Appendix J. HDD Preliminary Site Investigation and Planning Report and Inadvertent Release and Recover Plan (HDD)

Champlain Hudson Power Express

HDD Design Summary Report
Crossings HDD 1 to HDD 2
in Segment 1 and 2

Putnam to Whitehall
Washington County, New York

CHA Project Number: 066076

Prepared for:
Transmission Developers Inc.
1301 Avenue of the Americas, 26th Floor
New York, NY 10019

Prepared by:
CHA Consulting, Inc.
III Winners Circle
Albany, New York 12205
(518) 453-4500

April 2022

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1.0 INTRODUCTION

1.1 PURPOSE

The Champlain Hudson Power Express (CHPE) consists of installing a pair of HVDC electrical transmission cables with an associated telecommunications line from Canada to New York City. The portion of the work addressed herein is located in the upland portion of the route from the south end of Lake Champlain to New York City along the uplands of the Hudson River Valley. This work includes approximately 126 crossings under roads, railroads, wetlands water bodies, and obstructions to be installed using horizontal directional drilling (HDD) methods to minimize interference with use or impacts to the environment. This Design Summary Report addresses the design for the HDD crossings in Segment 1 and 2 from Putnam and Whitehall. These crossings are designated HDD 1 through HDD 2.

The purposes of this Design Summary Report are to provide the following:

- Review of the existing geological, hydrogeological, and geotechnical conditions for HDD 1 through HDD 2 for total of 4 crossings (2 per site) in Segment 1 and 2.
- Provide a descriptive narrative of the HDD Crossings in support of the attached design drawings and technical specifications.
- Present stress and inadvertent release analyses that support the proposed designs.
- Evaluate construction considerations including inadvertent return mitigation.

2.0 PROJECT DESCRIPTION

The proposed CHPE route follows the Hudson River Valley of New York. The new transmission line will be approximately 146 miles in length, extending from the south end of Lake Champlain to Astoria, NY. Segment 1 and 2 is located in approximately a 13-mile section of the route in Washington County, New York.

A Project Locus Map and a plan showing the locations of the HDD 1 through HDD 2 crossings are presented in Appendix A.

The HDD crossing addressed in this report are located as shown in Table 1 below:

Table 1: HDD Locations, Lengths, and Description

HDD #	Start Station	End Station	HDD Length, ft	Obstruction Crossed
1	10145+16	10154+30	897	Mill Brook Culverts
2	12920+90	12950+20	2984	South Bay of Lake Champlain

3.0 BACKGROUND

The underground construction of two HVDC electrical transmission cables is proposed to be housed in individual 10-inch-diameter DR 9 HDPE casings spaced approximately 15 feet apart. A third, 2-inch-diameter DR 9 casing will be bundled with one of the 10-inch diameter casings for a telecommunications line. The casings are to be installed in 16 to 20-inch final ream diameter bore holes. The proposal is to install the cables at least 25 feet below congested areas, roads, railroads, under/around other obstructions, 15 to 25 feet below wetland, and 35 to 45 feet below open bodies of water using HDD methods. HDD is a widely used trenchless construction method to install conduits with limited disturbance to the ground around the bore alignment, minimal ground surface impacts above the alignment, and to minimize the potential of inadvertent releases of drilling fluids while boring. The goal for using HDD methods is to install the conduits while controlling and minimizing the amount of impact congested areas, existing underground obstructions, and to the adjacent wetlands to the extent possible.

4.0 SITE CONDITIONS

4.1.1 Project Datum and Topography Need to confirm dimensions with final plans

HDD #1

The ground surface elevations along the HDD path gently undulates between El. 267 and El. 286 (reference datum NAVD 1988). Waterbodies/wetlands are present between approximately Sta. 10147+20 and Sta. 10147+60 (at about El. 267) and between approximately Sta. 10152+80 and Sta. 10153+25 (at about El. 276).

HDD #2

The ground surface elevations along the HDD path gently undulates between El. 100 and El. 111 (reference datum NAVD 1988). Wetlands are present between approximately Sta. 12927+50 and

Sta. 12944+60 and are at about El. 95-98. Waterbodies are present between approximately Sta. 12929+60 and Sta. 12938+20 and are at about El. 94.

4.1.2 Geotechnical Data

HDD #1

A subsurface investigations were conducted by AECOM subcontracted by Clough Harbour & Associates, LLP (CHA) and the Kiewit Team. The investigation consisting of two [2] boring (GTB-PD7 & GTB-PD7A) performed between 12/29/20 and 12/30/20.

Borings GTB-PD7 & GTB-PD7A are located along the proposed HDD alignment between approximately Sta. 10146+50 and Sta. 10148+00. These two [2] ranged in depth at approximately 50 feet (see Appendix B).

Based on the borings, the soil profile for the HDD #1 BoreAid analyses was divided into six [6] layers: Fill (Sand), Silt (ML), Clay (CL), Clay (CH), Silt (ML) and Organics (OH). The soil profiles used for BoreAid analyses of the HDD #1 in this segment are presented in Appendix E.

HDD #2

Subsurface investigations were conducted by in 2012 by TRC for Transmission Developers, Inc. and in 2022 by Kiewit. There are ten borings to date all drilled to the north of the bridge. Geophysics is planned to check for rock fill at shorelines for the alternative, and preferred, south route. These northern borings B109.7-1, B109.8-1, B110.0-1, and B110.1-1 (conducted in 2012) indicate mostly fat and lean clays at the depth of the planned drill. Borings K-109.6, K-109.7, K109.9, K110.0, K110.1, and K110.3 (conducted in 2022) indicate fill and rock at depth in addition to the fat clays. The geotechnical report for HDD #2 can be found in Appendix C. In addition, boring logs from the existing 1961 bridge were reviewed and considered during the evaluation of the southern route that is now considered the preferred route.

Based on these borings and historic borings for the State Route 22 bridge construction, the soil profile for the HDD #2 BoreAid analyses was divided into four [4] layers: Silt (M), and three layers of Clay (CL) with varying properties. The Rock Fill encountered during recent borings from the existing causeway is not expected to be present along the south of Bridge alignment selected. The soil profiles used for BoreAid analyses of the HDD #2 can be found in Appendix F. No new borings south of the bridge are planned at this time due to barge access.

Archeological ruins and remains of old bridges were noted north of the bridge at HDD #2. Remains of approximately 10 sunken ships or barges, some circa 1812, and a 1913 bridge are located just north of the jetties, see Appendix D. In addition, the records appear to indicate that barges were sunk as part of the foundation system for the 1913 bridge in addition to dumpling gravel, cobbles and boulders and pushing them down into the soft sediments. The locations of these ruins and related obstructions are not expected to be present along the south of bridge alignment selected, however this still needs to be confirmed.

5.0 DESIGN SUMMARY

The HDD construction process in soils generally consists of three steps:

Step 1: Drill a small diameter (approximately 7 to 9 inches diameter) pilot hole along the preplanned bore path. During the pilot hole boring, the location of the drill bit is tracked to confirm that it is following the planned path. If the drilling is observed to start to deviate from the planned path, corrections are made using a “bent” lead drilling section and controlled rotation of drill pipe string. The drill bit is design to cut through the soil in combination with pressurized drilling fluid assisting the cutting of the soil, and transport of the cuttings to the entry pit for removal. The drilling fluid is generally a combination of bentonite (a clay mineral) and water, combined with inert biodegradable additives to support sides of the borehole and to better carry the cuttings to the entry pit at lower pressures and velocities. The drilling fluids typically used under waterbodies and wetland areas are typically required in the project specifications to be “non-toxic and environmentally friendly”. Once the pilot bore reaches the exit point, the next step of the process, hole enlargement begins.

Step 2: Enlarge the pilot hole to the diameter required for insertion of the conduits. This is accomplished by using successively larger reaming bits pulled through the pilot bore to gradually enlarge the bore from about 8 inches diameter 16 to 20 inches diameter to accommodate in this case a HDPE conduit about 10 inches in diameter in one bore and a bundle of two, conduits, one

10 inches diameter and the other 2 inches diameter that are to be pulled into the enlarged bore hole. We estimate that one and possibly a second reaming passe will be used to create the 16 to 20 inch -inch-diameter borehole. This pulling in of a bundle of conduits is sometimes referred to as a slick bore. During this step, the borehole is still filled with drilling fluid to support the sides of the bore hole in preparation for Step 3, the insertion of the conduit.

Step 3: Pull the conduits into the enlarged hole. While the pilot hole and reaming operations are going on, the contractor will also be fabricating the conduits to be installed. The conduits come in about 40-foot-long sections and need to be fusion butt welded, debeaded, and arranged for the pullback into to the borehole. Ideally, the complete conduit (or bundle of conduits) will be welded (and bundled) into one long length for insertion. The goal is usually to pull the bundle into the bore in one, continuous, smooth, around the clock, operation. However, depending on work area and access constraints, sometimes the pipe is assembled in 2 or 3 lengths that then joined (welded), “on the fly” as the conduit (bundle) is slowly pulled into the borehole. As the conduit (bundle) is pulled into the hole it is usually ballasted with clean water, and some of the drilling fluid supporting the sides of the hole is displaced by the conduit and collected for eventual disposal.

5.1 GEOMETRY AND LAYOUT

The HDD profiles are generally defined by the following parameters:

- Entry point location;
- Exit point location;
- Entry angle;
- Exit angle;
- Horizontal and vertical radius of Curvature;
- Lengths of tangent sections;
- Length of crossing;
- Depth of crossing and depth of cover;
- Site constraints and obstructions; and
- Available work and layout areas

The proposed bore paths entry angle, exit angle, and a vertical and horizontal design radius of curvature for each HDD crossing in this segment are shown in the design drawings provided in Appendix H. Inadvertent release prevention and mitigation plans for each HDD crossing are provided as separate documents.

The design drawings that summarize the proposed HDD installations are in Appendix H. The HDD technical specifications are found in Section 330507.13 of the Technical Specifications. Inadvertent release prevention and mitigation plans for each HDD crossing are provided as separate documents.

The site conditions posed various challenges in developing a design that is both constructible and minimizes the potential for negative environmental impacts. The proposed design has entry and exit pits areas constrained by available easements and traffic constraints. Available work areas may limit the lengths of the conduit that can be pre-assembled, necessitating having to pre-assemble the bundle several segments that will have to be welded together during the pull back. Typical workspace requirements are provided in Figures 1a and 1b. HDD specific work areas at the entry and exit ends of the bores are noted on the drawings in Appendix H. In addition, space and easement constraints will require that during pullback, the above ground sections of the conduit will not be straight and will require rollers to accommodate a horizontal bend. Conduit assembly is expected to be performed at the ends of the alignment shown on the drawings in Appendix H for HDD specific work areas. In some cases, the limited work area at the one end of the HDD alignment, may require that the drilling and reaming prior to pullback be performed by the HDD rig located at the one end of the alignment, but the HDD rig may need to be relocated to the other end of the alignment for the pullback/conduit installation phase of the work. In addition, for some longer bores in soft/weak ground conditions, the intersection bore method may be used to better control the risk of inadvertent drilling fluid releases.

5.2 SUBSURFACE MODEL DEVELOPMENT

A subsurface model was developed based on the boring logs as approximate representation of subsurface conditions along the proposed HDD alignment (see Appendix E, F and D for soil property calculations). BoreAid Version 5.0.14 (2015) modeling software (a product of Vermeer) was used to model the HDD. Geotechnical input parameters of the soil were estimated as described below.

The internal friction angles (AASHTO LRFD, Ed. 7) were estimated using the SPT blow counts. The shear modulus (G) of each layer was estimated using soil density or consistency based on SPT blow count (N-value) and representative soil layer descriptions were used to estimate Young's

Modulus (E) using Hunt (1986). The shear modulus was estimated using the relationship G = E/[2(1=ν)], taking Poison's Ratio (ν) equal to 0.3. Dry and saturated unit weights were selected based on soil type using Table 2-8 from the Manual on Estimating Soil Properties for Foundation Design (EPRI, 1990). For cohesive soils, cohesion was estimated based on empirical correlations with SPT blow counts (EPRI 1990). Tables for soil properties used for the HDDs in Segment 1 and 2 are presented in Appendix G.

5.2.1 BoreAid Analysis

For the BoreAid analyses, the pipe configuration analyzed was for a pipe with a dimension ratio (DR) of 9 which is assumed to be ballasted with water during pullback to create a near neutral buoyancy. The following conduit configurations will be used:

1) An individual 10-inch-diameter DR 9 HDPE casing, and

2) A bundle consisting of a 10-inch-diameter DR 9 HDPE casing and a 2-inch-diameter DR 9 HDPE casing

The stresses and deflections of the pipe are evaluated and compared to allowable values as shown on the BoreAid runs presented in Appendix E and F.

5.2.2 Inadvertent Return and Hydro-fracture Analysis

BoreAid modeling software was used to perform inadvertent return analyses for each HDD alignment. The bore path alignment was selected and checked so that the allowable bore pressures are greater than the static and circulating pressures throughout most of the alignment except at the ends. The allowable pressures are related to in-situ ground and water stresses around the bore hole, and the strength of the ground. The Limiting Formation Pressure Figure indicates a generally acceptable factor of safety against the potential for hydrofracture along the proposed bore paths except at the ends.

Based on the bore path selection process, areas with the greatest potential for an inadvertent return were examined and adjusted during the design process to further limit the risks associated with an inadvertent return when possible. The entry and exit points exhibited the greatest potential for inadvertent returns. The depth of the entry/exit pits should be considered by the Contractor to increase the effective soil stress and provide a storage volume for returns to and near the entry and exit points. Note that while the potential for hydrofracture has been reduced through the design process, inadvertent returns are still possible through existing fissures in the soil or rock, shrinkage cracks, weak soils, or porous deposits of coarse gravel.

Fractures within and/or hydraulic fracturing (frac-out) of the surrounding soils may cause loss of drilling fluid pressures or inadvertent return of drilling fluid into the wetlands. The areas of greatest concern are reduced soil cover over the bore alignment and where there is a risk of release to the wetlands. The contractor will be required to institute pre-emptive measures in this area to mitigate the effects of a release in the event that one should occur. Such measures may include containment booms and a standby vacuum truck to collect any released drilling fluids immediately. Ground heave or settlement from frac-out and inadvertent returns also pose risks to structures such as roadways. The HDD alignment was designed with geometries to providing enough soil cover to reduce the risk of inadvertent return. The Inadvertent Release Contingency Plan details additional methods for mitigating inadvertent returns.

5.3 LIMITATIONS

The structural analysis and inadvertent return mitigation analysis were performed using the proposed design bore paths and typically anticipated equipment and means and methods. The HDD subcontractor must submit structural and inadvertent return mitigation calculations and analysis for each bore path, including their final bore path geometry reflecting its specific equipment and contractor's specific means, methods drilling fluids, and proposed final contractor refined final planned alignment. It is important to note that the Kiewit Design Team's analysis has been done without consideration for point loading due to unpredictable subsurface features such as encountering rocks, boulders, or other extremely dense material that may damage the pipe. The risk of such pipeline damage is low yet has been reported on some projects in recent years.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 RISK AWARENESS AND ASSESSMENT

The risks to be aware of during HDD include: inadvertent returns or fluid loss; any potential obstructions blocking or causing large deviations from the planned bore path; and electromagnetic effects of the HDD steering equipment from nearby high voltage power lines.

6.2 SITE ANALYSIS

What does the site look like and what considerations might need to be taken for site access, construction of HDD entry and exit pits, and layout area for equipment and supplies?

6.3 EROSION CONTROL

The proposed bore path crosses under roads, parking lots, water, stormwater and gas and electric utility lines, as well as under streams/wetlands, bodies of water, and railroads. The soil erosion control drawing will show where primary soil erosion control measures are required. The technical specifications and Inadvertent Release Contingency Plan both detail the requirements for both primary and secondary sediment and erosion control measures to be followed in case of an inadvertent return, which ultimately could deposit the fine bentonite sediment into the stream or wetland or bodies of water if not controlled. Construction of the exit pit will be close to the stream/wetlands. Silt fence, hay bales, and other soil erosion control measures will be required to be installed as shown in the construction drawings. Secondary control measures are to be readily accessible at or near the work areas in accordance with the project specifications and Inadvertent Release Contingency Plan.

6.4 SURVEILLANCE AND MONITORING

During installation of the pipe by HDD, monitoring the stream, wetlands, waterbodies and bore alignment for indications of potential inadvertent returns or hydrofracture will be necessary. The contractor will have primary responsibility for this monitoring and associated response and reporting in real-time. This will be accomplished as detailed in the Inadvertent Release Contingency Plan. Continuous visual inspection of the entire path is the most significant method of detection. However, an experienced drill crew can often prevent a return by monitoring drilling fluid pressures. A loss of pressure may indicate hydrofracture has occurred. Regardless of the level of preparation, inspection, monitoring, etc., inadvertent returns are not always possible to predict or prevent. However, a significant effort can minimize the possibility but not eliminate it.

7.0 REFERENCES

American Association of State Highway and Transportation Officials. (2014). AASHTO LRFD bridge design specifications, Seventh edition, U.S. customary units. Washington, DC: American Association of State Highway and Transportation Officials.

Mayne, P.W., and Kulhawy, F.H. (1990). Manual on Estimating Soil Properties for Foundation Design. Electric Power Research Institute (EPRI).

Hunt, R.E. (1986). Geotechnical Engineering Analysis and Evaluation, McGraw-Hill Book Company, New York.

- Drill rig & HDD entry point
- Mud pump
- Drill pipe
- Power unit & control trailer
- Fluid system & tank
- Other supporting equipment & supplies

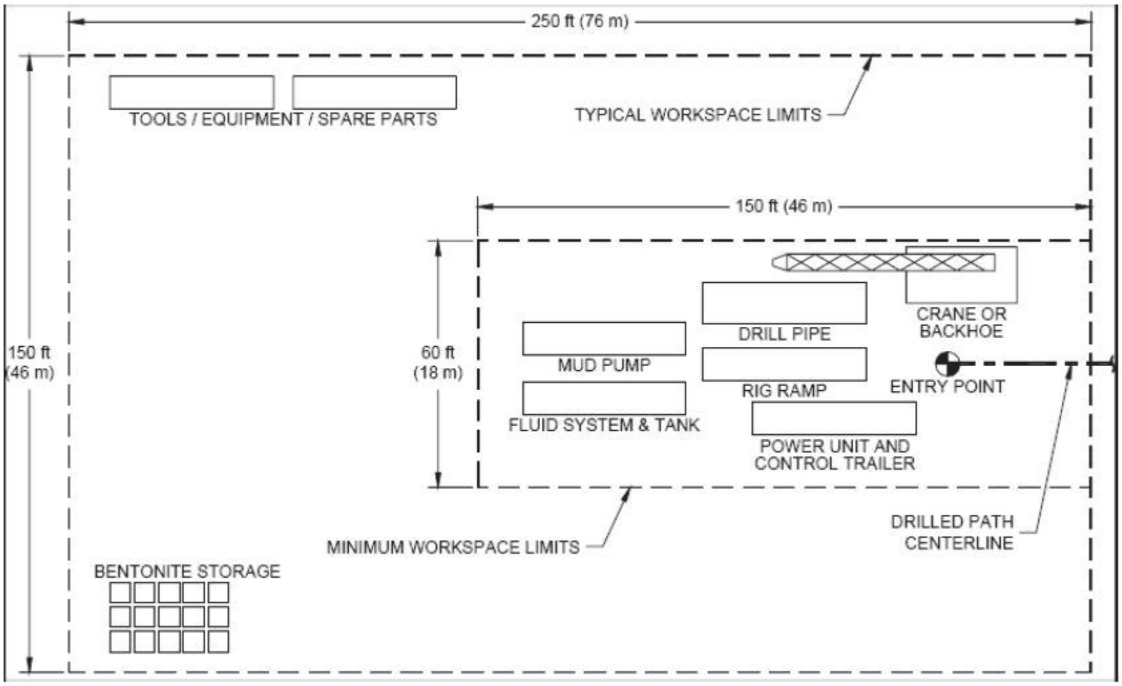
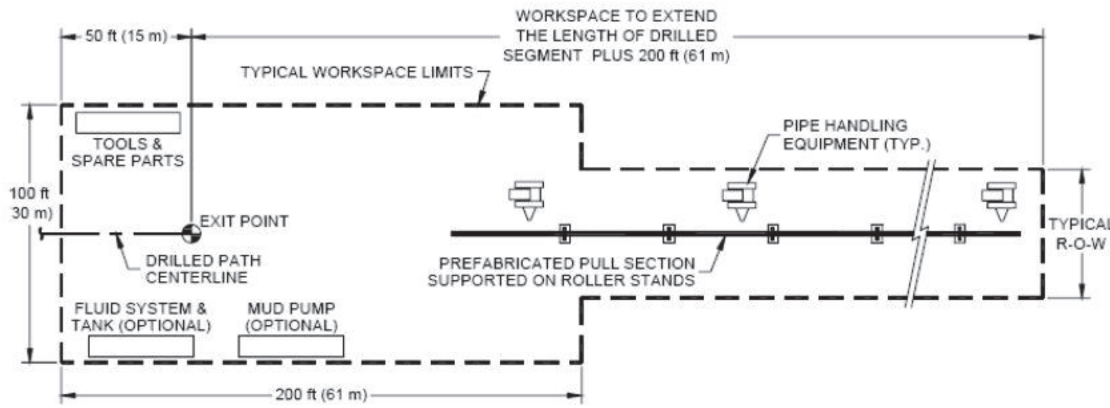


Figure 1a: Typical HDD Entry Workspace Area

Excerpt from Trenchless Construction Feasibility Analysis,
Pennsylvania Pipeline Project By TetraTech, Inc., December 2018, *Page 4*

The drill exit workspace typically contains the following features (see Figure below):

- Exit point
- Pipe handling equipment
- Prefabricated pullback pipeline section
- Other supporting equipment & supplies



The size of the entry and exit workspace areas is directly related to the diameter of the pipe to be installed. A summary of typical workspace areas is provided below:

Typical HDD Entry and Exit Workspace Areas

System Description	Entry Workspace	Exit Workspace
Maxi-HDD (24” to 48” diameter pipe)	150’ x 350’	150’ x 250’
Midi-HDD (12” to <24” diameter pipe)	150’ x 250’	100’ x 200’
Mini-HDD (2” to <12” diameter pipe)	Varies greatly per site	Varies greatly per site

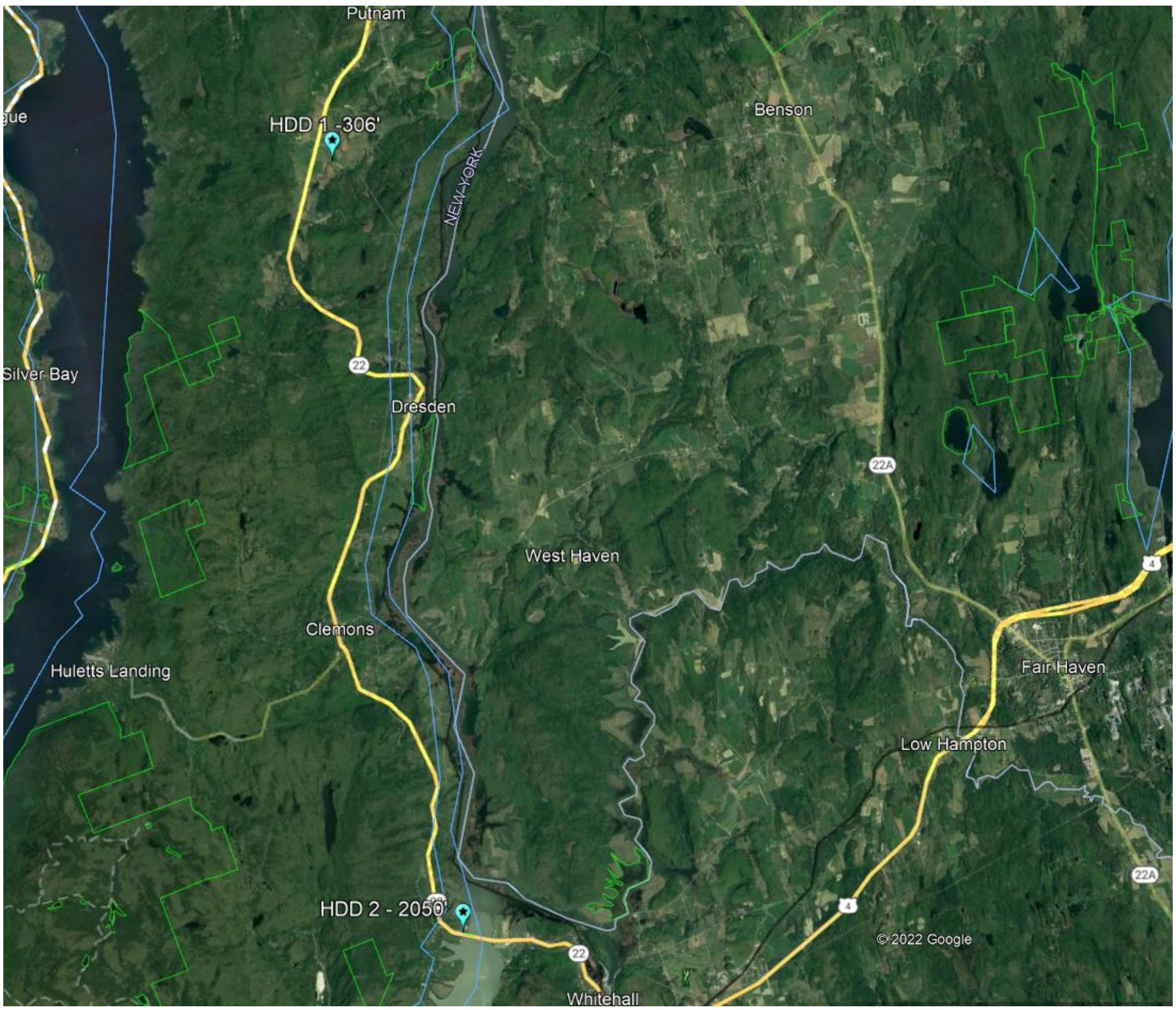
Figure 1b: Typical HDD Exit Workspace Area

Excerpt from Trenchless Construction Feasibility Analysis,
Pennsylvania Pipeline Project By TetraTech, Inc., December 2018, Page 5

By MD Boscardin: Depending on equipment specifics, for Mini-HDD rig (say for bores <12' diam. and < 800 feet long) in a road or next to railroad:
1) an entry work space approximately 20 to 25 feet wide x 150 to 200 feet long for a rig with a mounted pipe rack and self-contained power unit and operator control cabin on the rig; plus a separate mud mixing and pumping unit, plus a separate mud processing and separation unit support equipment arranged linearly in line may be possible, and
2) an exit work space approximately 15 to 20 feet wide and between 60% and 110% of the bore length is needed to layout and assemble the pipe for pullback is needed. Somewhat smaller entry work areas may be possible depending drill rig specifics and availability of nearby areas for support equipment support operations. Often need to coordinate final work areas with selected contractor's specific operations. Keep in mind that the smaller work areas tend to reduce access and efficiency of operations, thus raise costs.

Appendix A

Locus Map



Putnam
HDD 1 -306'
Benson
NEW YORK
Silver Bay
22
Dresden
22A
West Haven
4
Clemons
Huletts Landing
Fair Haven
Low Hampton
22A
HDD 2 - 2050'
4
22
© 2022 Google
Whitehall

Appendix B

HDD #1 Geotechnical Data Report

MEMORANDUM

DATE: April 14, 2022

TO: Antonio Marruso, P.E.; CHA Consulting, Inc.

FROM: Matthew Hawley, P.E.; Kiewit Engineering (NY) Corp. MKH
Jaren Knighton; Kiewit Engineering (NY) Corp.

SUBJECT: Geotechnical Data: Segment 1 - HDD Crossing 1
Champlain Hudson Power Express Project
Putnam Station, New York

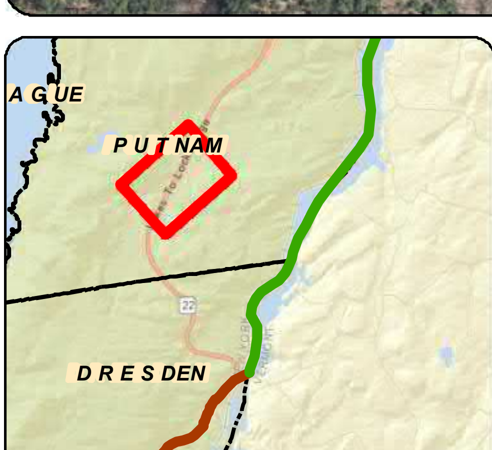
Kiewit Engineering is providing the enclosed geotechnical data for use in the Lake Road horizontal direction drill (HDD) design for the Champlain Hudson Power Express project in Upstate New York. This HDD crossing is located west of Putnam Station, New York. The approximate station for HDD crossing Number 1 is STA 10148+00 (43.722099° N, 73.418212° W).

The geotechnical data at this HDD crossing is enclosed. The available data is from the previous investigation by AECOM, referenced below. No additional exploratory borings were performed at this HDD location.

- AECOM, Geotechnical Data Report, Upland Segments, Champlain Hudson Power Express, dated May 28, 2021.

Contact us if you have questions or require additional information.

HDD 1
Boring PD-7, PD-7A
Segment 1



LEGEND

- 111.8 Certified Milepost - Tenths
- Certified Milepost
- 111.8 Preferred Alternative Milepost - Tenths
- 135 Preferred Alternative Milepost
- Terrestrial Route HVDC
- Submarine Route HVDC
- Terrestrial Route HVAC
- Preliminary HDD Locations
- Preliminary Pipe Bridge Location
- 2021 Boring Location
- Previous (2013) Boring Location
- Streams/Ditches
- Railroad ROW
- Deviation Zone
- Deviation Zone Outside ROW
- Preferred Alternative Deviation Zone
- Preferred Alternative Deviation Zone Outside ROW
- Town Boundary
- Village Boundary
- State Park (OPRHP)

Parcel Ownership
T O W N N AME
Road Name
Village Name

Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

BORING LOCATION PLAN

Putnam to Dresden

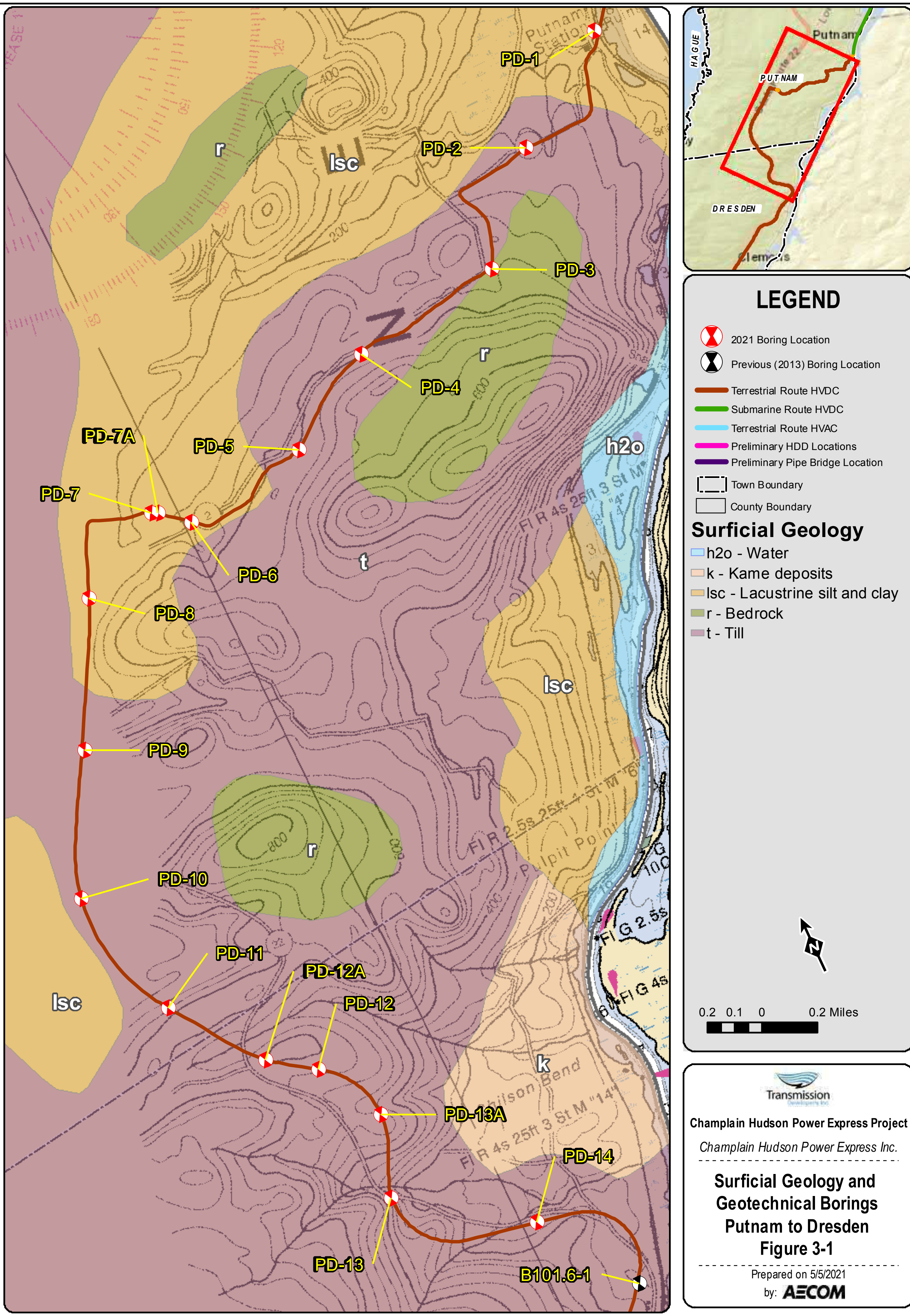
Figure A-1

Sheet 3 of 6

Prepared by: AECOM 5/18/2021

DATA SOURCES: ESRI, NETWORK MAPPING 2010, NYSDOT, OPRHP, TDI, TRC

Y:\Projects\CHPE\Route\Consensus_Alternative_Routes\MXD\Alt_5_Routes_DZ_201909\Boring_Locations\Maps_for_May_2021_Report\Putnam_to_Dresden_Boring_Locations_Mapset_May_2021_Report.mxd



Transmission Developers Inc.

Champlain Hudson Power Express Project

Champlain Hudson Power Express Inc.

Surficial Geology and Geotechnical Borings Putnam to Dresden Figure 3-1

Prepared on 5/5/2021

by: AECOM

DATA SOURCES: ESRI, NYSDOT, NOAA, USACE, NYDOS, TDI, TRC

Y:\Projects\CHPE\Route\Consensus_Alternative_Routes\MXD\Alt_5_Routes_DZ_201909\Boring_Locations\Maps_for_May_2021_Report\Putnam_to_Dresden_Boring_Locations_Surficial_May_2021_Report.mxd

BORING CONTRACTOR: ADT	AECOM	SHEET 1 OF 3
DRILLER: Chris Chaillou		PROJECT NAME: CHPE -
SOILS ENGINEER: Chris French		PROJECT NO.: 60323056
		HOLE NO.: **PD-7**
		START DATE: 12/30/20
	BORING LOG	FINISH DATE: 12/30/20
LOCATION: MP - 3.03 (Lake Road)		OFFSET: N/A

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL	DRILL RIG: Geoprobe 7822DT
Water at 20' (inferred)	TYPE	Flush Joint Steel	California Modified	Tricone Roller Bit		BORING TYPE: SPT
	SIZE I.D.	4"	2.5"	- -		BORING O.D.: 4.5"
	SIZE O.D.	4.5"	3"	3 7/8"		SURFACE ELEV.:
	HAMMER WT.	140 lbs	140 lbs			LONGITUDE:
	HAMMER FALL	30"	30"			LATITUDE:

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.(2)	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		0'-5'				Hand Cleared					SP		0.0'-1.0'; Dark brown fine-coarse SAND, some cobbles, little gravel; dense, frozen-mud
1.0											ML		1.0'-5.0'; Gray SILT, little clay, trace medium-fine sand; stiff, moist
2.0													
3.0		3'-5'	S-1										TR-1; (3.0'-5.0')
4.0													
5.0		5'-7'	S-2	24"	12"	4	5	5	4	7	ML		Gray SILT and clay; medium stiff, moist
6.0													
7.0		7'-9'	S-3	24"	18"	8	7	7	8	5	CL		Brown CLAY and silt; medium stiff, moist
8.0													
9.0		9'-11'	S-4	24"	18"	6	8	9	11	11	ML		Gray brown SILT, some glay; stiff, moist
10.0													
11.0		11'-'13'	S-5	24"	15"	8	10	9	10	12	ML		SAA
12.0													TR-2; (12.0'-12.5')
13.0		13'-15'	S-6	24"	24"	5	11	11	8	14	ML		Gray brown clayey SILT; stiff, moist
14.0													
15.0		15'-17'	S-7	24"	24"	3	2	3	4	3	CL		Gray and brown CLAY and silt, ~1" lenses of stiff silt; soft, moist
16.0													TR-3; (16.0'-16.5')
17.0													
18.0													
19.0													
20.0													

NOTES:

(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.

(2) Correction factor: $N_{corr}=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT		SHEET 2 OF 3
		PROJECT NAME: CHPE -
DRILLER: Chris Chaillou	AECOM	PROJECT NO.: 60323056
		HOLE NO.: **PD-7**
SOILS ENGINEER: Chris French		START DATE: 12/30/20
	BORING LOG	FINISH DATE: 12/30/20
LOCATION: MP - 3.03 (Lake Road)		OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		20'-22'	S-8	24"	24"	WOH					CL		Gray CLAY and silt; stiff, wet
21.0													
22.0													
23.0													
24.0													
25.0		25'-27'	S-9	24"	24"	WOH	WOH	WOH	2		CL		Gray CLAY and silt; soft, wet
26.0													TR-4; (26.0'-26.5')
27.0													
28.0													
29.0													
30.0		30'-32'	S-10	24"	24"	WOH					CL		SAA
31.0													
32.0													
33.0													
34.0													
35.0		35'-37'	S-11	24"	24"	WOH					CL		SAA
36.0													
37.0													
38.0													
39.0													
40.0		40'-42'	S-12	24"	24"	WOH					CL		Gray silty CLAY; soft, wet
41.0													
42.0													
43.0													
44.0													
45.0													

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT DRILLER: Chris Chaillou SOILS ENGINEER: Chris French	AECOM **BORING LOG**	SHEET 3 OF 3 PROJECT NAME: CHPE - PROJECT NO.: 60323056 HOLE NO.: **PD-7** START DATE: 12/30/20 FINISH DATE: 12/30/20
LOCATION: MP - 3.03 (Lake Road)		OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		45'-47'	S-13	24"	24"	WOR	WOH	WOH	2		CL		SAA
46.0													TR-5; (46.0'-46.5')
47.0													
48.0		48'-50'	S-14	24"	24"	WOR	WOR	WOH	WOH		CL		SAA
49.0													
50.0													Boring PD-7 terminated at 50', grouted to surface
51.0													
52.0													
53.0													
54.0													
55.0													
56.0													
57.0													
58.0													
59.0													
60.0													
61.0													
62.0													
63.0													
64.0													
65.0													
66.0													
67.0													
68.0													
69.0													
70.0													

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against DMJM Harris AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT	AECOM		SHEET 1 OF 3
DRILLER: Chris Chaillou			PROJECT NAME: CHPE -
SOILS ENGINEER: Chris French	BORING LOG		PROJECT NO.: 60323056
			HOLE NO.: **PD-7A**
			START DATE: 12/29/20
			FINISH DATE: 12/29/20
LOCATION: MP - 2.99 (Lake Road)			OFFSET: N/A

GROUND WATER OBSERVATIONS		CASING	SAMPLER	DRILL BIT	CORE BARREL	DRILL RIG: Geoprobe 7822DT
Water at 15' (inferred)	TYPE	Flush Joint Steel	California Modified	Tricone Roller Bit		BORING TYPE: SPT
	SIZE I.D.	4"	2.5"	- -		BORING O.D.: 4.5"
	SIZE O.D.	4.5"	3"	3 7/8"		SURFACE ELEV.:
	HAMMER WT.	140 lbs	140 lbs			LONGITUDE:
	HAMMER FALL	30"	30"			LATITUDE:

DEPTH	CORING RATE MIN/FT	SAMPLE DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.(2)	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		0'-5'				Hand Cleared					SP		0.0'-2.0'; Brown fine-coarse SAND, little silt, little subangular gravel; loose, moist
1.0													
2.0											ML		2.0'-5.0'; Brown clayey SILT, little fine-medium sand, medium stiff, moist
3.0		3'-5'	S-1										TR-1; (3.0'-5.0')
4.0													
5.0		5'-7'	S-2	24"	24"	12	14	16	19	20	ML		Brown silt, some clay; very stiff, moist
6.0													
7.0		7'-9'	S-3	24"	16"	15	15	12	10	8	ML		Brown SILT, some clay; medium stiff, moist, pink mottling
8.0													TR-2; (8.0'-8.5')
9.0		9'-11'	S-4	24"	18"	9	15	15	15	20	ML		Brown clayey SILT; very stiff, moist
10.0													
11.0		11'-'13'	S-5	24"	24"	9	12	11	15	15	ML		Brown clayey SILT, stiff, moist
12.0													
13.0		13'-15'	S-6	24"	24"	9	8	10	9	12	ML		SAA
14.0													
15.0		15'-17'	S-7	24"	22"	3	4	5	5	6	ML		Brown SILT and clay, trace fine-medium sand, trace subangular gravel; medium stiff, wet
16.0													TR-3; (16.0'-16.5')
17.0													
18.0													
19.0													
20.0													

NOTES:
(1) Thick-wall ring lined drive sampler (California sampler) used for SPT samples. Rings dimensions = 2-1/2" O.D. by 2-7/16" I.D. by 6" length.
(2) Correction factor: $N_{corr}=N*(2.0^2-1.375^2)in./(3.0^2-2.4^2)in. = N*0.65$.

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT		SHEET 2 OF 3
DRILLER: Chris Chaillou	AECOM	PROJECT NAME: CHPE -
		PROJECT NO.: 60323056
		HOLE NO.: **PD-7A**
SOILS ENGINEER: Chris French	**BORING LOG**	START DATE: 12/29/20
		FINISH DATE: 12/29/20
LOCATION: MP - 2.99 (Lake Road)		OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		20'-22'	S-8	24"	20"	WOH	1	1	2	1	ML		Gray SILT and clay; very soft, wet
21.0													
22.0													
23.0													
24.0													
25.0													
		25'-27'	S-9	24"	18"	WOH	WOH	WOH	3		ML		SAA
26.0													TR-4; (26.0'-26.5')
27.0													
28.0													
29.0													
30.0													
		30'-32'	S-10	24"	24"	WOH	WOH	2	2	1	CL		Gray CLAY and silt; soft, wet
31.0													
32.0													
33.0													
34.0													
35.0													
		35'-37'	S-11	24"	24"	WOH	WOH	WOH	3		CL		SAA, very soft
36.0													TR-5; (36.0'-36.5')
37.0													
38.0													
39.0													
40.0													
		40'-42'	S-12	24"	24"	WOH	WOH	1	1	1	CL		SAA
41.0													
42.0													
43.0													
44.0													
45.0													

NOTES:

Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

BORING CONTRACTOR: ADT		SHEET 3 OF 3
DRILLER: Chris Chaillou		PROJECT NAME: CHPE -
SOILS ENGINEER: Chris French		PROJECT NO.: 60323056
		HOLE NO.: **PD-7A**
		START DATE: 12/29/20
	BORING LOG	FINISH DATE: 12/29/20
LOCATION: MP - 2.99 (Lake Road)		OFFSET: N/A

DEPTH	CORING RATE MIN/FT	DEPTHS FROM - TO (FEET)	TYPE AND NO.	PEN. in	REC. in	BLOWS PER 6 in ON SAMPLER (ROCK QUALITY DESIGNATION)				N Corr.	USCS CLASS.	STRAT. CHNG. DEPTH	FIELD IDENTIFICATION OF SOILS
		45'-47'	S-13	24"	20"	WOH	WOH	WOH	1		CL		Gray silty CLAY; very soft, wet
46.0													TR-6; (46.0'-46.5')
47.0													
48.0													
		48'-50'	S-14	24"	24"	WOR	WOR	WOH	3		CL		SAA
49.0													
50.0													
													Boring terminated at 50', grouted to surface
51.0													
52.0													
53.0													
54.0													
55.0													
56.0													
57.0													
58.0													
59.0													
60.0													
61.0													
62.0													
63.0													
64.0													
65.0													
66.0													
67.0													
68.0													
69.0													
70.0													

NOTES:

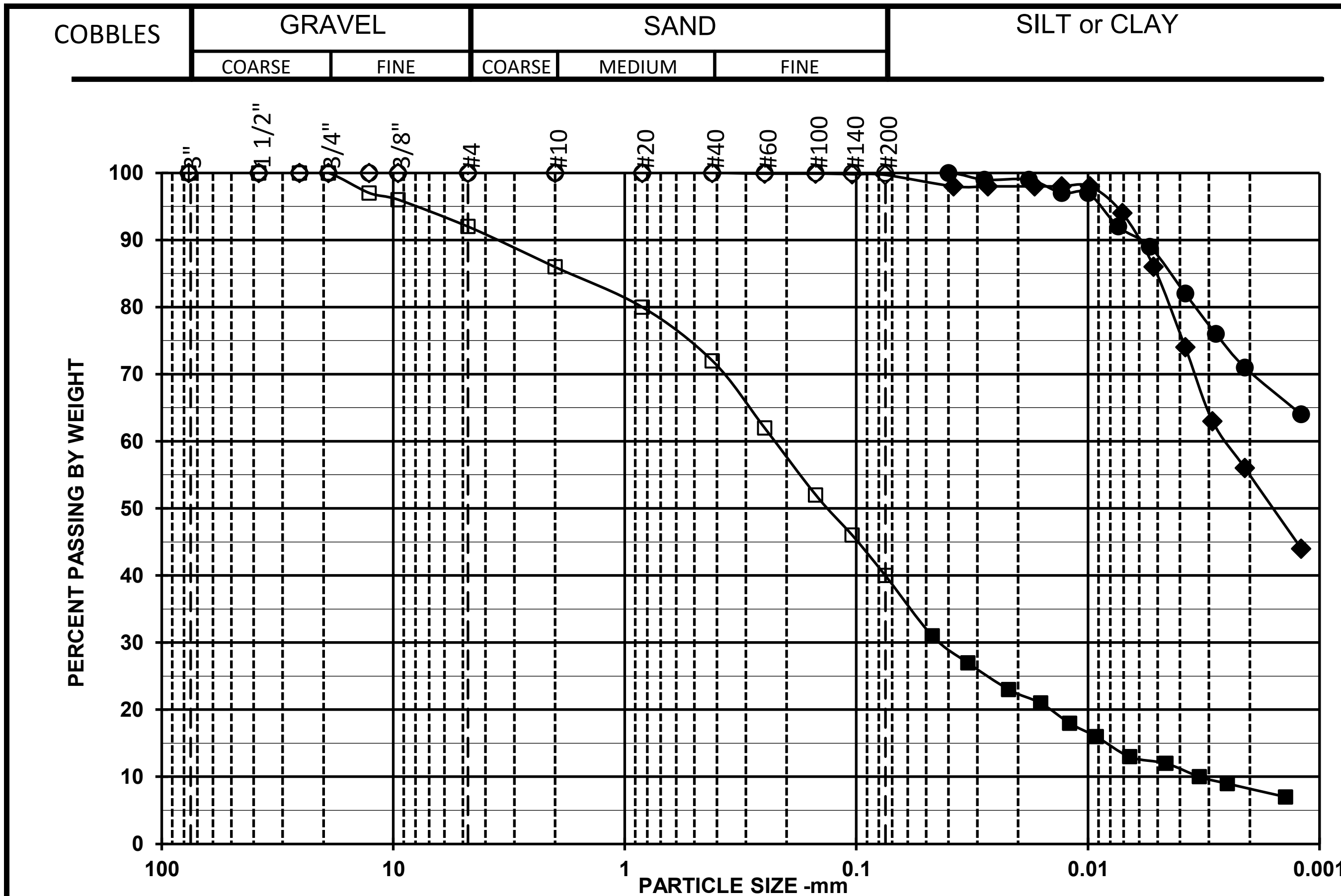
Soil description represents a field identification after D.M. Burmister unless otherwise noted.

The information contained on this log is not warranted to show the actual subsurface condition. The contractor agrees that he will make no claims against DMJM Harris AECOM if he finds that the actual conditions do not conform to those indicated by this log.

SAMPLE TYPE:	S= SPLIT SPOON	U=SHELBY TUBE	R=ROCK CORE	
PROPORTIONS:	TRACE=1-10%	LITTLE=10-20%	SOME=20-35%	AND=35-50%

Table 3-1: Summary of Geotechnical Laboratory Testing of Soil Samples Putnam to Dresden Segment (PD)												
Boring ID	Sample ID	Depth (ft)	USCS Symbol	% Gravel	% Sand	% Silt	% Clay	LL (1) (%)	PL (2) (%)	PI (3) (%)	Water Content	Org. Content (%)
PD-1	S-4	9-11	ML	0	27.5	65.5	7	-	-	-	19.2	-
	S-8	20-22	SM	0	63.9	32.1	4	-	-	-	18.8	-
	S-10	30-32	ML	0	37.6	57.4	5	-	-	-	18.0	-
	S-12	40-42	SM	0	83.8	13.2	3	-	-	-	18.6	-
PD-2	S-2	5-7	ML	0	2.3	82.7	15	-	-	-	18.5	-
PD-4	S-2	5-7	CH	3	9	14	74	81	30	51	42.2	-
	S-2	7-9	CH	0	5.7	19.3	75	72	24	48	37.8	-
	S-3	11-13	CH	2	11	40	47	60	21	39	33.1	-
PD-5	S-3	7-9	SM	8	52	32	8	12	12	NP	7.2	-
PD-7	S-4	9-11	CH	0	0.3	44.7	55	59	20	39	34.4	-
	S-8	20-22	OH	0	0	30	70	50	19	31	68.4	-
	S-10	30-32	OH	0	0	30	70	63	20	43	37.3	-
	S-12	40-42	OH	0	0	28	72	70	22	48	61.7	-
PD-9	S-1	5-7	CH	0	0.1	19.9	80	70	23	47	30.7	-
	S-3	9-11	CH	0	0	21	79	66	23	43	44	-
	S-5	13-15	CH	0	0	8	92	75	24	51	43.8	-
PD-10	S-1	6-8	GW	49	47	3	1	-	-	-	8.5	-
	S-2	8-10	SM	13	49	33	5	-	-	-	8.7	-
PD-13	S-1	5-7	SM	21	42	28	9	-	-	-	4.2	-
	S-2	7-8	SM	22	42	27	9	-	-	-	4.6	-
PD-14	S-1	5-7	ML	0.2	7	85.8	7	-	-	-	24.1	-
	S-3	9-11	ML	0	23	72	5	-	-	-	24.2	-
	S-5	13-15	ML	0	15.3	80.7	4	-	-	-	22.7	-

Notes:
(1) LL = Liquid Limit
(2) PL = Plastic Limit
(3) PI = Plasticity Index
(4) SG = Specific Gravity



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	7.2	12	12	NP	SM		Brown, Silty sand, Insufficient sample size	3/15/2021
◇	34.4	59	20	39	CH		Brown, Fat clay	03/17/21
○	68.4	50	19	31	OH		Gray, Organic clay	03/17/21

Symbol	□	◇	○
Boring	PD-5	PD-7	PD-7
Sample	S-3	S-4	S-8
Depth	7-9	9-11	20-22
% +3"	0	0	0
% Gravel	8	0	0
% SAND	52	0.3	0
%C SAND	6	0	0
%M SAND	14	0	0
%F SAND	32	0.3	0
% FINES	40	99.7	100
D_{100} (mm)	19.1	2	0.075
D_{60} (mm)	0.225	0.003	
D_{30} (mm)	0.043		
D_{10} (mm)	0.003		
Cc	2.5		
Cu	68.2		

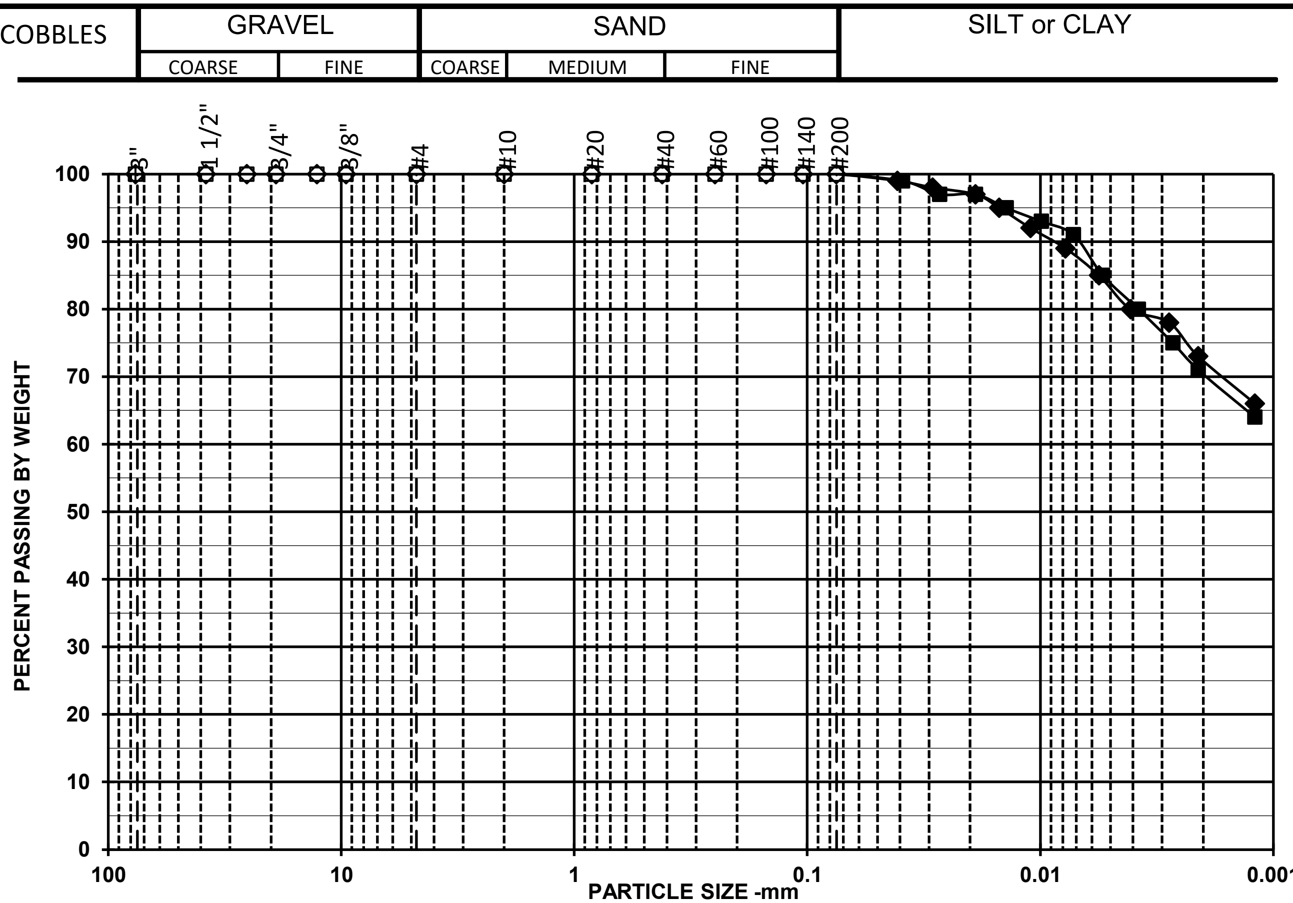
Sieve Size/ID #	Percent Finer Data		
6"	100	100.0	100
4"	100	100.0	100
3"	100	100.0	100
1 1/2"	100	100.0	100
1"	100	100.0	100
3/4"	100	100.0	100
1/2"	97	100.0	100
3/8"	96	100.0	100
#4	92	100.0	100
#10	86	100.0	100
#20	80	100.0	100
#40	72	100.0	100
#60	62	99.9	100
#100	52	99.9	100
#140	46	99.8	100
#200	40	99.7	100
5µ m	12	85	87
2µ m	8	55	70
1µ m	6	40	62

Aquifer #602201207

TerraSense, LLC #7853-21001

CHPE - Putnam-Dresden Borings

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	37.3	63	20	43	OH		Gray, Organic clay	03/17/21
◇	61.7	70	22	48	OH		Gray, Organic clay	03/17/21
○								

Aquifer	#602201207
TerraSense, LLC	#7853-21001

CHPE - Putnam-Dresden Borings

Symbol	□	◇	○
Boring	PD-7	PD-7	
Sample	S-10	S-12	
Depth	30-32	40-42	
% +3"	0	0	
% Gravel	0	0	
% SAND	0	0	
%C SAND	0	0	
%M SAND	0	0	
%F SAND	0	0	
% FINES	100	100	
D_{100} (mm)	0.075	0.075	
D_{60} (mm)			
D_{30} (mm)			
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100	
4"	100.0	100	
3"	100.0	100	
1 1/2"	100.0	100	
1"	100.0	100	
3/4"	100.0	100	
1/2"	100.0	100	
3/8"	100.0	100	
#4	100.0	100	
#10	100.0	100	
#20	100.0	100	
#40	100.0	100	
#60	100.0	100	
#100	100.0	100	
#140	100.0	100	
#200	100.0	100	
5μ m	84	83	
2μ m	70	72	
1μ m	62	64	

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

TerraSense Analysis File: GrainSizeV6Rev1a14

Siev1i.xlsx 4/5/2021

Appendix C

HDD #2 Geotechnical Data Report

Appendix D

HDD #2 Historic Resources

Gmail

Marco Boscardin <marco@boscardinconsulting.com>

FW: [--EXTERNAL--]: RE: Champlain-Hudson Power Express

2 messages

Einstein, Chris <CEinstein@chacompanies.com> Thu, Dec 9, 2021 at 11:48 AM
To: Marco Boscardin <marco@boscardinconsulting.com>
Cc: "Marruso, Antonio" <AMarruso@chacompanies.com>, "O'Donnell, Jeffrey" <JODonnell@chacompanies.com>

Marco,

See below and attached regarding historic wrecks in South Bay. This is preliminary info. Hartgen will hopefully get the sonar info and may have to refine the coordinates.

Chris

Christopher Einstein, PWS

Principal Scientist

CHA

Office: (518) 453-4505

ceinstein@chacompanies.com

www.chacompanies.com

CHA

Responsibly Improving the World We Live In

From: Matthew Kirk <mkirk@hartgen.com>
Sent: Thursday, December 9, 2021 11:45 AM
To: Einstein, Chris <CEinstein@chacompanies.com>
Cc: Justin DiVirgilio <jDivirgilio@hartgen.com>; Marruso, Antonio <AMarruso@chacompanies.com>
Subject: [--EXTERNAL--]: RE: Champlain-Hudson Power Express

Hi Chris,

There are three reported wrecks near the bridge, these were from a survey conducted by the LCMM, they only sent us data for portions of the lake during our initial IA report. So I don't think we have the actual sonar data. But I can check. Take the coordinates with a grain of salt until we review the sonar data. The SHPO reviewer who used to deal with underwater resources is not there anymore. So let me check to see what guidance they may have now. My guess is it would be best to thread the needle and try not to go under any of them. I'm not sure you would need a large buffer; 20 feet maybe.

1. LCMM 17, Wreck KKKK standard canal boat, depth 10 feet, Easting:-73.4294; Northing: 43.572833
    a. Wreck KKKKK is part of the South Bay Canal Boat Graveyard, consisting of at least seven canal boats abandoned there in the early twentieth century. Although not dive verified, the sonar image shows a likely intact canal boat very close to the site of Wrecks HHHHH, JJJJJ, and IIIII, other standard canal boats. Site dimensions are unknown. This site is in shallow water, with a featureless mud plain lake bottom and heavy weed growth. Visibility at this site is near zero or less.
    b. Wreck KKKKK was located during the 2003 Lake Survey and at that time was captured with sonar imagery. The site has not been dive verified and no artifacts have been recovered.
2. LCMM 11, Wreck EEEEE, NYSM11641, Easting: -73.430567, Northing: 43.57305
    a. Wreck EEEEE is part of the South Bay Canal Boat Graveyard, consisting of at least seven canal boats abandoned there in the early twentieth century. Although not dive verified, the sonar image shows an intact canal boat with six deck beams visible. Site dimensions are unknown. This site is in shallow water, with a featureless mud plain lake bottom and heavy weed growth. Visibility at this site is near zero or less.
    b. Wreck EEEEE was located during the 2003 Lake Survey and at that time was captured with sonar imagery. The sonar image clearly shows six deck beams. The site has not been dive verified and no artifacts have been recovered.
3. LCMM13, Wreck GGGGG, NYSM11643, Easting: -73.430567, Northing: 43.57305
    a. Wreck GGGGG is part of the South Bay Canal Boat Graveyard, consisting of at least seven canal boats abandoned there in the early twentieth century. Although not dive verified, the sonar image shows a potentially partially broken-up canal boat very close to the site of Wreck FFFFF, another standard canal boat. Site dimensions are unknown. This site is in shallow water, with a featureless mud plain lake bottom and heavy weed growth. Visibility at this site is near zero or less.
    b. Wreck GGGGG was located during the 2003 Lake Survey and at that time was captured with sonar imagery. The site has not been dive verified and no artifacts have been recovered.

4.

Best,

Matt

Matthew Kirk, MA RPA
Principal Investigator / Vice President
Hartgen Archeological Associates, Inc.
1744 Washington Avenue Ext. | Rensselaer, NY 12144
office: 518.283.0534 | mobile: 518.330.5940
mkirk@hartgen.com

From: Einstein, Chris <CEinstein@chacompanies.com>
Sent: Wednesday, December 8, 2021 5:16 PM
To: Matthew Kirk <mkirk@hartgen.com>
Cc: Justin DiVirgilio <jDivirgilio@hartgen.com>; Marruso, Antonio <AMarruso@chacompanies.com>
Subject: Champlain-Hudson Power Express

Matt,

Came across an issue today with the Phase 1 design up near Whitehall along Route 22. As you can see from the attached plans, the alignment will cross South Bay and it is intended that the crossing will be directionally drilled. Apparently there is an historic wreck (must just be some remnants because this area is so shallow). It would be best to avoid it (no drill directly under it) so looking to see if you can find the coordinates for this wreck and the associated polygon (limits of wreck) that we can use to design the crossing. Also looking for guidance on what SHPO is likely to require in terms of buffer to avoid impacts. If this is something you can look into soon, that would be very helpful. Thanks so much.

Chris

Christopher Einstein, PWS

Principal Scientist

CHA

Office: (518) 453-4505

ceinstein@chacompanies.com

www.chacompanies.com

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LCMM Rte 22 underwater sites.pdf
80K

Marco Boscardin <marco@boscardinconsulting.com> Fri, Dec 17, 2021 at 3:25 PM
To: Adriane Boscardin <adriane@boscardinconsulting.com>

Marco D. Boscardin, Ph.D., P.E., D.GE, F.ASCE
Consulting Engineer
Registered Professional Engineer in IL, MA, NY, CT, VT, NH, PA, NJ, VA
53 Rolling Ridge Road
Amherst, MA 01002-1420

413-237-4852 Mobile (Preferred)
413-549-3804 Office
413-825-0467 Fax
marco@boscardinconsulting.com
www.boscardinconsulting.com

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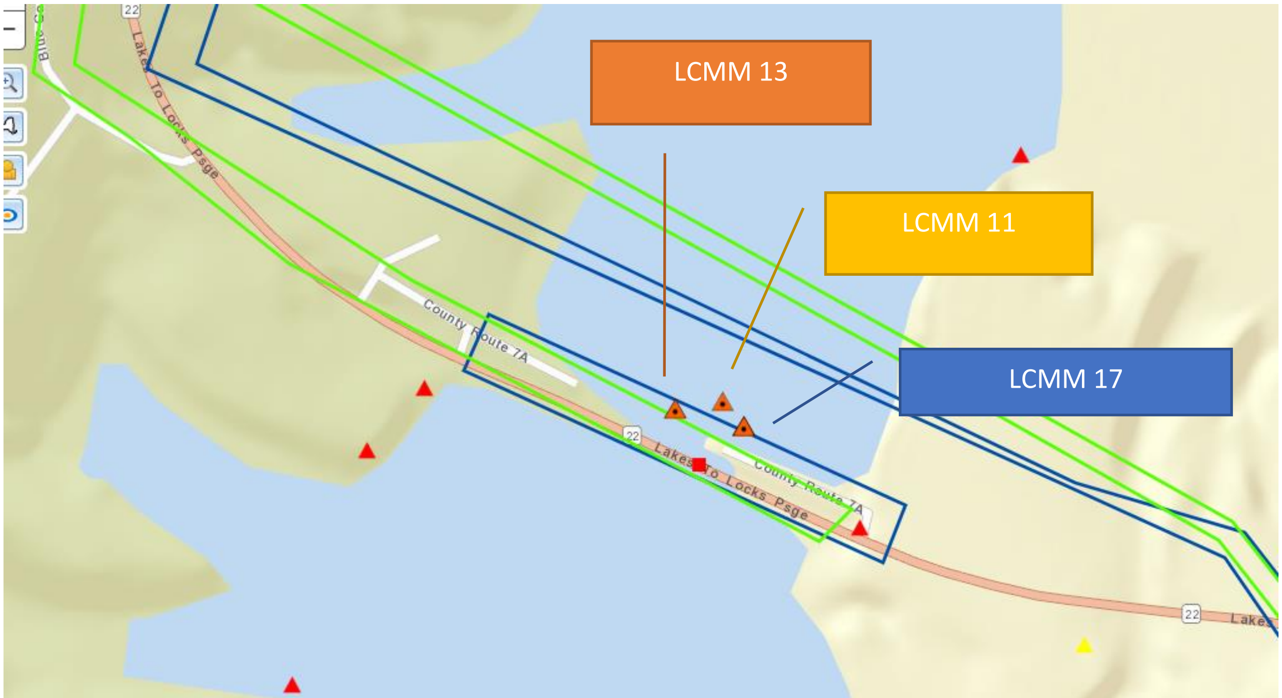

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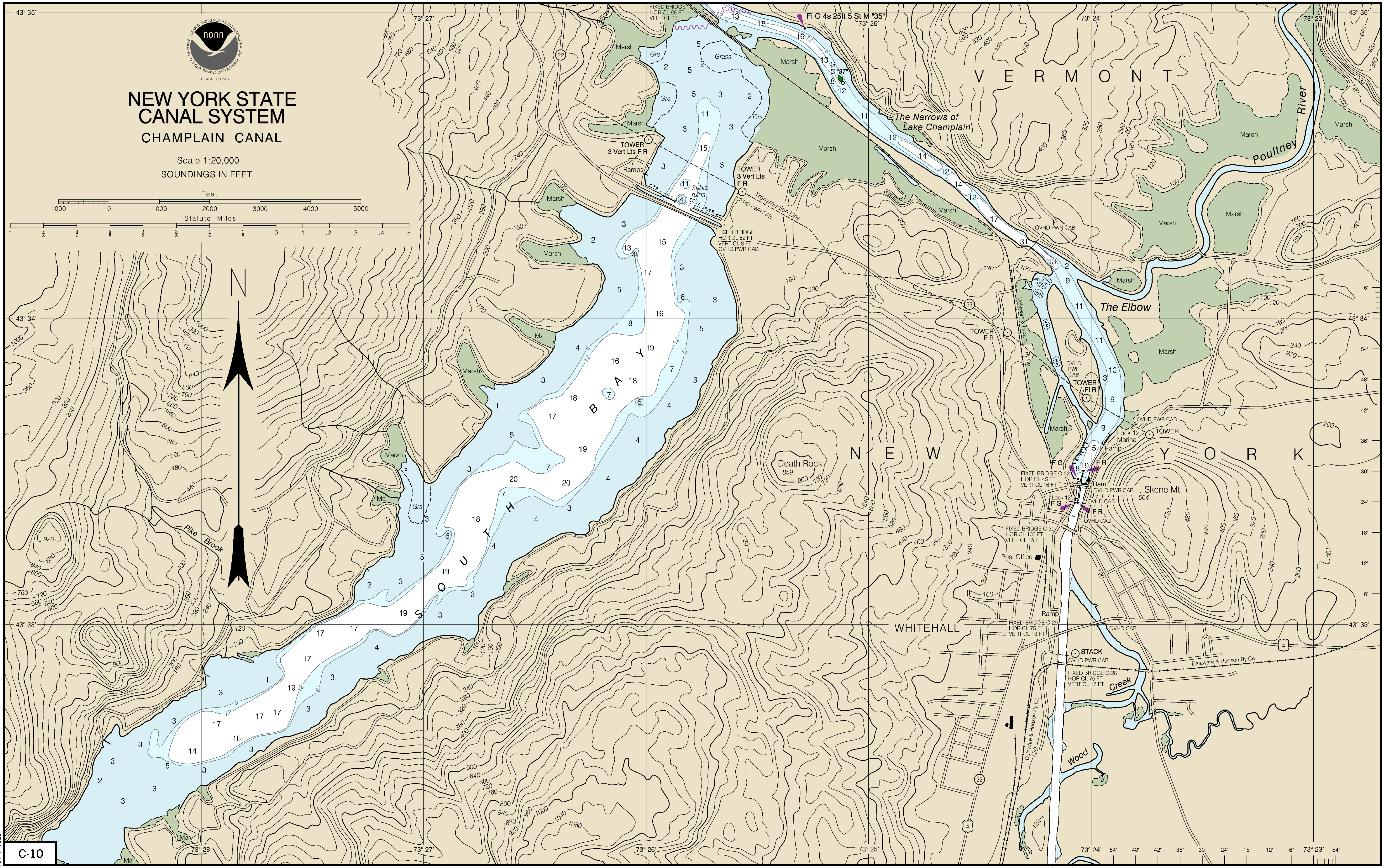

JOINS C-9

To ensure that this chart was printed at the proper scale, the line below should measure six inches (152 millimeters). If the line does not measure six inches (152 millimeters), this copy is not certified safe for navigation.

KAPP 1055

14786

Use ENC charts for the most up to date information. References to other charts may no longer be applicable.

15th Ed., Nov. 2018. Last Correction: 4/12/2021. Cleared through:
LNM: 4121 (10/12/2021), NM: 4321 (10/23/2021), CHS: 0921 (9/24/2021)

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SOUTH BAY SURVEY

In May 2003, the Lake Champlain Maritime Museum completed a side scan sonar survey of the South Bay, located to the west of Whitehall, New York. This was the first sonar survey of South Bay since the Champlain Maritime Society (CMS) carried out a similar, yet less extensive, survey in 1982, which located the wrecks of several canal boats and one steamer.

South Bay is a narrow, shallow, pinched-off part of Lake Champlain, lying to the west of the lake proper (Figure 6-38). It is abutted by the Village of Whitehall and the New York State Barge Canal (formerly the Champlain Canal). It has a maximum depth of 20ft (6.1m) at low lake level, a length of 4½mi (7.2km) and a maximum width of 1½mi (2.4km). It flows into Lake Champlain at its north end through a narrow outlet spanned by a drawbridge on the former Delaware & Hudson Railroad (now Amtrak). South Bay has a northeast to southwest orientation and lies between Bald Mountain on the west in the Town of Dresden, Warren County, New York, and West Mountain on the east in the Town of Whitehall, Washington County, New York. A small part of the Bay and its headwaters at the south end are located in the Town of Fort Ann, Washington County, New York.

During the French and Indian Wars and the American Revolution, South Bay provided a route for scouting parties traveling between Lake George and Lake Champlain. Although it required crossing the mountains between these two lakes, it bypassed the more exposed Lake George Route to Ticonderoga and provided another, possibly shorter, route to Skenesborough, present day Whitehall. In the nineteenth and early twentieth centuries, South Bay supported some commercial activity, primarily associated with the lumber and graphite industries. The Bay now serves fishing and other recreational boating uses.

It was primarily the commercial activity that drew researchers to South Bay in 1982 an again in 2003. Based on the historical record and the results of the 1982 CMS survey, it was known that there were shipwrecks in the Bay, but the number found was initially a surprise. Most of the wrecks were located north of the Route 22 highway bridge crossing at the north end of the Bay between Whitehall and Dresden. The 1982 survey reported three or four barge wrecks in this area, but he 2003 survey located at least seven with the possibility of parts of four or five others. The site was a confusing collection of wrecks and old bridge remnants that will require extensive diver verification and documentation to sort out. It is likely that other wrecks, possibly buried under the old bridges, exist in this area.

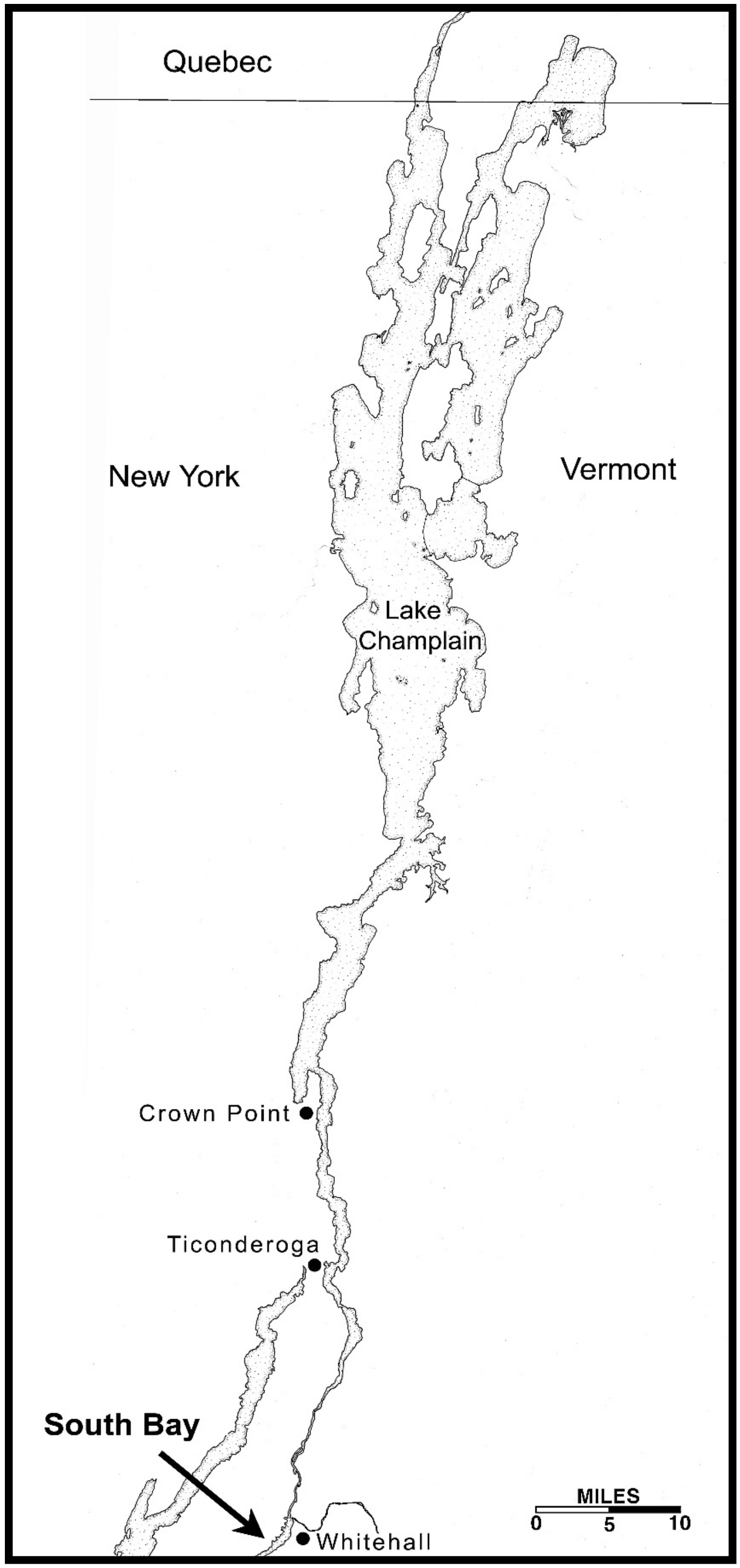


Figure 6-1. Map of Lake Champlain showing the location of South Bay.

South Bay Bridges

Two bridges, a railroad bridge at the outlet of South Bay and a highway bridge located about a half-mile to the south, currently cross South Bay. The former Delaware and Hudson (Canal Company) Railroad Bridge, located at the Bay outlet consist of two approach fills, a short half-through plate girder span and an 84ft (25.6m) iron or steel center pivot draw bridge with two 29ft (8.8m) clear openings. The draw has been made inoperable and may be the original circa 1875 structure. The plate girder span, based on old photos, has replaced an iron truss bridge. Due to the low clearance of the bridge only small boats can pass under the draw when entering or leaving South Bay (Figure 6-39).

Figure 6-2. Photo of the original railroad drawbridge crossing South Bay looking northerly (by A. Peter Barrannco).

The current NY Route 22 highway bridge, which was constructed in 1973, is the fourth such bridge at this crossing since 1856. Due to deep, soft, unconsolidated sediments at its location, this 1/3mi (.54km) crossing has consistently been a challenge to bridge builders. The following is a short history of these bridges:

The First Bridge (1856-1860)

The exact location of this short lived structure is unknown, but it was likely near the present day bridge. The contract to build the South Bay Bridge is reported on in the following article:

> "*Anniversary Sketched This Date in Whitehall by C. E. Holden, October 22, 1856, Contract to Build South Bay Bridge:*
>
> 'Contract made this 22nd day of October 1856, between A. G. Meiklejohn of Putnam, W. G. Wolcott of Whitehall and David Barrett of Dresden, commissioners, for constructing a bridge across South Bay by Act of Legislature of New York passed April 15th, 1856, parties of the first part and Alwyn Martin, party of the second part, from a point of the Whitehall side near the brick house on the Bunce Farm to a point near Benjamin's house on the Dresden side.
>
> The bridge to be built on three rows of piles forming a foundation 16ft wide, the piles to be 14 inches in diameter at the butt and driven down to hard bottom, 12ft apart from center to center. Across the piles a pine cap to be places 21ft long and 10 inches thick, the tops of the piles to be securely fastened to the cap. Upon the caps are to be placed six tiers of sleepers of pine 5x10 and covered with 2 1-2 inch hemlock flooring 16ft wide, with substantial railing 4ft high braced from cap to posts. Bridge to be provided with a good substantial draw for passage of canal boats and other craft. Each end of the bridge out to a depth of 2ft of water to be filled with earth and stone to make the roadway.'

The contract provides that the bridge must be completed by June 1st, and the price is $7000. However there were allowances for extras which brought the final cost to about $8000. The bridge was destroyed by floating ice in the spring of 1860."[i]

This first bridge did not survive long and the ferry crossing resumed its operations. It is reported that the South Bay ferry, which ran from Dresden to Whitehall, was operated by Thomas D. Wilson from around 1880 to 1913. It was originally a sail ferry, but later had an engine.

The Second Bridge (1913-1930)

After many years of trying by the citizens of Whitehall and Dresden, the New York State Legislature approved construction of the second South Bay Bridge under Chapter 518 of the Laws of 1912. The bridge was designed by the NY Department of Highways in 1912 and constructed by the Oswego Bridge Co., of Oswego, NY for $44,431.20 in 1913.

The bridge design drawings which were approved August 14, 1912 called for a 928ft (282.9m) long by 16ft (4.9m) wide open pile trestle with stone fill approaches, 323ft (98.5m) long on the east (Whitehall) side and 659ft (200.9m) long on the Dresden side. It incorporated a 50ft (15.2m) long steel truss bridge on concrete abutment with pile foundation, and a 33ft (10.1m) ling single leaf bascule bridge to accommodate vessels. A hand-operated wheel opened and closed the bascule leaf with its counter weight (Figure 6-40).[ii]

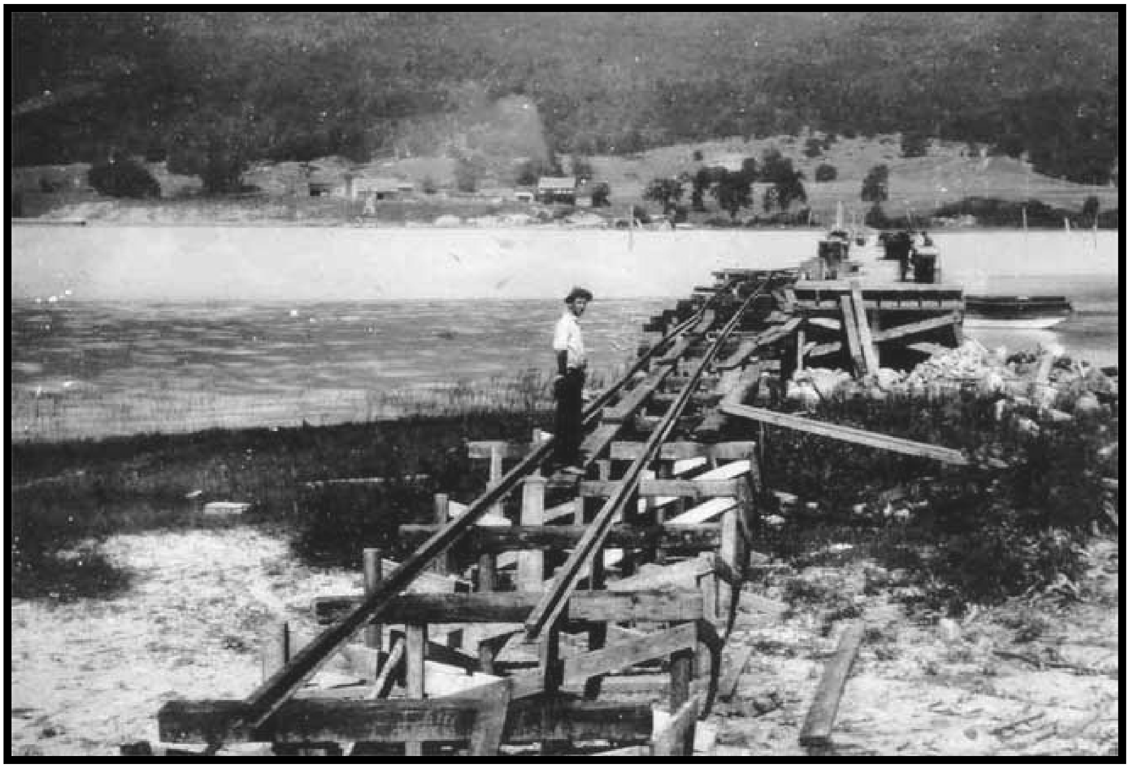


Figure 6-3. Image of the 1913 bridge under construction, looking west (courtesy of the Historic Society of Whitehall).

In spite of the work having been completed on time, it had been necessary to sink canal boats along the bottom to support the piles.[iii] On of the canal boast was the *Frederick S. Dale*, O/N 37519, built at West Haven, VT in 1888. A note on her enrollment papers says: "Out of Commission and sold to Sup't [Nelson] Fagan to fill new bridge at South Bay near Whitehall N.Y. now under said highway. Sold in Aug. 1913."

Almost immediately there were problems with the bridge due to the soft sediments it rested upon. In November of 1914 a delegation from Whitehall met with the Highway Department to see if the bridge could be strengthened- the figure of $25,000 was talked about.[iv] It is reported that "In 1917-1918 a contract was signed with the State Superintendent of Prisons for convict labor on a new span. Boatbuilder William Ryan agreed to sell the state old barges at $30 each to provide a foundation for a bridge." [v] It is not know what, if anything, came of this plan.

The bridge continued to deteriorate and was in such poor condition by the 1920s due to movement and settlement that a new bridge was necessary (Figure 6-41). Agnes Peterson, Dresden Town Historian, recalls while in high school, the school bus had to let off the students to walk across the bridge while the bus traveled across it empty because it was in such poor condition.[vi]

Figure 6-4. Photo showing the west end of the 1913 bridge looking south (courtesy of the Historical Society of Whitehall).

The Third Bridge (1930-1973)

The third bridge was constructed about 75ft (22.9m) south of the second (1913) bridge. During its construction, all but a short section of the rock fill approach at the east end of the 1913 bridge appears to have been removed. It is not known, however, how much of the 1913 structure, including canal boats buried under the fill, actually remains today.

The design for the 1930 bridge called for a rock fill causeway across most of the bay with a fixed and moveable (drawbridge) span in the center. The original estimate for the work to be done was $353,800, including extras. The contractor, Donahue Construction Co., began work on June 14, 1929 and immediately ran into major problems. The following excerpts are taken from an article entitled “South Bay History”, printed in the *Whitehall Times* in June of 1971:

> “Rock fill dumped into the bay during the day, was still well above the water level when night fell; but by the following morning, the fill had all disappeared beneath the surface”;
>
> By December 28, 1929: “The east side of the…bridge has tilted toward the east to such an extent that the end of the iron span of the bridge is about the three feet from it. To support the iron span and to keep it from developing into the bay, wooden props have been placed under it, but this is not expected to hold it up”

"The stone fill in trying to reach a solid bottom, has given the most trouble and besides dropping out of sight at times, wrecked the old (second) bridge which is still closed to traffic…for nearly four weeks."

"Sixty thousand cubic yards of stone were estimated for the entire width of the bay; more than that amount has been used and it will be necessary to make another blast [to produce more rock fill]."

"…the pier tipped over and now plan to continue the stone fill out to the tipped pier and over it, and on top of this build a new pier."

In February 1930, "Practically all of a 110-foot steel span…has slipped into the waters… as a result of the sinking of the stone fill which served to support this structure..."

"…there is danger of the old bridge being forced out of position."

"…the fill under the end of the bridge began dropping into the bay, because of the soft bottom…and with it went the bridge."

The troubles continued and "Ultimately, the idea of a stone fill all the way across the bay had to be abandoned and the present half and half creation (part piling and part stone fill) was installed." Prior to implementing this half and half design, additional problems had to be addressed. An article in the August 7, 1930 edition of the *Ticonderoga Sentinel* indicated that:

> Three wooden bents [piles] of the new South Bay bridge, north of Whitehall, have sunk from site in the bay. In the construction of the bridge, not much trouble has been experienced in the last several months, because from the west end of the iron span a wooden trestle about 300 feet has been built. It was intended to resume the stone fill from the end of the trestle to the west shore, and it was started with the result that when the stone fill was dropped into the bay it forced three of the bents up into the air.
>
> These three bents had to be sawed into tow to save the remainder of the new wooden structure. When this is completed the fill will be continued towards the east end [of] the iron bridge.…
>
> The estimated cost of the structure was about $321,000 and it is said that when the bridge is complete it will cost nearly $1,000,000.[vii]

The bridge was finally completed and opened to traffic in 1930. By the 1960s a new bridge was needed because of continuing problems with the 1930 bridge and in 1971 two Bailey bridges were constructed on top of one of the sections to strengthen the span until a new bridge could be built. These proved to be a danger to traffic and construction of a new bridge was approved in 1972. Most of the central part of the 1930 bridge was removed during construction this fourth bridge; however the rock fill approaches and pile bents remain (Figure 6-42).

Figure 6-5. Photo taken circa 1972 of the removal of the 1932 bridge, looking northwest toward Dresden shore (courtesy of the Historical Society of Whitehall).

The Fourth Bridge (1973-Present)

The fourth bridge was constructed approximately 90ft (27.4m) south of the third bridge. The contract for this bridge was awarded to Thomason and Perry, Inc. of Troy NY for $2,083,000. Construction began in November 1972 and was completed in 1973. The new bridge was a unique structure, the only one of its kind in the state of New York. At 580ft (176.8m) long and 40ft (12.2m) wide, the new bridge has a steel plate deck and was design to be very light. This is because engineers determined the depth of lake sediments at the area of the bridges to be in excess of 600ft (182.9m) deep. The piles for the 1973 bridge were driven 140ft (42.7m) below the lake bottom, and pressure from the silt surrounding the piles was believed to be enough to hold them in place. The 1973 bridge also had no draw, and the clearance is 11ft (3.4m) at mean water level.[viii]

Finally, after 117 years, a bridge that solved the extremely adverse foundation conditions of this site was successfully constructed across South Bay. Apparently the foundation conditions of the railroad bridge site at the outlet of South Bay were more favorable since that structure has existed for 130 years.

Wreck A5: Canal Boat (NYSM 11637)

Wreck A5 is a standard canal boat in Lake Champlain's South Bay. The site was reported to the LCMM by Richard Bennett, a public lands surveyor/examiner for the New York Office of General Service, in 1998. Mr. Bennett discovered the shallow water wreck while fishing, and contacted LCMM Executive Director Arthur Cohn to report the find. In May 1999, LCMM researchers undertook a preliminary investigation of the site.

Dive observations revealed the site to be an 1873 class standard canal boat. Because of the site's shallow depth, ice has removed the sides and deck, leaving only the bottom of the hull. The canal boat is edge-fastened, with an overall length of 97ft 2in (29.6m) and a beam of 20ft (6.1m). The vessel's extant structural features included transverse bottom planking, the keelson (6in by 6in [15cm by 15cm]), eight stringers (4in by 5in [10cm by 12.7cm]), chine logs (5½in by 4in [14cm by 10cm]), a breast hook and bow framing.

Researchers also noted several artifacts on the site including some coal in the bow area, a leather pump, a broken dish and some fittings. The LCMM recovered a number of iron rods from the site for use in a zebra mussel-monitoring project. The rods were lying on the bottom, presumably from the no longer extant sides.

The location of this wreck, and possibly that of one or two others in South Bay, suggest that it may have been abandoned for use as a dock. There is no information that links this wreck, or the others, to a particular vessel, however, it is noted that the enrollment papers of the canal boat *Mary A. Stafford* (O/N 51133) report that: "Name changed to May & Annie [,] abandoned in 1909 and made into a dock in South Bay near Whitehall."

The *Mary A. Stafford* was built at Fort Ann in 1881, with dimensions of 95.7ft by 17.6ft by 8.7ft (29.1m by 5.3m by 2.65m) and had a tonnage of 122.26 GT and 116.02 NT. In 1906 she was owned by the [New York and] Lake Champlain Transportation Co. (The "Line"), her homeport was Plattsburgh, her hailing port, Whitehall and her master, C.F. Reed.

Statement of Significance

Wreck A5 lacks sufficient site integrity to be eligible for inclusion in the NYSRHP or the NRHP. The boat consists of only the bottom of the hull, and appears to be a derelict vessel. It is unlikely to contain a significant artifact assemblage relating to the life of its former operators.

Wreck C5: Canal Boat (NYSM 11639)

Wreck C5, also in South Bay, was initially located in 1982 by the Champlain Maritime Society; its original designation was VT-LC84-13. The site was rediscovered during the 2003 Lake Survey. In the 1982 dive verification the site was identified as a canal boat carrying a load of graphite. The sonar image of the canal boat indicates that it is largely intact (Figure 6-43).

The South Bay Graphite industry flourished briefly between 1900 and 1924 but the principal deposits and mining operations were located near Hague on the west shore of Lake George between c. 1890 and 1921. These mines and milling operations came into the ownership of the Joseph Dixon Crucible Company of Jersey City, NJ who used the refined graphite to make its "Ticonderoga" brand pencils, lubricants and crucible.[ix] Graphite was first discovered in the Ticonderoga area about 1815 and by 1833, a process had been developed to refine the material for use in pencils. By 1863, the American Graphite Co. of Jersey City, NJ had purchased several mining operations in the area and under the direction of mining engineer William Hooper, Ticonderoga became the center of the graphite industry. In 1873 the Joseph Dixon Crucible Co. bought out the American Graphite Co. and continued to manufacture its products at the Ticonderoga mill. The South Bay mining operations also came under the control of Joseph Dixon. In 1921 and 1924, the graphite operations at Hague and South Bay respectively were closed due to the availability of cheaper foreign ores, however the Ticonderoga pencil operation continued as a subsidiary of Joseph Dixon until the 1980s.[x]

There were four, possibly five, graphite mines located on the west side of South Bay between 1903 and 1924: The Adirondack Graphite Mining and Milling Co. (c.1903); Silverleaf (never opened); Tintsman Mine and Mill (c. 1904-1916); Hooper Mine and Mill (1916-1924); Champlain Graphite Mill (c. 1912).

Little is known of the Champlain Graphite Mill and the Silverleaf Mine. Although little is know of the workings of the Adirondack Graphite Mining Milling, which began in 1903, it is known that the company was foreclosed and sold at auction in 1906: “The graphite works of the Adirondack Mining and Milling Co. at South Bay near Whitehall is to be sold at auction on a mortgage foreclosure. It is expected that a new company will be organized and the work resumed. The works were bonded for $60,000.”[xi] It is unknown if the mine ever did reopened.

The Hooper Mine and Mill was the largest graphite mine in the area. It had been started by George H. and Frank C. Hooper in 1916 and ran until 1924. It was located about a mile and a half west of South Bay, at an elevation of approximately 1000ft (305m). All of the graphite from this mine was shipped by road. The Tintsman Mine and Mill was located near the lakeshore within 100yd (91.4m) of South Bay. Opened in 1904, it was a very active operation. The mine was shut down in 1916 due to contamination of the graphite product with sand and sabotage was rumored.

Based on the known information on the graphite industry in South Bay, it is likely that wreck C5 was loaded at the Tintsman Mine between 1904 and 1916. The Tintsman Mine shipped graphite from its mine to Whitehall across South Bay regularly. The mine had a dock and loading facility, whereas the other known mines in the area either did not have docks for lake shipping or there is not a record of such facilities.

Statement of Significance

Based on the apparent intact nature of the site from the 2003 sonar records and the reported presence of cargo, Wreck C5 is likely eligible for inclusion in the NYSRHP and the NRHP under Criterion D: Information Potential.

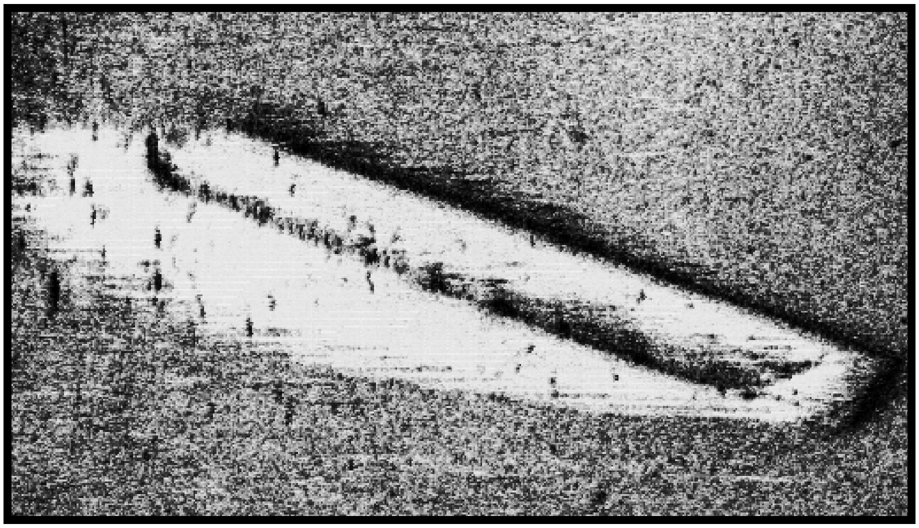


Figure 6-6. Sonar image of Wreck C5 (LCMM Collection).

Wreck D5: Steamboat *Reindeer* (NYSM 11640)

Wreck D5 is believed to be the hull of the steamboat *Reindeer*. The vessel was originally located in 1982 during a side scan sonar survey by the Champlain Maritime Society; its remains were not located during the 2003 Lake Survey likely due to its shallow water location.

The steamboat *Reindeer* was built by master carpenter Jermiah Faulks in 1882 at Alburgh, Vermont for the Grand Isle Steamboat Company. This 168ft (51.2m) steam-powered vessel ran between Burlington and Alburgh, Vermont and remained the only steamboat on Lake Champlain that maintained independence from the Champlain Transportation Company for its entire career (Figure 6-44). It was also the largest vessel to navigate to the falls on Otter Creek at Vergennes, Vermont, under the direction of Master Captain Ell B. Rockwell.

Reindeer sank at the Central Vermont wharf in Burlington in 1902 (Figure 6-45). It was then raised and taken to Whitehall, NY for dismantling, with its 800-horsepower engine cut up for scrap iron and the hull abandoned in South Bay (Figure 6-46). The pilothouse was removed and used as a gazebo in Castleton, Vermont, and was eventually donated to the Lake Champlain Maritime Museum in Vergennes, Vermont, where it is on public display.

Statement of Significance

It is not possible with the current data to accurately assess this site's integrity and historic significance.

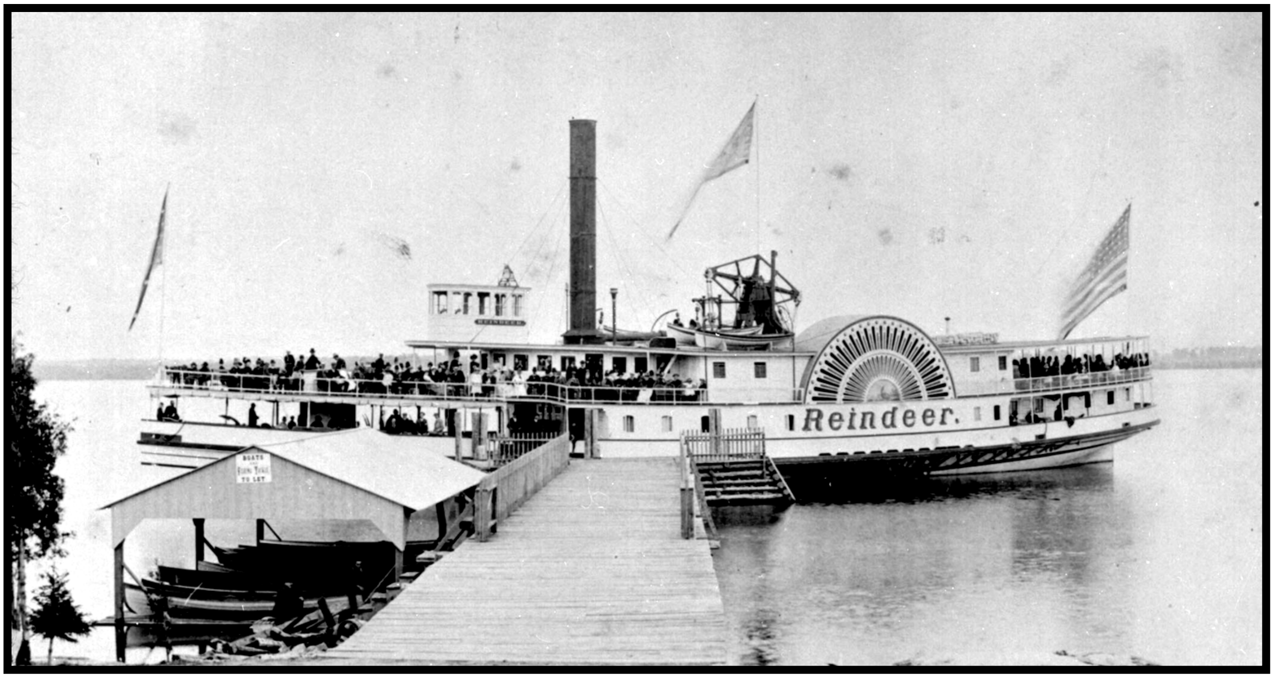


Figure 6-7. Steamboat *Reindeer* while in operation (LCMM Collection).

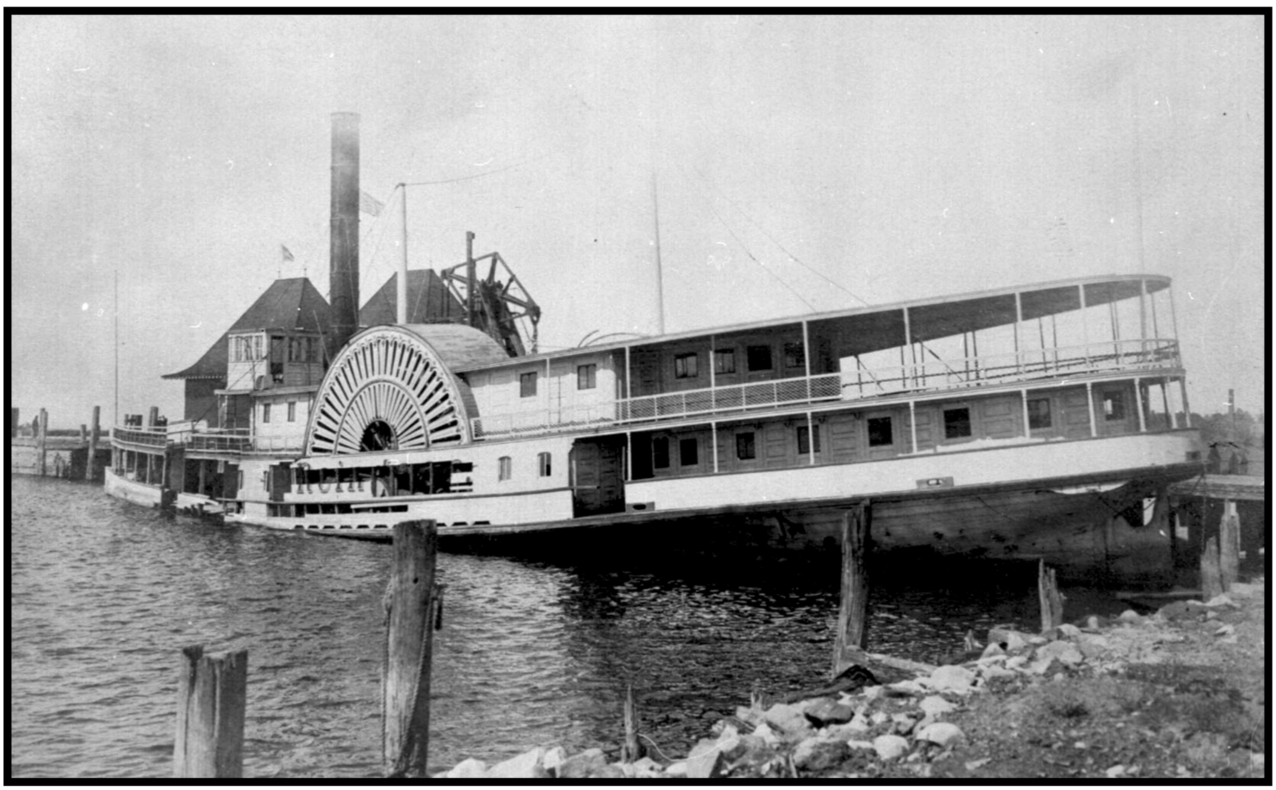


Figure 6-8. Steamboat *Reindeer* abandoned on the Burlington, Vermont waterfront, circa 1902 (LCMM Collection).

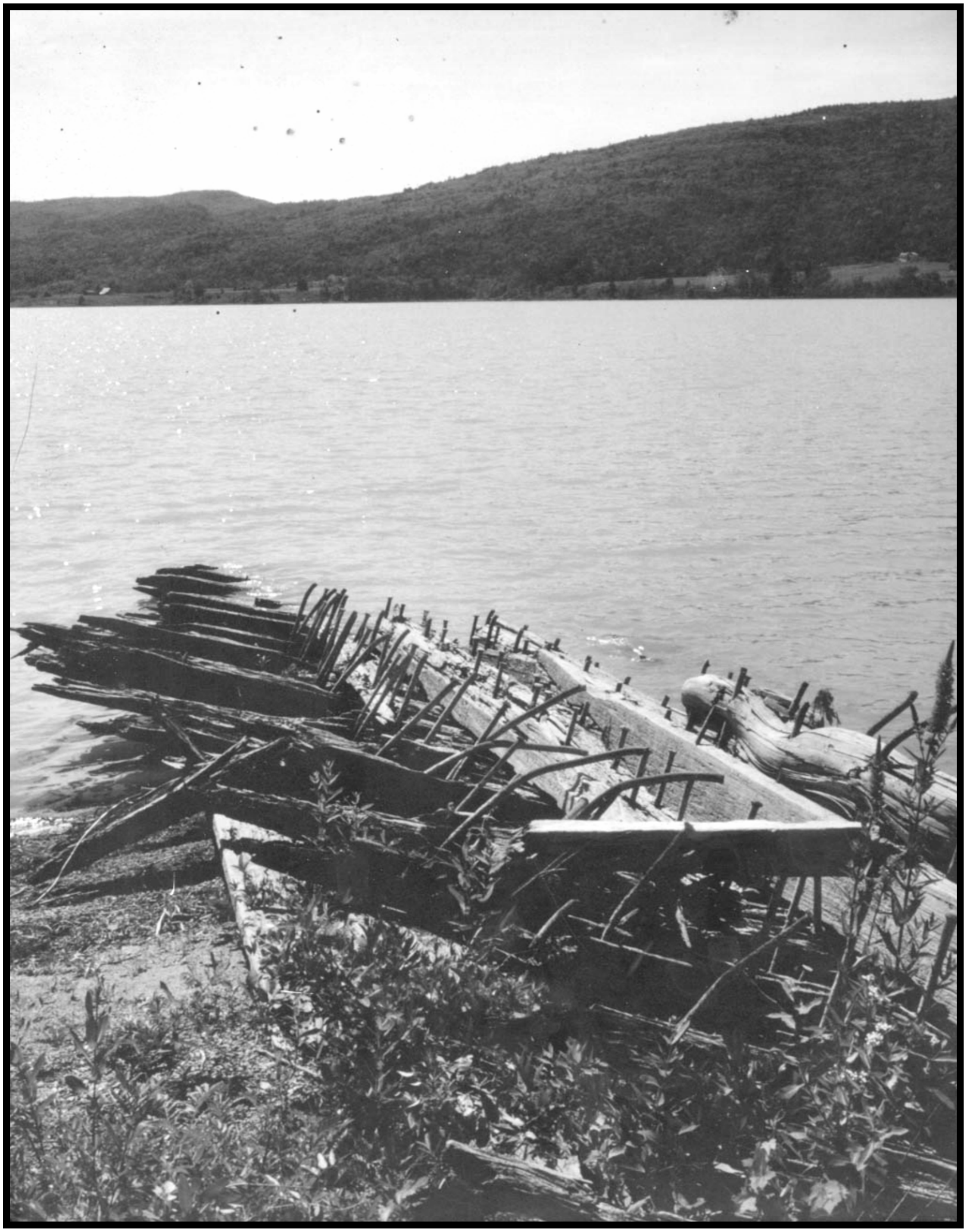


Figure 6-9. Remains of steamboat *Reindeer's* hull in South Bay in the 1980s (LCMM Collection).

South Bay Canal Boat Graveyard Historic District
The South Bay Canal Boat Graveyard consists of at least seven canal boats abandoned there in the early decades of the twentieth century. Researchers have been aware of this complex of canal boats since the early 1980s, however, no significant in-water documentation of these sites has yet been undertaken. The vessels lie near the current Route 22 Bridge across South Bay (see page 3). The 1973 bridge is the fourth bridge to occupy this site. The remnants of these bridge building episodes can still be seen from the surface and were clearly visible on the sonar records.

The bridge construction episodes, when combined with the side scan sonar data, give a date range for the canal boats in this area. The boats lie just north of the remnants of the 1913 bridge, indicating that they were abandoned after its construction. Moreover, the absence of vessels next to the 1930 bridge suggests that the canal boats were abandoned prior to its completion, although this evidence is not conclusive. The abandonment of canal boats in the 1913 to 1930 time period is consistent with the end of the canal boat era and the subsequent abandonment of numerous canal boats in Lake Champlain. This date range and the sonar records indicate that these vessels are all 1873-class canal boats, which are typically 97ft (29.5m) long and 17½ft (5.3m) wide.

The seven canal boats located during the 2003 Lake Survey are likely only a portion of the collection of canal boat hulls in this part of South Bay. The sonar records showed other acoustic anomalies which could not be conclusively identified. Early twentieth century photographs show numerous canal boat hulls rotting along the shoreline in this area; the remains of some of these vessels may still be extant, however, their shallow water locations allowed them to go undetected during the Lake Survey. Extensive dive verification of sonar anomalies in this area will be necessary to conclusively identify all of the cultural resources present in the South Bay Canal Boat Graveyard.

Wreck E5: Canal Boat (NYSM 11641)
Wreck E5 was located during the 2003 Lake Survey; it has yet to be dive verified (Figure 6-47, Figure 6-48 and Figure 6-49). Wreck E5 appears to be an intact canal boat with six deck beams clearly visible in the sonar image.

Wreck F5: Canal Boat (NYSM 11642)
Wreck F5 was located during the 2003 Lake Survey; it has yet to be dive verified (Figure 6-49). Wreck F5 appears to be an intact canal boat. The vessel lies next to canal boat Wreck G5.

Wreck G5: Canal Boat (NYSM 11643)
Wreck G5 was located during the 2003 Lake Survey; it has yet to be dive verified (Figure 6-49). The condition of the vessel is not clear from the sonar image; however, it may be partially broken-up. The vessel lies next to another canal boat, Wreck F5.

Wreck H5: Canal Boat (NYSM 11644)
Wreck H5 was located during the 2003 Lake Survey; it has yet to be dive verified (Figure 6-48). Based on the sonar image the vessel may be partially broken-up. The wreck lies next to three other canal boats, Wrecks I5, J5 and K5.

Wreck I5: Canal Boat (NYSM 11645)
Wreck I5 was located during the 2003 Lake Survey; it has yet to be dive verified (Figure 6-48). Based on the sonar image the vessel appears to be intact. The wreck lies next to three other canal boats, Wrecks H5, J5 and K5.

Wreck J5: Canal Boat (NYSM 11646)
Wreck J5 was located during the 2003 Lake Survey; it has yet to be dive verified (Figure 6-48). Based on the sonar image it may be partially broken-up. The wreck lies next to three other canal boats, Wrecks H5, I5 and K5.

Wreck K5: Canal Boat (NYSM 11647)
Wreck K5 was located during the 2003 Lake Survey; it has yet to be dive verified (Figure 6-49). Based on the sonar image the vessel appears to be intact. The wreck lies next to three other canal boats, Wrecks H5, I5 and J5.

Statement of Significance
The South Bay Canal Boat Graveyard contains a significant collection of submerged cultural resources with the potential to yield important information about the construction of late nineteenth/early twentieth century Champlain canal boats. Each of the vessels would likely be eligible for the NYSRHP and the NRHP when evaluated individually; however, it is more appropriate to consider them as an historical archaeological district. The South Boat Canal Boat Graveyard Historic District is eligible for the NRHP under Criterion D: Information Potential and Criterion A: Event(s) and Broad Patterns of Events.

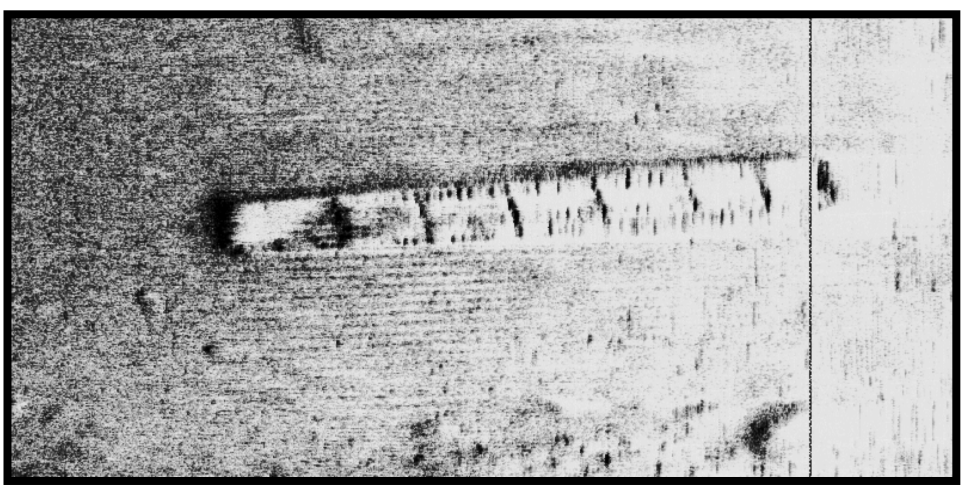


Figure 6-10. Sonar image of Wreck E5 (LCMM Collection).

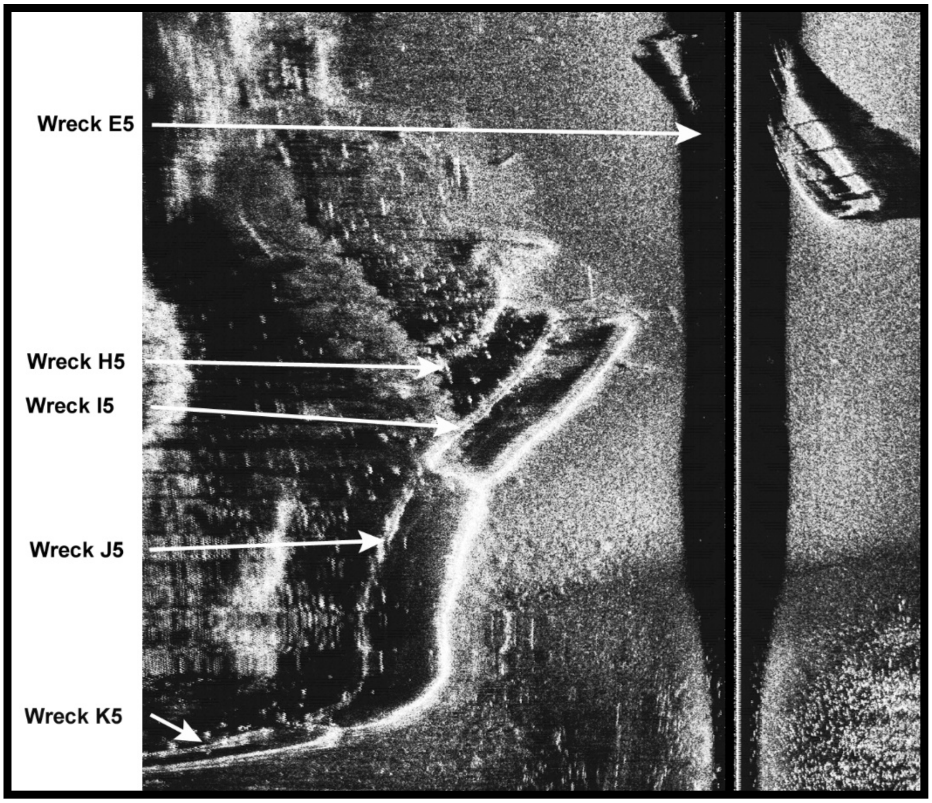


Figure 6-11. Sonar image of Wrecks E5, H5, I5, J5 and K5 (LCMM Collection).

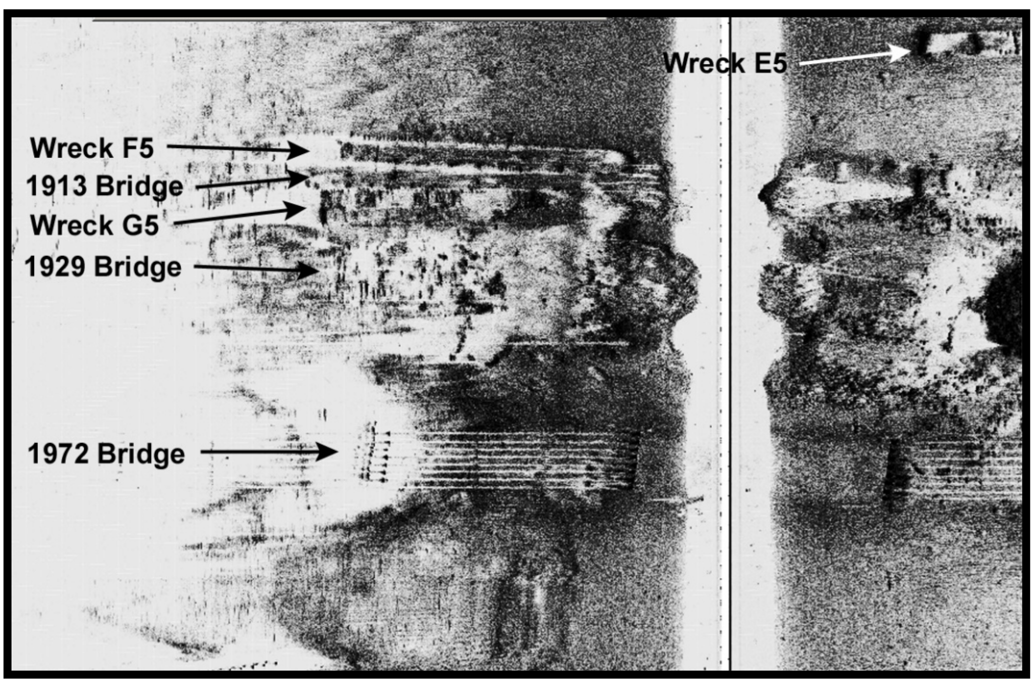


Figure 6-12. Sonar image of Wrecks E5, F5, and G5 and the 1913, 1930 and 1973 highway bridges (LCMM Collection).

[i] Paper and year not given, Referenced newspaper clipping from the Historical Society of Whitehall.

[ii] New York Department of Highways, plans dated July 12, 1912. Courtesy of the Historical Society of Whitehall.

[iii] *Whitehall Times* 3 June 1971. Courtesy of Agnes Peterson, Dresden Town Historian.

[iv] *Whitehall Times* 12 November 1914.

[v] *Whitehall Times,* 8 February 1971.

[vi] Letter written from Agnes Peterson to Peter Barranco, 24 July 2003.

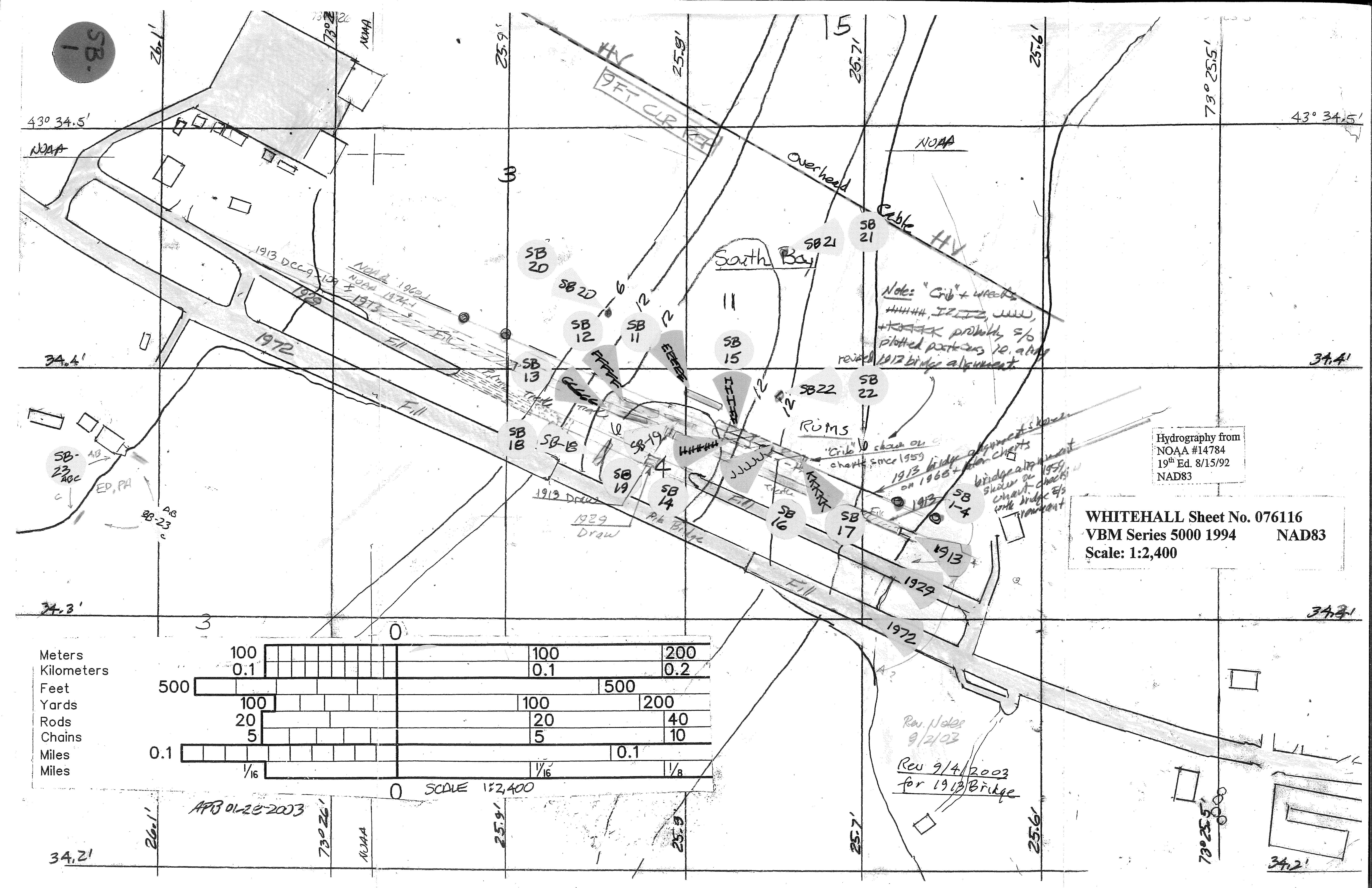
[vii] *Ticonderoga Sentinel,* 7 August 1930 1:3.

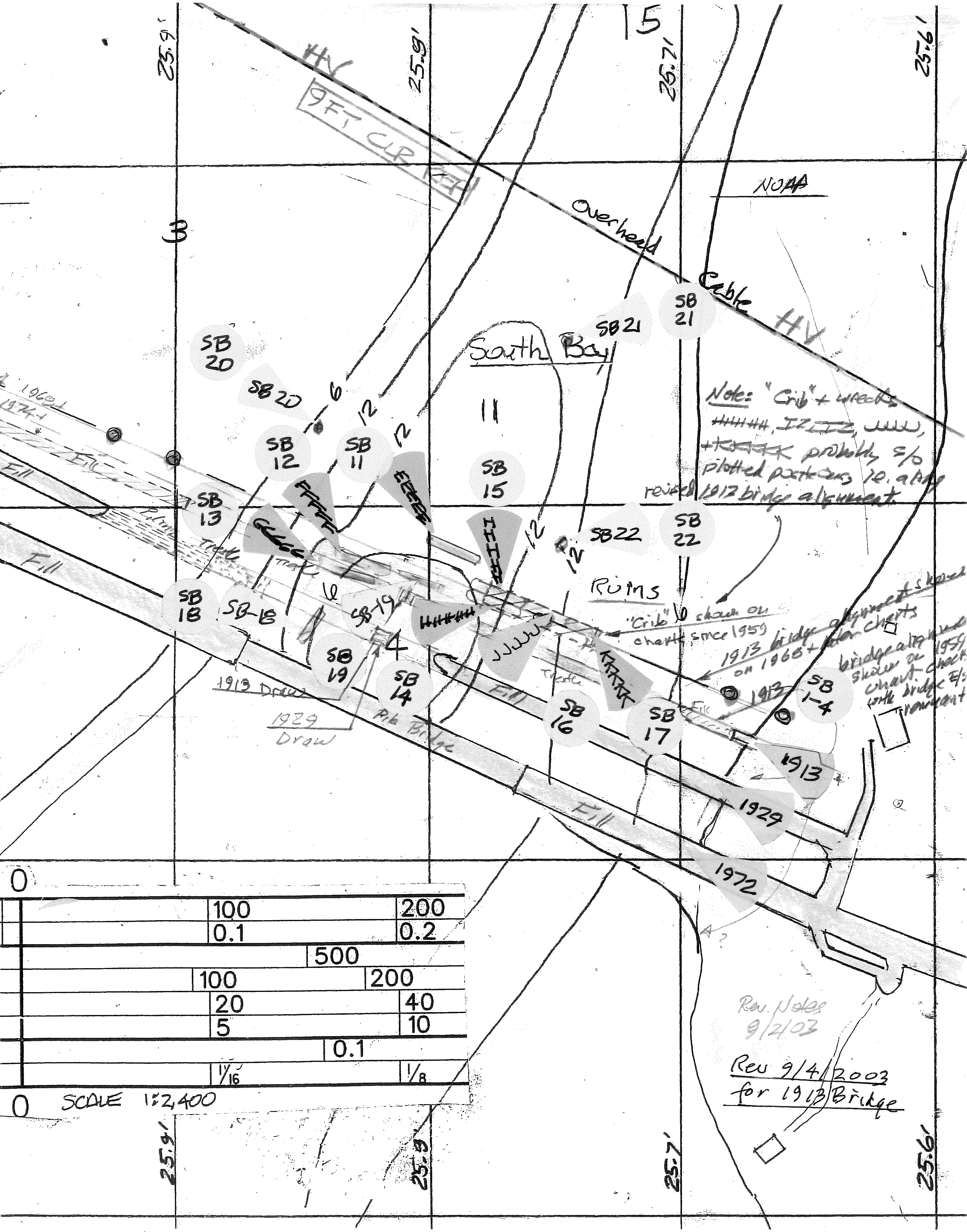
[viii] *The Whitehall Times,* 8 February 1973 and 27 December 1973.

[ix] *The Glens Falls Post Star,* 30 March 1976:HSW and 2 August 1992:WCHS.

[x] ibid.

[xi] *The Plattsburgh Republican* 21 July 1906: 1:6.


WHITEHALL Sheet No. 076116
VBM Series 5000 1994
NAD83
Scale: 1:2,400
Hydrography from
NOAA #14784
19th Ed. 8/15/92
NAD83
SB-1
South Bay
Overhead Cable
HV
9FT CLR
NOAA
Ruins
Fill
1972
1929
1913
Trestle
1913 Draw
1929 Draw
Rev. Notes 9/2/03
Rev 9/4/2003 for 1913 Bridge
APB 01-28-2003
SCALE 1:2,400
Meters
Kilometers
Feet
Yards
Rods
Chains
Miles
Miles
SB 11
SB 12
SB 13
SB 14
SB 15
SB 16
SB 17
SB 18
SB 19
SB 20
SB 21
SB 22
SB 1-4
SB-23 ABC
43° 34.5'
34.4'
34.3'
34.2'
73° 26'
73° 25.5'
25.9'
25.7'
25.6'
26.1'


15
25.9'
25.9'
25.7'
25.6'
HV
9FT CLR
NOAA
Overhead Cable
HV
3
SB 20
SB 20
SB 21
SB 21
South Bay
11
SB 12
SB 11
SB 15
SB 13
SB 22
SB 22
Note: "Crib" + wrecks probably s/o plotted positions re. alt revised 1912 bridge alignment
Ruins
"Crib" shown on charts since 1959
1913 bridge alignment shown on 1968+ later charts
bridge alignment shown on 1959 chart. check with bridge E/S
SB 18
SB-18
SB-19
SB 19
SB 14
SB 16
SB 17
SB 1-4
1913
1913
1929
1972
Fill
Fill
Fill
Fill
Trestle
Trestle
1913 Draw
1929 Draw
Pile Bridge
0
100
200
0.1
0.2
500
100
200
20
40
5
10
0.1
1/16
1/8
0
SCALE 1:2,400
Rev. Notes 9/2/03
Rev 9/4/2003 for 1913 Bridge
25.9'
25.9'
25.7'
25.6'

Longitude	Latitude_Y	LCMM_Lette	Type	LCSS_Year	Notes
-73.42975	43.57315	E5	canal boat	2003	sonar image also includes SB-19; E5 also appears in sonar contact 1135
-73.430567	43.57305	F5	canal boat	2003	multiple wrecks in this sonar image incl. F5(SB-12), G5(SB-13), E5(SB-11), SB-19, SB-18, 1972 bridge
-73.430567	43.57305	G5	canal boat	2003	in same sonar contact as F5(SB-12)
-73.4294	43.572833	H5	canal boat	2003	in same sonar contact as E5(SB-11), H5(SB-14), I5(SB-15), J5(SB-16), K5(SB-17)
-73.4294	43.572833	I5	canal boat	2003	in same sonar contact as E5(SB-11), H5(SB-14), J5(SB-16), K5(SB-17)
-73.4294	43.572833	J5	canal boat	2003	in same sonar contact as E5(SB-11), H5(SB-14), I5(SB-15), K5(SB-17)
-73.4294	43.572833	K5	canal boat	2003	in same sonar contact as E5(SB-11), H5(SB-14), I5(SB-15), J5(SB-16)
-73.430733	43.5737	0	unknown	2003	linear object; unknown
-73.429117	43.574133	0	unknown	2003	linear object; unknown
-73.429117	43.5732	0	unknown	2003	angular object with shadow

Appendix E

BoreAid HDD #1 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.

Project Summary

General:	CHPE HDD Ref: Lake Road - New York P1A Start Date: 12-10-2021 End Date: 12-10-2021
Project Owner:	...
Project Contractor:	...
Project Consultant:	...
Designer:	TAR CHA ... ..., ... Phone: ... Fax: ... ...
Description:	Lake Road HDD - New York

Input Summary

Start Coordinate	(0.00, 0.00, 289.76) ft
End Coordinate	(904.00, 0.00, 291.00) ft
Project Length	904.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

Number of Layers: 6

Soil Layer #1 USCS, Sand (S), SP

Depth: 2.00 ft

Unit Weight: 0.0634 (dry), 0.0733 (sat) [lb/in3]

Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Silt (M), ML

Depth: 5.00 ft

Unit Weight: 0.0463 (dry), 0.0579 (sat) [lb/in3]

Phi: 28.00, S.M.: 50.00, Coh: 4.40 [psi]

Soil Layer #3 USCS, Clay (C), CL

Depth: 2.00 ft

Unit Weight: 0.0463 (dry), 0.0637 (sat) [lb/in3]

Phi: 0.00, S.M.: 300.00, Coh: 7.30 [psi]

Soil Layer #4 USCS, Clay (C), CH

Depth: 2.00 ft

Unit Weight: 0.0405 (dry), 0.0579 (sat) [lb/in3]

Phi: 0.00, S.M.: 200.00, Coh: 8.70 [psi]

Soil Layer #5 USCS, Silt (M), ML

Depth: 4.00 ft

Unit Weight: 0.0463 (dry), 0.0579 (sat) [lb/in3]

Phi: 28.00, S.M.: 50.00, Coh: 4.40 [psi]

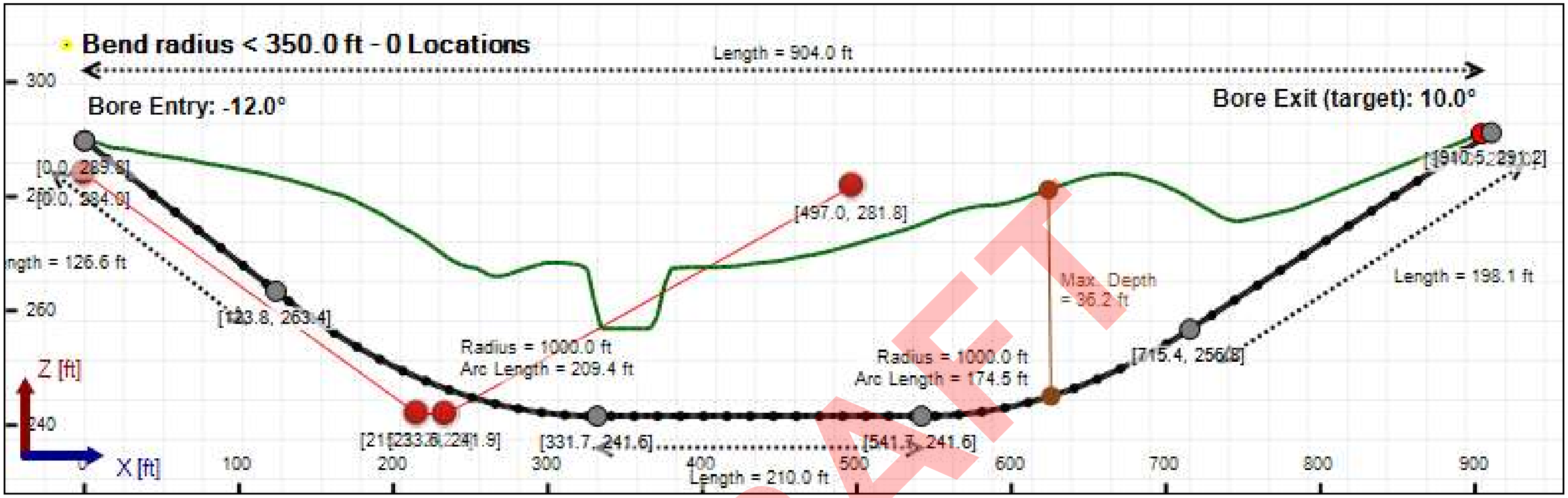
Soil Layer #6 USCS, Organic (O), OH

Depth: 20.00 ft

Unit Weight: 0.0405 (dry), 0.0579 (sat) [lb/in3]

Phi: 0.00, S.M.: 200.00, Coh: 1.50 [psi]

Bore Cross-Section View



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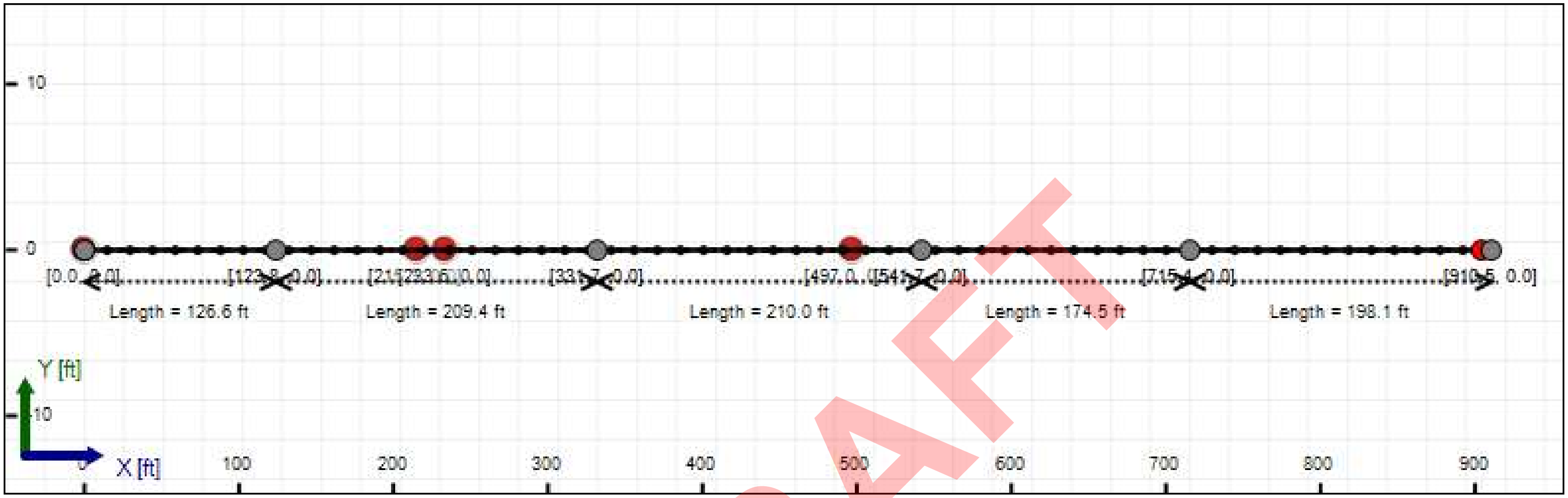
Powered by BoreAid

Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable

Pipe Type: HDPE

Classification: IPS

Pipe OD: 10" (10.75")

Pipe DR: 9

Pipe Length: 930.00 ft

Internal Pressure: 0 psi

Borehole Diameter: 1.34400002161662 ft

Silo Width: 1.34400002161662 ft

Surface Surcharge: 0 psi

Short Term Modulus: 57500 psi

Long Term Modulus: 28200 psi

Short Term Poisson Ratio: 0.35

Long Term Poisson Ratio: 0.45

Pipe Unit Weight: 0.03430 lb/in3

Allowable Tensile Stress (Short Term): 1200 psi

Allowable Tensile Stress (Long Term): 1100 psi

Allowable Compressive Stress (Short Term): 1150 psi

Allowable Compressive Stress (Long Term): 1150 psi

Surface-pipe friction coefficient at entrance: 0.5

Surface-pipe friction coefficient in borehole: 0.3

Pipe-soil friction angle: 30

Slurry Unit Weight: 0.05419 lb/in3

Hydrokinetic Pressure: 10 psi

Ballast Unit Weight: 0.03613 lb/in3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	7.0	27.6
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	7.0	27.6
Deflection		
Earth Load Deflection	1.896	7.514
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	2.028	7.646
Compressive Stress [psi]		
Compressive Wall Stress	31.3	124.2

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	16254.8	16254.8
Pullback Stress [psi]	453.3	453.3
Pullback Strain	7.884E-3	7.884E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	453.3	477.6
Tensile Strain	7.884E-3	8.754E-3

Net External Pressure = 28.4 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	2.028	7.5	3.7	OK
Unconstrained Collapse [psi]	33.5	118.9	3.5	OK
Compressive Wall Stress [psi]	31.3	1150.0	36.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	43.5	229.0	5.3	OK
Tensile Stress [psi]	477.6	1200.0	2.5	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	90.599 psi	90.599 psi
1	8.00 in	12.00 in	90.523 psi	90.523 psi
2	12.00 in	16.13 in	90.415 psi	90.415 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): 0.00 US (liquid) gallon/min

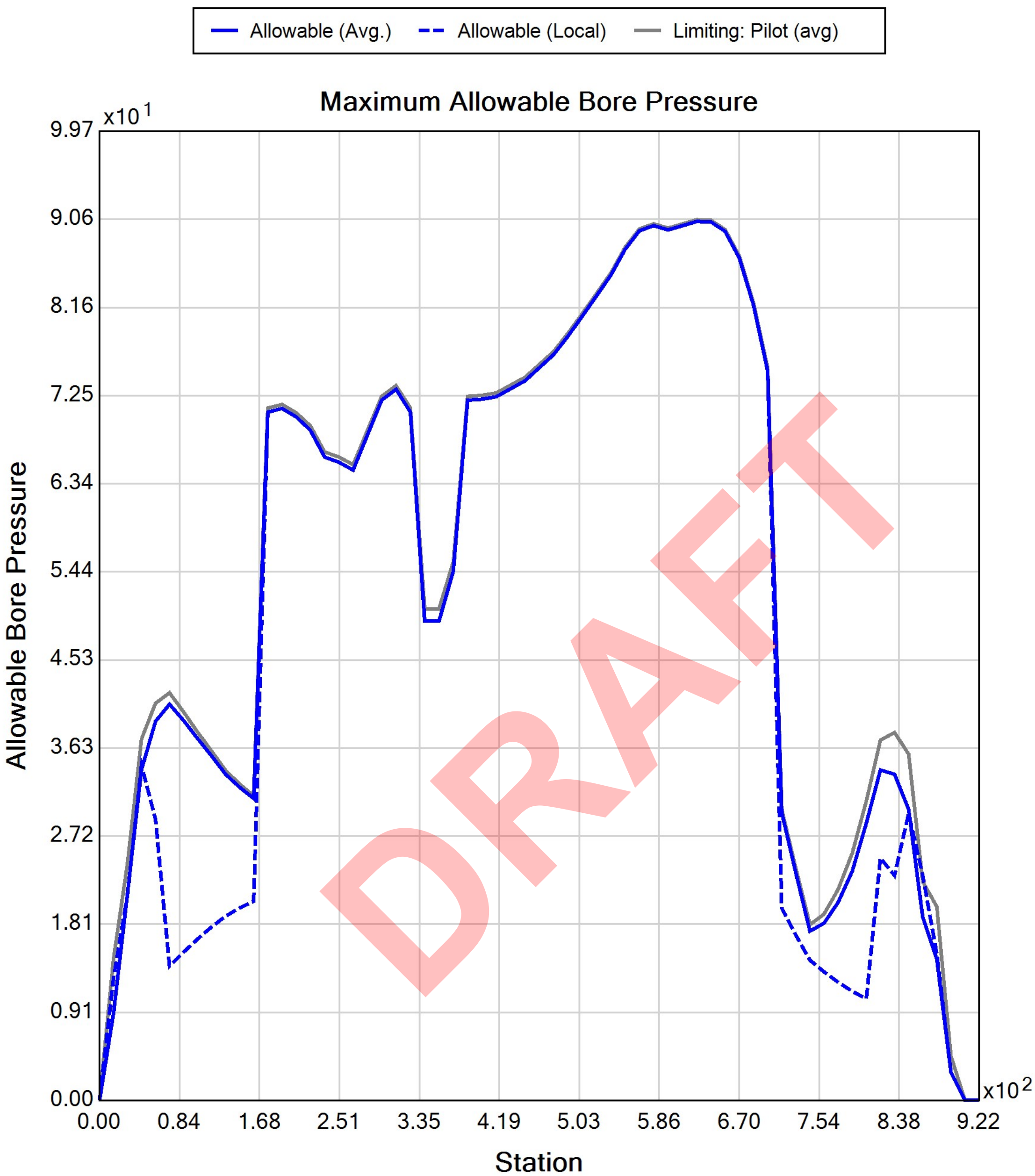
Drill Fluid Density: 0.040 lb/in3

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): Infinity



Allowable (Avg.)
Allowable (Local)
Limiting: Pilot (avg)
Maximum Allowable Bore Pressure
x10 1
9.97
9.06
8.16
7.25
6.34
5.44
4.53
3.63
2.72
1.81
0.91
0.00
Allowable Bore Pressure
x10 2
0.00
0.84
1.68
2.51
3.35
4.19
5.03
5.86
6.70
7.54
8.38
9.22
Station
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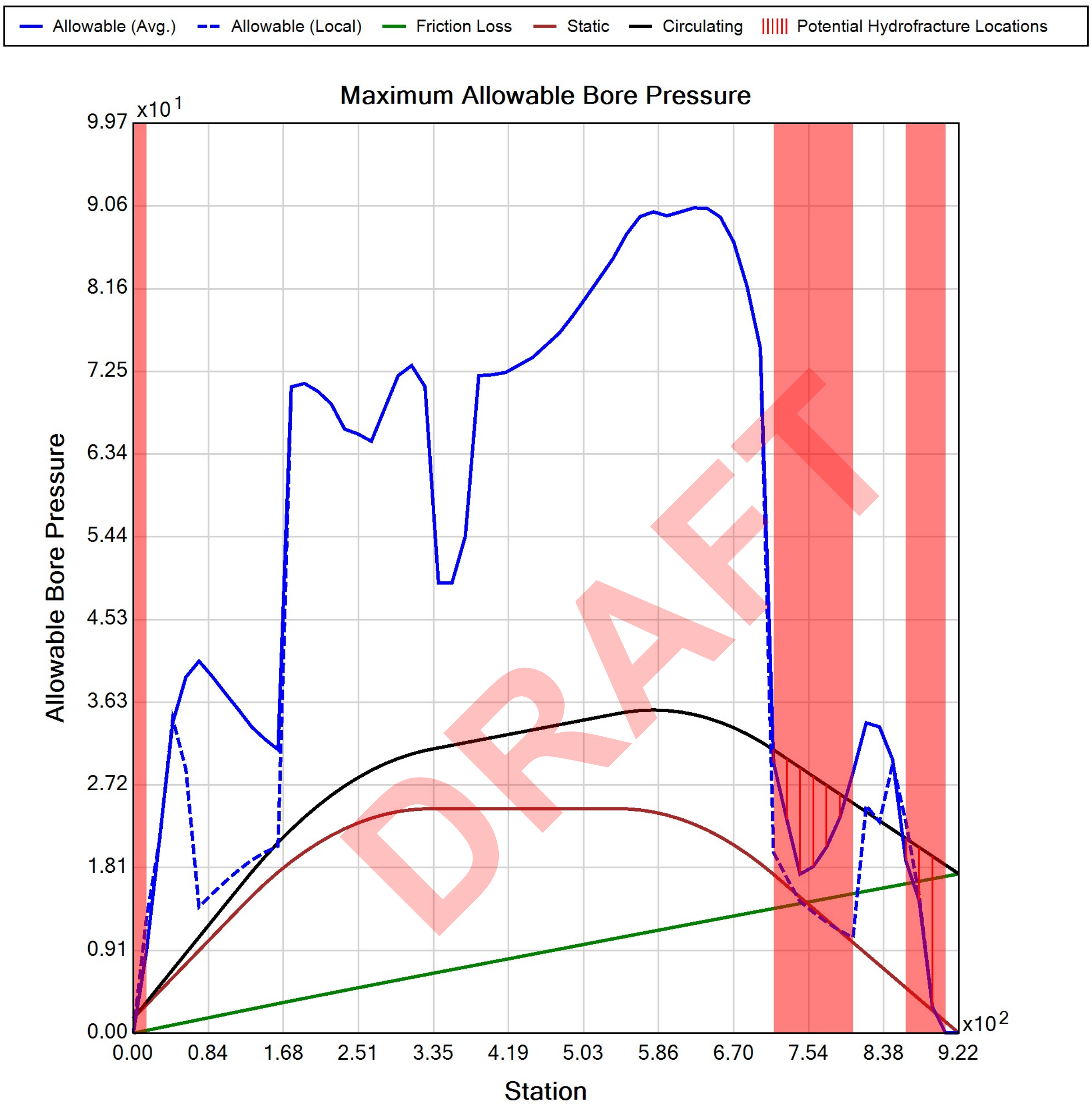

Allowable (Avg.)
Allowable (Local)
Friction Loss
Static
Circulating
Potential Hydrofracture Locations
Maximum Allowable Bore Pressure
x10 1
9.97
9.06
8.16
7.25
6.34
5.44
4.53
3.63
2.72
1.81
0.91
0.00
Allowable Bore Pressure
x10 2
0.00
0.84
1.68
2.51
3.35
4.19
5.03
5.86
6.70
7.54
8.38
9.22
Station
DRAFT

Appendix F

BoreAid HDD #2 Simulation Output

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:	CHPE Package 1B HDD 2 Draft Ref: South Bay, Whitehall, NY Washington cty J2105 Start Date: 04-12-2022 End Date: 04-12-2022
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	CHA-BCE
Designer:	MDB BCE Amherst, Massachusetts
Description:	South Route 10" DR7 Deeper bore path

Input Summary

Start Coordinate	(0.00, 0.00, 122.00) ft
End Coordinate	(2969.00, 0.00, 119.00) ft
Project Length	2969.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	7.0
Pipe Thickness	1.54 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

Number of Layers: 4

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: 70.0000 (dry), 100.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 3.10 [psi]

Soil Layer #3 USCS, Clay (C), CL

From Assistant

Unit Weight: 80.0000 (dry), 110.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 5.50 [psi]

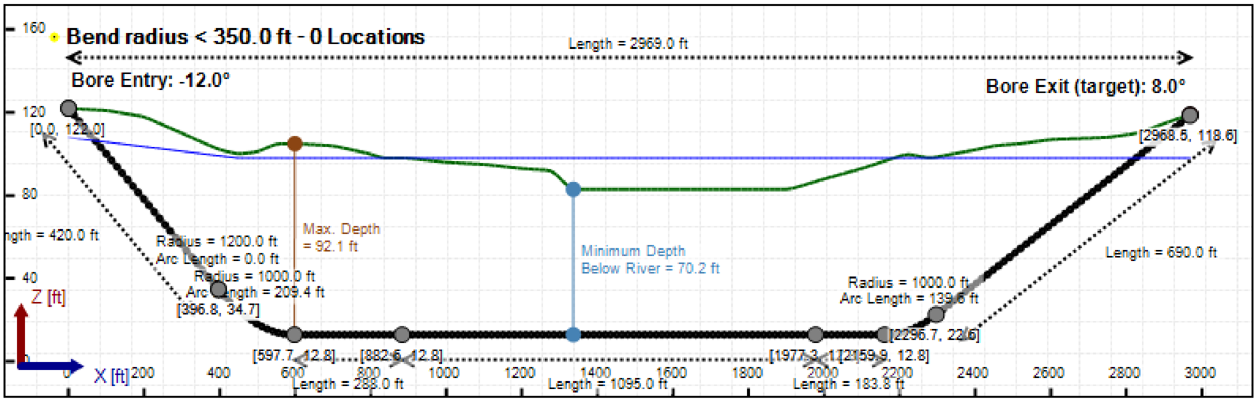
Soil Layer #4 USCS, Clay (C), CL

From Assistant

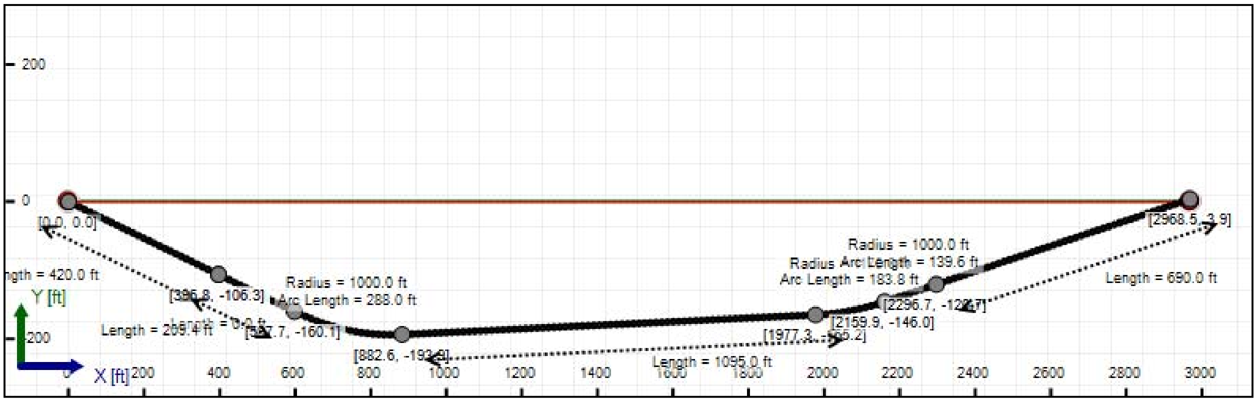
Unit Weight: 70.0000 (dry), 100.0000 (sat) [lb/ft3]

Phi: 0.00, S.M.: 145.00, Coh: 3.10 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable

Pipe Type: HDPE

Classification: IPS

Pipe OD: 10" (10.75")

Pipe DR: 7

Pipe Length: 3029.99 ft

Internal Pressure: 0 psi

Borehole Diameter: 1.34400002161662 ft

Silo Width: 1.34400002161662 ft

Surface Surcharge: 0 psi

Short Term Modulus: 57500 psi

Long Term Modulus: 28200 psi

Short Term Poisson Ratio: 0.35

Long Term Poisson Ratio: 0.45

Pipe Unit Weight: 59.30500 lb/ft3

Allowable Tensile Stress (Short Term): 1200 psi

Allowable Tensile Stress (Long Term): 1100 psi

Allowable Compressive Stress (Short Term): 1150 psi

Allowable Compressive Stress (Long Term): 1150 psi

Surface-pipe friction coefficient at entrance: 0.5

Surface-pipe friction coefficient in borehole: 0.3

Pipe-soil friction angle: 30

Slurry Unit Weight: 80.00000 lb/ft3

Hydrokinetic Pressure: 10 psi

Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	31.3	31.3
Water Pressure	36.9	36.9
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	68.2	68.2
Deflection		
Earth Load Deflection	3.597	3.597
Bouyant Deflection	0.053	0.053
Reissner Effect	0	0
Net Deflection	3.650	3.650
Compressive Stress [psi]		
Compressive Wall Stress	238.8	238.8

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	30134.6	30134.6
Pullback Stress [psi]	677.9	677.9
Pullback Strain	1.179E-2	1.179E-2
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	677.9	680.6
Tensile Strain	1.179E-2	1.222E-2

Net External Pressure = 10.3 [psi]

Bouyant Deflection = 0.0

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	3.650	7.5	2.1	OK
Unconstrained Collapse [psi]	68.2	236.2	3.5	OK
Compressive Wall Stress [psi]	238.8	1150.0	4.8	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.026	7.5	288.1	OK
Unconstrained Collapse [psi]	23.3	501.9	21.5	OK
Tensile Stress [psi]	680.6	1200.0	1.8	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	9.50 in	90.856 psi	83.270 psi
1	9.50 in	14.00 in	90.844 psi	83.258 psi
2	14.00 in	16.13 in	90.836 psi	83.250 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): 50.00 US (liquid) gallon/min

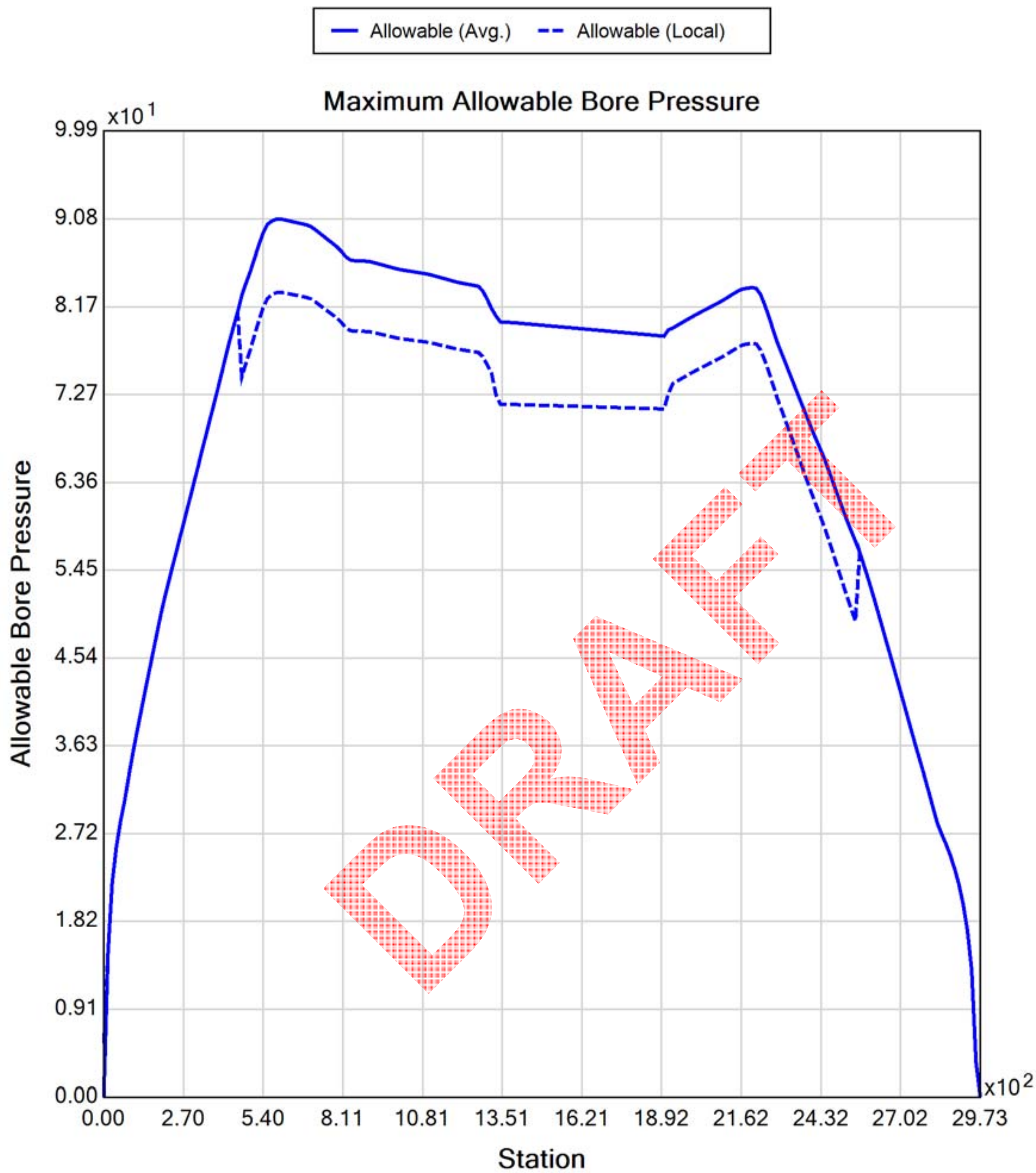
Drill Fluid Density: 68.670 lb/ft3

Rheological model: Power-Law

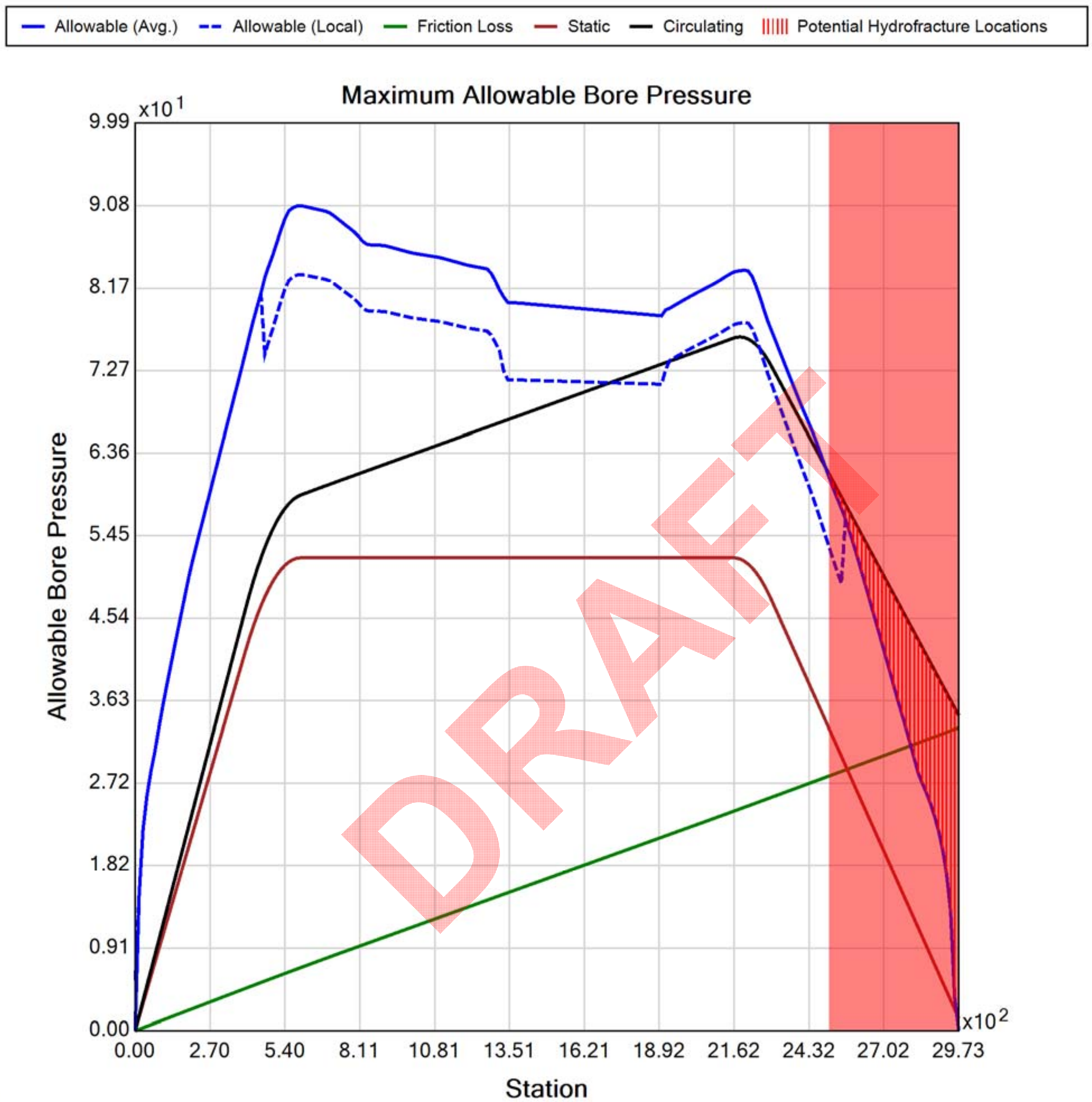
Fluid Consistency Index (K): 63.17

Power Law Exponent (n): 0.14

Effective Viscosity (cP): 1294.5



Allowable (Avg.)
Allowable (Local)
Maximum Allowable Bore Pressure
x10 1
9.99
9.08
8.17
7.27
6.36
5.45
4.54
3.63
2.72
1.82
0.91
0.00
Allowable Bore Pressure
0.00
2.70
5.40
8.11
10.81
13.51
16.21
18.92
21.62
24.32
27.02
29.73
x10 2
Station
DRAFT



Allowable (Avg.)
Allowable (Local)
Friction Loss
Static
Circulating
Potential Hydrofracture Locations
Maximum Allowable Bore Pressure
x10 1
9.99
9.08
8.17
7.27
6.36
5.45
4.54
3.63
2.72
1.82
0.91
0.00
Allowable Bore Pressure
0.00
2.70
5.40
8.11
10.81
13.51
16.21
18.92
21.62
24.32
27.02
29.73
x10 2
Station
DRAFT

Rod-by-Rod Plan

Rod #	Dist (ft)	L+/R- (ft)	Elev (ft)	Depth (ft)	Inclin (Deg)	Azim (Deg)	Dip (Deg)	Length (ft)	Radius (ft)
1	0.000	0.000	122.000	0.000	-12.00	345.0	309.4	0.0	0.0
2	14.172	-3.797	118.881	2.977	-12.00	345.0	309.4	15.0	0.0
3	28.345	-7.595	115.763	5.954	-12.00	345.0	309.4	30.0	0.0
4	42.517	-11.392	112.644	8.931	-12.00	345.0	309.4	45.0	0.0
5	56.689	-15.190	109.525	11.908	-12.00	345.0	309.4	60.0	0.0
6	70.861	-18.987	106.407	14.885	-12.00	345.0	309.4	75.0	0.0
7	85.034	-22.785	103.288	17.862	-12.00	345.0	309.4	90.0	0.0
8	99.206	-26.582	100.169	20.777	-12.00	345.0	309.4	105.0	0.0
9	113.378	-30.380	97.051	23.548	-12.00	345.0	309.4	120.0	0.0
10	127.550	-34.177	93.932	26.242	-12.00	345.0	309.4	135.0	0.0
11	141.723	-37.974	90.813	28.935	-12.00	345.0	309.4	150.0	0.0
12	155.895	-41.772	87.695	31.629	-12.00	345.0	309.4	165.0	0.0
13	170.067	-45.569	84.576	34.322	-12.00	345.0	309.4	180.0	0.0
14	184.240	-49.367	81.457	37.016	-12.00	345.0	309.4	195.0	0.0
15	198.412	-53.164	78.339	39.595	-12.00	345.0	309.4	210.0	0.0
16	212.584	-56.962	75.220	41.773	-12.00	345.0	309.4	225.0	0.0
17	226.756	-60.759	72.101	43.758	-12.00	345.0	309.4	240.0	0.0
18	240.929	-64.557	68.983	45.743	-12.00	345.0	309.4	255.0	0.0
19	255.101	-68.354	65.864	47.728	-12.00	345.0	309.4	270.0	0.0
20	269.273	-72.152	62.745	49.713	-12.00	345.0	309.4	285.0	0.0
21	283.445	-75.949	59.626	51.698	-12.00	345.0	309.4	300.0	0.0
22	297.618	-79.746	56.508	53.683	-12.00	345.0	309.4	315.0	0.0
23	311.790	-83.544	53.389	55.668	-12.00	345.0	309.4	330.0	0.0
24	325.962	-87.341	50.270	57.653	-12.00	345.0	309.4	345.0	0.0
25	340.134	-91.139	47.152	59.637	-12.00	345.0	309.4	360.0	0.0
26	354.307	-94.936	44.033	61.622	-12.00	345.0	309.4	375.0	0.0
27	368.479	-98.734	40.914	63.607	-12.00	345.0	309.4	390.0	0.0
28	382.651	-102.531	37.796	65.592	-12.00	345.0	309.4	405.0	0.0
29	396.824	-106.329	34.677	67.668	-12.00	345.0	309.4	420.0	0.0
30	411.018	-110.132	31.669	69.891	-11.14	-15.0	308.3	435.0	-2.4
31	425.254	-113.947	28.881	72.109	-10.28	-15.0	306.2	450.0	1000.0
32	439.529	-117.772	26.314	74.104	-9.42	-15.0	303.9	465.0	1000.0

Rod #	Dist (ft)	L+/R- (ft)	Elev (ft)	Depth (ft)	Inclin (Deg)	Azim (Deg)	Dip (Deg)	Length (ft)	Radius (ft)
33	453.840	-121.606	23.970	76.107	-8.56	-15.0	301.4	480.0	1000.0
34	468.183	-125.449	21.848	78.516	-7.70	-15.0	298.9	495.0	1000.0
35	482.555	-129.300	19.949	80.702	-6.84	-15.0	296.2	510.0	1000.0
36	496.953	-133.158	18.273	82.744	-5.98	-15.0	293.5	525.0	1000.0
37	511.374	-137.022	16.822	85.088	-5.12	-15.0	290.6	540.0	1000.0
38	525.814	-140.891	15.594	87.471	-4.27	-15.0	287.6	555.0	1000.0
39	540.270	-144.765	14.591	89.624	-3.41	-15.0	284.5	570.0	1000.0
40	554.740	-148.642	13.812	91.174	-2.55	-15.0	281.4	585.0	1000.0
41	569.219	-152.522	13.258	91.742	-1.69	-15.0	278.1	600.0	1000.0
42	583.704	-156.403	12.929	92.071	-0.83	-15.0	274.8	615.0	1000.0
43	598.192	-160.285	12.825	92.176	0.00	-15.0	271.5	630.0	1000.0
44	612.712	-164.050	12.824	92.048	0.00	-14.1	270.0	645.0	1000.0
45	627.286	-167.597	12.824	91.903	0.00	-13.2	270.0	660.0	1000.0
46	641.912	-170.926	12.824	91.756	0.00	-12.4	270.0	675.0	1000.0
47	656.586	-174.034	12.824	91.610	0.00	-11.5	270.0	690.0	1000.0
48	671.306	-176.922	12.824	91.463	0.00	-10.7	270.0	705.0	1000.0
49	686.067	-179.589	12.824	91.315	0.00	-9.8	270.0	720.0	1000.0
50	700.866	-182.034	12.824	91.058	0.00	-9.0	270.0	735.0	1000.0
51	715.700	-184.257	12.824	90.548	0.00	-8.1	270.0	750.0	1000.0
52	730.566	-186.257	12.824	89.953	0.00	-7.2	270.0	765.0	1000.0
53	745.460	-188.034	12.824	89.357	0.00	-6.4	270.0	780.0	1000.0
54	760.379	-189.587	12.824	88.761	0.00	-5.5	270.0	795.0	1000.0
55	775.320	-190.916	12.824	88.163	0.00	-4.7	270.0	810.0	1000.0
56	790.279	-192.021	12.824	87.565	0.00	-3.8	270.0	825.0	1000.0
57	805.253	-192.902	12.824	86.783	0.00	-2.9	270.0	840.0	1000.0
58	820.239	-193.558	12.824	85.827	0.00	-2.1	270.0	855.0	1000.0
59	835.233	-193.989	12.824	85.282	0.00	-1.2	270.0	870.0	1000.0
60	850.231	-194.195	12.824	85.176	0.00	-0.4	270.0	885.0	1000.0
61	865.231	-194.176	12.824	85.176	0.00	0.5	89.9	900.0	1000.0
62	880.229	-193.932	12.824	85.176	0.00	1.4	90.0	915.0	1000.0
63	895.224	-193.542	12.824	85.176	0.00	1.5	90.0	930.0	0.0
64	910.219	-193.150	12.824	84.972	0.00	1.5	90.0	945.0	0.0
65	925.213	-192.757	12.824	84.672	0.00	1.5	90.0	960.0	0.0
66	940.208	-192.364	12.824	84.372	0.00	1.5	90.0	975.0	0.0

Rod #	Dist (ft)	L+/R- (ft)	Elev (ft)	Depth (ft)	Inclin (Deg)	Azim (Deg)	Dip (Deg)	Length (ft)	Radius (ft)
67	955.203	-191.972	12.824	84.072	0.00	1.5	90.0	990.0	0.0
68	970.198	-191.579	12.824	83.772	0.00	1.5	90.0	1005.0	0.0
69	985.193	-191.186	12.824	83.472	0.00	1.5	90.0	1020.0	0.0
70	1000.188	-190.794	12.824	83.206	0.00	1.5	90.0	1035.0	0.0
71	1015.183	-190.401	12.824	83.024	0.00	1.5	90.0	1050.0	0.0
72	1030.177	-190.008	12.824	82.874	0.00	1.5	90.0	1065.0	0.0
73	1045.172	-189.616	12.824	82.725	0.00	1.5	90.0	1080.0	0.0
74	1060.167	-189.223	12.824	82.575	0.00	1.5	90.0	1095.0	0.0
75	1075.162	-188.831	12.824	82.425	0.00	1.5	90.0	1110.0	0.0
76	1090.157	-188.438	12.824	82.275	0.00	1.5	90.0	1125.0	0.0
77	1105.152	-188.045	12.824	82.057	0.00	1.5	90.0	1140.0	0.0
78	1120.147	-187.653	12.824	81.773	0.00	1.5	90.0	1155.0	0.0
79	1135.141	-187.260	12.824	81.474	0.00	1.5	90.0	1170.0	0.0
80	1150.136	-186.867	12.824	81.174	0.00	1.5	90.0	1185.0	0.0
81	1165.131	-186.475	12.824	80.874	0.00	1.5	90.0	1200.0	0.0
82	1180.126	-186.082	12.823	80.574	0.00	1.5	90.0	1215.0	0.0
83	1195.121	-185.689	12.823	80.274	0.00	1.5	90.0	1230.0	0.0
84	1210.116	-185.297	12.823	80.050	0.00	1.5	90.0	1245.0	0.0
85	1225.111	-184.904	12.823	79.863	0.00	1.5	90.0	1260.0	0.0
86	1240.105	-184.511	12.823	79.675	0.00	1.5	90.0	1275.0	0.0
87	1255.100	-184.119	12.823	79.488	0.00	1.5	90.0	1290.0	0.0
88	1270.095	-183.726	12.823	79.300	0.00	1.5	90.0	1305.0	0.0
89	1285.090	-183.334	12.823	77.986	0.00	1.5	90.0	1320.0	0.0
90	1300.085	-182.941	12.823	75.561	0.00	1.5	90.0	1335.0	0.0
91	1315.080	-182.548	12.823	72.862	0.00	1.5	90.0	1350.0	0.0
92	1330.075	-182.156	12.823	70.768	0.00	1.5	90.0	1365.0	0.0
93	1345.069	-181.763	12.823	70.177	0.00	1.5	90.0	1380.0	0.0
94	1360.064	-181.370	12.823	70.177	0.00	1.5	90.0	1395.0	0.0
95	1375.059	-180.978	12.823	70.177	0.00	1.5	90.0	1410.0	0.0
96	1390.054	-180.585	12.823	70.177	0.00	1.5	90.0	1425.0	0.0
97	1405.049	-180.192	12.823	70.177	0.00	1.5	90.0	1440.0	0.0
98	1420.044	-179.800	12.823	70.177	0.00	1.5	90.0	1455.0	0.0
99	1435.039	-179.407	12.823	70.177	0.00	1.5	90.0	1470.0	0.0
100	1450.033	-179.015	12.823	70.177	0.00	1.5	90.0	1485.0	0.0

Rod #	Dist (ft)	L+/R- (ft)	Elev (ft)	Depth (ft)	Inclin (Deg)	Azim (Deg)	Dip (Deg)	Length (ft)	Radius (ft)
101	1465.028	-178.622	12.823	70.177	0.00	1.5	90.0	1500.0	0.0
102	1480.023	-178.229	12.823	70.177	0.00	1.5	90.0	1515.0	0.0
103	1495.018	-177.837	12.823	70.177	0.00	1.5	90.0	1530.0	0.0
104	1510.013	-177.444	12.823	70.177	0.00	1.5	90.0	1545.0	0.0
105	1525.008	-177.051	12.823	70.177	0.00	1.5	90.0	1560.0	0.0
106	1540.003	-176.659	12.823	70.177	0.00	1.5	90.0	1575.0	0.0
107	1554.998	-176.266	12.823	70.177	0.00	1.5	90.0	1590.0	0.0
108	1569.992	-175.873	12.823	70.177	0.00	1.5	90.0	1605.0	0.0
109	1584.987	-175.481	12.823	70.177	0.00	1.5	90.0	1620.0	0.0
110	1599.982	-175.088	12.823	70.177	0.00	1.5	90.0	1635.0	0.0
111	1614.977	-174.695	12.823	70.177	0.00	1.5	90.0	1650.0	0.0
112	1629.972	-174.303	12.823	70.177	0.00	1.5	90.0	1665.0	0.0
113	1644.967	-173.910	12.823	70.177	0.00	1.5	90.0	1680.0	0.0
114	1659.962	-173.518	12.823	70.177	0.00	1.5	90.0	1695.0	0.0
115	1674.956	-173.125	12.823	70.177	0.00	1.5	90.0	1710.0	0.0
116	1689.951	-172.732	12.823	70.177	0.00	1.5	90.0	1725.0	0.0
117	1704.946	-172.340	12.823	70.177	0.00	1.5	90.0	1740.0	0.0
118	1719.941	-171.947	12.823	70.177	0.00	1.5	90.0	1755.0	0.0
119	1734.936	-171.554	12.823	70.177	0.00	1.5	90.0	1770.0	0.0
120	1749.931	-171.162	12.823	70.177	0.00	1.5	90.0	1785.0	0.0
121	1764.926	-170.769	12.822	70.178	0.00	1.5	90.0	1800.0	0.0
122	1779.920	-170.376	12.822	70.178	0.00	1.5	90.0	1815.0	0.0
123	1794.915	-169.984	12.822	70.178	0.00	1.5	90.0	1830.0	0.0
124	1809.910	-169.591	12.822	70.178	0.00	1.5	90.0	1845.0	0.0
125	1824.905	-169.198	12.822	70.178	0.00	1.5	90.0	1860.0	0.0
126	1839.900	-168.806	12.822	70.178	0.00	1.5	90.0	1875.0	0.0
127	1854.895	-168.413	12.822	70.178	0.00	1.5	90.0	1890.0	0.0
128	1869.890	-168.021	12.822	70.178	0.00	1.5	90.0	1905.0	0.0
129	1884.884	-167.628	12.822	70.178	0.00	1.5	90.0	1920.0	0.0
130	1899.879	-167.235	12.822	70.178	0.00	1.5	90.0	1935.0	0.0
131	1914.874	-166.843	12.822	70.543	0.00	1.5	90.0	1950.0	0.0
132	1929.869	-166.450	12.822	71.282	0.00	1.5	90.0	1965.0	0.0
133	1944.864	-166.057	12.822	72.115	0.00	1.5	90.0	1980.0	0.0
134	1959.859	-165.665	12.822	72.948	0.00	1.5	90.0	1995.0	0.0

Rod #	Dist (ft)	L+/R- (ft)	Elev (ft)	Depth (ft)	Inclin (Deg)	Azim (Deg)	Dip (Deg)	Length (ft)	Radius (ft)
135	1974.854	-165.272	12.822	73.781	0.00	1.5	90.0	2010.0	0.0
136	1989.846	-164.812	12.822	74.614	0.00	2.1	90.0	2025.0	1170.0
137	2004.832	-164.162	12.822	75.410	0.00	2.9	90.0	2040.0	1170.0
138	2019.809	-163.320	12.822	76.168	0.00	3.6	90.0	2055.0	1170.0
139	2034.773	-162.286	12.822	76.917	0.00	4.3	90.0	2070.0	1170.0
140	2049.722	-161.060	12.822	77.664	0.00	5.1	90.0	2085.0	1170.0
141	2064.655	-159.643	12.822	78.411	0.00	5.8	90.0	2100.0	1170.0
142	2079.569	-158.034	12.822	79.156	0.00	6.5	90.0	2115.0	1170.0
143	2094.460	-156.235	12.822	79.901	0.00	7.3	90.0	2130.0	1170.0
144	2109.327	-154.244	12.822	80.738	0.00	8.0	90.0	2145.0	1170.0
145	2124.168	-152.064	12.822	81.628	0.00	8.7	90.0	2160.0	1170.0
146	2138.979	-149.693	12.822	82.517	0.00	9.5	90.0	2175.0	1170.0
147	2153.759	-147.132	12.822	83.404	0.00	10.2	90.0	2190.0	1170.0
148	2168.511	-144.415	12.860	84.250	0.50	10.4	90.8	2205.0	1000.0
149	2183.257	-141.682	13.105	84.891	0.93	10.5	95.1	2220.0	1090.0
150	2197.999	-138.950	13.574	85.279	1.79	10.5	99.7	2235.0	1000.0
151	2212.732	-136.219	14.268	85.368	2.65	10.5	104.3	2250.0	1000.0
152	2227.453	-133.491	15.187	84.564	3.51	10.5	108.6	2265.0	1000.0
153	2242.159	-130.765	16.331	82.931	4.37	10.5	112.8	2280.0	1000.0
154	2256.846	-128.043	17.698	81.074	5.23	10.5	116.7	2295.0	1000.0
155	2271.511	-125.325	19.290	78.993	6.09	10.5	120.3	2310.0	1000.0
156	2286.152	-122.612	21.105	77.100	6.95	10.5	123.8	2325.0	1000.0
157	2300.765	-119.903	23.134	75.558	7.78	10.5	126.8	2340.0	0.0
158	2315.370	-117.196	25.222	73.957	8.00	10.5	127.6	2355.0	0.0
159	2329.975	-114.489	27.309	72.357	8.00	10.5	127.6	2370.0	0.0
160	2344.581	-111.783	29.397	70.756	8.00	10.5	127.6	2385.0	0.0
161	2359.186	-109.076	31.484	69.155	8.00	10.5	127.6	2400.0	0.0
162	2373.791	-106.369	33.572	67.554	8.00	10.5	127.6	2415.0	0.0
163	2388.397	-103.662	35.659	65.954	8.00	10.5	127.6	2430.0	0.0
164	2403.002	-100.955	37.747	64.373	8.00	10.5	127.6	2445.0	0.0
165	2417.607	-98.248	39.835	62.870	8.00	10.5	127.6	2460.0	0.0
166	2432.212	-95.541	41.922	61.366	8.00	10.5	127.6	2475.0	0.0
167	2446.818	-92.834	44.010	59.832	8.00	10.5	127.6	2490.0	0.0
168	2461.423	-90.127	46.097	58.066	8.00	10.5	127.6	2505.0	0.0

Rod #	Dist (ft)	L+/R- (ft)	Elev (ft)	Depth (ft)	Inclin (Deg)	Azim (Deg)	Dip (Deg)	Length (ft)	Radius (ft)
169	2476.028	-87.420	48.185	56.187	8.00	10.5	127.6	2520.0	0.0
170	2490.634	-84.713	50.272	54.308	8.00	10.5	127.6	2535.0	0.0
171	2505.239	-82.007	52.360	52.429	8.00	10.5	127.6	2550.0	0.0
172	2519.844	-79.300	54.448	50.550	8.00	10.5	127.6	2565.0	0.0
173	2534.450	-76.593	56.535	48.826	8.00	10.5	127.6	2580.0	0.0
174	2549.055	-73.886	58.623	47.104	8.00	10.5	127.6	2595.0	0.0
175	2563.660	-71.179	60.710	45.381	8.00	10.5	127.6	2610.0	0.0
176	2578.265	-68.472	62.798	43.659	8.00	10.5	127.6	2625.0	0.0
177	2592.871	-65.765	64.885	41.936	8.00	10.5	127.6	2640.0	0.0
178	2607.476	-63.058	66.973	40.061	8.00	10.5	127.6	2655.0	0.0
179	2622.081	-60.351	69.061	38.087	8.00	10.5	127.6	2670.0	0.0
180	2636.687	-57.644	71.148	36.096	8.00	10.5	127.6	2685.0	0.0
181	2651.292	-54.937	73.236	34.106	8.00	10.5	127.6	2700.0	0.0
182	2665.897	-52.231	75.323	32.116	8.00	10.5	127.6	2715.0	0.0
183	2680.502	-49.524	77.411	30.126	8.00	10.5	127.6	2730.0	0.0
184	2695.108	-46.817	79.498	28.136	8.00	10.5	127.6	2745.0	0.0
185	2709.713	-44.110	81.586	26.145	8.00	10.5	127.6	2760.0	0.0
186	2724.318	-41.403	83.674	24.155	8.00	10.5	127.6	2775.0	0.0
187	2738.924	-38.696	85.761	22.165	8.00	10.5	127.6	2790.0	0.0
188	2753.529	-35.989	87.849	20.279	8.00	10.5	127.6	2805.0	0.0
189	2768.134	-33.282	89.936	18.517	8.00	10.5	127.6	2820.0	0.0
190	2782.740	-30.575	92.024	16.795	8.00	10.5	127.6	2835.0	0.0
191	2797.345	-27.868	94.111	15.072	8.00	10.5	127.6	2850.0	0.0
192	2811.950	-25.162	96.199	13.350	8.00	10.5	127.6	2865.0	0.0
193	2826.555	-22.455	98.287	11.718	8.00	10.5	127.6	2880.0	0.0
194	2841.161	-19.748	100.374	10.370	8.00	10.5	127.6	2895.0	0.0
195	2855.766	-17.041	102.462	9.256	8.00	10.5	127.6	2910.0	0.0
196	2870.371	-14.334	104.549	8.142	8.00	10.5	127.6	2925.0	0.0
197	2884.977	-11.627	106.637	7.028	8.00	10.5	127.6	2940.0	0.0
198	2899.582	-8.920	108.724	5.914	8.00	10.5	127.6	2955.0	0.0
199	2914.187	-6.213	110.812	4.800	8.00	10.5	127.6	2970.0	0.0
200	2928.793	-3.506	112.900	3.687	8.00	10.5	127.6	2985.0	0.0
201	2943.398	-0.799	114.987	2.520	8.00	10.5	127.6	3000.0	0.0
202	2958.003	1.908	117.075	1.085	8.00	10.5	127.6	3015.0	0.0

Rod #	Dist (ft)	L+/R- (ft)	Elev (ft)	Depth (ft)	Inclin (Deg)	Azim (Deg)	Dip (Deg)	Length (ft)	Radius (ft)
203	2972.608	4.614	119.162	0.000	8.00	10.5	127.6	3030.0	0.0

Appendix G

Proposed Soil Properties for CHPE Segment 1 and 2 HDDs

Proposed Soil Properties for CHPE Segment 1 and 2 HDDs

Soil Type	N	Wet unit wgt, pcf	Dry unit Sgt, pcf	Bouyant unit wgt, pcf	Φ, °	Undrained Shear strength, su, psf	Maximum Shear Modulus, psi*
Loose Sand	4-10	115	105	53	30	---	200
Med. Dense Sand	10-30	125	110	63	34	---	500
V Soft to Soft clay	0-4	100	70	38	---	450	200
Med Stiff Clay (approx. 40 feet deep)	4-8	110	80	48	---	800	300
Stiff Clay (approx. 80 ft deep)	8-16	120	100	58	---	1200	400
Loose Silt	4-10	100	80	38	28	---	50
Med Dense Silt	10-30	110	110	48	32	---	100
Rock Fill	>50	140	120	80	37	---	1000

- where BoreAid default values are less than these shear moduli, use the default values.

Appendix H

HDD Design Drawings

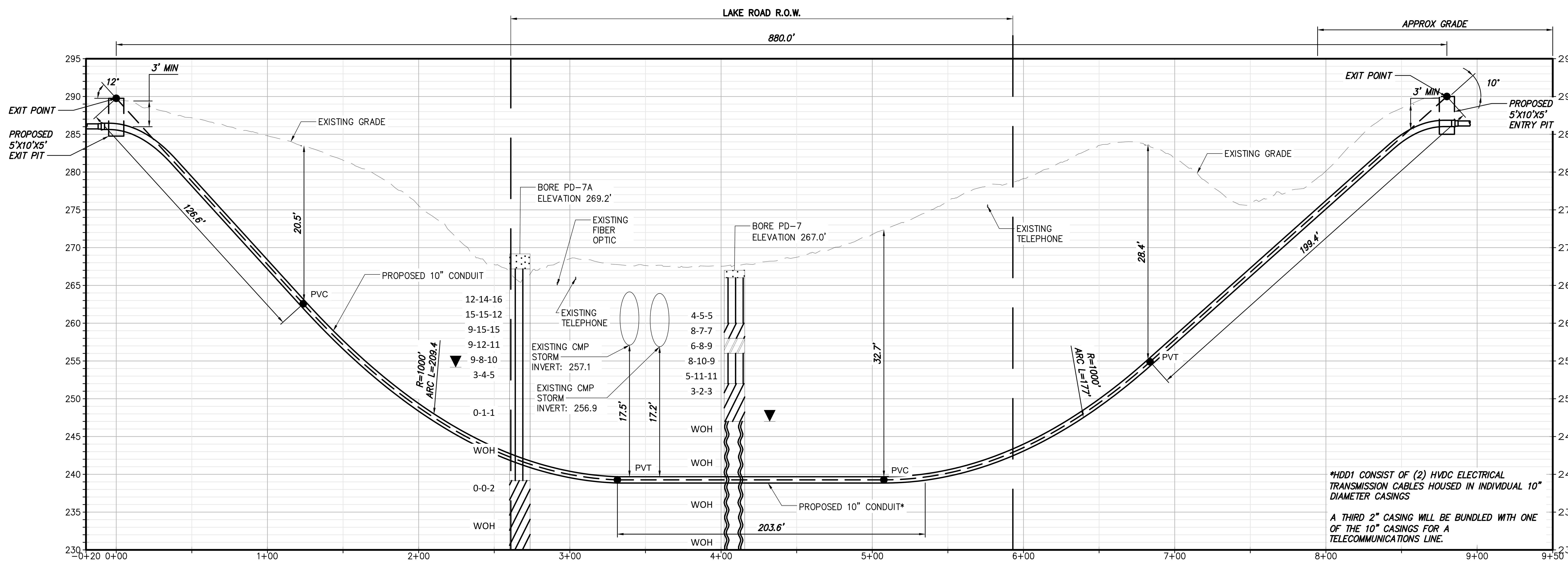
1 2 3 4

PROPOSED HDD 1 PLAN VIEW
CONDUIT 1

A

BORING LOG STRIP LEGEND
B101
Blow Counts per 6" =10-10-10
Recovery %/RQD % =95%/90%
11000 =UCS

Legend		
	ASPHALT	Asphalt
	CH	Fat CLAY
	CL	Lean CLAY
	CL-ML	SILTY CLAY
	CONCRETE	Concrete
	Fill	Fill
	GC	CLAYEY GRAVEL
	GM	SILTY GRAVEL
	Gneiss	Undefined
	GP	Poorly Graded GRAVEL
	GW	Well Graded GRAVEL
	ML	SILT
	OL	ORGANIC Lean CLAY
	OL/OH	ORGANIC SOIL
	Rock	Undefined
	Sandstone	Sandstone
	SC	CLAYEY SAND
	SC-SM	SILT, CLAYEY SAND
	SHALE	Shale
	SM	SILTY SAND
	SP	Poorly Graded SAND
	SP-SM	Poorly Graded SAND with SILT
	SW	Well graded SAND
	Topsoil	Topsoil
	USGS 708	Gneiss
	USGS 718	Granite 1
	USGS 732	Quartz



*HDD1 CONSIST OF (2) HVDC ELECTRICAL TRANSMISSION CABLES HOUSED IN INDIVIDUAL 10" DIAMETER CASINGS

A THIRD 2" CASING WILL BE BUNDLED WITH ONE OF THE 10" CASINGS FOR A TELECOMMUNICATIONS LINE.

PROPOSED HDD 1 PROFILE VIEW
CONDUIT 1

B

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Kiewit

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No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP
A	04/15/2022	EM&CP REGULATORY SUBMISSION	JM	JR

CHAMPLAIN HUDSON POWER EXPRESS
SEGMENT 1 - PUTNAM TO DRESDEN
HDD 1 PLAN AND PROFILE - CONDUIT 1
BOX CULVERT CROSSING, CONDUIT 1
WHITEHALL, WASHINGTON COUNTY, NY

KIEWIT PROJECT NO. 21162
CHA PROJECT NO. 066076
DRAWING NO. C-301

DRAWN BY: TAR DESIGNED BY: TAR APPROVED BY: JEO SCALE AS NOTED REV. NO. B DATE 04/15/2022 SH.NO. XXX OF XXX

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PROPOSED HDD 1 PLAN VIEW

CONDUIT 2

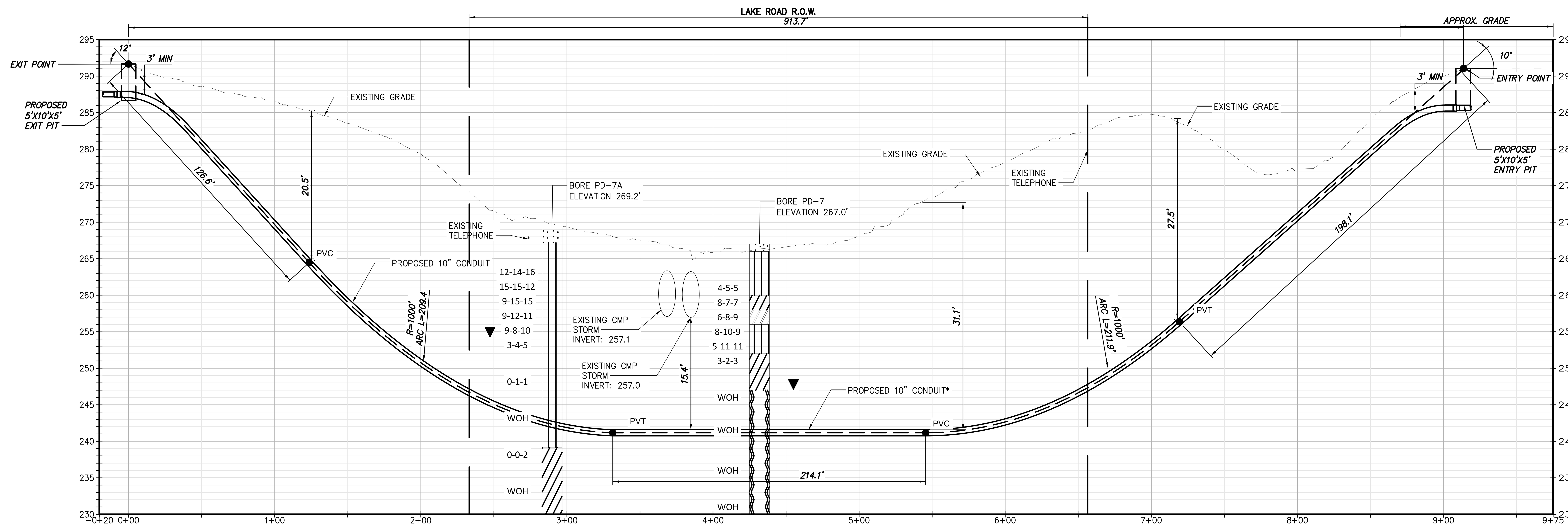
BORING LOG STRIP LEGEND

B101

Blow Counts per 6" =10-10-10

Recovery %/RQD % =95%/90%

11000 =UCS



PROPOSED HDD 1 PROFILE VIEW

CONDUIT 2

*HDD1 CONSIST OF (2) HVDC ELECTRICAL TRANSMISSION CABLES HOUSED IN INDIVIDUAL 10" DIAMETER CASINGS

A THIRD 3" CASING WILL BE BUNDLED WITH ONE OF THE 10" CASINGS FOR A TELECOMMUNICATIONS LINE.

Legend

	ASPHALT	Asphalt
	CH	Fat CLAY
	CL	Lean CLAY
	CL-ML	SILTY CLAY
	CONCRETE	Concrete
	Fill	Fill
	GC	CLAYEY GRAVEL
	GM	SILTY GRAVEL
	Gneiss	Undefined
	GP	Poorly Graded GRAVEL
	GW	Well Graded GRAVEL
	ML	SILT
	OL	ORGANIC Lean CLAY
	OL/OH	ORGANIC SOIL
	Rock	Undefined
	Sandstone	Sandstone
	SC	CLAYEY SAND
	SC-SM	SILT, CLAYEY SAND
	SHALE	Shale
	SM	SILTY SAND
	SP	Poorly Graded SAND
	SP-SM	Poorly Graded SAND with SILT
	SW	Well graded SAND
	Topsoil	Topsoil
	USGS 708	Gneiss
	USGS 718	Granite 1
	USGS 732	Quartz

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No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP
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CHAMPLAIN HUDSON POWER EXPRESS

SEGMENT 1 - PUTNAM TO DRESDEN

HDD 1 PLAN AND PROFILE - CONDUIT 2

BOX CULVERT CROSSING, CONDUIT 2

WHITEHALL, WASHINGTON COUNTY, NY

DRAWN BY: TAR DESIGNED BY: TAR APPROVED BY: JEO

SCALE: AS NOTED REV. NO. B

KIEWIT PROJECT NO. 21162

CHA PROJECT NO. 066076

DRAWING NO. C-301A

DATE 04/15/2022

SH.NO. XXX OF XXX

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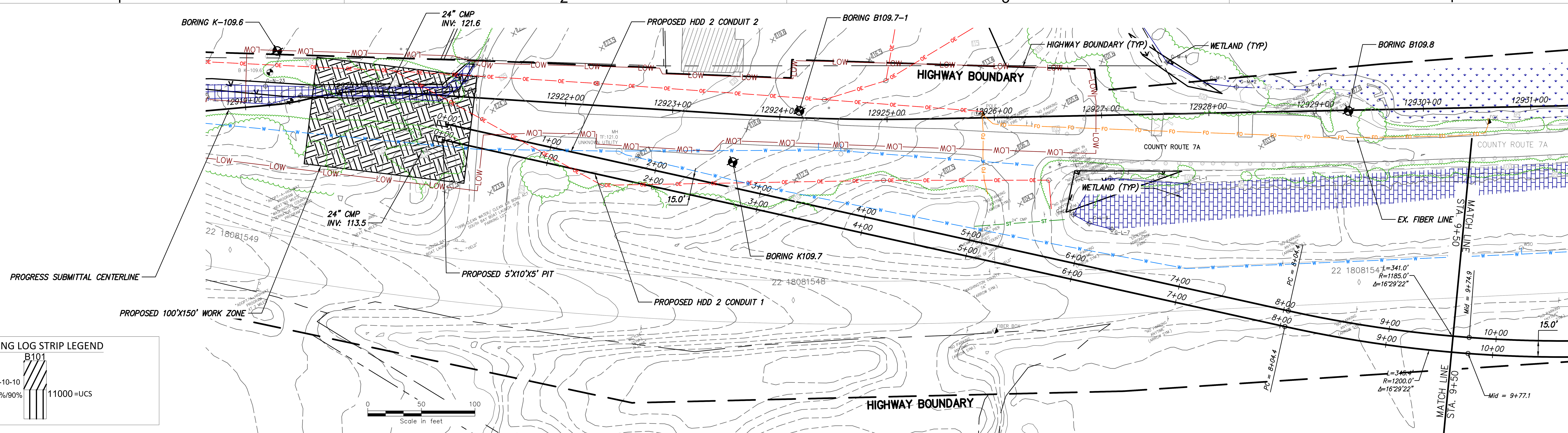

PROPOSED HDD 2 PLAN VIEW

CONDUIT 1

BORING LOG STRIP LEGEND

B101

Blow Counts per 6" =10-10-10

Recovery %/RQD % =95%/90%

11000 =UCS

Legend		
	ASPHALT	Asphalt
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	CL-ML	SILTY CLAY
	CONCRETE	Concrete
	Fill	Fill
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	GM	SILTY GRAVEL
	Gneiss	Undefined
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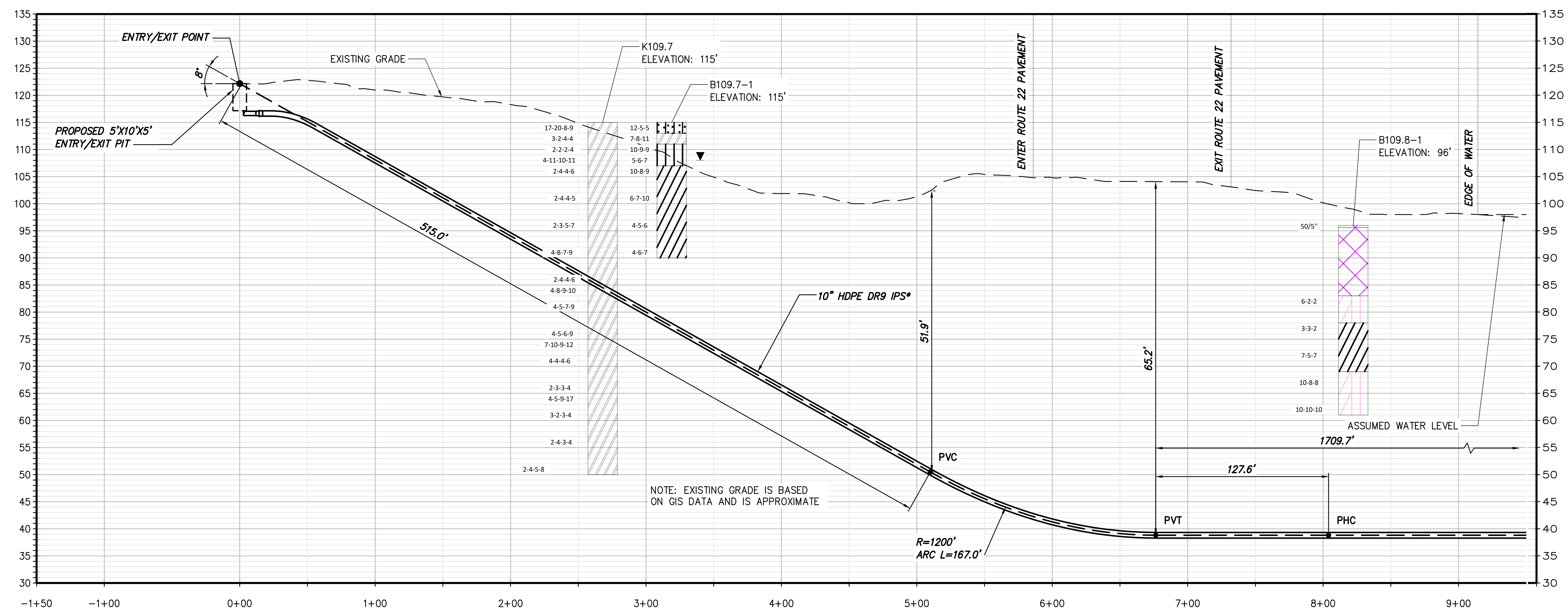
	ML	SILT
	OL	ORGANIC Lean CLAY
	OL/OH	ORGANIC SOIL
	Rock	Undefined
	Sandstone	Sandstone
	SC	CLAYEY SAND
	SC-SM	SILT, CLAYEY SAND
	SHALE	Shale
	SM	SILTY SAND
	SP	Poorly Graded SAND
	SP-SM	Poorly Graded SAND with SILT
	SW	Well graded SAND
	Topsoil	Topsoil
	USGS 708	Gneiss
	USGS 718	Granite 1
	USGS 732	Quartz

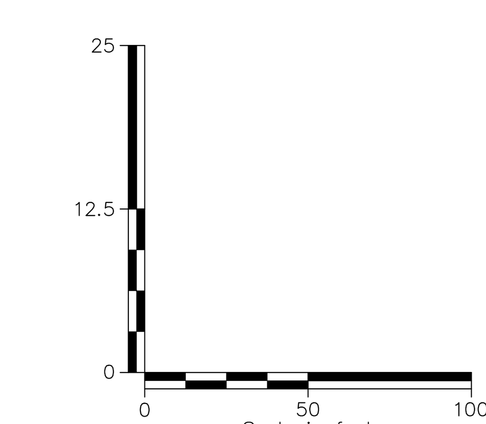


PROPOSED HDD 2 PROFILE

CONDUIT 1

* HDD2 CONSISTS OF (2) HVDC ELECTRICAL TRANSMISSION CABLES HOUSED IN INDIVIDUAL 10" HDPE DR 9 IPS CASINGS

A THIRD 2" CASING WILL BE BUNDLED WITH ONE OF THE 10" HDPE DR 9 IPS FOR A TELECOMMUNICATIONS LINE.



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CHAMPLAIN HUDSON POWER EXPRESS
SEGMENT 2 - ROUTE 22: DRESDEN - WHITEHALL
PROPOSED HDD PLAN AND PROFILE - HDD 2
ALTERNATE SOUTH BAY CROSSING, CONDUIT 1
WHITEHALL, WASHINGTON COUNTY, NY

DRAWN BY: MCS DESIGNED BY: MB APPROVED BY: JEO SCALE AS NOTED REV. NO. X DATE 04/15/2022 SH.NO. XXX OF XXX

KIEWIT PROJECT NO. 21162
CHA PROJECT NO. 066076
DRAWING NO. **C-302**

A B

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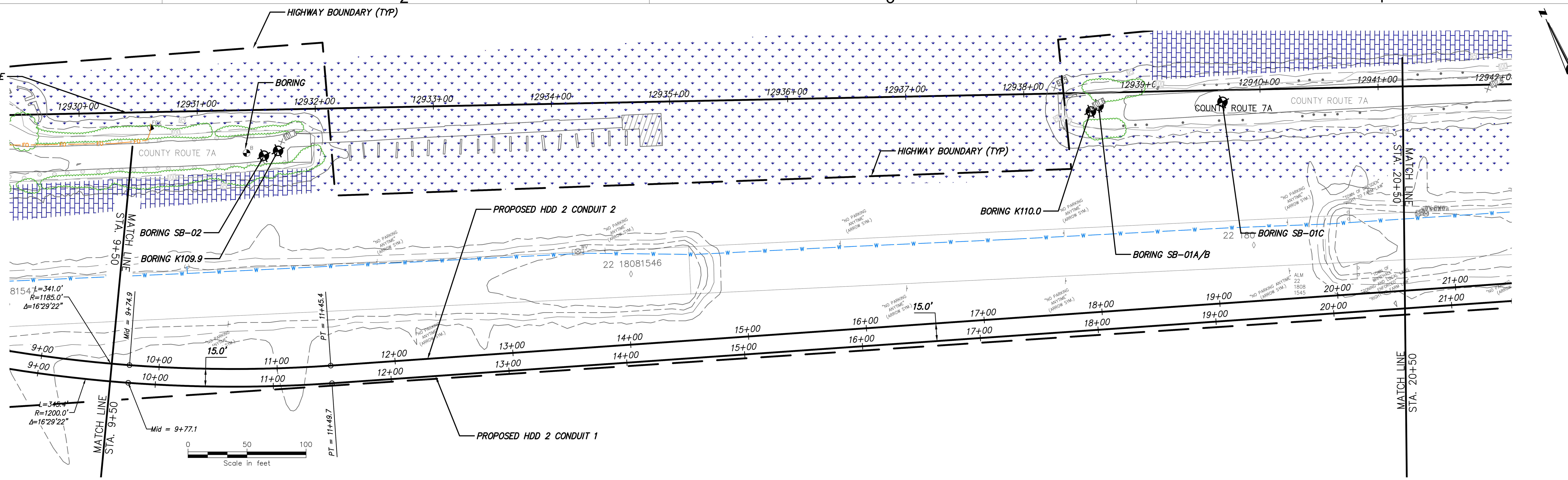

BORING LOG STRIP LEGEND

B101

Blow Counts per 6" =10-10-10

Recovery %/RQD % =95%/90%

11000 =UCS

Legend		
	ASPHALT	Asphalt
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	GM	SILTY GRAVEL
	Gneiss	Undefined
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	OL/OH	ORGANIC SOIL
	Rock	Undefined
	Sandstone	Sandstone
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	SC-SM	SILT, CLAYEY SAND
	SHALE	Shale
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	SP-SM	Poorly Graded SAND with SILT
	SW	Well graded SAND
	Topsoil	Topsoil
	USGS 708	Gneiss
	USGS 718	Granite 1
	USGS 732	Quartz

PROPOSED HDD 2 PLAN VIEW

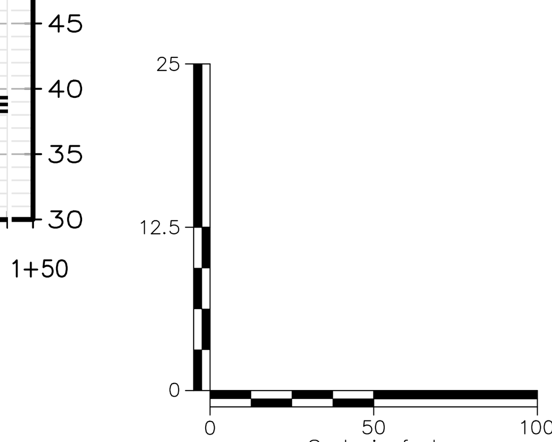
CONDUIT 1

PROPOSED HDD 2 PROFILE

CONDUIT 1

* HDD2 CONSISTS OF (2) HVDC ELECTRICAL TRANSMISSION CABLES HOUSED IN INDIVIDUAL 10" HDPE DR 9 IPS CASINGS

A THIRD 2" CASING WILL BE BUNDLED WITH ONE OF THE 10" HDPE DR 9 IPS FOR A TELECOMMUNICATIONS LINE.



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No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP
A	04/15/2022	EM&CP REGULATORY SUBMISSION	JM	JR

CHAMPLAIN HUDSON POWER EXPRESS
SEGMENT 2 - ROUTE 22: DRESDEN - WHITEHALL
PROPOSED HDD PLAN AND PROFILE - HDD 2
ALTERNATE SOUTH BAY CROSSING, CONDUIT 1
WHITEHALL, WASHINGTON COUNTY, NY

KIEWIT PROJECT NO. 21162
CHA PROJECT NO. 066076
DRAWING NO. C-302.1

DRAWN BY: MCS DESIGNED BY: MB APPROVED BY: JEO SCALE AS NOTED REV. NO. X DATE 04/15/2022 SH.NO. XXX OF XXX

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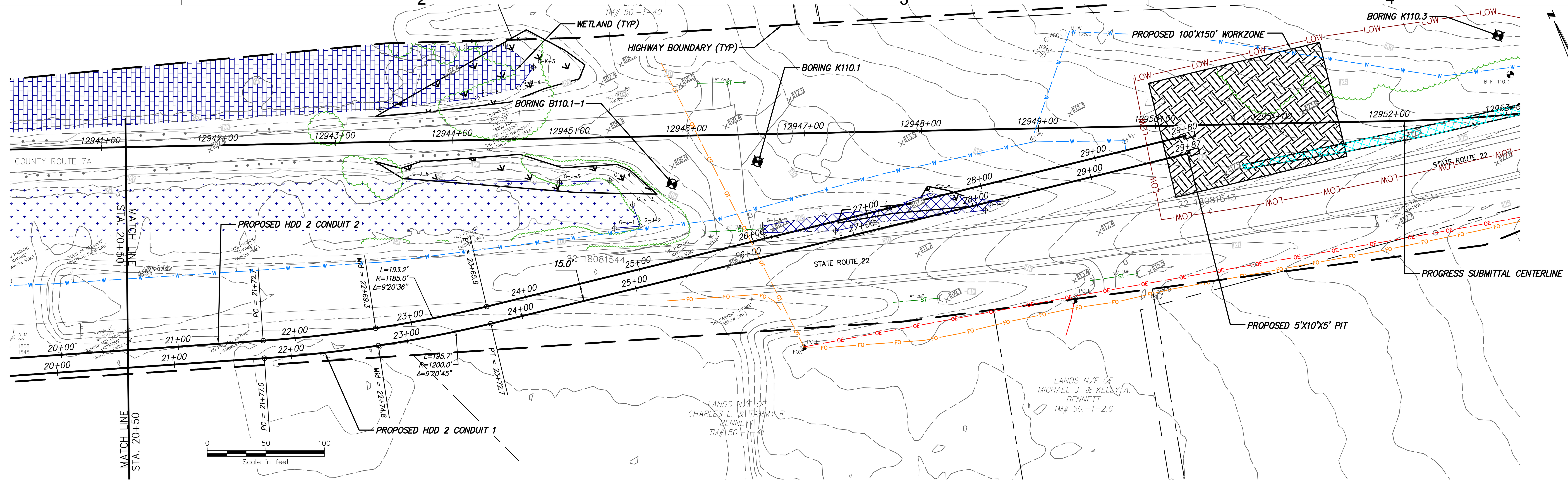
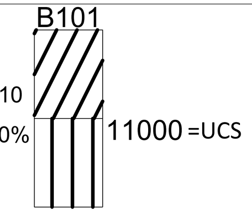


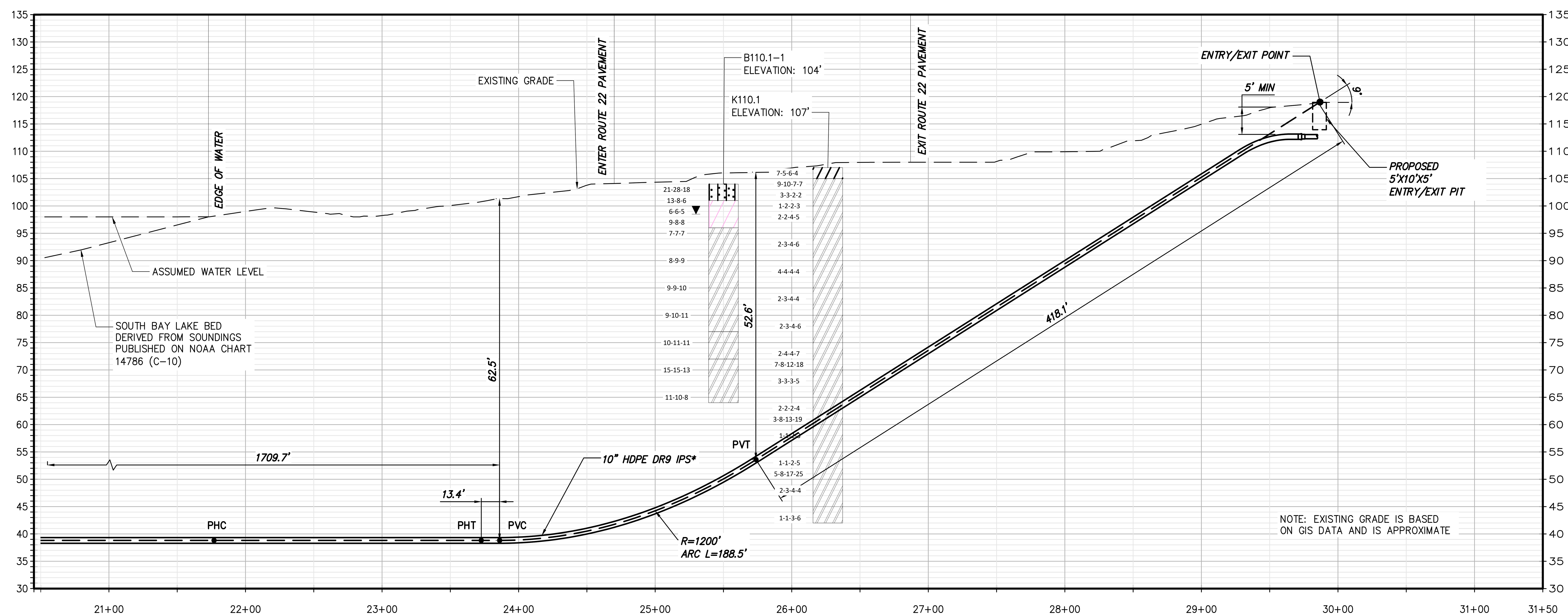
PROPOSED HDD 2 PLAN VIEW

CONDUIT 1



Legend

	ASPHALT	Asphalt
	CH	Fat CLAY
	CL	Lean CLAY
	CL-ML	SILTY CLAY
	CONCRETE	Concrete
	Fill	Fill
	GC	CLAYEY GRAVEL
	GM	SILTY GRAVEL
	Gneiss	Undefined
	GP	Poorly Graded GRAVEL
	GW	Well Graded GRAVEL
	ML	SILT
	OL	ORGANIC Lean CLAY
	OL/OH	ORGANIC SOIL
	Rock	Undefined
	Sandstone	Sandstone
	SC	CLAYEY SAND
	SC-SM	SILT, CLAYEY SAND
	SHALE	Shale
	SM	SILTY SAND
	SP	Poorly Graded SAND
	SP-SM	Poorly Graded SAND with SILT
	SW	Well graded SAND
	Topsoil	Topsoil
	USGS 708	Gneiss
	USGS 718	Granite 1
	USGS 732	Quartz



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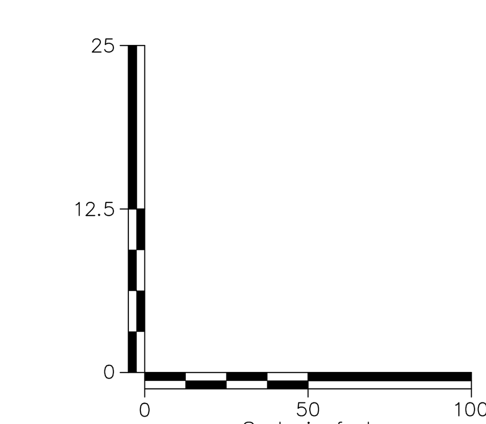
A THIRD 2" CASING WILL BE BUNDLED WITH ONE OF THE 10" HDPE DR 9 IPS FOR A TELECOMMUNICATIONS LINE.

B



PROPOSED HDD 2 PROFILE

CONDUIT 1

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CHAMPLAIN HUDSON POWER EXPRESS
SEGMENT 2 - ROUTE 22: DRESDEN - WHITEHALL
PROPOSED HDD PLAN AND PROFILE - HDD 2
ALTERNATE SOUTH BAY CROSSING, CONDUIT 1
WHITEHALL, WASHINGTON COUNTY, NY

KIEWIT PROJECT NO. 21162
CHA PROJECT NO. 066076
DRAWING NO. C-302.2

DRAWN BY: MCS DESIGNED BY: MB APPROVED BY: JEO SCALE AS NOTED REV. NO. X DATE 04/15/2022 SH.NO. XXX OF XXX

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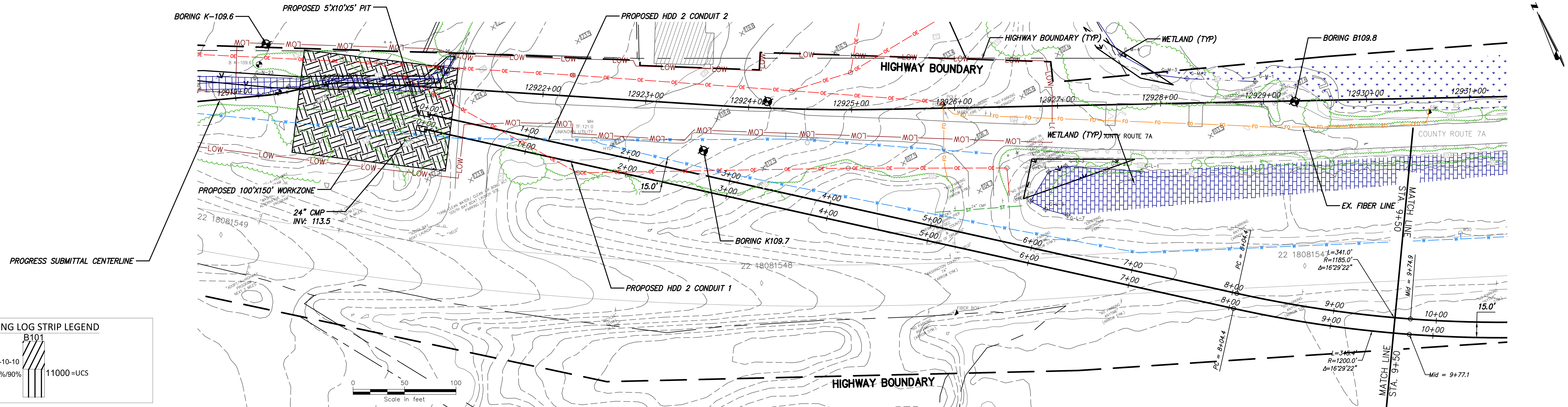

PROPOSED HDD 2 PLAN VIEW
CONDUIT 2

BORING LOG STRIP LEGEND

B101

Blow Counts per 6" =10-10-10

Recovery %/RQD % =95%/90%

11000 =UCS

Legend		
	ASPHALT	Asphalt
	CH	Fat CLAY
	CL	Lean CLAY
	CL-ML	SILTY CLAY
	CONCRETE	Concrete
	Fill	Fill
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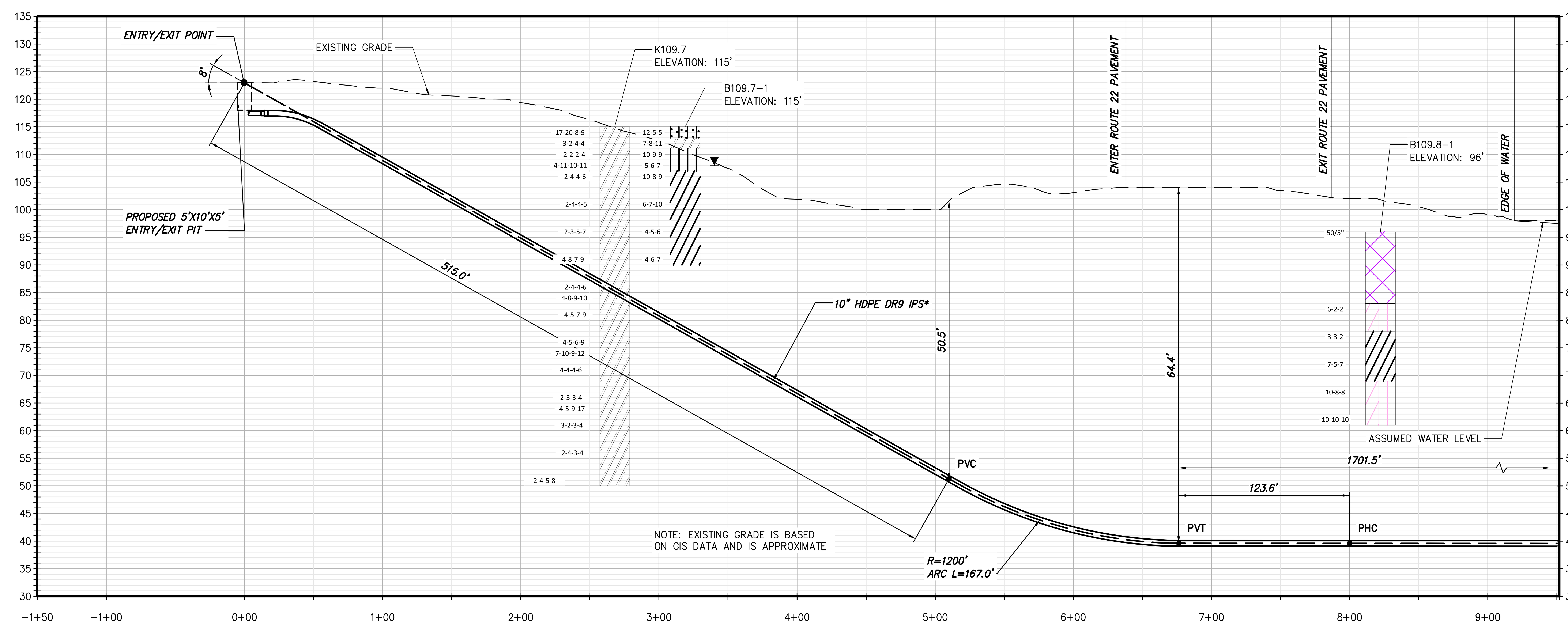
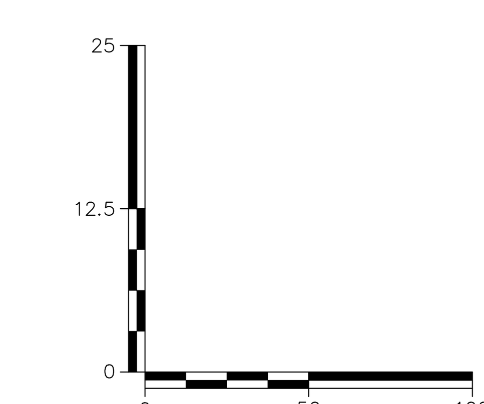
	USGS 718	Granite 1
	USGS 732	Quartz



PROPOSED HDD 2 PROFILE
CONDUIT 2

* HDD2 CONSISTS OF (2) HVDC ELECTRICAL TRANSMISSION CABLES HOUSED IN INDIVIDUAL 10" HDPE DR 9 IPS CASINGS

A THIRD 2" CASING WILL BE BUNDLED WITH ONE OF THE 10" HDPE DR 9 IPS FOR A TELECOMMUNICATIONS LINE.



CHPE Champlain Hudson Power Express

Kiewit

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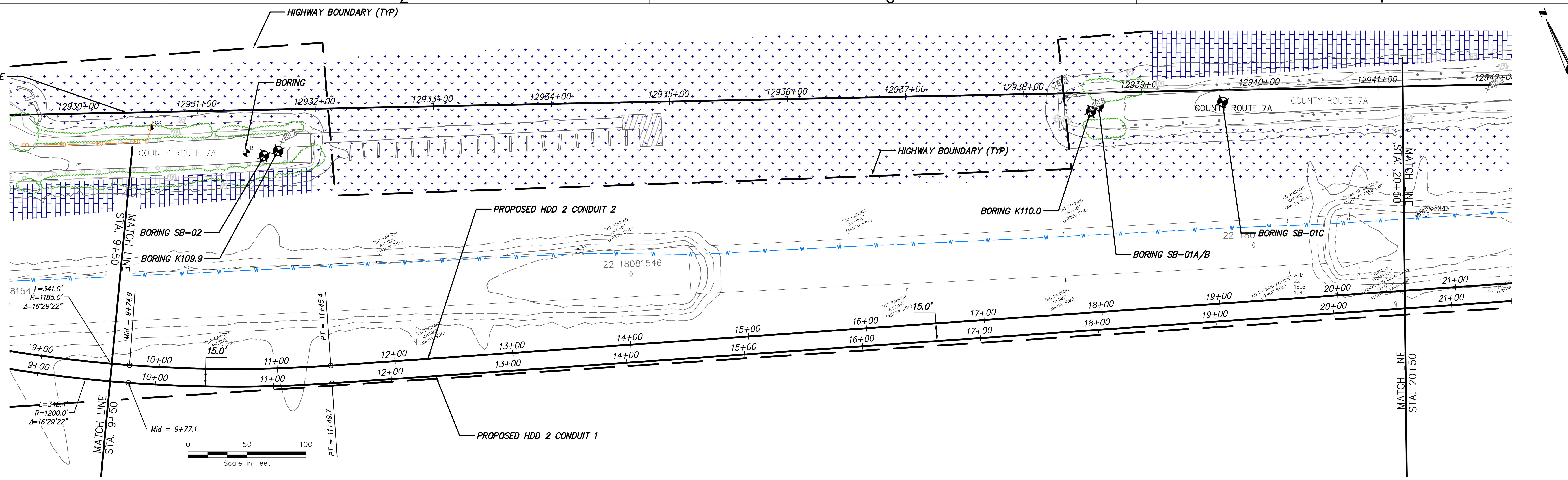
Albany, NY 12205-0269
518.453.4500 . www.chacompanies.com

No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP
A	04/15/2022	EM&CP REGULATORY SUBMISSION	JM	JR

CHAMPLAIN HUDSON POWER EXPRESS
SEGMENT 2 - ROUTE 22: DRESDEN - WHITEHALL
PROPOSED HDD PLAN AND PROFILE - HDD 2
ALTERNATE SOUTH BAY CROSSING, CONDUIT 2
WHITEHALL, WASHINGTON COUNTY, NY

KIEWIT PROJECT NO. 21162
CHA PROJECT NO. 066076
DRAWING NO. C-302A

DRAWN BY: MCS DESIGNED BY: MB APPROVED BY: JEO SCALE AS NOTED REV. NO. X DATE 04/15/2022 SH.NO. XXX OF XXX



PROPOSED HDD 2 PLAN VIEW

CONDUIT 1

BORING LOG STRIP LEGEND

B101

Blow Counts per 6" =10-10-10

Recovery %/RQD % =95%/90%

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Legend		
	ASPHALT	Asphalt
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	SC-SM	SILT, CLAYEY SAND
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	SP-SM	Poorly Graded SAND with SILT
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	Topsoil	Topsoil
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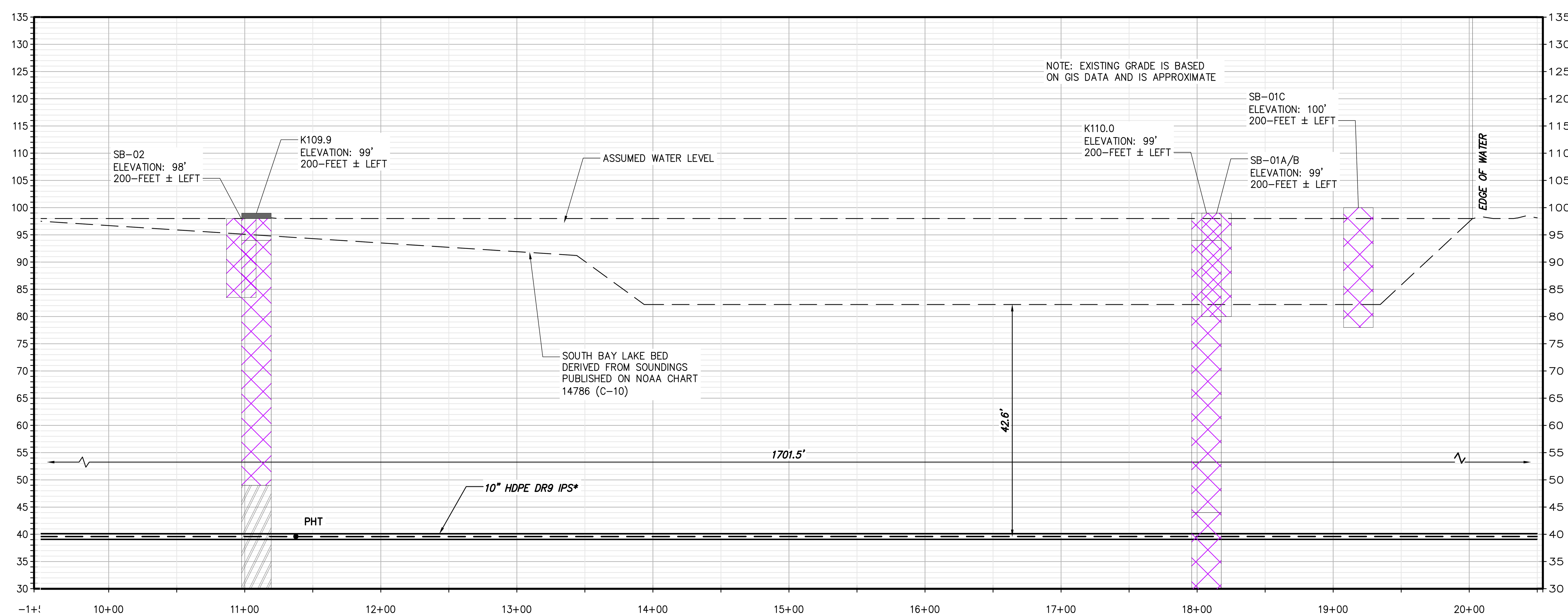

PROPOSED HDD 2 PROFILE

CONDUIT 1

* HDD2 CONSISTS OF (2) HVDC ELECTRICAL TRANSMISSION CABLES HOUSED IN INDIVIDUAL 10" HDPE DR 9 IPS CASINGS

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Kiewit

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CHAMPLAIN HUDSON POWER EXPRESS

SEGMENT 2 - ROUTE 22: DRESDEN - WHITEHALL

PROPOSED HDD PLAN AND PROFILE - HDD 2

ALTERNATE SOUTH BAY CROSSING, CONDUIT 2

WHITEHALL, WASHINGTON COUNTY, NY

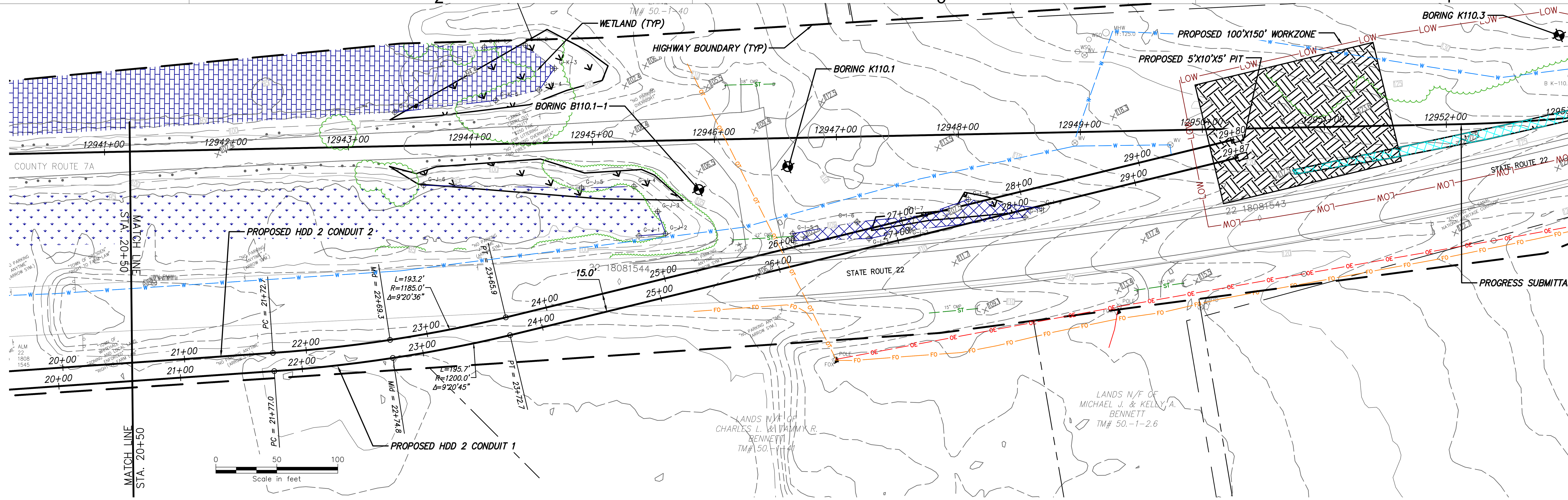
DRAWN BY: MCS DESIGNED BY: MB APPROVED BY: JEO

SCALE AS NOTED | REV. NO. X | DATE 04/15/2022 | SH.NO. XXX OF XXX

KIEWIT PROJECT NO. 21162

CHA PROJECT NO. 066076

DRAWING NO. C-302A.1



PROPOSED HDD 2 PLAN VIEW

CONDUIT 2

BORING LOG STRIP LEGEND

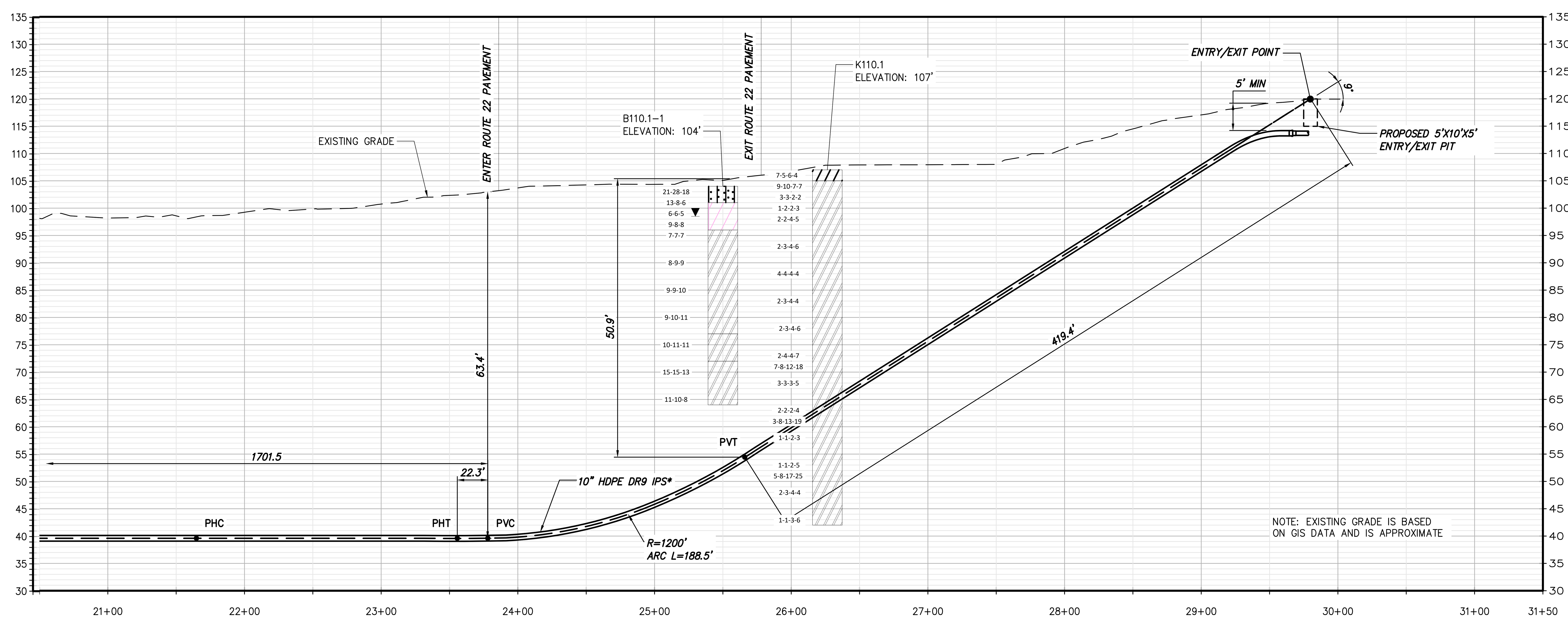
B101

Blow Counts per 6" =10-10-10

Recovery %/RQD % =95%/90%

11000 =UCS

Legend	
ASPHALT	Asphalt
CH	Fat CLAY
CL	Lean CLAY
CL-ML	SILTY CLAY
CONCRETE	Concrete
Fill	Fill
GC	CLAYEY GRAVEL
GM	SILTY GRAVEL
Gneiss	Undefined
GP	Poorly Graded GRAVEL
GW	Well Graded GRAVEL
ML	SILT
OL	ORGANIC Lean CLAY
OL/OH	ORGANIC SOIL
Rock	Undefined
Sandstone	Sandstone
SC	CLAYEY SAND
SC-SM	SILT, CLAYEY SAND
SHALE	Shale
SM	SILTY SAND
SP	Poorly Graded SAND
SP-SM	Poorly Graded SAND with SILT
SW	Well graded SAND
Topsoil	Topsoil
USGS 708	Gneiss
USGS 718	Granite 1
USGS 732	Quartz



PROPOSED HDD 2 PROFILE

CONDUIT 2

* HDD2 CONSISTS OF (2) HVDC ELECTRICAL TRANSMISSION CABLES HOUSED IN INDIVIDUAL 10" HDPE DR 9 IPS CASINGS

A THIRD 2" CASING WILL BE BUNDLED WITH ONE OF THE 10" HDPE DR 9 IPS FOR A TELECOMMUNICATIONS LINE.

CHPE Champlain Hudson Power Express

Kiewit

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

No.	DATE	SUBMITTAL / REVISION DESCRIPTION	DB	APP
A	04/15/2022	EM&CP REGULATORY SUBMISSION	JM	JR

CHAMPLAIN HUDSON POWER EXPRESS

SEGMENT 2 - ROUTE 22: DRESDEN - WHITEHALL

PROPOSED HDD PLAN AND PROFILE - HDD 2

ALTERNATE SOUTH BAY CROSSING, CONDUIT 2

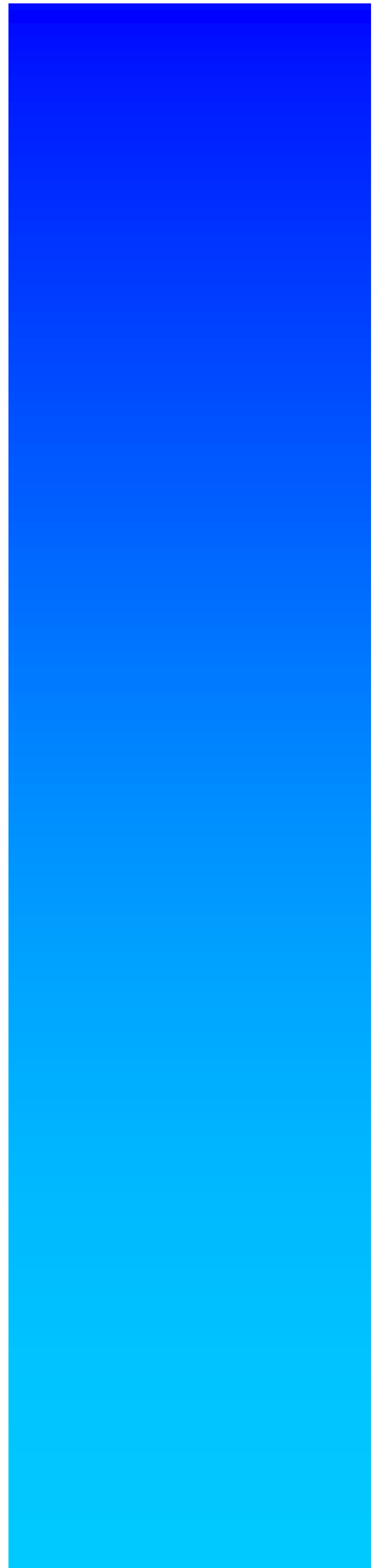
WHITEHALL, WASHINGTON COUNTY, NY

KIEWIT PROJECT NO. 21162

CHA PROJECT NO. 066076

DRAWING NO. **C-302A.2**

DRAWN BY: MCS DESIGNED BY: MB APPROVED BY: JEO SCALE AS NOTED REV. NO. X DATE 04/15/2022 SH.NO. XXX OF XXX



Champlain Hudson Power Express

Inadvertent Release Contingency Plan For Horizontal Directional Drilling in Segment 1 & 2

Putnam to Whitehall
Washington County, New York

CHA Project Number: 066076

Prepared for:
Transmission Developers Inc.
1301 Avenue of the Americas, 26th Floor
New York, NY 10019

Prepared by:
CHA Consulting, Inc.
III Winners Circle
Albany, New York 12205
(518) 453-4500

April 2022

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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 80 horizontal directional drilling (HDD) crossings for a pair of HVDC electrical transmission cables 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 casings 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 casings spaced minimum 15 feet apart, center to center. A third, 2-inch-diameter DR 9 casing will be bundled with one of the 10-inch-diameter casings for a telecommunications line. The casings are to be installed in 16-inch to 21-inch final reamed diameter bore holes.

This Inadvertent Release Contingency Plan (IRCP) is for Segment 1 and 2 which includes two HDD crossings: HDD#1 on Lake Road; and HDD #2 at South Bay.

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 the 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. 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 pipe 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 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 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 in advertent 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 Subcontractor specific means and methods plan for each HDD crossing reaffirming and detailing how the 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 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. 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 inert biodegradable additives to improve and modify fluid stability, carrying capacity, and drilling properties to address site-specific ground characteristics and 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 inert biodegradable additives are required by specification for use on this project and those planned for use by the 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 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 pipe 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. Steps two and three may be combined, with the conduit being pulled back through the bore hole immediately behind the final reaming bit or swabbing pass.

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 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 lubricant during the pipe insertion process.

The drilling fluids are composed primarily of potable water, which will likely be obtained from nearby sources selected and permitted by the 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, improve its hole stabilization ability, and reduce seepage loss through the ground characteristics. Environmentally acceptable (i.e. inert biodegrable) 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 crossing data environmental and toxicity data regarding any additives for review and acceptance by the design team.

During the HDD process and subsequent pipe 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 or 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 Phone TBD Email
Construction Manager	TBD
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, 3rd Floor North 1 Buffington Street Watervliet, NY 12189-4000 518-266-6350 cenan.rfo@usace.army.mil
New York State Department of Public Service	TBD
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. The proposed work at HDD 1 would be located underneath Lake Road, the Mill Brook and adjacent wetlands and uplands. No work is proposed within the wetland's surface.

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 Design Engineer for the HDD Design is CHA and Kiewit in collaboration with BCE. During construction, the Design Engineer 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 is CHA and Kiewit in collaboration with BCE. During construction, CHA/Kiewit/BCE will be assisting Power Engineers with the review of the 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 Construction Subcontractors (Subcontractors) for the various HDD crossing of this project have yet to be selected. The Subcontractor will be responsible for completion of the conduit casing 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 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 for 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 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 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 surficial soils. Soil 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 a cement/bentonite grout to limit the risk of a release through an abandoned bore hole during the HDD construction.

4.2 HDD DESIGN

The HDD crossing is being 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 soil 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 casing riser pipes).
- 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 large 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, 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 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 that, during the performance of any HDD waterbody crossing, contractors monitor the use of inert biodegradable drilling solution (Article VII Certificate: 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 of details of the release and the course of action they recommend taking.
- Requiring monitoring and controlling drilling fluid pressures with down-the-hole sensors during pilot hole drilling.

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;
- 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;
- Safety Data Sheet (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 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). Intended approach shall 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, aboveground 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. Example configurations are shown in Figures 1a and 1b, final dimensions to be adjusted based on actual space available and shown on the drawings for each HDD crossing.

4.4 DRILLING FLUIDS MANAGEMENT

As described in the Project EMCP document, drilling fluid (typically bentonite and water based with selected inert biodegradable additives) will be National Sanitation Foundation (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 HDD subcontractor. However, the drilling fluid management system and subsequent disposal will adhere to the following requirements:

- Drilling fluid will be processed through an initial clearing that separates the solid materials from the fluid;
- Solids will be sifted out by a screening apparatus/system and the solids deposited into 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;
- Drilling fluid accidentally spilled during construction and operation of drilling rigs 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;
- 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,
- 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.

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); and,
- Disturbed soil, such unconsolidated fill.
- Soft soils with low overburden capacity
- Presence of archeological resources.

Our opinions regarding 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 and promptly stop the drilling and they can modify the drilling fluid composition, 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 substantial reduction in the volume of return fluid (loss of circulation)
- 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 adequate staff and equipment available 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 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 from 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, 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 Subcontractor will be required to contain/isolate and remove any fluid that has emanated from the 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 immediately respond as described above to limit the extents 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 Subcontractor will work closely to determine the best course of action for inadvertent releases occurring within upland areas.

Upon containment of the release, the 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 casings 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. ring the performance of any HDD waterbody crossing, contractors monitor the use of inert biodegradable 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 Subcontractor will be required to cease drilling operations and reduce pressures in borehole immediately, and notify the Environmental Inspector, 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. The Subcontractor is required to develop general in-stream or in-rail response methods and pre-place necessary materials and equipment at the site prior to construction. Specific response actions will be determined in consultation with the Environmental Inspector and 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, hand-placed sedimentation control measures including, but not limited to hay 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 Subcontractor must abandon the drilled hole, a plan to fill the abandoned hole will be implemented as detailed in the 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 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 steering difficulties due to the presence of or hydraulic connection causing drill fluid loss to the abandoned hole.

9.0 CROSSING SPECIFIC DISCUSSION

9.1 HDD CROSSING #1 – LAKE ROAD

HDD #1 consists of two, straight (in plan view) HDD bores, each approximately 900 feet long as shown in Appendix D. The HDD bores will pass approximately 16 feet below the bottoms of a pair of 12-foot-diameter culverts stream which conduct the Mill Brook under Lake Road. The approximate center of the HDD bores located under the culverts at latitude 43.7222126°N and longitude -73.418252°W, in Putnam, NY. The ground surface elevations along the path of HDD #1 gently undulates between El. 267 and El. 290 (reference datum NAVD 1988). Waterbodies are present between approximately Sta. 10147+20 and Sta. 10147+60 (at about El. 267) and between approximately Sta. 10152+80 and Sta. 10153+25 (at about El. 276).

The bores will have no horizontal curves. The vertical curves of the bore path are designed so that the bore will pass beneath Lake Road and the culverts under Lake Road. 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#1</u> - Borings GTB-PD7 & GTB-PD7A are located along the proposed HDD alignment between approximately Sta. 10146+50 and Sta. 10148+00. These two [2] ranged

in depth to approximately 50 feet and are shown on Appendix D. Based on the borings, the soil profile for the HDD #1 BoreAid analyses was divided into six [6] layers: Fill (Sand), Silt (ML), Clay (CL), Clay (CH), Silt (ML) and Organics (OH). The soil profiles used for BoreAid analyses of this HDD in this segment is shown in Appendix A.

Specific design considerations for HDD #1 include:

- General depth of soil cover under the culverts and the adjacent Mill Brook is 16 feet near the centers of the bore paths. Preliminary analysis of the bores, assuming typical drilling methods, indicates that the allowable lowest maximum allowable pressure capacity in the middle of the bore is approximately 50 psi and the pressure estimated to occur in the bore in the middle portion ranges from 30 to 36 psi assumed standard HDD drilling methods. In the remainder of the bore the maximum allowable pressure ranges from approximately 0 to 90 psi and the approximate applied slurry pressure during drilling ranges from 0 to 36 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 at the starting end as well as underneath the wetland (at an elevation dip) of HDD #1. These should be relatively easily controlled through the use of conductive casing, haybales, silt fences, erosion control measures and vacuum trucks.
- Since these HDD bores will be along and crossing Lake Road, the entry and exit work areas will be configured as 20 feet wide and 80 feet long at both the entry and exit pit ends with a 700-foot-long by 20-foot-wide pipe assembly corridor in order to occupy only one lane of the road. The entry and exit points are established outside the wetland or waterway boundary to permit detection and response, in the event of a release, before environmentally sensitive boundaries are reached or impacted. Erosion and sediment control measures will be placed between the entry/exit location and any watercourses, waterbodies, and environmentally sensitive areas as an additional precaution.

In our opinion the conditions conducive to inadvertent releases that may exist this at this site based on the ground conditions described in the borings at the site include:

- Highly permeable soil such as cobbles and gravel in the stream bottom - In our opinion, based on the geomorphology of the area, the presence of sufficient highly permeable soils of sufficient thickness is not likely and the risk of a release due to this condition is low
- Soft soils with low overburden capacity encountered in the borings – The borings indicate that 5 feet of clay immediately below the culverts is a medium stiff to stiff clay which combined with the depth of the bores below the culverts and the results of the Boreaid analyses leads to our opinion that the risk of a release due to this condition is low also.

9.2 HDD CROSSING #2 – SOUTH BAY

HDD #2 consists of two, curved (in plan view) HDD bores located under the Champlain Canal-South Bay, south of the State Route 22 bridge across the canal. The bores are approximately 2970 and 2990 feet long as shown Appendix D. The HDD bores will pass approximately 43 to 44 feet below the low mudline of the canal. The horizonal alignment of HDD #2 was revised from north of the bridge to south of the bridge to avoid archeological ruins in bottom of the canal and to avoid deep (up to 95 feet deep) deposits of rock fill that were place in the bottom of the canal in unsuccessful attempts to support two earlier bridges located north of the current bridge. The rock fill is generally not compatible with the HDD method of construction and if encountered, creates a greater risk for inadvertent releases. The approximate center of the HDD bores the under the Champlain Canal-South Bay are at latitude 43.572187°N and longitude -73.431718°W, in Whitehall, NY. The ground surface elevations along the path of HDD #2 ranges from approximately El. 125 at the west end of the bore alignment, to approximately Elevation 82 at the mudline in the middle of the canal, to El. 120 at the east end of the bore alignment (reference datum NAVD 1988). Approximately 1500 feet of the bore alignment will be under the waters of the Champlain Canal – South Bay.

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). The design curves for both the horizontal and vertical paths of the alignment have a minimum radius of approximately 1200 feet.to limit steering issues in the soft soils at this site.

The proposed work at HDD #2 will be located underneath the South Bay of the Champlain Canal and adjacent wetlands and uplands. No work is proposed within the water body and wetlands.

The Certificate Holders have received permits for the project including a modified Section 404 permit from the USACE.

Ground conditions at HDD#2 -Based on borings drilled for this project and historic borings for the State Route 22 bridge construction, the soil profile for HDD #2 BoreAid analyses was divided into four [4] layers: Silt (M), and three layers of Clay (CL) with varying properties. The Rock Fill encountered during recent borings from the existing causeway is not expected to be present along the south of Bridge alignment selected. The soil profiles used for BoreAid analyses of this HDD in this segment are presented in Appendix C.

Archeological ruins and remains of old bridges were noted north of the bridge at HDD #2. Remains of approximately 10 sunken ships or barges, some circa 1812, and a 1913 bridge are located just north of the jetties, see Appendix B. In addition, the records appear to indicate that barges were sunk as part of the foundation system for the 1913 bridge in addition to dumpling gravel, cobbles and boulders and pushing them down into the soft sediments. The locations of these ruins and related obstructions are not expected to be present along the south of bridge alignment selected, however this still needs to be confirmed.

Specific design considerations for HDD #2 include:

- Depth of cover during profile design (based on soil borings) to limit the potential inadvertent break through to the water body, road, wetlands, or ground surface. General depth of cover under the Canal mudline is 40 or more feet with a depth of cover of about 45 feet near the center of the bore path. Preliminary analysis of the bore, assuming typical drilling methods, indicates that the allowable lowest maximum allowable pressure capacity in the middle of the bore is approximately 95 psi and the pressure estimated to occur in the bore in the middle portion ranges from 50 to 75 psi assumed standard HDD drilling methods. In the remainder of the bore the maximum allowable pressure ranges from approximately 0 to 60 psi and the approximate applied slurry pressure during drilling ranges from 0 to 70 psi. A sketch showing the maximum allowable pressure and the applied pressure is provided in the summary BoreAid analyses in the attached Appendix C for both an east to west boring direction and a west to east boring direction.
- It appears that a potential for releases in the last 200 to 300 feet of the bores near as each bore approaches the exit pit exists, regardless of the direction of the bore E-W or W-E. this is related to the length and depth of the bores and the slope of the ground surface up from the water's edge to the entry and exit pits about 30 feet higher.

- 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,
- Requiring monitoring and controlling drilling fluid pressures with down-the-hole sensors during pilot hole drilling,
- Requiring the use of intersect bore method (drilling the pilot bore from each end and meeting in the middle) to reduced slurry pressures at the exit end during pilot bore drilling, thereby reducing the potential for a released at the exit end of the pilot bore, and
- The use of conductor casings, temporary steel casing approximately 30 inches diameter and 100 feet long at each end of each bore to contain drilling fluids during drilling reaming and pullback.

- Drill rig & HDD entry point
- Mud pump
- Drill pipe
- Power unit & control trailer
- Fluid system & tank
- Other supporting equipment & supplies

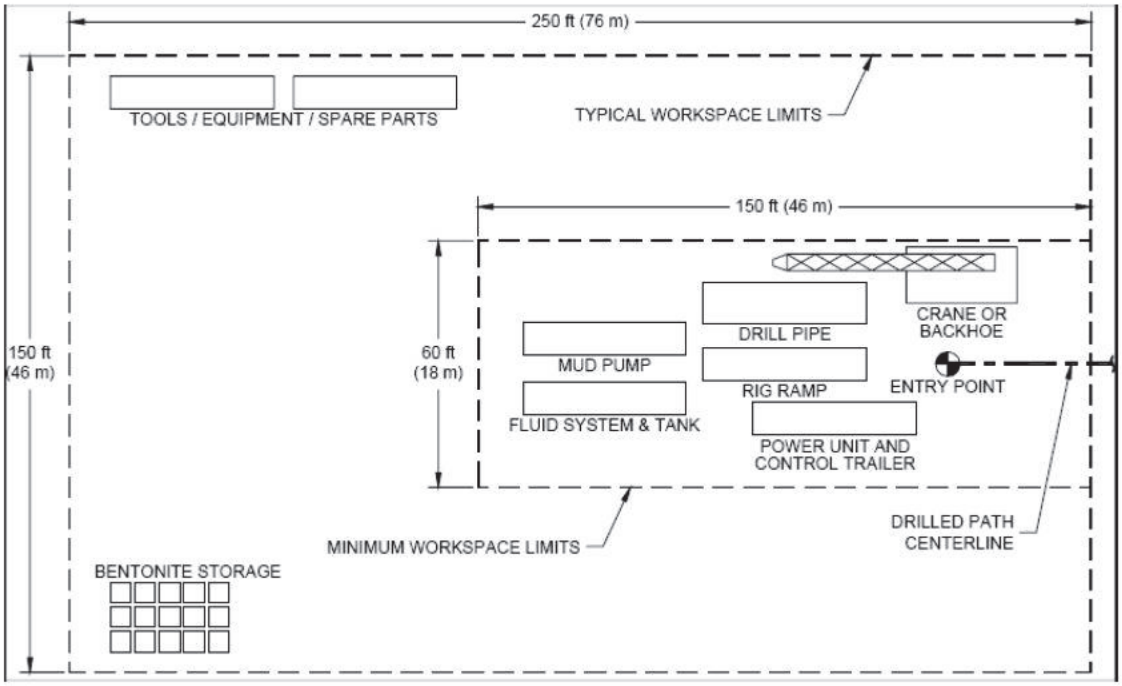
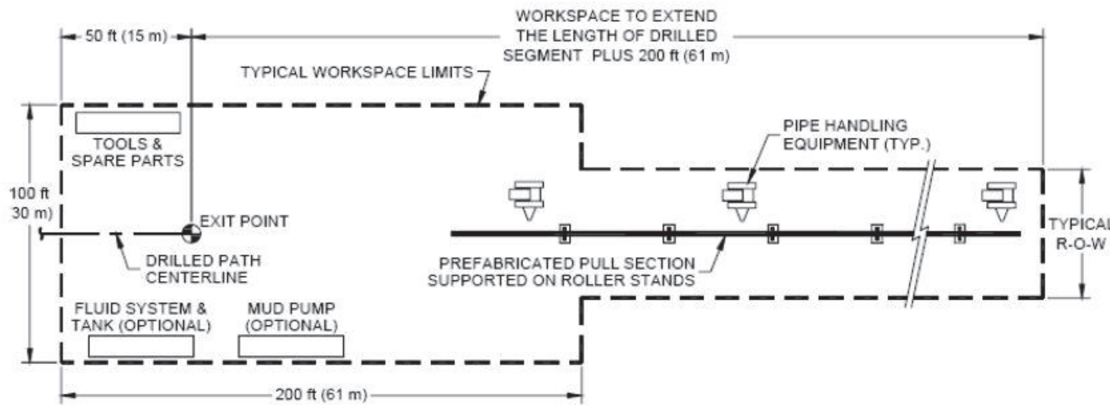


Figure 1a: Typical HDD Entry Workspace Area

Excerpt from Trenchless Construction Feasibility Analysis, Pennsylvania Pipeline Project By TetraTech, Inc., December 2018, Page 4

The drill exit workspace typically contains the following features (see Figure below):

- Exit point
- Pipe handling equipment
- Prefabricated pullback pipeline section
- Other supporting equipment & supplies



The size of the entry and exit workspace areas is directly related to the diameter of the pipe to be installed. A summary of typical workspace areas is provided below:

Typical HDD Entry and Exit Workspace Areas

System Description	Entry Workspace	Exit Workspace
Maxi-HDD (24” to 48” diameter pipe)	150’ x 350’	150’ x 250’
Midi-HDD (12” to <24” diameter pipe)	150’ x 250’	100’ x 200’
Mini-HDD (2” to <12” diameter pipe)	Varies greatly per site	Varies greatly per site

Figure 1b: Typical HDD Exit Workspace Area

Excerpt from Trenchless Construction Feasibility Analysis,
Pennsylvania Pipeline Project By TetraTech, Inc., December 2018, Page 5

By MD Boscardin: Depending on equipment specifics, for Mini-HDD rig (say for bores <12' diam. and < 800 feet long) in a road or next to railroad:
1) an entry work space approximately 20 to 25 feet wide x 150 to 200 feet long for a rig with a mounted pipe rack and self-contained power unit and operator control cabin on the rig; plus a separate mud mixing and pumping unit, plus a separate mud processing and separation unit support equipment arranged linearly in line may be possible, and
2) an exit work space approximately 15 to 20 feet wide and between 60% and 110% of the bore length is needed to layout and assemble the pipe for pullback is needed. Somewhat smaller entry work areas may be possible depending drill rig specifics and availability of nearby areas for support equipment support operations. Often need to coordinate final work areas with selected contractor's specific operations. Keep in mind that the smaller work areas tend to reduce access and efficiency of operations, thus raise costs.

Appendix A

BoreAid HDD #1 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.

Project Summary

General:	CHPE HDD
	Ref: Lake Road - New York
	P1A
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	...
Project Contractor:	...
Project Consultant:	...
Designer:	TAR
	CHA
	...
	..., ...
	... ...
	Phone: ...
	Fax: ...
	...
Description:	Lake Road HDD - New York

Input Summary

Start Coordinate	(0.00, 0.00, 289.76) ft
End Coordinate	(904.00, 0.00, 291.00) ft
Project Length	904.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	10.750 in
Pipe DR	9.0
Pipe Thickness	1.19 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Soil Summary

Number of Layers: 6

Soil Layer #1 USCS, Sand (S), SP
Depth: 2.00 ft
Unit Weight: 0.0634 (dry), 0.0733 (sat) [lb/in3]
Phi: 30.00, S.M.: 145.00, Coh: 0.00 [psi]

Soil Layer #2 USCS, Silt (M), ML
Depth: 5.00 ft
Unit Weight: 0.0463 (dry), 0.0579 (sat) [lb/in3]
Phi: 28.00, S.M.: 50.00, Coh: 4.40 [psi]

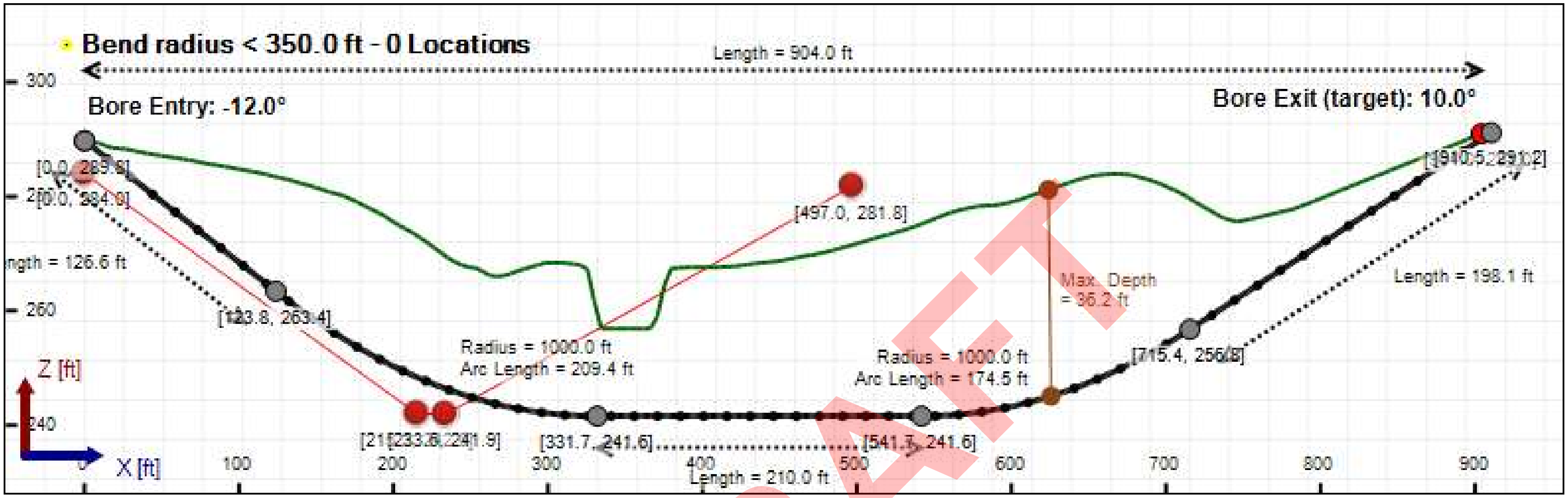
Soil Layer #3 USCS, Clay (C), CL
Depth: 2.00 ft
Unit Weight: 0.0463 (dry), 0.0637 (sat) [lb/in3]
Phi: 0.00, S.M.: 300.00, Coh: 7.30 [psi]

Soil Layer #4 USCS, Clay (C), CH
Depth: 2.00 ft
Unit Weight: 0.0405 (dry), 0.0579 (sat) [lb/in3]
Phi: 0.00, S.M.: 200.00, Coh: 8.70 [psi]

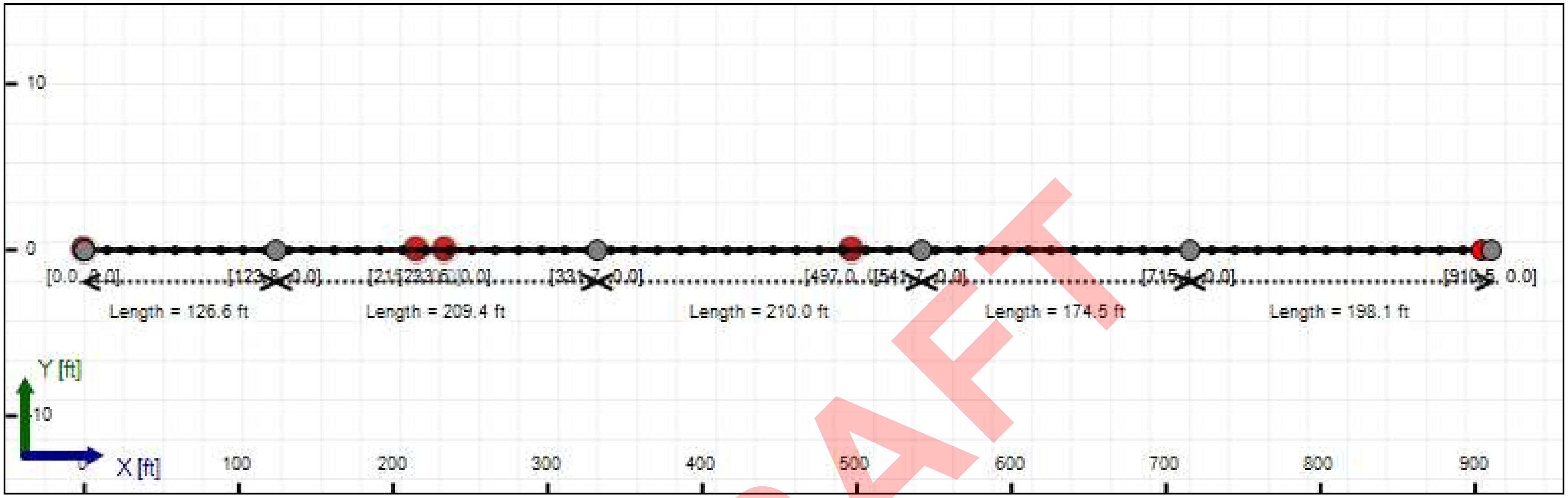
Soil Layer #5 USCS, Silt (M), ML
Depth: 4.00 ft
Unit Weight: 0.0463 (dry), 0.0579 (sat) [lb/in3]
Phi: 28.00, S.M.: 50.00, Coh: 4.40 [psi]

Soil Layer #6 USCS, Organic (O), OH
Depth: 20.00 ft
Unit Weight: 0.0405 (dry), 0.0579 (sat) [lb/in3]
Phi: 0.00, S.M.: 200.00, Coh: 1.50 [psi]

Bore Cross-Section View



Bore Plan View



Load Verifier Input Summary:

Pipe Application: Electrical Cable

Pipe Type: HDPE

Classification: IPS

Pipe OD: 10" (10.75")

Pipe DR: 9

Pipe Length: 930.00 ft

Internal Pressure: 0 psi

Borehole Diameter: 1.34400002161662 ft

Silo Width: 1.34400002161662 ft

Surface Surcharge: 0 psi

Short Term Modulus: 57500 psi

Long Term Modulus: 28200 psi

Short Term Poisson Ratio: 0.35

Long Term Poisson Ratio: 0.45

Pipe Unit Weight: 0.03430 lb/in3

Allowable Tensile Stress (Short Term): 1200 psi

Allowable Tensile Stress (Long Term): 1100 psi

Allowable Compressive Stress (Short Term): 1150 psi

Allowable Compressive Stress (Long Term): 1150 psi

Surface-pipe friction coefficient at entrance: 0.5

Surface-pipe friction coefficient in borehole: 0.3

Pipe-soil friction angle: 30

Slurry Unit Weight: 0.05419 lb/in3

Hydrokinetic Pressure: 10 psi

Ballast Unit Weight: 0.03613 lb/in3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	7.0	27.6
Water Pressure	0.0	0.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	7.0	27.6
Deflection		
Earth Load Deflection	1.896	7.514
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	2.028	7.646
Compressive Stress [psi]		
Compressive Wall Stress	31.3	124.2

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	16254.8	16254.8
Pullback Stress [psi]	453.3	453.3
Pullback Strain	7.884E-3	7.884E-3
Bending Stress [psi]	0.0	25.8
Bending Strain	0	4.479E-4
Tensile Stress [psi]	453.3	477.6
Tensile Strain	7.884E-3	8.754E-3

Net External Pressure = 28.4 [psi]

Buoyant Deflection = 0.1

Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	2.028	7.5	3.7	OK
Unconstrained Collapse [psi]	33.5	118.9	3.5	OK
Compressive Wall Stress [psi]	31.3	1150.0	36.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	43.5	229.0	5.3	OK
Tensile Stress [psi]	477.6	1200.0	2.5	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	90.599 psi	90.599 psi
1	8.00 in	12.00 in	90.523 psi	90.523 psi
2	12.00 in	16.13 in	90.415 psi	90.415 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): 0.00 US (liquid) gallon/min

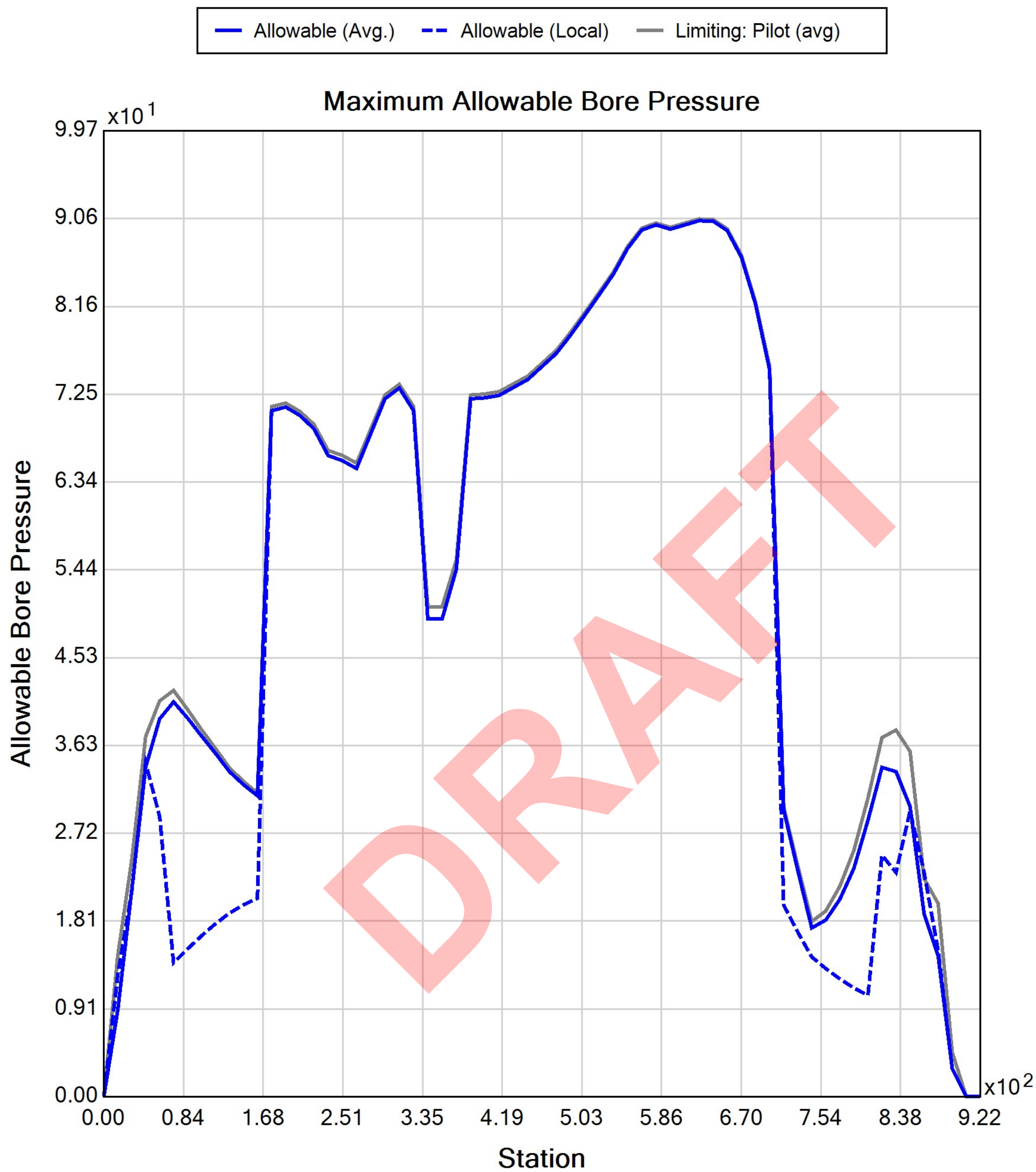
Drill Fluid Density: 0.040 lb/in3

Rheological model: Bingham-Plastic

Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): Infinity



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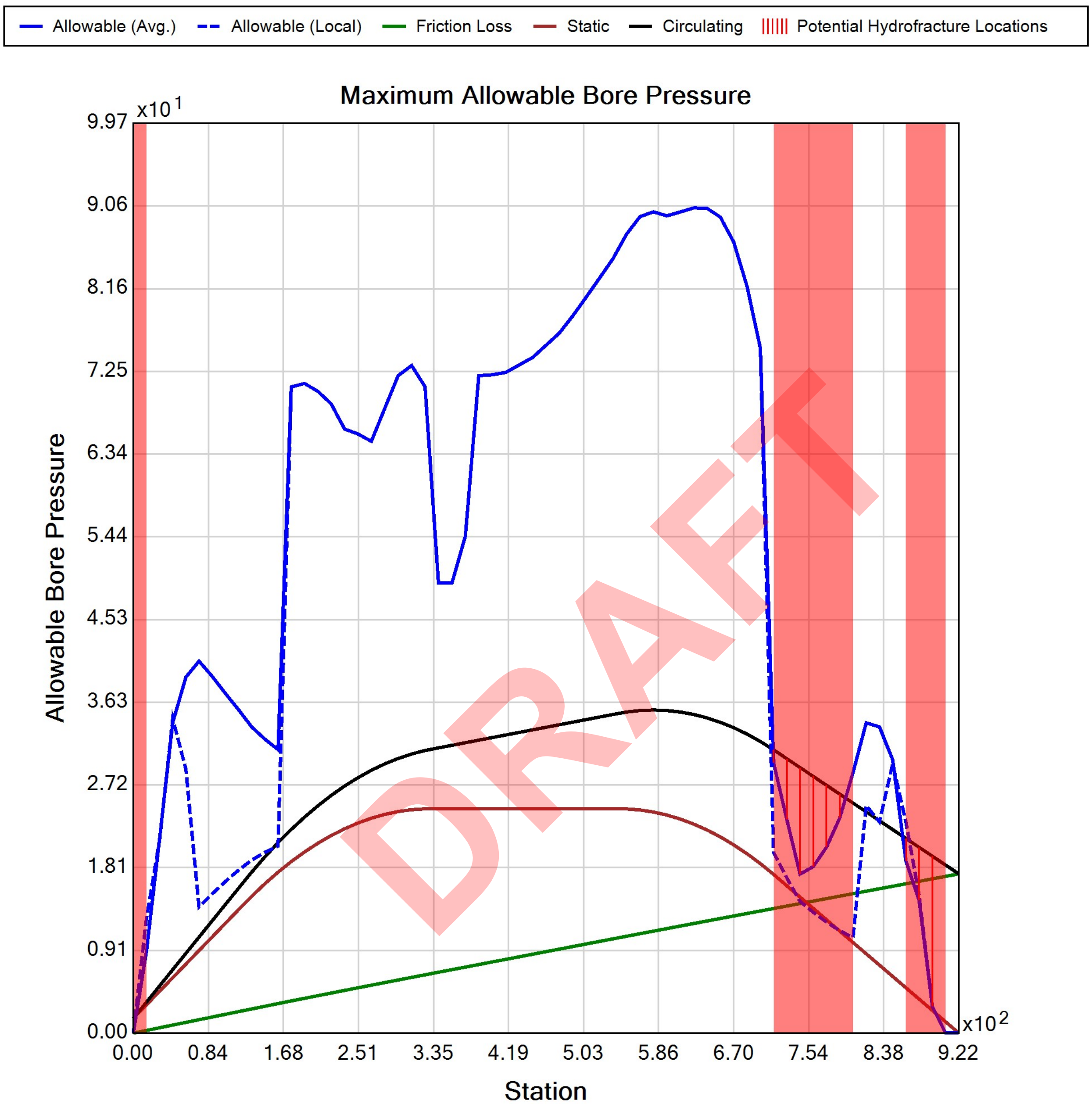

Powered by BoreAid

Appendix B

HDD #2 Historic Resources

Gmail

Marco Boscardin <marco@boscardinconsulting.com>

FW: [--EXTERNAL--]: RE: Champlain-Hudson Power Express

2 messages

Einstein, Chris <CEinstein@chacompanies.com> Thu, Dec 9, 2021 at 11:48 AM
To: Marco Boscardin <marco@boscardinconsulting.com>
Cc: "Marruso, Antonio" <AMarruso@chacompanies.com>, "O'Donnell, Jeffrey" <JODonnell@chacompanies.com>

Marco,

See below and attached regarding historic wrecks in South Bay. This is preliminary info. Hartgen will hopefully get the sonar info and may have to refine the coordinates.

Chris

Christopher Einstein, PWS

Principal Scientist

CHA

Office: (518) 453-4505

ceinstein@chacompanies.com

www.chacompanies.com

CHA

Responsibly Improving the World We Live In

From: Matthew Kirk <mkirk@hartgen.com>
Sent: Thursday, December 9, 2021 11:45 AM
To: Einstein, Chris <CEinstein@chacompanies.com>
Cc: Justin DiVirgilio <jDivirgilio@hartgen.com>; Marruso, Antonio <AMarruso@chacompanies.com>
Subject: [--EXTERNAL--]: RE: Champlain-Hudson Power Express

Hi Chris,

There are three reported wrecks near the bridge, these were from a survey conducted by the LCMM, they only sent us data for portions of the lake during our initial IA report. So I don't think we have the actual sonar data. But I can check. Take the coordinates with a grain of salt until we review the sonar data. The SHPO reviewer who used to deal with underwater resources is not there anymore. So let me check to see what guidance they may have now. My guess is it would be best to thread the needle and try not to go under any of them. I'm not sure you would need a large buffer; 20 feet maybe.

1. LCMM 17, Wreck KKKK standard canal boat, depth 10 feet, Easting:-73.4294; Northing: 43.572833
    a. Wreck KKKKK is part of the South Bay Canal Boat Graveyard, consisting of at least seven canal boats abandoned there in the early twentieth century. Although not dive verified, the sonar image shows a likely intact canal boat very close to the site of Wrecks HHHHH, JJJJJ, and IIIII, other standard canal boats. Site dimensions are unknown. This site is in shallow water, with a featureless mud plain lake bottom and heavy weed growth. Visibility at this site is near zero or less.
    b. Wreck KKKKK was located during the 2003 Lake Survey and at that time was captured with sonar imagery. The site has not been dive verified and no artifacts have been recovered.
2. LCMM 11, Wreck EEEEE, NYSM11641, Easting: -73.430567, Northing: 43.57305
    a. Wreck EEEEE is part of the South Bay Canal Boat Graveyard, consisting of at least seven canal boats abandoned there in the early twentieth century. Although not dive verified, the sonar image shows an intact canal boat with six deck beams visible. Site dimensions are unknown. This site is in shallow water, with a featureless mud plain lake bottom and heavy weed growth. Visibility at this site is near zero or less.
    b. Wreck EEEEE was located during the 2003 Lake Survey and at that time was captured with sonar imagery. The sonar image clearly shows six deck beams. The site has not been dive verified and no artifacts have been recovered.
3. LCMM13, Wreck GGGGG, NYSM11643, Easting: -73.430567, Northing: 43.57305
    a. Wreck GGGGG is part of the South Bay Canal Boat Graveyard, consisting of at least seven canal boats abandoned there in the early twentieth century. Although not dive verified, the sonar image shows a potentially partially broken-up canal boat very close to the site of Wreck FFFFF, another standard canal boat. Site dimensions are unknown. This site is in shallow water, with a featureless mud plain lake bottom and heavy weed growth. Visibility at this site is near zero or less.
    b. Wreck GGGGG was located during the 2003 Lake Survey and at that time was captured with sonar imagery. The site has not been dive verified and no artifacts have been recovered.

4.

Best,

Matt

Matthew Kirk, MA RPA
Principal Investigator / Vice President
Hartgen Archeological Associates, Inc.
1744 Washington Avenue Ext. | Rensselaer, NY 12144
office: 518.283.0534 | mobile: 518.330.5940
mkirk@hartgen.com

From: Einstein, Chris <CEinstein@chacompanies.com>
Sent: Wednesday, December 8, 2021 5:16 PM
To: Matthew Kirk <mkirk@hartgen.com>
Cc: Justin DiVirgilio <jDivirgilio@hartgen.com>; Marruso, Antonio <AMarruso@chacompanies.com>
Subject: Champlain-Hudson Power Express

Matt,

Came across an issue today with the Phase 1 design up near Whitehall along Route 22. As you can see from the attached plans, the alignment will cross South Bay and it is intended that the crossing will be directionally drilled. Apparently there is an historic wreck (must just be some remnants because this area is so shallow). It would be best to avoid it (no drill directly under it) so looking to see if you can find the coordinates for this wreck and the associated polygon (limits of wreck) that we can use to design the crossing. Also looking for guidance on what SHPO is likely to require in terms of buffer to avoid impacts. If this is something you can look into soon, that would be very helpful. Thanks so much.

Chris

Christopher Einstein, PWS

Principal Scientist

CHA

Office: (518) 453-4505

ceinstein@chacompanies.com

www.chacompanies.com

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Marco Boscardin <marco@boscardinconsulting.com> Fri, Dec 17, 2021 at 3:25 PM
To: Adriane Boscardin <adriane@boscardinconsulting.com>

Marco D. Boscardin, Ph.D., P.E., D.GE, F.ASCE
Consulting Engineer
Registered Professional Engineer in IL, MA, NY, CT, VT, NH, PA, NJ, VA
53 Rolling Ridge Road
Amherst, MA 01002-1420

413-237-4852 Mobile (Preferred)
413-549-3804 Office
413-825-0467 Fax
marco@boscardinconsulting.com
www.boscardinconsulting.com

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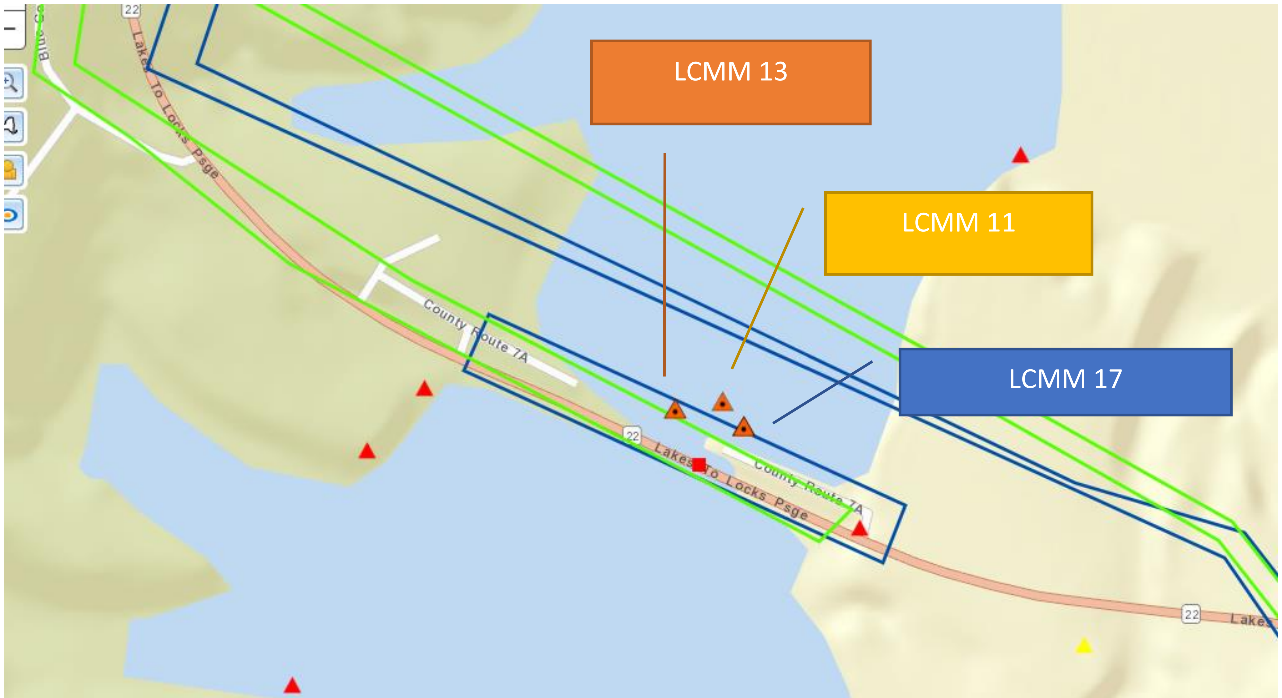
LCMM 13
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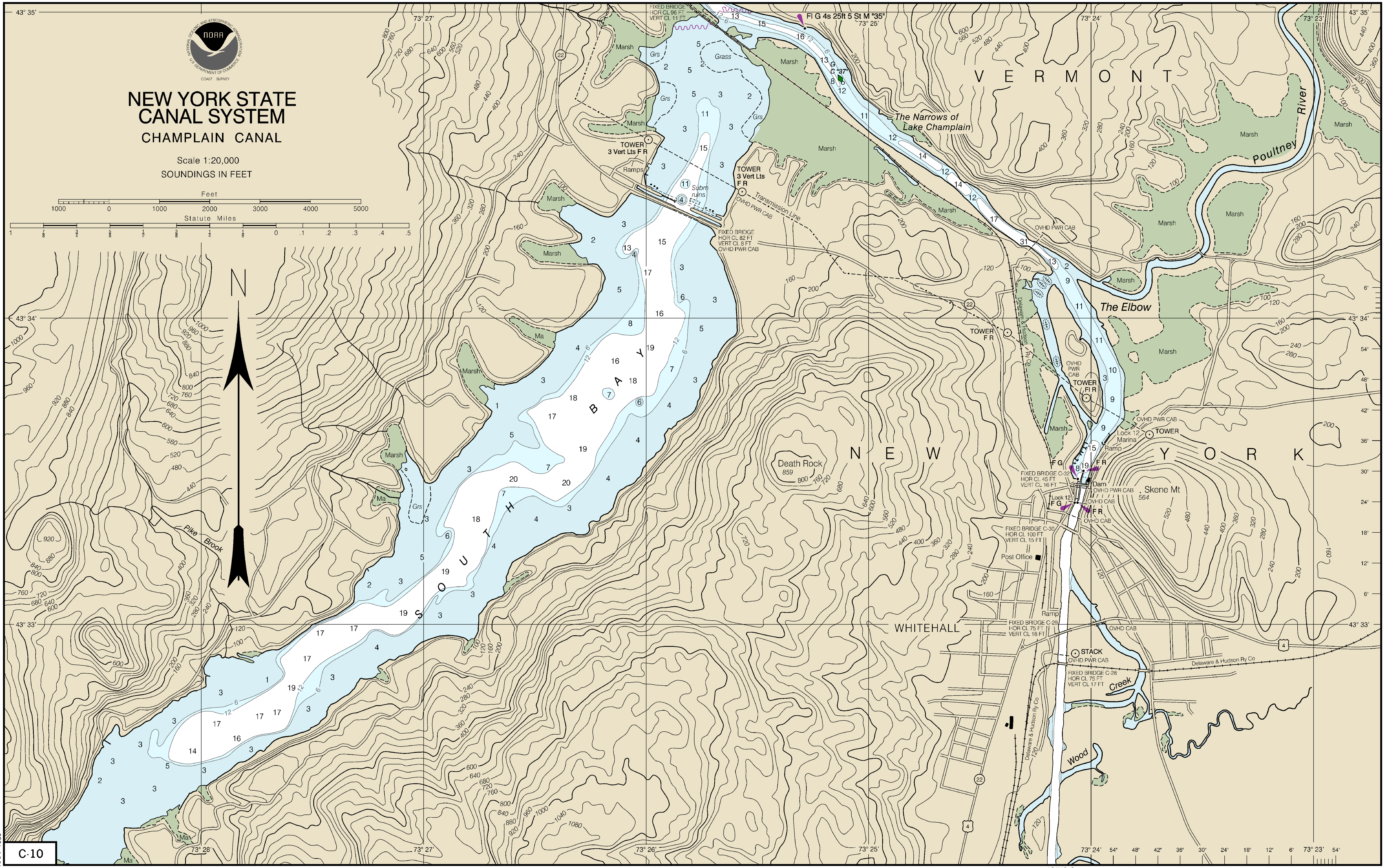

JOINS C-9

14786

Use ENC charts for the most up to date information. References to other charts may no longer be applicable.

15th Ed., Nov. 2018. Last Correction: 4/12/2021. Cleared through:
LNM: 4121 (10/12/2021), NM: 4321 (10/23/2021), CHS: 0921 (9/24/2021)

SOUTH BAY SURVEY

In May 2003, the Lake Champlain Maritime Museum completed a side scan sonar survey of the South Bay, located to the west of Whitehall, New York. This was the first sonar survey of South Bay since the Champlain Maritime Society (CMS) carried out a similar, yet less extensive, survey in 1982, which located the wrecks of several canal boats and one steamer.

South Bay is a narrow, shallow, pinched-off part of Lake Champlain, lying to the west of the lake proper (Figure 6-38). It is abutted by the Village of Whitehall and the New York State Barge Canal (formerly the Champlain Canal). It has a maximum depth of 20ft (6.1m) at low lake level, a length of 4½mi (7.2km) and a maximum width of 1½mi (2.4km). It flows into Lake Champlain at its north end through a narrow outlet spanned by a drawbridge on the former Delaware & Hudson Railroad (now Amtrak). South Bay has a northeast to southwest orientation and lies between Bald Mountain on the west in the Town of Dresden, Warren County, New York, and West Mountain on the east in the Town of Whitehall, Washington County, New York. A small part of the Bay and its headwaters at the south end are located in the Town of Fort Ann, Washington County, New York.

During the French and Indian Wars and the American Revolution, South Bay provided a route for scouting parties traveling between Lake George and Lake Champlain. Although it required crossing the mountains between these two lakes, it bypassed the more exposed Lake George Route to Ticonderoga and provided another, possibly shorter, route to Skenesborough, present day Whitehall. In the nineteenth and early twentieth centuries, South Bay supported some commercial activity, primarily associated with the lumber and graphite industries. The Bay now serves fishing and other recreational boating uses.

It was primarily the commercial activity that drew researchers to South Bay in 1982 an again in 2003. Based on the historical record and the results of the 1982 CMS survey, it was known that there were shipwrecks in the Bay, but the number found was initially a surprise. Most of the wrecks were located north of the Route 22 highway bridge crossing at the north end of the Bay between Whitehall and Dresden. The 1982 survey reported three or four barge wrecks in this area, but he 2003 survey located at least seven with the possibility of parts of four or five others. The site was a confusing collection of wrecks and old bridge remnants that will require extensive diver verification and documentation to sort out. It is likely that other wrecks, possibly buried under the old bridges, exist in this area.

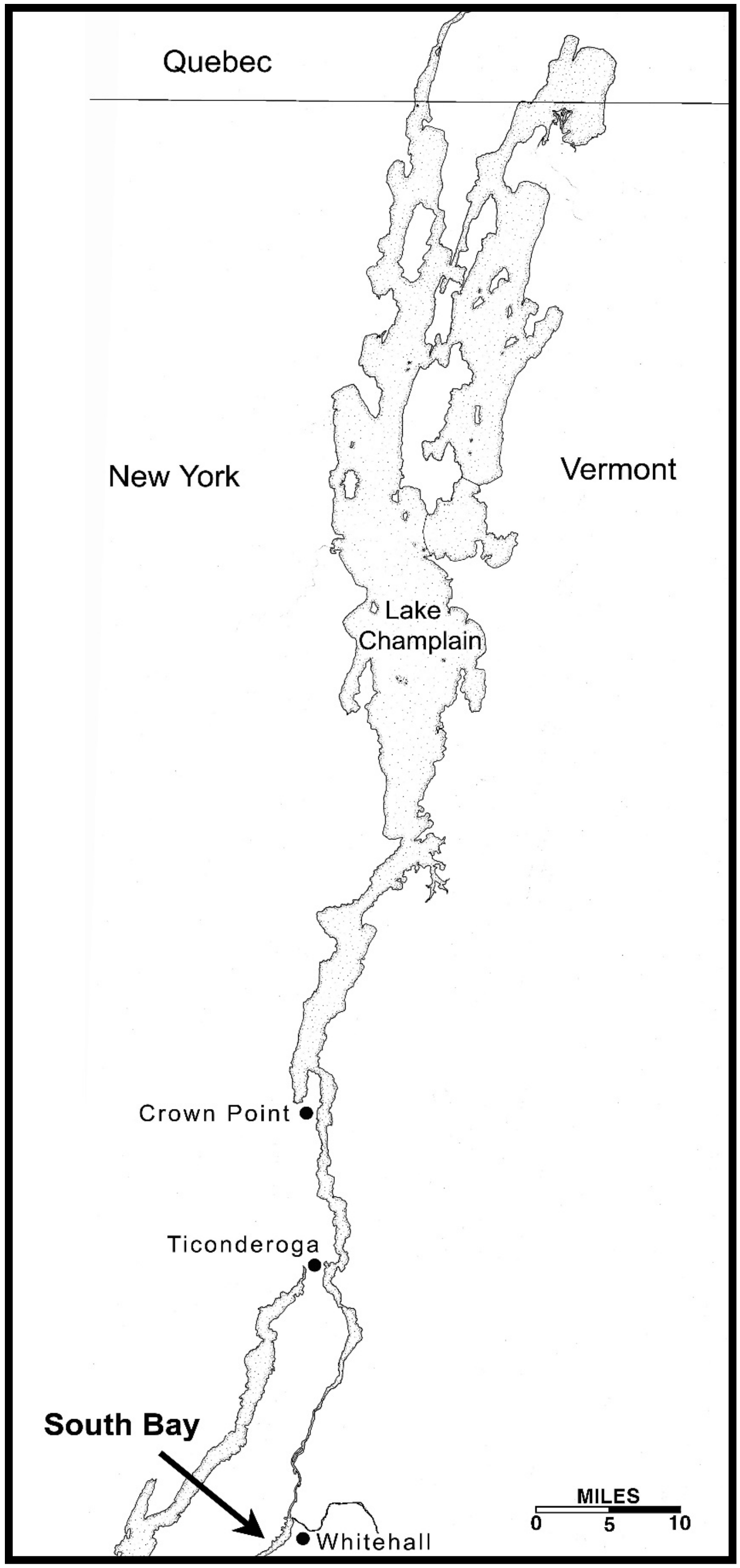

Figure 6-1. Map of Lake Champlain showing the location of South Bay.

South Bay Bridges
Two bridges, a railroad bridge at the outlet of South Bay and a highway bridge located about a half-mile to the south, currently cross South Bay. The former Delaware and Hudson (Canal Company) Railroad Bridge, located at the Bay outlet consist of two approach fills, a short half-through plate girder span and an 84ft (25.6m) iron or steel center pivot draw bridge with two 29ft (8.8m) clear openings. The draw has been made inoperable and may be the original circa 1875 structure. The plate girder span, based on old photos, has replaced an iron truss bridge. Due to the low clearance of the bridge only small boats can pass under the draw when entering or leaving South Bay (Figure 6-39).

Figure 6-2. Photo of the original railroad drawbridge crossing South Bay looking northerly (by A. Peter Barrannco).

The current NY Route 22 highway bridge, which was constructed in 1973, is the fourth such bridge at this crossing since 1856. Due to deep, soft, unconsolidated sediments at its location, this 1/3mi (.54km) crossing has consistently been a challenge to bridge builders. The following is a short history of these bridges:

The First Bridge (1856-1860)
The exact location of this short lived structure is unknown, but it was likely near the present day bridge. The contract to build the South Bay Bridge is reported on in the

following article:

> "*Anniversary Sketched This Date in Whitehall by C. E. Holden, October 22, 1856, Contract to Build South Bay Bridge:*
>
> 'Contract made this 22nd day of October 1856, between A. G. Meiklejohn of Putnam, W. G. Wolcott of Whitehall and David Barrett of Dresden, commissioners, for constructing a bridge across South Bay by Act of Legislature of New York passed April 15th, 1856, parties of the first part and Alwyn Martin, party of the second part, from a point of the Whitehall side near the brick house on the Bunce Farm to a point near Benjamin's house on the Dresden side.
>
> The bridge to be built on three rows of piles forming a foundation 16ft wide, the piles to be 14 inches in diameter at the butt and driven down to hard bottom, 12ft apart from center to center. Across the piles a pine cap to be places 21ft long and 10 inches thick, the tops of the piles to be securely fastened to the cap. Upon the caps are to be placed six tiers of sleepers of pine 5x10 and covered with 2 1-2 inch hemlock flooring 16ft wide, with substantial railing 4ft high braced from cap to posts. Bridge to be provided with a good substantial draw for passage of canal boats and other craft. Each end of the bridge out to a depth of 2ft of water to be filled with earth and stone to make the roadway.'

The contract provides that the bridge must be completed by June 1st, and the price is $7000. However there were allowances for extras which brought the final cost to about $8000. The bridge was destroyed by floating ice in the spring of 1860."[i]

This first bridge did not survive long and the ferry crossing resumed its operations. It is reported that the South Bay ferry, which ran from Dresden to Whitehall, was operated by Thomas D. Wilson from around 1880 to 1913. It was originally a sail ferry, but later had an engine.

The Second Bridge (1913-1930)

After many years of trying by the citizens of Whitehall and Dresden, the New York State Legislature approved construction of the second South Bay Bridge under Chapter 518 of the Laws of 1912. The bridge was designed by the NY Department of Highways in 1912 and constructed by the Oswego Bridge Co., of Oswego, NY for $44,431.20 in 1913.

The bridge design drawings which were approved August 14, 1912 called for a 928ft (282.9m) long by 16ft (4.9m) wide open pile trestle with stone fill approaches, 323ft (98.5m) long on the east (Whitehall) side and 659ft (200.9m) long on the Dresden side. It incorporated a 50ft (15.2m) long steel truss bridge on concrete abutment with pile foundation, and a 33ft (10.1m) ling single leaf bascule bridge to accommodate vessels. A hand-operated wheel opened and closed the bascule leaf with its counter weight (Figure 6-40).[ii]

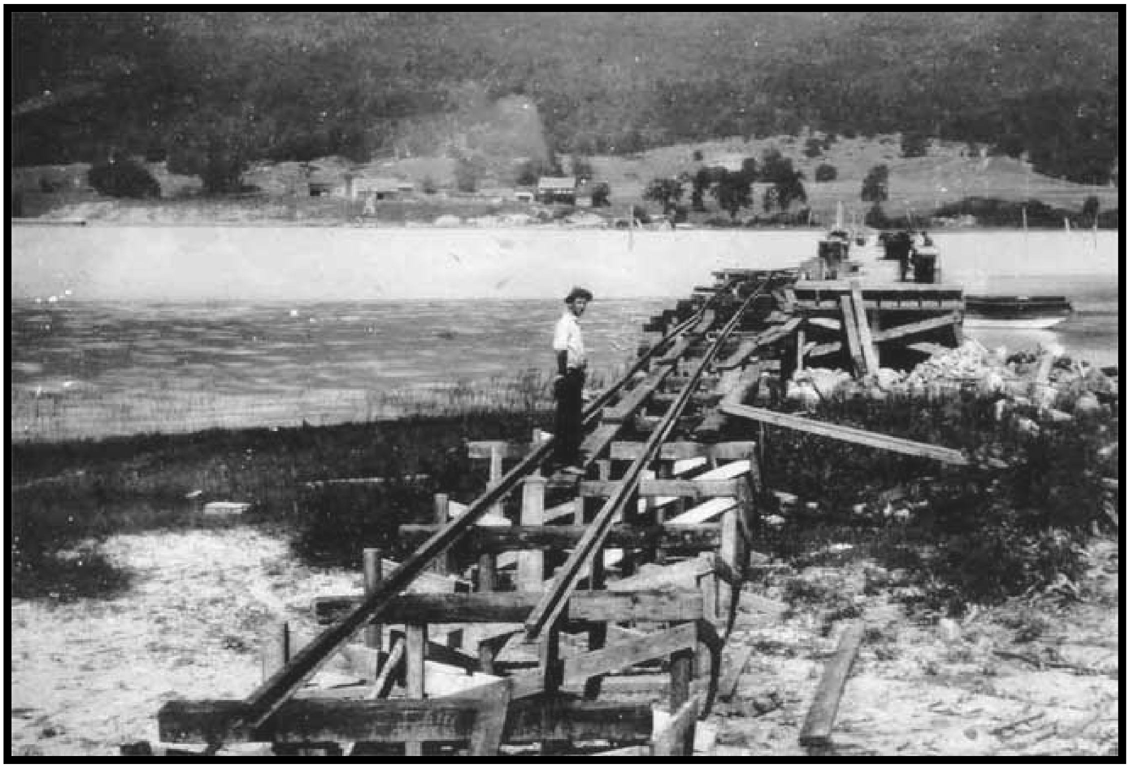

Figure 6-3. Image of the 1913 bridge under construction, looking west (courtesy of the Historic Society of Whitehall).

In spite of the work having been completed on time, it had been necessary to sink canal boats along the bottom to support the piles.[iii] On of the canal boast was the *Frederick S. Dale*, O/N 37519, built at West Haven, VT in 1888. A note on her enrollment papers says: "Out of Commission and sold to Sup't [Nelson] Fagan to fill new bridge at South Bay near Whitehall N.Y. now under said highway. Sold in Aug. 1913."

Almost immediately there were problems with the bridge due to the soft sediments it rested upon. In November of 1914 a delegation from Whitehall met with the Highway Department to see if the bridge could be strengthened- the figure of $25,000 was talked about.[iv] It is reported that "In 1917-1918 a contract was signed with the State Superintendent of Prisons for convict labor on a new span. Boatbuilder William Ryan agreed to sell the state old barges at $30 each to provide a foundation for a bridge." [v] It is not know what, if anything, came of this plan.

The bridge continued to deteriorate and was in such poor condition by the 1920s due to movement and settlement that a new bridge was necessary (Figure 6-41). Agnes Peterson, Dresden Town Historian, recalls while in high school, the school bus had to let off the students to walk across the bridge while the bus traveled across it empty because it was in such poor condition.[vi]

Figure 6-4. Photo showing the west end of the 1913 bridge looking south (courtesy of the Historical Society of Whitehall).

The Third Bridge (1930-1973)

The third bridge was constructed about 75ft (22.9m) south of the second (1913) bridge. During its construction, all but a short section of the rock fill approach at the east end of the 1913 bridge appears to have been removed. It is not known, however, how much of the 1913 structure, including canal boats buried under the fill, actually remains today.

The design for the 1930 bridge called for a rock fill causeway across most of the bay with a fixed and moveable (drawbridge) span in the center. The original estimate for the work to be done was $353,800, including extras. The contractor, Donahue Construction Co., began work on June 14, 1929 and immediately ran into major problems. The following excerpts are taken from an article entitled “South Bay History”, printed in the *Whitehall Times* in June of 1971:

> “Rock fill dumped into the bay during the day, was still well above the water level when night fell; but by the following morning, the fill had all disappeared beneath the surface”;
>
> By December 28, 1929: “The east side of the…bridge has tilted toward the east to such an extent that the end of the iron span of the bridge is about the three feet from it. To support the iron span and to keep it from developing into the bay, wooden props have been placed under it, but this is not expected to hold it up”

> “The stone fill in trying to reach a solid bottom, has given the most trouble and besides dropping out of sight at times, wrecked the old (second) bridge which is still closed to traffic…for nearly four weeks.”
>
> “Sixty thousand cubic yards of stone were estimated for the entire width of the bay; more than that amount has been used and it will be necessary to make another blast [to produce more rock fill].”
>
> “…the pier tipped over and now plan to continue the stone fill out to the tipped pier and over it, and on top of this build a new pier.”
>
> In February 1930, “Practically all of a 110-foot steel span…has slipped into the waters… as a result of the sinking of the stone fill which served to support this structure...”
>
> “…there is danger of the old bridge being forced out of position.”
>
> “…the fill under the end of the bridge began dropping into the bay, because of the soft bottom…and with it went the bridge.”

The troubles continued and “Ultimately, the idea of a stone fill all the way across the bay had to be abandoned and the present half and half creation (part piling and part stone fill) was installed.” Prior to implementing this half and half design, additional problems had to be addressed. An article in the August 7, 1930 edition of the *Ticonderoga Sentinel* indicated that:

> Three wooden bents [piles] of the new South Bay bridge, north of Whitehall, have sunk from site in the bay. In the construction of the bridge, not much trouble has been experienced in the last several months, because from the west end of the iron span a wooden trestle about 300 feet has been built. It was intended to resume the stone fill from the end of the trestle to the west shore, and it was started with the result that when the stone fill was dropped into the bay it forced three of the bents up into the air.
>
> These three bents had to be sawed into tow to save the remainder of the new wooden structure. When this is completed the fill will be continued towards the east end [of] the iron bridge.…
>
> The estimated cost of the structure was about $321,000 and it is said that when the bridge is complete it will cost nearly $1,000,000.[vii]

The bridge was finally completed and opened to traffic in 1930. By the 1960s a new bridge was needed because of continuing problems with the 1930 bridge and in 1971 two Bailey bridges were constructed on top of one of the sections to strengthen the span until a new bridge could be built. These proved to be a danger to traffic and construction of a new bridge was approved in 1972. Most of the central part of the 1930 bridge was removed during construction this fourth bridge; however the rock fill approaches and pile bents remain (Figure 6-42).

Figure 6-5. Photo taken circa 1972 of the removal of the 1932 bridge, looking northwest toward Dresden shore (courtesy of the Historical Society of Whitehall).

The Fourth Bridge (1973-Present)

The fourth bridge was constructed approximately 90ft (27.4m) south of the third bridge. The contract for this bridge was awarded to Thomason and Perry, Inc. of Troy NY for $2,083,000. Construction began in November 1972 and was completed in 1973. The new bridge was a unique structure, the only one of its kind in the state of New York. At 580ft (176.8m) long and 40ft (12.2m) wide, the new bridge has a steel plate deck and was design to be very light. This is because engineers determined the depth of lake sediments at the area of the bridges to be in excess of 600ft (182.9m) deep. The piles for the 1973 bridge were driven 140ft (42.7m) below the lake bottom, and pressure from the silt surrounding the piles was believed to be enough to hold them in place. The 1973 bridge also had no draw, and the clearance is 11ft (3.4m) at mean water level.[viii]

Finally, after 117 years, a bridge that solved the extremely adverse foundation conditions of this site was successfully constructed across South Bay. Apparently the foundation conditions of the railroad bridge site at the outlet of South Bay were more favorable since that structure has existed for 130 years.

Wreck A5: Canal Boat (NYSM 11637)

Wreck A5 is a standard canal boat in Lake Champlain's South Bay. The site was reported to the LCMM by Richard Bennett, a public lands surveyor/examiner for the New York Office of General Service, in 1998. Mr. Bennett discovered the shallow water wreck while fishing, and contacted LCMM Executive Director Arthur Cohn to report the find. In May 1999, LCMM researchers undertook a preliminary investigation of the site.

Dive observations revealed the site to be an 1873 class standard canal boat. Because of the site's shallow depth, ice has removed the sides and deck, leaving only the bottom of the hull. The canal boat is edge-fastened, with an overall length of 97ft 2in (29.6m) and a beam of 20ft (6.1m). The vessel's extant structural features included transverse bottom planking, the keelson (6in by 6in [15cm by 15cm]), eight stringers (4in by 5in [10cm by 12.7cm]), chine logs (5½in by 4in [14cm by 10cm]), a breast hook and bow framing.

Researchers also noted several artifacts on the site including some coal in the bow area, a leather pump, a broken dish and some fittings. The LCMM recovered a number of iron rods from the site for use in a zebra mussel-monitoring project. The rods were lying on the bottom, presumably from the no longer extant sides.

The location of this wreck, and possibly that of one or two others in South Bay, suggest that it may have been abandoned for use as a dock. There is no information that links this wreck, or the others, to a particular vessel, however, it is noted that the enrollment papers of the canal boat *Mary A. Stafford* (O/N 51133) report that: "Name changed to May & Annie [,] abandoned in 1909 and made into a dock in South Bay near Whitehall."

The *Mary A. Stafford* was built at Fort Ann in 1881, with dimensions of 95.7ft by 17.6ft by 8.7ft (29.1m by 5.3m by 2.65m) and had a tonnage of 122.26 GT and 116.02 NT. In 1906 she was owned by the [New York and] Lake Champlain Transportation Co. (The "Line"), her homeport was Plattsburgh, her hailing port, Whitehall and her master, C.F. Reed.

Statement of Significance

Wreck A5 lacks sufficient site integrity to be eligible for inclusion in the NYSRHP or the NRHP. The boat consists of only the bottom of the hull, and appears to be a derelict vessel. It is unlikely to contain a significant artifact assemblage relating to the life of its former operators.

Wreck C5: Canal Boat (NYSM 11639)

Wreck C5, also in South Bay, was initially located in 1982 by the Champlain Maritime Society; its original designation was VT-LC84-13. The site was rediscovered during the 2003 Lake Survey. In the 1982 dive verification the site was identified as a canal boat carrying a load of graphite. The sonar image of the canal boat indicates that it is largely intact (Figure 6-43).

The South Bay Graphite industry flourished briefly between 1900 and 1924 but the principal deposits and mining operations were located near Hague on the west shore of Lake George between c. 1890 and 1921. These mines and milling operations came into the ownership of the Joseph Dixon Crucible Company of Jersey City, NJ who used the refined graphite to make its "Ticonderoga" brand pencils, lubricants and crucible.[ix] Graphite was first discovered in the Ticonderoga area about 1815 and by 1833, a process had been developed to refine the material for use in pencils. By 1863, the American Graphite Co. of Jersey City, NJ had purchased several mining operations in the area and under the direction of mining engineer William Hooper, Ticonderoga became the center of the graphite industry. In 1873 the Joseph Dixon Crucible Co. bought out the American Graphite Co. and continued to manufacture its products at the Ticonderoga mill. The South Bay mining operations also came under the control of Joseph Dixon. In 1921 and 1924, the graphite operations at Hague and South Bay respectively were closed due to the availability of cheaper foreign ores, however the Ticonderoga pencil operation continued as a subsidiary of Joseph Dixon until the 1980s.[x]

There were four, possibly five, graphite mines located on the west side of South Bay between 1903 and 1924: The Adirondack Graphite Mining and Milling Co. (c.1903); Silverleaf (never opened); Tintsman Mine and Mill (c. 1904-1916); Hooper Mine and Mill (1916-1924); Champlain Graphite Mill (c. 1912).

Little is known of the Champlain Graphite Mill and the Silverleaf Mine. Although little is know of the workings of the Adirondack Graphite Mining Milling, which began in 1903, it is known that the company was foreclosed and sold at auction in 1906: "The graphite works of the Adirondack Mining and Milling Co. at South Bay near Whitehall is to be sold at auction on a mortgage foreclosure. It is expected that a new company will be organized and the work resumed. The works were bonded for $60,000."[xi] It is unknown if the mine ever did reopened.

The Hooper Mine and Mill was the largest graphite mine in the area. It had been started by George H. and Frank C. Hooper in 1916 and ran until 1924. It was located about a mile and a half west of South Bay, at an elevation of approximately 1000ft (305m). All of the graphite from this mine was shipped by road. The Tintsman Mine and Mill was located near the lakeshore within 100yd (91.4m) of South Bay. Opened in 1904, it was a very active operation. The mine was shut down in 1916 due to contamination of the graphite product with sand and sabotage was rumored.

Based on the known information on the graphite industry in South Bay, it is likely that wreck C5 was loaded at the Tintsman Mine between 1904 and 1916. The Tintsman Mine shipped graphite from its mine to Whitehall across South Bay regularly. The mine had a dock and loading facility, whereas the other known mines in the area either did not have docks for lake shipping or there is not a record of such facilities.

Statement of Significance

Based on the apparent intact nature of the site from the 2003 sonar records and the reported presence of cargo, Wreck C5 is likely eligible for inclusion in the NYSRHP and the NRHP under Criterion D: Information Potential.

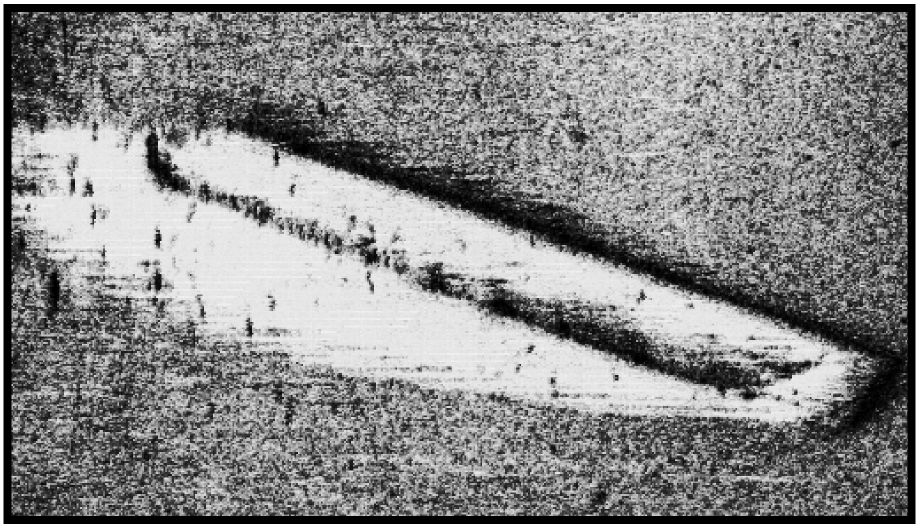

Figure 6-6. Sonar image of Wreck C5 (LCMM Collection).

Wreck D5: Steamboat *Reindeer* (NYSM 11640)

Wreck D5 is believed to be the hull of the steamboat *Reindeer*. The vessel was originally located in 1982 during a side scan sonar survey by the Champlain Maritime Society; its remains were not located during the 2003 Lake Survey likely due to its shallow water location.

The steamboat *Reindeer* was built by master carpenter Jermiah Faulks in 1882 at Alburgh, Vermont for the Grand Isle Steamboat Company. This 168ft (51.2m) steam-powered vessel ran between Burlington and Alburgh, Vermont and remained the only steamboat on Lake Champlain that maintained independence from the Champlain Transportation Company for its entire career (Figure 6-44). It was also the largest vessel to navigate to the falls on Otter Creek at Vergennes, Vermont, under the direction of Master Captain Ell B. Rockwell.

Reindeer sank at the Central Vermont wharf in Burlington in 1902 (Figure 6-45). It was then raised and taken to Whitehall, NY for dismantling, with its 800-horsepower engine cut up for scrap iron and the hull abandoned in South Bay (Figure 6-46). The pilothouse was removed and used as a gazebo in Castleton, Vermont, and was eventually donated to the Lake Champlain Maritime Museum in Vergennes, Vermont, where it is on public display.

Statement of Significance

It is not possible with the current data to accurately assess this site's integrity and historic significance.