



CHPE LLC 623 Fifth Avenue, 20th Floor New York, NY 10022

Segment 6 (Package 4A)

EM&CP Appendix J

HDD Design Summary Report Additions for HDD 57B



UPDATES TO HDD Design Summary Report Crossings HDD 51 to HDD 61 in Segment 6 – Package 4A

For HDD 57B For Design Rev. #1 || *Design Rev. Date: 12/20/2023*

Ballston Spa to Glenville Saratoga & Schenectady 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

December 2023

1.0 INTRODUCTION

1.1 PURPOSE

Revised Text

• Review of the existing geological, hydrogeological, and geotechnical conditions for HDD 51 through HDD 61 for total of *20* crossings (2 per site) in Segment 6 – Package 4A.

2.0 **PROJECT DESCRIPTION**

Revised Table 1

HDD#	Start Station	End Station	HDD Length, ft	Obstruction Crossed
51	40001+97	40022+12	1907/2018	Road/Rail/Wetland
52	40060+84	40087+80	2701	Wetland
53	40098+47	40106+61	815	Road (Rail
				Bridge)/Stream
53A	40227+56	40233+76	625/627	Culvert/Stream (Rail
				Bridge)
57 B	A-P4A-18+50	A-P4A-38+35	1985/1978	Road/Wetland/Culvert
59	40409+11	40420+63	1124/1159	Culvert
59A	40425+37	40443+60	1826	Road/Rail
59B	40489+82	40498+10	829	Rail/Wetland
60	40511+60	40524+98	1332/1335	Wetland/Streams (Rail
				Bridge)
61	40527+60	40534+42	684/689	D.O.T Road

Table 1: HDD Locations, Lengths, and Description

4.0 SITE CONDITIONS

4.1.1 Project Datum and Topography

Text Added

<u>HDD #57B</u>

HDD #57B consists of two HDD bores approximately 1985 feet and 1978 feet long that runs on the west side of the CP Rail railroad tracks, crossing underneath Main Street (RT 146A), existing utilities, multiple culverts, wetland and a pond in Ballston, NY, at approximately latitude 42.9109°N and longitude 73.8753°W. Both bores remain on west side of the tracks for the entire run. The HDD bores will pass approximately 16 feet below the estimated mulline (assuming a 5' water depth). The ground surface elevation at entry and exit of bore alignment is approximately El. 279 and El. 274, while most of the run it undulates between El. 275 to El. 280 and dipping down to El. 272 near water level (reference datum NAVD 1988).

4.1.2 Geotechnical Data

Text Added

<u>HDD #57B</u>

Subsurface investigations were conducted in 2013 by TRC, 2022 by Terracon. and 2022 by Kiewit for Transmission Developers, Inc. There are five borings to date at HDD #57B: B165.5-1, KB-165.5A, KB-165.5B, B165.8-1 and K-165.8, which reached depths of 13, 45, 35, 15 and 39 feet below grade, respectively. There appears to be a 4-foot layer of medium dense silty sand over a 4-foot layer of very dense gravel sized rock fragments, over a 5-foot layer of shale bedrock in boring B165.5-1. There appears to be a 2-foot layer of medium dense fill over a 4-foot layer of dense to very dense silty sand, over a 39-foot layer of shale bedrock in boring KB-165.5A. There appears to be a 2-foot layer of shale bedrock in boring KB-165.5A.

layer of medium stiff silt over a 5-foot layer of very dense weathered rock, over an 8-foot layer of shale bedrock in boring B165.8-1. There appears to be a 4-foot layer of loose fill over a 2.5foot layer of soft lean clay, over a 3.5-foot layer of very dense weathered rock, over a 29-foot layer of shale bedrock in boring K-165.8. Due to the length of the proposed HDD alignment, and the varying thickness of the five main soil layers observed onsite, the BoreAid analysis will be based on non-horizontal layering corresponding to borings KB-165.5A, KB-165.5B, B165.8-1 and K-165.8. The Geotechnical Data Report for this location is provided in Appendix C

Based on the borings, the soil profile for the HDD #57B BoreAid analysis will consist of five (5) layers: loose fill (SM), medium dense silty sand (SM), soft low plasticity clay (CL), very dense weathered rock (GP) and shale bedrock. The soil profiles used for BoreAid analyses for the HDD in this segment are presented in Appendix D.

Appendix B

Revised

Appendix B

Locus Map



Appendix C

Sheets Added

Appendix C

HDD Geotechnical Data Report for CHPE Segment 6 – Package 4A HDDs

MEMORANDUM



DATE: August 9, 2023
TO: Antonio Marruso, P.E.; CHA Consulting, Inc.
FROM: Matthew Hawley, P.E.; Kiewit Engineering (NY) Corp.
SUBJECT: Geotechnical Data: Segment 6 – Package 4A – HDD Crossing 57B Champlain Hudson Power Express Project Burnt Hills, New York

Kiewit Engineering is providing the attached geotechnical data for use in the horizontal direction drill (HDD) design for the Champlain Hudson Power Express project in Upstate New York. This HDD crossing is located in Burnt Hills, New York. The approximate station for HDD crossing Number 57B is STA 40352+50 (42.9109° N, 73.8753° W).

The geotechnical data at this HDD crossing is attached. The available data is from the previous investigation by TRC as well as recent investigations by Terracon and Kiewit, referenced below.

- TRC, Geotechnical Data Report, Champlain Hudson Power Express, Canadian Pacific Railway Borings MP 113.1-177.1, dated March 29, 2013.
- Terracon, Results of Field Exploration, Champlain Hudson Power Express, Ballston Clifton Park Glenville, NY, dated June 22, 2022
- Kiewit Engineering (NY) Corp., Package 4A Phase 4 Borings, Champlain Hudson Power Express, New York, dated January 20, 2023.

Contact us if you have questions or require additional information.

HDD 57B Borings B165.5-1, B165.8-1, K-165.8, KB-165.5A, KB-165.5B Segment 6 - Design Package 4A

CHPE Segment 6 Package 4A Soil Boring Coordinates and Elevations

Finne	Devine	Northing	Easting	Ground Surface
Firm	Boring	(feet)	(feet)	Elevation (feet)
	A162.1-1	1502786.734	664476.477	284.0
	B158.87-1	1519228.136	669050.444	288.3
	B159.1-1	1517722.124	668720.464	291.0
	B159.5-1	1516012.300	668217.400	295.8
	B160.3-1	1511903.990	667182.915	294.6
	B160.7-1	1509749.417	666636.945	295.0
	B161.4-1	1506284.600	665799.100	288.0
	B163.3-1	1496630.400	662351.700	280.2
TRC*	B164.4-1	1490795.529	661205.362	267.5
	B165.5-1	1485722.400	659432.900	277.6
	B165.8-1	1484324.089	658853.809	275.4
	B166.5-1	1480752.600	656954.600	263.5
	B166.9-1	1479253.700	655902.600	265.4
	B167.1-1	1478553.300	655364.300	261.0
	B168.0-1	1474529.400	653290.100	251.4
	B168.64-1	1471082.866	652655.655	245.2
	B168.86-1	1470035.900	652059.906	231.6
	BM-1	1500593.800	663479.000	283.4
	BM-1B	1513675.554	667631.458	293.5
	BM-1C	1508115.700	666263.900	291.9
	BM-1D	1504574.200	665267.500	283.4
	BM-1E	1511220.853	667016.761	294.1
	BM-2	1494386.900	661852.400	271.4
AECOM**	BM-2A	1498788.900	662752.200	279.1
	BM-2B	1492715.315	661511.300	269.7
	BM-3	1487269.097	659995.860	275.1
	BM-3A	1488755.829	660606.619	270.8
	BM-3B	1482501.900	658059.300	273.6
	BM-3C	1480192.269	656553.384	263.2
	BM-4	1477890.500	654882.600	260.5

Notes:

- Northings and Eastings are provided in NAD83 New York State Plane East Zone.

- Elevations are referenced to the NAVD88 datum.

* TRC boring coordinates as shown in Table 1-6 in AECOM report (reference below). Boring elevations estimated from November 2021 topographic survey by Williams Aerial.

** AECOM boring coordinates and elevations as shown in Table 1-6 in AECOM report.

*** Kiewit boring coordinates and elevations are noted on the boring logs.

Reference:

AECOM, Geotechnical Data Report, Upland Segments: Putnam Station, Washington County, to Cementon, Green County, NY, Champlain Hudson Power Express, dated May 28, 2021.







Alternative_Route/Consensus_Alternative_Routes/MXDMIt_5_Routes_DZ_201909/Boring_Locations/Maps_for

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

CTRC

TEST BORING LOG

PROJECT: TDI CHAMPLAIN HUDSON POWER EXPRESS

LOCATION: CP RAILROAD ROW, NY

	GROU	NDWATEF	R DATA]	METHOD OF ADVANCING BOREHOLE					
FIRST ENCOUNTERED NR					а	FROM	0.0 '	то	6.3 '	
DEPTH	HOUR	DATE	ELAPSED TIME	-	d	FROM	6.3 '	ТО	8.0 '	
3.5'	14:23	23 1/15 0 HR			C ₂	FROM	8.0 '	то	13.0 '	
				Ī						
				-						

 BORING
 B165.5-1

 G.S. ELEV.
 N/A

 FILE
 195651

SHEET 1 OF 1

DRILLER	J. MEHALICK	
HELPER	M. KERLIN	
INSPECTOR	C. POPPE	
DATE STARTED	01/15/2013	
DATE COMPLETED	01/15/2013	



CTRC

TEST BORING LOG

PROJECT: TDI CHAMPLAIN HUDSON POWER EXPRESS

LOCATION: CP RAILROAD ROW, NY

	GROU	NDWATEF	R DATA		METHOD OF ADVANCING BOREHOLE					
FIRST ENCOUNTERED DRY					а	FROM	0.0 '	то	4.0 '	
DEPTH	HOUR	DATE ELAPSED TIME			d	FROM	4.0 '	TO	5.0 '	
					C ₂	FROM	5.0 '	TO	15.0 '	
				-						
				1						

 BORING
 B165.8-1

 G.S. ELEV.
 N/A

FILE 195651 SHEET 1 OF 1

DRILLER	T. FARRELL
HELPER	J. LANGDON
INSPECTOR	N/A
DATE STARTED	02/12/2013
DATE COMPLETE	D 02/12/2013

	DEPTH	-	А		В		С		DESCRIPTION		Wn	REMARKS
			S-1	3 2	з	8		2.0	BROWN GRAVELLY CLAY, SM SILT, TR F/ SAND			
	5 _		S-2 S-3	15 24 47 50/	<u>35</u> /0.2	50		5.0	BROWN SILT, SM ROCK FRAGMENTS (DECOMPOSED ROCK)			
		_						7.0	GRAY, SEVERELY WEATHERED, SOFT SHALE, VERY CLOSE TO CLOSE, 0 TO 90 DEGREE FRACTURES			
	10	_	P _1	REC =8	0%							
	10 _	_	11		<u>JO 70</u>				GRAY, MODERATELY WEATHERED, SOFT SHALE, CLOSE TO MODERATELY CLOSE, 0 TO 60 DEGREE FRACTURES			
		_		REC =1	00%							
	15 _		R-2	RQD =8	88%			15.0				
		_							END OF BORING AT 15			
		_										
	20 _	_										
3/27/1:		_										
GDT		_										
VELT.		_										
BLAU	25	_										
SITE	25 _	-										
o.GPJ												
5651_		_										
G 19	30 _	_										
NGLC		_										
BORI		-										
TEST												
ECTS	35											
PROJ							1	L		N		JPB
NEV										.D		PWK



195651

SUMMARY OF LABORATORY TEST DATA

Project Name: Client Name:

TDI Champlain Hudson Power Express - CP Transmission Developers, Inc.

TRC Project #:

Organic Content (%) **GRAIN SIZE** Soil Group (USCS System) Moisture Content (%) SAMPLE IDENTIFICATION PLASTICITY Unit Weight (pcf) DISTRIBUTION Specific Gravity Compressive Strength (tsf) Gravel (%) Plasticity Index (%) Liquid Limit (%) Depth (ft) Liquidity Index) # Limit (%) Boring # Sand (%) Clay (%) Sample Silt (%) Plastic R-2 18.1-18.8 _ 169.1 _ _ _ _ 475 _ _ _ _ _ _ _ S-2 2.0-4.0 27.5----_ ---_ ----S-4 6.0-8.0 SM 28.2 50.4 21.4 15.2 --------B163.3-1 8.0-10.0 S-5 167.6 R-1 12.9-13.4 _ _ _ _ _ _ _ _ _ _ 220 _ R-2 16.0-16.6 169.3 ----_ -_ ---435 -S-3 4.0-6.0 SM 26.3 16.2 53.720.0 --_ --_ _ -S-4 6.0-8.0 B164.4-1 R-1 168.2 12.5-13.0 950 -----------890 **R-2** 17.2-17.7 169.1 --_ --_ _ -_ --S-3 4.0-6.0 -_ _ --_ -13.4 _ _ _ _ --B165.5-1 R-1 9.0-9.4 166.5 -----------390 -B165.8-1 7.0-7.6 167.2 850 R-1 _ ---_ -----_ _

DRAWN BY: TBT 03/27/13



SUMMARY OF LABORATORY TEST DATA

Project Name: Client Name: TRC Project #: TDI Champlain Hudson Power Express - CP

Transmission Developers, Inc. <u>195651</u>

SAMPLE I	DENTIF	FICATION	USCS]	GRAIN SIZE DISTRIBUTION PLASTICITY			PLASTICITY			(pcf)	e O	tent (%)			
Boring #	Sample #	Depth (ft)	Soil Group (System)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index)	Specific Grav	Moisture Co (%)	Unit Weight	Compressive Strength (tsf	Organic Con
	R-2	10.0-10.5	-	-	-	-	-	-	-	-	-	-	-	165.3	700	-
	S-2	2.0-4.0	SM	28.0	22.7	49	9.3	-	-	-	-	-	15.1	-	-	-
B166.5-1	R-1	9.0-9.4	-	-	-		-	-	-	-	-	-	-	166.9	410	-
	S-1	0.0-2.0	OM	40 -			1.0						10.4			
	S-2	2.0-4.0	GM	42./	23.3	34	4.0	-	-	-	-	-	19.4	-	-	-
B166.9-1	R-1	8.0-8.4	-	-	-	-		-	-	-	-	-	-	171.6	385	-
	Da		-	-	-		-	-	-	-	-	-	-	168.7	-	-
	K-2	11.1-11.4	-	-	-		-	-	-	-	-	-	-	162.5	-	-
	S-2	2.0-4.0	-	-	-	-	-	-	-	-	-	-	23.9	-	-	19.3
B167.1-1	S-5	8.0-9.3	-	-	-	-	-	-	-	-	-	-	7.0	-	-	-
	R-1	14.9-15.3	-	-	-	-	-	-	-	-	-	-	-	168.5	340	-
B168.0-1	S-2	2.0-4.0	SM	13.5	51.9	34	4.6	-	-	-	-	-	8.2	-	-	-
B168.64-1	S-4	6.0-8.0	SM	1.1	73.9	2	5.0	-	-	-	-	-	9.9	-	-	-

DRAWN BY: TBT 03/27/13

TRC Engineers, Inc. Soil Mechanics Laboratory

Unconfined Compression Strength Test of Rock Core

Project Name:	TDI									
Project No.:	195651		Average S	ample Diame	eter (in.):	1.979	Sample Desc	ription:		
Boring No.:B165.5-1Cross SetSample No:R-1Average			Cross Sec	Sectional Area (sq. in.) 3.076 ge Sample Height (in.): 3.971			GRAY SHALE			
			Average S							
Depth (ft):	9.0-9.4		Sample M	ass-Dry (g):		533.8				
Elevation (ft):			Unit Weig	ht (PCF)		166.5				
<u>Test Data</u>				500						
Strain Dial (in.)	Load (lb)	Strain (%)	Stress (tsf)	-						
0.000	0	0.00	0							
0.010	250	0.25	6	400						
0.020	1200	0.50	28							
0.030	3600	0.76	84	-						
0.040	7200	1.01	169				*	•		
0.050	10500	1.26	246	G 300						
0.060	14200	1.51	332	(ts						
0.070	16650	1.76	390	SS						
0.080	14000	2.01	328	al Str			7			
				X 200						
				100						
Failu	re Conditions:	X								
		/ \		0.00	0.50	1.00	1.50	2.00	2.50	
		Y \				۵vial	Strain (%)			
FIGURE: 127)	

TRC Engineers, Inc. Soil Mechanics Laboratory

Unconfined Compression Strength Test of Rock Core

Project Name:	TDI				
Project No.:	195651	Average Sample Diameter (in.):	1.978	Sample Description:	
Boring No.:	B165.8-1	Cross Sectional Area (sq. in.)	3.073	GRAY SHALE	
Sample No:	R-1	Average Sample Height (in.):	3.965		
Depth (ft):	7.0-7.6	Sample Mass-Dry (g):	534.67		
Elevation (ft):		Unit Weight (PCF)	167.2		

<u>Test Data</u>

Strain Dial (in.)	Load (lb)	Strain (%)	Stress (tsf)
0.000	0	0.00	0
0.010	450	0.25	11
0.020	1200	0.50	28
0.030	3000	0.76	70
0.040	7550	1.01	177
0.050	13000	1.26	305
0.060	22500	1.51	527
0.070	30000	1.77	703
0.080	36000	2.02	844
0.090	5000	2.27	117





FIGURE: 128

TRC Engineers, Inc. Soil Mechanics Laboratory

Unconfined Compression Strength Test of Rock Core

Project Name:	TDI			
Project No.:	195651	Average Sample Diameter (in.):	1.979	Sample Description:
Boring No.:	B165.8-1	Cross Sectional Area (sq. in.)	3.076	GRAY SHALE
Sample No:	R-2	Average Sample Height (in.):	3.970	
Depth (ft):	10.0-10.5	Sample Mass-Dry (g):	529.83	
Elevation (ft):		Unit Weight (PCF)	165.3	

<u>Test Data</u>

Strain Dial (in.)	Load (lb)	Strain (%)	Stress (tsf)
0.000	0	0.00	0
0.010	500	0.25	12
0.020	1050	0.50	25
0.030	4600	0.76	108
0.040	9200	1.01	215
0.050	16600	1.26	389
0.060	23800	1.51	557
0.070	29750	1.76	696
0.080	20000	2.02	468





FIGURE: 129

EXPLORATION PLAN

Champlain-Hudson Power Express Design Package 4a
Ballston - Clifton Park - Glenville, NY June 22, 2022
Terracon Project No. JB215256A





DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

BORING LOG NO. K-165.8

Page 1 of 2

PR	OJECT: Champlain-Hudson Power Express Design Package 4a	CLIENT: Kiewit Engineering (NY) Corp.										
SIT	E: Champlain to Hudson HDD Crossings Ballston - Clifton Park - Glenville, NY											
GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 42.9051° Longitude: -73.8784° Surface Elev.: 2	273.13 (Ft.) ATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES	
	FILL - SILTY SAND WITH GRAVEL, brown, very loose	271	_		X	5	1-1-1-1 N=2					
	FILL - SILT, contains organics, brown, soft	269	_		X	6	3-1-1-1 N=2					
	LEAN CLAY (CL), brown, soft	200	5 -	-		12	WOH-WOH-3-3 N = 3		26.7	36-23-13	85	
	6.5 WEATHERED ROCK, gray, very dense	266.5	– –		X	1.1	3-57-50/1"					
			-	-	\times	0	50/5"					
	10.0 <u>SHALE</u> , slightly weathered, close to moderate fractured, good RQD, gray	263	- 10 - - -	-			REC = 92% RQD = 88%					
	15.0 <u>SHALE</u> , slightly weathered, close to moderate fractured, excellent RQD, gray	258	- 15- - -	-			REC = 100% RQD = 96%					
	20.0 <u>SHALE</u> , slightly weathered, moderate fractured, excellent RQD gray	253	- 20- - -	-			REC = 100% RQD = 96%					
	<u>SHALE</u> , unweathered, moderate to wide fractured, excellent RQD, gray		- 25 - - -	-			REC = 98% RQD = 97%					
	Stratification lines are approximate. In-situ, the transition may be gradual.		1	<u> </u>	i l Ha	imme	r Type: Automatic		I		<u> </u>	
Advan 4 1/ Abanc Bor	cement Method: See Exploration and idescription of field an used and additional of used and additional of symbols and abbreviating backfilled with bentonite grout upon completion See Supporting Information symbols and abbreviation of field and the symbols	Testing Proc d laboratory ata (If any). nation for ex ations. ded by Kiew	edures fo procedu planation	or a ires	Not Log Har Ene Har	iged k mmer ergy T mmer	by CS Efficiency Summary: ransfer Ratio: 84.7% Efficiency Correction	+/-5.0% (CE):1	.41			
	WATER LEVEL OBSERVATIONS				Borir	ng Sta	rted: 05-06-2022	Borii	ng Com	oleted: 05-06-	2022	
	30 Corpor Alt	cite Cir Ste 2 bany, NY	201		Drill Proje	Rig: E	Diedrich D-50	Driller: S. Morey				

BORING L	OG NO.	K-165.8
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Page 2 of 2

	PR	OJECT: Champlain-Hudson Power Express Des Package 4a	press Design CLIENT: Kiewit Engineering (NY) Cor											
	SIT	E: Champlain to Hudson HDD Crossings Ballston - Clifton Park - Glenville, NY												
	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 42.9051° Longitude: -73.8784° Surface	e Elev.: 273 ELEVATI	3.13 (Ft.) ION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES	
TE.GDT 6/20/22		29.0 SHALE, unweathered, moderate fractured, excellent RQ 34.0	D, gray	244	- 30- - -	-			REC = 98% RQD = 93%					
TERRACON_DATATEMPLA		SHALE, unweathered, moderate fractured, excellent RQ	D, gray	224		-			REC = 100% RQD = 98%					
D FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL JB215256A CHAMPLAIN-HUDSON. GP.		Boring Terminated at 39 Feet												
NOT VALID IF SEPARAT	Stratification lines are approximate. In-situ, the transition may Advancement Method: 4 1/4 ID HSA		tion and Tes f field and la ditional data ing Informat abbreviatio	sting Proce aboratory a (If any) tion for exp ons.	edures fo procedu	or a res n of	Hi Lo Ha En Ha	amme otes: gged k ammer iergy T ammer	y CS Efficiency Summary: ransfer Ratio: 84.7% - Efficiency Correction	+/-5.0% (CE):1	.41			
S BORING LOG IS		WATER LEVEL OBSERVATIONS Elevations we No measurable groundwater prior to coring Image: Control of the contr	Elevations were provided by Kiewit					ng Sta Rig: D	rted: 05-06-2022 Diedrich D-50	Boring Completed: 05-06-2022 Driller: S. Morey				
ΞĦ		3	o Corporate Alban	e ur Ste 2 iy, NY	UT		Proj	ect No	.: JB215256A					

Geotechnical Data Report

Champlain-Hudson Power Express- Package 4a June 22, 2022 Terracon Project No. JB215256A



Terracon

Geotechnical Data Report

Champlain-Hudson Power Express- Package 4a June 22, 2022
Terracon Project No. JB215256A



Terracon

				Sheet 1 of 1					
BORING ID	Depth (Ft.)		Organic Content (%)						
K-160.1	4-6		0.8						
K-165.8	2-4		75.5						
K-168.6	4-6		7.4						
PROJECT: C	hamplain-Hud	son Power Express		PROJECT NUMBER: JB215256A					
SITE: Champ Ballsto	Design Package 4a SITE: Champlain to Hudson HDD Crossings Ballston - Clifton Park - Glenville, NY		Tierracon	CLIENT: Kiewit Engineering (NY) Corp.					
			Albany, NY	EXHIBIT: B-1					

Summary of Laboratory Results



LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. ATTERBERG LIMITS JB215256A CHAMPLAIN-HUDSON GPJ TERRACON DATATEMPLATE GDT 6/20/22

GRAIN SIZE DISTRIBUTION







PROJECT NUMBER

Package 4A Phase 4 Borings Champlain Hudson Power Express

Legend Key

Kiewit Borings





EXPLORATORY BORING LOG

BORING NO: KB-165.5A

Champlain Hudson Power Express

New York

PRO.		JMBER	20001480	LOGGED B	(S	5. Ahn	nad		COORDINATES		N 14 E 65	8571 5944	6.78 0.27	8	
	STAR	T DATE	12/06/2022	DRILLER/RIC	Johr	ı/G	eopro	be 782	22DT	GROUND ELEV.		278.5 ft				
	FINIS		12/06/2022	DRILL CONTRACTO	DR		ADT	Inc.		HAMMER TYPE/	EFF.	ŀ	Autor	nati	с	
Depth (ft)	Elevation (ft)	Graphic Log	Material C	Description	Sample Type	aample Type :ore Run No. Recovery % RQD Pocket Pen.		(tsf)	Blow Counts (N Value)	Notes		L ▲ SP MC PL Fin	-egei T N Va ; (%) .& LL (es Cor	1d lue %) itent (%)	
-		XXXXX	FILL: Clayey SAND wit	h Gravel (SC), gray to					<u> </u>		2	20 4	10	60	80	_
	-		black, medium dense, i	moist		58	%	4-	1-9-6-9 (15)					\square		
 	276.5	ŶŶŶŶŶ	Silty SAND with Gravel very dense, moist	(SM), gray, dense to	2	79	%	9-9	9-40-33 (49)							
- 5 -	272 5				3	57	%	3-9-	-50-50/3" (59)							
	272.0		SHALE, gray, very poo	r RQD, l aminated												
	-				1	22 1	% 3			10 minute core run						
	-															
	-		fair RQD											-		
	-					100	1%							+		
]				2	7)			15 minute core run				+	+	
	-													\square	+	
- 15 -	-		good RQD											+		
	-															
	-				3	90 8	<u>%</u> 5			15 minute core run						
	-													+		
- 20 -	-		fair RQD										+	+	+	
	1													+		
	-				4	100	1%			20 minute core run				+		
	-					0	5									
	-															
25-]		excellent RQD													
	-					100								\square		_
	-				5	10	0			20 minute core run				\downarrow		_
	1												+	+		
- 30 -	1												F		10	



EXPLORATORY BORING LOG

BORING NO: KB-165.5A

New York

PRO	JECT N	UMBER	20001480	LOGGED B	,		S. A	hmad	l	COORDINATES	N E	148 5 659	571 9440	6.78).27	3
	STAR	T DATE	12/06/2022	 DRILLER/RIG	Joh	n	/ Geo	probe		GROUND ELEV.		27	8.5 1	ft	
	FINIS	H DATE	12/06/2022	DRILL CONTRACTO	R		A	DT Inc.		HAMMER TYPE/EF	F.	A	uton	natio	
Depth (ft)	Elevation (ft)	Graphic Log	Material D	_ escription	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	Blow Counts (N Value)	Notes		Lo SPT MC (PL &	egen N Valu %) & LL (% s Cont	d ue 6) tent ('	%)
- ,			SHALE, gray, excellent	RQD, laminated	Π						20	40			80
			fair RQD			6	<u>100%</u> 93			20 minute core run UCS = 17,365 psi					
 - 40 -						7	<u>82%</u> 72			15 minute core run					
 - 45 -	233.5		Boring Terminated at 45	5ft		8 -	<u>100%</u> 62			20 minute core run					
- 60 -													Pa	age	2 of 2



50 62 3 4 5 6 7 8 9 10 11 1 13 14 15

5



40-45

Rins



EXPLORATORY BORING LOG

BORING NO: KB-165.5B

N 1485596.65

Champlain Hudson Power Express

New York

PROJECT NUMBER			20001480	LOGGED BY	COORDINATES E 659319.38											
START DATE		DATE	12/05/2022	DRILLER/RIG	GROUND ELEV. 278.0 ft											
	FINISH	DATE	12/06/2022	DRILL CONTRACTO	HAMMER TYPE/EFF. Automatic											
Depth (ft)	The formula fo		Material De	escription	iample Type ore Run No. Recovery % RQD Pocket Pen. (tsf)			Pocket Pen. (tsf)	Blow Counts (N Value)	Notes		Legend ▲ SPT N Value ● MC (%) P L & LL (%) ¥ Fines Content (%)				
	276.0		FILL: SAND with Gravel medium dense	(SP), black to brown,	M	1	66%		5-8-5-8 (13)	-						
 	274.0		dense, shale fragments	SM), brown, medium		2	84%		4-6-8-13 (14)	-	-	3				
- 5 - - 5 -			SHALE, gray, very poor	RQD	X	3	100%		22-50/5"	-						
						1	<u>100%</u> 0									
 - 10 -			fair RQD							-						
 						2	<u>100%</u> 67			-						
 - 15 -			good RQD							-						
						3	<u>100%</u> 82									
										-						
						4	<u>100%</u> 78									
- 25 -																
						5	84% 84									
- 30 -										-			Pa	age 1	of 2	
													Pa	ige 1	ot 2	


EXPLORATORY BORING LOG

BORING NO: KB-165.5B

New York

PRO		UMBER	20001480	LOGGED B	Y		J. ⁻	Fechel		COORDINATES	N E	1485 659	596. 319.3	.65 38	
	STAR	T DATE	12/05/2022	DRILLER/RIC	G Eri	ic /	Geor	orobe [·]		GROUND ELEV.		278	.0 ft		
	FINISI	H DATE	12/06/2022	DRILL CONTRACTO	DR		AI	DT Inc		HAMMER TYPE/EF	F.	Au	toma	atic	
Depth (ft)	Elevation (ft)	Graphic Log	Material De	escription	Sample Type	Core Run No.	Recovery % RQD	Pocket Pen. (tsf)	3low Counts (N Value)	Notes		Le SPT N MC (% PL & Fines	gend Value) LL (%) Conter	nt (%))
			SHALE, gray, good RQD)	Ű	0		_	ш		20	40	60		30
	243.0		Boring Terminated at 35f	t		6	<u>100%</u> 78								
- 50 - 															
- 60 -	1												Pac	ne 2	 of 2

KB-165.5B - Runs 1 through 4



KB-165.5B - Runs 5 through 6

		KB-165.5B Runs 5-6
a state of	Run Depth Rec ROD(1/2) . Run 5 25-30' 4.2' #8455	
	Run 6 30-35' 5' 784	G
CARCINE	and the state	TO REAL OF

		1		Sheet 2 of 2
DODINO			10/	
BORING ID	Depth (Ft.)		Vvater Content (%)	
KB-149.6	60-62		22.7	
KB-158.9	2-4		24.5	
KB-165.5A	2		13.6	
KB-165.5B	2-4		14.3	
ŝ				
AIEI				
-				
0				
р Ц				
9070				
787				
KD .				
000				
AAL				
PROJECT: I	_ab Testing			
	6			PROJECT NUMBER: JB215256H
SITE: Champlain to Hudsdon Power Express			llerracon	CLIENT: Kiewit Engineering (NY) Corp Lone Tree, CO
			30 Corporate Cir Ste 201 Albany, NY	
				EXHIBIT: B-2

Summary of Laboratory Results

GRAIN SIZE DISTRIBUTION





GRAIN SIZE DISTRIBUTION



30 Corporate Cir Ste 201 Albany, NY

GRAIN SIZE: USCS-2 JB215256H LAB TESTING GPJ TERRACON_DATATEMPLATE GDT 1/19/23 REPORT. ORIGINAL SEPARATED FROM Щ TESTS ARE NOT VAL **ABORATORY**

EXHIBIT: B-10



Client

Kiewit Engineering Corp

Project

Lab Testing

Project No. JB215256H





SAMPLE LOCATION							
Site:	JB215256H						
Description:		Shale					
Boring:	KB-165.5A	Depth (feet):	34				
SPE	ECIMEN I	NFORMAT	ION				
Sample No.:	LAB 11456	Mass (g):	552.11				
ength (in.):	4.13	Diameter (in.):	1.96				
./D Ratio:	2.107	Density (pcf):	168.792				
	TEST F	RESULTS					
ailure Load (lbs):			52393				
ailure Strain (in/in):		0.048				
Jnconfined Compr	essive Strength (osi):	17,365				
Elastic Modulus, E, (ksi):			1409				
ime of Failure (min): 04:03							
ate of Loading (in/sec): 0.04							
Noisture Content P	ost-break:		1.30%				



Client		Project	
Kiewit Engineering Corp		Lab Testing	
		Project No.	JB215256H
Equipment:	TICCS ID:		
Calipers	W-44049		
Scale	B-71466		
Dial Indicator	C-70608		
Compression (spherically seated)	C-48999		

Samples were prepared and tested in accordance with ASTM D4543 and D7012. Deviations, if any, are noted below: Notes:

Per ASTM D4543, this specimen has not met the requirements for perpendicularity, by exceeding 0.250°. Per ASTM D4543, this specimen has not met the requirements for flatness, by exceeding 0.001 inches. Per ASTM D4543, this specimen has not met the requirements for parallelism, by exceeding 0.25°.

Per ASTM D4543, this specimen has not met the requirements for flatness, by exceeding 0.001 inches.

Per ASTM D4543 and ASTM D7012, the desired specimen length to diameter are between 2.0:1 and 2.5:1. According to ASTM D7012 Section 8.2.1, this specimen, although not meeting all requirements of ASTM D4543 is acceptable for testing. However, the results reported may differ from results obtained from a test specimen that meets the requirements of D4543.

Appendix D

Sheets Added

Appendix to EM&CP Appendix J HDD Design Summary Report

Appendix D

BoreAid HDD Simulation Output



Generated Output

1

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

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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 HDD 57B
	P4A
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	СНА
Designer:	KDL
	СНА
Description:	HDD 57B 10-inch DR9 Conduit-1

Input Summary

Start Coordinate	(0.00, 0.00, 279.95) ft
End Coordinate	(1985.00, 0.00, 273.93) ft
Project Length	1985.00 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: 5

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

Soil Layer #2 USCS, Sand (S), SM From Assistant Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3] Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

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

Soil Layer #4 USCS, Gravel (G), GP From Assistant Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3] Phi: 37.00, S.M.: 1000.00, Coh: 0.00 [psi]

Soil Layer #5 Rock, Geological Classification, Sedimentary Rocks From Assistant Unit Weight: 160.0000 (dry), 170.0000 (sat) [lb/ft3] Phi: 37.00, S.M.: 2000.00, Coh: 3000.00 [psi]

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Bore Cross-Section View



Bore Plan View



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Load Verifier Input Summary:

Pipe Application: Electrical Cable Pipe Type: HDPE Classification: IPS Pipe OD: 10" (10.75") Pipe DR: 9 Pipe Length: 2025.00 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: 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: 93.64118 lb/ft3 Hydrokinetic Pressure: 10 psi Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	6.3	29.7
Water Pressure	10.0	10.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	16.3	39.6
Deflection		
Earth Load Deflection	1.721	8.076
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.853	8.208
Compressive Stress [psi]		
Compressive Wall Stress	73.3	178.3

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	34133.2	34133.2
Pullback Stress [psi]	951.9	951.9
Pullback Strain	1.656E-2	1.656E-2
Bending Stress [psi]	0.0	21.5
Bending Strain	0	3.733E-4
Tensile Stress [psi]	951.9	966.9
Tensile Strain	1.656E-2	1.714E-2

Net External Pressure = 23.6 [psi] Buoyant Deflection = 0.1 Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.853	7.5	4.0	OK
Unconstrained Collapse [psi]	23.4	117.0	5.0	OK
Compressive Wall Stress [psi]	73.3	1150.0	15.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	33.3	193.9	5.8	OK
Tensile Stress [psi]	966.9	1200.0	1.2	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	1968.475 psi	2014. 8 44 psi
1	8.00 in	12.00 in	1967.716 psi	2014.440 psi
2	12.00 in	16.13 in	1966.616 psi	2013.854 psi

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

Estimated Circulating Pressure Summary

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

Flow Rate (Q): 40.00 US (liquid) gallon/min
Drill Fluid Density: 68.700 lb/ft3
Rheological model: Bingham-Plastic
Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1202.0

Virtual Site







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Generated Output

1

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	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	СНА
Designer:	KDL
	СНА
Description:	HDD 57B 2-inch DR9 Conduit-1

Input Summary

Start Coordinate	(0.00, 0.00, 279.95) ft
End Coordinate	(1985.00, 0.00, 273.93) ft
Project Length	1985.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Load Verifier Input Summary:

Pipe Application: Electrical Cable Pipe Type: HDPE Classification: IPS Pipe OD: 2" (2.375") Pipe DR: 9 Pipe Length: 2025.00 ft Internal Pressure: 0 psi Borehole Diameter: 0.531000018119812 ft Silo Width: 0.531000018119812 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: 93.64118 lb/ft3 Hydrokinetic Pressure: 10 psi Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	2.6	29.7
Water Pressure	10.0	10.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	12.5	39.6
Deflection		
Earth Load Deflection	0.734	8.076
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.763	8.105
Compressive Stress [psi]		
Compressive Wall Stress	56.4	178.3

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1775.6	1775.6
Pullback Stress [psi]	1014.5	1014.5
Pullback Strain	1.764E-2	1.764E-2
Bending Stress [psi]	0.0	4.7
Bending Strain	0	8.247E-5
Tensile Stress [psi]	1014.5	1015.2
Tensile Strain	1.764E-2	1.773E-2

Net External Pressure = 23.6 [psi] Buoyant Deflection = 0.0 Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.763	7.5	9.8	OK
Unconstrained Collapse [psi]	23.4	129.4	5.5	OK
Compressive Wall Stress [psi]	56.4	1150.0	20.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	33.3	190.7	5.7	OK
Tensile Stress [psi]	1015.2	1200.0	1.2	OK



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Project Summary

General:	CHPE HDD 57B
	P4A
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	СНА
Designer:	KDL
	СНА
Description:	HDD 57B 10-inch DR9 Conduit-2

Input Summary

Start Coordinate	(0.00, 0.00, 279.20) ft
End Coordinate	(1978.16, 0.00, 274.00) ft
Project Length	1978.16 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: 5

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

Soil Layer #2 USCS, Sand (S), SM From Assistant Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3] Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

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

Soil Layer #4 USCS, Gravel (G), GP From Assistant Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3] Phi: 37.00, S.M.: 1000.00, Coh: 0.00 [psi]

Soil Layer #5 Rock, Geological Classification, Sedimentary Rocks From Assistant Unit Weight: 160.0000 (dry), 170.0000 (sat) [lb/ft3] Phi: 37.00, S.M.: 2000.00, Coh: 3000.00 [psi]

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Bore Plan View



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Load Verifier Input Summary:

Pipe Application: Electrical Cable Pipe Type: HDPE Classification: IPS Pipe OD: 10" (10.75") Pipe DR: 9 Pipe Length: 2010.00 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: 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: 93.64118 lb/ft3 Hydrokinetic Pressure: 10 psi Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	6.3	31.8
Water Pressure	10.0	10.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	16.3	41.8
Deflection		
Earth Load Deflection	1.727	8.663
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.859	8.795
Compressive Stress [psi]		
Compressive Wall Stress	73.4	188.0

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	33801.3	33801.3
Pullback Stress [psi]	942.7	942.7
Pullback Strain	1.639E-2	1.639E-2
Bending Stress [psi]	0.0	21.5
Bending Strain	0	3.733E - 4
Tensile Stress [psi]	942.7	956.4
Tensile Strain	1.639E-2	1.695E-2

Net External Pressure = 22.2 [psi] Buoyant Deflection = 0.1 Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.859	7.5	4.0	OK
Unconstrained Collapse [psi]	22.9	116.9	5.1	OK
Compressive Wall Stress [psi]	73.4	1150.0	15.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	32.9	194.7	5.9	OK
Tensile Stress [psi]	956.4	1200.0	1.3	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	1972.691 psi	2016. 88 7 psi
1	8.00 in	12.00 in	1971.960 psi	2016.529 psi
2	12.00 in	16.13 in	1970.899 psi	2016.010 psi

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

Estimated Circulating Pressure Summary

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

Flow Rate (Q): 40.00 US (liquid) gallon/min
Drill Fluid Density: 68.700 lb/ft3
Rheological model: Bingham-Plastic
Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1202.0

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- Allowable (Avg.) -- Allowable (Local) - Friction Loss - Static - Circulating



Generated Output

1

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 57B
	P4A
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	СНА
Designer:	KDL
	СНА
Description:	HDD 57B 2-inch DR9 Conduit-2

Input Summary

Start Coordinate	(0.00, 0.00, 279.20) ft
End Coordinate	(1978.16, 0.00, 274.00) ft
Project Length	1978.16 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Load Verifier Input Summary:

Pipe Application: Electrical Cable Pipe Type: HDPE Classification: IPS Pipe OD: 2" (2.375") Pipe DR: 9 Pipe Length: 2010.00 ft Internal Pressure: 0 psi Borehole Diameter: 0.531000018119812 ft Silo Width: 0.531000018119812 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: 93.64118 lb/ft3 Hydrokinetic Pressure: 10 psi Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	2.6	31.8
Water Pressure	10.0	10.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	12.5	41.8
Deflection		
Earth Load Deflection	0.738	8.663
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.767	8.692
Compressive Stress [psi]		
Compressive Wall Stress	56.5	188.0

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1759.4	1759.4
Pullback Stress [psi]	1005.3	1005.3
Pullback Strain	1.748E-2	1.748E-2
Bending Stress [psi]	0.0	4.7
Bending Strain	0	8.247E-5
Tensile Stress [psi]	1005.3	1005.3
Tensile Strain	1.748E-2	1.754E-2

Net External Pressure = 22.2 [psi] Buoyant Deflection = 0.0 Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.767	7.5	9.8	OK
Unconstrained Collapse [psi]	22.9	129.3	5.7	OK
Compressive Wall Stress [psi]	56.5	1150.0	20.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	32.9	191.5	5.8	OK
Tensile Stress [psi]	1005.3	1200.0	1.2	OK

Appendix E

Sheets Added

Appendix to EM&CP Appendix J HDD Design Summary Report

Appendix E

HDD Design Drawings



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50/5"	- 265	110	OL OL/OH	ORGANIC Lean CLAY ORGANIC SOIL	
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	- 260		Rock	Rock	
0%/96%	- 255	(7.)	SC	CLAYEY SAND	
0% /0.6%		1911	SC-SM	SILT, CLAYEY SAND	
0%/96%	- 250		SHALE	Siltstone	
3%/97%	245		SM	SILTY SAND	
	243	111	SP SP-SC	Poorly Graded SAND Poorly Graded SAND with CLAY	
3%/93%	- 240		SP-SM	Poorly Graded SAND with SILT	
0%/98%		<u> </u>	SW SW-SC	Well graded SAND	
	- 235		SW-SM	Well Graded SAND with SILT	
	230		Topsoil	Topsoil Gravel or Conglamerate 1	
23+00	23+50		USGS 654	Subgraywacke	
			USGS 670	Interbedded Sandstone and Shale	
		2777	USGS 702 USGS 705	Quartzite Schist	
			USGS 705	Schist	
BORING LOG STRI	P LEGEND		USGS 708 USGS 708	Gneiss	
		<u>-</u>	USGS 718	Granite 1	
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		CUNCRETE	Concrete
	2.2	Fill	Fill
	90	60	CLATET GRAVEL
	90	GC-GM	SILTE CLATET GRAVEL
	00	GM	SILTY GRAVEL
295	00	GP	Poorly Graded GRAVEL
205	20	GP-GC	Poorly Gladed Graver with CEAT
	90	GP-GM	
280		GW 00	Well Graded GRAVEL
		GW-GC	well Graded GRAVEL with CLAY
275		GW-GM	Well Graded GRAVEL with SILT
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	110	OL/OH	ORGANIC SOIL
260	<u> (17</u>	PT	PEAT
200		Rock	Rock
		Sandstone	Sandstone
255	: Z/	SC	CLAYEY SAND
	1914	SC-SM	SILT, CLAYEY SAND
- 250		SHALE	Shale
		SILTSTONE	Siltstone
245		SM	SILTY SAND
243		SP	Poorly Graded SAND
	1.7.1	SP-SC	Poorly Graded SAND with CLAY
240		SP-SM	Poorly Graded SAND with SILT
	<u>.</u>	SW	Well graded SAND
235	- /· ^	SW-SC	Well Graded SAND with CLAY
		SW-SM	Well Graded SAND with SILT
		Topsoil	Topsoil
23+000		USGS 601	Gravel or Conglomerate 1
		USGS 654	Subgraywacke
		USGS 670	Interbedded Sandstone and Shale
		USGS 702	Quartzite
	M	USGS 705	Schist
		USGS 705	Schist
BORING LOG STRIP LEGEND	2	USGS 708	Gneiss
<u>B101</u>		USGS 708	Gneiss
[//]	1-1	USGS 718	Granite 1
ver 6" = 10-10-10		Void	Void
QD % = 95%/90%		Water	Water
	1233	Weathered Rock	Undefined
2D strip logs shown at 10x exaggeration	Y	Water Table	Water Table during drilling
3D strip logs have no exaggeration	V	Delayed Water Table	Water Table after drilling
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CHPE LLC 623 Fifth Avenue, 20th Floor New York, NY 10022

Segment 6 (Package 4A) EM&CP Appendix J2 HDD Inadvertent Release Contingency Plan Additions for HDD 57B



UPDATES TO Inadvertent Release Contingency Plan For Horizontal Directional Drilling in Segment 6 – Package 4A

For HDD 57B For Design Rev. #1 || *Design Rev. Date: 12/20/2023*

Ballston Spa to Glenville Saratoga & Schenectady 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

December 2023

1.0 INTRODUCTION

Revised Text

This Inadvertent Release Contingency Plan (IRCP) is for Segment 6 – Package 4A which includes *ten* HDD crossings labeled HDD 51 through HDD 61.

9.0 CROSSING SPECIFIC DISCUSSION Text Added

HDD CROSSING #57B

HDD #57B consists of two HDD bores located west of the CP Railroad Canadian Mainline, north of the Ballston Lake. The bores are approximately 1985 feet and 1978 feet long as shown in Appendix B. The HDD bores will pass approximately 16-23 feet below the estimated mudline of a pond (assuming a 5' water depth). The ground surface elevation at entry and exit of bore alignment is at approximately El. 279 and El. 274, while most of the run it undulates between El. 275 to El. 280 and dipping down to El. 272 near water level (reference datum NAVD 1988).

Portions of the work zones on both side of the bores are proposed to minorly impact NY designated wetlands. 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 #57B:</u> Based on the layering observed in the three borings conducted along the alignment, the soil profile for the HDD #57B BoreAid analysis will consist of five (5) layers: loose fill (SM), medium dense silty sand (SM), soft low plasticity clay (CL), very dense weathered rock (GP) and shale bedrock. The soil profiles used for BoreAid analyses for the HDD in this segment are presented in Appendix A.

Specific design considerations for HDD #57B include:

Depth of cover during profile design (based on soil borings) to limit the potential inadvertent break through to the road, railroad, or ground surface. General depth of cover under the estimated mudline of the pond (assuming a 5' water depth) is 16-23 feet. Preliminary analysis of the bore, assuming typical drilling methods, indicates that the lowest maximum allowable pressure capacity in the middle of the bore is approximately 1500 psi, Conduit 2and the total circulating pressure estimated to occur in the middle portion of the bore is approximately 38 psi assuming standard HDD drilling methods. In the remainder of the bore the maximum allowable pressure and the approximately 0 to 1930 psi and the approximate applied slurry pressure during drilling ranges from 0 to 56 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 inadvertent releases in the last 15 ft of Conduit-1 & 2 near exit pit exist. These should be relatively easy to control through the use of conductive conduits, straw bales, silt fences, erosion control measures and vacuum trucks.
- Due to work zones being located within wetlands, measures to mitigate the potential inadvertent release are required:
 - Barriers to contain the releases to the ground surface, railroad surface and provisions to clean it up (such as use of a vacuum truck).
 - In addition, down the hole slurry pressure monitoring and/or conductor casings may be implemented to limit the potential for releases depending on the details of the HDD Subcontractor's selected means and methods.
- Generally, for the formation of inadvertent releases, the more critical stage of the HDD process tends to be during the initial pilot hole drilling when the annular space between the bore sidewall and the drill string is the smallest.
- Adjusting the drill alignment to miss existing infrastructure including existing utilities, and other obstacles,
- Establishing a drill alignment line that allows for gradual angular changes to minimize pressure build-up,
- Requiring drilling fluid composition and drilling procedures that minimize drilling fluid pressures,
- Requiring drilling fluids that adequately address site-specific drilling concerns while posing the least threat to the environment,
- Requiring monitoring and controlling drilling fluid pressures with down-the-hole sensors during pilot hole drilling.

Appendix A

Sheets Added

Appendix to EM&CP Appendix J2 HDD Inadvertent Release Contingency Plan

Appendix A

BoreAid HDD Simulation Output



Generated Output

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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 57B
	P4A
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	СНА
Designer:	KDL
	СНА
Description:	HDD 57B 10-inch DR9 Conduit-1

Input Summary

Start Coordinate	(0.00, 0.00, 279.95) ft
End Coordinate	(1985.00, 0.00, 273.93) ft
Project Length	1985.00 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: 5

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

Soil Layer #2 USCS, Sand (S), SM From Assistant Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3] Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

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

Soil Layer #4 USCS, Gravel (G), GP From Assistant Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3] Phi: 37.00, S.M.: 1000.00, Coh: 0.00 [psi]

Soil Layer #5 Rock, Geological Classification, Sedimentary Rocks From Assistant Unit Weight: 160.0000 (dry), 170.0000 (sat) [lb/ft3] Phi: 37.00, S.M.: 2000.00, Coh: 3000.00 [psi]

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Bore Cross-Section View



Bore Plan View



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Load Verifier Input Summary:

Pipe Application: Electrical Cable Pipe Type: HDPE Classification: IPS Pipe OD: 10" (10.75") Pipe DR: 9 Pipe Length: 2025.00 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: 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: 93.64118 lb/ft3 Hydrokinetic Pressure: 10 psi Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	6.3	29.7
Water Pressure	10.0	10.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	16.3	39.6
Deflection		
Earth Load Deflection	1.721	8.076
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.853	8.208
Compressive Stress [psi]		
Compressive Wall Stress	73.3	178.3

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	34133.2	34133.2
Pullback Stress [psi]	951.9	951.9
Pullback Strain	1.656E-2	1.656E-2
Bending Stress [psi]	0.0	21.5
Bending Strain	0	3.733E-4
Tensile Stress [psi]	951.9	966.9
Tensile Strain	1.656E-2	1.714E-2

Net External Pressure = 23.6 [psi] Buoyant Deflection = 0.1 Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.853	7.5	4.0	OK
Unconstrained Collapse [psi]	23.4	117.0	5.0	OK
Compressive Wall Stress [psi]	73.3	1150.0	15.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	33.3	193.9	5.8	OK
Tensile Stress [psi]	966.9	1200.0	1.2	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	1968.475 psi	2014. 8 44 psi
1	8.00 in	12.00 in	1967.716 psi	2014.440 psi
2	12.00 in	16.13 in	1966.616 psi	2013.854 psi

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

Estimated Circulating Pressure Summary

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

Flow Rate (Q): 40.00 US (liquid) gallon/min
Drill Fluid Density: 68.700 lb/ft3
Rheological model: Bingham-Plastic
Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1202.0

Virtual Site





















Generated Output

1

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Project Summary

General:	CHPE HDD 57B
	P4A
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	СНА
Designer:	KDL
	СНА
Description:	HDD 57B 2-inch DR9 Conduit-1

Input Summary

Start Coordinate	(0.00, 0.00, 279.95) ft
End Coordinate	(1985.00, 0.00, 273.93) ft
Project Length	1985.00 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Load Verifier Input Summary:

Pipe Application: Electrical Cable Pipe Type: HDPE Classification: IPS Pipe OD: 2" (2.375") Pipe DR: 9 Pipe Length: 2025.00 ft Internal Pressure: 0 psi Borehole Diameter: 0.531000018119812 ft Silo Width: 0.531000018119812 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: 93.64118 lb/ft3 Hydrokinetic Pressure: 10 psi Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	2.6	29.7
Water Pressure	10.0	10.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	12.5	39.6
Deflection		
Earth Load Deflection	0.734	8.076
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.763	8.105
Compressive Stress [psi]		
Compressive Wall Stress	56.4	178.3

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1775.6	1775.6
Pullback Stress [psi]	1014.5	1014.5
Pullback Strain	1.764E-2	1.764E-2
Bending Stress [psi]	0.0	4.7
Bending Strain	0	8.247E-5
Tensile Stress [psi]	1014.5	1015.2
Tensile Strain	1.764E-2	1.773E-2

Net External Pressure = 23.6 [psi] Buoyant Deflection = 0.0 Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.763	7.5	9.8	OK
Unconstrained Collapse [psi]	23.4	129.4	5.5	OK
Compressive Wall Stress [psi]	56.4	1150.0	20.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	33.3	190.7	5.7	OK
Tensile Stress [psi]	1015.2	1200.0	1.2	OK



Generated Output

1

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Project Summary

General:	CHPE HDD 57B
	P4A
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	СНА
Designer:	KDL
	СНА
Description:	HDD 57B 10-inch DR9 Conduit-2

Input Summary

Start Coordinate	(0.00, 0.00, 279.20) ft
End Coordinate	(1978.16, 0.00, 274.00) ft
Project Length	1978.16 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: 5

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

Soil Layer #2 USCS, Sand (S), SM From Assistant Unit Weight: 110.0000 (dry), 125.0000 (sat) [lb/ft3] Phi: 34.00, S.M.: 500.00, Coh: 0.00 [psi]

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

Soil Layer #4 USCS, Gravel (G), GP From Assistant Unit Weight: 120.0000 (dry), 140.0000 (sat) [lb/ft3] Phi: 37.00, S.M.: 1000.00, Coh: 0.00 [psi]

Soil Layer #5 Rock, Geological Classification, Sedimentary Rocks From Assistant Unit Weight: 160.0000 (dry), 170.0000 (sat) [lb/ft3] Phi: 37.00, S.M.: 2000.00, Coh: 3000.00 [psi]

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Bore Plan View



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Load Verifier Input Summary:

Pipe Application: Electrical Cable Pipe Type: HDPE Classification: IPS Pipe OD: 10" (10.75") Pipe DR: 9 Pipe Length: 2010.00 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: 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: 93.64118 lb/ft3 Hydrokinetic Pressure: 10 psi Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	6.3	31.8
Water Pressure	10.0	10.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	16.3	41.8
Deflection		
Earth Load Deflection	1.727	8.663
Buoyant Deflection	0.132	0.132
Reissner Effect	0	0
Net Deflection	1.859	8.795
Compressive Stress [psi]		
Compressive Wall Stress	73.4	188.0

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	33801.3	33801.3
Pullback Stress [psi]	942.7	942.7
Pullback Strain	1.639E-2	1.639E-2
Bending Stress [psi]	0.0	21.5
Bending Strain	0	3.733E - 4
Tensile Stress [psi]	942.7	956.4
Tensile Strain	1.639E-2	1.695E-2

Net External Pressure = 22.2 [psi] Buoyant Deflection = 0.1 Hydrokinetic Force = 567.6 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	1.859	7.5	4.0	OK
Unconstrained Collapse [psi]	22.9	116.9	5.1	OK
Compressive Wall Stress [psi]	73.4	1150.0	15.7	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.065	7.5	115.8	OK
Unconstrained Collapse [psi]	32.9	194.7	5.9	OK
Tensile Stress [psi]	956.4	1200.0	1.3	OK

Maximum Allowable Bore Pressure Summary

Ream Number	Initial Diameter	Final Diameter	Estimated Maximum Pressure (Avg.)	Estimated Maximum Pressure (Local)
Pilot Bore	0.00 in	8.00 in	1972.691 psi	2016. 88 7 psi
1	8.00 in	12.00 in	1971.960 psi	2016.529 psi
2	12.00 in	16.13 in	1970.899 psi	2016.010 psi

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

Estimated Circulating Pressure Summary

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

Flow Rate (Q): 40.00 US (liquid) gallon/min
Drill Fluid Density: 68.700 lb/ft3
Rheological model: Bingham-Plastic
Plastic Viscosity (PV): 25.53

Yield Point (YP): 16.49

Effective Viscosity (cP): 1202.0

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- Allowable (Avg.) -- Allowable (Local) - Friction Loss - Static - Circulating



Generated Output

1

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Project Summary

General:	CHPE HDD 57B
	P4A
	Start Date: 12-10-2021
	End Date: 12-10-2021
Project Owner:	TDI
Project Contractor:	Kiewit
Project Consultant:	СНА
Designer:	KDL
	СНА
Description:	HDD 57B 2-inch DR9 Conduit-2
Input Summary

Start Coordinate	(0.00, 0.00, 279.20) ft
End Coordinate	(1978.16, 0.00, 274.00) ft
Project Length	1978.16 ft
Pipe Type	HDPE
OD Classification	IPS
Pipe OD	2.375 in
Pipe DR	9.0
Pipe Thickness	0.26 in
Rod Length	15.00 ft
Rod Diameter	3.5 in
Drill Rig Location	(0.00, 0.00, 0.00) ft

Load Verifier Input Summary:

Pipe Application: Electrical Cable Pipe Type: HDPE Classification: IPS Pipe OD: 2" (2.375") Pipe DR: 9 Pipe Length: 2010.00 ft Internal Pressure: 0 psi Borehole Diameter: 0.531000018119812 ft Silo Width: 0.531000018119812 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: 93.64118 lb/ft3 Hydrokinetic Pressure: 10 psi Ballast Unit Weight: 62.42746 lb/ft3

In-service Load Summary:

Pressure [psi]	Deformed	Collapsed
Earth Pressure	2.6	31.8
Water Pressure	10.0	10.0
Surface Surcharge	0.0	0.0
Internal Pressure	0.0	0.0
Net Pressure	12.5	41.8
Deflection		
Earth Load Deflection	0.738	8.663
Buoyant Deflection	0.029	0.029
Reissner Effect	0	0
Net Deflection	0.767	8.692
Compressive Stress [psi]		
Compressive Wall Stress	56.5	188.0

Installation Load Summary:

Forces/Stresses	@Maximum Force	Absolute Maximum
Pullback Force [lb]	1759.4	1759.4
Pullback Stress [psi]	1005.3	1005.3
Pullback Strain	1.748E-2	1.748E-2
Bending Stress [psi]	0.0	4.7
Bending Strain	0	8.247E-5
Tensile Stress [psi]	1005.3	1005.3
Tensile Strain	1.748E-2	1.754E-2

Net External Pressure = 22.2 [psi] Buoyant Deflection = 0.0 Hydrokinetic Force = 137.3 lb

In-service Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.767	7.5	9.8	OK
Unconstrained Collapse [psi]	22.9	129.3	5.7	OK
Compressive Wall Stress [psi]	56.5	1150.0	20.4	OK

Installation Analysis

	Calculated	Allowable	Factor of Safety	Check
Deflection [%]	0.014	7.5	524.3	OK
Unconstrained Collapse [psi]	32.9	191.5	5.8	OK
Tensile Stress [psi]	1005.3	1200.0	1.2	OK

Appendix **B**

Sheets Added

Appendix to EM&CP Appendix J2 HDD Inadvertent Release Contingency Plan

Appendix B

HDD Design Drawings



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ASPHALT Aspholt 	Boulder Boulder Boulder Boulder GH GH Fot CLAY GH GL	A CL-MAN CL-ML CL-ML CL-ML CL-ML SILTY CLAY CL-ML SILTY CLAY CONCRETE CONCRET	ASPHALT Asphalt 	Rock Rock	
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ASPHALT Aspholt - Bedrock Bedrock - Boulder Boulder - Bedrock Bedrock - Boulder - Bedrock Bedrock - Boulder - Bedrock Bedrock - Boulder - Bedrock Bedrock - Boulder - Bedrock Bedrock - CL - Leon CLAY - CL-ML - SILTY CLAY - CL-ML - SILTY CLAY - CONCRETE - Concrete - Fill - Fill - Fill - Fill - Fill - Fill - Ge-GC - Ge-GC - Ge-GC - Poorly Groded GRAVEL - GW-GC - Weil Groded GRAVEL - GW-GC - Weil Groded GRAVEL - GW-GC - Weil Groded GRAVEL - GW-GC - Weil Groded GRAVEL - GW-GC - GW-GC	Boulder Boulder Boulder Boulder GH Fot CLAY GL	SLIT Fot CLAY CL-ML SLIT Fot CLAY CL-ML SLITY CLAY CL-ML SLITY CLAY CONCRETE Concrete Fill Fill GC CLATE GRAVEL GC CLA	ASPHALT Asphalt 		
ASPHALT Asphalt Asphalt Asphalt Bedrock Bedrock Golder Boulder Boulder Boulder Boulder CH-MH SILTY CLAY CL Lean CLAY CL-ML SILTY CLAY CL-ML SILTY CLAY CONCRETE Concrete Fill Fill Fill GO GC CLAYEY GRAVEL GC-GM SILTY CLAYEY GRAVEL GP-CC Poorly Graded GRAVEL CP-CC Poorly Graded GRAVEL CP-CM Well Graded GRAVEL GW-GM Well Graded GRAVEL GW-GM Well Graded GRAVEL GW-GM Well Graded GRAVEL	Boulder Boulder CH Fot CLAY CH-MH SILTY Fat CLAY CL-ML SILTY CLAY CONCRETE Concrete Fill Fill COL CONCRETE CONCRETE Concrete GC CLAYEY GRAVEL GC CLAYEY GRAVEL GC CLAYEY GRAVEL GP Poorly Graded GRAVEL GP-CC Poorly Graded GRAVEL GW Well Graded GRAVEL GW-GM Well Graded GRAVEL with SLT	A CL-MAN SILTY CLAY CL-ML SILTY CLAY CL-ML SILTY CLAY CL-ML SILTY CLAY CONCRETE Concrete Fill Fill CONCRETE Concrete CONCRETE Concrete Fill CONCRETE Concrete CONCRETE CON	ASPHALT Asphalt 	Limestone Limestone	
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ASPHALT Aspholt ASPHALT Aspholt Bedrock Bedrock Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder Boulder	Source Boulder Boulder CH Fot CLAY CH-MH SiLTY Fot CLAY CL-ML SiLTY CLAY CONCRETE Concrete Fill Fill CG CLAYEY GRAVEL CG CLAYEY GRAVEL CG CLAYEY GRAVEL CG GC CLAYEY GRAVEL CG GM SILTY GRAVEL CG CP-GC	SILTY CLAY CL-ML SILTY CLAY CL-ML SILTY CLAY CONCRETE Concrete Fill Fill GC GC CLAY GC	ASPHALT Asphalt 	GP-GM Poorly Graded GRAVEL with	SILT
ASPHALT Asphalt 	Boulder Boulder CH Fot CLAY CH-MH SiLTY Fot CLAY CL-ML SiLTY CLAY CONCRETE Concrete Fill CONCRETE Concrete Fill CONCRETE CONCRET	CL-ML SILTY CLAY CL-ML SILTY CLAY CL-ML SILTY CLAY CONCRETE Concrete Fil Fil GC GC CLAYEY GRAVEL GC GC CLAYEY GRAVEL GC GC GM SILTY CLAYEY GRAVEL GM SILTY GRAVEL P Poorty Conder (CRAYE) COM SILTY CLAYEY GRAVEL COM SILTY GRAVEL COM SI	ASPHALT Asphalt 		CLAY
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ASPHALT Aspholt Bedrock Bedrock Boulder Boulder CH Fot CLAY CH-MH SILTY Fat CLAY CL Lean CLAY CL-ML SILTY CLAY	Off Boulder Boulder CH Fot CLAY CH-MH SiLTY Fot CLAY CL Lean CLAY CL-ML SiLTY CLAY	Um-win SILTY Fot CLAY /// CL Lean CLAY /// CL-ML SILTY CLAY	ASPHALT Aspholt 	CONCRETE Concrete	
ASPHALT Asphalt 	Off Boulder Boulder CH Fot CLAY /// CH Fot CLAY /// CL Leon CLAY	CL Lean CLAY	ASPHALT Aspholt - Bedrock Bedrock """""" Boulder Boulder """" CH Fot CLAY /// CH-MH SILTY Fot CLAY //// CL Lean CLAY	CL-ML SILTY CLAY	
ASPHALT Aspholt Bedrock Bedrock Boulder Boulder	CH Fot CLAY		ASPHALT Aspholt - Bedrock Bedrock C ^{OV} Boulder Boulder OH Fot CLAY	CH-MH SILTY Fat CLAY	
ASPHALT Asphalt - Bedrock Bedrock Boulder Boulder	Boulder Boulder		ASPHALT Aspholt 		
ASPHALT Aspholt — Bedrock Bedrock		Boulder Boulder	ASPHALT Aspholt — Bedrock Bedrock	Boulder Boulder	
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5		2/\		Legend	
N- 8	}		ASPHALT	Asphalt	
an a	(ent)(ent)(ent)(ent)(ent)(ent)(ent)	··· Ø* ··	Bedrock Boulder	Bedrock Boulder	
			СН	Fat CLAY	
			CH-MH	SILTY Fat CLAY	
			CL-ML	SILTY CLAY	
			CONCRETE	Concrete	
		53	GC	CLAYEY GRAVEL	
		66	GC-GM	SILTY CLAYEY GRAVEL	
		50	GM GP	SILTY GRAVEL Poorly Graded GRAVEL	
	- 285	50	GP-GC	Poorly Graded Gravel with CLAY	
K−165.8 √: 273.1'		00	GP-GM GW	Poorly Graded GRAVEL with SILT	
	280		GW-GC	Well Graded GRAVEL with CLAY	
	- 275	20	GW-GM	Well Graded GRAVEL with SILT	
-1-1-1			MH	Elastic SILT	
-1-1-1	270		ML	SILT	
7-50/1"		<u></u>	OH OL	ORGANIC Fat CLAY ORGANIC Lean CLAY	
50/5"	265	110	OL/OH	ORGANIC SOIL	
2%/88%	260	<u></u>	PT	PEAT	
			Sandstone	Sandstone	
0%/96%	- 255	: /. :,	SC CH	CLAYEY SAND	
0%/96%	050		SC-SM SHALE	SILI, CLAYEY SAND Shale	
	250	X	SILTSTONE	Siltstone	
\$%/97%	- 245	1.1.1	SM SP	SILTY SAND Poorly Graded SAND	
8%/93%		17.1	SP-SC	Poorly Graded SAND with CLAY	
	- 240		SP-SM SW	Poorly Graded SAND with SILT Well graded SAND	
0%/98%	235	- /· ^	SW-SC	Well Graded SAND with CLAY	
	233		SW-SM Topsoil	Well Graded SAND with SILT	
23-00	23+50	\sim	USGS 601	Gravel or Conglomerate 1	
20100	20100		USGS 654	Subgraywacke	
			USGS 870	Quartzite	
			USGS 705	Schist	
BORING LOG STR			USGS 705 USGS 708	Schist Gneiss	
<u></u>			USGS 708	Gneiss	
per 6" = 10-10-10		1-Y	USGS 718 Void	Granite 1 Voiri	
QD % = 95%/90%11	1000psi =UCS		Water	Water	
		<u> 10 80</u>	Weathered Rock	Undefined	
2D strip logs shown at 10 3D strip logs have no es)x exaggeration xaggeration	× ▼	water Table Delayed Water Table	Water Table after drilling	
				PERMIT DRAWING NO.	_
	JSON POW			00	
o (PACKAGE 4	A) - CP: BALLS	SION T	U GLENV		
N AND PROF	ILE - HDD 57	B, CON	IDUIT 1	BRANKING NO.	
				DRAWING NO.	
				C-304R	1

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WIF-6-884



RK/LUNE			
			Legend
		ASPHALT	Asphalt
And the first set of the set of the set		Bedrock	Bedrock
	1111	Boulder	Boulder
		CH	Fat CLAY
		CH-MH	SILTY Fat CLAY
	444	CL	Lean CLAY
		CL-ML	SILIT GLAT
		CONCRETE	Concrete
	29.3	Fill	Fill
	90	60	CLATET GRAVEL
	90	GC-GM	SILTY CLATET GRAVEL
	00	GM GD	SILTY GRAVEL
295	00	GP	Poorly Graded GRAVEL
205	20	GP-GC	Poorly Graded Graver with CEAT
	00	GP-GM	Poorly or deed on Avel with sill
280		GW CO	Well Graded GRAVEL
		GW-GC	well Graded GRAVEL with CLAY
275		GW-GM	Well Graded GRAVEL with SILT
		Limestone	Limestone
		мн	Elastic SILT
270		ML	SILT
	N N	он	ORGANIC Fat CLAY
265		OL	ORGANIC Lean CLAY
	110	OL/OH	ORGANIC SOIL
260	<u> ~ //</u>	PT	PEAT
200		Rock	Rock
		Sandstone	Sandstone
255	<u>: 7</u>	SC	CLAYEY SAND
	1.91.5	SC-SM	SILT, CLAYEY SAND
- 250		SHALE	Shale
		SILTSTONE	Siltstone
245	111	SM	SILTY SAND
243		SP	Poorly Graded SAND
	. <i>4</i>	SP-SC	Poorly Graded SAND with CLAY
240		SP-SM	Poorly Graded SAND with SIL1
	<u>.</u>	SW	Well graded SAND
- 235	<u>^</u> /.*	SW-SC	Well Graded SAND with CLAY
		SW-SM	Well Graded SAND with SILT
070		Topsoil	Topsoil
23+00		USGS 601	Gravel or Conglomerate 1
		USGS 654	Subgraywacke
		USGS 670	Interbedded Sandstone and Shale
		USGS 702	Quartzite
	$M(\mathcal{N})$	USGS 705	Schist
		USGS 705	Schist
BORING LOG STRIP LEGEND		USGS 708	Gneiss
<u>B101</u>		USGS 708	Gneiss
1///	1-1	USGS 718	Granite 1
per 6" = 10-10-10		Void	Void
QD % = 95%/90%		Water	Water
	1285	Weathered Rock	Undefined
2D strip logs shown at 10x exaggeration	T	Water Table	Water Table during drilling
3D strip logs have no exaggeration	_ ∑	Delayed Water Table	Water Table after drilling
PLAIN HUDSON POW	FR F	XPRES	
PLAIN HUDSON POW 6 (PACKAGE 4A) - CP: BALLST			ILLE N/A
PLAIN HUDSON POW 6 (PACKAGE 4A) - CP: BALLST N AND PROFILE - HDD 57B	ER E ON T	XPRES 0 GLENV DUIT 2	ILLE N/A
PLAIN HUDSON POW 6 (PACKAGE 4A) - CP: BALLST N AND PROFILE - HDD 57B	ERE TONT , CON	XPRES 0 GLENV DUIT 2	SSILLE N/A DRAWING NO.



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