

Inadvertent Release Contingency Plan For Horizontal Directional Drilling in Segment 3 – Package 1C

Whitehall to Fort Ann Washington County, New York

CHA Project Number: 066076

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1.0 INTRODUCTION

CHA Consulting, Inc. (CHA) and the Kiewit Team, with the support of Boscardin Consulting Engineers (BCE), proposes to design and construct approximately 170 Horizontal Directional Drilling (HDD) crossings for a pair of HVDC electrical transmission cables (two crossings at 85 locations) plus a telecommunications line located in upland areas of the Hudson River Valley of New York for Segments 1 through 7 from Putnam Station to Schenectady, NY. Horizontal directional drilling (HDD) methods will be used to route the crossings below congested areas, railroads, under/around obstructions (e.g., existing infrastructure or utilities), and below wetlands and bodies of water. The portions of the cable between HDD bores will be installed in PVC conduits via trenching methods. The trenching construction is addressed in a separate report.

The underground construction of the two HVDC electrical transmission cables is proposed to be housed in individual 10-inch-diameter DR 9 HDPE conduits spaced a distance dependent on depth and soil Thermal Resistivity (TR) values provided by NKT and as shown on drawing plans. A third, typically 2-inch-diameter DR 9 conduit will be bundled with one of the 10-inch-diameter conduits for a telecommunications line. The conduits are to be installed in 16-inch to 22-inch final reamed diameter bore holes. Final conduit diameter and DR values will depend on length and depth of the HDD bores. Longer and deeper bores may require a larger diameter (i.e. 12-inch and 3-inch) HDPE conduits and larger DR values, thicker walls, (i.e. DR 7) to resist tension stresses during installation and collapsing long-term. This is checked and determined on a case-by-case basis and design sizes are shown on the design drawings (see Appendix B).

This Inadvertent Release Contingency Plan (IRCP) is for Segment 3 – Package 1C which includes seven HDD crossings: HDD #3 through HDD #8.

HDD is a widely used trenchless construction method to install conduits with limited disturbance to the ground around the bore alignment and minimal ground surface impacts above the alignment. The goal for using HDD methods is to install the conduits while controlling and minimizing the amount of impact on water bodies, congested areas, existing underground obstructions, and to wetlands, to the extent possible.

A primary potential environmental concern associated with HDD involves the inadvertent release of drilling fluids, also referred to as drilling mud, during the drilling process, which is addressed

in this plan. The purpose of this plan is to establish general procedures to prevent a fluid release (sometimes referred to as a frac-out) during HDD construction and to present steps to manage, control and minimize the impacts in the event that an inadvertent release of drilling fluid occurs. The objectives of this plan are to:

- Provide an overview of the HDD process with a specific focus on the composition, management and use of drilling fluids;
- Identify controls to be implemented during construction to minimize the potential of an inadvertent release;
- Identify the planned means of monitoring to permit early detection of inadvertent releases;
- Identify planned means to protect areas that are considered environmentally sensitive (rivers, wetlands, other biological resources or cultural resources);
- Establish site-specific environmental protection measures to be utilized prior to, during, and following drilling and conduit installation activities to minimize and control erosion and sediment releases to adjoining wetlands or watercourses;
- Have site specific preplanned general response programs in place at the start of construction that is understood and can be implemented immediately by all field crews in the event of an inadvertent release of drilling fluid occurs; and
- Establish a chain of command for reporting and notifying, in a timely manner, the construction management team, the Certificate Holders, and the proper authorities in the event of an inadvertent release of drilling fluid and of the preplanned mitigation actions that are to be implemented.

It is important to note that the plan in this document serves as the guiding framework for confirming that the HDD Construction Subcontractor (HDD Subcontractor) is adhering to the specifications and provisions to be protective of the environment. Since there are a variety of potential measures listed in this document available for preventing inadvertent releases and mitigating the effects of a release should one occur. The specifications require that each HDD Subcontractor submit to the project design team, for its review and acceptance, a supplemental site and HDD Subcontractor specific means and methods plan for each HDD crossing reaffirming and detailing how the HDD Subcontractor will conform with the requirements of this plan and the project specifications to prevent inadvertent releases and to mitigate any effects of a release should one occur. The supplemental plan by the HDD Subcontractor shall be consistent with the site conditions and constraints, and the Subcontractor's selected means, methods and equipment. The selected HDD Subcontractor will be responsible for incorporating specific permit

conditions, applicable regulatory requirements, site specific environmental features and geotechnical information not available at this time into its submittal. The submittal shall be reviewed and approved by the design team and the Environmental Inspector prior to the start of construction of a specific HDD location.

2.0 DESCRIPTION OF THE HDD PROCESS

The Horizontal Directional Drilling process begins by mechanically excavating shallow (approximately 5 feet wide by 10 feet long by 4 to 5 feet deep entry and exit pits at either end of the directional bore alignment within a designated work area. Typical work areas and equipment layouts are discussed in the Design Summary Report. However, final individual work areas and equipment layouts will be site specific and depend on the length of bore, size of drill rig to be used, and site constraints. A small diameter (on the order of 5 to 9 inches in diameter) pilot bore is then drilled from the entry pit using directional boring methods. During the pilot bore, a drilling fluid (typically bentonite and water based with selected, NSF certified, additives to improve and modify fluid stability, carrying capacity, and drilling properties to address site-specific ground characteristics and HDD Subcontractor preferences is pumped through nozzles in the drill head to support the hole and to hydraulically transport drill cuttings from the drill bit back to the entry pit. Environmentally acceptable (formally National Sanitation Foundation) NSF certified, additives are required by specification for use on this project and those planned for use by the HDD Subcontractor will be checked for compliance by the design team prior to their use.

A guidance system is mounted immediately behind the drilling head to allow the crew to track and steer the path of the drilling so that it follows the preplanned alignment within the specification's permitted tolerances. The drilling fluid holds the cuttings in suspension and carries the drill cuttings back through the annular space between the drill rods and the bore hole wall to the entry pit where it is collected and processed for re-used by a recycling system. The cuttings are separated from the bentonite, using screens, centrifuges, and desanding units which prepares the bentonite for re-use. Once the pilot bore reaches the exit pit, a larger diameter, back-reaming head is then attached to the drill string and pulled back through the pilot hole to enlarge the hole. Depending on the size of the conduit to be installed and the ground conditions, several successively larger reaming passes may be needed. Again, a bentonite and water slurry is pumped into the bore hole during reaming to remove cuttings and to stabilize the bore hole. Lastly, the

drill string is pulled back through the bore hole with the new, preassembled conduit attached to it in one continuous process until the lead end of the conduit emerges at the entry pit. Final reaming or swabbing and conduit pull back may be combined.

Specific to this plan, it is important to have an awareness of the function and composition of the HDD drilling fluids. The drilling fluid composition and drilling fluid management are integral components of the HDD process with the following primary purposes:

- Support and stabilize the drill hole,
- Suspend and transport the cuttings from drill bit through the drill hole annulus,
- Control fluid loss through the bore's side walls by forming a filter cake on the bore hole walls,
- Managing and modifying the drilling fluid mix to improve its cutting carrying characteristics, its pumpability, and its hole stabilization and support characteristics,
- Power the downhole cutting tools (e.g., via mud motors if required); and,
- Serve as a coolant and lubricant to the drill bit during the drilling process, and serve as a lubricant during the conduit insertion process.

The drilling fluids are composed primarily of potable water, which will likely be obtained from nearby sources selected and permitted by the HDD Subcontractor. As mentioned above, the drilling fluid also contains bentonite clay as a viscosifier. Bentonite is a naturally occurring, nontoxic, inert substance that meets NSF/ANSI 60 NSF Drinking Water Additives Standards and is frequently used for drilling potable water wells. While bentonite is non-toxic and commonly used in farming practices, it has the potential to impact plants, fish and their eggs if discharged to waterways in significant quantities. Frequently, additives are used to: amend the drilling fluid, improve its compatibility with the ground and groundwater chemical characteristics, improve its cutting suspension and carrying characteristics. Environmentally acceptable (i.e. NSF certified) additives are required by specification for this project and before the start of work at a specific HDD, the HDD Subcontractor is required to submit for each crossing, environmental and toxicity data including Safety Data Sheets (SDS) for review and acceptance by the design team.

During the HDD process and subsequent conduit insertion, the drilling fluid pumped downhole will tend to flow along the path of least resistance. Generally, this will be though the annulus between the drill string and the drill hole side wall. However, the bore alignment may encounter

ground conditions where the path of least resistance is an existing fracture, fissure, hole of anthropogenic origin, areas with low overburden confinement, areas of hole collapse, or coarse gravel zones in the soil or rock substrate. When this occurs, circulation can be lost or reduced. This is a common occurrence in the HDD process, but does not necessarily prevent completion of the bore or result in a release to the environment. However, the environment may be impacted if the fluid inadvertently releases to the surface at a location on a waterway's banks or within a waterway or wetland. Again, additives to amend the properties of the drilling fluid may be used as necessary to prevent and limit releases and losses through such paths of lower flow resistance.

3.0 ORGANIZATION AND STAFFING RESPONSIBILITIES

The organizational chart shown below lists the contact information of the principal organizations involved in this project. The remainder of Section 3 discusses the roles and responsibilities of these principal organizations.

Organizational Chart

Entity	Contact Information
Certificate Holders	Name, Title TDI Phone Email
Construction Manager	TBD
HDD Design Engineer Team	TDB - CHA contact
HDD Construction Subcontractor	TBD
Environmental Inspector	TBD
U.S. Army Corps of Engineers, New York District Office	USACE New York District Upstate Regulatory Field Office ATTN; CENAN-OP-UR, Bldg. 10, 3 rd Floor North 1 Buffington Street Watervliet, NY 12189-4000 518-266-6350 cenan.rfo@usace.army.mil
New York State Department of Public Service	Matthew Smith Department of Public Service Empire State Plz 3 Albany, NY 12223 (518) 402-5141 matthew.smith@dps.ny.gov
New York State Department of Environmental Conservation	Regional Office(s) Information NYSDEC REGION 5 Sub-Office Regional Permit Administrator 232 Golf Course Rd Warrensburg, NY 12885-1172 518-623-1281 dep.r5@dec.ny.gov
New York State Department of Environmental Conservation (Spills)	NYS Spill Hotline: 1-800-457-7362

3.1 **RESPONSIBILITIES OF VARIOUS ORGANIZATIONS**

The principal organizations involved in this project include the Regulatory Agencies, Certificate Holders, Design Engineer, HDD Construction Subcontractor, Construction Manager, and Environmental Inspector. The roles and responsibilities of the principal organizations are discussed in the following subsections and are shown in the organizational chart included above.

3.2 REGULATORY AGENCIES

The Certificate of Conditions issued by the NY Public Service Commission is the primary regulatory agency for the requirements associated with the project. The Champlain Hudson Power Express (CHPE) Route Project also has permits from the Department of Energy, and the US Army Corps of Engineers, and the New York Water Quality Certification. Various HDDs within this package take place within or adjacent to wetlands, underneath or adjacent to bodies of water, and underneath or adjacent to railroad tracks. Measures are discussed throughout this report to control/mitigate any potential releases before environmentally sensitive boundaries are reached or impacted.

3.3 CERTIFICATE HOLDERS

The project Certificate Holders are TDI. TDI's Project Manager will have the overall responsibility to coordinate this project for TDI. The Project Manager, will be responsible for correspondence and coordination among all parties and will have the authority to stop work as necessary.

3.4 DESIGN ENGINEER

The Front End Engineering and Design (FEED) Design Engineer for the HDD Design is CHA and Kiewit in collaboration with BCE. During construction, the yet to be confirmed Design Engineer during construction will be responsible for reviewing and approving required Subcontractor submittals, shop drawings, and material certificates. Power Engineers will also take responsibility for review and acceptance of submittals, and documenting the materials and methods used in performance of the construction work to document that the construction complies with the contract documents.

3.5 THIRD-PARTY ENGINEER

The Third-Party Engineer for the HDD inadvertent return analysis has yet to be confirmed. During construction, chosen Third Party engineer will be assisting Transmission Developers Inc. with the review of the HDD Subcontractors Inadvertent Release Plan and providing technical assistance as needed with the HDD installation.

3.6 CONSTRUCTION MANAGER

The Construction Manager for this project has yet to be selected. The Construction Manager will be responsible for on-site management of the project for the Certificate Holders to ensure overall Subcontractor compliance with the EM&CP documents, environmental permits, and, local and federal regulations.

3.7 HDD CONSTRUCTION SUBCONTRACTOR

The HDD Subcontractors for the various HDD crossing of this project have yet to be selected. The Subcontractor will be responsible for completion of the conduit installation by HDD methods in accordance with the design criteria, contract documents, environmental compliance permits and federal regulations. The Subcontractor will be expected to use the appropriate construction procedures and techniques to complete the project, including supplemental site specific and means and methods specific HDD Subcontractor-prepared Inadvertent Release Prevention and Contingency Plans reviewed and accepted by the design team for each crossing in accordance with the contract documents.

The HDD Drill Operator (Drill Operator) will be responsible for operating the HDD drill rig and observing and managing changes in annular fluid pressure or loss of circulation. The Drill Operator will communicate with other members of the drill crew as needed when issues arise. The Subcontractor will be responsible for developing the specific lines of communication within their organization and shall dedicate a responsible person(s) for monitoring and communicating inadvertent releases to the Construction Management team and Environmental Inspector.

3.8 Environmental Inspector

The Environmental Inspector for this project has not yet been determined. In general, the

Environmental Inspector will perform full-time observation and documentation during the HDD activities at a specific site. The Environmental Inspector will be responsible for coordination with all county, state and federal resource agencies, compliance with and changes to any environmental permits.

The Environmental Inspector shall have the authority to stop work when the environmental permit conditions are not being followed or when appropriate environmental precautions are being disregarded by the HDD Subcontractor.

3.9 LINES OF COMMUNICATION AND AUTHORITY

Formal lines of communication will generally follow the established lines of authority. However, open communications between all parties will be encouraged to facilitate more efficient communication and coordination.

3.10 TRAINING

The HDD Subcontractor will verify and document that all construction personnel have appropriate environmental training before they begin work. The Environmental Inspector will also conduct a project orientation meeting for staff assigned with specific roles during the HDD installation and will review the site-specific environmental concerns and permit conditions. The Certificate Holders and Design Engineer will also attend the orientation meeting to review the procedures that will be used to document inadvertent releases in accordance with the HDD specifications.

4.0 FLUID RELEASE MINIMIZATION MEASURES

4.1 GEOTECHNICAL INVESTIGATION

The first steps taken to minimize the potential risk of an inadvertent release included conducting a geotechnical investigation at the site to develop an understanding of the ground around the planned HDD bores. Test borings were conducted near the proposed cable alignment within or immediately adjacent to the HDD sites. We understand that each boring has been backfilled and sealed with cement or cement/bentonite grout, and located off the planned bore path, to limit the risk of a release through an abandoned bore hole during the HDD construction.

4.2 HDD DESIGN

Each HDD crossing is designed to reduce the potential risk of an inadvertent fluid release during construction. General design considerations for HDD include:

- Depth of cover during profile design (based on test borings) to limit the potential inadvertent break through to the water body, road, wetlands, or ground surface;
- Typically, potential exists for releases near the entry and exit pits of a bore. The distance where there is a potential for releases at the ends depends on the soil conditions, the slope of the ground surface and the length of the bore. Generally, the longer and deeper the bore the greater the slurry pressures required to hold the borehole open and to carry the cuttings back to the entry or exit pit;
- Specific provisions regarding exit pit design for underwater cable installation (i.e. via the use of temporary dredged cofferdams or steel conduit riser pipes for pressure relief);
- Generally, for the formation of inadvertent releases, the more critical stage of the HDD process tends to be during the initial pilot hole drilling when the annular space between the bore sidewall and the drill string is the smallest and therefore requires larger slurry pressures to overcome flow resistance to carry cuttings back to the entry pit;
- Adjusting the drill alignment to miss existing infrastructure including existing utilities, pile foundations, and other obstacles;
- Establishing a drill alignment line that allows for gradual angular changes to minimize pressure build-up and limit pull back stresses and bending stresses in the conduit, as well as being compatible with the bending capacity of the drill

steel;

- Requiring drilling fluid composition, flow rates, and drilling procedures that minimize drilling fluid pressures;
- Requiring drilling fluids that adequately address site-specific drilling concerns while posing the least threat to the environment;
- Use of conductor casings/conduits at the entry and exit ends of bores when ability of the ground to provide sufficient confinement to resist the drilling slurry pressures is expected;
- Requiring monitoring and controlling drilling fluid pressures with down-the-hole sensors during pilot hole drilling; and
- Requiring that, during the performance of any HDD waterbody crossing, contractors monitor the use of NSF certified drilling slurry additives (Article VII: General Condition No. 114 [m]) and, in the event of a detected release of fluid, implement the procedures specified in the approved EM&CP. For any release occurring in a waterbody, the Certificate Holders shall immediately notify DPS Staff and NYSDEC Region 5 Staff of details of the release and the course of action they recommend taking.

4.3 CONTINGENCY PLAN

As mentioned above, prior to construction the selected Subcontractor will be required to submit a supplemental site and Subcontractor-Specific Inadvertent Release Contingency Plan for review and approval by design team. The project specifications require that the following major elements be addressed in detail in the Subcontractor's Plan:

- Work plan and detailed description of the drilling program (details for executing pilot hole, reaming, pull-back operations, and schedule), this plan shall include necessary procedures for addressing problems that are typically encountered during HDD installations through the anticipated subsurface for each drill location and to prevent inadvertent releases of drilling slurry;
- Drilling fluid composition design and on-hand amendments to alter fluid properties to reduce pressures, potential for plugging, and seepage losses;
- Description of the planned drilling equipment and drill site layout;
- SDS information for all drilling fluid products proposed for use;
- Procedures for drilling fluid pressure control, and fluid and pressure loss monitoring and management to aid in prevention and the detection of an inadvertent release (i.e.,

metering of makeup water, recording of drilling fluid product quantities utilized, fluid return volumes, fluid and cuttings disposal quantities, turbidity of river water, etc.);

- Contingency plans for addressing inadvertent releases into wetlands, or other sensitive areas, which includes the specific procedures used to halt the release and then contain, clean-up, and remove materials from the release site;
- Notification procedures and chain-of-command in the event of a release;
- Criteria for evaluating the need for a drill hole abandonment and the associated plan for sealing the drill hole if abandoned;
- Drilling fluid management and disposal procedures;
- The work plan and detailed drilling program description should include documentation regarding site restoration, vegetation management, sedimentation and erosion control, and hazardous material usage (if applicable). The intended approach will be in compliance with those measures presented in the Project EM&CP.
- Notice shall be provided to residents, businesses, and building, structure, and facility (including underground, above ground and underwater facilities) owners and operators within one hundred (100) feet of any HDD staging area or trenching activity with an offer to inspect foundations before, during, and after construction. Additional detail regarding this notice, associated inspections, intended benefits, proof of notice, cost reimbursements and associated construction initiation schedule is included in General Condition 154.

In addition to providing a site-specific Inadvertent Release Contingency Plan, the specifications require that the Subcontractor implement the additional necessary safeguards to minimize the likelihood of a fluid release and management/control should a release occur. This includes having a readily available supply of spill response devices (containment booms, pumps, straw bales, silt fence, sediment logs, sandbags, vacuum trucks, and storage tanks) and any other materials or equipment necessary to contain and clean up inadvertent releases. To maximize protection to sensitive environmental areas these measures shall be pre-positioned at the site, readily available and operational prior to the start of any drilling. If needed, additional spill response measures shall be employed immediately, as secondary measures, in the event of a fluid release.

The workspace layout for HDD materials and equipment will be configured to reduce the likelihood of a release. Final dimensions and equipment layouts are to be adjusted based on actual space available and constraints shown on the drawings for each HDD crossing.

4.4 DRILLING FLUIDS MANAGEMENT

As described in the Project EM&CP document, drilling fluid (typically bentonite and water based with selected additives) will be NSF certified and all recycling and reuse regulations will be followed where applicable. The drilling fluid management system and subsequent disposal is the responsibility of the subcontractor performing the HDD. However, the drilling fluid management system and subsequent disposal will adhere to the following requirements:

- Drilling fluid will be processed through an initial cleaning that separates the solid materials from the fluid;
- Solids will be sifted out by a screening apparatus/system and the solids deposited into a rolloff or a dump truck and periodically transported off-site and disposed of at an approved disposal facility determined by the HDD construction subcontractor;
- Drilling fluid that is deemed unacceptable to be reused during construction or left over at the end of drilling will be collected and transferred into a tanker truck for disposal at an approved disposal facility determined by the HDD construction subcontractor;
- Petroleum-based fluids and other potentially hazardous materials associated with drilling operations that are spilled during HDD construction will be contained following the mitigation measures described in the SPCC (Appendix K of the EM&CP) and disposed of at an approved disposal facility as determined by the HDD construction subcontractor and included in the EM&CP;
- Supply of spill containment equipment and measures shall be maintained and readily available around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system, if used, to prevent spills into the surrounding environment. Pumps, vacuum trucks, and/or storage of sufficient size will be in place to contain excess drilling fluid; and,
- Under no circumstances will drilling fluid that has escaped containment be reused in the drilling system.

An overview of the drilling fluid system will be submitted to the Environmental Inspector for approval once determined and prior to any HDD installation activities. The role of the Environmental Inspector is discussed in Chapter 3 of the EM&CP.

4.5 EARLY FLUID RELEASE DETECTION

The HDD method has the potential for seepage or fluid loss into pervious geologic formations that the bore path crosses. This may occur due to the presence of fractures in the rock, low overburden confinement, or from seepage through porous soils such as coarse gravels or via prior exploratory boreholes. It is important to note that inadvertent releases of drilling fluid can occur even if the down-hole pressures are minimal. Subsurface conditions that could be conducive and lead to inadvertent releases or drill difficulties include:

- Highly permeable soil such as cobbles and gravel;
- Presence of rock joints, solution features, or other subsurface fractures;
- Considerable differences in the elevations of HDD entry and exit points (typically greater than 50 feet);
- Disturbed soil, such as unconsolidated fill;
- Soft/weak soils with low overburden confining capacity;
- Low density soils in areas where the HDD bore is relatively shallow;
- Longer bore alignments; and,
- The presence of archeological or anthropogenic features such as, existing wells, piles and culverts, in close proximity to the HDD bore that may provide a preferential path for the drilling slurry to escape from the bore path.

The risks associated with the above conditions at specific crossings are discussed in Section 9 of this report.

An experienced drill crew is the most effective approach to detecting reaction to drilling fluid seepage prior to a surface release. They can promptly stop the drilling, modifying the drilling fluid composition, fluid properties, and pressures to address indications of loss of drill fluid. The HDD Subcontractor is required to utilize experienced drill crews particularly in and adjacent to environmentally sensitive areas. The following factors can be used for identifying the potential for drill fluid release:

- The loss of pressure within the drill hole utilizing a downhole pressure monitoring system;
- A large rapid buildup of pressure within the drill hole utilizing a downhole pressure monitoring system or at the drill rig;
- A substantial reduction in the volume of return fluid (loss of circulation); and
- The lack of drill cuttings returning in the drill fluid

In addition to an experienced drill crew, the HDD Subcontractor will be required to perform periodic (at least twice a day) visual inspection and monitoring of the stream channel bottom and wetlands in the vicinity of the drill bit or reaming bit for signs of an inadvertent release. The Environmental Inspector will monitor the status of each HDD waterbody crossing while construction activities are underway until the crossing has been completed and the stream and stream banks have been restored. In the event of any potential or actual failure of the crossing, the Certificate Holders shall have engaged adequate staff, materials, and equipment to take necessary steps to prevent or avoid adverse environmental impacts. If visual monitoring indicates a potential release, additional measures such as turbidity measurements and bentonite accumulation measurements both upstream and downstream of the current active location of the drill bit are required.

5.0 INADVERTENT RELEASE MONITORING AND NOTIFICATIONS

The HDD Subcontractor is responsible for monitoring of the drilling operation to detect a potential inadvertent release by observing and documenting the flow characteristics of drilling fluid returns to the HDD entry/exit pits and by visual inspection along the drill path. If drilling fluid to the HDD entry/exit pits are lost, the Subcontractor shall implement the following steps:

- The Drill Operator will monitor and document pertinent drilling parameters and conditions and observe and monitor the drill path for evidence of an inadvertent release, if there is evidence (typically visual) of a release, the Subcontractor will be required to stop the drilling immediately;
- The Subcontractor shall notify the lead Environmental Inspector of any significant loss of drilling fluid returns at the drill rig; and, in the event of a detected release of drilling fluid during the performance of any HDD waterbody crossing, implement the procedures specified in the approved EM&CP. The Certificate Holders shall immediately notify New York State Department of Public Service (NYSDPS) Staff and New York State Department of Environmental Conservation of details of the release and the course of action they recommend taking.
- The subcontractor will take steps to modify the drill fluid properties and pressures to reduce the potential of drill fluid loss or release; and
- The Drill Operator will take steps to restore drilling fluid circulation in accordance with the requirements of the HDD technical specifications.

If a fluid release is identified, an immediate response is necessary and the Subcontractor is required to take proper corrective actions to minimize impacts, particularly to environmentally sensitive resources (e.g. watercourse, waterbodies, and wetlands).

6.0 INADVERTENT RELEASE RESPONSE (UPLAND AND ROAD AREAS)

A common reason for upward movement and release of drill fluid is a borehole collapse or blockage and a resulting increase in the pressure exerted by drill pumps. Lowering drill fluid pressure is a first step to limiting extent of a release and can be accomplished by stopping drill rig pumps and allowing pressure to bleed off. With no pumping pressure in the hole, surface seepage will generally stop immediately, then the Subcontractor can trip the drill steel back a selected distance and attempt to clear cuttings from the annulus to re-establish circulation.

The HDD Subcontractor will be required to contain/isolate and remove any fluid that has escaped to the ground or mudline surface. On land this can be done through use of berms, straw bales, shovels as needed, or silt fence to contain the release in conjunction with excavating a small sump pit and/or use of vacuum collection equipment, if needed. Sufficient spill-absorbent material will also be required on-site.

If a release is identified in an upland area, the Subcontractor will be required to respond immediately as described above to limit the extent of the release. After containment is established, cleanup and removal can be conducted by hand, with vacuum trucks, or other equipment. The Environmental Inspector will be present during clean up and removal activities, as they may need to be conducted outside of the pre-authorized temporary workspace areas. The Environmental Inspector, Construction Manager, and the HDD Subcontractor will work together closely to determine the best course of action for inadvertent releases occurring within upland areas.

Upon containment of the release, the HDD Subcontractor will be required to evaluate the cause of the seepage and develop mitigation strategies to limit the likelihood of recurrence. The location of the seepage and the area around the seep will be monitored upon the re-start of the HDD operations for changes in conditions. The segments of borehole nearest the entry and exit points and other areas of low overburden cover tend to be the most susceptible to surface seepage as they have the least amount of soil confinement. These locations will generally be in areas of dry land where seepage detection is easily identified and contained. If areas of high risk for inadvertent releases are identified during the HDD design phase, they can be protected from an uncontrolled release through use of strategically placed confinement/filter beds, straw bales, silt fence, or earth berms place prior to the start of drilling or the use of conductor conduits if at entry and exit areas.

7.0 INADVERTENT RELEASE RESPONSE (WETLAND, RAILROAD, AND OPEN WATER BODY AREAS)

For any release occurring in a waterbody, the Certificate Holders shall immediately notify DPS Staff and NYSDEC of details of the release and the course of action they recommend taking. During the performance of any HDD waterbody crossing, contractors monitor the use of NSF certified and approved drilling solution and, in the event of a detected release of fluid, implement the procedures specified in the approved EM&CP. If an inadvertent release occurs when working beneath the waterway, wetland, or railroad the HDD Subcontractor will be required to cease drilling operations and reduce pressures in borehole immediately, and notify the Environmental Inspector, the Railroad (if within railroad property), the construction management team and the Certificate Holders. The Environmental Inspector, with input from the Drill Operator, will evaluate the potential impact of the release on a site-specific basis and will determine the appropriate course of action. Prior to construction, the HDD Subcontractor is required to develop a detailed, site-specific submittal for general in-stream or in-rail response methods and pre-place necessary materials and equipment at or near the site prior to Specific response actions will be determined in consultation with the construction. Environmental Inspector and HDD Subcontractor and could include the following:

- Shutting down or slowing the drill fluid pumps;
- Modifying the drill fluid properties, add agents to reduce drilling fluid pressures and/or to plug/seal release path;
- Tripping the drill steel back a selected distance and attempt to clear cuttings from the annulus to re-establish circulation
- Stopping drilling activities for 24 hours to allow the bentonite in the subsurface pathways to gel and seal the pathways;
- Evaluate the current drill methods to identify site specific improvements to lower the risk of additional inadvertent releases and,
- Implementation of proper in-wetlands and in upland, road and railroad, handplaced sedimentation control measures including, but not limited to straw bales, vacuum trucks, silt curtains, containment cells, turbidity curtains, or if suitable, sand bags and confinement/filter beds. These activities will require that qualified construction personnel and other support equipment, and supplies be prepositioned and readily available at or near the site.
- Use of a relief well installed at the location of the release. A well or pit

equipped with a subsurface pump to control slurry pressures and future releases at that location by evacuating drilling fluid as it accumulates can also be used. The relief well can be utilized to immediately lower the borehole pressures in the event of an inadvertent release and later to control and manage the release as the drilling continues.

8.0 DRILL HOLE ABANDONMENT PLAN

In the event the HDD Subcontractor must abandon the drilled hole, a plan to fill the abandoned hole will be implemented as detailed in the HDD Subcontractor's supplemental Inadvertent Release Contingency Plan and an alternative plan/alignment for crossing shall be evaluated. If it becomes necessary to abandon a partially completed hole, the abandoned hole will be filled with a mixture of high-yield bentonite, water, and drill spoil. The first ten feet of the bore path will be compacted and filled with soil or a cement-bentonite mix to prevent future settlement. The Subcontractor submitted site-specific abandonment plan shall be approved by the Design Engineer and the Construction Manager prior to being performed in the field.

After the abandoned hole has been filled, an alternative entry and exit hole and bore path alignment will be evaluated by the HDD Subcontractor, Construction Manager, and the Design Engineer. The new alignment shall be offset from the abandoned hole by at least 10 feet (except at the ends where a 5- foot offset may be used) to help limit the risk of steering difficulties due to the presence of a hydraulic connection causing drill fluid loss to the abandoned hole.

9.0 CROSSING SPECIFIC DISCUSSION

9.1 HDD CROSSING #3

HDD #3 consists of two, straight (in plan view) HDD bores, approximately 1893 and 1894 feet long as shown in Appendix B. The HDD bores will pass approximately 35 feet below the estimated mudline (assuming a 5' water depth) to the east of CP Rail railroad tracks at the CP Whitehall yard. The approximate center of the HDD bores located under the open water is at latitude 43.5342°N and longitude -73.4078°W, in Whitehall, NY (see Appendix B). The ground surface elevations along the HDD path gently slope down from North to South starting at El. 127 and reaching El. 121. About 100' north of the entry, the drill passes underneath open water in a wetland with standing water at about El. 116 (reference datum NAVD 1988).

The bores will have both horizontal and vertical curves, but no segments of the bore path are designed with compound curves (segments with compound curves would have both horizontal and vertical curves). Given the presence of wetlands near/in the work areas, we recommend the use of barriers to contain potential releases to the ground surface near the exit pits and work area. The proposed work at this location must be constructed in accordance with the Article VII Certificate and associated EM&CP.

<u>Ground conditions at HDD #3</u> Based on the borings drilled for this project, the soil profile for the HDD #3 BoreAid analyses will be divided into three [3] layers: Medium dense poorly graded sand, medium stiff fat clay, and very soft to soft fat clay. The soil profiles used for BoreAid analyses of the HDDs in this segment are presented in Appendix A.

Specific design considerations for HDD #3 include:

• General depth of soil cover beneath the estimated mudline of the open water body hovers around 35 feet. Preliminary analysis of the bores, assuming typical drilling methods, indicates that the lowest maximum allowable pressure capacity in the middle of the bore is approximately 58 psi. The total circulating pressure estimated to occur in the bore in the middle portion is approximately 40 psi assumed standard HDD drilling methods. In the remainder of the bore the maximum allowable pressure ranges from approximately 0 to 78 psi and the approximate applied slurry pressure during drilling ranges from 0 to 50 psi. A sketch showing the maximum allowable pressure and the applied pressure is provided in the summary BoreAid analyses in the attached Appendix A.

- It appears that there is a potential for releases 10 to 30 feet at either end of the bore path. These should be relatively easily controlled through the use of conductive conduit, straw bales, silt fences, erosion control measures and vacuum trucks.
- The entry pits and entry work area have been located at the south end of the alignment as there appears to be more space for the assembly of the conduits.
- Generally, for the formation of inadvertent releases, the more critical stage of the HDD process tends to be during the initial pilot hole drilling when the annular space between the bore sidewall and the drill string is the smallest.
- Adjusting the drill alignment to miss existing infrastructure including existing utilities, and other obstacles,
- Establishing a drill alignment line that allows for gradual angular changes to minimize pressure build-up,
- Requiring drilling fluid composition and drilling procedures that minimize drilling fluid pressures,
- Requiring drilling fluids that adequately address site-specific drilling concerns while posing the least threat to the environment, and
- Requiring monitoring and controlling drilling fluid pressures with down-the-hole sensors during pilot hole drilling.

9.2 HDD CROSSING #4

HDD #4 consists of two, straight bores, approximately 628 and 650 feet long, located at the CP Railway east of Old Route 4 and west of the Champlain Hudson Canal. The bores pass underneath an 84" RCP with approximately a 16 to 17 foot clearance at approximately 43.5198°N and longitude -73.4116°W (approximately Sta. 15141+91), in Whitehall, NY (see Appendix B). The ground surface elevations along the HDD path gently undulates between El. 124 and El. 121 for the majority of the run before taking a dip to El. 114 at the southern end, approximately 70% through the alignment (reference datum NAVD 1988).

Given the presence of wetlands near/in the work areas, we recommend the use of barriers to contain potential releases to the ground surface near the exit pits and work area. The proposed work for HDD 4 must be constructed in accordance with the Article VII Certificate and associated EM&CP.

<u>Ground conditions at HDD #4</u> –Based on the borings drilled for this project, the soil profile for the HDD #4 BoreAid analyses will be divided into five [5] layers: Gravel, loose silt, medium stiff clay, and two layers of lower soft clays. The soil profiles used for BoreAid analyses of the HDDs in this segment are presented in Appendix A.

Specific design considerations for HDD #4 currently include:

- Depth of cover during profile design (based on soil borings) to limit the potential inadvertent break through to the water bodies, road, wetlands, or ground surface. General depth of cover under the 84" RCP is approximately 16 to 17 feet. Preliminary analyses of the bore indicate the lowest maximum allowable pressure capacity in the middle of the bores to be approximately 51 psi. The total circulating pressure estimated to occur in the middle portion of the bore is approximately 24 psi assuming standard HDD drilling methods. In the remainder of the bores the maximum allowable pressure ranges from approximately 0 to 74 psi and the approximate applied slurry pressure during drilling ranges from 0 to 29 psi. Sketches showing the maximum allowable pressure and the applied pressure is provided in the summary BoreAid analyses in the attached Appendix A.
- Generally, for the formation of inadvertent releases, the more critical stage of the HDD process tends to be during the initial pilot hole drilling when the annular space between the bore sidewall and the drill string is the smallest.
- It appears that there is a potential for releases 0 to 10 feet at the exit of the bore path. This should be relatively easily controlled through the use of conductive conduit, straw bales, silt fences, erosion control measures and vacuum trucks.
- Due to the work zones being located within wetlands, measures to mitigate the potential inadvertent release are required:
 - Barriers to contain the releases to the ground surface, railroad surface and provisions to clean it up (such as use of a vacuum truck).
 - In addition, down the hole slurry pressure monitoring and/or conductor casings may be implemented to limit the potential for releases depending on the details of the HDD Subcontractor's selected means and methods.
- Adjusting the drill alignment to miss existing infrastructure including existing utilities, and other obstacles,
- Establishing a drill alignment line that allows for gradual angular changes to minimize pressure build-up,

- Requiring drilling fluid composition and drilling procedures that minimize drilling fluid pressures,
- Requiring drilling fluids that adequately address site-specific drilling concerns while posing the least threat to the environment, and
- Requiring monitoring and controlling drilling fluid pressures with down-the-hole sensors during pilot hole drilling.

9.3 HDD CROSSING #4A

HDD #4A consists of two straight HDD bores, approximately 755 feet long, that cross from the west side of the CP Rail railroad tracks, under two sets of tracks, and to the east side approximately 500 feet east of the Champlain Canal. The bores cross underneath the tracks at a depth range between 33 to 34 feet at approximately latitude 43.5131°N and longitude -73.4135°W in Whitehall, NY (see Appendix B). The ground surface elevations along the HDD path gently builds from around El. 116 to El. 124 under the tracks and then gently back down to around El. 113 on the south end of the alignment (reference datum NAVD 1988). Given the presence of wetlands near/in the work areas, we recommend the use of barriers to contain potential releases to the ground surface near the exit pits and work area. The proposed work for HDD 4Amust be constructed in accordance with the Article VII Certificate and associated EM&CP.

<u>Ground conditions at HDD #4A</u> – The soil conditions at this location were estimated based on nearby borings since no subsurface investigations were conducted along the alignment. It is recommended that the HDD subcontractor drill a test boring at the start of construction at the HDD 4A site before starting the HDD to confirm the ground conditions. Based on the adjacent borings, the soil profile for HDD #4A BoreAid analysis was divided into three [3] layers: gravel, medium stiff lean clay, and very soft to soft fat clay. The soil profiles used for BoreAid analyses of the HDDs in this segment are presented in Appendix A.

Specific design considerations for HDD #4A currently include:

• Depth of cover during profile design (based on soil borings) to limit the potential inadvertent break through to the water bodies, rail, road, wetlands, or ground surface. General depths of cover under the rail are between 33 and 34 feet for both bore paths. Preliminary analyses of the bore indicate the

lowest maximum allowable pressure capacity in the middle of the bore to be approximately 49 psi. The total circulating pressure estimated to occur in the middle portion of the bore is approximately 19 psi assuming standard HDD drilling methods. In the remainder of the bores the maximum allowable pressure ranges from approximately 0 to 49 psi and the approximate applied slurry pressure during drilling ranges from 0 to 21 psi. Sketches showing the maximum allowable pressure and the applied pressure is provided in the summary BoreAid analyses in the attached Appendix A.

- It appears that a potential for releases in the starting and ending 0 to 35 feet of each bore near the entry and exit pits exists. These should be relatively easily controlled through the use of conductive conduit, straw bales, silt fences, erosion control measures and vacuum trucks.
- Due to the work zones being located within wetlands, measures to mitigate the potential inadvertent release are required:
 - Barriers to contain the releases to the ground surface, railroad surface and provisions to clean it up (such as use of a vacuum truck).
 - In addition, down the hole slurry pressure monitoring and/or conductor casings may be implemented to limit the potential for releases depending on the details of the HDD Subcontractor's selected means and methods.
- Generally, for the formation of inadvertent releases, the more critical stage of the HDD process tends to be during the initial pilot hole drilling when the annular space between the bore sidewall and the drill string is the smallest.
- Adjusting the drill alignment to miss existing infrastructure including existing utilities, and other obstacles,
- Establishing a drill alignment line that allows for gradual angular changes to minimize pressure build-up,
- Requiring drilling fluid composition and drilling procedures that minimize drilling fluid pressures,
- Requiring drilling fluids that adequately address site-specific drilling concerns while posing the least threat to the environment, and
- Requiring monitoring and controlling drilling fluid pressures with down-the-hole sensors during pilot hole drilling.

9.4 HDD CROSSING #5

HDD #5 consists of two, straight, HDD bores, approximately 735 and 760 feet long, both located on the East side of CP Rail railroad tracks in Whitehall, NY. The middle of both bores cross underneath an arm of the Champlain canal, using an assumed 5 foot water depth, between 21 to 22 feet below the estimated mudline between approximately latitude 43.5100°N and longitude - 73.4140°W in Whitehall, NY (see Appendix B). The ground surface elevations along the HDD path gently undulates around El. 117 to El. 124 aside from an El. drop to approximately El. 111 at the canal edges (reference datum NAVD 1988). The culverts have inverts at a range of El. 107.7 to El. 109.2 (reference datum NAVD 1988). The proposed work for HDD5 must be constructed in accordance with the Article VII Certificate and associated EM&CP.

<u>Ground conditions at HDD #5</u>–Based on the borings drilled for the project and the elevation and location of that bore, the soil profile for the HDD #5 BoreAid analyses will be divided into three [3] layers: gravel, medium stiff lean clay, and soft fat clay. The soil profiles used for BoreAid analyses of the HDDs in this segment are presented in Appendix A.

Specific design considerations for HDD #5 currently include:

- Depth of cover during profile design (based on soil borings) to limit the potential inadvertent break through to the water bodies, road, wetlands, or ground surface. General depths of cover under the estimated mudline are 21 to 22 feet for both bore paths. Preliminary analyses of the bore indicate the lowest maximum allowable pressure capacity in the middle of the bore to be approximately 54 psi. The total circulating pressure estimated to occur in the bore in the middle portion of the bore is approximately 25 psi assuming standard HDD drilling methods. In the remainder of the bores the maximum allowable pressure ranges from approximately 0 to 58 psi and the approximate applied slurry pressure during drilling ranges from 0 to 26 psi. Sketches showing the maximum allowable pressure and the applied pressure is provided in the summary BoreAid analyses in the attached Appendix A.
- It appears that a potential for releases in the ending 0 to 10 feet of each bore exists. This should be relatively easily controlled through the use of conductive conduit, straw bales, silt fences, erosion control measures and vacuum trucks.
- Generally, for the formation of inadvertent releases, the more critical stage of the HDD process tends to be during the initial pilot hole drilling when the annular space between the bore sidewall and the drill string is the smallest.

- Adjusting the drill alignment to miss existing infrastructure including existing utilities, and other obstacles,
- Establishing a drill alignment line that allows for gradual angular changes to minimize pressure build-up,
- Requiring drilling fluid composition and drilling procedures that minimize drilling fluid pressures,
- Requiring drilling fluids that adequately address site-specific drilling concerns while posing the least threat to the environment, and
- Requiring monitoring and controlling drilling fluid pressures with down-the-hole sensors during pilot hole drilling.

9.5 HDD CROSSING #6

HDD #6 consists of two horizontally curved HDD bores, approximately 1339 and 1453 feet long. Both bores ross CP Rail railroad tracks diagonally, curve, and then cross underneath a water way at an 84" RCP in Whitehall, NY. The bores pass underneath the tracks at a depth between 30 and 39 feet. The clearance underneath the estimated mudline at the 84" RCP is 20 feet at approximately latitude 43.4975°N and longitude -73.4207°W in Whitehall, NY (see Appendix B). The ground surface elevations along the HDD path ends hover around El. 120 with the tracks at the center of the path reaching a peak at El. 127 (reference datum NAVD 1988). The culvert invert ranges El. 112.3 (on the west side of the tracks) to El. 109.4 (on the east) (reference datum NAVD 1988).

The bores will have both horizontal and vertical curves, but no segments of the bore path are designed with compound curves (segments with compound curves would have both horizontal and vertical curves). Given the presence of wetlands near/in the work areas, we recommend the use of barriers to contain potential releases to the ground surface near the exit pits and work area. The proposed work for HDD 6 must be constructed in accordance with the Article VII Certificate and associated EM&CP.

<u>Ground conditions at HDD #6</u>–Based on the borings drilled for the project, the soil profile for the HDD #6 BoreAid analyses will be divided into five [5] layers: Loose silt, medium stiff lean clay, second layer of loose silt, poorly graded medium dense sand, and soft clay. The soil profiles used for BoreAid analyses of the HDDs in this segment are presented in Appendix A.

Specific design considerations for HDD #6 currently include:

- Depth of cover during profile design (based on soil borings) to limit the potential inadvertent break through to the water bodies, road, wetlands, or ground surface. General depths of cover under the CP Rail railroad tracks are 39 feet. Both bores cross underneath the waterway at the 84" RCP with a clearance of 20 feet under estimated mudline. Preliminary analyses of the bore indicate the lowest maximum allowable pressure capacity in the middle of bores to be approximately 53 psi. The total circulating pressure estimated to occur in the bore in the middle portion of the bore is approximately 30 psi assuming standard HDD drilling methods. In the remainder of the bores the maximum allowable pressure during drilling ranges from 0 to 38 psi. Sketches showing the maximum allowable pressure and the applied pressure is provided in the summary BoreAid analyses in the attached Appendix A.
- It appears that a potential for releases in the starting 5 to 10 feet of each bore and the ending 60 feet exists. This should be relatively easily controlled through the use of conductive conduit, straw bales, silt fences, erosion control measures and vacuum trucks.
- Due to the work zones being located within wetlands, measures to mitigate the potential inadvertent release are required:
 - Barriers to contain the releases to the ground surface, railroad surface and provisions to clean it up (such as use of a vacuum truck).
 - In addition, down the hole slurry pressure monitoring and/or conductor casings may be implemented to limit the potential for releases depending on the details of the HDD Subcontractor's selected means and methods.
- Generally, for the formation of inadvertent releases, the more critical stage of the HDD process tends to be during the initial pilot hole drilling when the annular space between the bore sidewall and the drill string is the smallest.
- Adjusting the drill alignment to miss existing infrastructure including existing utilities, and other obstacles,
- Establishing a drill alignment line that allows for gradual angular changes to minimize pressure build-up,
- Requiring drilling fluid composition and drilling procedures that minimize drilling fluid pressures,
- Requiring drilling fluids that adequately address site-specific drilling concerns while posing the least threat to the environment, and

• Requiring monitoring and controlling drilling fluid pressures with down-the-hole sensors during pilot hole drilling.

9.6 HDD CROSSING #7

HDD #7 consists of two, straight, HDD bores, approximately 1305 feet long, passing approximately 40 feet below estimated mullines of standing water/wetlands located approximately 55 to 74 feet west of CP Rail railroad tracks in Whitehall, NY. The bores run from approximately latitude 43.4903°N and longitude 73.4248°W to latitude 43.4869°N and longitude 73.4262°W, see Appendix B. The ground surface elevations along the HDD path gently undulates between El. 121 and El. 119 (reference datum NAVD 1988). The depth of water at this crossing is not known, a water depth of 5 feet was assumed for design purposes and analysis. Given the presence of wetlands in the work areas, we recommend the use of barriers to contain potential releases to the ground surface near the entry and exit pits and work area. The proposed work for HDD #7 must be constructed in accordance with the Article VII Certificate and associated EM&CP.

<u>Ground conditions at HDD #7</u>–Based on the borings drilled for the project and the elevation and location of that bore, the soil profile for the HDD #7 BoreAid analyses will be divided into three [3] layers: poorly graded medium dense sand, stiff lean clay, and soft to very soft fat clay. The soil profiles used for BoreAid analyses of the HDDs in this segment are presented in Appendix A.

Specific design considerations for HDD #7 currently include:

• Depth of cover during profile design (based on soil borings) to limit the potential inadvertent break through to the water bodies, road, wetlands, or ground surface. General depths of cover under the estimated mudline are 40 feet. Preliminary analyses of the bore indicate the lowest maximum allowable pressure capacity in the middle of the bore to be approximately 50 psi. The total circulating pressure estimated to occur in the middle portion of the bore is approximately 40 psi assuming standard HDD drilling methods. In the remainder of the bores the maximum allowable pressure ranges from approximately 0 to 60 psi and the approximate applied slurry pressure during drilling ranges from 0 to 47 psi. Sketches showing the maximum allowable pressure and the applied pressure is provided in the summary BoreAid analyses in the attached Appendix A.

- It appears that a potential for releases in the starting and ending 5 to 30 feet of each bore at the entry and exit pits exists. These should be relatively easy to control through the use of conductive conduits, strawbales, silt fences, erosion control measures and vacuum trucks.
- Due to the work zones being located within wetlands, measures to mitigate the potential inadvertent release are required:
 - Barriers to contain the releases to the ground surface, railroad surface and provisions to clean it up (such as use of a vacuum truck).
 - In addition, down the hole slurry pressure monitoring and/or conductor casings may be implemented to limit the potential for releases depending on the details of the HDD Subcontractor's selected means and methods.
- Generally, for the formation of inadvertent releases, the more critical stage of the HDD process tends to be during the initial pilot hole drilling when the annular space between the bore sidewall and the drill string is the smallest.
- Adjusting the drill alignment to miss existing infrastructure including existing utilities, and other obstacles,
- Establishing a drill alignment line that allows for gradual angular changes to minimize pressure build-up,
- Requiring drilling fluid composition and drilling procedures that minimize drilling fluid pressures,
- Requiring drilling fluids that adequately address site-specific drilling concerns while posing the least threat to the environment, and
- Requiring monitoring and controlling drilling fluid pressures with down-the-hole sensors during pilot hole drilling.

9.7 HDD CROSSING #8

HDD #8 consists of two straight HDD bores, approximately 655 and 838 feet long, both crossing from the western side of the CP Rail railroad tracks to the east side, located east of State Route 4 and west of N. Old Route 4. They will be passing approximately 29 feet (El 104) below the top of rail of the CP Railway and 17 feet below a 28"x48" box culvert in Whitehall, Washington County, New York. The bores run from approximately latitude 43.2847°N and longtidue 73.25451°W to latitude 43.2839°N and longitude 73.2547°W, see Appendix B. The ground surface elevations along the HDD path gently undulates between El. 133 and El. 129, with the

largest change in elevation occurring within the first 20% of the bores (reference datum NAVD 1988). The proposed work for HDD #8 must be constructed in accordance with the Article VII Certificate and associated EM&CP.

<u>Ground conditions at HDD #8</u>–Based on the borings drilled for this project, the soil profile for the HDD #8 BoreAid analyses will be divided into two [2] layers: Poorly graded sand and medium stiff fat clay. The soil profiles used for BoreAid analyses of the HDDs in this segment are presented in Appendix A.

Specific design considerations for HDD #8 currently include:

- Depth of cover during profile design (based on soil borings) to limit the potential inadvertent break through to the water bodies, road, wetlands, or ground surface. General depth of cover under the CP railway is 29 feet near the centers of the bore paths. Preliminary analyses of the bore indicate the lowest maximum allowable pressure capacity in the middle of the bore to be approximately 52 psi. The total circulating pressure estimated to occur in the bore in the middle portion of the bore is approximately 20 psi assuming standard HDD drilling methods. In the remainder of the bores the maximum allowable pressure ranges from approximately 0 to 65 psi and the approximate applied slurry pressure during drilling ranges from 0 to 25 psi. Sketches showing the maximum allowable pressure and the applied pressures for each conduit is provided in the summary BoreAid analyses in the attached Appendix A.
- It appears that a potential for releases in the starting and ending 5 to 20 feet of each bore near entry and exit pit exists. This should be relatively easily controlled through the use of conductive conduit, straw bales, silt fences, erosion control measures and vacuum trucks.
- Generally, for the formation of inadvertent releases, the more critical stage of the HDD process tends to be during the initial pilot hole drilling when the annular space between the bore sidewall and the drill string is the smallest.
- Adjusting the drill alignment to miss existing infrastructure including existing utilities, and other obstacles,
- Establishing a drill alignment line that allows for gradual angular changes to minimize pressure build-up,
- Requiring drilling fluid composition and drilling procedures that minimize drilling fluid pressures,
- Requiring drilling fluids that adequately address site-specific drilling concerns while

posing the least threat to the environment, and

- Requiring monitoring and controlling drilling fluid pressures with down-the-hole sensors during pilot hole drilling.
- Due to the work zones being located within wetlands, measures to mitigate the potential inadvertent release are required:
 - Barriers to contain the releases to the ground surface, railroad surface and provisions to clean it up (such as use of a vacuum truck).
- In addition, down the hole slurry pressure monitoring and/or conductor casings may be implemented to limit the potential for releases depending on the details of the HDD Subcontractor's selected means and methods.

Appendix A

BoreAid HDD Simulation Output



Generated Output

WARNING: The accuracy of the data obtained by the BoreAid® system is highly dependent upon accurate data gathering, data input and proper use of the software. Vermeer is not responsible for that information. BoreAid® data is not intended to replace the need for future on-site utility locating, measuring and verification procedures, which are essential for accurate placement of new underground installations and avoidance of existing utilities.

CALL YOUR ONE-CALL SYSTEM FIRST

WARNING: Always contact your local One-Call system before the start of your digging project. The BoreAid® system is intended to be used with other utility locating methods, such as the use of the One-Call system and the exposing of existing utilities by potholing.

Locate utilities before drilling. Call 811 (U.S. only) or 1-888-258-0808 (U.S. or Canada) or local utility companies or national regulating authority.

Before you start any digging project, do not forget to call the local One-Call system in your area and any utility company that does not subscribe to the One-Call system. For areas not represented by One-Call Systems International, contact the appropriate utility companies or national regulating authority to locate and mark the underground installations. If you do not call, you may have an accident or suffer injuries; cause interruption of services; damage the environment; or experience job delays.

OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.
	Designer:		General:	Project Summary
CHA	TAR	Start Date: 12-10-2021 End Date: 12-10-2021	HDD #3 - Conduit 1	

Description:

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Input Summary

(1894.40, 0 1894.40 ft HDPE IPS 10.750 in 9.0 1.19 in 15.00 ft 3.5 in (0.00, 0.00,
(0.00, 0.00,

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Soil Summary

Number of Layers: 3

Soil Layer #1 USCS, Sand (S), SM Depth: 11.60 ft Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3] Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CH Depth: 15.60 ft Unit Weight: 90.0000 (dry), 115.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 350.00, Coh: 6.90 [psi]

Soil Layer #3 USCS, Clay (C), CH Depth: 35.00 ft Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Bore Cross-Section View



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Bore Plan View



Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 3.32999992370605 psi Silo Width: 1.34400002161662 ft Borehole Diameter: 1.34400002161662 ft Internal Pressure: 0 psi Pipe Length: 1904.99 ft Pipe DR: 9 Pipe OD: 10" (10.75") Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi Classification: IPS 0.5

In-service Load
Summary

Deformed	Collapsed
10.8	22.1
18.4	18.4
3.3	3.3
0.0	0.0
29.2	40.4
2.944	6.018
0.132	0.132
0	0
3.076	6.150
131.2	181.9
	Deformed 10.8 18.4 3.3 0.0 29.2 2.944 0.132 0 3.076 131.2

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	32831.0	32831.0
Pullback Stress [psi]	915.6	915.6
Pullback Strain	1.592E-2	1.592E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	915.6	938.8
Tensile Strain	1.592E-2	1.678E-2

Net External Pressure = 25.6 [psi] Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	3.076	7.5	2.4	OK
Unconstrained Collapse [psi]	34.1	104.9	3.1	OK
Compressive Wall Stress [psi]	131.2	1150.0	8.8	OK
Installation Analysis				
	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	44.1	198.5	4.5	OK
Tensile Stress [psi]	938.8	1200.0	1.3	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	78.802 psi	61.984 psi
1	8.00 in	12.00 in	78.754 psi	61.797 psi
2	12.00 in	16.13 in	78.685 psi	61.535 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

Rheological model: Power-Law

Fluid Consistency Index (K): 63.17 Power Law Exponent (n): 0.14

Effective Viscosity (cP): 859.3

Virtual Site



















Generated Output

WARNING: The accuracy of the data obtained by the BoreAid® system is highly dependent upon accurate data gathering, data input and proper use of the software. Vermeer is not responsible for that information. BoreAid® data is not intended to replace the need for future on-site utility locating, measuring and verification procedures, which are essential for accurate placement of new underground installations and avoidance of existing utilities.

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Input Summary

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Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 3.32999992370605 psi Silo Width: 0.531000018119812 ft Borehole Diameter: 0.531000018119812 ft Internal Pressure: 0 psi Pipe Length: 1904.99 ft Pipe DR: 9 Pipe OD: 2" (2.375") Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi Classification: IPS 0.5

In-service Load
Summary

Deformed	Collapsed
7.4	22.1
18.4	18.4
3.3	3.3
0.0	0.0
25.8	40.4
2.019	6.018
0.029	0.029
0	0
2.048	6.047
116.0	181.9
	Deformed 7.4 18.4 3.3 0.0 25.8 2.019 0.029 0.029 0 2.048 2.048

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1712.1	1712.1
Pullback Stress [psi]	978.2	978.2
Pullback Strain	1.701E-2	1.701E-2
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	978.2	981.4
Tensile Strain	1.701E-2	1.717E-2

Net External Pressure = 25.6 [psi] Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	2.048	7.5	3.7	OK
Unconstrained Collapse [psi]	34.1	114.9	3.4	OK
Compressive Wall Stress [psi]	116.0	1150.0	9.9	OK
Installation Analysis				
	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	44.1	195.9	4.4	OK
Tensile Stress [psi]	981.4	1200.0	1.2	OK

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Generated Output

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Designer:	General:	Project Summary
TAR CHA	HDD #3 - Conduit 2 Start Date: 12-10-2021 End Date: 12-10-2021	

Description:

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Input Summary

(1894.40, 0.00, 1) 1894.40 ft HDPE IPS 10.750 in 9.0 1.19 in 15.00 ft 3.5 in (0.00, 0.00, 0.00)	End Coordinate Project Length Pipe Type OD Classification Pipe OD Pipe DR Pipe DR Pipe Thickness Rod Length Rod Diameter Drill Rig Location
(0.00, 0.00, 121.0	Start Coordinate

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Soil Summary

Number of Layers: 3

Soil Layer #1 USCS, Sand (S), SM Depth: 11.60 ft Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3] Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CH Depth: 15.60 ft Unit Weight: 90.0000 (dry), 115.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 350.00, Coh: 6.90 [psi]

Soil Layer #3 USCS, Clay (C), CH Depth: 35.00 ft Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Bore Cross-Section View



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Bore Plan View



Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 3.32999992370605 psi Silo Width: 1.34400002161662 ft Borehole Diameter: 1.34400002161662 ft Internal Pressure: 0 psi Pipe Length: 1904.99 ft Pipe DR: 9 Pipe OD: 10" (10.75") Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi Classification: IPS 0.5

In-service Load
Summary

Pressure [psi]	Deformed	Collapsed
Earth Pressure	6.6	21.6
Water Pressure	18.4	18.3
Surface Surcharge	3.3	3.3
Internal Pressure	0.0	0.0
Net Pressure	25.0	40.0
Deflection		
Earth Load Deflection	1.799	5.890
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.931	6.022
Compressive Stress [psi]		
Compressive Wall Stress	112.3	179.8

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	32821.6	32821.6
Pullback Stress [psi]	915.4	915.4
Pullback Strain	1.592E-2	1.592E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	915.4	938.5
Tensile Strain	1.592E-2	1.677E-2

Net External Pressure = 25.5 [psi] Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.931	7.5	3.9	OK
Unconstrained Collapse [psi]	34.0	116.2	3.4	ОК
Compressive Wall Stress [psi]	112.3	1150.0	10.2	OK
Installation Analysis	Calculated	Allowable	Factor of Safety	Check

·	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	44.0	198.5	4.5	OK
Tensile Stress [psi]	938.5	1200.0	1.3	OK

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Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	77.758 psi	62.450 psi
1	8.00 in	12.00 in	77.700 psi	62.270 psi
2	12.00 in	16.13 in	77.616 psi	62.017 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

Rheological model: Bingham-Plastic Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1202.0

Virtual Site
















Generated Output

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Input Summary

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Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 3.32999992370605 psi Silo Width: 0.531000018119812 ft Borehole Diameter: 0.531000018119812 ft Internal Pressure: 0 psi Pipe Length: 1904.99 ft Pipe DR: 9 Pipe OD: 2" (2.375") Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi Classification: IPS 0.5

In-service Load
Summary

Pressure [psi]	Deformed	Collapsed
Earth Pressure	2.9	21.6
Water Pressure	18.4	18.3
Surface Surcharge	3.3	3.3
Internal Pressure	0.0	0.0
Net Pressure	21.3	40.0
Deflection		
Earth Load Deflection	0.948	5.890
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.977	5.919
Compressive Stress [psi]		
Compressive Wall Stress	95.8	179.8

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1711.6	1711.6
Pullback Stress [psi]	978.0	978.0
Pullback Strain	1.701E-2	1.701E-2
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	978.0	981.1
Tensile Strain	1.701E-2	1.716E-2

Net External Pressure = 25.5 [psi] Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.977	7.5	7.7	ОК
Unconstrained Collapse [psi]	34.0	128.2	3.8	OK
Compressive Wall Stress [psi]	95.8	1150.0	12.0	OK
Installation Analysis				
Installation Analysis	Calculated	Allowable	Factor of Safety	Check

Tensile Stress [psi]

Unconstrained Collapse [psi]

0.014 44.0 981.1

> 7.5 195.9

524.3 4.5 1.2

OK OK

1200.0

Deflection [%]



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	CHA BLANK BLANK, BLANK BLANK BLANK Fax: BLANK BLANK BLANK	Ref: BLANKBLANKBLANKStart Date: 03-01-2Project Owner:Project Contractor:Project Consultant:BLANKBLANKBLANKBLANKBLANKBLANKBLANKBLANK	Project Summary General: HDD #4
ANK .	A ANK ANK, BLANK ANK BLANK ne: BLANK BLANK ANK	BLANK ANK t Date: 03-01-2022 Date: 03-01-2022 ANK ANK ANK	D #4

Input Summary

(021-70, 0.00	(051.40)
631.40 ft	631.40 f
HDPE	HDPE
IPS	IPS
10.750 in	10.750 i
9.0	9.0
1.19 in	1.19 in
15.00 ft	15.00 ft
3.5 in	3.5 in
(0.00, 0.00, 0	(0.00, 0.
(0.00, 0.00, 1	(0.00, 0.

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Soil Summary

Number of Layers: 5

Soil Layer #1 USCS, Gravel (G), GM Depth: 6.00 ft Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3] Phi: 37.00, S.M.: 1000.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Silt (M), ML Depth: 2.00 ft Unit Weight: 80.0000 (dry), 100.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 50.00, Coh: 4.40 [psi]

Soil Layer #3 USCS, Clay (C), CH Depth: 15.50 ft Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 300.00, Coh: 5.50 [psi]

Soil Layer #4 USCS, Clay (C), CH Depth: 6.50 ft Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Soil Layer #5 USCS, Clay (C), CH Depth: 10.00 ft Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Bore Cross-Section View







Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 0 psi Silo Width: 1.34400002161662 ft Borehole Diameter: 1.34400002161662 ft Internal Pressure: 0 psi Pipe Length: 645.00 ft Pipe DR: 9 Pipe OD: 10" (10.75") Classification: IPS Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi 0.5

In-service Load
Summary

Pressure [psi]	Deformed	Collapsed
Earth Pressure	6.8	14.8
Water Pressure	7.9	7.9
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	14.7	22.7
Deflection		
Earth Load Deflection	1.845	4.036
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.978	4.168
Compressive Stress [psi]		
Compressive Wall Stress	66.2	102.3

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	11031.9	11031.9
Pullback Stress [psi]	307.7	307.7
Pullback Strain	5.351E-3	5.351E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	307.7	332.6
Tensile Strain	5.351E-3	6.232E-3

Net External Pressure = 18.0 [psi] Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	61.383 psi	48.194 psi
1	8.00 in	12.00 in	61.145 psi	44.345 psi
2	12.00 in	16.13 in	60.810 psi	43.969 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3 Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1202.0

Virtual Site

















In-service Load
Summary

Pressure [psi]	Deformed	Collapsed
Earth Pressure	6.8	14.8
Water Pressure	7.9	7.9
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	14.7	22.7
Deflection		
Earth Load Deflection	1.845	4.036
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.978	4.168
Compressive Stress [psi]		
Compressive Wall Stress	66.2	102.3

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	11031.9	11031.9
Pullback Stress [psi]	307.7	307.7
Pullback Strain	5.351E-3	5.351E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	307.7	332.6
Tensile Strain	5.351E-3	6.232E-3

Net External Pressure = 18.0 [psi] Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.978	7.5	3.8	OK
Unconstrained Collapse [psi]	20.5	115.7	5.6	OK
Compressive Wall Stress [psi]	66.2	1150.0	17.4	OK
Installation Analysis				

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	30.5	237.4	7.8	OK
Tensile Stress [psi]	332.6	1200.0	3.6	OK

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Input Summary

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Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 0 psi Silo Width: 0.531000018119812 ft Borehole Diameter: 0.531000018119812 ft Internal Pressure: 0 psi Pipe Length: 645.00 ft Pipe DR: 9 Pipe OD: 2" (2.375") Classification: IPS Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi 0.5

In-servic
e Load S
Summary
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Deformed	Collapsed
6.8	14.8
7.9	7.9
0.0	0.0
0.0	0.0
14.7	22.7
1.845	4.036
0.029	0.029
0	0
1.875	4.065
66.2	102.3
	Deformed 6.8 7.9 0.0 0.0 14.7 1.845 0.029 0 1.875 1.875

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	648.1	648.1
Pullback Stress [psi]	370.3	370.3
Pullback Strain	6.440E-3	6.440E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	370.3	375.2
Tensile Strain	6.440E-3	6.623E-3

Net External Pressure = 18.0 [psi] Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

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Calculated Allowable	Factor of Safety	Check
1.875 7.5	4.0	OK
20.5 116.7	5.7	OK
66.7 1150.0	17.4	OK
Calculated Allowable 1.875 7.5 20.5 116.7 66.2 1150.0	Factor of Safety 4.0 5.7 17.4	Check OK OK

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	30.5	235.8	7.7	OK
Tensile Stress [psi]	375.2	1200.0	3.2	OK

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Generated Output

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HDD#4A
Ref: Washington County, NY Whitehall
Start Date: 02-28-2022
End Date: 02-28-2022
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CHA
MCS
CHA
BLANK
BLANK, BLANK
BLANK BLANK
Phone: BLANK
Fax: BLANK
BLANK
BLANK

Input Summary

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Soil Summary

Number of Layers: 3

Soil Layer #1 USCS, Gravel (G), GM Depth: 4.00 ft Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 100.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CL Depth: 8.00 ft Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 200.00, Coh: 7.30 [psi]

Soil Layer #3 USCS, Clay (C), CH Depth: 30.00 ft Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 200.00, Coh: 8.70 [psi]

Bore Cross-Section View



Bore Plan View



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Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 0 psi Silo Width: 1.34400002161662 ft Borehole Diameter: 1.34400002161662 ft Internal Pressure: 0 psi Pipe Length: 765.00 ft Pipe DR: 9 Pipe OD: 10" (10.75") Classification: IPS Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi 0.5

In-service Load
Summary

Pressure [psi]	Deformed	Collapsed
Earth Pressure	16.1	16.1
Water Pressure	10.2	10.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	26.3	26.3
Deflection		
Earth Load Deflection	4.378	4.378
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	4.510	4.510
Compressive Stress [psi]		
Compressive Wall Stress	118.4	118.4

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	12249.6	12249.6
Pullback Stress [psi]	341.6	341.6
Pullback Strain	5.941E-3	5.941E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	341.6	365.2
Tensile Strain	5.941E-3	6.799E-3

Net External Pressure = 18.7 [psi] Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	4.510	7.5	1.7	OK
Unconstrained Collapse [psi]	26.3	92.3	3.5	OK
Compressive Wall Stress [psi]	118.4	1150.0	9.7	OK
Installation Analysis	Calculated	Allowable	Factor of Safety	Check

Deflectio
n [%]

psi]

0.065 26.8 365.2

7.5 235.1 1200.0

115.8 8.8 3.3

OK OK

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Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	48.852 psi	62.230 psi
1	8.00 in	12.00 in	48.776 psi	62.135 psi
2	12.00 in	16.13 in	48.667 nsi	61.999 nsi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	3	15

Flow Rate (Q): 20.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3 Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 2378.4

Virtual Site











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Generated Output

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Input Summary

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Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 0 psi Silo Width: 0.531000018119812 ft Borehole Diameter: 0.531000018119812 ft Internal Pressure: 0 psi Pipe Length: 765.00 ft Pipe DR: 9 Pipe OD: 2" (2.375") Classification: IPS Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi 0.5

In-servic
e Load S
Summary
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Pressure [psi]	Deformed	Collapsed
Earth Pressure	16.1	16.1
Water Pressure	10.2	10.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	26.3	26.3
Deflection		
Earth Load Deflection	4.378	4.378
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	4.407	4.407
Compressive Stress [psi]		
Compressive Wall Stress	118.4	118.4

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	707.5	707.5
Pullback Stress [psi]	404.2	404.2
Pullback Strain	7.030E-3	7.030E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	404.2	407.7
Tensile Strain	7.030E-3	7.190E-3

Net External Pressure = 18.7 [psi] Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	4.407	7.5	1.7	ОК
Unconstrained Collapse [psi]	26.3	93.1	3.5	OK
Compressive Wall Stress [psi]	118.4	1150.0	9.7	OK
Installation Analysis	Calculated	Allowable	Factor of Safety	Check

Tensile Stress [psi]

Unconstrained Collapse [psi]

0.014 26.8 407.7

7.5 233.4 1200.0

2.9

524.3 8.7

OK OK

Deflection [%]



Generated Output

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Description:		Designer:			General:	Project Summary
	CHA	MCS	End Date: 02-28-2022	Start Date: 02-28-2022	HDD #5	

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Input Summary

rdinate (7 .ength 7] e 7] e 11 sification 11 sification 10 10 .ckness 1. .ckness 1. .ckness 1. .ckness 1. .cknest 1.	710.00, 0.00, 122.00) ft 10.00 ft DPE 98 98 0.750 in 0.750 in 0.750 ft 5.00 ft .5 in .00, 0.00, 0.00) ft
ordinate (0).00, 0.00, 123.02) ft

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Soil Summary

Number of Layers: 3

Soil Layer #1 USCS, Gravel (G), GM Depth: 4.00 ft Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 100.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CL Depth: 8.00 ft Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 200.00, Coh: 7.30 [psi]

Soil Layer #3 USCS, Clay (C), CH Depth: 30.00 ft Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 200.00, Coh: 8.70 [psi]

Bore Cross-Section View



Bore Plan View



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Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 0 psi Silo Width: 1.34400002161662 ft Borehole Diameter: 1.34400002161662 ft Internal Pressure: 0 psi Pipe Length: 720.00 ft Pipe DR: 9 Pipe OD: 10" (10.75") Classification: IPS Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi 0.5

In-service Load
Summary

Pressure [psi]	Deformed	Collapsed
Earth Pressure	11.6	11.6
Water Pressure	12.8	12.8
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	24.5	24.5
Deflection		
Earth Load Deflection	3.183	3.183
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	3.315	3.315
Compressive Stress [psi]		
Compressive Wall Stress	110.1	110.1

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	12466.7	12466.7
Pullback Stress [psi]	347.7	347.7
Pullback Strain	6.047E-3	6.047E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	347.7	372.7
Tensile Strain	6.047E-3	6.930E-3

Net External Pressure = 18.8 [psi] Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	3.315	7.5	2.3	OK
Unconstrained Collapse [psi]	25.4	103.3	4.1	OK
Compressive Wall Stress [psi]	110.1	1150.0	10.4	OK
Installation Analysis				
Installation Analysis	Calculated	Allowable	Factor of Safety	Check

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	35.4	235.3	6.6	OK
Tensile Stress [psi]	372.7	1200.0	3.2	OK

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Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
oilot Bore	0.00 in	8.00 in	58.142 psi	60.390 psi
	8.00 in	12.00 in	58.061 psi	60.307 psi
0	12.00 in	16.13 in	57.944 psi	60.188 psi

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Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	ω	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

Rheological model: Bingham-Plastic Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1202.0

Virtual Site



















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Input Summary

Start Coordinate End Coordinate Project Length Pipe Type OD Classification Pipe OD Pipe DR Pipe DR Pipe Thickness Rod Length Rod Diameter	(0.00, 0.00, 123.02) ft (710.00, 0.00, 122.00) ft 710.00 ft HDPE IPS 2.375 in 9.0 0.26 in 15.00 ft 3.5 in
Rod Diameter Drill Rig Location	3.5 in (0.00, 0.00, 0.00) ft

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Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 0 psi Silo Width: 0.531000018119812 ft Borehole Diameter: 0.531000018119812 ft Internal Pressure: 0 psi Pipe Length: 720.00 ft Pipe DR: 9 Pipe OD: 2" (2.375") Classification: IPS Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi 0.5
In-servic
e Load S
Summary
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Pressure [psi]	Deformed	Collapsed
Earth Pressure	11.6	11.6
Water Pressure	12.8	12.8
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	24.5	24.5
Deflection		
Earth Load Deflection	3.183	3.183
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	3.212	3.212
Compressive Stress [psi]		
Compressive Wall Stress	110.1	110.1

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	718.1	718.1
Pullback Stress [psi]	410.3	410.3
Pullback Strain	7.136E-3	7.136E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	410.3	415.2
Tensile Strain	7.136E-3	7.321E-3

Net External Pressure = 18.8 [psi] Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	3.212	7.5	2.3	ОК
Unconstrained Collapse [psi]	25.4	104.3	4.1	OK
Compressive Wall Stress [psi]	110.1	1150.0	10.4	OK
Installation Analysis				
Installation Analysis	Calculated	Allowable	Factor of Safety	Check

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	35.4	233.6	6.6	OK
Tensile Stress [psi]	415.2	1200.0	2.9	OK



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Project Summary	
General:	HDD #6
	Start Date: 02-24-2022
	End Date: 02-24-2022

Designer:

Description:

CHA

MCS/mdb

Noth to south

Input Summary

(1451.00, 0.00 1451.00 ft HDPE IPS 10.750 in 9.0 1.19 in 15.00 ft 3.5 in (0.00, 0.00, 0.0	End Coordinate Project Length Pipe Type OD Classification Pipe OD Pipe DR Pipe DR Pipe Thickness Rod Length Rod Diameter Drill Rig Location
(0.00, 0.00, 12	Start Coordinate

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Soil Summary

Number of Layers: 5

Soil Layer #1 USCS, Silt (M), ML From Assistant Unit Weight: 80.0000 (dry), 100.0000 (sat) [lb/ft3] Phi: 28.00, S.M.: 50.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CL From Assistant Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 300.00, Coh: 5.50 [psi]

Soil Layer #3 USCS, Silt (M), ML From Assistant Unit Weight: 80.0000 (dry), 100.0000 (sat) [lb/ft3] Phi: 28.00, S.M.: 50.00, Coh: 0.00 [psi]

Soil Layer #4 USCS, Sand (S), SP From Assistant Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3] Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

Soil Layer #5 USCS, Clay (C), CL From Assistant Unit Weight: 75.0000 (dry), 105.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 250.00, Coh: 4.30 [psi]





Bore Plan View



Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 0 psi Silo Width: 1.34400002161662 ft Borehole Diameter: 1.34400002161662 ft Internal Pressure: 0 psi Pipe Length: 1470.00 ft Pipe DR: 9 Pipe OD: 10" (10.75") Classification: IPS Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi 0.5

In-service Load
Summary

Pressure [psi]	Deformed	Collapsed
Earth Pressure	3.2	14.7
Water Pressure	12.2	12.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	15.4	26.9
Deflection		
Earth Load Deflection	1.694	4.199
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.826	4.331
Compressive Stress [psi]		
Compressive Wall Stress	69.1	120.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	24196.2	24196.2
Pullback Stress [psi]	674.8	674.8
Pullback Strain	1.174E-2	1.174E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	674.8	694.8
Tensile Strain	1.174E-2	1.253E-2

Net External Pressure = 20.2 [psi] Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.826	7.5	4.1	OK
Unconstrained Collapse [psi]	21.7	123.0	5.7	OK
Compressive Wall Stress [psi]	69.1	1150.0	16.6	OK
Installation Analysis	Calculated	Allowahle	Factor of Safety	Check

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	31.7	214.3	6.8	OK
Tensile Stress [psi]	694.8	1200.0	1.7	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	75.791 psi	85.829 psi
1	8.00 in	12.00 in	75.449 psi	84.758 psi
2	12.00 in	16.13 in	74.968 psi	83.299 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	ω	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3

Rheological model: Bingham-Plastic Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1202.0

Virtual Site



















Generated Output

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Input Summary

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Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 0 psi Silo Width: 0.531000018119812 ft Borehole Diameter: 0.531000018119812 ft Internal Pressure: 0 psi Pipe Length: 1470.00 ft Pipe DR: 9 Pipe OD: 2" (2.375") Classification: IPS Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi 0.5

In-servic
e Load S
Summary
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Pressure [psi]	Deformed	Collapsed
Earth Pressure	1.3	14.7
Water Pressure	12.2	12.2
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	13.5	26.9
Deflection		
Earth Load Deflection	1.694	4.199
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	1.723	4.229
Compressive Stress [psi]		
Compressive Wall Stress	60.5	120.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1290.6	1290.6
Pullback Stress [psi]	737.4	737.4
Pullback Strain	1.282E-2	1.282E-2
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	737.4	737.4
Tensile Strain	1.282E-2	1.292E-2

Net External Pressure = 20.2 [psi] Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	31.7	212.0	6.7	OK
Tensile Stress [psi]	737.4	1200.0	1.6	OK



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Description:	CHA CHA	Designer	End Date	Start Dat	General: HDD #7	Project Summary
			te: 02-23-2022	ate: 02-23-2022	7	

Input Summary

HDPE	Pipe Type
IPS	OD Classification
10.750 in	Pipe OD
9.0	Pipe DR
1.19 in	Pipe Thickness
15.00 ft	Rod Length
3.5 in	Rod Diameter
(0.00, 0.00, 0.00) ft	Drill Rig Location
(0.00, 0.00, 118.40) ft	Start Coordinate
(1305.00, 0.00, 124.40) ft	End Coordinate
1305.00 ft	Project Length

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Soil Summary

Number of Layers: 3

Soil Layer #1 USCS, Sand (S), SP From Assistant Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3] Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CL From Assistant Unit Weight: 100.0000 (dry), 120.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 400.00, Coh: 5.60 [psi]

Soil Layer #3 USCS, Clay (C), CH From Assistant Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 200.00, Coh: 3.10 [psi]

Bore Cross-Section View



Bore Plan View

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Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 0 psi Silo Width: 1.34400002161662 ft Borehole Diameter: 1.34400002161662 ft Internal Pressure: 0 psi Pipe Length: 1320.00 ft Pipe DR: 9 Pipe OD: 10" (10.75") Classification: IPS Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi 0.5

In-servic
e Load S
Summary
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Pressure [psi]	Deformed	Collapsed
Earth Pressure	13.7	16.8
Water Pressure	20.3	20.3
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	34.0	37.1
Deflection		
Earth Load Deflection	3.740	4.571
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	3.872	4.703
Compressive Stress [psi]		
Compressive Wall Stress	153.1	166.8

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	22225.7	22225.7
Pullback Stress [psi]	619.8	619.8
Pullback Strain	1.078E-2	1.078E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	619.8	642.8
Tensile Strain	1.078E-2	1.163E-2

Net External Pressure = 34.9 [psi] Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

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Deflection [%] 3.872 7.5 1.9 OK Unconstrained Collapse [psi] 36.0 97.7 2.7 OK Compressive Wall Stress [psi] 153.1 1150.0 7.5 OK		Calculated	Allowable	Factor of Safety	Check
Unconstrained Collapse [psi] 36.0 97.7 2.7 OK Compressive Wall Stress [psi] 153.1 1150.0 7.5 OK	Deflection [%]	3.872	7.5	1.9	OK
Compressive Wall Stress [psi] 153.1 1150.0 7.5 OK	Unconstrained Collapse [psi]	36.0	97.7	2.7	OK
	Compressive Wall Stress [psi]	153.1	1150.0	7.5	OK
Installation Analysis Calculated Allowable Factor of Safety Check	Installation Analysis	Calculated	Allowable	Factor of Safety	Check

Tensile Stress [psi]

Unconstrained Collapse [psi]

0.065 45.9

642.8

7.5 218.1 1200.0

115.8 4.7 1.9

OK OK

Deflection [%]

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	59.964 psi	53.067 psi
1	8.00 in	12.00 in	59.926 psi	53.023 psi
2	12.00 in	16.13 in	59.871 psi	52.961 psi

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	J	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.670 lb/ft3 Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1202.0





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Input Summary

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Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 0 psi Silo Width: 0.531000018119812 ft Borehole Diameter: 0.531000018119812 ft Internal Pressure: 0 psi Pipe Length: 1320.00 ft Pipe DR: 9 Pipe OD: 2" (2.375") Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi Classification: IPS 0.5

In-servic
e Load S
Summary
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Pressure [psi]	Deformed	Collapsed
Earth Pressure	13.7	16.8
Water Pressure	20.3	20.3
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	34.0	37.1
Deflection		
Earth Load Deflection	3.740	4.571
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	3.769	4.600
Compressive Stress [psi]		
Compressive Wall Stress	153.1	166.8

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1194.4	1194.4
Pullback Stress [psi]	682.5	682.5
Pullback Strain	1.187E-2	1.187E-2
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	682.5	685.4
Tensile Strain	1.187E-2	1.202E-2

Net External Pressure = 34.9 [psi] Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	3.769	7.5	2.0	OK
Unconstrained Collapse [psi]	36.0	98.6	2.7	OK
Compressive Wall Stress [psi]	153.1	1150.0	7.5	OK
Installation Analysis	Calculated	Allowable	Factor of Safety	Check

Tensile Stress [psi]

Unconstrained Collapse [psi]

0.014 45.9

685.4

7.5 216.0 1200.0

524.3 4.7 1.8

OK OK

Deflection [%]



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Designer:	General:	Project Summary
TAR CHA	HDD #8 - Conduit 1 Start Date: 12-10-2021 End Date: 12-10-2021	

Description:

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Input Summary

h 800.00 ft HDPE IPS 10.750 in 9.0 9.0 1.19 in 15.00 ft 3.5 in (0.00, 0.0	0, 0.00) ft
ate (0.00, 0.0	0.00. 130.00) ft
	NO 120 11\ A

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Soil Summary

Number of Layers: 2

Soil Layer #1 USCS, Sand (S), SP Depth: 6.00 ft Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3] Phi: 30.00, S.M.: 200.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CH Depth: 25.00 ft Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 300.00, Coh: 8.70 [psi]

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Bore Cross-Section View









Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 0 psi Silo Width: 1.34400002161662 ft Borehole Diameter: 1.34400002161662 ft Internal Pressure: 0 psi Pipe Length: 810.00 ft Pipe DR: 9 Pipe OD: 10" (10.75") Classification: IPS Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi 0.5

In-service Load
Summary

Pressure [psi]	Deformed	Collapsed
Earth Pressure	6.3	12.8
Water Pressure	8.0	8.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	14.4	20.9
Deflection		
Earth Load Deflection	1.728	3.499
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.860	3.631
Compressive Stress [psi]		
Compressive Wall Stress	64.6	93.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	13251.4	13251.4
Pullback Stress [psi]	369.6	369.6
Pullback Strain	6.427E-3	6.427E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	369.6	393.9
Tensile Strain	6.427E-3	7.298E-3

Net External Pressure = 18.6 [psi] Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.860	7.5	4.0	ОК
Unconstrained Collapse [psi]	17.6	116.9	6.6	OK
Compressive Wall Stress [psi]	64.6	1150.0	17.8	OK
Installation Analysis	Calculated	Allowable	Factor of Safety	Check

e	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	27.6	233.7	8.5	OK
Tensile Stress [psi]	393.9	1200.0	3.0	OK

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Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
oilot Bore	0.00 in	8.00 in	64.880 psi	60.219 psi
	8.00 in	12.00 in	64.710 psi	60.013 psi
	12.00 in	16.13 in	64.468 psi	59.722 psi

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Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	ω	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3 Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1202.0

Virtual Site

















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Generated Output

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Input Summary

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Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 0 psi Silo Width: 0.531000018119812 ft Borehole Diameter: 0.531000018119812 ft Internal Pressure: 0 psi Pipe Length: 810.00 ft Pipe DR: 9 Pipe OD: 2" (2.375") Classification: IPS Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi 0.5

In-service Load
Summary

Pressure [psi]	Deformed	Collapsed
Earth Pressure	6.3	12.8
Water Pressure	8.0	8.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	14.3	20.9
Deflection		
Earth Load Deflection	1.724	3.499
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	1.753	3.528
Compressive Stress [psi]		
Compressive Wall Stress	64.6	93.9

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	756.4	756.4
Pullback Stress [psi]	432.2	432.2
Pullback Strain	7.516E-3	7.516E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	432.2	436.5
Tensile Strain	7.516E-3	7.690E-3

Net External Pressure = 18.6 [psi] Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.753	7.5	4.3	OK
Unconstrained Collapse [psi]	17.6	118.0	6.7	OK
Compressive Wall Stress [psi]	64.6	1150.0	17.8	OK
Installation Analysis				
Installation Analysis	Calculated	Allowship	Factor of Safety	Check

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	27.6	231.9	8.4	OK
Tensile Stress [psi]	436.5	1200.0	2.7	OK

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Generated Output

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OSHA CFR 29 1926.651 requires that the estimated location of underground utilities be determined before beginning the excavation or underground drilling operation. When the actual excavation or bore approaches an estimated utility location, the exact location of the underground installation must be determined by a safe, acceptable and dependable method. If the utility cannot be precisely located, it must be shut off by the utility company.

Project Summary	
General:	HDD #8 - Conduit 2
	Start Date: 12-10-2021
	End Date: 12-10-2021
Designer:	TAR
	CHA
Description:	

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Input Summary

		End Coordinate Project Length Pipe Type OD Classification Pipe OD Pipe DR Pipe Thickness Rod Length Rod Diameter Drill Rig Location	(0.00, 0.00, 129.50) f 626.20 ft HDPE IPS 10.750 in 9.0 1.19 in 15.00 ft 3.5 in (0.00, 0.00, 0.00) ft
		End Coordinate	(626.20, 0.00, 129.50)
End Coordinate (626.20, 0.00, 129.50)	End Coordinate (626.20, 0.00, 129.30)	Project Length	626.20 ft
End Coordinate (626.20, 0.00, 129.50) Project Length 626.20 ft	End Coordinate (626.20, 0.00, 129.50) Project Length 626.20 ft	Pipe Type	HDPE
End Coordinate (626.20, 0.00, 129.50) Project Length 626.20 ft Pipe Type HDPE	End Coordinate (626.20, 0.00, 129.50) Project Length 626.20 ft Pipe Type HDPE	OD Classification	IPS
End Coordinate(626.20, 0.00, 129.50)Project Length626.20 ftPipe TypeHDPEOD ClassificationIPS	End Coordinate(626.20, 0.00, 129.30)Project Length626.20 ftPipe TypeHDPEOD ClassificationIPS	Pipe OD	10.750 in
End Coordinate(600, 000, 129.50)Project Length626.20 ftPipe TypeHDPEOD ClassificationIPSPipe OD10.750 in	End Coordinate(626.20, 0.00, 129.50)Project Length626.20 ftPipe TypeHDPEOD ClassificationIPSPipe OD10.750 in	Pipe DR	9.0
End Coordinate(600, 000, 129.50)Project Length626.20, 0.00, 129.50)Pripe Type626.20 ftPipe TypeHDPEOD ClassificationIPSPipe OD10.750 inPipe DR9.0	End Coordinate(626.20, 0.00, 129.50)Project Length626.20 ftPipe TypeHDPEOD ClassificationIPSPipe OD10.750 inPipe DR9.0	Pipe Thickness	1.19 in
End Coordinate(6000, 000, 129.50)Project Length626.20, 0.00, 129.50)Pipe Type626.20 ftPipe TypeHDPEOD ClassificationIPSPipe OD10.750 inPipe DR9.0Pipe Thickness1.19 in	End Coordinate(626.20, 0.00, 129.50)Project Length626.20 ftPipe TypeHDPEOD ClassificationIPSPipe OD10.750 inPipe DR9.0Pipe Thickness1.19 in	Rod Length	15.00 ft
End Coordinate(626.20, 0.00, 129.50)Project Length626.20 ftPipe TypeHDPEOD ClassificationIPSPipe OD10.750 inPipe DR9.0Pipe Thickness1.19 inRod Length15.00 ft	End Coordinate(626.20, 0.00, 129.50)Project Length626.20 ftPipe TypeHDPEOD ClassificationIPSPipe OD10.750 inPipe DR9.0Pipe Thickness1.19 inRod Length15.00 ft	Rod Diameter	3.5 in
End Coordinate(7000, 0000, 129.50)Project Length626.20, 0.00, 129.50)Pripe TypeHDPEOD ClassificationIPSPipe OD10.750 inPipe DR9.0Pipe Thickness1.19 inRod Length15.00 ftRod Diameter3.5 in	End Coordinate(626.20, 0.00, 129.50)Project Length626.20 ftPipe TypeHDPEOD ClassificationIPSPipe OD10.750 inPipe DR9.0Pipe Thickness1.19 inRod Length15.00 ftRod Diameter3.5 in	Drill Rig Location	(0.00, 0.00, 0.00) ft
End Coordinate(626.2Project Length626.2(Pipe TypeHDPEOD ClassificationIPSPipe OD10.75(Pipe DR9.0Pipe Thickness1.19 inRod Length15.00Rod Diameter3.5 inDrill Rig Location(0.00,	End Coordinate(626.2)Project Length626.2)Pipe TypeIDPEOD ClassificationIPSPipe OD10.75(Pipe DR9.0Pipe Thickness1.19 inRod Length15.00Rod Diameter3.5 inDrill Rig Location(0.00,		

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Soil Summary

Number of Layers: 2

Soil Layer #1 USCS, Sand (S), SP Depth: 6.00 ft Unit Weight: 105.0000 (dry), 115.0000 (sat) [lb/ft3] Phi: 30.00, S.M.: 200.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Clay (C), CH Depth: 25.00 ft Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3] Phi: 0.00, S.M.: 300.00, Coh: 8.70 [psi]

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Bore Plan View

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	550		JOJ		
	600		115.5 tt		
-	650		1 0.0j		

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Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 0 psi Silo Width: 1.34400002161662 ft Borehole Diameter: 1.34400002161662 ft Internal Pressure: 0 psi Pipe Length: 630.00 ft Pipe DR: 9 Pipe OD: 10" (10.75") Classification: IPS Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi 0.5

In-servic
e Load S
Summary
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Pressure [psi]	Deformed	Collapsed
Earth Pressure	5.9	13.0
Water Pressure	8.0	8.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	14.0	21.0
Deflection		
Earth Load Deflection	1.620	3.530
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.752	3.662
Compressive Stress [psi]		
Compressive Wall Stress	62.9	94.4

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	10437.4	10437.4
Pullback Stress [psi]	291.1	291.1
Pullback Strain	5.062E-3	5.062E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	291.1	314.0
Tensile Strain	5.062E-3	5.908E-3

Net External Pressure = 16.9 [psi] Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.752	7.5	4.3	ОК
Unconstrained Collapse [psi]	16.8	118.0	7.0	ОК
Compressive Wall Stress [psi]	62.9	1150.0	18.3	OK
Installation Analysis	Calculated	Allowable	Factor of Safety	Check

·	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	26.7	238.3	8.9	OK
Tensile Stress [psi]	314.0	1200.0	3.8	OK

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Maximum Allowable Bore Pressure Summary

keam Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
lot Bore	0.00 in	8.00 in	65.109 psi	60.334 psi
	8.00 in	12.00 in	64.940 psi	60.130 psi
	12.00 in	16.13 in	64.700 psi	59.842 psi

-

Note: The maximum bore pressures presented in this table are the maximum values along the length of the bore and not the maximum allowable at any point. The estimated maximum pressures should be compared to the estimated circulating pressures along the bore to determine potential locations of inadvertant returns.

Estimated Circulating Pressure Summary

Active	Shear Rate [rpm]	Shear Stress [Fann Degrees]
No	600	37
No	300	32
No	200	29
Yes	100	25
Yes	6	17
No	ω	15

Flow Rate (Q): 40.00 US (liquid) gallon/min

Drill Fluid Density: 68.700 lb/ft3 Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1202.0

Virtual Site



















Generated Output

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Input Summary

Drill Rig Location	(0.00, 0.00, 0.00) ft
Rod Diameter	3.5 in
Rod Length	15.00 ft
ipe Thickness	0.26 in
ipe DR	9.0
ipe OD	2.375 in
DD Classification	IPS
ipe Type	HDPE
Project Length	626.20 ft
End Coordinate	(626.20, 0.00, 129.50) ft
Start Coordinate	(0.00, 0.00, 130.11) ft

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Load Verifier Input Summary:

Ballast Unit Weight: 62.42746 lb/ft3 Hydrokinetic Pressure: 10 psi Slurry Unit Weight: 93.64118 lb/ft3 Pipe-soil friction angle: 30 Surface-pipe friction coefficient in borehole: 0.3 Surface-pipe friction coefficient at entrance: Allowable Compressive Stress (Short Term): 1150 psi Allowable Tensile Stress (Long Term): 1100 psi Allowable Tensile Stress (Short Term): 1200 psi Pipe Unit Weight: 59.30500 lb/ft3 Short Term Poisson Ratio: 0.35 Short Term Modulus: 57500 psi Surface Surcharge: 0 psi Silo Width: 0.531000018119812 ft Borehole Diameter: 0.531000018119812 ft Internal Pressure: 0 psi Pipe Length: 630.00 ft Pipe DR: 9 Pipe OD: 2" (2.375") Classification: IPS Pipe Type: HDPE Pipe Application: Electrical Cable Allowable Compressive Stress (Long Term): 1150 psi Long Term Poisson Ratio: 0.45 Long Term Modulus: 28200 psi 0.5

In-servic
e Load S
Summary
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Pressure [psi]	Deformed	Collapsed
Earth Pressure	5.9	13.0
Water Pressure	8.0	8.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	14.0	21.0
Deflection		
Earth Load Deflection	1.620	3.530
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	1.649	3.559
Compressive Stress [psi]		
Compressive Wall Stress	62.9	94.4

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	619.0	619.0
Pullback Stress [psi]	353.7	353.7
Pullback Strain	6.151E-3	6.151E-3
Bending Stress [psi]	0.0	5.7
Bending Strain	0	9.896E-5
Tensile Stress [psi]	353.7	356.5
Tensile Strain	6.151E-3	6.299E-3

Net External Pressure = 16.9 [psi] Buoyant Deflection = 0.0

Hydrokinetic Force = 137.3 lb

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	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.649	7.5	4.5	ОК
Unconstrained Collapse [psi]	16.8	119.1	7.1	OK
Compressive Wall Stress [psi]	62.9	1150.0	18.3	OK
Installation Analysis				
Installation Analysis	Calculated	Allowable	Factor of Safety	Check

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	26.7	236.6	8.8	OK
Tensile Stress [psi]	356.5	1200.0	3.4	OK

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Appendix B

HDD Design Drawings



III Winners Circle, PO Box 5269 Albany, NY 12205-0269 518.453.4500 . www.chacompanies.com

Champlain Hudson

Power Express

1. THE USE OF CONDUCTOR CASINGS IS RECOMMENDED TO MITIGATE THE POTENTIAL RELEASES OF THE DRILLING FLUIDS DUE TO THE LIMITED DEPTH OF COVER UNDER THE

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION. JTM JPR 0 12/16/2022 FINAL EM&CP SUBMISSION DB APP No. DATE SUBMITTAL / REVISION DESCRIPTION

			SCALE	ASI		
_		- ,				C-301
PL	AN AND PR	OFILE - HDD 3.	COND	UIT 1		066076 DRAWING NO.
MENT	3 (PACKA	GE 1C) WHITE	HALL T	O FORT		CHA PROJECT NO.
HAMF	PLAIN HL	IDSON POW	ER E	XPRES	SS	KIEWIT PROJECT NO. 21162
	3D strip logs have n	o exaggeration		Table	Water	able after drilling
	2D strip logs shown at	10x exaggeration		Water Table Delayed Water	Water	Table during drilling
				Weathered Rock		Undefined
overy %/R	QD % = 95%/90%	11000psi =UCS		Water		Water
w Counts p	per 6" = 10-10-10			Void		Void
	(77)			USGS 718		Granite 1
	<u></u> <u></u> <u></u> <u>_</u> <u>_</u> <u>_</u> <u>_</u> <u></u>	1		USGS 708		Gneiss
	BORING LOG S	TRIP LEGEND		USGS 708		Gneiss
				USGS 705		Schist
				USGS 705		Schist
				USGS 702		Quartzite
				USGS 670	Interbedo	ded Sandstone and Shale
				USGS 654		Subgraywacke
				USGS 601	Grave	el or Conglomerate 1
				Topsoil		Topsoil
				SW-SM	Well G	raded SAND with SILT
				SM-2C	Well G	raded SAND with CLAY
				5K-2M		/ell graded SAND
			· · ·	SP-SU SP-SM	Poorty	Graded SAND with SILT
				5P_50	Poorly	Graded SAND with CLAY
				SM		SILTY SAND
				SILTSTONE		Siltstone
				SHALE		Shale
				SC-SM	5	ILT, CLAYEY SAND
			: /. :/	SC		CLAYEY SAND
				Sandstone		Sandstone
				Rock		Rock
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				۵W		aded GRAVEL
				GP-GM	Poorly G	raded GRAVEL with SILT
				GP-GC	Poorly G	raded Gravel with CLAY
			00	GP	Poo	rly Graded GRAVEL
			55	GM		SILTY GRAVEL
			55	GC-GM	SIL	TY CLAYEY GRAVEL
			EXC3	GC		CLAYEY GRAVEL
				Fill		Fill
				UL-ML 		Concrete
			<u> </u>			Lean CLAY
			<u> , </u>	CH-MH		SILTY Fat CLAY
				СН		Fat CLAY
				Boulder		Boulder
				Bedrock		Bedrock



Champlain Hudson

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AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A						1
SPECIFIC DESCRIPTION OF THE ALTERATION.	0	12/16/2022	FINAL EM&CP SUBMISSION	JTM	JPR	
	No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP	DR

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Power Express

1) THE USE OF CONDUCTOR CASINGS IS RECOMMENDED TO MITIGATE THE POTENTIAL RELEASES OF DRILLING FLUIDS DUE TO THE LIMITED DEPTH OF COVER UNDER THE MUDLINE.

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION. 12/16/2022 FINAL EM&CP SUBMISSION JTM JPR 0 DB APP No. DATE SUBMITTAL / REVISION DESCRIPTION

		CL	Lean CLAY	
		CL-ML	SILTY CLAY	
		CONCRETE	Concrete	
		Fill	Fill	
	P Y S			
			ULATET UKAVEL	
	00	GC-GM	SILTY CLAYEY GRAVEL	
	00	GM	SILTY GRAVEL	
	00	GP	Poorly Graded GRAVEL	
	Prov	GP-GC	Poorly Graded Gravel with CLAY	
	Phra	GR_GM	Poorly Graded GRAVEL with SILT	
	20			
		GW	Well Graded GRAVEL	
		GW-GC	Well Graded GRAVEL with CLAY	
		GW-GM	Well Graded GRAVEL with SILT	
		Limestone	Limestone	
		МН	Flostic SILT	
		ML	SILI	
		DH	ORGANIC Fat CLAY	
		DL	ORGANIC Lean CLAY	
	S.S.A	OL/OH	ORGANIC SOIL	
		PT	PFAT	
		Doct	Port	
		RUCK	RULK	
		Sandstone	Sandstone	
		SC	CLAYEY SAND	
		SC-SM	SILT, CLAYEY SAND	
		SHALE	Shale	
		SILTSTONE	Siltstone	
		M		
		25	Poorty Graded SAND	
	. /	SP-SC	Poorly Graded SAND with CLAY	
		SP-SM	Poorly Graded SAND with SILT	
		SW	Well graded SAND	
		SM-SC	Well Graded SAND with CLAY	
		M2-\//2	Well Graded SAND with STIT	
		Tappall		
		ropson	Ιορεοίι	
		USGS 601	Gravel or Conglomerate 1	
		USGS 654	Subgraywacke	
		USGS 670	Interbedded Sandstone and Shale	
			Quortzite	
	NTTX N	0303 702		
		0262 /05	Schist	
		USGS 705	Schist	
BORING LOG STRIP LEGEND		USGS 708	Gneiss	
		USGS 708	Gneiss	
r / / /		USGS 718	Granite 1	
w Counts per 6" = 10.40.40 $\left \right $		Vold		
overy %/KQD % = 95%/90% 11000psi =0CS		Water	Water	
		Weathered Rock	Undefined	
ے <u>۔</u> 2D strip logs shown at 10x exaggeration		Water Table	Water Table during drilling	
3D strip logs have no exaggeration		Delayed Water	Water Table after drilling	
AMPLAIN HUDSON POW	ER E	EXPRES	SS KIEWIT PROJECT NO. 21162	
MENT 3 (PACKAGE 1C.) WHITEH	ΔΙΙ Τ		ANN CHA PROJECT NO.	
			066076	
			DRAWING NO.	
	JONL	0112	C-301A	
PLAN AND PROFILE - HDD 3, (0-30 IA	
PLAN AND PROFILE - HDD 3, (SCALE	AS	NOTED DATE 12/16/2	2022

Legend

Asphalt

Bedrock

Boulder

Fat CLAY

ASPHALT

Bedrock

Boulder

СН

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Champlain Hudson

Power Express

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IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED							S
PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED. THE ALTERING ENCINEER ADDITECT LANDSCAPE							
ARCHITECT, OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A							-
SPECIFIC DESCRIPTION OF THE ALTERATION.		0	12/16/2022	FINAL EM&CP SUBMISSION	JTM	JPR	1
	N	No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP	DR/

		CL	
PROPOSED		CL-ML	
7,877 SF		CONCRETE	
WORKZONE	\mathbf{X}	Fill	
	30	GC	
170	00	GC-GM	
	00	GM	
	00	GP	
- 125	00	GP-GC	Poor
	00	GP-GM	Poorl
		GW	
		GW-GC	Well
A	66	GW-GM	Well
- FNTRY POINT		Limestone	
CP RAIL CANADIAN MAINLINE		МН	
MP 76.42		ML	
		DH	
PROPOSED 5'X10'X5'	<u> </u>	OL	
ENTRY PIT	550	OL/OH	
	<u>///</u> и_и_и_и	PT	
- 100		Rock	
- 200' RADIUS OVERBEND TO		Sandstone	
BE EXCAVATED (POST HDD)	· ·/·	SC	
	· · · · ·	SC-SM	
	· · / - ·	SHALE	
- 90		STL TSTONE	
		SM	
	 		Poor
		SP-SM	Pool
- 80		51 511 SW	
		SW-SC	we Wo
			we
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0 20+00 20+30	<u> </u>		
		0363 670	Inter
BORING LOG STRIP LEGEND		0303 708	
B101		0202 708	
	$\left[-\right]$	0565 /18	
		Void	
Recovery %/RQD % = 95%/90% I TUUUPSI =UCS		Water	
		Weathered Rock	
2D strip logs shown at 10x exaggeration		Water Table Delayed Water	W c
3D strip logs have no exaggeration	\Box	Table	W d
		YDDEC	20
			5
EGMENT 3 (PACKAGE 1C) WHITEHA	ALL T	O FORT	ANN
PLAN AND PROFILE - HDD 3, C	UNL	JUH 2	

		Legend
	ASPHALT	Asphalt
	Bedrock	Bedrock
· 🔷 • · · ·	Boulder	Boulder
	СН	Fat CLAY
	СН-МН	SILTY Fat CLAY
$\gamma \gamma$	CL	Lean CLAY
	CL-ML	SILTY CLAY
/	CONCRETE	Concrete
\mathbf{X}	Fill	Fill
1	60	CLAYEY GRAVEL
	<u>БС</u> -БМ	
10	GM	SILTY GRAVEL
	GP	Poorly Graded GRAVEL
		Poorly Graded Gravel with CLAY
		Poonly Graded GRAVEL with SILT
10		FOUND GRADER GRAVEL WITH SILT
		well uraded URAVEL with CLAY
	ы₩-6М	well Graded GRAVEL with SILT
	Limestone	Limestone
	MH	Elastic SILT
	ML	SILT
	DH	ORGANIC Fat CLAY
	OL	ORGANIC Lean CLAY
, de de	OL/OH	ORGANIC SOIL
1,	PT	PEAT
	Rock	Rock
	Sandstone	Sandstone
	SC	CLAYEY SAND
	SC-SM	SILT, CLAYEY SAND
	SHALE	Shale
Х	SILTSTONE	Siltstone
	SM	SILTY SAND
111	SP	Poorly Graded SAND
/	SP-SC	Poorly Graded SAND with CLAY
	SP-SM	Poorly Graded SAND with SILT
Â	SM	Well graded SAND
/ ^	SW-SC	Well Graded SAND with CLAY
	SW-SM	Well Graded SAND with SILT
\mathbf{X}	Topsoil	Topsoil
× ×)	USGS 601	Gravel or Conglomerate 1
	USGS 654	Subgraywacke
	USGS 670	Interbedded Sandstone and Shale
	USGS 702	Quartzite
11.1	US68 705	Schist
		Schiet
		Gnoice
<u>{ ~~</u>		
- : 1		
	Void	Void
	Water	Water
<u> </u>	weathered Rock	Undefined
⊻	Water Table Delaved Water	water lable during drilling
V	Table	Water lable after drilling
		KIEWIT PROJECT NO

В

SCALE RAWN BY: JAS DESIGNED BY: JAS APPROVED BY: JEO REV. NO. AS NOTED DATE

12/16/2022 XXX

21162 CHA PROJECT NO.

> 066076 DRAWING NO.

C-301A.1

















PROPOSED HDD 4 PROFILE CONDUIT 1

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	H	HHH	HHH	F.
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		<u>LOW</u>	<u></u>	
		15149+00		151
appending and a second	<u> </u>	<u> <u> </u></u>	North Carl	
CP RAIL HORIZONTAL CLEARANCE BOUNDARY				
			Legend	
		ASPHALT	Aspho	lt
	- · · · · · · · · · · · · · · · · · · ·	Boulder	Bould	er
		СН	Fat Cl	
		CL	Lean C	LAY
		CL-ML	SILTY (CLAY
		Fill	Fill	. •C
		GC GC-GM	CLAYEY G SILTY CLAYE	ravel í gravel
		GM	SILTY GR	AVEL
	00	GP GP-GC	Poorly Grade Poorly Graded Gr	d GRAVEL avel with CLAY
	00	GP-GM	Poorly Graded GR	AVEL with SILT
		GW GW-GC	Well Gradeo Well Graded GRAN	GRAVEL /EL with CLAY
130	23	G₩-GM	Well Graded GRA	/EL with SILT
405		Limestone MH	Limest Elastic	SILT
125		ML	SIL	
120		OL	ORGANIC Le	an CLAY
		OL/OH	DRGANIC	SOIL
115		Rock	Rock	<
110	······································	Sandstone	Sandst CLAYEY	one Sand
		SC-SM	SILT, CLAYI	EY SAND
105	$\overline{\mathbf{X}}$	SHALE	Shal Siltsto	e one
100		SM	SILTY S	AND
		SP SP-SC	Poorly Grad Poorly Graded Si	AND with CLAY
95		SP-SM	Poorly Graded S	AND with SILT
90		SW-SC	Well Graded SAI	ND with CLAY
		SW-SM Topsoil	Well Graded SA	ND with SILT
85 50		USGS 601	Gravel or Con	glomerate 1
		USGS 654 USGS 670	Subgray	vacke tone and Shale
		USGS 702	Quartz	ite
		USGS 705 USGS 705	Schis Schis	t t
BORING LOG STRIP LEGEND		USGS 708	Gneis	S
B101		USGS 708 USGS 718	Gneis Granit	5 e 1
pw Counts per 6" = $10-10-10$		Vold	Voic	1
соvery %/кцр % = 95%/90% — — ТТОООРSI =0CS		Water Weathered Rock	Wate Undefi	ned
2D strip logs shown at 10x exaggeration		Water Table Delayed Water	Water Table du	aring drilling
			wuter lable a	
IAMPLAIN HUDSON POWE	ERE	XPRES		21162
MENT 3 (PACKAGE 1C) WHITEH	ALL T	UFORT	ANN CH/	066076
	• •			
PLAN AND PROFILE - HDD 4, (CONE	DUIT 1	D	RAWING NO.

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PROPOSED HDD 4 PROFILE

 It is a volcation of Law for any person, unless they are acting under the direction of a licensed processional engineer, architect, Landscape architect of clams and support of a licensed processional is a licensed processi licensed processi a licensed processional is a licensed processi

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15147+0015148+00		15149+00		151
CP RAIL HORIZONTAL CLEARANCE BOUNDAR				
		<i>[</i>		
		ASPHALT		Asphalt
	· · · ◇•• ·	Bedrock Boulder		Bedrock Boulder
		CH		Fat CLAY
		CH-MH CL		Lean CLAY
		CL-ML CONCRETE		SILTY CLAY
		Fill		Fill
		GC GC-GM	SI	CLAYEY GRAVEL
		GM	Po	SILTY GRAVEL
	00	GP-GC	Poorly	Graded Gravel with CLAY
	00	GP-GM GW	Poorly I W	Graded GRAVEL with SIL
		GW-GC	Well Gr	raded GRAVEL with CLAY
		GW-GM Limestone	Well Gr	naded GRAVEL with SILT Limestone
		MH		Elastic SILT
	$\langle \langle \rangle \rangle$	ОН		DRGANIC Fat CLAY
		OL 0L/0H	C	DRGANIC Lean CLAY
		PT		PEAT
		Sandstone		KOCK Sandstone
		SC SC-SM		CLAYEY SAND
	. /	SHALE		Shale
		SILTSTONE SM		Siltstone SILTY SAND
		SP SP-SC	P	oorly Graded SAND Graded SAND with CLAY
		SP-SM	Poorly	Graded SAND with SILT
		SW-SC	Well (Well graded SAND Graded SAND with CLAY
		SW-SM	Well	Graded SAND with SILT
		USGS 601	Grav	vel or Conglomerate 1
		USGS 654 USGS 670	Interbeo	Subgraywacke Ided Sandstone and Shal
		USGS 702		Quartzite
		USGS 705		Schist
				Gneiss
BORING LOG STRIP LEGEND		USGS 708		Gneiss
BORING LOG STRIP LEGEND B101		USGS 708 USGS 708 USGS 718		Gneiss Granite 1
$\frac{\text{BORING LOG STRIP LEGEND}}{\text{B101}}$ bw Counts per 6" = 10-10-10 covery %/RQD % = 95%/90% - 11000psi =UCS		USGS 708 USGS 708 USGS 718 Void Water		Gneiss Granite 1 Void Water
$\frac{\text{BORING LOG STRIP LEGEND}}{\text{B}101}$ by Counts per 6" = 10-10-10 becovery %/RQD % = 95%/90% - 11000psi =UCS		USGS 708 USGS 708 USGS 718 Void Water Weathered Rock	\./o+o	Gneiss Granite 1 Void Water Undefined r Table during doilling
BORING LOG STRIP LEGEND B101 B100 B10 B1		USGS 708 USGS 708 USGS 718 Void Water Weathered Rock Water Table Delayed Water Table	Wate	Gneiss Granite 1 Void Water Undefined r Table during drilling r Table after drilling
BORING LOG STRIP LEGEND B101 B101 B101 B101 11000psi =UCS 2D strip logs shown at 10x exaggeration 3D strip logs have no exaggeration HAMPI AIN HIIDSON POW		USGS 708 USGS 708 USGS 718 Void Water Weathered Rock Water Table Delayed Water Table	Wate Wate	Gneiss Granite 1 Void Water Undefined r Table during drilling r Table after drilling KIEWIT PROJECT N
BORING LOG STRIP LEGEND B101 B100 B101 B100 B101 B100 B101 B100 B101 B100 B101 B100 B101 B100 B101 B100 B101 B100		USGS 708 USGS 708 USGS 718 Void Water Weathered Rock Water Table Delayed Water Table	Wate Wate	Gneiss Granite 1 Void Water Undefined r Table during drilling r Table after drilling KIEWIT PROJECT N 21162 CHA PROJECT N 066076

AS NOTED DATE

12/16/2022

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PROPOSED HDD 4A PROFILE

NOTE: 1) NO SUBSURFACE INVESTIGATIONS WERE CONDUCTED AT HDD #4A. THE SOIL CONDITIONS WERE ESTIMATED BASED ON NEARBY BORINGS. IT IS RECOMMENDED THAT THE HDD SUBCONTRACTOR DRILL A TEST BORING AT THE START OF CONSTRUCTION AT THE HDD #4A SITE BEFORE STARTING THE HDD TO CONFIRM THE GROUND CONDITIONS.

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AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.	0 No.	12/16/2022 DATE	FINAL EM&CP SUBMISSION SUBMITTAL / REVISION DESCRIPTION	MCS DB	JEO APP	

	ASPHALT Bedrock	Legend Asphalt Bedrock
	Boulder CH CH-MH CL	Boulder Fat CLAY SILTY Fat CLAY Lean CLAY
	CL-ML CONCRETE Fill GC	SILTY CLAY Concrete Fill CLAYEY GRAVEL
20INT	GP GP-GC GP-GM	SILTI CLATET GRAVEL SILTY GRAVEL Poorly Graded GRAVEL Poorly Graded Gravel with CLAY Poorly Graded GRAVEL with SILT
DIAN MAINLINE 125 2.95 	GW-GC GW-GM Limestone	Well Graded GRAVEL Well Graded GRAVEL with CLAY Well Graded GRAVEL with SILT Limestone
- 115	МН МL ПН ПL	Elastic SILT SILT DRGANIC Fat CLAY DRGANIC Lean CLAY
OSED 5'X10'X5' PIT 105 S OVERBEND VATED 100	DL/DH PT Rock Sandstone	DRGANIC SUIL PEAT Rock Sandstone
	SC SC-SM SHALE SILTSTONE	CLAYEY SAND SILT, CLAYEY SAND Shale Siltstone
90 90 8+60	SM SP SP-SC SP-SM	SILTY SAND Poorly Graded SAND Poorly Graded SAND with CLAY Poorly Graded SAND with SILT
	SW SW-SC SW-SM Topsoil	Well graded SAND Well Graded SAND with CLAY Well Graded SAND with SILT Topsoil
	USGS 601 USGS 654 USGS 670 USGS 702	Gravel or Conglomerate 1 Subgraywacke Interbedded Sandstone and Shale Quartzite
BORING LOG STRIP LEGEND	USGS 705 USGS 705 USGS 708	Schist Gneiss
v Counts per 6" = 10-10-10 overy %/RQD % = 95%/90% - 11000psi =UCS	USUS 708 USGS 718 Void Water	Uneiss Granite 1 Void Water
2D strip logs shown at 10x exaggeration	Weathered Rock Water Table	Undefined Water Table during drilling

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---- PLAN AND PROFILE

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1AÍV MEN	T 3 (PACKAGE 1C	N POVVER E WHITEHALL 1 HDD 4A CON	COFORT /	ANN 21162 CHA PROJECT NO. 066076 DRAWING NO.
				KIEWIT PROJECT NO
	2D strip logs shown at 10x exaggeration 3D strip logs have no exaggeration	ion	Delayed Water	Water Table after drilling
			Weathered Rock	Undefined
overy %	/RQD % = 95%/90%		Water	Water
Count	s per 6" = 10-10-10		Void	Void
	$\left(\frac{1}{2} \right)$		USGS 718	Granite 1
	BONING LOG STRIP LEGE		USGS 708	Gneiss
	BORING LOG STRIDIEGE	D	USGS 708	Gneiss
			USGS 705	Schist
			USGS 702	Schist
				Duontzite
				Subgraywacke
		<u> </u>	USGS 601	Gravel or Conglomerate 1
			Topsoil	Topsoil
			SW-SM	Well Graded SAND with SILT
			SW-SC	Well Graded SAND with CLAY
	9+'80`		SW	Well graded SAND
	- 85		SP-SM	Poorly Graded SAND with SILT
			SP-SC	Poorly Graded SAND with CLAY
	- 90		SP	Poorly Graded SAND
			SM	SILTY SAND
	95		SILTSTONE	Siltstone
		· /l. ·	SHALE	Shale
	100	· /. ·/	SC-SM	SILT, CLAYEY SAND
		······································	Sanastone	Sanastone CI AYEY SAND
	CUI		Kock	Kock
	105		PT	PLAT
		<u>i i i</u>	OL/OH	ORGANIC SOIL
	110			ORGANIC Lean CLAY
			DH	ORGANIC Fat CLAY
			ML	SILT
			МН	Elastic SILT
			Limestone	Limestone
			GW-GM	Well Graded GRAVEL with SILT
			GW-GC	Well Graded GRAVEL with CLAY
ZONE	125		GW	Well Graded GRAVEL
			GP-GM	Poorly Graded GRAVEL with SILT
	130		GP-GC	Poorly Graded Gravel with CLAY
		00	GP	Poorly Graded GRAVEL
		66	GM	SILTY GRAVEL
			GC-GM	SILTY CLAYEY GRAVEL
		56	GC	CLAYEY GRAVEL
			Fill	Fill
			CONCRETE	Concrete
			CL-ML	SILTY CLAY
			CL	Lean CLAY
			СН-МН	SILTY Fat CLAY
			CH	Ect CLAY
		· · · • • • • •	Bedrock	Bedrock
			ASPHALT	Asphalt
				Legend
				Legend

yuu \sim - J-J-J-J-J- PROPOSED 35'X235 WORKZONE













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Boulder CH CL-ML CL-ML CDNCRETE Fill GC GC-GM GP-GC GP-GC GW-GC GW-GC GW-GL DL/DH PT Rock Sandstone SC	Boulder Fat CLAY SILTY Fat CLAY Lean CLAY SILTY CLAY Concrete Fill CLAYEY GRAVEL SILTY CLAYEY GRAVEL SILTY CLAYEY GRAVEL Poorly Graded GRAVEL Poorly Graded GRAVEL Poorly Graded GRAVEL with CLAY Poorly Graded GRAVEL with SILT Well Graded GRAVEL with SILT Well Graded GRAVEL with SILT Well Graded GRAVEL with SILT Limestone Elastic SILT SILT ORGANIC Fat CLAY ORGANIC SOIL PEAT Rock Sandstone CLAYEY SAND
CH CH-MH CL CL-ML CDNCRETE Fill GC GC-GM GP GP-GC GP-GM GW-GC GW-GC GW-GC GW-GC GW-GM Limestone MH ML DH DL DL DL DL DL DL DL DL DL CL CDNCRETE C	Fat CLAY SILTY Fat CLAY Lean CLAY SILTY CLAY Concrete Fill CLAYEY GRAVEL SILTY CLAYEY GRAVEL SILTY CLAYEY GRAVEL Poorly Graded GRAVEL Poorly Graded GRAVEL with CLAY Poorly Graded GRAVEL with SILT Well Graded GRAVEL with SILT Well Graded GRAVEL with SILT Limestone Elastic SILT SILT ORGANIC Fat CLAY ORGANIC SOIL PEAT Rock Sandstone CLAYEY SAND
CH-MH CL CL-ML CUNCRETE Fill GC GC-GM GP-GC GP-GC GP-GC GW-GC GW-GC GW-GC GW-GC GW-GC GW-GC GW-GC GW-GC GW-GC SC SC-SM	SILTY Fat CLAY Lean CLAY SILTY CLAY Concrete Fill CLAYEY GRAVEL SILTY CLAYEY GRAVEL SILTY CLAYEY GRAVEL Poorly Graded GRAVEL Poorly Graded GRAVEL with CLAY Poorly Graded GRAVEL with SILT Well Graded GRAVEL with SILT Well Graded GRAVEL with SILT Limestone Elastic SILT SILT ORGANIC Fat CLAY ORGANIC Lean CLAY ORGANIC SOIL PEAT Rock Sandstone CLAYEY SAND
CL CL-ML CDNCRETE Fill GC GC-GM GM GP-GC GP-GC GP-GM GW-GC GW-GM Limestone MH ML DH DL DL/DH PT Rock Sandstone SC SC-SM	Lean CLAY SILTY CLAY Concrete Fill CLAYEY GRAVEL SILTY CLAYEY GRAVEL SILTY CLAYEY GRAVEL Poorly Graded GRAVEL Poorly Graded GRAVEL Poorly Graded GRAVEL with CLAY Poorly Graded GRAVEL with SILT Well Graded GRAVEL with CLAY Well Graded GRAVEL with SILT Limestone Elastic SILT SILT ORGANIC Fat CLAY ORGANIC Fat CLAY ORGANIC SOIL PEAT Rock Sandstone CLAYEY SAND
CL-ML CDNCRETE Fill GC GC-GM GP-GM GP-GC GP-GM GW-GC GW-GC GW-GM Limestone MH ML DH DL DL DL DL DL DL CL/DH PT Rock Sandstone SC SC-SM	SILTY CLAY SILTY CLAY Concrete Fill CLAYEY GRAVEL SILTY CLAYEY GRAVEL SILTY CLAYEY GRAVEL Poorly Graded GRAVEL Poorly Graded GRAVEL with CLAY Poorly Graded GRAVEL with SILT Well Graded GRAVEL with SILT Well Graded GRAVEL with SILT Limestone Elastic SILT SILT ORGANIC Fat CLAY ORGANIC Fat CLAY ORGANIC SOIL PEAT Rock Sandstone CLAYEY SAND
CUNCRETE Fill GC GC-GM GM GP-GC GP-GC GV-GC GW-GC GW-GC GW-GC GW-GC ULIMESTONE MH ML DH DL DL/DH PT ROCK Sandstone SC SC-SM	Concrete Fill CLAYEY GRAVEL SILTY CLAYEY GRAVEL SILTY CLAYEY GRAVEL Poorly Graded GRAVEL Poorly Graded GRAVEL with CLAY Poorly Graded GRAVEL with SILT Well Graded GRAVEL with SILT Well Graded GRAVEL with SILT Limestone Elastic SILT SILT ORGANIC Fat CLAY ORGANIC Lean CLAY ORGANIC SOIL PEAT Rock Sandstone CLAYEY SAND
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GP-GM GW-GC GW-GM Limestone MH DL DH DL/DH PT Rock Sandstone SC SC-SM	Poorly Graded GRAVEL with SILT Well Graded GRAVEL Well Graded GRAVEL with CLAY Well Graded GRAVEL with SILT Limestone Elastic SILT SILT ORGANIC Fat CLAY ORGANIC Lean CLAY ORGANIC SOIL PEAT Rock Sandstone CLAYEY SAND
GW GW-GC GW-GM Limestone MH ML OH OL OL/OH PT Rock Sandstone SC SC-SM	Well Graded GRAVEL Well Graded GRAVEL with CLAY Well Graded GRAVEL with SILT Limestone Elastic SILT SILT DRGANIC Fat CLAY DRGANIC SDIL PEAT Rock Sandstone CLAYEY SAND
GW-GC GW-GM Limestone MH ML OH OL OL/OH PT Rock Sandstone SC SC-SM	Well Graded GRAVEL with CLAY Well Graded GRAVEL with SILT Limestone Elastic SILT ORGANIC Fat CLAY ORGANIC Lean CLAY ORGANIC SOIL PEAT Rock Sandstone CLAYEY SAND
GW-GM Limestone MH ML OH OL OL/OH PT Rock Sandstone SC SC-SM	Well Graded GRAVEL with SILT Limestone Elastic SILT SILT ORGANIC Fat CLAY ORGANIC Lean CLAY ORGANIC SOIL PEAT Rock Sandstone CLAYEY SAND
Limestone MH ML DH DL DL/DH PT Rock Sandstone SC SC-SM	Limestone Elastic SILT SILT ORGANIC Fat CLAY ORGANIC Lean CLAY ORGANIC SDIL PEAT Rock Sandstone CLAYEY SAND
MH ML DH DL/DH PT Rock Sandstone SC SC-SM	Elastic SILT SILT ORGANIC Fat CLAY ORGANIC Lean CLAY ORGANIC SOIL PEAT Rock Sandstone CLAYEY SAND
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DL/DH PT Rock Sandstone SC SC-SM	DRGANIC SOIL PEAT Rock Sandstone CLAYEY SAND
PT Rock Sandstone SC SC-SM	PEAT Rock Sandstone CLAYEY SAND
Rock Sandstone SC SC-SM	Rock Sandstone CLAYEY SAND
Sandstone SC SC-SM	Sandstone CLAYEY SAND
SUNUS TONE SC SC-SM	CLAYEY SAND
SC-SM	LLAYEY SAND
SC-SM	a contraction of the second se
	SILI, ULAYEY SAND
SHALE	Shale
SILTSTONE	Siltstone
SM	SILTY SAND
SP	Poorly Graded SAND
SP-SC	Poorly Graded SAND with CLAY
SP-SM	Poorly Graded SAND with SILT
SW	Well graded SAND
SW-SC	Well Graded SAND with CLAY
SW-SM	Well Graded SAND with SILT
Topsoil	Topsoil
USGS 601	Gravel or Conglomerate 1
USGS 654	Subgraywacke
USGS 670	Interbedded Sandstone and Shale
	Quartzite
USGS 705	Schist
0503 /08	
USGS 718	Granite 1
Void	Void
Water	Water
Weathered Rock	Undefined
Water Table	Water Table during drilling
Delayed Water <u>T</u> able	Water Table after drilling
· · · · · · · · ·	
VDDCO	
X H K F >	
XPRES 0 FORT /	
	Topsoil USGS 601 USGS 654 USGS 702 USGS 705 USGS 705 USGS 708 USGS 708 USGS 708 USGS 718 Void Water Water Table Delayed Water Table

Legend

Asphalt



B

C-304

12/16/2022

AS NOTED DATE











IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION. MCS JEO 0 12/16/2022 FINAL EM&CP SUBMISSION No. DB APP DF DATE SUBMITTAL / REVISION DESCRIPTION

1	05		Rock		Rock
		· · · · · · · · · · · ·	Sandstone		Sandstone
L	00		SC		CLAYEY SAND
ן י			SC-SM		SILT, CLAYEY SAND
			SHALE		Shale
- 9	95	\mathbf{X}	SILTSTONE		Siltstone
			SM		SILTY SAND
- 9	00		SP	F	Poorly Graded SAND
		171	SP-SC	Poorly	Graded SAND with CLAY
			SP-SM	Poorly	/ Graded SAND with SILT
			SW		Well graded SAND
		<u> </u>	SW-SC	Well	Graded SAND with CLAY
- 8	30		SW-SM	Well	Graded SAND with SILT
		\times	Topsoil		Topsoil
	75		USGS 601	Gra	vel or Conglomerate 1
·7!		·	USGS 654		Subgraywacke
			USGS 670	Interbe	dded Sandstone and Shale
			USGS 702		Quartzite
		<u>) [(</u>	USGS 705		Schist
			USGS 705		Schist
	BORING LOG STRIP LEGEND		USGS 708		Gneiss
	B101		USGS 708		Gneiss
	$\overline{(77)}$		USGS 718		Granite 1
	Blow Counts per 6" = 10-10-10	1	Void		Void
	Recovery %/RQD % = 95%/90% - 11000psi =UCS		Water		Water
			Weathered Rock		Undefined
	2D strip logs shown at 10x exaggeration	X	Water Table	Wate	er Table during drilling
	3D strip logs have no exaggeration	∇	Delayed Water Table	Wat	er Table after drilling
^				0	KIEWIT PROJECT NO.
L				う	21162
Е	GMENT 3 (PACKAGE 1C) WHITEHA	ALL 1	FORT /	ANN	CHA PROJECT NO.
_					066076
	PLAN AND PROFILE - HDD 5, C	ONL	JUH 2		DRAWING NO.
					C-304A
				I	
		SCALE	ASN	OTED	DATE 12/16/202

75 15184+00 15185+00 CERTIFIED ROUTE	
<u>10-115.5</u>	

man and a series of the series

V i Z JAM

1

Legend

Asphalt

Bedrock

Boulder

Fat CLAY

SILTY Fat CLAY

Lean CLAY

SILTY CLAY

Concrete

Fill

CLAYEY GRAVEL

SILTY CLAYEY GRAVEL

SILTY GRAVEL

Poorly Graded GRAVEL

Poorly Graded Gravel with CLAY

Poorly Graded GRAVEL with SILT

Well Graded GRAVEL

Well Graded GRAVEL with CLAY

Well Graded GRAVEL with SILT

Limestone

Elastic SILT

ORGANIC Fat CLAY

ORGANIC Lean CLAY

ORGANIC SOIL

PEAT

В

ASPHALT

Bedrock

Boulder

СН

СН-МН

CL CL-ML

CONCRETE

Fill

GC

GC-GM

GM

GP

GP-GC

GP-GM

GW

GW-GC

GW-GM

Limestone

MH

ПΗ

ΠL

OL/OH

РT

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110

105-

100-

PROPOSED —

0+'00

5'X10'X5' 95: ENTRY PIT

80 + 60



1+'00



NOTE: 1) THE USE OF CONDUCTOR CASINGS IS RECOMMENDED TO MITIGATE THE POTENTIAL RELEASES OF FRILLING FLUIDS.

PROPOSED HDD 6 PROFILE

	No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP	DR
SPECIFIC DESCRIPTION OF THE ALTERATION.	0	12/16/2022	FINAL EM&CP SUBMISSION	MCS	JEO	
ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A						-
IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR TO ALTER AN ITEM IN ANY WAY, IF AN UTEM BEADING THE STAND OF A LICENSED PROFESSIONAL IS						S
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NOTE Under solution NOTE Solution Solution NOTE Solution Solution NOTE Solution Solution NOTE Solution Solution Solution	Image: State of the state
NATURE Comparison 000000000000000000000000000000000000	Box over Rouses Cli Title Live Live Cli Title Title Cli Tittle Cli Title Cli Title Cli Tittle
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ASABAL Adjenici ASABAL Bernoris ASABAL Bernoris ASABAL Bernoris ASABAL Bernoris ASABAL Bernoris Bernoris Status Bernoris	Open Source Boulder 0-
Counts per 6" = 10-000 Counts per 6" = 10-0000 Counts per 6" = 10-0000 Counts per 6"	Image: Second
	V Boulder Boulder CH Fit ELV CH Fit ELV CH Fit ELV CH Example Cultures CL Less CLAY Cultures CL Example Cultures Cultures CL
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Image: second	Image: Second State Boulder Boulder CH C: Listy CH C: Listy CH C: Listy C: Listy C: Listy CH C: L
Image: constraint of the second sec	NATCH UNE NATCH UNE
Logend Brance k	Builder Boulder CH Fig. CLAY CH Fig. CLAY CH-H-H SULTY Fig. CLAY CL-H SULTY Fig. CLAY CL-H SULTY CLAY CL-H CL-H
Lingeno ASTINUT Apphalitility Bearcak Bearcak Bearcak Start Provide CENDETE Denorete Bearca Bearcak Bearca Start Proceed BraveL Bearca Bearcak Bearcak Bearcak<	Andder Beutder CH Pet CLAY Cit Hill SILTY Fat DL CL Lean CLAY CL-ML SILTY CLAY CDURETTE Cencrete CO CLAYEY GRAVE SILTSTINE SILTSTINE SILTY GRAVE SILTY GRAVE SILTY GRAVE SILTY GRAVE SILTY GRAVE SILTY GRAVE CO CLAYEY GRAVE SILTY GRAVE
ASPAULT Asphalt ASPAULT Asphalt Bechack Bechack Bechack Bechack Bechack Bechack CH Fat CLAY CH: 48 SILTY For CLAY CL: 40 SILTY GAVEL CIRCLE Control CIRCLE SILTY CLAYEY For CLAY CL: 41 SILTY CLAYEY For CLAY CL: 42 SILTY CLAYEY For CLAY CIRCLE Control	Bouteer Bouteer Bouteer Bouteer Cit C
Lingend 45PHALT Address 45PHALT Address 45PHALT Address 45PHALT Address 45PHALT Address 59.13en Boulsen 01 Fill 01 Fill 02 Fill 03 Fill 04 CH-MH 05 CH-MH 06 SLITY CLAYEY GRAVEL 06 CH-MH 07 Packy Chasto CRAVEL 06 CH-MH 07 CH-MH 08 CH-MH 08 CH-MH 08 CH-MH 08 CH-MH	Alter Butter CH Butter Butter Butter CH Butter Butter Butter CH Butter CH Butter CH Butter CH CH Butter CH CH Butter CH CL Lean ILM CL C
Legeno ASPHAL: Aophal: Bedrack: Bedrack: Bedrack: Bedrack: Bolder Bolder CH Fac OLAY CH Fac OLAY CH Fac OLAY CH Lean CLAY CL Lean CLAY CL Lean CLAY CL CLAY CL CLAY CDMCETT Concepte F11 F11 COMMETT Concepte CDMCETT Concepte F11 F11 CH CAREY GRAVEL CH CLAY (GAVEL) CH CH CH	MICH LINE STA. 850 STA.
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NATURE ASPHALT Asphalt ASPHALT Asphalt Bedrock Bedrock Boulder Boulder Boulder CH Fot CLAY CH Fot CLAY CL Lean CLAY CL-ML SILTY Fot CLAY CL-ML SILTY CLAY CL-ML SILTY CLAY CL-ML Fill GC CLAYEY GRAVEL GC CLAYEY GRAVEL GC CLAYEY GRAVEL GC CLAYEY GRAVEL GG CFOM SILTY CLAYEY GRAVEL GGP-CC Poorly Graded GRAVEL GGP-CC Poorly Graded GRAVEL GGV Well Graded GRAVEL with CLAY GV-CC Well Graded GRAVEL with CLAY GV-CC Well Graded GRAVEL with SILT CM Well Graded GRAVEL with SILT CM MH Elastic SILT MH Elastic SILT MH Elastic SILT MH Elastic SILT MH BEGANC SOLL MH BEGANC	Boulder Boulder Boulder Boulder Boulder CH GH GH GH GL CL Lean CLAY CL-ML CL-ML SILTY CLAY CDNCRETE Concrete Fill Fill GC CLAYEY GRAVE GC GC-GM SILTY CLAYEY GR GF-GC GP-GC Poorly Graded GR SLTY GRAVE GP-GC GP-GC Poorly Graded GR CL GW GR SILTY GR GR SILTY GR GR SILTY GR GP-GC GP-GC Poorly Graded GR GW GN SILT GN GW GW GN GN SILT GN GW GW GN GN GN SILT GN GN GN GN SILT GN
	NATCH LINE NATCH
	CH Boulder Boulder CH Boulder CH Fat CLAY CH CL Lean CLAY CL CL Lean CLAY CL-ML SILTY CLAY CLAYEY GRAVE GC CLAYEY GRAVE GC GC-GM SILTY CLAYEY GR GF-GM SILTY CLAYE GF-GM SILTY CLAYE GF-GM SILTY CLAYE GF-GM SILTY DH DRGANIC GR SILT DH DRGANIC FAT CL DI DI DRGANIC FAT CL DI DRGANIC FAT CL DI DRGANIC FAT CL DRGANIC FAT DR DRGANIC FAT DRGANIC FAT DRGANIC
	Boulder Boulder CH Boulder CH Fat CLAY CH-MH SILTY Fat CL CL Lean CLAY CL-ML SILTY CLAY CDNCRETE Concrete Fill CDNCRETE Concrete Fill CDNCRETE Concrete Fill CCDNCRETE Concrete GC CLAYEY GRAVE GC CLAYEY GRAVE GC GC-GM SILTY CLAYEY GRAVE GC GP-GC Poorly Graded Gravel GP-GC Poorly Graded Gravel GP-GC Poorly Graded GRAVEL GW Well Graded GRAVEL GW-GM Well Graded GRAVEL Limestone Limestone MH Elastic SILT MH SILTY MH SILTY
ASPHALT Asphalt Bedrock Bedrock Boulder Boulder CH Fat CLAY CH-MH SILTY Fat CLAY CL-ML SILTY CLAY CLOCKETE Concrete Fill Fill GG CLAYEY GRAVEL GG CLAYEY GRAVEL GG GLAYEY GRAVEL GG GLAYEY GRAVEL GG GCLAYEY GRAVEL GG GCLAYEY GRAVEL GGP Poorly Graded GRAVEL GF-GC Poorly Graded GRAVEL GW Well Graded GRAVEL GW-GC Well Graded GRAVEL MH Elastic SILT ML SILT	Boulder Boulder Boulder Boulder CH Fat CLAY CH-MH SILTY Fat CL CL Lean CLAY CL-ML SILTY CLAY CDNCRETE Concrete Fill Fill GC GC CLAYEY GRAVE GC GC-GM SILTY CLAYEY GR GG GC-GM SILTY CLAYEY GR GM SILTY GRAVE GF-GC Poorly Graded GRAVEL GW Well Graded GRAVEL GW Well Graded GRAVEL GW-GC Well Graded GRAVEL Limestone Limestone MH Elastic SILT MH SILT
ASPHALT Asphalt Bedrock Bedrock Boulder Boulder CH Fat CLAY CH Fat CLAY CL Lean CLAY CL Lean CLAY CL Lean CLAY CL Clark SILTY CLAY CLONCRETE CONCRETE Concrete Fill Fill GC CLAYEY GRAVEL GG GC-GM GP Poorly Graded GRAVEL GP Poorly Graded GRAVEL GW Well Graded GRAVEL with SILT GW-GM Well Graded GRAVEL with SILT Limestone Limestone Limestone Limestone	Boulder Boulder CH Fat CLAY CH-MH SILTY Fat CL CL Lean CLAY CL-ML SILTY CLAY CCDNCRETE Concrete Fill Fill CCDNCRETE Concrete Fill GC CLAYEY GRAVE GC CLAYEY GRAVE GGP Poorly Graded GRAVEL GP Poorly Graded GRAVEL GW Vell Graded GRAVEL GW Well Graded GRAVEL Limestone Limestone MH Elastic SILT
Legend ASPHALT Asphalt - Bedrock Bedrock - Boulder Boulder - Boulder Boulder - CH Fat CLAY CH Fat CLAY CLAY CL Lean CLAY CL-ML SILTY CLAY CDNCRETE Concrete Fill Fill GC CLAYEY GRAVEL GG GCLAYEY GRAVEL GM SILTY GRAVEL GP Poorly Graded GRAVEL GP-GM Poorly Graded GRAVEL GW Well Graded GRAVEL GW Well Graded GRAVEL with SILT GW Well Graded GRAVEL with SILT GW-GC Well Graded GRAVEL with SILT GW-GC Well Graded GRAVEL with SILT GW-GC Well Graded GRAVEL with SILT	Boulder Boulder CH CH CH CH CH CL CL CL CL CL CL CL CL CL CL CL CL CL
ASPHALT Asphalt Bedrock Bedrock CH Fat CLAY CH-MH SILTY Fat CLAY CL-ML SILTY CLAY CLONCRETE Concrete Fill Fill GC CLAYEY GRAVEL GC GCHAYEY GRAVEL GC GP-GC GP-GC Poorly Graded GRAVEL GF-GM Poorly Graded GRAVEL with SILT GW Well Graded GRAVEL with CLAY	Boulder Boulder Boulder Boulder CH Fat CLAY CH-MH SILTY Fat CLA CL-ML SILTY CLAY CL-ML SILTY CLAY CDNCRETE Concrete Fill Fill CDNCRETE Concrete Fill GC CLAYEY GRAVE GC CLAYEY GRAVE GC GP-GM SILTY CLAYEY GR GP-GM Poorly Graded Gravel GV Well Graded GRAVEL GW-GC Well Graded GRAVEL
ASPHALT Asphalt ASPHALT Asphalt Bedrock Bedrock Boulder Boulder CH Fat CLAY CH Fat CLAY CL Lean CLAY CL-ML SILTY CLAY CUNCRETE Concrete Fill Fill GC CLAYEY GRAVEL GM SILTY GRAVEL GP Poorly Graded GRAVEL GP-GC Poorly Graded GRAVEL GW Well Graded GRAVEL	Boulder Boulder CH Fat CLAY CH-MH SILTY Fat CLA CL-ML SILTY CLAY CDNCRETE Concrete Fill Fill CDNCRETE Concrete Fill GC CLAYEY GRAVE GC CLAYEY GRAVE GC GM SILTY CLAYEY GR GM SILTY GRAVE GP Poorly Graded GRAVEL GP-GC Poorly Graded GRAVEL GW Well Graded GRAVEL
Legend ASPHALT Asphalt Bedrock Bedrock Boulder Boulder CH Fat CLAY CH-MH SILTY Fat CLAY CL-ML SILTY CLAY CUNCRETE Concrete Fill Fill Fill Fill GC CLAYEY GRAVEL GG GCLAYEY GRAVEL GG SILTY CLAYEY GRAVEL GG GCLAYEY GRAVEL GG GCLAYEY GRAVEL GG SILTY CLAYEY GRAVEL GG GP Poorly Graded GRAVEL GP-GC GP-GM Poorly Graded GRAVEL with SILT	Boulder Boulder CH Fat CLAY CH-MH SILTY Fat CLA CL-ML SILTY CLAY CL-ML SILTY CLAY CDNCRETE Concrete Fill Fill GC CLAYEY GRAVE GC CLAYEY GRAVE GC GC CLAYEY GRAVE GF-GC Poorly Graded GRAVEL GP-GC Poorly Graded GRAVEL
ASPHALT Asphalt Bedrock Bedrock CH Fat CLAY CH Fat CLAY CL Lean CLAY CL-ML SILTY CLAY CL-ML SILTY CLAY CONCRETE Concrete Fill Fill GC CLAYEY GRAVEL GC GCAYEY GRAVEL GM SILTY CLAYEY GRAVEL GM SILTY GRAVEL GP Poorly Graded GRAVEL	Boulder Boulder CH Fat CLAY CH-MH SILTY Fat CLA CL Lean CLAY CL-ML SILTY CLAY CDNCRETE Concrete Fill Fill GC CLAYEY GRAVE GC CLAYEY GRAVE GC SILTY CLAYEY GR GM SILTY GRAVE GP Poorly Graded Gravel
ASPHALT Asphalt Bedrock Bedrock CH Fat CLAY CH Fat CLAY CL Lean CLAY CL Lean CLAY CL-ML SILTY CLAY CDNCRETE Concrete Fill Fill GC CLAYEY GRAVEL GM SILTY CLAYEY GRAVEL	Boulder Boulder CH Fat CLAY CH-MH SILTY Fat CLA CL-ML SILTY CLAY CL-ML SILTY CLAY CUNCRETE Concrete Fill Fill GC CLAYEY GRAVE GC CLAYEY GRAVE
Legend ASPHALT Asphalt Bedrock Bedrock CH Boulder CH Fat CLAY CH-MH SILTY Fat CLAY CL-ML SILTY CLAY CUNCRETE Concrete Fill Fill GC CLAYEY GRAVEL GC CLAYEY GRAVEL	Boulder Boulder CH Fat CLAY CH-MH SILTY Fat CLAY CL-ML SILTY CLAY CDNCRETE Concrete Fill GC CLAYEY GRAVE GC-GM SILTY CLAYEY GRAVE
Legend ASPHALT Asphalt Bedrock Bedrock Boulder Boulder CH Fat CLAY CH-MH SILTY Fat CLAY CL Lean CLAY CL-ML SILTY CLAY CUNCRETE Concrete Fill Fill Fill Fill	Boulder Boulder Boulder CH Fat CLAY CH-MH SILTY Fat CLAY CL Lean CLAY CL-ML SILTY CLAY CUNCRETE Concrete Fill Fill GC CLAYFY GRAVE
ASPHALT Asphalt Bedrock Bedrock Boulder Boulder CH Fat CLAY CL Lean CLAY CL-ML SILTY CLAY CDNCRETE Concrete	Boulder CH Fat CLAY CH-MH SILTY Fat CLA CL Lean CLAY CL-ML SILTY CLAY CUNCRETE Concrete
LegendASPHALTAsphalt—BedrockBedrockMarkowskiBoulderMarkowskiCHFat CLAYCHSILTY Fat CLAYCLLean CLAYCLLean CLAYCL-MLSILTY CLAY	Boulder CH Fat CLAY CH-MH SILTY Fat CLA CL Lean CLAY CL-ML SILTY CLAY
ASPHALT Asphalt ASPHALT Asphalt ASPHALT Bedrock Bedrock CH Fat CLAY CH-MH SILTY Fat CLAY CL Lean CLAY	Boulder CH Fat CLAY CH-MH SILTY Fat CL4 CL Lean CLAY
ASPHALT Asphalt - Bedrock Bedrock Boulder Boulder CH Fat CLAY	Boulder CH Fat CLAY
ASPHALT Asphalt Bedrock Bedrock Boulder Boulder	Boulder Boulder
ASPHALT Asphalt Bedrock Bedrock	
Legend ASPHALT Asphalt	- Bedrock Bedrock
	Legend ASPHALT Asphalt



III Winners Circle, PO Box 5269 Albany, NY 12205-0269 518.453.4500 . www.chacompanies.com

Champlain Hudson

Power Express

NOTE	•
1)	THE USE OF CONDUCTOR CASINGS I
	RECOMMENDED TO MITIGATE THE
	POTENTIAL RELEASES OF FRILLING
	FLUIDS

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION. MCS JEO 12/16/2022 FINAL EM&CP SUBMISSION 0 No. DATE SUBMITTAL / REVISION DESCRIPTION

		СН		Fat CLAY	
		СН-МН		SILTY Fat CLAY	
		CL		Lean CLAY	
		CL-ML		SILTY CLAY	
		CONCRETE		Concrete	
		Fill		Fill	
	00	GC		CLAYEY GRAVEL	
	00	GC-GM	SI	LTY CLAYEY GRAVEL	
>	00	GM		SILTY GRAVEL	
	00	GP	Po	orly Graded GRAVEL	
	00	GP-GC	Poorly	Graded Gravel with CLAY	
	00	GP-GM	Poorly	Graded GRAVEL with SILT	
130		GW	\ \	ell Graded GRAVEL	
		GW-GC	Well G	raded GRAVEL with CLAY	
		GW-GM	Well G	raded GRAVEL with SILT	
125		Limestone		Limestone	
		МН		Elastic SILT	
120		ML		SILT	
		ОН		ORGANIC Fat CLAY	
115		DL	[JRGANIC Lean CLAY	
- 115		OL/OH		ORGANIC SOIL	
	$\overline{\sqrt{\sqrt{2}}}$	PT		PEAT	
— 110		Rock		Rock	
	· · · · · · · · · · · · · · · · · · ·	Sandstone		Sandstone	
105		SC		CLAYEY SAND	
		SC-SM		SILT, CLAYEY SAND	
100		SHALE		Shale	
100	\mathbf{X}	SILTSTONE		Siltstone	
		SM		SILTY SAND	
95		SP	P	oorly Graded SAND	
	. /	SP-SC	Poorly	Graded SAND with CLAY	
		SP-SM	Poorly	Graded SAND with SILT	
		SW		Well graded SAND	
05	<u> </u>	SW-SC	Well	Graded SAND with CLAY	
- 65		SW-SM	Well	Graded SAND with SILT	
		Topsoil		Topsoil	
+00 = 16+50		USGS 601	Grav	vel or Conglomerate 1	
		USGS 654		Subgraywacke	B
		USGS 670	Interbed	ded Sandstone and Shale	
		USGS 702		Quartzite	
		USGS 705		Schist	
		USGS 705		Schist	
BORING LOG STRIP LEGEND		USGS 708		Gneiss	
B101		USGS 708		Gneiss	
	<u> </u>	USGS 718		Granite 1	
Blow Counts per 6" = 10-10-10	L	Void		Void	
Recovery %/RQD % = 95%/90% - 11000psi =0CS		Water		Water	
	<u> </u>	Weathered Rock		Undefined	
2D strip logs shown at 10x exaggeration		Water Table Delayed Water	Wate	er Table during drilling	
3D strip logs have no exaggeration		Table	Wate	er lable after drilling	
				KIEWIT PROJECT NO.	•
CHAMPLAIN HUDSUN POWE		IXPRES	うし	21162	
EGMENT 3 (PACKAGE 1C) WHITEH	ALL T		ANN	CHA PROJECT NO.	
				066076	
PLAN AND PROFILE - HDD 6, 0	JONL		-	DRAWING NO.	
				6-305.1	
	SCALE	ASI	NOTED	DATE 12/16	5/2022
		0.	X		

Legend

Asphalt

Bedrock

Boulder

ASPHALT

Bedrock

Boulder

· 🖉 .



NOTE	
1)	THE USE OF CONDUCTOR CASINGS IS
	RECOMMENDED TO MITIGATE THE
	POTENTIAL RELEASES OF FRILLING
	FLUIDS.

PROPOSED HDD 6 PROFILE CONDUIT 2

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED. THE ALTERING ENCINERE ARCHITECT LANDSCAPE						S
ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.	0	12/16/2022	FINAL EM&CP SUBMISSION	MCS	JEO	_
	No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP	DR

CP RAIL MP 73.88

- 84" RCP INV.=109.2

		No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP	D
SPECIFIC DESCRIPTION OF THE ALTERATION.	-	0	12/16/2022	FINAL EM&CP SUBMISSION	MCS	JEO	
ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A							-
IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS	-						
	-						c

	56	GC		CLAYEY GRAVEL	
	36	GC-GM	S	ILTY CLAYEY GRAVEL	
	66	GM		SILTY GRAVEL	
	50	GP	P	porly Graded GRAVEL	
	00	GP-GC	Poorly	Graded Gravel with CLAY	
	00	GP-GM	Poorly	Graded GRAVEL with SILT	
		GW		Well Graded GRAVEL	
		GW-GC	Well (Graded GRAVEL with CLAY	
	X	GW-GM	Well (Graded GRAVEL with SILT	
		Limestone		Limestone	
		MH		Elastic SILT	
		ML		SILT	
	((ПН		DRGANIC Fot CLAY	
	55				
	<u> </u>	F I		Pasti	
	· · · · · ·	ROCK		ROCK	
	······	Sanastone		Sanastone	
	· / · /	<u> </u>		CLAYEY SAND	
		SC-SM		SILI, CLAYEY SAND	
		SHALE		Shale	
		SILTSTONE		Siltstone	
		SM		SILTY SAND	
		SP		Poorly Graded SAND	
	. /	SP-SC	Poorl	y Graded SAND with CLAY	
		SP-SM	Poorl	y Graded SAND with SILT	
		۶W		Well graded SAND	
	<u> </u>	SW-SC	Well	Graded SAND with CLAY	
		SW-SM	Well	Graded SAND with SILT	
		Topsoil		Topsoil	
		USGS 601	Gro	ivel or Conglomerate 1	
		USGS 654		Subgraywacke	
		USGS 670	Interbe	dded Sandstone and Shale	
		USGS 702		Quartzite	
	<u>) [[[[[[[[[[[[[[[[[[[</u>	USGS 705		Schist	
		USGS 705		Schist	
BORING LOG STRIP LEGEND		USGS 708		Gneiss	
B101	1.1.2	USGS 708		Gneiss	
$\left(\overline{77} \right)$		USGS 718		Granite 1	
Blow Counts per 6" = 10-10-10		Void		Void	
Recovery %/RQD % = 95%/90% - 11000psi =UCS		Water		Water	
		Weathered Rock		Undefined	
2D strip logs shown at 10x exaggeration	▼	Water Table	Wat	er Table during drilling	
3D strip logs have no exaggeration	\Box	Delayed Water	Wat	er Table after drilling	
	J LI	Ταριε			
HAMPI AIN HUDSON POWE	R F	XPRES	22	KIEWIT PROJECT NO.	
	_ I `\				
JMENT 3 (PACKAGE 1C) WHITEH	ALL I	U FURI /	ANN		
				DRAWING NO	
PLAN AND PROFILE - HDD 6 (
PLAN AND PROFILE - HDD 6, (C-305A.1	

Legend

Asphalt

Bedrock Boulder

Fat CLAY

SILTY Fat CLAY

Lean CLAY SILTY CLAY

> Concrete Fill

ASPHALT

Bedrock

Boulder

СН

CH-MH

CL

CL-ML CONCRETE

Fill

cale in fe

PROPOSED HDD 7 PLAN VIEW CONDUIT 1

PROPOSED HDD 7 PROFILE

PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY		-
PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT		
IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED		 SI

		Fill		Fill	
	36	GC		CLAYEY GRAVEL	
	36	GC-GM	SII	TY CLAYEY GRAVEL	
	66	GM		SILTY GRAVEL	
	50	GP	Poo	orly Graded GRAVEL	
	00	GP-GC	Poorly	Graded Gravel with CLAY	
	55	GP-GM	Poorly (Graded GRAVEL with SILT	
		GW	W	ell Graded GRAVEL	
		GW-GC	Well Gr	aded GRAVEL with CLAY	
		GW-GM	Well Gr	aded GRAVEL with SILT	
		Limestone		Limestone	
		МН		Elastic SILT	
		MI		SIL T	
		ПН	[IRGANIC Ent CLAY	
))))				
	55				
		Dest		- Dack	
		ROCK		ROCK	
		Sandstone		Sandstone	
				CLAYEY SAND	
		SC-SM	2	SILT, ULAYEY SAND	
		SHALE		Shale	
		SILTSTONE		Siltstone	
		SM		SILTY SAND	
		SP	P	oorly Graded SAND	
	. /	SP-SC	Poorly	Graded SAND with CLAY	
		SP-SM	Poorly	Graded SAND with SILT	
		SW		Well graded SAND	
	<u> </u>	SM-SC	Well (Graded SAND with CLAY	
		SW-SM	Well (Graded SAND with SILT	
		Topsoil		Topsoil	
		USGS 601	Grav	el or Conglomerate 1	
		USGS 654		Subgraywacke	
		USGS 670	Interbed	ded Sandstone and Shale	
		USGS 702		Quartzite	
	<u>] : [: [:] :</u>	USGS 705		Schist	
		USGS 705		Schist	
BORING LOG STRIP LEGEND		USGS 708		Gneiss	
B101		USGS 708		Gneiss	
$\overline{(77)}$		USGS 718		Granite 1	
ow Counts per 6" = 10-10-10	· · · · ·	Void		Void	
ecovery %/RQD % = 95%/90% - 11000psi =UCS		Water		Water	
		Weathered Rock		Undefined	
2D strip logs shown at 10x exaggeration	· _ · · _	Water Table	Wate	r Table during drilling	
3D strip logs have no exaggeration	∇	Delayed Water	Wate	r Table after drilling	
				KIEWIT PROJECT NO.	
TAMPLAIN HUDSUN POW		XYKES	うし	21162	
MENT 3 (PACKAGE 1C) WHITE	HALL T	O FORT	ANN	CHA PROJECT NO.	
				066076	
PLAN AND PROFILE - HDD 7,	COND	UIT 1		DRAWING NO.	
				C-306	
N BY: MCS DESIGNED BY: MCS APPROVED BY: JI	EO REV. NO	AS N.	NOTED X	DATE 12/16/2	202

Legend

Asphalt

Bedrock

Boulder Fat CLAY

SILTY Fat CLAY

Lean CLAY SILTY CLAY

Concrete

Fill

ASPHALT

Bedrock

Boulder

СН

CH-MH

CL

CL-ML

CONCRETE

Fill

	IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT						S
,	OR LAND SURVEYOR TO ALTER AN THEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY						
	THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.	0	12/16/2022	FINAL EM&CP SUBMISSION	MCS	JEO	
		No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP	DR

		G₩-GM	Well C	Graded GRAVEL with SILT	
		Limestone		Limestone	
		МН		Elastic SILT	
		ML		SILT	
		ΩН		ORGANIC Fat CLAY	
		ΠL		ORGANIC Lean CLAY	
	880	OL/OH		DRGANIC SDIL	
	$\frac{\sqrt{1}}{\sqrt{2}}$	PT		PEAT	
		Rock		Rock	
		Sandstone		Sandstone	
		SC		CLAYEY SAND	
		SC-SM		SILT, CLAYEY SAND	
		SHALE		Shale	
	X	SILTSTONE		Siltstone	
		SM		SILTY SAND	
		SP	F	Poorly Graded SAND	
	1 / 1	SP-SC	Poorly	/ Graded SAND with CLAY	
		SP-SM	Poorly	y Graded SAND with SILT	
		SM		Well graded SAND	
		SW-SC	Well	Graded SAND with CLAY	
		SW-SM	Well	Graded SAND with SILT	
	\sim	Topsoil		Topsoil	
		USGS 601	Gra	vel or Conglomerate 1	
		USGS 654		Subgraywacke	
		USGS 670	Interbe	dded Sandstone and Shale	
		USGS 702		Quartzite	
		USGS 705		Schist	
		USGS 705		Schist	
BORING LOG STRIP LEGEND		USGS 708		Gneiss	
<u>B101</u>		USGS 708		Gneiss	
		USGS 718		Granite 1	
Blow Counts per 6" = 10-10-10		Void		Void	
Recovery %/RQD % = 95%/90% - 11000psi =UCS		Water		Water	
		Weathered Rock		Undefined	
2D strip logs shown at 10x exaggeration	T	Water Table	Wat	er Table during drilling	
3D strip logs have no exaggeration	\Box	Delayed Water Table	Wat	er Table after drilling	
				KIEWIT PROJECT NO.	
CHAMPLAIN HUDSON POW	'EK E	XPRES	5	21162	
EGMENT 3 (PACKAGE 1C) WHITEH	T I IAF	O FORT	ΔΝΝ	CHA PROJECT NO.	
				066076	
PLAN AND PROFILE - HDD 7,	CONL	0011 1		DRAWING NO.	
				C-306.1	
	SCALE	ASN	NOTED	DATE 12/16/2	2022
AVVN BY: MCS DESIGNED BY: MCS APPROVED BY: JE	EO REV. NC).	Х		

PROPOSED 40'X150' WORKZONE

- PLAN AND PROFILE CENTERLINE

Legend

Asphalt

Bedrock

Boulder Fat CLAY

SILTY Fat CLAY

Lean CLAY SILTY CLAY

> Concrete Fill

CLAYEY GRAVEL

SILTY CLAYEY GRAVEL

SILTY GRAVEL

Poorly Graded GRAVEL

Poorly Graded Gravel with CLAY

Poorly Graded GRAVEL with SILT

Well Graded GRAVEL

Well Graded GRAVEL with CLAY

ASPHALT

Bedrock

Boulder

СН

CH-MH

CL

CL-ML

CONCRETE

Fill

GC

GC-GM

GM

GP

GP-GC

GP-GM

GW

GW-GC

В

100

EX. FIBER OPTIC	>		Γ	— EX. TELEPHONE	
		- PROPOSED HDD 7 CONDUIT 2		BORING B116.8-1	MAIC STA.
BOUNDARY				RAILROAD R.O.W. & B	
ICE BOUNDARY				CP RAIL HORIZONTAL	
		01 01 01 01 01 01 01 01 01 01 01 01 01 0	TO FO FO FO FO FO FO	FO F	
			UE UE UE	CP RAIL HORIZONTAL C	
2+00	* 3 +00	G-R-)4+00	5+00	6+00	7+00 H
3238+00	3+00	× + 15260+00 ++00 ++00	5+00 5+00		13+00 7+00 UNDARY
	PROPOSE				
CHAR	LANDS N/F OF LES J., JOSEPH A., & LEDA PALMER TM# 861-5	M.			
	AG LAND				IANDS N /F AF
	<u>PRO</u>	CONDUIT 2			1

PROPOSED HDD 7 PROFILE

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION. MCS JEO 0 12/16/2022 FINAL EM&CP SUBMISSION No. DB APP D DATE SUBMITTAL / REVISION DESCRIPTION

	00	GP	Po	porly Graded GRAVEL
	00	GP-GC	Poorly	Graded Gravel with CLAY
	66	GP-GM	Poorly	Graded GRAVEL with SILT
		GW	N N	Well Graded GRAVEL
		GW-GC	Well C	Graded GRAVEL with CLAY
		GW-GM	Well (Graded GRAVEL with SILT
		Limestone		Limestone
		МН		Elastic SILT
		ML		SILT
		ОН		DRGANIC Fot CLAY
		OL		ORGANIC Lean CLAY
	55	ΠΙ ΖΠΗ		RGANIC SITI
	$\sqrt{\sqrt{2}}$	PT		PFAT
		Rock		Rock
		Savalatora		Sandstana
	· · · · · · · · ·	Surids torie		
	. //	SU SU		CLATET SAND
	· · / · ·	SU-SM		SILI, CLATET SAND
		SHALE		Shale
		SILISIUNE		Siltstone
		SM		SILIY SAND
		SP		Conty Graded SAND
	· / ·	SP-SC	Poorty	y Graded SAND with CLAY
		SP-SM	Poort	y Graded SAND with SILI
		SW		well graded SAND
	<u> </u>	5W-5U	Well	Graded SAND with CLAY
		SW-SM	Well	Graded SAND with SILI
		lopsoil		
		USGS 601	Gra	vel or Longlomerate 1
		USGS 654		Зиюдгаужаске
		USGS 670	Interbe	dded Sandstone and Shale
		USGS 702		Quartzite
		USGS 705		Schist
		USGS 705		Schist
BORING LOG STRIP LEGEND		USGS 708		Gneiss
<u>B101</u>		USGS 708		Gneiss
	<u>`-`ı</u>	USGS 718		Granite 1
Blow Counts per 6" = 10-10-10		Void		Void
Recovery %/RQD % = 95%/90% 11000psi =0CS		Water		Water
	·	Weathered Rock		Undefined
2D strip logs shown at 10x exaggeration		Water Table Delayed Water	Wat	er Table during drilling
3D strip logs have no exaggeration		Table	Wat	er lable after drilling
HAMPLAIN HUDSON POW	ER E	XPRES	SS	KIEWIT PROJECT NO. 21162
GMENT 3 (PACKAGE 1C.) WHITEH			ANN	CHA PROJECT NO.
				066076
PLAN AND PROFILE - HDD 7, (COND	UIT 2		DRAWING NO.
				C-306A
				I
	SCALE	ASI	NOTED	DATE 12/16/

Legend

Asphalt

Bedrock

Boulder Fat CLAY

SILTY Fat CLAY

Lean CLAY SILTY CLAY

> Concrete Fill

CLAYEY GRAVEL

SILTY CLAYEY GRAVEL

SILTY GRAVEL

ASPHALT

Bedrock

Boulder

СН

CH-MH

CL

CL-ML CONCRETE

Fill

GC

GC-GM

GM

X

20








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	P-y-3	GC	CLAYEY GRAVEL			
		GC-GM	SILTY CLAYEY GRAVEL			
		GM	SILTY GRAVEL			
	2003	GP	Poorly Graded GRAVEL			
		GP-GC	Poorly Graded Gravel with CLAY			
		<u></u> GP-GM	Poorly Graded GRAVEL with SILT			
		GW	Well Graded GRAVE			
		 GW=GC	Well Graded GRAVEL with CLAY			
		GW-GM	Well Graded GRAVEL with SILT			
		Limestone	Limestone			
		мн				
		MI				
		ПН	DRGANIC Eat CLAY			
	55					
		PT				
		Pock	Pork			
		Sandstone	Sandstong			
	·····	Surias ione				
	. /. •	SU-SM	SILT, CLATET SAND			
		SHALE	Shale			
		SILISIUNE	Siltstone			
		5M	SILIY SAND			
		SP 50	Poorly Graded SAND with CLAY			
	· · ·	SP-SU	Poorly Graded SAND with SUT			
		SP-SM				
		2 V 20	Well Graded SAND			
		SW-SU	Well Graded SAND with CLAY			
		5 w - 5 M	Well Graded SAND with SILT			
			Enavel on Canalomanata 1			
	<u> </u>			_		
				∣E		
			Interbedded Sandstone and Shale			
			Schist			
		0565 705	Schist			
BORING LOG STRIP LEGEND		0503 708	uneiss			
B101		0202 708	uneiss			
	<u> </u>	0565 /18	Granite 1			
Blow Counts per 6 = $10-10-10$		Void	Void			
1100000000000000000000000000000000000		Water	Water			
		weathered Rock	Undefined			
2D strip logs shown at 10x exaggeration		water Table Delayed Water	water table actor shilling			
3D strip logs have no exaggeration		Table	water table after drilling			
			KIEWIT PROJECT NO.			
		VLKES	21162			
SEGMENT 3 (PACKAGE 1C) WHITE	HALL T	O FORT A	ANN CHA PROJECT NO.			
PLAN AND PROFILE - HDD 7,	, COND		DRAWING NO.			
			C-306A. ⁴	1		
				-		
	SCALE	ASI	NOTED DATE 12/16/2	2022		
RAWN BY: MCS DESIGNED BY: MCS APPROVED BY: J	IEO REV. NC).	X			

- PLAN AND PROFILE CENTERLINE

Legend

Asphalt

Bedrock

Boulder Fat CLAY

SILTY Fat CLAY

Lean CLAY

SILTY CLAY

Concrete Fill

ASPHALT

Bedrock

Boulder

СН

СН-МН

CL

CL-ML CONCRETE

Fill



Champlain Hudson

Power Express

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	_							
	THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.		0	12/16/2022	FINAL EM&CP SUBMISSION	MCS	JEO	
			No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP	DR



13,550 SF WORKZONE	
T POINT RAIL CANADIAN MAINLINE	140
72.46	- 135
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	-130
MIN.	- 125
200' RADIUS OVERBEND TO BE EXCAVATED (POST HDD)	- 120
PPOSED	- 115
	- 110
	- 105
9+00 1	100 10+00

DRAWING NO.			
C-	307		

12/16/2022

## SCALE AWN BY: CKZ DESIGNED BY: CKZ APPROVED BY: JEO REV. NO.

AS NOTED DATE



**Champlain Hudson** Power Express



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PROPOSED HDD 8 PLAN VIEW CONDUIT 2	LOG WFE-1C		Legend         ASPHALT       Asphalt         Bedrock       Bedrock         Boulder       Boulder         CH       Fat CLAY         CH-MH       SILTY Fat CLAY         CL       Lean CLAY         CL-ML       SILTY CLAY         CONCRETE       Concrete         Fill       Fill         GC       CLAYEY GRAVEL         GC-GM       SILTY CLAYEY GRAVEL
654.4', RHO = 110 (K*CM)/W			GM SILTY GRAVEL GP Poorly Graded GRAVEL
BASE OF RAIL BASE	EXIT POINT CP RAIL CANADIAN MAINLINE MP 72.48           Image: Constraint of the state	WORKZONE	CP-CC       Poorly Graded Gravel with CLAY         CP-CM       Poorly Graded GRAVEL with SILT         GW       Well Graded GRAVEL with SILT         GW-CC       Well Graded GRAVEL with SILT         Limestone       Limestone         MH       Elastic SILT         ML       SILT         OH       ORGANIC Fat CLAY         OL       ORGANIC Fat CLAY         OL       ORGANIC SolL         PT       PEAT         Rock       Rock         Sandstone       Sandstone         Silt Stone       Sandstone         Silt Stone       Silt CLAYEY SAND         SC       CLAYEY SAND         SP       Poorly Graded SAND         SP -SC       Poorly Graded SAND         SP -SC       Poorly Graded SAND with CLAY         SW -SC       Well Graded SAND with SILT         SW -SSC       Well Graded SAND with SILT         SW -SSC       Well Graded SAND with SILT         SW -SSC       Well Graded SAND with SILT         Topsoil       Topsoil       Topsoil
PROPOSED HDD 8 PROFILE CONDUIT 2		BORING LOG STRIP LEGEND B101 Blow Counts per 6'' =10-10-10 Recovery %/RQD % =95%/90%	USGS 654     Subgraywacke       USGS 670     Interbedded Sandstone and Shale       USGS 702     Quartzite       USGS 705     Schist       USGS 705     Schist       USGS 705     Schist       USGS 708     Gneiss       USGS 718     Granite 1       Void     Void       ✓     Water     Water       ✓     Water     Water       ✓     Water Table     Undefined       ✓     Delayed Water     Water Table during drilling       ✓     Delayed Water     Water Table after drilling
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