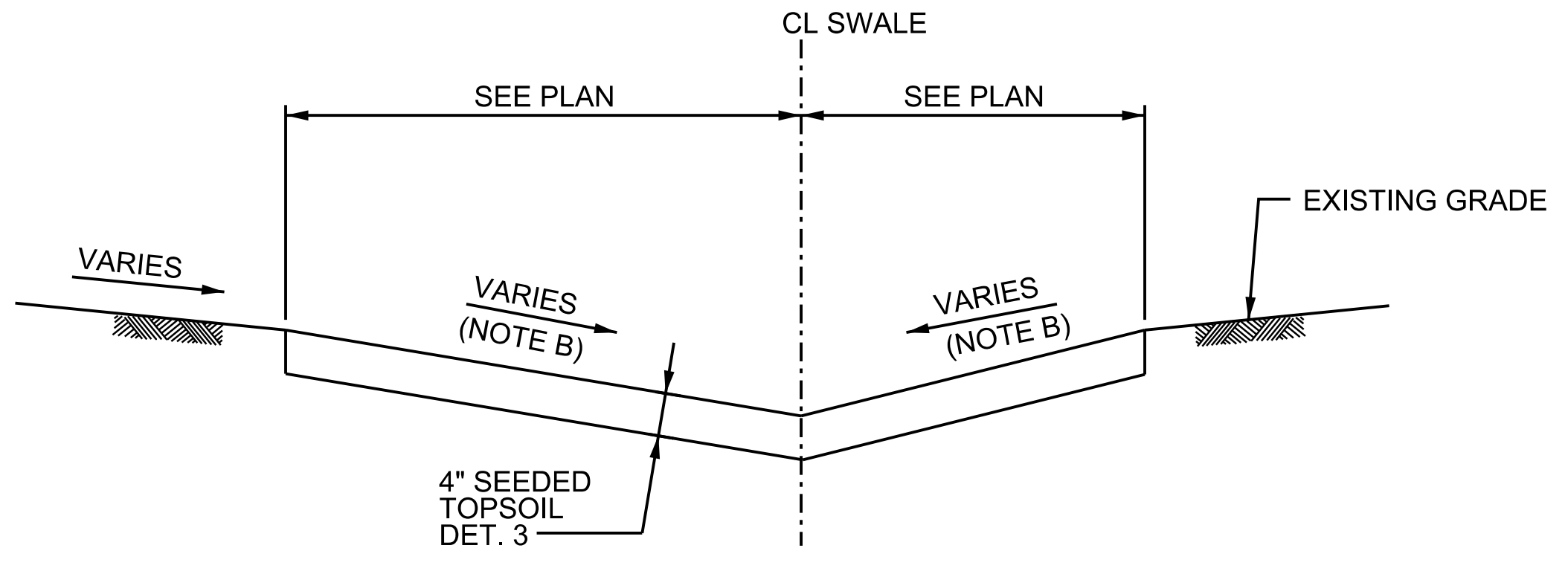
ARMCO STANDARD DIAPHRAGMS. ARMCO DWG. 103195 (OR EQUAL) GALVANIZED STEEL WITH 2 2/3 "X ½" CORRUGATIONS. DIAPHRAGMS TO BE FULLY BITUMINOUS COATED 40 MILS THICK. INSTALL DIAPHRAGMS WITH CORRUGATIONS VERTICAL.

LAP BETWEEN TWO HALF SECTIONS TO BE CAULKED WITH ASPHALT AT TIME OF INSTALLATION.

D (IN.)	METAL GAGE	W (1) (IN.)	H (1) (IN.)
12	16	64	32½
18	16	69¼	35½
24	14	72	38½
30	14	82½	41½

(1) SIZE FOR 20 FOOT CENTER TO CENTER SPACING OF COLLARS WITH UNSTRUTTED DIAPHRAGMS.

ANTI-SEEP COLLAR FOR CMP
DETAIL 9
N.T.S



NOTES:
A. SEE PLAN FOR SWALE LOCATION, WIDTH AND ELEVATIONS.
B. SLOPES VARY, SEE PLAN FOR SWALE GRADES. DAYLIGHT TO EXISTING GRADE AT 4H:1V SLOPE WHERE APPLICABLE.

TYPICAL SWALE SECTION
DETAIL 11
N.T.S

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE PERFORMED BY SPECIFICATION A-8808 UNLESS NOTED OTHERWISE.
2. FOR CIVIL GENERAL NOTES, SYMBOLS, AND ABBREVIATIONS SEE DRAWING C1-0002.
3. AGGREGATE FOR ROAD BASE COURSE SHALL MEET REQUIREMENTS OF SECTION 260 OF THE SOUTH DAKOTA DOT STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES.

REFERENCE DRAWINGS

C1-0002	CIVIL GENERAL NOTES, LEGEND, SYMBOLS AND ABBREVIATIONS
C1-0031	INITIAL GRADING PLAN SHEET 1
C1-0032	INITIAL GRADING PLAN SHEET 2
C1-0033	INITIAL GRADING PLAN SHEET 3
C1-0034	INITIAL GRADING PLAN SHEET 4

UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED.

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HOLD INFORMATION

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RELEASE INFORMATION

REV.	DATE	DESCRIPTION
0	01-11-2019	FOR COMMENT
1	02-08-2019	FOR COMMENT

ISSUE PURPOSE: COMMENT
SPECIFICATION: A-8808
PROJECT NO.: 12715-010

I HEREBY CERTIFY THAT THIS ENGINEERING DOCUMENT WAS PREPARED BY ME OR UNDER MY DIRECT PERSONAL SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF SOUTH DAKOTA.

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ENTER DATE

MY LICENSE RENEWAL DATE IS: ENTER DATE
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THIS DOCUMENT ONLY.

CERTIFICATE OF AUTHORIZATION

CAD FILE NAME: C1-0035.DGN
PREPARED BY: A. PAAPE
REVIEWED BY: M. TURNER
APPROVED BY: ---

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SARGENT & LUNDY LLC
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CHICAGO, ILLINOIS 60603-5780

OTTER TAIL POWER COMPANY

PROJECT

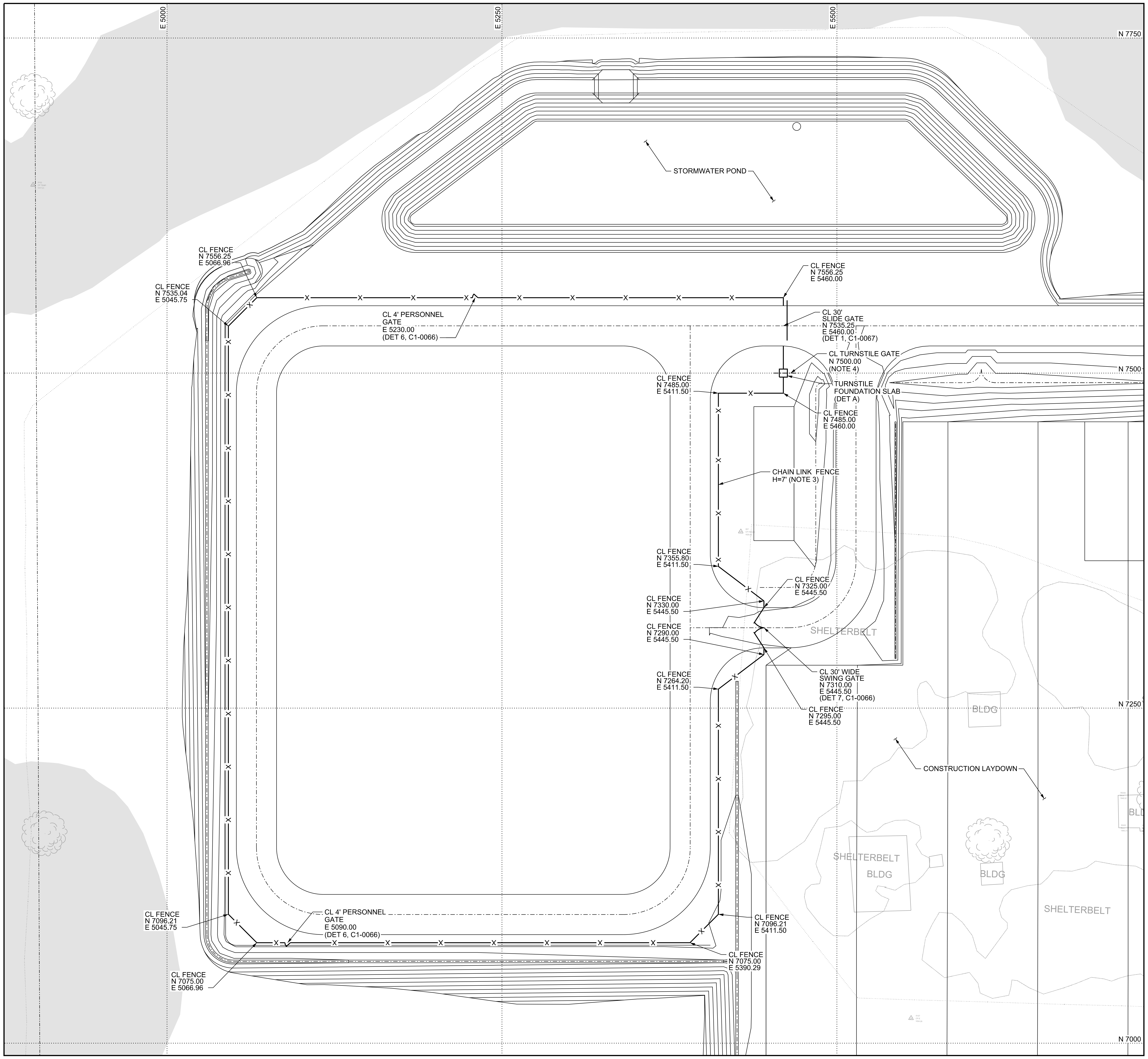
ASTORIA STATION
SIMPLE CYCLE PROJECT AND
482nd TOWNSHIP ROAD UPGRADE

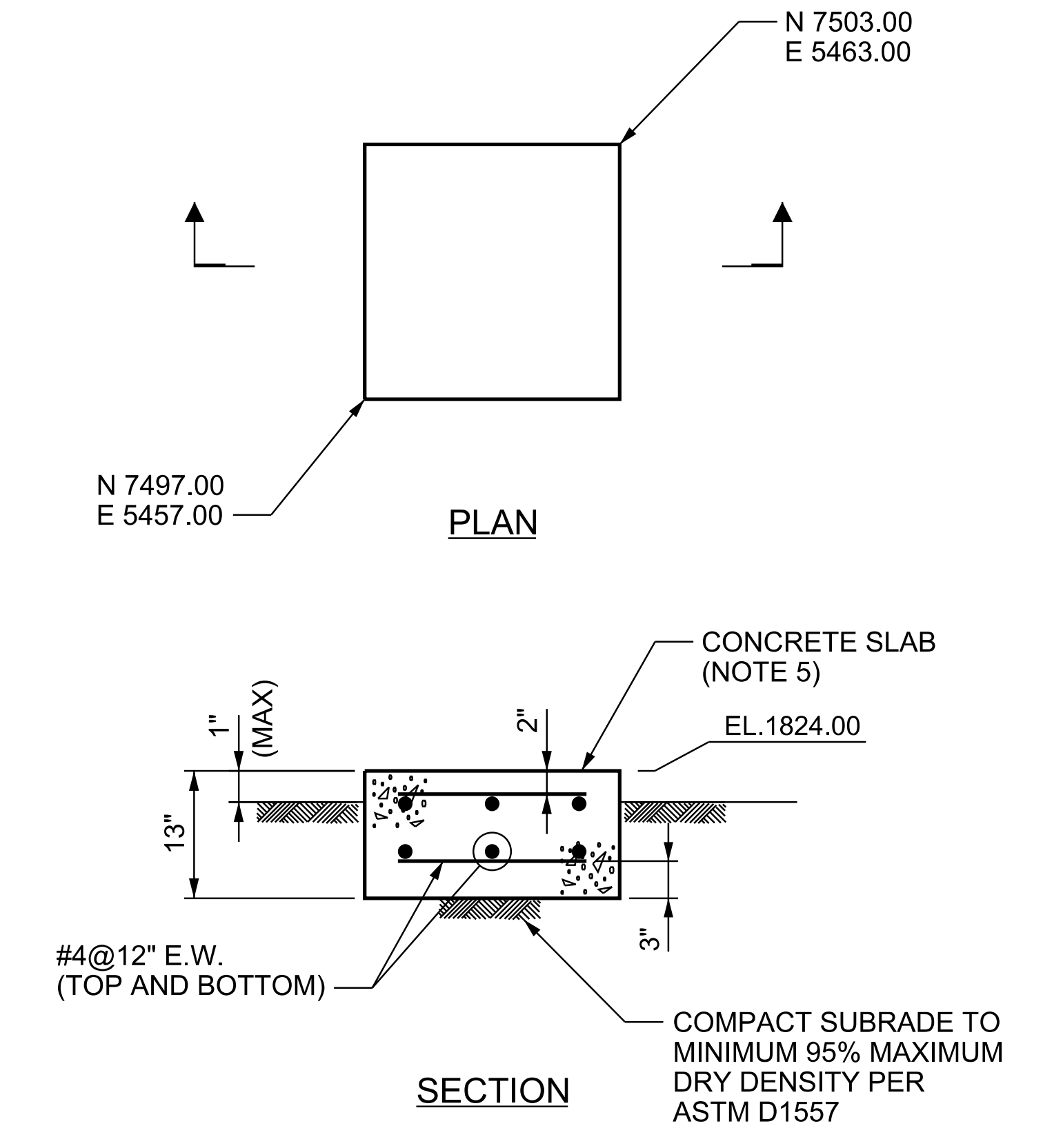
SOUTH DAKOTA

DRAWING TITLE

INITIAL GRADING DETAILS
SHEET 1

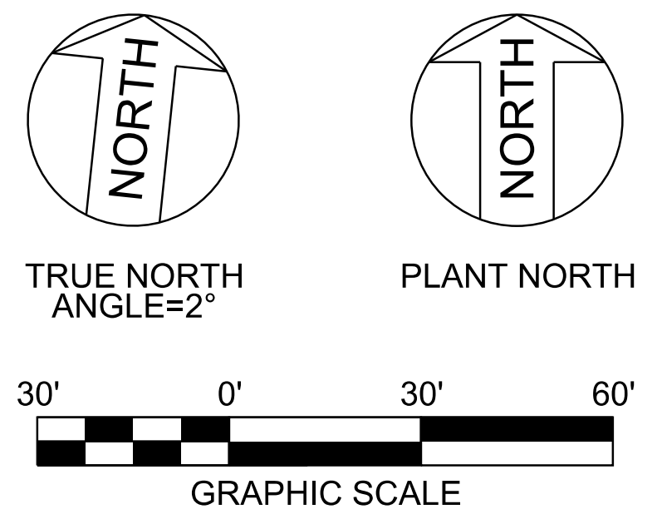
DRAWING NUMBER: C1-0035
REVISION: 1
SHEET 1 OF 1





DETAIL A

N.T.S.



DRAWING SCALE
1"=30'-0"

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE PERFORMED BY SPECIFICATION A-8808 UNLESS NOTED OTHERWISE.
2. FOR CIVIL GENERAL NOTES SEE DRAWING C1-0002.
3. FOR FENCING DETAILS SEE DRAWINGS C1-0066 AND C1-0067.
4. TURNSTILE SHALL BE ALVARADO MANUFACTURING COMPANY MODEL MST OR OWNER APPROVED EQUAL. INSTALL PER MANUFACTURERS RECOMMENDATIONS UNLESS NOTED.
5. CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4500 PSI AT 28 DAYS, AND SHALL HAVE A BROOM FINISH.

REFERENCE DRAWINGS

C1-0002	CIVIL GENERAL NOTES, LEGEND, SYMBOLS AND ABBREVIATIONS
C1-0066	FENCING DETAILS SHEET 1
C1-0067	FENCING DETAILS SHEET 2

UNDERGROUND OR EMBEDDED UTILITIES MAY BE LOCATED WITHIN OR ADJACENT TO THE AREA IN WHICH EXCAVATION, DEMOLITION, FOUNDATION, OR MODIFICATION WORK IS TO BE PERFORMED.

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CAD FILE NAME: C1-0065.DGN
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REVIEWED BY: M. TURNER
APPROVED BY: ---

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CHICAGO, ILLINOIS 60603-5780

OTTER TAIL POWER COMPANY

PROJECT

ASTORIA STATION
SIMPLE CYCLE PROJECT AND
482nd TOWNSHIP ROAD UPGRADE

SOUTH DAKOTA

DRAWING TITLE

PERMANENT FENCING PLAN

DRAWING NUMBER	REVISION
C1-0065	1

SHEET 1 OF 1

ZD11185/0p2962/D:\ASTORIA\checkout\c1-0065.dgn
Form GDG-0401-01-08, ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 10, Revision Date: 10-16-2009

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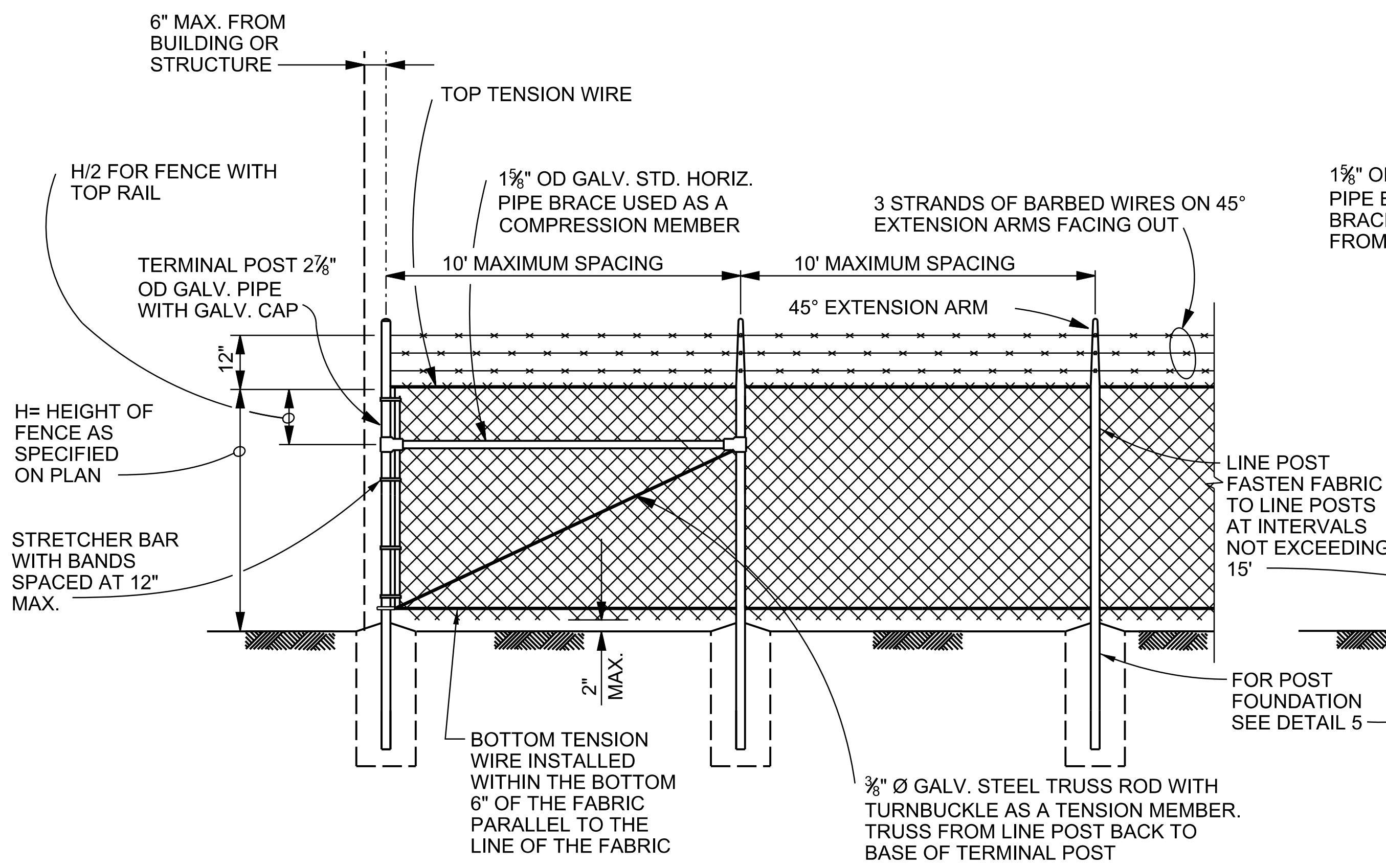


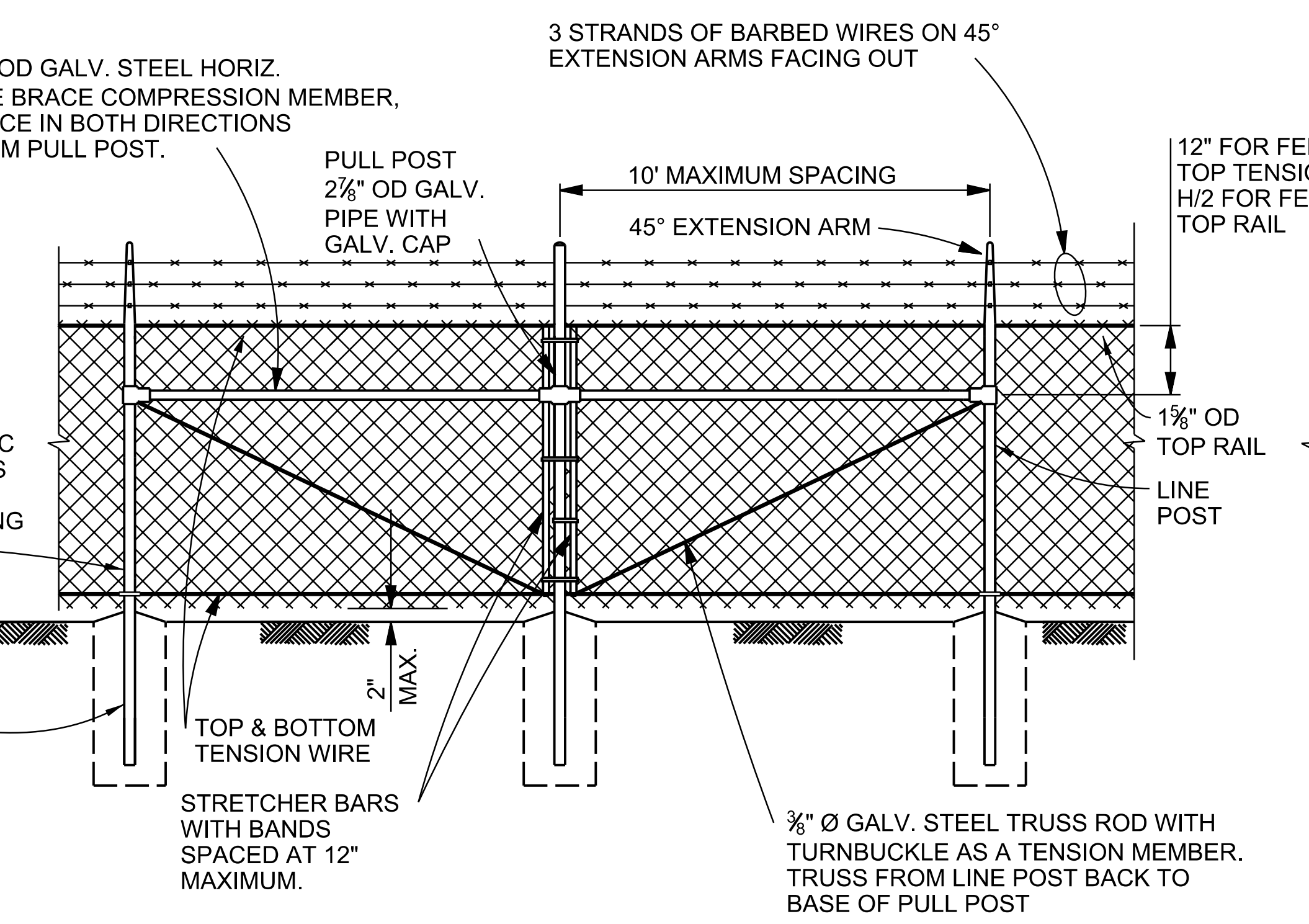
CHAIN LINK FENCE

TYPICAL TERMINAL POST DETAIL

DETAIL 1

N.T.S.

<table>
<tr><th rowspan="3">FENCE HEIGHT, H</th><th colspan="4">POST EMBEDMENT, E</th></tr>
<tr><th rowspan="2">LINE POSTS</th><th colspan="3">TERMINAL, CORNER, PULL, ANGLE AND SWING GATE POSTS</th></tr>
<tr><th>2⅞" TO 4"</th><th>6⅝"</th><th>8⅝"</th></tr>
<tr><td>6' TO 12'</td><td>42"</td><td>42"</td><td>42"</td><td>42"</td></tr>
</table>



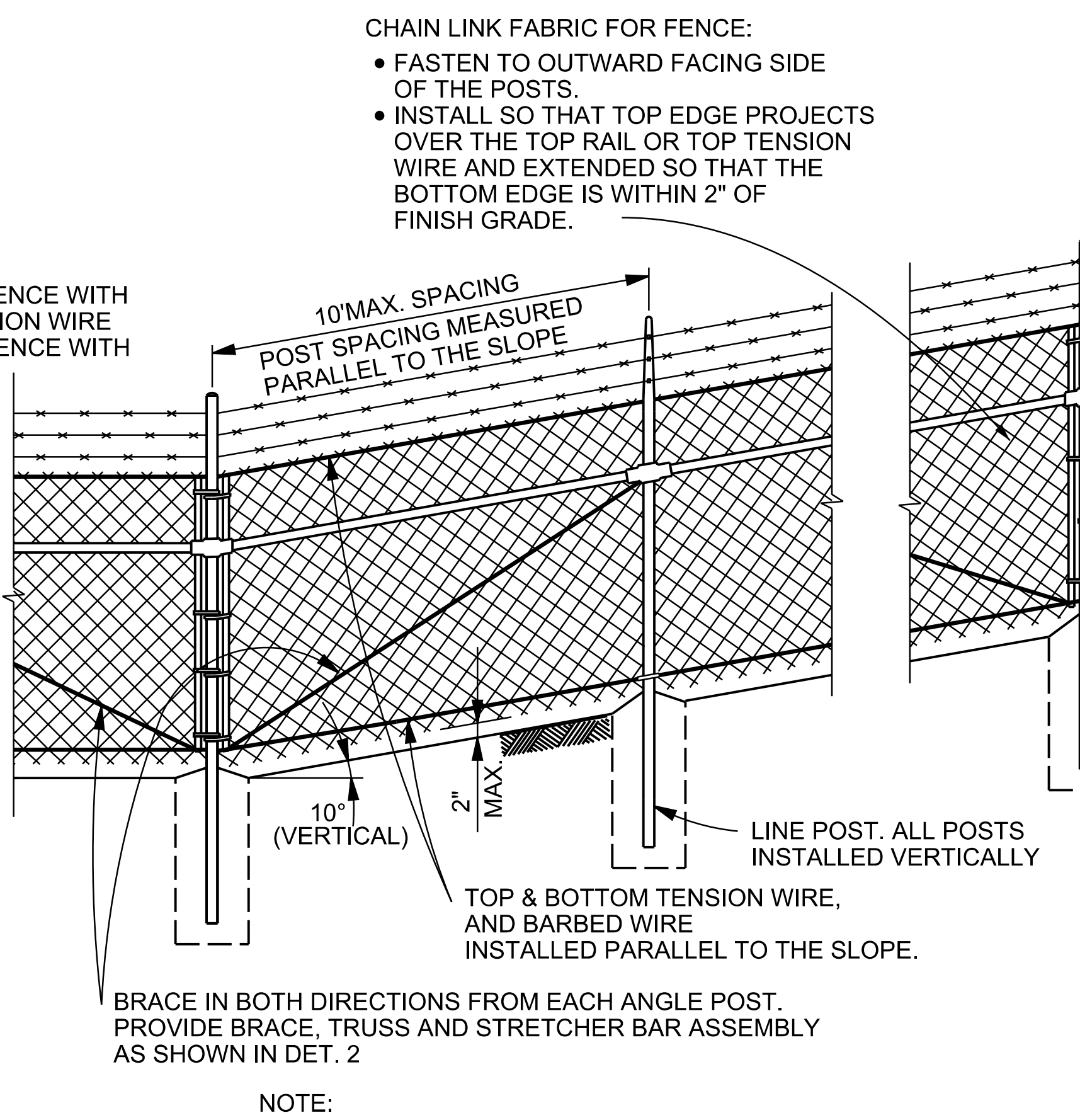
NOTE:
PROVIDE PULL POST AT MAXIMUM 500' SPACING ALONG STRAIGHT LINE FENCING.

CHAIN LINK FENCE

TYPICAL PULL POST

DETAIL 2

N.T.S.



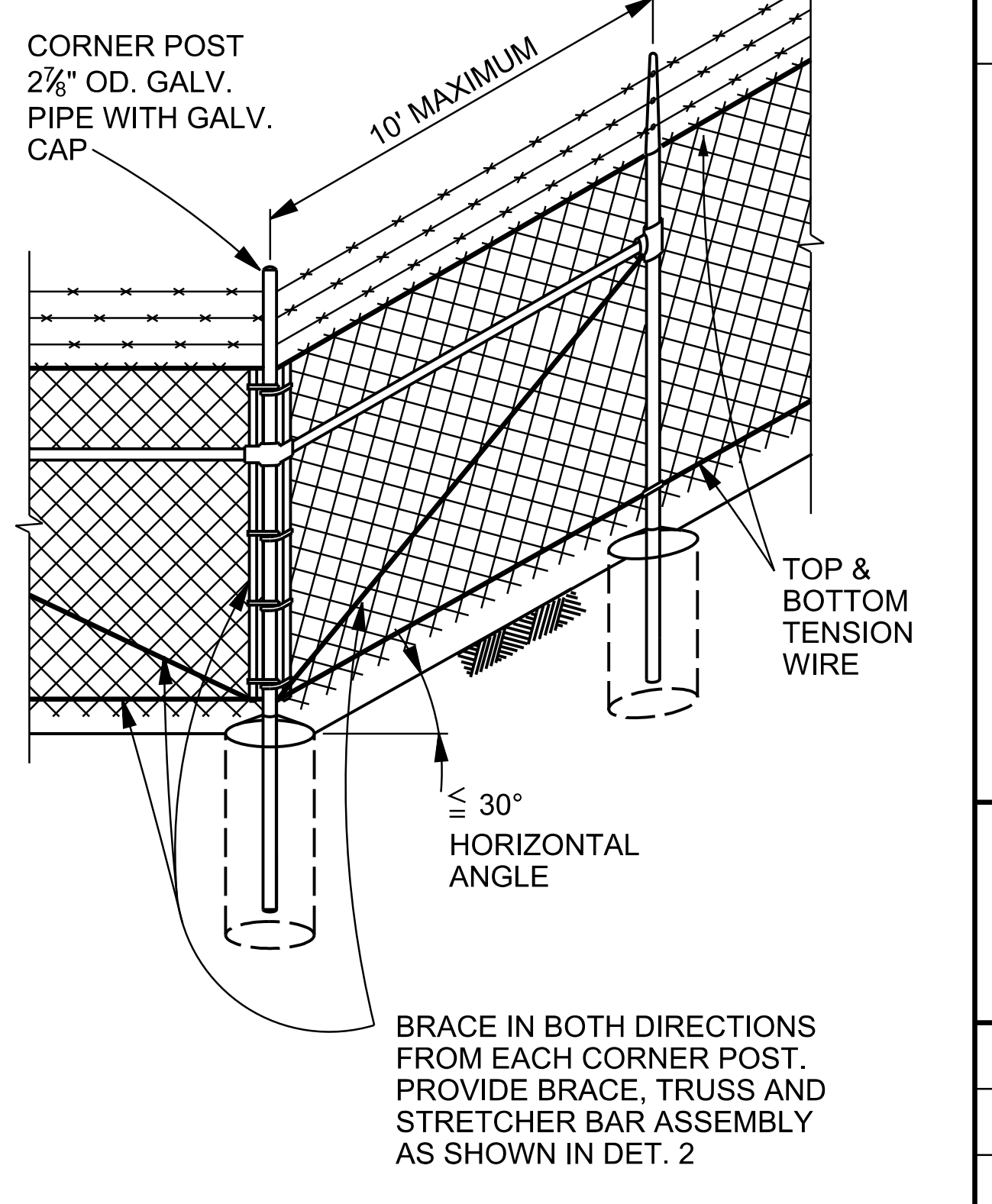
NOTE:
PROVIDE ANGLE POSTS WHEN CHANGE IN GRADE EXCEEDS 10° (17.6% OR 5.67 TO 1) AND WHERE SPECIFIED ON PLAN.

CHAIN LINK FENCE

TYPICAL ANGLE POST

DETAIL 3

N.T.S.



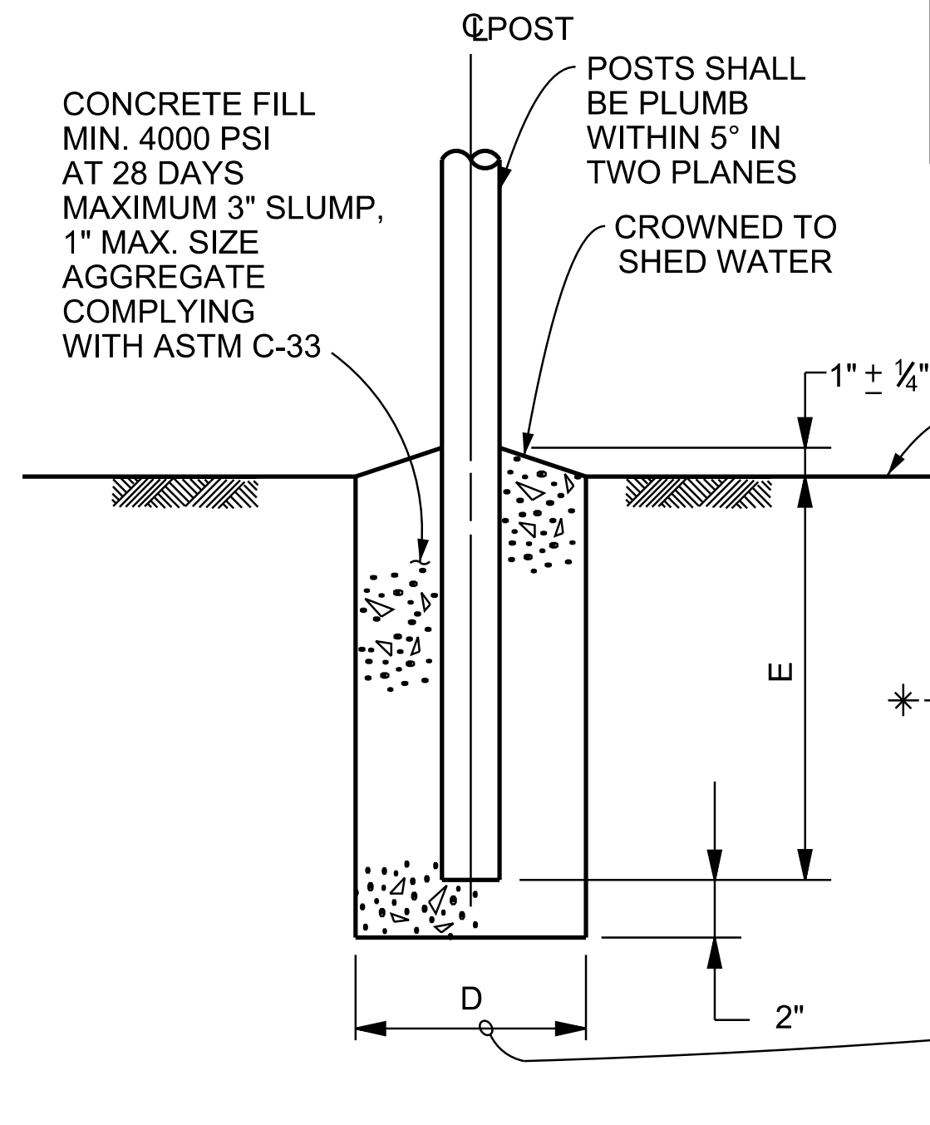
NOTE:
PROVIDE A CORNER POST WHEN THE CHANGE IN HORIZONTAL ANGLE EQUALS OR EXCEEDS 30° AND WHERE SPECIFIED ON PLAN.

CHAIN LINK FENCE

TYPICAL CORNER POST

DETAIL 4

N.T.S.



1" ± ¼"

T/GRADE
EL. VARIES

✳✳ HOLE DIAMETER, "D" FOR POSTS IN SOIL

9" FOR LINE POSTS
12" FOR CORNER, ANGLE, TERMINAL AND PULL POSTS
12" FOR 2⅞" SWING GATE POSTS
16" FOR 4" SWING GATE POSTS

CHAIN LINK FENCE

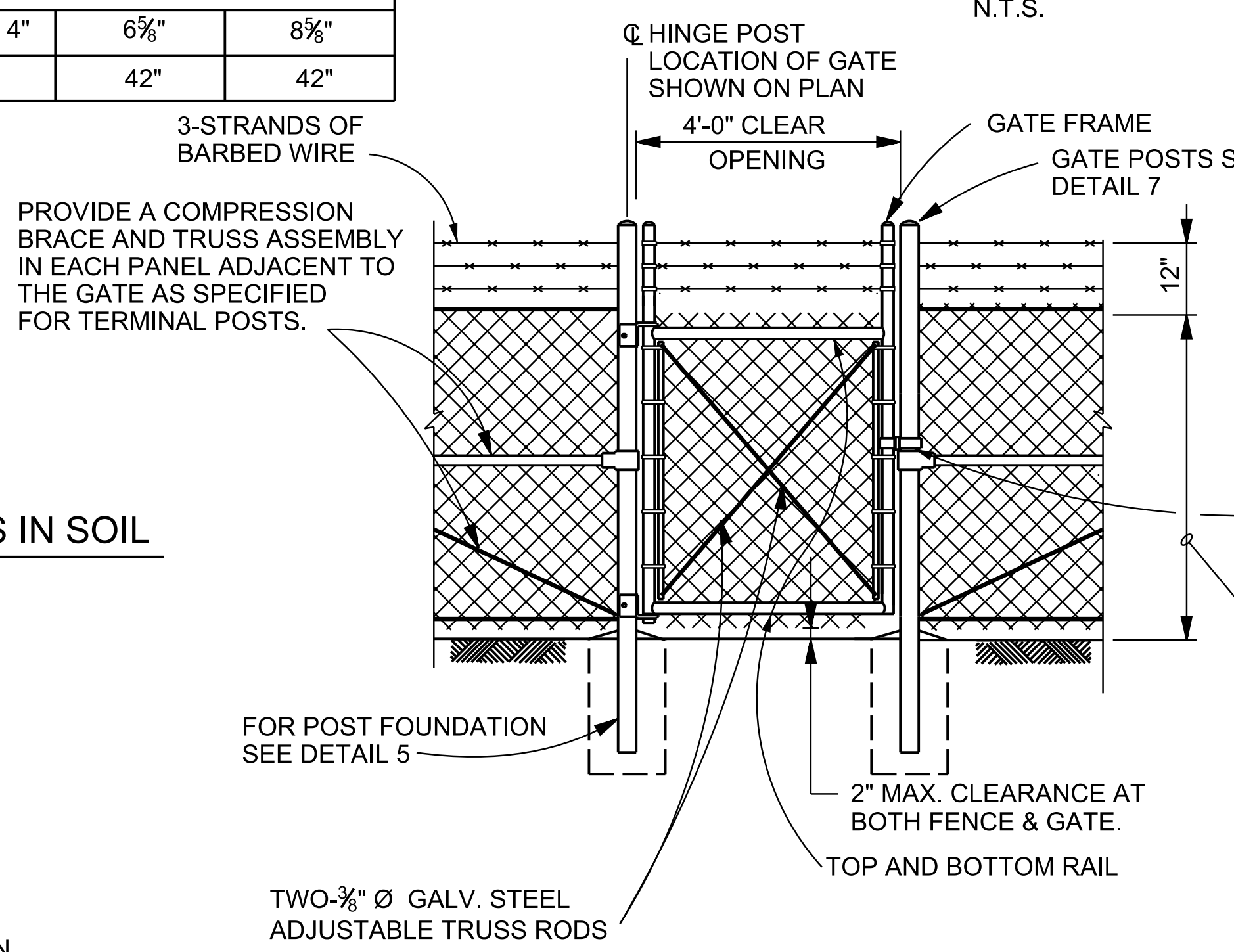
TYPICAL FOUNDATION DETAIL

FENCE AND SWING GATE POSTS

DETAIL 5

N.T.S.

✳✳ THE HOLE DIAMETER "D" COMPLIES WITH THE REQUIREMENTS OF ASTM F-567, "INSTALLATION ON CHAIN LINK FENCE", THAT THE DIAMETER SHALL BE A MINIMUM OF 4 TIMES THE LARGEST CROSS SECTION OF THE POSTS.

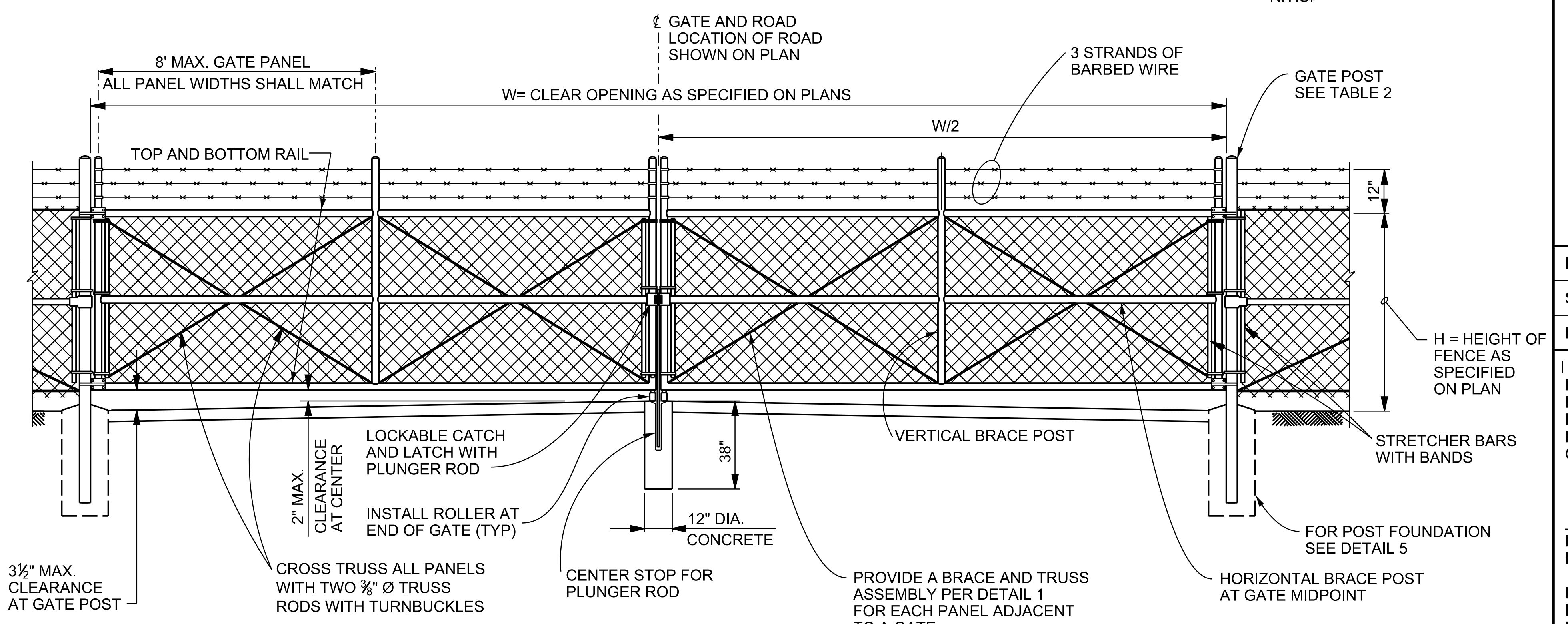


CHAIN LINK FENCE

TYPICAL 4'-0" WIDE PERSONNEL GATE

DETAIL 6

N.T.S.



CHAIN LINK FENCE

TYPICAL DOUBLE SWING GATE

DETAIL 7

N.T.S.

SWING GATE DATA

TABLE 2

GATE POST SIZES			
W DOUBLE SWING GATE	W SINGLE GATE	GATE POST SIZE OD	MINIMUM WEIGHT (LB/FT)
TO 12'	TO 6'	2⅞" Ø	4.64
13' TO 24'	7' TO 12'	4" Ø	8.65

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE PERFORMED BY SPECIFICATION A-8808 UNLESS NOTED OTHERWISE.
2. FOR CIVIL GENERAL NOTES, SYMBOLS, AND ABBREVIATIONS SEE DRAWING C1-0002.
3. CHAIN LINK FENCE SHALL MEET REQUIREMENTS OF SECTION 621, CHAIN LINK FENCING, OF SOUTH DAKOTA DOT STANDARD SPECIFICATIONS FOR ROADS AND BRIDGES.

REFERENCE DRAWINGS

C1-0002	CIVIL GENERAL NOTES, LEGEND, SYMBOLS AND ABBREVIATIONS
C1-0002	PERMANENT FENCING PLAN

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ISSUE PURPOSE: COMMENT
SPECIFICATION: A-8808
PROJECT NO.: 12715-010

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CERTIFICATE OF AUTHORIZATION

CAD FILE NAME: C1-0066.DGN
PREPARED BY: A. PAAPE
REVIEWED BY: M. TURNER
APPROVED BY: ---

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OTTER TAIL POWER COMPANY

PROJECT

ASTORIA STATION
SIMPLE CYCLE

SOUTH DAKOTA

DRAWING TITLE

FENCING DETAILS
SHEET 1

DRAWING NUMBER: C1-0066
REVISION: 1
SHEET 1 OF 1

ZD11185/0p2962/D:\ASTORIA\checkout\c1-0066.dgn
Form GDG-0401-01-08, ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 10, Revision Date: 10-16-2009

2/8/2019 1:41:07 PM
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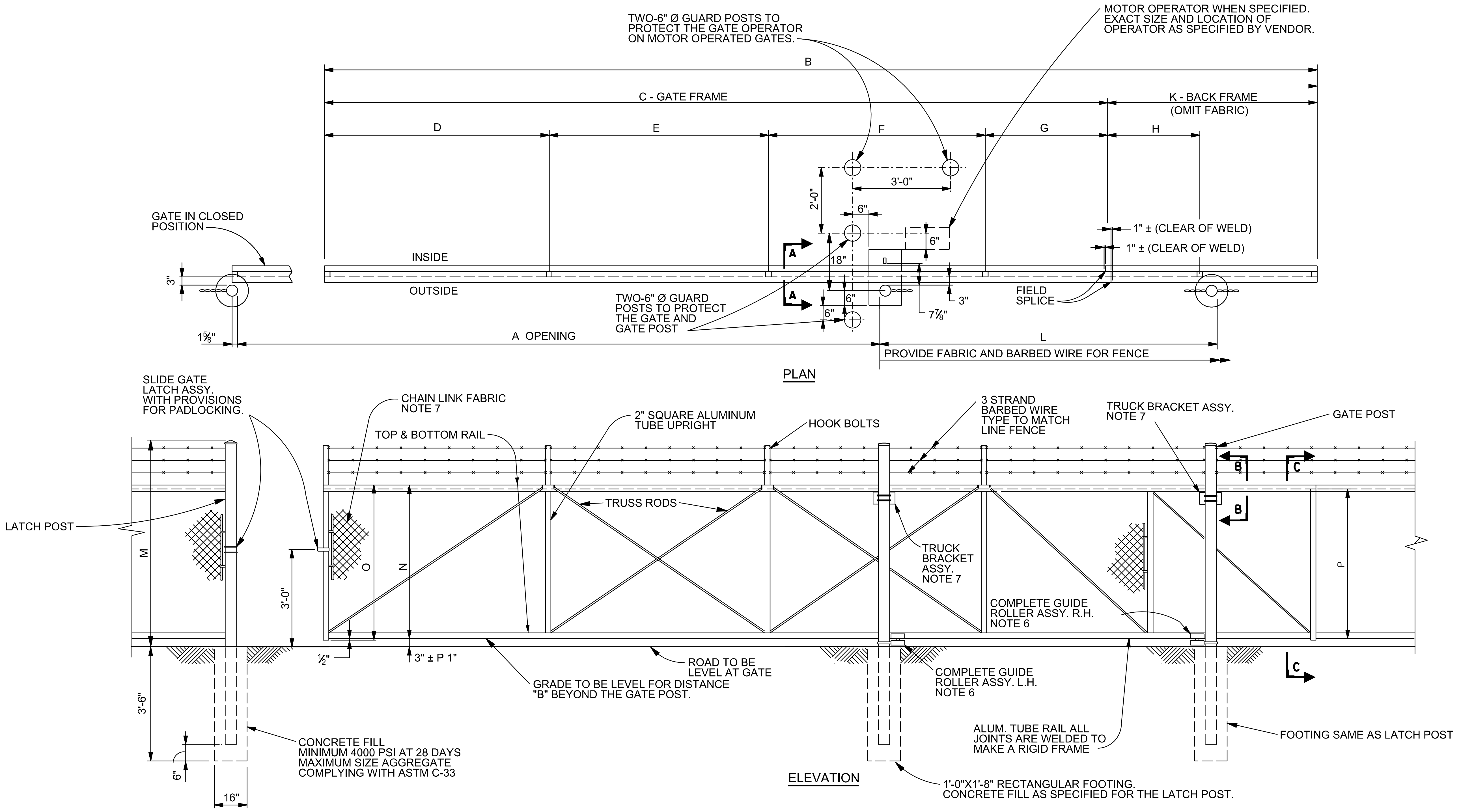


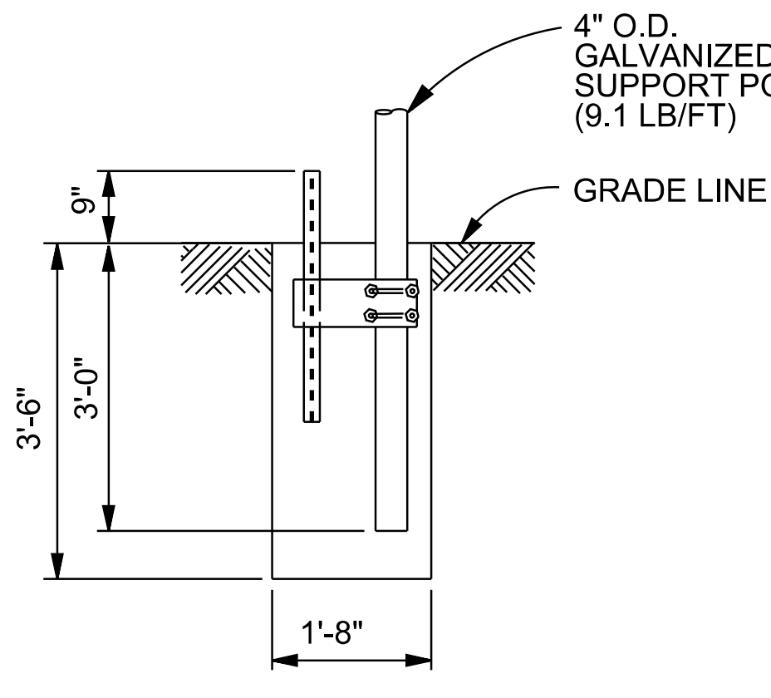
DIMENSION CHART										
SINGLE OPENING	A	B	C	D	E	F	G	H	K	L
30'-0"	30'-0"	42'-3"	30'-2"	7'-7½"	7'-6½"	7'-6½"	7/5½"	6'-0½"	12'-1"	12'-0"

HEIGHTS FOR GATES WITH BARBED WIRE			
6'-0" HIGH			
M	N	O	P
9'-1"	7'-8½"	8'-10"	7'-7"

ALUMINUM CANTILEVER SLIDE GATE

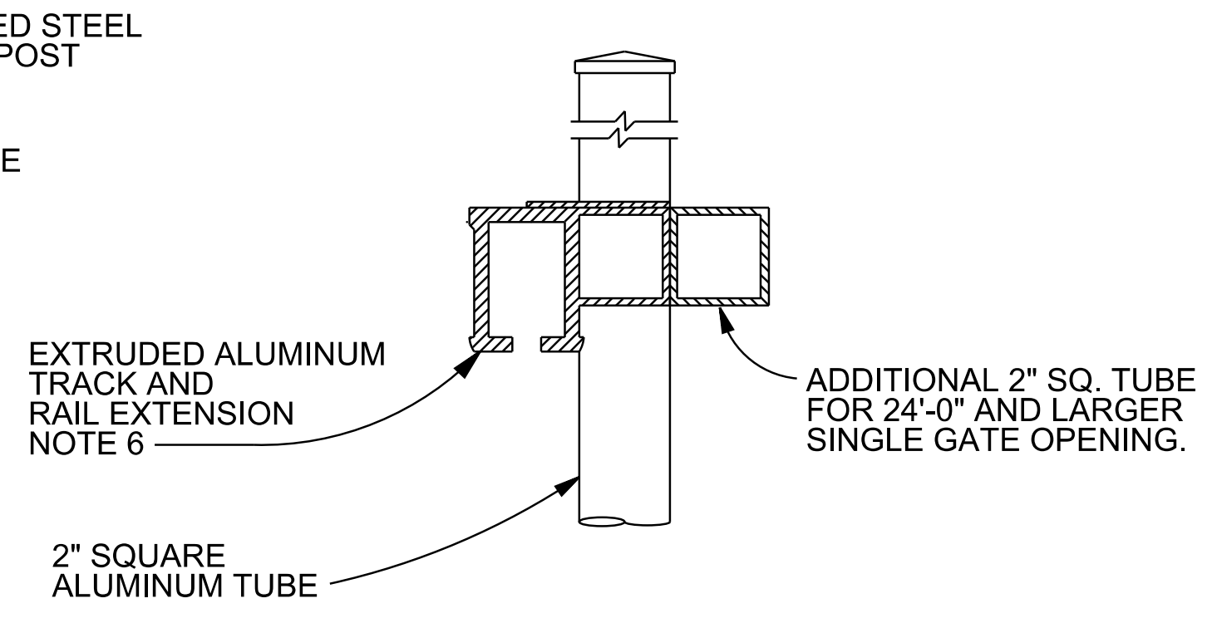
DETAIL 1

N.T.S.

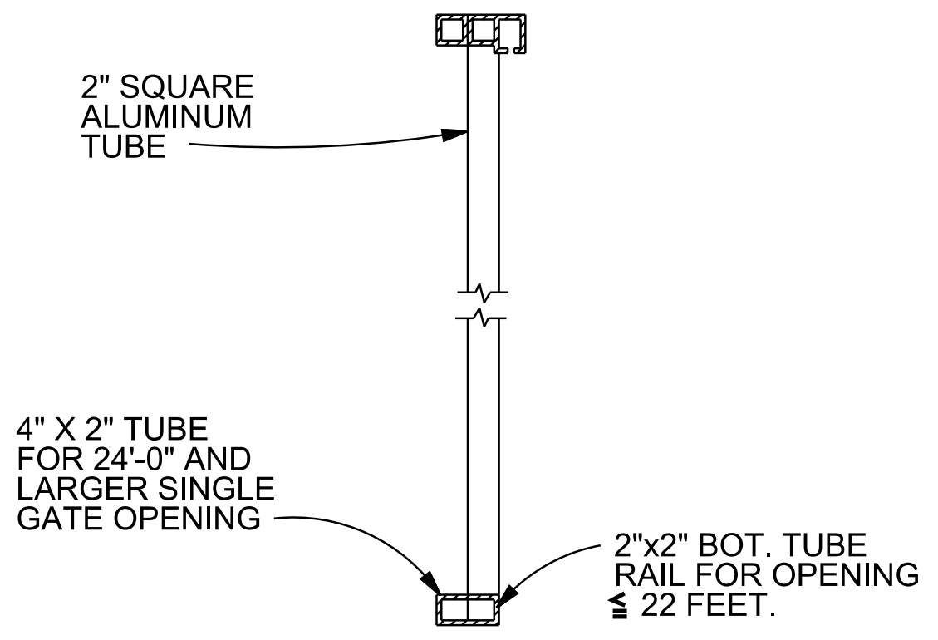


SECTION A

(ABOVE & BELOW GRADE)



SECTION B



SECTION C

NOTES

1. ALL WORK SHOWN ON THIS DRAWING SHALL BE PERFORMED BY SPECIFICATION A-8808 UNLESS NOTED OTHERWISE.
2. FOR CIVIL GENERAL NOTES, SYMBOLS, AND ABBREVIATIONS SEE DRAWING C1-0002.

REFERENCE DRAWINGS

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HOLD INFORMATION	
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RELEASE INFORMATION		
REV.	DATE	DESCRIPTION
0	01-11-2018	FOR COMMENT
1	02-08-2019	FOR COMMENT

ISSUE PURPOSE: COMMENT
SPECIFICATION: A-8808
PROJECT NO.: 12715-010

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CERTIFICATE OF AUTHORIZATION

CAD FILE NAME: C1-0067.DGN
PREPARED BY: A. PAAPE
REVIEWED BY: M. TURNER
APPROVED BY: ---

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CHICAGO, ILLINOIS 60603-5780

OTTERTAIL
POWER COMPANY

PROJECT

ASTORIA STATION
SIMPLE CYCLE

SOUTH DAKOTA

DRAWING TITLE

FENCING DETAILS
SHEET 2

DRAWING NUMBER: C1-0067
REVISION: 1
SHEET 1 OF 1

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Form GDG-0401-01-08, ANSI (Imperial) MicroStation Border - Size E - 34 x 44
Revision 10, Revision Date: 10-16-2009

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ASTORIA STATION
SIMPLE CYCLE PROJECT
STORMWATER POLLUTION PREVENTION PLAN

APPENDIX D

SWPPP AMENDMENTS FORM

ASTORIA STATION
STORMWATER POLLUTION PREVENTION PLAN
APPENDIX D AMENDMENT FORM

Date: ____________________________ Inspector's Name ____

Location and Description of Grading and Stabilization Activities

Amendments to the SWP3: ____

Date: ____________________________ Inspector's Name ____

Location and Description of Grading and Stabilization Activities

Amendments to the SWPPP: ____

Date: ____________________________ Inspector's Name ____

Location and Description of Grading and Stabilization Activities

Amendments to the SWPPP: ____

APPENDIX E

RECORD KEEPING (RECORD OF CONSTRUCTION ACTIVITIES)

INSPECTION REPORT FORM WITH FREQUENCY DOCUMENTATION/DROUGHT MAPS

ASTORIA STATION
STORMWATER POLLUTION PREVENTION PLAN
APPENDIX E EROSION AND SEDIMENT CONTROL FEATURES INSPECTION FORM

Date: ____________________ Inspector's Name/Title__________________________________
Inspector Qualified in accordance with Texas General Construction Storm Water Permit: ☐ Yes ☐ No
Inspector's Company:_______________
Inspection Type: ☐ Routine ☐Storm Event (0.5 inch or greater) Rainfall Amount: ________
Weather Conditions: ☐Clear ☐Cloudy ☐Rain ☐ Sleet ☐Fog ☐ Snowing ☐ High Winds ☐Other:
Temperature:_____

Erosion and Sediment Control Features Inspected:

☐ Silt Fence
Properly anchored/installed: ☐ Yes ☐ No _________________________________
Action Taken: ____
Repairs Needed:☐ Yes ☐ No _________________________________
Action Taken: ____
Sediment Removal Required (sediment 1/3 height of Silt Fence): ☐Yes ☐ No _____________________
Actions Taken: ____
____

☐ Straw Wattles
Properly anchored/installed: ☐ Yes ☐ No _________________________________
Action Taken: ____
Repairs Needed:☐ Yes ☐ No _________________________________
Action Taken: ____
Sediment Removal Required (sediment 1/3 height of Straw Wattles): ☐Yes ☐ No _____________________
Actions Taken: ____
____

☐ Straw Bale
Properly anchored/installed: ☐ Yes ☐ No _________________________________
Action Taken: ____
Repairs Needed:☐ Yes ☐ No _________________________________
Action Taken: ____
Sediment Removal Required (sediment 1/3 height of Straw Bale): ☐Yes ☐ No _____________________
Actions Taken: ____
____

☐ Construction Entrance
Entrance Stabilized: ☐Yes ☐ No Evidence of mud tracked on roadway: ☐Yes ☐ No
Actions Taken: ____
____
____

☐Temporary & Permanent Stabilization
Are all disturbed areas at final grade or not actively being worked properly stabilized: ☐Yes ☐ No_____________________
Record Seeding dates on Grading and Stabilization Log
Actions Taken:____

☐ Material Storage Areas
Materials Storage Areas located on site: ☐Yes ☐ No
Materials properly contained and labeled: ☐Yes ☐ No______________________
Evidence of spills or releases ☐Yes_________________________ ☐ No
Actions Taken: ____

If modifications are made, update the Erosion Control Drawings and document changes on the SWPPP amendment log

Inspector's Signature: ________________________________Date ______________________