APPENDIX B

STORMWATER MANAGEMENT CALCULATIONS FOR THE PROPOSED METER STATION AND ACCESS ROAD

TABLE OF CONTENTS

POST CONSTRUCTION STORMWATER MANAGEMENT NARRATIVE

DUNKIRK PIPELINE PROJECT-
METER STATION AND ACCESS ROAD

CITY OF DUNKIRK, DUNKIRK AND POMFRET TOWNSHIPS, CHAUTAUQUA COUNTY, NEW YORK

1. INTRODUCTION

The Dunkirk Pipeline Project is located in the City of Dunkirk, Dunkirk and Pomfret Townships, Chautauqua County. The facility consists of a steel gathering line, a meter station and access road located just off Cummings Road (analyzed as Subarea 1).

2. PRE-DEVELOPMENT CONDITIONS

The pre-development site within the project area is generally a meadow condition and can be seen as such with aerial photography. Subarea Area "1" is comprised of the proposed access road and meter station off Cummings Road. The study area has been limited to the areas of proposed impervious cover and their related grading. Predominantly, the underlying site soils have a hydrologic soil group classification of 'C.'

3. POST-DEVELOPMENT CONDITIONS

The post-development condition analyzes the study area mentioned above, but now observing the impacts of the proposed gravel meter station and access road. An infiltration berm has been designed to control the increase in runoff from the additional gravel surface.

4. STORMWATER MANAGEMENT ANALYSIS

The runoff rate analysis was performed using the Rational Method utilizing *Hydraflow Hydrographs for AutoCAD, 2012* for the routing. The events analyzed in the predevelopment and developed condition include the 2, 10, 25, 50, and 100 year storm events.

The post-development condition was analyzed by separating the developed site (study area) into a "bypass" area and "captured" area the stormwater facility. The peak outflow of the stormwater facility was then combined to the peak outflow hydrograph of the "bypass" area to form a total composite post development flow.

The SCS Curve Number method was used for calculation of runoff volumes for the 2-Year, 24-hour storm.

4.1 Stormwater Facility Modifications

Site BMPs have been designed to manage both the 2-year through 100-year rate increase and the volume increase of the 2-Year 24-Hour rainfall. The soils were tested for infiltration using a double ring infiltrometer test and were found suitable for infiltration.

The Study Area 1 berm has the ability to treat 8,002cf of runoff, though it captures only 4,196cf of runoff. Taking credit for the lower of the treated and captured area, the entire Area "1" 2-Year volume increase of 3,393cf is managed.

Additionally, the basin has enough volume to completely store the 2 though 100-year storm without overtopping the spillway.

4.2 Conclusion

This Post Construction Management Plan illustrates the project controlling the release rate for the 2 through 100-Year storm events and the 2-Year volume increase.

A summary table has been included on the following page.

SUMMARY OF SITE RUNOFF

Project: Dunkirk Pipeline

Date :
Revised:

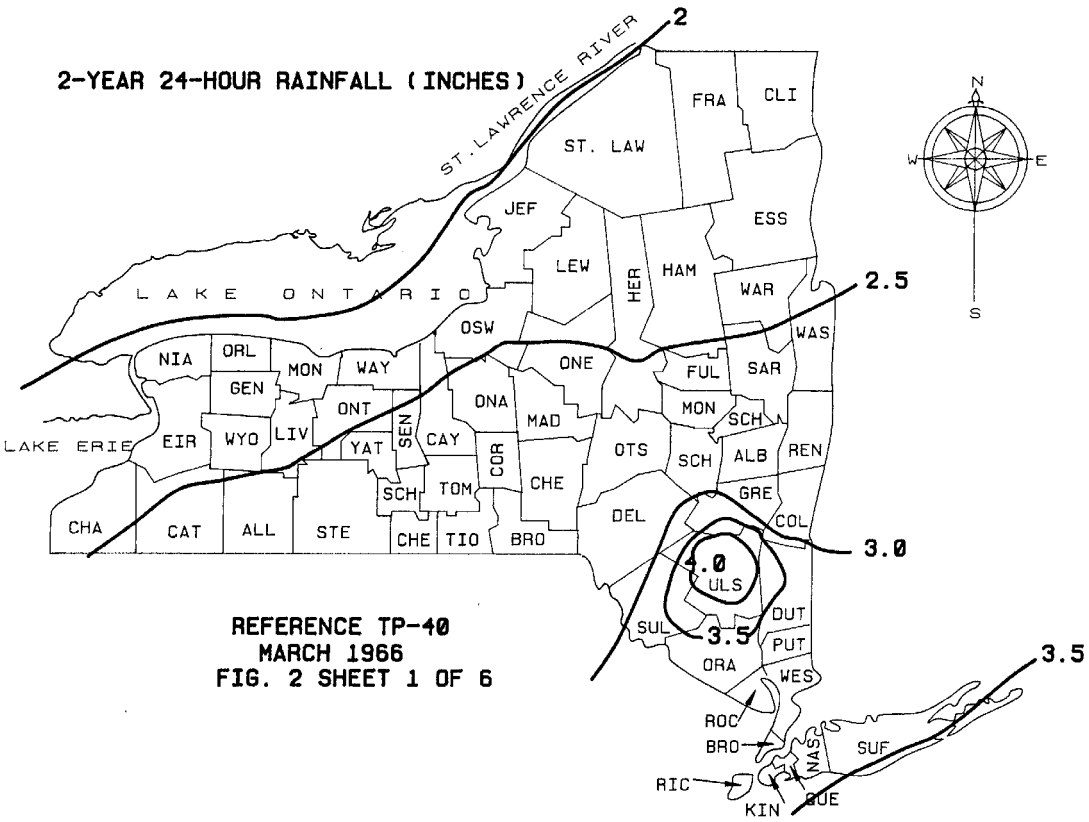
Location: City of Dunkirk, Dunkirk & Pomfret Townships

County: Chautauqua

	Peak Flows (CFS)					
	Storm Frequency (Years)					
	2	10	25	50	100	
Pre-Development Flow From-						
"Area 1"	2.29	3.11	4.40	4.88	5.36	
Allowable release rates	2.29	3.11	4.40	4.88	5.36	
Post-Development Flow From-						
Area 1 Bypass	0.64	0.87	1.17	1.30	1.43	
Infiltration Berm	0	0	0	0	0	
Total Post-Development Flow	0.64	0.87	1.17	1.30	1.43	
Net Increase Area 1	**-1.65**	**-2.24**	**-3.23**	**-3.58**	**-3.93**	

	2-Yr Volume (CF)	**2-Yr Volume (ac-ft)**
Pre-Development Area A	2842	0.0652
Post-Development Area A	2039	0.0468
Net Increase Area A	**-803**	-0.0184

Figure 4.7 2-Year Design Storm



CHANGE IN RUN OFF VOLUME FOR 2-YR STORM EVENT

PROJECT NAME:DUNKIRK PIPELINE PROJECT
LOCATION:
PREPARED BY: JER 12-Sep-14
CHECKED BY:
HEA PROJECT: NRG-1003.5B

Hanover
Engineering Associates Inc

SUBAREA 1

EXISTING CONDITIONS

STORM FREQUENCY:		2 YEAR						
RAINFALL AMOUNT (INCHES):		2.50						
COVER TYPE/CONDITION	SOIL TYPE	AREA (AC)	AREA (SF)	CN	S	Ia	Q (in)	Vol (CF)
IMPERVIOUS	C	0.00		98	0.20	0.04	2.27	0
GRAVEL/STONE	C	0.00	0	89	1.24	0.25	1.45	0
WOODED	C	0.00	0	70	4.29	0.86	0.46	0
MEADOW	C	1.59	69447	71	4.08	0.82	0.49	2842
TOTAL		1.59						2842

DEVELOPED CONDITIONS

STORM FREQUENCY:		2 YEAR						
RAINFALL AMOUNT (INCHES):		2.50						
COVER TYPE/CONDITION	SOIL TYPE	AREA (AC)	AREA (SF)	CN	S	Ia	Q (in)	Vol (CF)
IMPERVIOUS	C	0.00		98	0.20	0.04	2.27	0
GRAVEL/STONE	C	0.88	38493	89	1.24	0.25	1.45	4666
WOODED	C			70	4.29	0.86	0.21	0
MEADOW	C	0.00	0	71	4.08	0.82	0.49	0
LAWN	C	0.71	30954	74	3.51	0.70	0.61	1569
STONE ACCESS	C	0.00		74	3.51	0.70	0.61	0
TOTAL		1.59						6235

2 YEAR VOLUME INCREASE(CF)= 3393

2 YEAR VOLUME INFILTRATED (CF) = 4196

POST CONSTRUCTION 2 YEAR RUN OFF VOLUME WITH BMPs (CF) = 2039

NET CHANGE IN 2 YEAR RUN OFF VOLUME WITH BMPs (CF) = -803

INFILTRATION BERMS

Infiltration Volume	
Berm Height (ft) =	2
Ground Slope (ft/ft)=	0.05
Berm Length (ft)=	100
Infiltration Rate (in/hr)=	1
Infiltration Period (hr)=	24

Infiltration Area (IA)=W (at 1' Berm Height) x Berm Length

Where W= Berm Height/sin(arctan (Slope))

W= 20.02

IA= 2002.50

Infiltration Volume (cf) = IA x Rate x Period

Infiltration Volume (cf)= 4005.00

Storage Volume

Storage Volume= Area behind Berm x Berm Length

Storage Volume (cf)= 3996.67

Total Volume Credit= Storage Volume + Infiltration Volume

Total Volume Credit (cf) = 8001.66

CHANGE IN RUN OFF VOLUME FOR 2-YR STORM EVENT

PROJECT NAME:DUNKIRK PIPELINE PROJECT
LOCATION:
PREPARED BY: JER 12-Sep-14
CHECKED BY:
HEA PROJECT: NRG-1003.5B

Hanover
Engineering Associates Inc

Infiltration Berm Captured

DEVELOPED CONDITIONS

STORM FREQUENCY:		2 YEAR						
RAINFALL AMOUNT (INCHES):		2.50						
COVER TYPE/CONDITION	SOIL TYPE	AREA (AC)	AREA (SF)	CN	S	Ia	Q (in)	Vol (CF)
IMPERVIOUS	C	0.00	0	98	0.20	0.04	2.27	0
GRAVEL/STONE	C	0.55	24162	89	1.24	0.25	1.45	2929
WOODED	C			70	4.29	0.86	0.21	0
MEADOW	C	0.71	30954	71	4.08	0.82	0.49	1267
LAWN	C			74	3.51	0.70	0.61	0
STONE WELL PAD	C	0.00		74	3.51	0.70	0.61	0
TOTAL		1.27						4196

2 YEAR VOLUME CAPTURED(CF)= 4196

MAX TREATABLE VOLUME BY BMP = 8002

2 YEAR VOLUME CREDIT TAKEN FOR THIS BMP(CF) = 4196

RATIONAL METHOD - AREA COMPOSITE COEFFICIENTS

PRE-DEVELOPMENT SUMMARY

PROJECT: **Dunkirk Meter Station**
LOCATION:
COUNTY:

JOB #
DATE:
REVISED:

* RAINFALL REGION I

		LAND USE	AREAS (acres)													
						Gravel		Meadow, Lawn		Forest, Woods						
		SLOPES				6%+		6%+		6%+						
	SOIL GROUP					C		C		C				TOTAL	COMPOSITE C		TC
SUBAREAS	C	2-10 yr				0.43		0.32		0.29					2-10	25-100	
	COEFF.	25-100 yr				0.50		0.39		0.36				ACRES			Min.
Subarea 1								1.590						1.590	0.32	0.39	5
TOTAL								1.590						1.590	0.32	0.39	5

RATIONAL METHOD - AREA COMPOSITE COEFFICIENTS

POST-DEVELOPMENT SUMMARY

PROJECT: **Dunkirk Meter Station**
LOCATION:
COUNTY:

JOB #
DATE:
REVISED:

* RAINFALL REGION: I

		LAND USE			Gravel			Meadow, Lawn								
		SLOPES			6%+			6%+								
	SOIL GROUP				C			C						TOTAL	COMPOSITE C		TC
SUBAREAS	C	2-10 yr			0.43			0.32									
	COEFF.	25-100 yr			0.50			0.39						ACRES	2-10	25-100	Min.
Subarea 1 Capt					0.550			0.710						1.260	0.37	0.44	5
Subarea 1 Bypass					0.330									0.330	0.43	0.50	5
TOTAL					**0.880**			**0.710**						**1.590**	**0.38**	**0.45**	**5**

Pond No. 1 - Berm

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1526.25 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1526.25	00	0	0
1.00	1527.25	2,532	844	844
2.00	1528.25	5,148	3,763	4,607
3.75	1530.00	6,118	9,845	14,452

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	Inactive	Inactive
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 100.00	0.00	0.00	0.00
Crest El. (ft)	= 1528.25	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 1.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1526.25	---	---	---	---	0.00	---	---	---	0.000	---	0.000
0.10	84	1526.35	---	---	---	---	0.00	---	---	---	0.006	---	0.006
0.20	169	1526.45	---	---	---	---	0.00	---	---	---	0.012	---	0.012
0.30	253	1526.55	---	---	---	---	0.00	---	---	---	0.018	---	0.018
0.40	338	1526.65	---	---	---	---	0.00	---	---	---	0.023	---	0.023
0.50	422	1526.75	---	---	---	---	0.00	---	---	---	0.029	---	0.029
0.60	506	1526.85	---	---	---	---	0.00	---	---	---	0.035	---	0.035
0.70	591	1526.95	---	---	---	---	0.00	---	---	---	0.041	---	0.041
0.80	675	1527.05	---	---	---	---	0.00	---	---	---	0.047	---	0.047
0.90	760	1527.15	---	---	---	---	0.00	---	---	---	0.053	---	0.053
1.00	844	1527.25	---	---	---	---	0.00	---	---	---	0.059	---	0.059
1.10	1,220	1527.35	---	---	---	---	0.00	---	---	---	0.065	---	0.065
1.20	1,597	1527.45	---	---	---	---	0.00	---	---	---	0.071	---	0.071
1.30	1,973	1527.55	---	---	---	---	0.00	---	---	---	0.077	---	0.077
1.40	2,349	1527.65	---	---	---	---	0.00	---	---	---	0.083	---	0.083
1.50	2,725	1527.75	---	---	---	---	0.00	---	---	---	0.089	---	0.089
1.60	3,102	1527.85	---	---	---	---	0.00	---	---	---	0.095	---	0.095
1.70	3,478	1527.95	---	---	---	---	0.00	---	---	---	0.101	---	0.101
1.80	3,854	1528.05	---	---	---	---	0.00	---	---	---	0.107	---	0.107
1.90	4,231	1528.15	---	---	---	---	0.00	---	---	---	0.113	---	0.113
2.00	4,607	1528.25	---	---	---	---	0.00	---	---	---	0.119	---	0.119
2.17	5,591	1528.43	---	---	---	---	19.04	---	---	---	0.121	---	19.16
2.35	6,576	1528.60	---	---	---	---	53.83	---	---	---	0.124	---	53.95
2.53	7,560	1528.78	---	---	---	---	98.91	---	---	---	0.126	---	99.04
2.70	8,545	1528.95	---	---	---	---	152.26	---	---	---	0.128	---	152.38
2.88	9,529	1529.13	---	---	---	---	212.81	---	---	---	0.130	---	212.94
3.05	10,514	1529.30	---	---	---	---	279.76	---	---	---	0.133	---	279.89
3.22	11,498	1529.47	---	---	---	---	352.50	---	---	---	0.135	---	352.64
3.40	12,483	1529.65	---	---	---	---	430.70	---	---	---	0.137	---	430.84
3.58	13,467	1529.82	---	---	---	---	513.89	---	---	---	0.139	---	514.03
3.75	14,452	1530.00	---	---	---	---	601.91	---	---	---	0.142	---	602.05

Hydrograph Report

Hyd. No. 7

Routed Berm-2-10

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 2 yrs	Time to peak	= 88 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Post Cap 2-10	Reservoir name	= Berm
Max. Elevation	= 1526.98 ft	Max. Storage	= 616 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
2	0.839	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
3	1.258	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
88	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
91	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
96	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
156	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
255	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
256	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
264	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
326	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
334	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
337	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
341	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
344	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
349	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
353	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
356	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
359	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
370	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
388	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

419	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
426	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
427	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
439	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
444	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
447	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
465	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
491	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
494	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
498	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
499	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
504	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
517	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
519	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
520	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
522	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
524	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
528	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
530	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
544	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
546	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
556	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
562	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
564	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
566	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
579	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
582	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
583	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
586	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
590	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
594	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
596	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
603	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
605	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

611	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
617	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
628	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
639	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
654	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
661	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
663	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
677	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
682	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
691	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
699	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
708	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
720	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
739	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
743	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
751	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
753	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
756	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
758	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
759	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
760	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
761	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
762	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
763	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
768	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
772	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
773	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
779	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
784	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
786	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
787	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
792	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
796	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
800	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

804	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
805	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
815	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
827	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
835	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
837	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
839	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
847	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
873	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
876	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
877	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
894	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
904	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
908	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
909	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
910	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

...End

Hydrograph Report

Hyd. No. 7

Routed Berm-2-10

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 10 yrs	Time to peak	= 41 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Post Cap 2-10	Reservoir name	= Berm
Max. Elevation	= 1527.24 ft	Max. Storage	= 837 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
1	0.570	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
41	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
<<												
162	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
165	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
172	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
174	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
232	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
247	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
248	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
270	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
323	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
332	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
333	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
334	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
335	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
412	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
413	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
418	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
421	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
432	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

Continues on next page...

Routed Berm-2-10

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
433	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
444	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
500	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
502	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
505	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
506	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
507	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
521	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
567	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
568	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
569	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
570	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
577	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
578	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
583	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
584	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
593	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
611	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
615	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
616	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
619	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
636	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
637	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
646	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
655	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
657	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
659	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
661	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
663	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

667	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
668	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
677	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
678	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
683	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
687	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
695	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
696	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
709	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
710	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
730	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
737	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
749	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
755	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
760	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
765	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
778	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
788	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
791	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
814	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
825	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
827	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
831	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
832	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
835	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
836	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
845	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
850	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
851	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
853	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
857	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
859	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
861	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
867	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

869	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
872	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
878	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
883	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
885	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
897	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
898	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
901	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
903	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
908	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
910	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
912	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
917	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
921	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
931	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
946	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
953	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
956	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
964	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
965	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
970	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
978	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

...End

Hydrograph Report

Hyd. No. 8

Routed 25-100

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= 17 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 4 - Post Cap 25-100	Reservoir name	= Berm
Max. Elevation	= 1527.52 ft	Max. Storage	= 1,876 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
17	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
<<												
210	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
211	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
216	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
217	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
221	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
225	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
234	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
235	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
242	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
244	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
253	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
254	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
257	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
258	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
263	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
265	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
420	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
422	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
426	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
433	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

437	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
445	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
455	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
473	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
529	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
583	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
593	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
619	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
685	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
688	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
729	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
753	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
755	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
756	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
757	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
762	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
763	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

...End

Pond Report

Pond No. 1 - Berm

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1526.25 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1526.25	00	0	0
1.00	1527.25	2,532	844	844
2.00	1528.25	5,148	3,763	4,607
3.75	1530.00	6,118	9,845	14,452

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	Inactive	Inactive
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 100.00	0.00	0.00	0.00
Crest El. (ft)	= 1528.25	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 1.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1526.25	---	---	---	---	0.00	---	---	---	0.000	---	0.000
0.10	84	1526.35	---	---	---	---	0.00	---	---	---	0.006	---	0.006
0.20	169	1526.45	---	---	---	---	0.00	---	---	---	0.012	---	0.012
0.30	253	1526.55	---	---	---	---	0.00	---	---	---	0.018	---	0.018
0.40	338	1526.65	---	---	---	---	0.00	---	---	---	0.023	---	0.023
0.50	422	1526.75	---	---	---	---	0.00	---	---	---	0.029	---	0.029
0.60	506	1526.85	---	---	---	---	0.00	---	---	---	0.035	---	0.035
0.70	591	1526.95	---	---	---	---	0.00	---	---	---	0.041	---	0.041
0.80	675	1527.05	---	---	---	---	0.00	---	---	---	0.047	---	0.047
0.90	760	1527.15	---	---	---	---	0.00	---	---	---	0.053	---	0.053
1.00	844	1527.25	---	---	---	---	0.00	---	---	---	0.059	---	0.059
1.10	1,220	1527.35	---	---	---	---	0.00	---	---	---	0.065	---	0.065
1.20	1,597	1527.45	---	---	---	---	0.00	---	---	---	0.071	---	0.071
1.30	1,973	1527.55	---	---	---	---	0.00	---	---	---	0.077	---	0.077
1.40	2,349	1527.65	---	---	---	---	0.00	---	---	---	0.083	---	0.083
1.50	2,725	1527.75	---	---	---	---	0.00	---	---	---	0.089	---	0.089
1.60	3,102	1527.85	---	---	---	---	0.00	---	---	---	0.095	---	0.095
1.70	3,478	1527.95	---	---	---	---	0.00	---	---	---	0.101	---	0.101
1.80	3,854	1528.05	---	---	---	---	0.00	---	---	---	0.107	---	0.107
1.90	4,231	1528.15	---	---	---	---	0.00	---	---	---	0.113	---	0.113
2.00	4,607	1528.25	---	---	---	---	0.00	---	---	---	0.119	---	0.119
2.17	5,591	1528.43	---	---	---	---	19.04	---	---	---	0.121	---	19.16
2.35	6,576	1528.60	---	---	---	---	53.83	---	---	---	0.124	---	53.95
2.53	7,560	1528.78	---	---	---	---	98.91	---	---	---	0.126	---	99.04
2.70	8,545	1528.95	---	---	---	---	152.26	---	---	---	0.128	---	152.38
2.88	9,529	1529.13	---	---	---	---	212.81	---	---	---	0.130	---	212.94
3.05	10,514	1529.30	---	---	---	---	279.76	---	---	---	0.133	---	279.89
3.22	11,498	1529.47	---	---	---	---	352.50	---	---	---	0.135	---	352.64
3.40	12,483	1529.65	---	---	---	---	430.70	---	---	---	0.137	---	430.84
3.58	13,467	1529.82	---	---	---	---	513.89	---	---	---	0.139	---	514.03
3.75	14,452	1530.00	---	---	---	---	601.91	---	---	---	0.142	---	602.05

Hydrograph Report

Hyd. No. 8

Routed 25-100

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 50 yrs	Time to peak	= 251 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 4 - Post Cap 25-100	Reservoir name	= Berm
Max. Elevation	= 1527.58 ft	Max. Storage	= 2,083 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
251	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
252	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
259	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
273	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
274	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
284	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
291	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
300	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
305	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
308	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
310	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
311	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
312	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
465	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
467	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

471	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
478	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
576	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
630	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
654	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
661	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
738	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
771	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
796	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
803	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
809	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
810	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
820	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

...End

Hydrograph Report

Hyd. No. 8

Routed 25-100

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= 291 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 4 - Post Cap 25-100	Reservoir name	= Berm
Max. Elevation	= 1527.63 ft	Max. Storage	= 2,287 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
291	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
293	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
294	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
299	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
307	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
308	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
310	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
312	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
324	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
329	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
332	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
336	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
337	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
340	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<

345	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

<<

347	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
349	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
350	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
351	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
366	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
493	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
517	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
521	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
524	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
533	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
557	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
561	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
578	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
580	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
604	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
660	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
676	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
682	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
686	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
688	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
759	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
782	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
847	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

...End

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	3.609	1	5	1,083	------	------	------	Pre 2-10
2	Rational	4.398	1	5	1,319	------	------	------	Pre 25-100
3	Rational	3.307	1	5	992	------	------	------	Post Cap 2-10
4	Rational	6.345	1	5	1,904	------	------	------	Post Cap 25-100
5	Rational	1.006	1	5	302	------	------	------	Post Bypass 2-10
6	Rational	1.170	1	5	351	------	------	------	Post Bypass 25-100
7	Reservoir	0.000	1	10	0	3	1527.29	972	Routed Berm-2-10
8	Reservoir	0.000	1	17	0	4	1527.52	1,876	Routed 25-100

Hydrograph Report

Hyd. No. 1

Pre 2-10

Hydrograph type	= Rational	Peak discharge	= 3.609 cfs
Storm frequency	= 25 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 1,083 cuft
Drainage area	= 1.6 ac	Runoff coeff.	= 0.320
Intensity	= 7.093 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	0.722
2	1.444
3	2.165
4	2.887
5	3.609
6	2.887
7	2.165
8	1.444
9	0.722

<<

...End

Hydrograph Report

Hyd. No. 2

Pre 25-100

Hydrograph type	= Rational	Peak discharge	= 4.398 cfs
Storm frequency	= 25 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 1,319 cuft
Drainage area	= 1.6 ac	Runoff coeff.	= 0.390
Intensity	= 7.093 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	0.880
2	1.759
3	2.639
4	3.519
5	4.398
6	3.519
7	2.639
8	1.759
9	0.880

<<

...End

Hydrograph Report

Hyd. No. 3

Post Cap 2-10

Hydrograph type	= Rational	Peak discharge	= 3.307 cfs
Storm frequency	= 25 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 992 cuft
Drainage area	= 1.3 ac	Runoff coeff.	= 0.370
Intensity	= 7.093 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	0.661
2	1.323
3	1.984
4	2.645
5	3.307

<<

6	2.645
7	1.984
8	1.323
9	0.661

...End

Hydrograph Report

Hyd. No. 4

Post Cap 25-100

Hydrograph type	= Rational	Peak discharge	= 6.345 cfs
Storm frequency	= 25 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 1,904 cuft
Drainage area	= 1.3 ac	Runoff coeff.	= 0.710
Intensity	= 7.093 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	1.269
2	2.538
3	3.807
4	5.076
5	6.345
6	5.076
7	3.807
8	2.538
9	1.269

<<

...End

Hydrograph Report

Hyd. No. 5

Post Bypass 2-10

Hydrograph type	= Rational	Peak discharge	= 1.006 cfs
Storm frequency	= 25 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 302 cuft
Drainage area	= 0.3 ac	Runoff coeff.	= 0.430
Intensity	= 7.093 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	0.201
2	0.403
3	0.604
4	0.805
5	1.006
6	0.805
7	0.604
8	0.403
9	0.201

<<

...End

Hydrograph Report

Hyd. No. 6

Post Bypass 25-100

Hydrograph type	= Rational	Peak discharge	= 1.170 cfs
Storm frequency	= 25 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 351 cuft
Drainage area	= 0.3 ac	Runoff coeff.	= 0.500
Intensity	= 7.093 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	0.234
2	0.468
3	0.702
4	0.936
5	1.170
6	0.936
7	0.702
8	0.468
9	0.234

<<

...End

Hydrograph Report

Hyd. No. 7

Routed Berm-2-10

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= 10 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Post Cap 2-10	Reservoir name	= Berm
Max. Elevation	= 1527.29 ft	Max. Storage	= 972 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
10	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
11	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
15	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
18	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
19	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
26	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
39	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
42	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
45	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
53	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
179	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
197	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
199	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
201	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
202	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
204	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

Continues on next page...

Routed Berm-2-10

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
205	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
206	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
366	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
391	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
438	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
463	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
467	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
469	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
475	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
480	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
482	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
487	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
496	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
532	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
545	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
600	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
605	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
615	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
619	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
621	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
625	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
632	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
633	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
637	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
643	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
646	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
653	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
659	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
661	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

695	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
701	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
707	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
715	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
716	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
722	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
723	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
726	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
736	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
740	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
741	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
745	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
749	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
755	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
759	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
761	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
766	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
768	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
769	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
773	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
781	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
783	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
786	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
791	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
796	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
817	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
825	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
831	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
851	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
852	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
863	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
864	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
871	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
874	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

878	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
884	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
886	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
888	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
889	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
894	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
909	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
931	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
932	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
939	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
940	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
945	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
946	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
958	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
961	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
971	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
986	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
988	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
992	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
993	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
996	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
998	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1000	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

...End

Pond Report

Pond No. 1 - Berm

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1526.25 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1526.25	00	0	0
1.00	1527.25	2,532	844	844
2.00	1528.25	5,148	3,763	4,607
3.75	1530.00	6,118	9,845	14,452

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	Inactive	Inactive
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 100.00	0.00	0.00	0.00
Crest El. (ft)	= 1528.25	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 1.000 (by Contour)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1526.25	---	---	---	---	0.00	---	---	---	0.000	---	0.000
0.10	84	1526.35	---	---	---	---	0.00	---	---	---	0.006	---	0.006
0.20	169	1526.45	---	---	---	---	0.00	---	---	---	0.012	---	0.012
0.30	253	1526.55	---	---	---	---	0.00	---	---	---	0.018	---	0.018
0.40	338	1526.65	---	---	---	---	0.00	---	---	---	0.023	---	0.023
0.50	422	1526.75	---	---	---	---	0.00	---	---	---	0.029	---	0.029
0.60	506	1526.85	---	---	---	---	0.00	---	---	---	0.035	---	0.035
0.70	591	1526.95	---	---	---	---	0.00	---	---	---	0.041	---	0.041
0.80	675	1527.05	---	---	---	---	0.00	---	---	---	0.047	---	0.047
0.90	760	1527.15	---	---	---	---	0.00	---	---	---	0.053	---	0.053
1.00	844	1527.25	---	---	---	---	0.00	---	---	---	0.059	---	0.059
1.10	1,220	1527.35	---	---	---	---	0.00	---	---	---	0.065	---	0.065
1.20	1,597	1527.45	---	---	---	---	0.00	---	---	---	0.071	---	0.071
1.30	1,973	1527.55	---	---	---	---	0.00	---	---	---	0.077	---	0.077
1.40	2,349	1527.65	---	---	---	---	0.00	---	---	---	0.083	---	0.083
1.50	2,725	1527.75	---	---	---	---	0.00	---	---	---	0.089	---	0.089
1.60	3,102	1527.85	---	---	---	---	0.00	---	---	---	0.095	---	0.095
1.70	3,478	1527.95	---	---	---	---	0.00	---	---	---	0.101	---	0.101
1.80	3,854	1528.05	---	---	---	---	0.00	---	---	---	0.107	---	0.107
1.90	4,231	1528.15	---	---	---	---	0.00	---	---	---	0.113	---	0.113
2.00	4,607	1528.25	---	---	---	---	0.00	---	---	---	0.119	---	0.119
2.17	5,591	1528.43	---	---	---	---	19.04	---	---	---	0.121	---	19.16
2.35	6,576	1528.60	---	---	---	---	53.83	---	---	---	0.124	---	53.95
2.53	7,560	1528.78	---	---	---	---	98.91	---	---	---	0.126	---	99.04
2.70	8,545	1528.95	---	---	---	---	152.26	---	---	---	0.128	---	152.38
2.88	9,529	1529.13	---	---	---	---	212.81	---	---	---	0.130	---	212.94
3.05	10,514	1529.30	---	---	---	---	279.76	---	---	---	0.133	---	279.89
3.22	11,498	1529.47	---	---	---	---	352.50	---	---	---	0.135	---	352.64
3.40	12,483	1529.65	---	---	---	---	430.70	---	---	---	0.137	---	430.84
3.58	13,467	1529.82	---	---	---	---	513.89	---	---	---	0.139	---	514.03
3.75	14,452	1530.00	---	---	---	---	601.91	---	---	---	0.142	---	602.05

Hydrograph Report

Hyd. No. 8

Routed 25-100

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 25 yrs	Time to peak	= 17 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 4 - Post Cap 25-100	Reservoir name	= Berm
Max. Elevation	= 1527.52 ft	Max. Storage	= 1,876 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
17	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
210	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
211	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
216	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
217	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
221	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
225	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
234	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
235	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
242	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
244	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
253	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
254	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
257	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
258	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
263	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
265	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
420	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
422	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
426	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
433	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

437	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
445	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
455	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
473	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
529	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
583	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
593	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
619	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
685	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
688	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
729	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
753	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
755	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
756	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
757	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
762	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
763	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

...End

Pond Report

Pond No. 1 - Berm

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1526.25 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1526.25	00	0	0
1.00	1527.25	2,532	844	844
2.00	1528.25	5,148	3,763	4,607
3.75	1530.00	6,118	9,845	14,452

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	Inactive	Inactive	Inactive	Inactive
Span (in)	= 0.00	0.00	0.00	0.00
No. Barrels	= 0	0	0	0
Invert El. (ft)	= 0.00	0.00	0.00	0.00
Length (ft)	= 0.00	0.00	0.00	0.00
Slope (%)	= 0.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 100.00	0.00	0.00	0.00
Crest El. (ft)	= 1528.25	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 1.000 (by Contour)

TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	1526.25	---	---	---	---	0.00	---	---	---	0.000	---	0.000
0.10	84	1526.35	---	---	---	---	0.00	---	---	---	0.006	---	0.006
0.20	169	1526.45	---	---	---	---	0.00	---	---	---	0.012	---	0.012
0.30	253	1526.55	---	---	---	---	0.00	---	---	---	0.018	---	0.018
0.40	338	1526.65	---	---	---	---	0.00	---	---	---	0.023	---	0.023
0.50	422	1526.75	---	---	---	---	0.00	---	---	---	0.029	---	0.029
0.60	506	1526.85	---	---	---	---	0.00	---	---	---	0.035	---	0.035
0.70	591	1526.95	---	---	---	---	0.00	---	---	---	0.041	---	0.041
0.80	675	1527.05	---	---	---	---	0.00	---	---	---	0.047	---	0.047
0.90	760	1527.15	---	---	---	---	0.00	---	---	---	0.053	---	0.053
1.00	844	1527.25	---	---	---	---	0.00	---	---	---	0.059	---	0.059
1.10	1,220	1527.35	---	---	---	---	0.00	---	---	---	0.065	---	0.065
1.20	1,597	1527.45	---	---	---	---	0.00	---	---	---	0.071	---	0.071
1.30	1,973	1527.55	---	---	---	---	0.00	---	---	---	0.077	---	0.077
1.40	2,349	1527.65	---	---	---	---	0.00	---	---	---	0.083	---	0.083
1.50	2,725	1527.75	---	---	---	---	0.00	---	---	---	0.089	---	0.089
1.60	3,102	1527.85	---	---	---	---	0.00	---	---	---	0.095	---	0.095
1.70	3,478	1527.95	---	---	---	---	0.00	---	---	---	0.101	---	0.101
1.80	3,854	1528.05	---	---	---	---	0.00	---	---	---	0.107	---	0.107
1.90	4,231	1528.15	---	---	---	---	0.00	---	---	---	0.113	---	0.113
2.00	4,607	1528.25	---	---	---	---	0.00	---	---	---	0.119	---	0.119
2.17	5,591	1528.43	---	---	---	---	19.04	---	---	---	0.121	---	19.16
2.35	6,576	1528.60	---	---	---	---	53.83	---	---	---	0.124	---	53.95
2.53	7,560	1528.78	---	---	---	---	98.91	---	---	---	0.126	---	99.04
2.70	8,545	1528.95	---	---	---	---	152.26	---	---	---	0.128	---	152.38
2.88	9,529	1529.13	---	---	---	---	212.81	---	---	---	0.130	---	212.94
3.05	10,514	1529.30	---	---	---	---	279.76	---	---	---	0.133	---	279.89
3.22	11,498	1529.47	---	---	---	---	352.50	---	---	---	0.135	---	352.64
3.40	12,483	1529.65	---	---	---	---	430.70	---	---	---	0.137	---	430.84
3.58	13,467	1529.82	---	---	---	---	513.89	---	---	---	0.139	---	514.03
3.75	14,452	1530.00	---	---	---	---	601.91	---	---	---	0.142	---	602.05

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	4.004	1	5	1,201	------	------	------	Pre 2-10
2	Rational	4.880	1	5	1,464	------	------	------	Pre 25-100
3	Rational	3.669	1	5	1,101	------	------	------	Post Cap 2-10
4	Rational	7.040	1	5	2,112	------	------	------	Post Cap 25-100
5	Rational	1.117	1	5	335	------	------	------	Post Bypass 2-10
6	Rational	1.298	1	5	390	------	------	------	Post Bypass 25-100
7	Reservoir	0.000	1	11	0	3	1527.31	1,080	Routed Berm-2-10
8	Reservoir	0.000	1	251	0	4	1527.58	2,083	Routed 25-100

Hydrograph Report

Hyd. No. 1

Pre 2-10

Hydrograph type	= Rational	Peak discharge	= 4.004 cfs
Storm frequency	= 50 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 1,201 cuft
Drainage area	= 1.6 ac	Runoff coeff.	= 0.320
Intensity	= 7.869 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	0.801
2	1.602
3	2.402
4	3.203
5	4.004
6	3.203
7	2.402
8	1.602
9	0.801

<<

...End

Hydrograph Report

Hyd. No. 2

Pre 25-100

Hydrograph type	= Rational	Peak discharge	= 4.880 cfs
Storm frequency	= 50 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 1,464 cuft
Drainage area	= 1.6 ac	Runoff coeff.	= 0.390
Intensity	= 7.869 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	0.976
2	1.952
3	2.928
4	3.904
5	4.880
6	3.904
7	2.928
8	1.952
9	0.976

<<

...End

Hydrograph Report

Hyd. No. 3

Post Cap 2-10

Hydrograph type	= Rational	Peak discharge	= 3.669 cfs
Storm frequency	= 50 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 1,101 cuft
Drainage area	= 1.3 ac	Runoff coeff.	= 0.370
Intensity	= 7.869 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	0.734
2	1.467
3	2.201
4	2.935
5	3.669
6	2.935
7	2.201
8	1.467
9	0.734

<<

...End

Hydrograph Report

Hyd. No. 4

Post Cap 25-100

Hydrograph type	= Rational	Peak discharge	= 7.040 cfs
Storm frequency	= 50 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 2,112 cuft
Drainage area	= 1.3 ac	Runoff coeff.	= 0.710
Intensity	= 7.869 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	1.408
2	2.816
3	4.224
4	5.632
5	7.040
6	5.632
7	4.224
8	2.816
9	1.408

<<

...End

Hydrograph Report

Hyd. No. 5

Post Bypass 2-10

Hydrograph type	= Rational	Peak discharge	= 1.117 cfs
Storm frequency	= 50 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 335 cuft
Drainage area	= 0.3 ac	Runoff coeff.	= 0.430
Intensity	= 7.869 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	0.223
2	0.447
3	0.670
4	0.893
5	1.117
6	0.893
7	0.670
8	0.447
9	0.223

<<

...End

Hydrograph Report

Hyd. No. 6

Post Bypass 25-100

Hydrograph type	= Rational	Peak discharge	= 1.298 cfs
Storm frequency	= 50 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 390 cuft
Drainage area	= 0.3 ac	Runoff coeff.	= 0.500
Intensity	= 7.869 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	0.260
2	0.519
3	0.779
4	1.039
5	1.298
6	1.039
7	0.779
8	0.519
9	0.260

<<

...End

Hydrograph Report

Hyd. No. 7

Routed Berm-2-10

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 50 yrs	Time to peak	= 11 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Post Cap 2-10	Reservoir name	= Berm
Max. Elevation	= 1527.31 ft	Max. Storage	= 1,080 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
1	0.734	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
11	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
14	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
28	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
30	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
40	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
41	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
42	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
45	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
46	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
51	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
52	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
57	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
61	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
63	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

65	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
74	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
202	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
232	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
235	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
237	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
240	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
394	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
417	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
477	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
480	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
487	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
495	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
505	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
515	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
517	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
533	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
548	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
564	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
567	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
570	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
571	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
572	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
612	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
640	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
645	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
648	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
653	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
658	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
675	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
681	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
683	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

685	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
688	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
700	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
704	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
706	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
710	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
711	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
718	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
725	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
733	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
737	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
739	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
740	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
741	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
742	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
743	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
744	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
755	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
758	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
760	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
764	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
767	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
770	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
771	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
775	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
792	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
793	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
804	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
810	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
812	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
814	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
826	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
831	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
840	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

843	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
855	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
856	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
859	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
871	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
878	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
879	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
884	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
894	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
895	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
902	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
905	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
912	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
916	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
922	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
924	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
930	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
935	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
942	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
953	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
956	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
966	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
974	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
975	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
977	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
994	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1001	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1003	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1019	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1022	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1024	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1028	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1032	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

Continues on next page...

Routed Berm-2-10

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
1033	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1035	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1036	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

...End

Hydrograph Report

Hyd. No. 8

Routed 25-100

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 50 yrs	Time to peak	= 251 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 4 - Post Cap 25-100	Reservoir name	= Berm
Max. Elevation	= 1527.58 ft	Max. Storage	= 2,083 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
251	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
252	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
259	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
273	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
274	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
284	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
291	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
300	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
305	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
308	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
310	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
311	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
312	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000 <<
465	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
467	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

471	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
478	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
576	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
630	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
654	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
661	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
738	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
771	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
796	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
803	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
809	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
810	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
820	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

...End

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Rational	4.394	1	5	1,318	------	------	------	Pre 2-10
2	Rational	5.355	1	5	1,607	------	------	------	Pre 25-100
3	Rational	4.026	1	5	1,208	------	------	------	Post Cap 2-10
4	Rational	7.726	1	5	2,318	------	------	------	Post Cap 25-100
5	Rational	1.225	1	5	368	------	------	------	Post Bypass 2-10
6	Rational	1.425	1	5	427	------	------	------	Post Bypass 25-100
7	Reservoir	0.000	1	31	0	3	1527.34	1,186	Routed Berm-2-10
8	Reservoir	0.000	1	291	0	4	1527.63	2,287	Routed 25-100

Hydrograph Report

Hyd. No. 1

Pre 2-10

Hydrograph type	= Rational	Peak discharge	= 4.394 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 1,318 cuft
Drainage area	= 1.6 ac	Runoff coeff.	= 0.320
Intensity	= 8.636 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	0.879
2	1.758
3	2.636
4	3.515
5	4.394
6	3.515
7	2.636
8	1.758
9	0.879

<<

...End

Hydrograph Report

Hyd. No. 2

Pre 25-100

Hydrograph type	= Rational	Peak discharge	= 5.355 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 1,607 cuft
Drainage area	= 1.6 ac	Runoff coeff.	= 0.390
Intensity	= 8.636 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	1.071
2	2.142
3	3.213
4	4.284
5	5.355
6	4.284
7	3.213
8	2.142
9	1.071

<<

...End

Hydrograph Report

Hyd. No. 3

Post Cap 2-10

Hydrograph type	= Rational	Peak discharge	= 4.026 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 1,208 cuft
Drainage area	= 1.3 ac	Runoff coeff.	= 0.370
Intensity	= 8.636 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	0.805
2	1.610
3	2.416
4	3.221
5	4.026
6	3.221
7	2.416
8	1.610
9	0.805

<<

...End

Hydrograph Report

Hyd. No. 4

Post Cap 25-100

Hydrograph type	= Rational	Peak discharge	= 7.726 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 2,318 cuft
Drainage area	= 1.3 ac	Runoff coeff.	= 0.710
Intensity	= 8.636 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	1.545
2	3.090
3	4.635
4	6.181
5	7.726
6	6.181
7	4.635
8	3.090
9	1.545

<<

...End

Hydrograph Report

Hyd. No. 5

Post Bypass 2-10

Hydrograph type	= Rational	Peak discharge	= 1.225 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 368 cuft
Drainage area	= 0.3 ac	Runoff coeff.	= 0.430
Intensity	= 8.636 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	0.245
2	0.490
3	0.735
4	0.980
5	1.225
6	0.980
7	0.735
8	0.490
9	0.245

<<

...End

Hydrograph Report

Hyd. No. 6

Post Bypass 25-100

Hydrograph type	= Rational	Peak discharge	= 1.425 cfs
Storm frequency	= 100 yrs	Time to peak	= 5 min
Time interval	= 1 min	Hyd. volume	= 427 cuft
Drainage area	= 0.3 ac	Runoff coeff.	= 0.500
Intensity	= 8.636 in/hr	Tc by User	= 5 min
IDF Curve	= NY-IDF.IDF	Asc/Rec limb fact	= 1/1

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Outflow cfs)
1	0.285
2	0.570
3	0.855
4	1.140
5	1.425
6	1.140
7	0.855
8	0.570
9	0.285

<<

...End

Hydrograph Report

Hyd. No. 7

Routed Berm-2-10

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= 31 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 3 - Post Cap 2-10	Reservoir name	= Berm
Max. Elevation	= 1527.34 ft	Max. Storage	= 1,186 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
31	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
<<												
38	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
40	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
41	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
43	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
52	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
57	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
58	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
64	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
72	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
83	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
86	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
96	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
97	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
99	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
231	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
255	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
256	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
260	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
266	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

Continues on next page...

Routed Berm-2-10

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
267	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
343	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
427	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
429	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
431	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
445	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
467	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
490	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
491	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
496	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
525	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
530	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
533	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
534	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
544	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
547	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
557	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
563	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
575	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
583	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
592	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
594	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
596	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
598	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
600	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
626	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
661	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
669	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
673	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

675	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
676	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
690	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
691	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
699	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
700	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
737	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
738	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
741	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
742	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
756	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
762	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
763	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
766	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
768	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
777	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
780	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
785	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
786	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
788	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
790	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
794	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
796	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
799	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
808	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
810	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
818	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
819	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
822	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
826	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
830	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
835	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
842	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

Continues on next page...

Routed Berm-2-10

Hydrograph Discharge Table

Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
843	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
850	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
852	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
857	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
864	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
868	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
871	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
875	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
880	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
884	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
888	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
889	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
894	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
895	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
911	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
919	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
920	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
922	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
925	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
926	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
927	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
931	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
932	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
934	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
957	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
959	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
960	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
962	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
978	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

981	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
983	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
989	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
990	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
992	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
994	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1002	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1005	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1007	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1008	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1010	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1011	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1015	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1032	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1060	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1070	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1073	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
1079	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

...End

Hydrograph Report

Hyd. No. 8

Routed 25-100

Hydrograph type	= Reservoir	Peak discharge	= 0.000 cfs
Storm frequency	= 100 yrs	Time to peak	= 291 min
Time interval	= 1 min	Hyd. volume	= 0 cuft
Inflow hyd. No.	= 4 - Post Cap 25-100	Reservoir name	= Berm
Max. Elevation	= 1527.63 ft	Max. Storage	= 2,287 cuft

Storage Indication method used. Exfiltration extracted from Outflow.

Hydrograph Discharge Table

(Printed values >= 1.00% of Qp.)

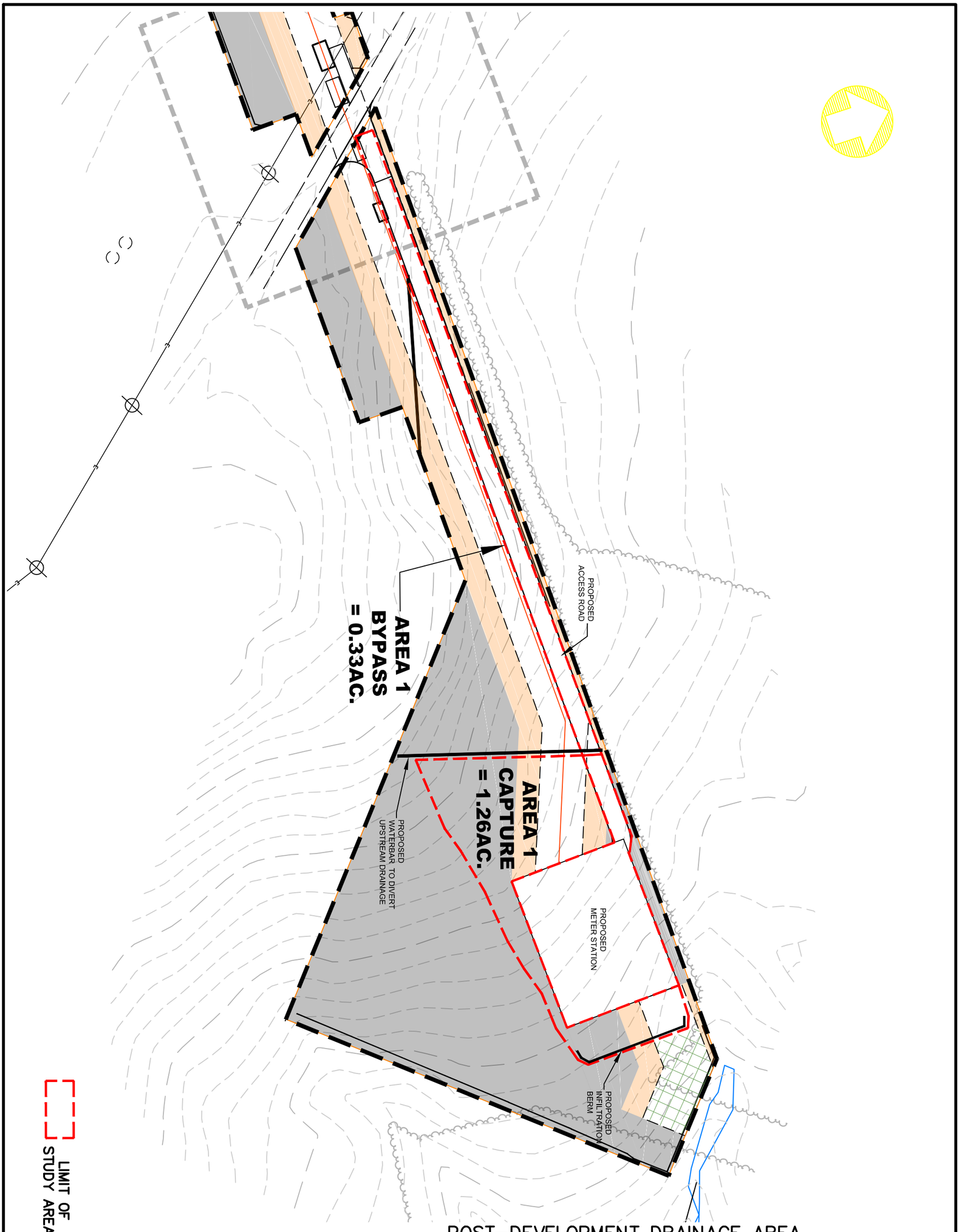
Time (min)	Inflow cfs	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	Outflow cfs
291	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
293	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
294	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
299	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
307	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
308	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
310	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
312	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
324	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
329	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
332	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
336	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
337	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
340	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
345	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

<<

347	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
349	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
350	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
351	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
366	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
493	0.000	1528.25 <<	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
517	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
521	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
524	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
533	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
557	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
561	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
578	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
580	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
604	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
660	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
676	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
682	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
686	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
688	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
759	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
782	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000
847	0.000	1528.25	-----	-----	-----	-----	-----	-----	-----	-----	0.119	0.000

...End

S:\Projects\Energy\NRG Energy\NRG-1003-05C-SiteSpecificDrawings&BMPDesign\Engineering\ NRG-1003-Dunkirk-ESPC Measures.dwg Sep 26,2014 - 3:58pm



POST-DEVELOPMENT DRAINAGE AREA

NO.	REVISIONS	DATE	REQUESTED BY

DUNKIRK PIPELINE PROJECT

DUNKIRK & POMFRET TOWNSHIPS
AND CITY OF DUNKIRK
CHAUTAUQUA COUNTY
NEW YORK

DRAWN BY: JER	PROJECT NO. NRG-1003
CHECKED BY: JER	
DATE: 10-02-14	SHEET NO. 1 OF 1
SCALE: 1"=100'	

Hanover
Engineering Associates Inc

252 Brodhead Road, Suite 100
Bethlehem, PA 18017-8944
610.691.5644
Fax 610.691.6968

APPENDIX C

INVASIVE SPECIES CONTROL PLAN

Dunkirk Gas Corporation
Invasive Species Control Plan

1.0 Introduction

The introduction or spread of invasive non-native vegetative species during construction activities of the Dunkirk Natural Gas Pipeline Project (Project) offers a potential threat to sensitive ecological resources in the Project area. Dunkirk Gas Corporation has prepared this Invasive Species Control Plan (Plan) to prevent the introduction and spread of the target invasive vegetative species to new locations during construction activities.

This Plan outlines the steps taken by Dunkirk Gas Corporation to identify the specific species considered invasive, location and density of the infestations within and immediately adjacent to the Limits of Disturbance (LOD) for the Project and the measures that will be taken to avoid and minimize spread of the invasive species within the proposed ROW and to other areas outside of the LOD.

2.0 Invasive Plant Species Identification

In conjunction with the development of the EM&CP, the Dunkirk Gas Corporation has performed the following activities to identify invasive plant species within the LOD of the Project:

1. Consulted the New York State Department of Environmental Conservation (NYSDEC) "Revised Interim List of Invasive Plant Species in New York State" (May 2012) to determine which plant species are considered invasive. The presence of any of these species occurring on this list were noted during the environmental field surveys for the Project.
2. Field surveys were conducted over the entire LOD during the late spring and summer of 2014. Where species were encountered that are found on the "Revised Interim List of Invasive Plant Species in New York State" in moderate to abundant densities, the infested area was mapped. Moderate density was defined as have 5-25% aerial coverage and abundant was greater than 25% aerial coverage. When individual plants of invasive species were found, these areas were noted to evaluate the potential spread or for the potential of other larger populations nearby.

The results of the field surveys indicated that the following species were encountered in the LOD. These species include:

Reed canary grass (*Phalaris arundinacea*);
Garlic mustard (*Alliaria petiolata*);
Mugwort (*Artemisia vulgaris*);
Spotted knapweed (*Centaurea stoebe*);
Canada thistle (*Cirsium arvense*);
Teasel (*Dipscacus laciniatus*);
Olive autumn (*Elaegnus umbellata*);
Black locust (*Robinia pseudoacacia*);
Multiflora rose (*Rosa multiflora*);
Honeysuckle (*Lonicera spps.*);
Purple loosestrife (*Lythrum salicaria*);
Common reed or Phragmites (*Phragmites australis*);
Japanese knotweed (*Polygonum cuspidatum*);
Common buckthorn (*Rhamnus cathartica*);
Glossy or smooth buckthorn (*Frangula alnus*).

These species are widespread and common in the Western New York Region. Several of the upland species such as honeysuckle, multiflora rose, teasel, Canada thistle, and garlic mustard are found as single plants or in a small area (less than 0.1 acres) throughout the entire LOD.

The results of the field surveys were discussed with NYSDEC. A list of the species that are found within the LOD that will require efforts to control the spread of these species into other areas during construction was determine in consultation with NYSDEC. These species include the following:

Purple loosestrife (*Lythrum salicaria*)
Common reed or Phragmites (*Phragmites australis*)
Japanese knotweed (*Polygonum cuspidatum*)
Glossy or smooth buckthorn (*Frangula alnus*)

Purple loosestrife and phragmites were considered the greatest threat for increasing their density and expanding their extent throughout the proposed natural gas pipeline right-of-way (ROW) within wetlands. These species have a tendency to displace native vegetation and create dense monoculture stands with little value to wildlife. These species were found in several wetland areas

in moderate to high densities within the LOD. Figure 1 depicts the locations where these species were found.

Japanese knotweed is a species that is often found at the border of wetlands, stream banks or in moist uplands. It grows in large dense patches and no other vegetation grows beneath the tall plants that die back during the winter leaving large areas of exposed soil. The exposed soil erodes and causes sedimentation into wetlands and streams. As a result, Japanese knotweed is a concern for further invasion into other areas. Japanese knotweed was found in several areas in the LOD as depicted on Figure 1.

Glossy buckthorn is an aggressive invasive shrub and also tends to form dense in uplands and in some wetlands. This species is found throughout the entire LOD in various densities. It is found abundantly within the National Grid electrical transmission line ROW, as single individuals within the understory of forested areas and in moderate to abundant densities in wetlands and abandoned agricultural fields. As it is located throughout the LOD and within the permanent ROW, control of this species to prevent further spread within the proposed ROW is nearly impossible. However efforts will be made to ensure glossy buckthorn plant material does not get transferred to a completely new site by equipment used on the Dunkirk Natural Gas Pipeline Project.

3.0 Preventing the Introduction and Transport of Invasive Plant Species

During the development of the Project's EM&CP, the Project's access routes, staging areas, and work areas were modified, as practicable, to reduce the potential spread of invasive species. Such efforts included shifting the pipeline to avoid areas with heaving infestations while taking into account adjacent land uses (such as agriculture), wetlands, streams, and other sensitive resources, and ease of construction. The Project has been designed to minimize soil disturbance. Disturbed areas will be stabilized and revegetated as soon as possible and in accordance with the Project's EM&CP stabilization procedures. Qualified Environmental Inspector (EI) will oversee work activities and will assure that these procedures are followed by work crews.

On a Project-wide basis, the following measures to prevent or reduce the transportation of invasive species will be implemented during construction of the Project:

- All vehicles entering the Project will be clean of all visible vegetation and soils. If vehicles or equipment arrive onsite with vegetation and soils, the vehicles or equipment will be

immediately directed to the nearest cleaning station and not permitted within the ROW until clean.

- Vehicle and equipment traffic within the ROW will be limited to a designated travel lane within the LOD. The topsoil will be stripped where the LOD crosses agricultural land and mats will be used within the travel lane to cross wetlands to avoid direct contact with equipment and vehicles traveling through the area. Mats will also be placed over upland areas where invasive species have been mapped within the travel lane to avoid any soil disturbance and subsequent transport of invasive species plant material.

- All areas with invasive species infestations as indicated on Figure 1 will be clearly marked in the field with signage to alert all construction crew members of special construction conditions in the area. The signage will be erected prior to clearing and grubbing.

- A limited amount of equipment will be used to clear, grub and excavate the trench for pipeline installation in areas of infestations of phragmites, purple loosestrife and Japanese knotweed. These areas are depicted on Figure 1. The EI(s) will be present when work is conducted in these areas to ensure equipment use is minimized.

- All soil excavated from the trench where the pipeline traverses the areas depicted on Figure 1 will be stockpiled within the immediate vicinity and will not be removed from the area.

- All vehicles, equipment and mats used to clear, grub and excavate in the areas depicted on Figure 1 will be cleaned at nearby designated cleaning stations prior to any further activities outside of the areas depicted on Figure 1. Cleaning stations have been designated at the nearest public road crossings of the pipeline immediately adjacent to the infested areas and are depicted on the EM&CP drawings. Cleaning shall consist of brushing and/or use of compressed air or power-blowers so that all visible vegetation and soils are removed. The material removed by compressed or power-blowers shall be directed into the infested area. Larger material that is removed via brushing will fall to the ground and collected on mats and/or plastic sheeting at the cleaning station. The cleaning stations will be periodically cleaned and the material will be disposed of within the infested area in the LOD or within a sanitary landfill licensed to accept such waste. Where particularly adhesive soils are encountered, the EI(s) may direct that power-washing with clean water and no detergents be used, as non-freezing seasonal conditions permit and within a designated cleaning station. Environmental controls will be set up to manage the discharge of wash water (no

wash water shall be directly discharged into wetlands, wetland adjacent areas, streams or stormwater conveyance).

- Cleaning station locations are depicted on the EM&CP drawings. They are generally located near the nearest public road crossing immediately adjacent to the infested areas. Cleaning stations are also planned for the contractor yards to clean incoming and outgoing vehicles and equipment from the Project. More cleaning stations or different locations of the stations maybe designated by the EI(s) as needed during construction. The EI(s) may also direct that portions of the LOD be isolated from vehicles and equipment with temporary physical barriers, i.e., fabric fencing tarps, etc. The primary barrier to prevent contact of invasive plant material with vehicles and equipment.

- All equipment used to clear, grub or excavate any soil within the LOD will be cleaned prior to transportation off of the Project at a designated cleaning station. Cleaning shall consist of brushing and/or use of compressed air or power-blowers so that all visible vegetation and soils are removed. The cleaning stations will be periodically cleaned and the material will be disposed of within the infested area in the LOD or within a sanitary landfill licensed to accept such waste. Where particularly adhesive soils are encountered, the EI(s) may direct that power-washing with clean water and no detergents be used, as non-freezing seasonal conditions permit and within a designated cleaning station.

4.0 Disposal of Wood, Plant Material, Soil, and Debris

Loose plant and soil material that has been removed form vehicles, equipment, and materials, or generated from the cleaning operations, will be:

a) rendered incapable of any growth or reproduction; or
b) placed in plastic bags at least 3 millimeter thick, hauled in a covered truck, and properly disposed of off-site; or
c) used within the same construction area that is infested, provided that no filling of any wetlands will occur as a result.

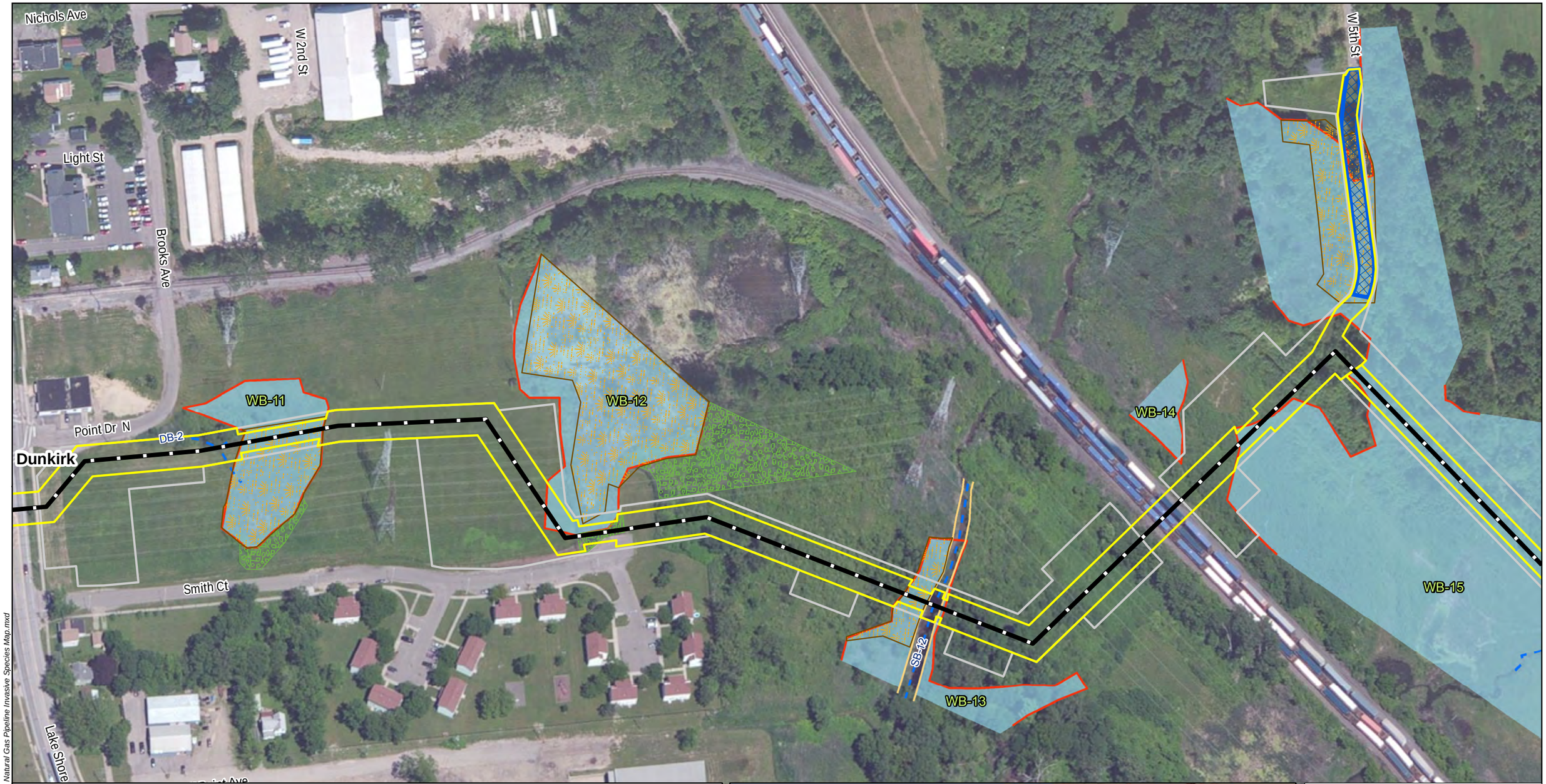
5.0 Invasive Insect Control

Asian Longhorned Beetle and Emerald Ash Borer are invasive insects that are a threat to forests in New York. NYSDEC has issued guidelines and quarantine areas to prevent the spread of these

insects into other areas. Chautauqua County and subsequently the Project, is within NYSDEC's Quarantine Area for Emerald Ash Borer. Asian Longhorned Beetle has not been detected within 30 miles of the Project.

In an effort to control and prevent the spread of invasive insects, Dunkirk will follow all NYSDEC and New York State Department of Agriculture and Markets (NYSDAM) regulations and guidelines. This includes the following:

- Coordinate with local logging contractors for sale and use of the merchantable timber that will be cleared who is familiar with the Asian Longhorned Beetle and Emerald Ash Borer regulations and certification programs;
- Provide unmerchantable timber as firewood to adjacent landowners for personal use;
- All woody material not used for timber or firewood will be chipped and left onsite;
- All nursery stock used during restoration will be from local stock (within 50-mile radius) or certified pest-free in accordance with NYSDAM and APHIS regulations.
- Make sure crews are trained to identify the Asian Longhorned Beetle and the Emerald Ash Borer and any other insects that the NYSDEC identifies as a potential problem. If these insects are found, they will be reported to the NYSDEC regional forester at (716) 851-7010 (Buffalo Office) or at (716) 372-0645 (Allegany Sub-Office).



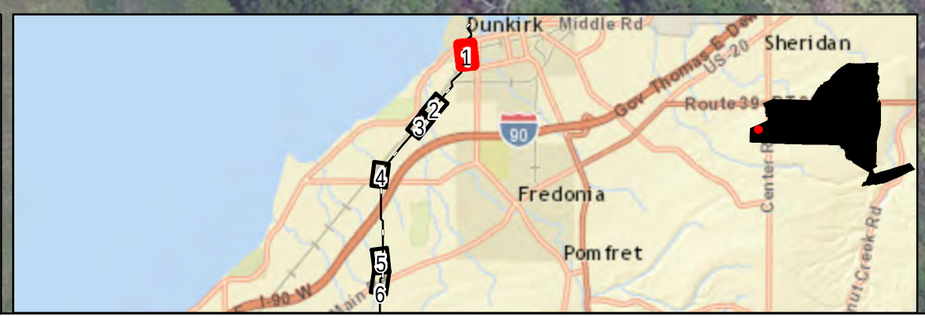
Pipeline
Limits of Distrubance
Permanently Cleared ROW
Project Facility
Access Roads

Delineated Wetland Area
Delineated Wetland Boundary
Stream Bank
Stream Centerline

Invasive Species
Japanese Knotweed
Phragmites
Purple Loosestrife

0 50 100 150 200
Feet
1 in = 150 ft

STREAMS WITH 6-FEET OR LESS BETWEEN THE OHWM'S ARE INDICATED ONLY WITH THE CENTERLINE DUE TO THE SUBMETER ACCURACY OF THE GPS RECEIVER USED TO COLLECT THE DATA AND DUE TO THE SCALE OF THE MAP. STREAMS WITH 6-FEET OR MORE BETWEEN THE OHWM'S ARE INDICATED WITH THE LOCATION OF THE OHWM'S ON BOTH SIDES AND THE CENTERLINE.



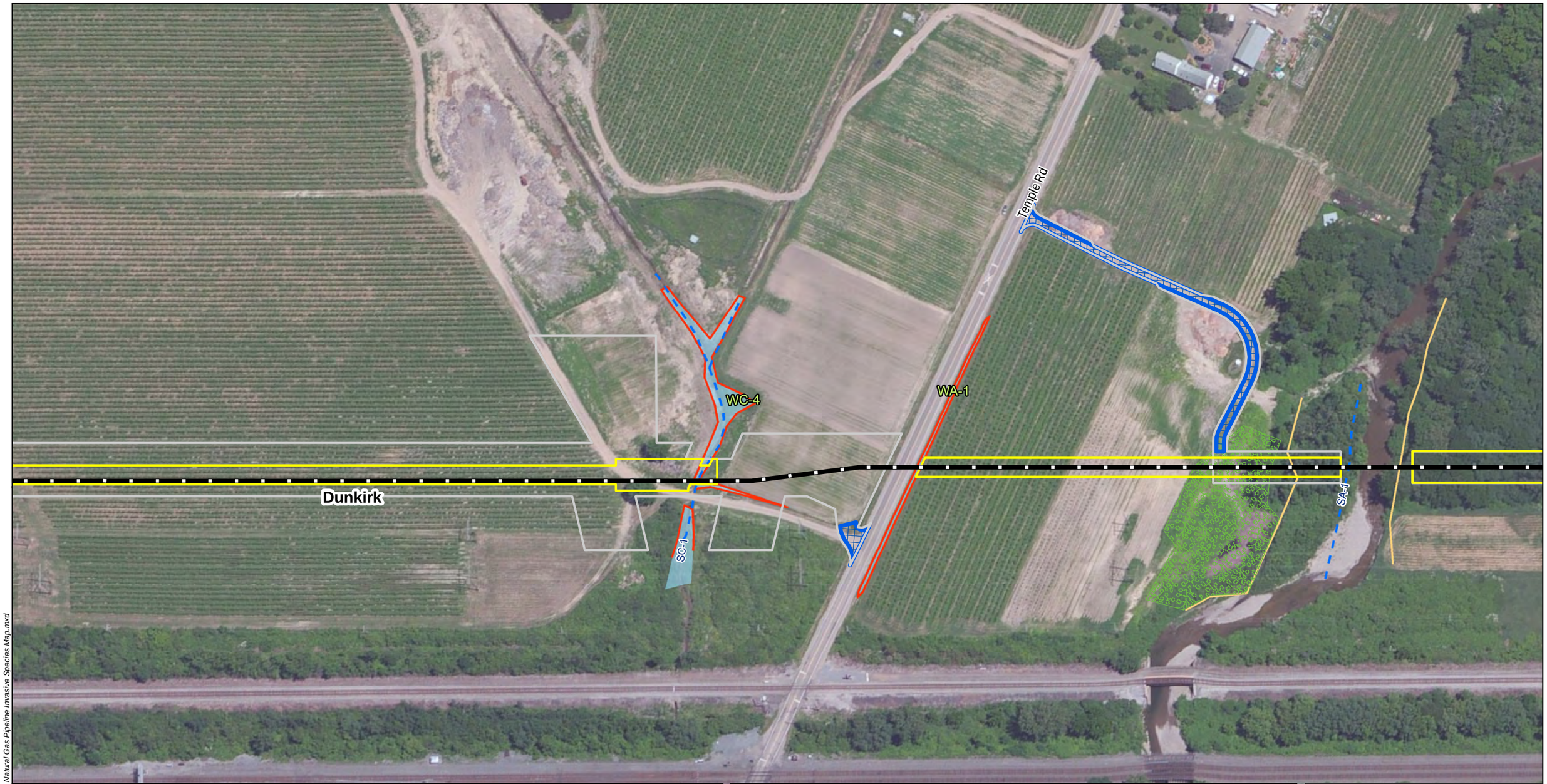
TRC
650 Suffolk Street
Lowell, MA 01854
978-970-5600

FIGURE 1

DUNKIRK NATURAL GAS PIPELINE
INVASIVE SPECIES MAP

Sheet 1 of 6 September 29, 2014

V:\PROJECTS\LOWELL\DUNKIRK\Figure 1- Dunkirk Natural Gas Pipeline Invasive Species Map.mxd



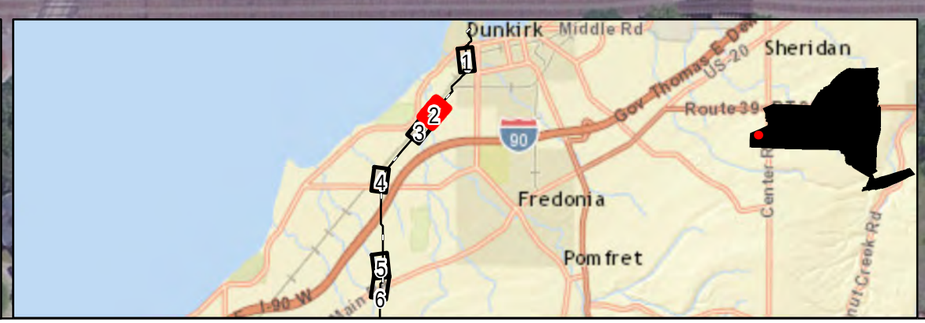
- Pipeline
- Limits of Distrubance
- Permanently Cleared ROW
- Project Facility
- Access Roads
- Delineated Wetland Area
- Delineated Wetland Boundary
- Stream Bank
- Stream Centerline

Invasive Species
- Japanese Knotweed
- Phragmites
- Purple Loosestrife

0 50 100 150 200

Feet
1 in = 150 ft

STREAMS WITH 6-FEET OR LESS BETWEEN THE OHWM'S ARE INDICATED ONLY WITH THE CENTERLINE DUE TO THE SUBMETER ACCURACY OF THE GPS RECEIVER USED TO COLLECT THE DATA AND DUE TO THE SCALE OF THE MAP. STREAMS WITH 6-FEET OR MORE BETWEEN THE OHWM'S ARE INDICATED WITH THE LOCATION OF THE OHWM'S ON BOTH SIDES AND THE CENTERLINE.



TRC
650 Suffolk Street
Lowell, MA 01854
978-970-5600

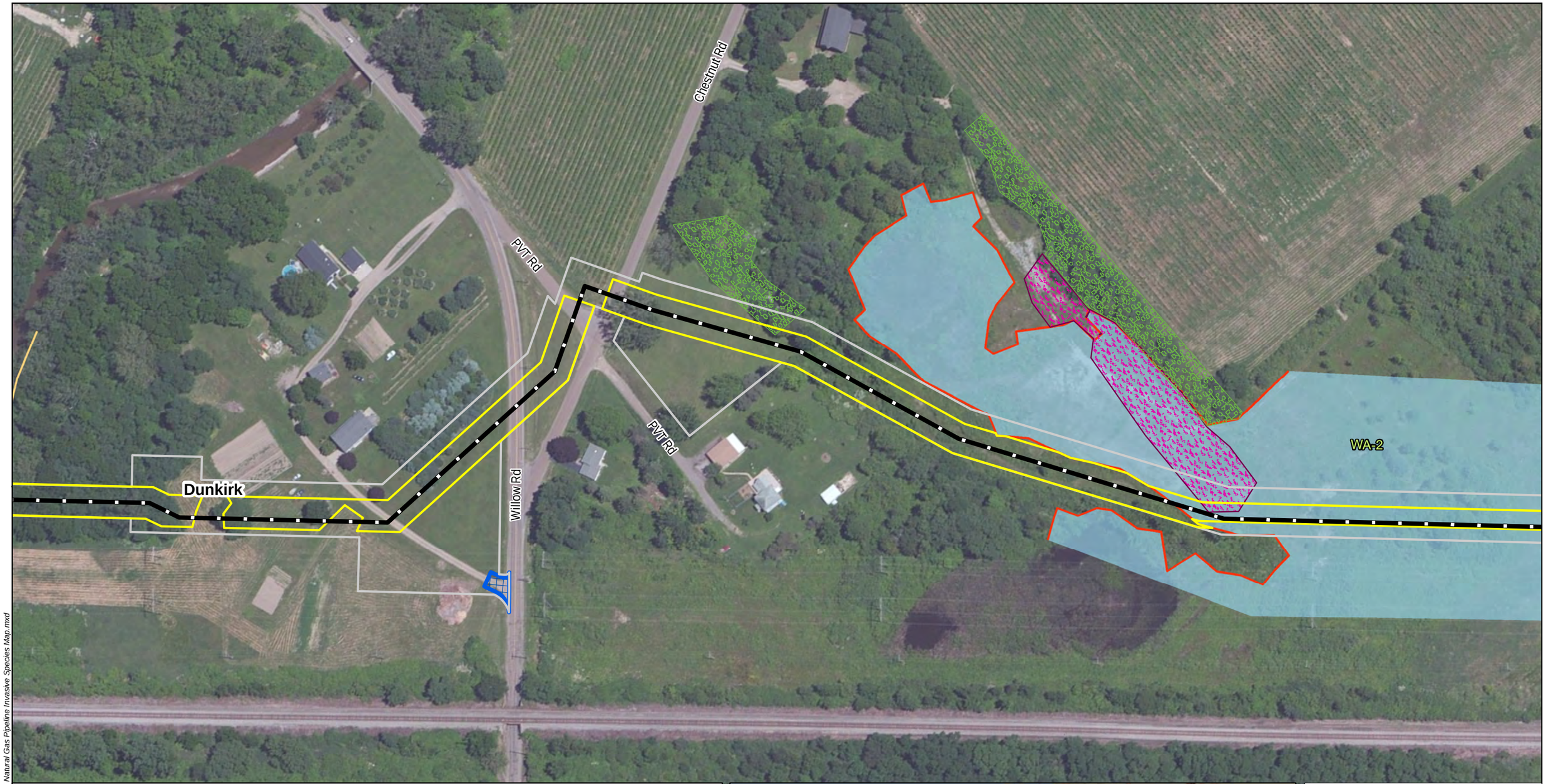
FIGURE 1

DUNKIRK NATURAL GAS PIPELINE
INVASIVE SPECIES MAP

Sheet 2 of 6

September 29, 2014

V:\PROJECTS\LOWELL\DUNKIRK\Figure 1- Dunkirk Natural Gas Pipeline Invasive Species Map.mxd



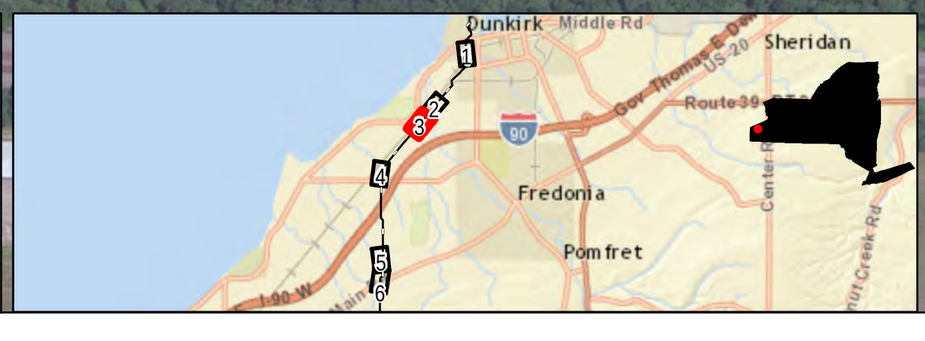
- Pipeline
- Limits of Distrubance
- Permanently Cleared ROW
- Project Facility
- Access Roads
- Delineated Wetland Area
- Delineated Wetland Boundary
- Stream Bank
- Stream Centerline

Invasive Species
- Japanese Knotweed
- Phragmites
- Purple Loosestrife

0 50 100 150 200

Feet
1 in = 150 ft

STREAMS WITH 6-FEET OR LESS BETWEEN THE OHWM'S ARE INDICATED ONLY WITH THE CENTERLINE DUE TO THE SUBMETER ACCURACY OF THE GPS RECEIVER USED TO COLLECT THE DATA AND DUE TO THE SCALE OF THE MAP. STREAMS WITH 6-FEET OR MORE BETWEEN THE OHWM'S ARE INDICATED WITH THE LOCATION OF THE OHWM'S ON BOTH SIDES AND THE CENTERLINE.



TRC
650 Suffolk Street
Lowell, MA 01854
978-970-5600

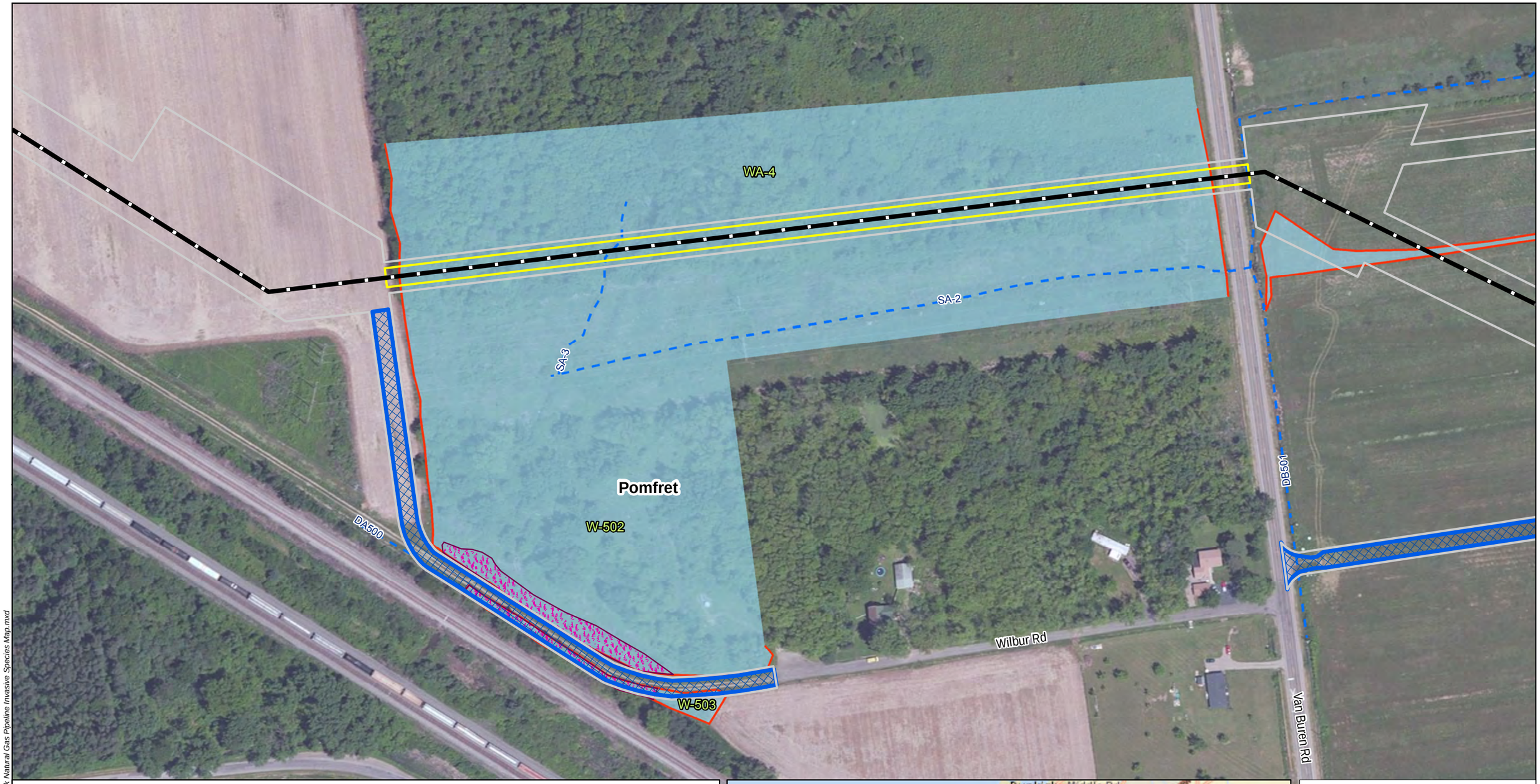
FIGURE 1

DUNKIRK NATURAL GAS PIPELINE
INVASIVE SPECIES MAP

Sheet 3 of 6

September 29, 2014

V:\PROJECTS\LOWELL\DUNKIRK\Figure 1- Dunkirk Natural Gas Pipeline Invasive Species Map.mxd

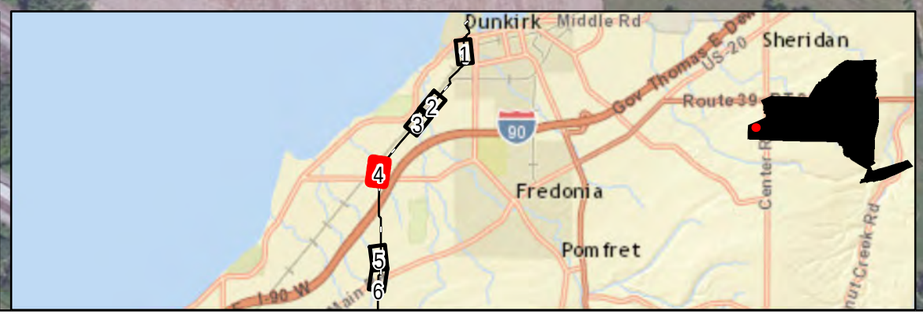


- Pipeline
- Limits of Distrubance
- Permanently Cleared ROW
- Project Facility
- Access Roads
- Delineated Wetland Area
- Delineated Wetland Boundary
- Stream Bank
- Stream Centerline

Invasive Species
- Japanese Knotweed
- Phragmites
- Purple Loosestrife

0 50 100 150 200
Feet
1 in = 150 ft

STREAMS WITH 6-FEET OR LESS BETWEEN THE OHWM'S ARE INDICATED ONLY WITH THE CENTERLINE DUE TO THE SUBMETER ACCURACY OF THE GPS RECEIVER USED TO COLLECT THE DATA AND DUE TO THE SCALE OF THE MAP. STREAMS WITH 6-FEET OR MORE BETWEEN THE OHWM'S ARE INDICATED WITH THE LOCATION OF THE OHWM'S ON BOTH SIDES AND THE CENTERLINE.



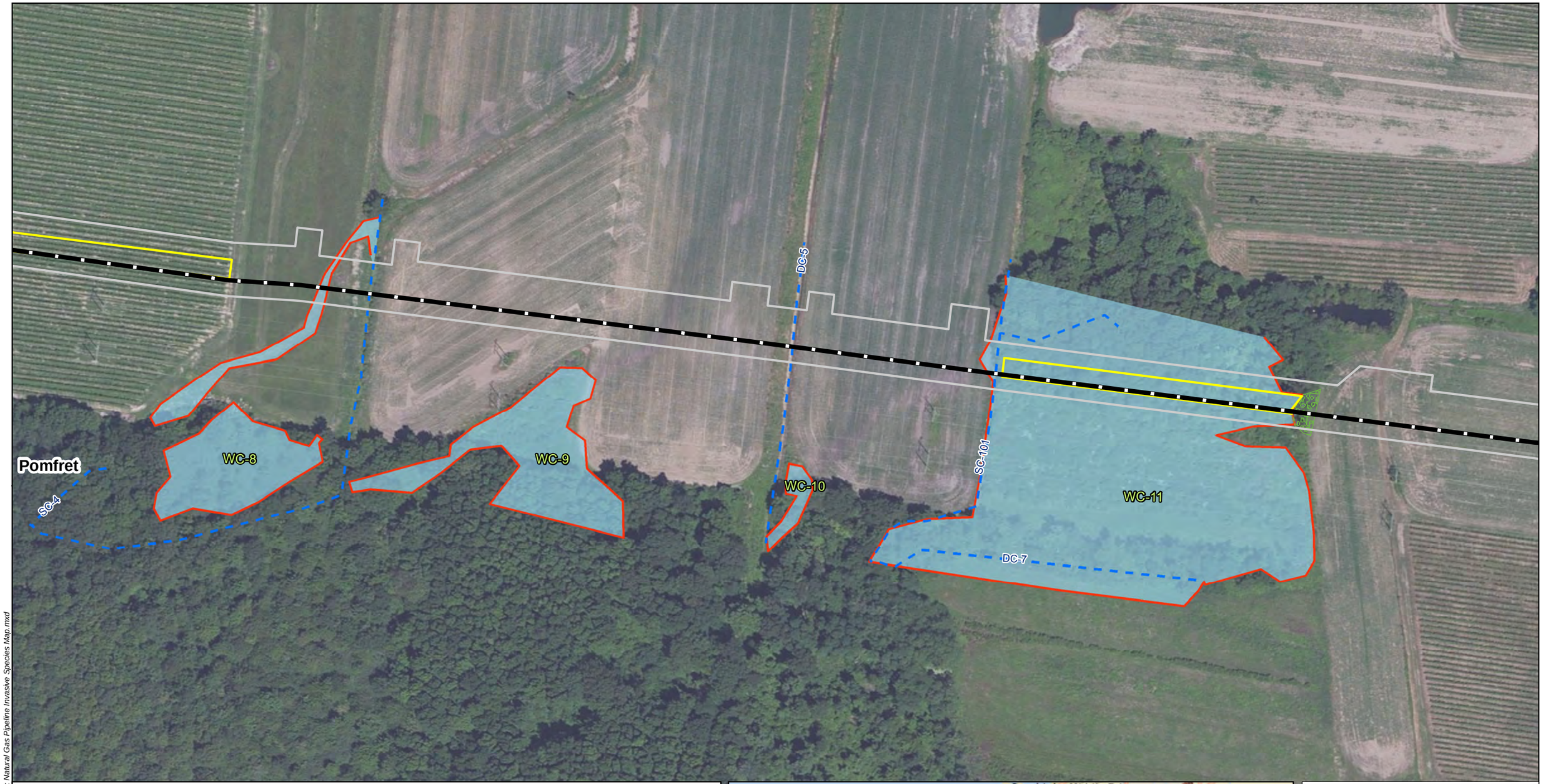
TRC
650 Suffolk Street
Lowell, MA 01854
978-970-5600

FIGURE 1

DUNKIRK NATURAL GAS PIPELINE
INVASIVE SPECIES MAP

Sheet 4 of 6 September 29, 2014

V:\PROJECTS\LOWELL\DUNKIRK\Figure 1 - Dunkirk Natural Gas Pipeline Invasive Species Map.mxd



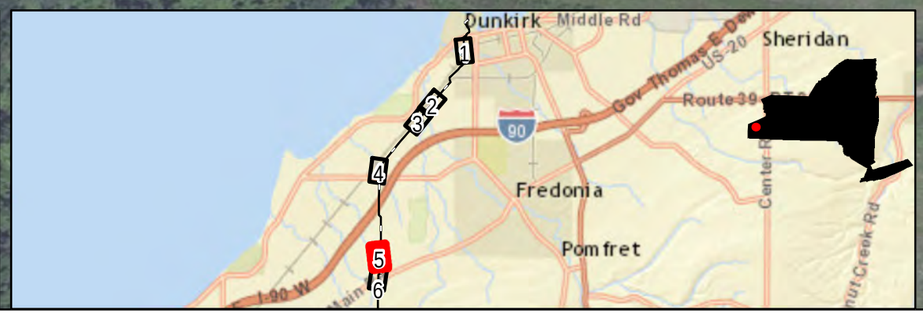
Pipeline
Limits of Distrubance
Permanently Cleared ROW
Project Facility
Access Roads

Delineated Wetland Area
Delineated Wetland Boundary
Stream Bank
Stream Centerline

Invasive Species
Japanese Knotweed
Phragmites
Purple Loosestrife

0 50 100 150 200
Feet
1 in = 150 ft

STREAMS WITH 6-FEET OR LESS BETWEEN THE OHWM'S ARE INDICATED ONLY WITH THE CENTERLINE DUE TO THE SUBMETER ACCURACY OF THE GPS RECEIVER USED TO COLLECT THE DATA AND DUE TO THE SCALE OF THE MAP. STREAMS WITH 6-FEET OR MORE BETWEEN THE OHWM'S ARE INDICATED WITH THE LOCATION OF THE OHWM'S ON BOTH SIDES AND THE CENTERLINE.



TRC
650 Suffolk Street
Lowell, MA 01854
978-970-5600

FIGURE 1

DUNKIRK NATURAL GAS PIPELINE
INVASIVE SPECIES MAP

Sheet 5 of 6

September 29, 2014

V:\PROJECTS\LOWELL\DUNKIRK\Figure 1- Dunkirk Natural Gas Pipeline Invasive Species Map.mxd

W Main Rd

DC-8

SC-5

WC-12

Pomfret

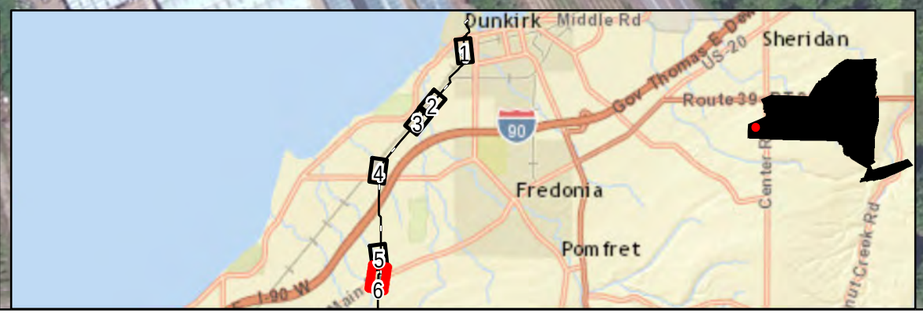
Pipeline
Limits of Distrubance
Permanently Cleared ROW
Project Facility
Access Roads

Delineated Wetland Area
Delineated Wetland Boundary
Stream Bank
Stream Centerline

Invasive Species
Japanese Knotweed
Phragmites
Purple Loosestrife

0 50 100 150 200
Feet
1 in = 150 ft

STREAMS WITH 6-FEET OR LESS BETWEEN THE OHWM'S ARE INDICATED ONLY WITH THE CENTERLINE DUE TO THE SUBMETER ACCURACY OF THE GPS RECEIVER USED TO COLLECT THE DATA AND DUE TO THE SCALE OF THE MAP. STREAMS WITH 6-FEET OR MORE BETWEEN THE OHWM'S ARE INDICATED WITH THE LOCATION OF THE OHWM'S ON BOTH SIDES AND THE CENTERLINE.



TRC

650 Suffolk Street
Lowell, MA 01854
978-970-5600

FIGURE 1

DUNKIRK NATURAL GAS PIPELINE
INVASIVE SPECIES MAP

Sheet 6 of 6

September 29, 2014

V:\PROJECTS\LOWELL\DUNKIRK\Figure 1- Dunkirk Natural Gas Pipeline Invasive Species Map.mxd

APPENDIX D

INADVERTENT RETURN CONTINGENCY PLAN

Dunkirk Gas Corporation
Inadvertent Return Contingency Plan
For Horizontal Directional Drilling

1.0 Introduction

Dunkirk Gas Corporation is proposing to utilize horizontal directional drilling (HDD) on the Dunkirk Natural Gas Pipeline Project (Project) to route under obstacles (i.e., New York State Thruway I-90, rails, and roads) and sensitive environmental areas (i.e., streams and wetlands). The HDD method was chosen at particular locations along the pipeline right-of-way because it minimizes impact to environmental resources and has been proven to be a safe and efficient method for crossing roads, railroads, streams, wetlands, and other environmentally sensitive areas.

The HDD process involves a drilling fluid made up primarily of water and bentonite, a naturally occurring clay. The purpose of the drilling fluid is to remove the cuttings from the borehole, to stabilize the borehole and to act as a coolant and lubricant during the drilling process. The bentonite clay-water mixture is not classified as a toxic or hazardous substance. However, if it is released into waterbodies, bentonite has the potential to adversely impact fish and invertebrates. Therefore, to protect public health and safety as well as natural resources, Dunkirk Gas Corporation has prepared this Inadvertent Return Contingency Plan (Plan) in the event of an inadvertent return of drilling fluid during the HDD activities. This Plan establishes operational procedures and responsibilities for the prevention, containment, and cleanup of inadvertent releases associated with the proposed HDD. The objective of this Plan is to:

1. Minimize the potential for an inadvertent release of drilling fluids associated with HDD activities;
2. Provide for the timely detection of inadvertent returns;
3. Protect the environmentally sensitive areas (streams, wetlands) while responding to an inadvertent release;
4. Ensure an organized, timely and "minimum-impact" response in the event of an inadvertent return and release of drilling fluids; and,
5. Ensure that all appropriate notifications are made immediately

2.0 Site Personnel Responsibilities

The HDD Contractor (Contractor) will be responsible for execution of the HDD operations, including actions for detecting and controlling inadvertent releases of drilling fluids.

The Contractor's Construction Supervisor (Construction Supervisor) will have overall responsibility for implementing the Inadvertent Return Contingency Plan and will be familiar with all aspects of the drilling activity, the contents of this Plan and the conditions of approval under which the activity is permitted to take place. The Construction Supervisor will ensure that a copy of this Plan is available onsite and accessible to all construction personnel during construction. The Construction Supervisor will provide the anticipated schedule of HDD operations to the Environmental Inspector responsible for environmental compliance monitoring prior to the commencement of work.

The Environmental Inspector will closely supervise the progress and actions of the HDD Contractor. The Environmental Inspector will be on the right-of-way, available during HDD operations to consult with HDD personnel and conduct inspections. The Construction Supervisor will promptly notify the Environmental Inspector when an inadvertent release is detected. The Environmental Inspector will have the authority to stop work evaluate and will evaluate the situation and determine the appropriate measures to address an inadvertent release. The Environmental Inspector will be responsible for notifying the regulatory agencies as appropriate.

3.0 Training

Prior to the start of construction, the Construction Supervisor and Environmental Inspector will ensure that the crew members receive training in the following:

- Review the provisions of this Plan, equipment maintenance and site-specific permit and monitoring requirements;
- Review location of sensitive environmental resources at the site and relevant permit conditions;
- Review inspection procedures for inadvertent release prevention and containment equipment and materials;

- Review contractor/crew member obligation to immediately stop the drilling operation upon first evidence of the occurrence of an inadvertent release and to immediately report any inadvertent releases to the Construction Supervisor and Environmental Inspector;
- Review contractor/crew member responsibilities in the event of an inadvertent release;
- Review operation of release prevention and control equipment and the location of release control materials, as necessary and appropriate; and,
- Review protocols for reporting observed releases and communication with appropriate regulatory agencies.

4.0 Equipment and Containment Materials

The Construction Supervisor will ensure that:

- All equipment and vehicles are checked and maintained daily to prevent leaks of hazardous materials;
- Spill kits and spill containment materials are available on-site at all times and that the equipment is in good working order;
- Equipment required to contain and clean up an inadvertent release will either be available at the work site or readily available at an off-site location within 10 minutes of the bore site; and,
- If equipment is required to be operated near a streambed, absorbent pads and plastic sheeting for placement beneath motorized equipment will be used to protect the streambed from engine fluids.

At a minimum, the following containment, response, and clean-up equipment will be available at each HDD crossing location at the time such crossings occur and easily mobilized for immediate use in the event of an accidental release of drilling fluids:

- spill kit;
- straw bales;
- silt fence;
- plastic sheeting;
- turbidity barriers;
- sand bags;
- shovels, 5 gallon buckets;
- push brooms;
- squeegees;
- pumps and suction hose;

- discharge hose,
- drilling fluid storage tanks; and,
- vacuum truck on 24-hour call (may be located off-site within a 10 minute response time).

5.0 Measures to Prevent Inadvertent Release

The following procedures will be followed each day, prior to the start of work. The Construction Supervisor will be on-site any time that drilling is occurring or is planned to occur. The Construction Supervisor shall ensure that a tailgate briefing meeting is held at the start of each day of drilling to review the appropriate procedures to be followed in case of an inadvertent return. Questions shall be answered and clarification given on any point over which the drilling crew or other Project staff has concerns.

Drilling pressures shall be closely monitored so they do not exceed those needed to penetrate the formation. Pressure levels shall be monitored randomly by the drill operators. Pressure levels shall be set at a minimum level to prevent inadvertent releases. During the pilot bore, the drill operator will maintain the drilled annulus. Cutters and reamers will be pulled back into previously-drilled sections after each new joint of pipe is added.

Exit and entry pits will be enclosed by silt fences and straw. If necessary, barriers (straw bales or sedimentation fences) between the bore site and edge of the water source will be constructed prior to drilling, to prevent released bentonite material from reaching the water.

The Construction Supervisor will ensure a corridor centered on the drill path will be continuously monitored for conditions and any signs of inadvertent return. In addition, when crossing a stream, the downstream area will be continuously monitored.

Water containing mud, silt, bentonite or other pollutants from equipment washing or other activities, will not be allowed to enter a flowing stream or other water source. The bentonite used in the drilling process will be either disposed of at an approved disposal facility or recycled in an approved manner.

6.0 Response to an Inadvertent Release

Once the drill rig is in place, and drilling begins, the drill operator will immediately stop work whenever the pressure in the drill rig drops, there is a lack of returns in the entrance pit, or other

evidence of an inadvertent release. The drill operator will pull back the bore stem to relieve pressure on the inadvertent release.

In the event an inadvertent release is suspected, the Construction Supervisor and Environmental Inspector will be notified immediately to ensure adequate response actions are taken and notifications are made. The Construction Supervisor and Environmental Inspector will conduct an evaluation of the situation and direct recommended mitigation actions.

If no inadvertent release to the surface is detected the driller will attempt to re-establish returns through standard HDD practice and continue HDD activity.

If an inadvertent release is detected to the surface, the Construction Supervisor and Environmental Inspector will:

1. Make appropriate initial notifications – see "Notifications" below.
2. Cease all drilling activities.
3. Containment measures will be taken to minimize the affected area in an upland area or if in a stream to minimize the flow of materials downstream.
    a. In upland areas or relatively dry wetland area techniques such as earthen dam/ditch installed with a hand shovel, placement of sand bags or silt fence, or other techniques which accomplish the containment of the flow may be utilized.
    b. In a flowing stream, turbidity curtain, sand bags placed to slow the flow on the bottom of the stream, pumping water from above the inadvertent release to below the inadvertent release, or other techniques which minimize or stop the flow of inadvertent release material further downstream may be utilized.
4. If the volume of the release is small and in an upland, riparian or relatively dry wetland area it can be cleaned up with shovels and 5 gallon buckets.
5. If the volume of the release is large, then a vacuum truck shall be used if practical or if suction hose cannot reach the area, diaphragm mud pumps shall be utilized.
6. For a release where standing or flowing water is present, the use of trash pumps and a person in the water if possible will allow the inadvertent release material to be sucked off of the bottom of the water way. The discharge of the pump shall be directed into a containment area, frac tank, vacuum truck or other containment area.

7.0 Notifications

The Environmental Inspector will be responsible for notifying the DPS Staff and NYSDEC within two hours of a detected inadvertent release.

Information to be documented shall include:

1. Time of loss of return;
2. Time of discovery of any drilling material to the surface of the ground;
3. Person making the first discovery;
4. Physical location of release;
5. If release is in an upland area, stream, or wetland;
6. Estimated volume of material released and surface if in wetland or upland area;
7. Containment activity;
8. Cleanup activity.

The Environmental Inspector is responsible for a log of all information pertaining to the event including names and times of contact or start/completion of various activities.

8.0 Clean Up and Restoration

Site-specific clean up measures will be developed by the Construction Supervisor and the Environmental Inspector, in consultation with DPS Staff and NYSDEC as practicable. Restoration measures shall be developed in consultation with DPS Staff and NYSDEC prior to the site being restored. However, the following measures are considered appropriate:

- The Construction Supervisor will be responsible for ensuring that the recovered drilling fluid is either properly disposed of at an approved disposal facility or properly recycled in an approved manner. No recovered drilling fluids will be discharged into streams, storm drains or any other water source.;
- All emergency excavation and clean-up sites will be returned to natural contours using clean fill, as necessary.
- All containment measures (i.e., straw bales, turbidity barriers, etc.) will be removed, unless otherwise specified by the Construction Supervisor.
- The Environmental Inspector will notify and take any necessary follow-up response actions in coordination with agency representatives.

9.0 Construction Restart

The Construction Supervisor and Environmental Inspector will agree on plan moving forward. Options may include industry standard practice of lower pressure/flow, changing viscosity of the mud, additives consistent with the geology, "pushing through" if the volume of inadvertent release is manageable and not in a stream or wetland, abandonment of the hole and relocating the entry or changing otherwise changing the drill path, etc.

Any such route changes will be in accordance with the EM&CP.

10.0 Site-Specific Plan for Little Canadaway Creek

Due to the unique nature of the crossing of Little Canadaway Creek and the limited access to the creek, specific measures will be taken to prepare for a response to an inadvertent release at that location. These measures include:

- Extra depth in bore path design.
- Limiting pilot bore drilling to daylight hours in proximity to the creek so that inspection can occur safely.
- Staging tools, materials, and equipment on top of the bank on the north side of the stream to minimize the time required to move those items to the stream if necessary.
- Additionally, an environmental inspector shall monitor the stream for an inadvertent release at a point approximately 900' downstream from the crossing, where there is an access trail to the stream edge from the top of the northern bank. In the case that an inadvertent release is observed, the same trail shall be used to safely access the stream with pumps and materials to contain and clean up the bentonite fluid release

11.0 Documentation

The Environmental Inspector will record the inadvertent release in the Project daily log. The log will include the following:

- Details on the release event, including an estimate of the amount of drilling fluid released;
- The location and time of the release;
- The size of the area impacted; and
- Summary of the response;
- The success of the clean-up action.

APPENDIX E

HYDROSTATIC TESTING PLAN

Dunkirk Gas Corporation
Hydrostatic Test Plan

1.0 Introduction

To ensure the pipeline's integrity following construction, Dunkirk Gas Corporation will pressure test the pipeline with water. The purpose of this plan is to outline the procedures for the hydrostatic testing of the Dunkirk Natural Gas Pipeline Project.

2.0 Pipeline Summary

The total length of the pipeline will be approximately 11.3 miles (approximately 59,664 feet). The majority of the pipeline will be 16-inch outside diameter with 0.375 inch wall thickness, 5L X60, ERW steel pipe. Pipe utilized in areas to be constructed via horizontal directional drilling (HDD) or conventional bore methods, and all road crossings, will be 16-inch outside diameter with 0.500-inch wall thickness, 5L X60, ERW steel pipe. All flanges, fittings, valves, etc. will be ANSI 600.

The design Maximum Allowable Operational Pressure (MAOP) will be 760 pounds per square inch (psig) resulting in 27 percent Specified Minimum Yield Strength (SMYS) for the 0.375-inch pipe and 20 percent SMYS for the 0.500-inch pipe.

3.0 Elevation Summary

The lowest point along the pipeline right-of-way is at the regulator station located at the Dunkirk Generating Station at an approximate elevation of 580 feet above mean sea level (AMSL). As the pipeline proceeds in a southerly direction towards the interconnect location with the Tennessee Gas Transmission Mainline Pipeline, the elevation rises approximately 270 feet in the first 7 miles. Over the next approximately 2 miles the rise is approximately 700 feet with a "dip" at Little Canadaway Creek. The final approximately 2 miles has only minor elevation changes with the high point near Cummings Road at 1562 feet AMSL. Approximately 1000 feet further south is the tap and meter location with the Tennessee Gas Transmission Mainline Pipeline at Station 588+41 and an elevation of 1538 AMSL.

4.0 Class Location

The first mile of the pipeline is within a Class 3 location, while the remaining of the pipeline in in either Class 2 or 1. To be consistent, the entire pipeline will be designed, constructed, and tested to meet the requirements for Class 3.

5.0 Pig Launcher/Receiver and Sectionalizing Block Valves

A pig launcher will be installed at the metering station off Cummings Road with a pig receiver located at the regulator station within the Dunkirk Generating Station. Two sectionalizing block valves will be installed along the pipeline, one at Station 112+00 near Temple Road and one at Station 248+00 near Berry Road. The launcher, receiver, and sectionalizing block valves may be tested separately from the main pipeline and installed in line once the main line testing is complete.

6.0 Hydrostatic Test Procedure

After the pipeline is constructed, cleaned and gage plates run, the pipeline will be hydrostatically pressure tested in two sections:

- North Section: Regulator Station to the second sectionalizing block valve at Berry Road (Station 0+00 to Station 248+00).
  This section will be approximately 4.7 miles of the 11.3 mile pipeline.
- South Section: Berry Road to the Meter Station (Station 248+00 to Station 576+50)
  This section will be approximately 6.5 miles of the 11.3 mile pipeline.

The water will be pumped into the pipeline at the pig receiver location at the Dunkirk Generating Station which is the low point of the entire pipeline. The water will be pumped into the line against a pig which is intended to separate the water from the air in the line. This section will require approximately 235,500 gallons of water. After the 12 hour test is successfully completed, the water will be transferred to the South Section This section will require approximately 325,000 gallons total. The additional water required to fill the second section will be added from the same source as is used to fill the first section. This section will also be tested for 12 hours.

The North Section has an elevation difference of approximately 80 feet resulting in an elevation head due to the height of water in the pipeline of approximately 35 psig. The MAOP

establishing 12 hour test will therefore require a minimum 760 x 1.5 = 1140 psig at 0+00, Dunkirk Generating Station site and 1140 + 35 = 1175 psig at 248+00 near Berry Road.

Should either test fail the leak will be located and repaired and the pipe will be retested.

The South Section has an elevation difference of approximately 902 feet resulting in an elevation head due to the height of water in the pipeline of approximately 391 psig. The MAOP establishing 12 hour test will therefore require a minimum 760 x 1.5 = 1140 psig at Station 248+00 near Berry Road and 1140 + 391 = 1531 psig at Station 576+50 near Cummings Road. Note that this is the high point of the pipeline and approximately 1000 feet south of the Tennessee Gas Transmission Pipeline Mainline tap and meter site which is at an approximate 1538 feet AMSL.

The meter facility and regulator facility will be hydrostatically tested either on site, at one of the staging areas, or pre-tested in a fabrication facility. Actual test equipment may be located at either end of the two sections of pipeline.

All notification and testing will be in full compliance with the applicable sections of NYCRR Title 16B, Part 255, specifically Section 255.302 – "Notification Requirements" and Section 255.505 – "Strength test requirements for steel pipeline to operate at 125 psig or more."

7.0 Water Source

All of the approximately 235,500 gallons of water required for hydrostatic pressure testing of the pipeline will be withdrawn from the cooling water currently permitted at the Dunkirk Generating Station. The Dunkirk Generating Station currently is permitted to withdraw up to 568 million gallons per day from Lake Erie. The hydrostatic test water will be drawn directly from the cooling system inside the Dunkirk Generating Station and delivered to the hydrostatic test segments trough a hose connected to the plant or by truck.

8.0 Dewatering

At the conclusion of a successful test of the two sections, the North Section and South Section will be jumpered together and the hydrostatic water will be free flowed initially and then "pushed" with pigs from the south to the north through the entire pipeline. All water will be removed from the pipeline at the Dunkirk Generating Station and disposed of.

APPENDIX F

UNANTICIPATED DISCOVERY OF CULTURAL RESOURCES OR HUMAN REMAINS PLAN

Dunkirk Gas Corporation
Procedures Guiding the Unanticipated Discovery of
Cultural Resources and Human Remains

1.0 Introduction

Dunkirk Gas Corporation is committed to the protection and preservation of cultural resources, in accordance with federal and state legislation, and is continuing that commitment as part of the Dunkirk Gas Natural Gas Pipeline Project (Project). Dunkirk Gas Corporation recognizes that despite intensive cultural resource field investigations that are typically performed prior to project construction, or a determination that a particular area exhibits low archaeological sensitivity, it is nonetheless possible that cultural resource deposits could be discovered during Project construction activities, particularly during excavation. Dunkirk Gas Corporation also recognizes the requirement for compliance with federal and state regulations and guidelines regarding the treatment of human remains, if any are discovered.

The purpose of archaeological investigations during the planning of natural gas projects is to determine the presence or absence of historic properties within a project area. These archaeological investigations are conducted in accordance with standards set forth in the Section 106 of the National Historic Preservation Act of 1966 (16 USC 470f), as amended (1976, 1980, 1992, 1999), and implementing regulations of the Advisory Council on Historic Preservation (Advisory Council) (36 CFR 800), specifically, those procedures regarding "post-review discoveries" as outlined in 36 CFR 800.13. All work is undertaken pursuant to the Secretary of the Interior Standards for Archaeology and Historic Preservation (48 Federal Regulations 44716-42 [1983]) and the applicable laws and regulations pertaining to the cultural resources of New York.

2.0 Notification Procedures

The following details the plan that will be followed in the event that new cultural resource sites or human remains are discovered during the construction process.

2.1 Archaeological Discoveries

The following procedures will be adhered to in the event of a potential discovery of archaeological remains during construction:

1. In the event that suspected artifacts are uncovered during a construction activity, all activities that could affect the integrity of the deposit(s) will be suspended immediately and the Construction Supervisor and Environmental Inspector will be notified immediately. Notification will include the specific construction area (i.e. trench wall, spoil pile, foundation excavation) in which the potential site is located.

2. Upon notification or discovery of a possible site, Dunkirk Gas Corporation will contact its cultural resource consultants, who will in turn be responsible for determining whether a visit to the area is required. If a site visit is necessary, the archaeologist will have a crew on site within 24 hours after notification.

   The location of any site-related materials, features, etc., will be identified on Project maps, along with the data on which they were identified.

   Note: Cultural material or features discovered within a previously recorded site location can be unrelated to the originally identified deposit and therefore have the potential to be classified as a new site, requiring new survey investigations.

3. If on-site archaeological investigations are required, the Dunkirk Gas Corporation's Environmental Inspector(s) will inform the Construction Supervisor. No construction work at the site that could affect the artifacts will be performed until the archaeologists review the site. The site will be flagged as being off- limits for work to protect the resources.

4. The archaeologists will conduct a review of the site and, in consultation with the DPS Staff and OPRHP, will survey the site as necessary, in accordance with New York standards and guidelines. Since the area will have already been partially disturbed by construction activities, the objective of any cultural resource investigations will be to evaluate data quickly so that the OPRHP notifications are made and consultation can proceed.

5. The archaeologists will determine, based on the deposits found and on the cultural sensitivity of the area in general, whether the site is potentially significant and whether the DPS Staff and the OPRHP require immediate notification by telephone. If not, data

regarding the site will be faxed or sent by express mail the OPRHP in order to ensure a quick site clearance.

6. Dunkirk Gas Corporation and its archaeologists will work with OPRHP to ensure that a treatment plan for the site is developed and implemented in as timely a fashion as possible.

2.2 Human Remains Discoveries

If any human remains are to be encountered, they will likely be discovered in excavations, possibly below areas tested by standard survey techniques.

The treatment of any human remains encountered during the Project will be guided by the policy statement adopted by the Advisory Council on Historic Preservation (see Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects, Advisory Council, February 23, 2007), and by the relevant state laws and guidelines. The Advisory Council policy statement recommends that, when burial sites, human remains, or funerary objects will be or are likely to be encountered in the course of Section 106 review, a federal agency should adhere to the following principles:

Principle 1: Participants in the Section 106 process should treat all burial sites, human remains, and funerary objects with dignity and respect.

Principle 2: Only through consultation, which is the early and meaningful exchange of information, can a federal agency make an informed and defensible decision about the treatment of burial sites, human remains, and funerary objects.

Principle 3: Native Americans are descendants of original occupants of this country. Accordingly, in making decisions, federal agencies should be informed by and utilize the special expertise of Indian tribes and Native Hawaiian organizations in the documentation and treatment of their ancestors.

Principle 4: Burial sites, human remains, and funerary objects should not be knowingly disturbed unless absolutely necessary, and only after the federal agency has consulted and fully considered avoidance of impact and whether it is feasible to preserve them in place.

Principle 5: When human remains or funerary objects must be disinterred, they should be removed carefully, respectfully, and in a manner developed in consultation.

Principle 6: The jurisdictional agency is ultimately responsible for making decisions regarding avoidance of impact to or treatment of burial sites, human remains, and funerary objects. In reaching its decisions, the federal agency must comply with applicable federal, tribal, state, or local laws.

Principle 7: Through consultation, agencies should develop and implement plans for the treatment of burial sites, human remains, and funerary objects that may be inadvertently discovered.

Principle 8: In cases where the disposition of human remains and funerary objects is not legally prescribed, agencies should proceed following a hierarchy that begins with the rights of lineal descendants, and if none, then the descendant community, which may include Indian tribes and Native Hawaiian organizations.

The procedures that will be followed in the event that human remains are discovered during construction of the Project are as follows:

1. If any personnel on the construction site identify human remains, all construction work in the immediate vicinity of the site will cease immediately. The remains should not be touched, moved, or further disturbed.

2. The Environmental Inspector will be informed immediately and notified of the exact location of the remains, as well as of the time of discovery, and in turn will be responsible for immediately contacting the Dunkirk Gas Corporation cultural resources consultant.

3. The Environmental Inspector and cultural resources consultant will be responsible for notifying appropriate OPRHP personnel as well as the County Coroner/State Medical Examiner and the State Police. If the cultural resources consultant determines that the remains are obviously human and recent, this should be indicated to the OPRHP, and the County Coroner/State Medical Examiner. If the cultural resources consultant considers that the remains appear to be over 100 years old, this should also be indicated to the

County Coroner/State Medical Examiner, and the cultural resources consultant should also inform the State Archaeologist so that these officials can coordinate and respond.

4. Dunkirk Gas Corporation will consult with the property owner to discuss whether there are prudent and feasible alternatives to protect the remains, and keep the OPRHP informed. If it is not possible to protect the remains, they may be excavated if permission to do so is granted by the State Archaeologist after review of an adequate data recovery plan that specifies a qualified research team and an appropriate research design, including a proposal for disposition of the remains. Analyses to be performed on Native American remains will be discussed in consultation with the OPRHP.

5. In all cases, due care will be taken in the excavation and subsequent transport and storage of the remains to ensure that the sacred meaning of the remains for Native Americans are respected and protected, as required.

3.0 List of Contacts

NYS Office of Parks, Recreation and Historic Preservation
625 Broadway
Albany NY 12207
518-474-0456

APPENDIX G

LANDOWNER EASEMENT STATUS

Dunkirk Gas Corporation
Landowner Easement Status
(as of September 26, 2014)

Reference	Tax Map Number	Parcel #	Owners Name	Parcel Address	City	Survey Access	Easement Status
1	**1**	79.01-1-14	Dunkirk Power LLC	106 Point Drive N	City of Dunkirk	Y	In Negotiations
2	**1.3**	79.09-2-8	Ehrheart, Robert S	80 Pointe Drive North	City of Dunkirk	Y	Complete
3	**1.4**	79.09-2-5	Dunkirk Power LLC	106 Point Drive N	City of Dunkirk	Y	In Negotiations
4	**1.5**	79.09-2-6	Dunkirk Power LLC	106 Point Drive N	City of Dunkirk	Y	In Negotiations
5	**1.6**	79.09-1-19	Dunkirk Power LLC	106 Point Drive N	City of Dunkirk	Y	In Negotiations
6	**5.2**	79.09-2-21	Niagara Mohawk	See Note 1	City of Dunkirk	y	In Negotiations
7	**7.1**	See Note 2	Point Drive North (Road)	n/a	City of Dunkirk	n/a	See Note 2
8	**8**	79.13-1-23	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations
9	**8.1**	79.13-1-24	Dunkirk Power LLC	106 Point Drive N	City of Dunkirk	Y	In Negotiations
10	**8.2**	79.13-1-25	Mekus, Gerald W	224 Lake Shore Drive	City of Dunkirk	Y	In Negotiations
11	**10**	79.13-1-21	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations
12	**11**	79.13-1-22	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations
13	**11.1**	See Note 2	Lake Shore Drive (AKA Route 5)	n/a	City of Dunkirk	n/a	See Note 2

Reference	Tax Map Number	Parcel #	Owners Name	Parcel Address	City	Survey Access	Easement Status
14	**12**	79.13-1-60	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations
15	**12.1**	79.13-1-61	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations
16	**12.2**	79.13-1-63	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations
17	**12.3**	79.13-1-64	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations
18	**12.4**	79.17-1-80	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations
19	**12.5**	79.17-1-81	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations
20	**13**	79.13-2-63	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations
21	**14**	79.17-1-83	New York Central Lines LLC	See Note 1	City of Dunkirk		In Negotiations
22	**14.1**	79.13-1-28	Lutz, Paul V	Lake Shore Drive	City of Dunkirk	Y	In Negotiations
23	**15.1**	79.13-1-29	Mekus, Gerald W	218 Lake Shore Drive	City of Dunkirk	Y	In Negotiations
24	**15.2**	79.13-1-30	Mekus, Gerald W	216 Lake Shore Drive	City of Dunkirk	Y	In Negotiations
25	**15.3**	79.13-1-31	Northern Chautauqua Community Foundation, INC	212 Lake Shore Drive West	City of Dunkirk	Y	In Negotiations
26	**15.5**	79.13-1-32	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations
27	**17**	79.17-1-84	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations
28	**17.1**	79.17-1-69	Corbett, Susan D	505 Brigham Road	City of Dunkirk	Y	In Negotiations
29	**17.2**	79.17-1-77	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations

Reference	Tax Map Number	Parcel #	Owners Name	Parcel Address	City	Survey Access	Easement Status
30	**17.3**	79.17-1-78	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations
31	**17.4**	79.17-1-70	Corbett, Clarence D Jr and Linda	Brigham Road Rear	City of Dunkirk	Y	In Negotiations
32	**17.5**	79.17-1-67	Benamati, James and Donna	519 Brigham Road	City of Dunkirk	Y	Complete
33	**17.6**	79.17-1-79	City Of Dunkirk	Pointe Drive West	City of Dunkirk	Y	In Negotiations
34	**17.7**	79.17-1-6	Buchanan, Lucian	Fifth Street	City of Dunkirk	Y	In Negotiations
35	**18.1**	79.17-1-71	Niagara Mohawk	See Note 1	City of Dunkirk	Y	In Negotiations
36	**19**	79.17-1-66	Privitera, Paul M and Carol A	523 Brigham Road	City of Dunkirk	Y	In Negotiations
37	**20**	79.17-1-65	Spierling, Nicole	525 Brigham Road	City of Dunkirk	Y	In Negotiations
38	**21**	79.17-1-72	Frye, Cathy; Poulos, Elizabeth; Sysol, Deborah; Guarino, Marygrace	Brigham Road	City of Dunkirk	Y	Not Started
39	**22**	96.05-1-1	Rem-tronics, Inc.	Brigham Road	City of Dunkirk	Y	In Negotiations
40	**23**	95.02-1-17	Niagara Mohawk	See Note 1	Dunkirk	Y	In Negotiations
41	**24**	95.02-1-16	New York Central Lines LLC	See Note 1	Dunkirk	Y	In Negotiations
42	**25**	95.02-1-29	Norfolk and Western Railway Company	See Note 1	Dunkirk	Y	In Negotiations
43	**26**	95.02-1-28	Norfolk and Western Railway Company	See Note 1	Dunkirk	Y	In Negotiations

Reference	Tax Map Number	Parcel #	Owners Name	Parcel Address	City	Survey Access	Easement Status
44	**27**	95.02-1-27	Niagara Mohawk	See Note 1	Dunkirk	Y	In Negotiations
45	**27.1**	95.02-1-18	Fred, Roberto and Milagros	Next to Railroad	Dunkirk	Y	In Negotiations
46	**27.2**	95.02-1-20	Fred, Roberto and Milagros	Next to Railroad	Dunkirk	Y	In Negotiations
47	**27.3**	95.02-1-26	Fred, Roberto and Milagros	Next to Railroad	Dunkirk	Y	In Negotiations
48	**27.41**	96.09-1-2	Niagara Mohawk	Willow Road	Dunkirk	Y	In Negotiations
49	**27.7**	95.02-1-19	Niagara Mohawk	See Note 1	Dunkirk	Y	In Negotiations
50	**28**	95.02-1-25	Niagara Mohawk	See Note 1	Dunkirk	Y	In Negotiations
51	**28.1**	95.02-1-24	Fred, Roberto and Milagros	Willow Road	Dunkirk	Y	In Negotiations
52	**28.2**	See Note 2	Temple Road (AKA County Road 113)	n/a	Dunkirk	n/a	See Note 2
53	**29**	95.04-1-13	Niagara Mohawk	See Note 1	Dunkirk	Y	In Negotiations
54	**29.1**	95.04-1-15	Fred, Roberto and Milagros	Temple Road	Dunkirk	Y	In Negotiations
55	**29.2**	95.04-1-28	Demonte, Kenneth	156 Willow Road	Dunkirk		Not Started
56	**30**	95.04-1-14	Fred, Roberto and Milagros	Temple Road	Dunkirk	Y	In Negotiations
57	**31**	95.04-1-21	Bender Properties, LLC	Willow Road	Dunkirk	y	In Negotiations
58	**31.1**	See Note 2	Willow Road (AKA County Road 98W)	n/a	Dunkirk	n/a	See Note 2
59	**32**	95.04-1-23	Niagara Mohawk	See Note 1	Dunkirk	Y	In Negotiations

Reference	Tax Map Number	Parcel #	Owners Name	Parcel Address	City	Survey Access	Easement Status
60	**33**	95.04-1-25	Szukala, Dolores A	Chestnut Road	Dunkirk	Y	Complete
61	**34**	95.04-1-47	Szukala, Dolores A	Chestnut Road	Dunkirk	Y	Complete
62	**35**	95.04-1-48	Niagara Mohawk	See Note 1	Dunkirk	Y	In Negotiations
63	**36**	112.00-2-7	Lesch, Sarah A	Hall Road	Pomfret	Y	In Negotiations
64	**37**	163.00-1-1	Niagara Mohawk	See Note 1	Pomfret	Y	In Negotiations
65	**37.1**	112.00-2-16	Zhang, Xiao	Van Buren Road	Pomfret	Y	In Negotiations
66	**37.2**	112.00-2-42	Grant, Timothy G and Rachel	4899 Van Buren Road	Pomfret	Y	In Negotiations
67	**37.3**	See Note 2	Van Buren Road (AKA County Road 73)	n/a	Pomfret	n/a	See Note 2
68	**38**	112.00-2-8	New York State (Interstate 90)	n/a	Pomfret		In Negotiations
69	**39**	112.00-2-40	Niagara Mohawk	See Note 1	Pomfret	Y	In Negotiations
70	**39.1**	112.00-2-38.2	Siebert, William P	Berry Road	Pomfret	Y	In Negotiations
71	**39.2**	112.00-2-39	Siebert, William P	4960 Berry Road	Pomfret	Y	In Negotiations
72	**39.21**	See Note 2	Berry Road (AKA County Road 618)	n/a	Pomfret	n/a	See Note 2
73	**39.4**	112.00-2-33	Lesch, Sarah J	Berry Road	Pomfret	Y	In Negotiations
74	**39.5**	129.00-2-2	Seibert, Paul	Farel Road	Pomfret	Y	In Negotiations
75	**40.2**	129.00-2-3	Dunkirk Service Corp	9867 Farel Road	Pomfret	Y	In Negotiations

Reference	Tax Map Number	Parcel #	Owners Name	Parcel Address	City	Survey Access	Easement Status
76	**40.3**	129.00-2-4	Dunkirk Service Corp	Farel Road	Pomfret	Y	In Negotiations
77	**40.4**	129.00-2-69	Lesch, John D.	Farel Road	Pomfret	Y	In Negotiations
78	**40.5**	129.00-2-67	Lesch, John D.	4890 Main Road	Pomfret	Y	In Negotiations
79	**41**	129.00-1-6	Joy, Rosemary	Berry Road	Pomfret	Y	In Negotiations
80	**41.1**	129.00-1-7	Willebrandt, Dennis C and Carol A	4936 Main Road	Pomfret	Y	In Negotiations
81	**41.2**	129.00-2-66.1	Willebrandt, Dennis C and Carol A	W Main Road	Pomfret	Y	In Negotiations
82	**41.3**	129.00-1-8.2	Willebrandt, Dennis C and Carol A	W Main Road	Pomfret	Y	In Negotiations
83	**41.4**	See Note 2	Route 20 (Road)	n/a	Pomfret	n/a	See Note 2
84	**41.5**	129.00-1-29	Reilly III, Thomas W and Catherine K	4973 W Main Road	Pomfret	Y	In Negotiations
85	**42**	129.00-1-10	Reilly III, Thomas W and Catherine K	Main Street	Pomfret	Y	In Negotiations
86	**42.1**	129.00-1-9	Lesch Farms, LLC	Main Road	Pomfret	Y	In Negotiations
87	**43**	146.00-1-10	Petke, Kenneth	4954 Webster Road	Pomfret	Y	In Negotiations
88	**43.1**	See Note 2	Webster Road	n/a	Pomfret	n/a	n/a
89	**44**	146.00-1-24	Garrasi, Bernard II	4939 Webster Road	Pomfret	y	In Negotiations

Reference	Tax Map Number	Parcel #	Owners Name	Parcel Address	City	Survey Access	Easement Status
90	**44.1**	146.00-1-26	Nalepa JR, Frank J and Pearson, Susan M	4955 Webster Road	Pomfret	Y	In Negotiations
91	**45**	146.00-1-29	Garrasi, Bernard II	Ellicott Road	Pomfret	Y	In Negotiations
92	**47**	146.00-1-31	Burlett, Kimberly	Webster Road	Pomfret	Y	In Negotiations
93	**47.1**	146.00-1-33	Burlett, Kimberly	Webster Road	Pomfret	Y	In Negotiations
94	**48**	146.00-1-32	Lewandowski, Raymond J and James E	Chautauqua Road	Pomfret	Y	In Negotiations
95	**49**	163.00-2-1	Lewandowski, Raymond J and David T	Chautauqua Road	Pomfret	Y	In Negotiations
96	**50**	163.00-2-51.2	Reigelman, Thomas R; Landrich, Sandi A	Chautauqua Road	Pomfret	Y	In Negotiations
97	**50.1**	See Note 2	Chautauqua Road	n/a	Pomfret	n/a	See Note 2
98	**51**	163.00-2-45	Hill, Harvey J and Patricia A	8820 Chautauqua Road	Pomfret	Y	In Negotiations
99	**51.2**	163.00-2-43	Hunt, Beverly J	Chautauqua Road	Pomfret	Y	In Negotiations
100	**52**	163.00-2-12	Briggs, Donald A and Carolyn A	8886 Chautauqua Road	Pomfret	Y	In Negotiations
101	**52.1**	163.00-2-44	Hunt, Beverly J	Chautuauqua Road	Pomfret	Y	In Negotiations
102	**53**	163.00-2-22	Whitehead, John W	Chautauqua Road	Pomfret	Y	Complete

Reference	Tax Map Number	Parcel #	Owners Name	Parcel Address	City	Survey Access	Easement Status
103	**54**	163.00-2-21	Dorman, David G	Concord Drive	Pomfret	Y	In Negotiations
104	**54.1**	163.00-2-36	Mikula, Joseph	Chautauqua Road	Pomfret	Y	In Negotiations
105	**55**	163.00-2-23	Way, Barry E and Joanne	8701 Concord Drive	Pomfret	Y	In Negotiations
106	**56**	163.00-2-25	JM Resources, Inc.	Concord Drive	Pomfret	Y	In Negotiations
107	**57**	163.00-2-26	Obarka, John and Patricia, Wieamore, Thomas (WROS)	Concord Drive	Pomfret		In Negotiations
108	**58**	163.00-2-31	Dorman, Troy D	8545 Fredonia-Stockton Road	Pomfret	Y	In Negotiations
109	**59**	180.00-1-14	Metzler, Paul T	8353 Fredonia-Stockton Road	Pomfret		In Negotiations
110	**60**	180.00-1-17	Jusko, Stephen E and Dawn N	8273 Fredonia-Stockton Road	Pomfret		In Negotiations
111	**60.1**	See Note 2	Fredonia-Stockton Road (AKA County Road 610)	n/a	Pomfret	n/a	See Note 2
112	**62**	181.00-1-57	Lauzon, Robert and Donna L	8172 Cummings Road	Pomfret	Y	In Negotiations
Notes:	1) Transmission line and railroad ROWs do not have local addresses. All coordination is through the company offices. 2) Road/sidewalk crossing easements will be established through the appropriate permit/approval process. All roads will be crossed at or near perpendicular. The Project does not parallel adjacent or within any public roads.						

APPENDIX H

HDD DRILLING PROFILES

Applus RTD
Quality Inspection Services, Inc.
37 Franklin Street • Suite 400
Buffalo, New York 14202
T +1 716-853-2611
F +1 716-853-2619
www.ApplusRTD.com

September 29, 2014

Hanover Engineering Associates, Inc.
26 Nesbitt Road
Suite 254
New Castle, PA 16105

ATTN: Mr. Joseph W Corona CPSS
Office Manager for New Castle Office

Office: (724) 598-6414
Email: jcorona@hanovereng.com

RE: SUMMARY REPORT: NRG HDD - I-90, WETLAND, AND RAVINE CROSSINGS, TOWN OF DUNKIRK/POMFRET, CHAUTAUQUA COUNTY, DUNKIRK, NEW YORK

Dear Mr. Corona:

At the request of Hanover Engineering Associates, Inc. (Hanover), Quality Inspection Services, Inc. – an Applus RTD Company –provided drilling and laboratory testing services for the above-referenced project location. Our scope of services included the following:

- Mobilized/Demobilized a Diedrich D-50 ATV-Mounted Drill Rig, Crew, and Equipment.
- Advance fourteen (14) soil borings in accordance with written and verbal directive from Client and completed split-spoon sampling and rock coring.
- Backfill borings with grout/soil cuttings.
- Conducted unconfined compressive strength (UCS) testing on rock cores as directed by client.
- Prepare boring logs, bedrock core testing, and a summary report.

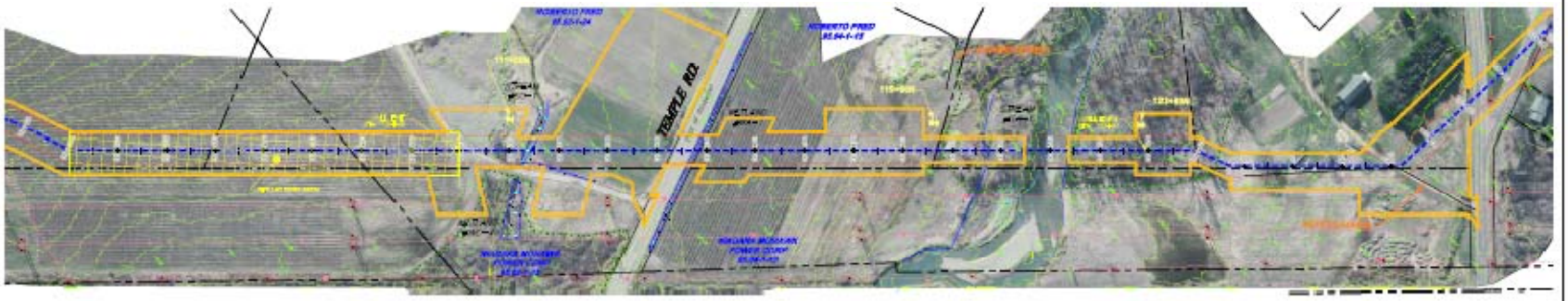
Soil borings and rock coring locations were completed between July 16 and August 12, 2014 at locations marked in the field by Hanover, and indicated on the attached Figures.

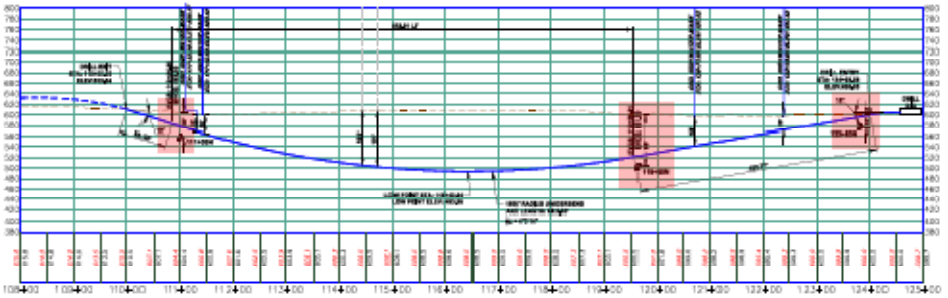
Hanover also requested laboratory testing on selected bedrock cores. Such testing included Unconfined Compressive Strength (UCS) testing at bedrock intervals selected by Hanover. However, depending on the integrity of the bedrock at the proposed test intervals, actual tested core depths varied in order to provide a suitable bedrock sample for testing in accordance with ASTM requirements. The results of the UCS testing are presented on the attached boring logs and as an Appendix to this report.

We appreciated this opportunity to have provided these services to Hanover on this project. Please feel free to contact the undersigned if you have any questions or comments regarding this submission.

Sincerely,
QUALITY INSPECTION SERVICES, INC.

Andrew J. Kucserik, CPG
Senior Geologist/Environmental Manager





ALL CORE SAMPLES ARE SHOWN AT
20' BELOW PROPOSED HDD BORE ELEVATION.

HDD PLAN & PROFILE

DUNKIRK GAS PIPELINE

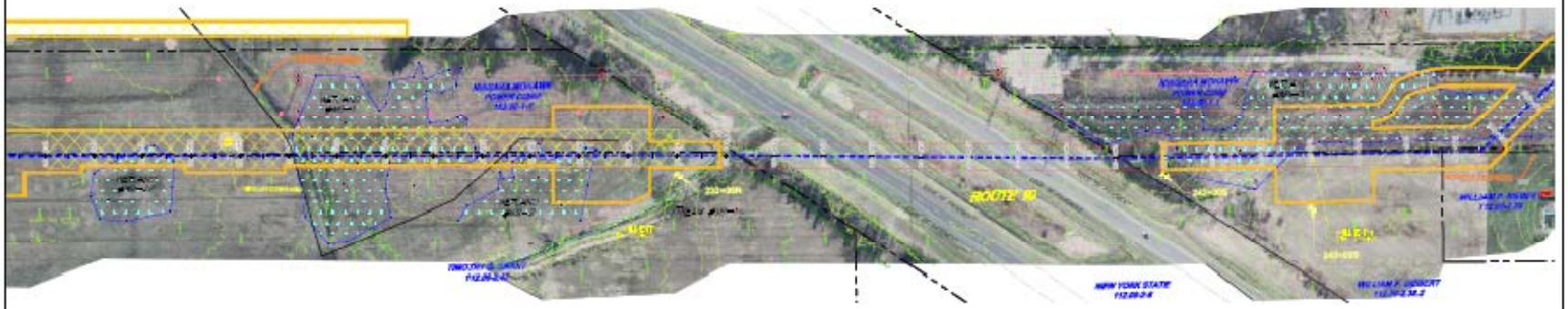
DUNKIRK & POMFRETT TOWNSHIPS
& THE CITY OF DUNKIRK
CHAUTAUQUA COUNTY
NEW YORK

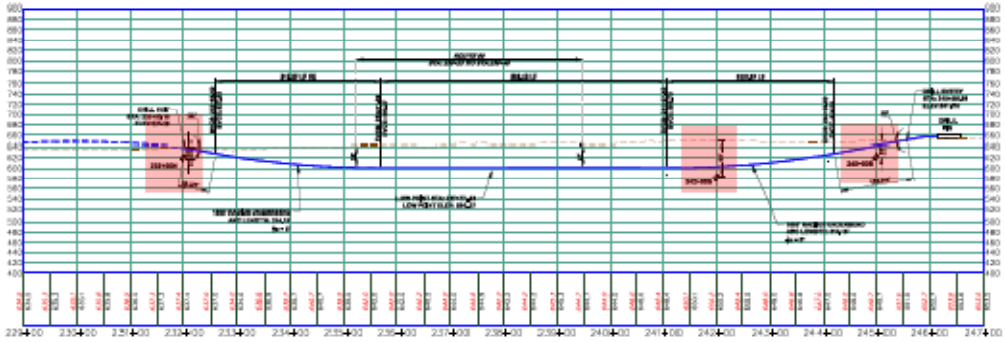
PROJECT NO. NRG-1003

SHEET NO. 1 of 1

Hanover Engineering Associates Inc.

3605 Route 611, Suite 1
Bartonsville, PA 18321-7622
570.880.9550
Fax 570.880.9706





HDD LENGTH = 1,297 LF
PIPE LAY DOWN = 1,297 LF

ALL CORE SAMPLES ARE SHOWN AT
20' BELOW PROPOSED HDD BORE ELEVATION.

GRAPHIC SCALE

(IN FEET)

ROUTE 90 HDD PLAN & PROFILE

DUNKIRK GAS PIPELINE

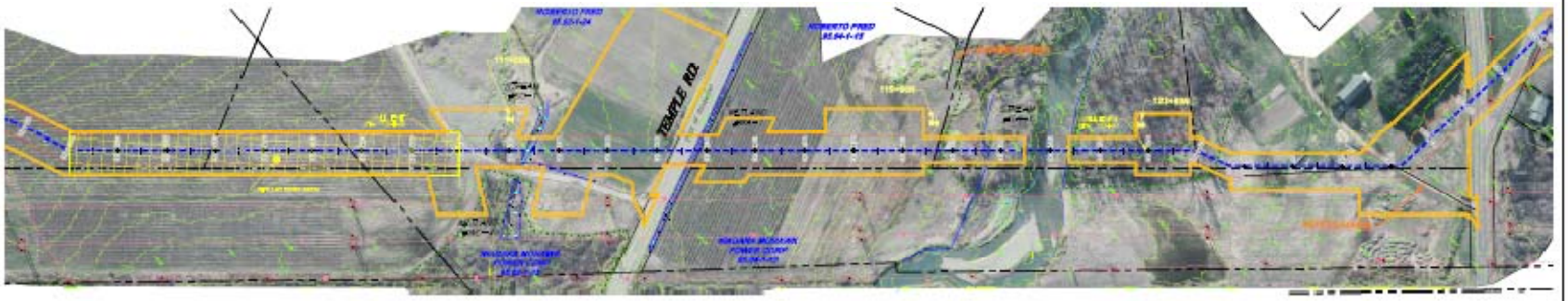
DUNKIRK & PORTER TOWNSHIPS
& THE CITY OF DUNKIRK
CHAUTAUQUA COUNTY
NEW YORK

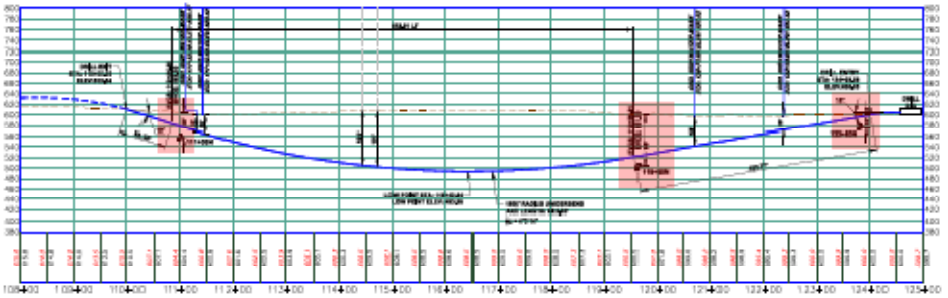
PROJECT NO.
NRG-1003

SHEET NO.
1 OF 1

Hanover
Engineering Associates, Inc.

3000 Route 611, Suite 1
Bartonsville, PA 18321-7622
570.895.9000
Fax 570.689.9798





ALL CORE SAMPLES ARE SHOWN AT
20' BELOW PROPOSED HDD BORE ELEVATION.

HDD PLAN & PROFILE

DUNKIRK GAS PIPELINE

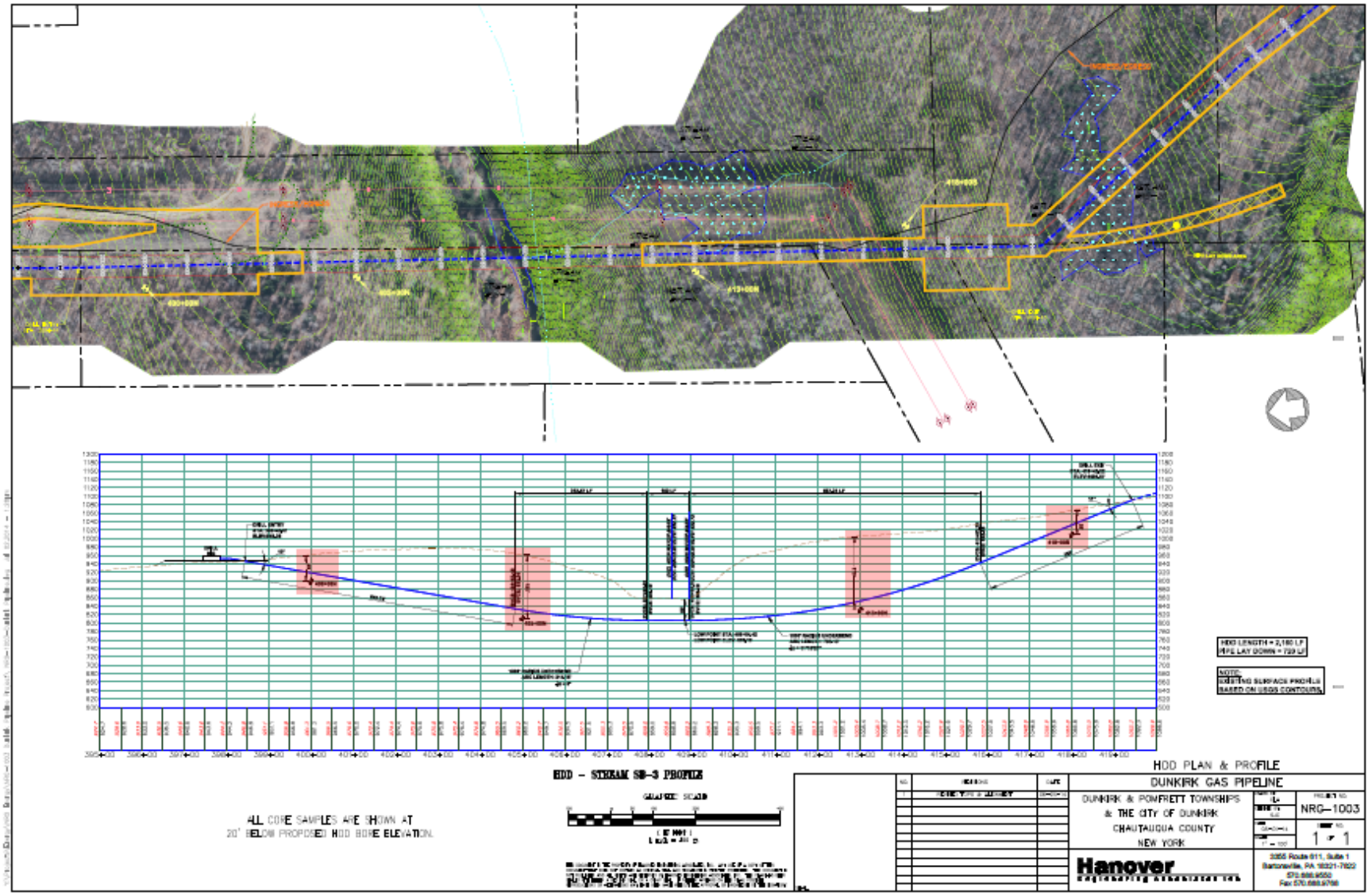
DUNKIRK & POMFRETT TOWNSHIPS
& THE CITY OF DUNKIRK
CHAUTAUQUA COUNTY
NEW YORK

PROJECT NO. NRG-1003

SHEET NO. 1 of 1

Hanover Engineering Associates Inc.

3605 Route 611, Suite 1
Bartonsville, PA 18321-7622
570.880.9550
Fax 570.880.9706



HDD LENGTH = 2,180 LF
PIPE LAY DOWN = 720 LF

NOTE:
EXISTING SURFACE PROFILE BASED ON USGS CONTOURS.

ALL CORE SAMPLES ARE SHOWN AT
20' BELOW PROPOSED HDD BORE ELEVATION.

HDD – STREAM SB-3 PROFILE

HDD PLAN & PROFILE

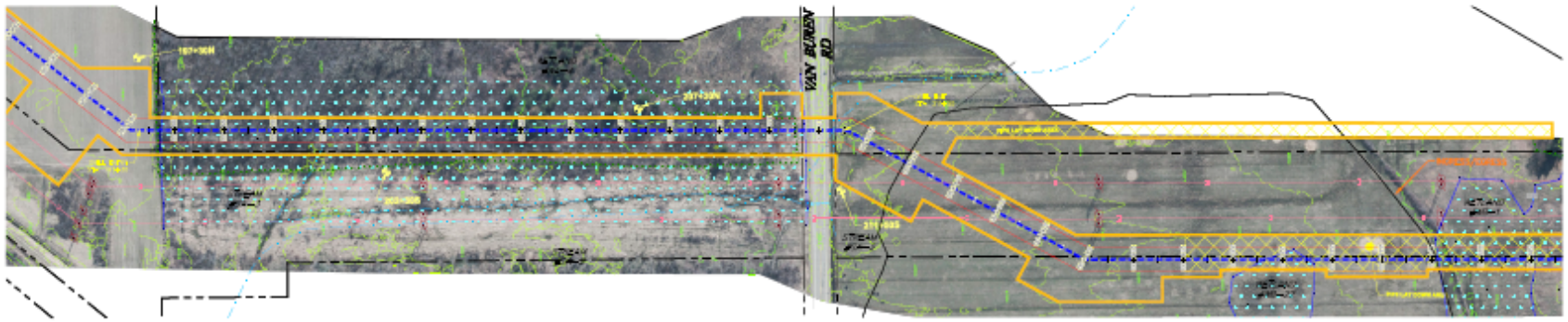
DUNKIRK GAS PIPELINE

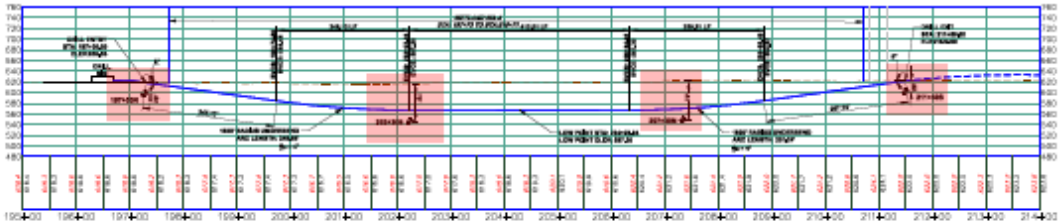
DUNKIRK & POMFRETT TOWNSHIPS
& THE CITY OF DUNKIRK
CHAUTAUQUA COUNTY
NEW YORK

PROJECT NO.
NRG-1003

SHEET NO.
1 OF 1

Hanover
engineering associates inc.





HDD LENGTH = 1,427 LF
PIPE LAY DOWN = 1,427 LF

ALL CORE SAMPLES ARE SHOWN AT
20' BELOW PROPOSED HDD BORE ELEVATION.

GRAPHIC SCALE

WETLAND #WA-4 HDD PLAN & PROFILE

DUNKIRK GAS PIPELINE

DUNKIRK & POMFRETT TOWNSHIPS
& THE CITY OF DUNKIRK
CHAUTAUQUA COUNTY
NEW YORK

PROJECT NO.
NRG-1003

SHEET NO.
1 OF 1

Hanover
engineering associates inc.

3255 Route 611, Suite 1
Bartonsville, PA 18321-7822
570.688.9450
Fax 570.688.9798

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 111+00N

CLIENT Hanover Engineering
PROJECT NAME NRG - 1003
PROJECT NUMBER 07.011295/006
PROJECT LOCATION Dunkirk NY
DATE STARTED 07/24/14 **COMPLETED** 07/24/14
GROUND ELEVATION _____ **HOLE SIZE** 6.5 inches
DRILLING CONTRACTOR Applus RTD
GROUND WATER LEVELS:
DRILLING METHOD 4.25-inch ID HSA
▽ **AT TIME OF DRILLING** 1.08 ft
LOGGED BY Jason Tojdowski **CHECKED BY** _____
AT END OF DRILLING ---
NOTES Sunny 75
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS S-1	25	2-3-5-7 (8)			▽ -Topsoil (rock in spoon blocked recovery)
						3.0
	SS S-2	71	5-8-7-50 (15)	ML		(ML) Brown to gray SILT and Gravel with Shale fragments
						7.3
10	R-1	100 (8)				Black SHALE, very fissile with fine laminae, weak grey beds of clay particles
	R-2	100 (100)				Black SHALE with very thin bedding of brown and grey layers of clay, very smooth -Depth: 11.9ft; Corrected Peak Stress, PSI: 1971 -Depth: 13.4ft; Corrected Peak Stress, PSI: 3656 -Depth: 14.7ft; Corrected Peak Stress, PSI: 2626
	R-3	100 (98)				17.3 Black SHALE, (monogenic composition), very thin to non laminae -Depth: 16.4ft; Corrected Peak Stress, PSI: 2451

Bottom of borehole at 17.3 feet.

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 119+60N

CLIENT Hanover Engineering
PROJECT NAME NRG - 1003
PROJECT NUMBER 07.011295/006
PROJECT LOCATION Dunkirk NY
DATE STARTED 07/24/14 **COMPLETED** 07/24/14
GROUND ELEVATION _____ **HOLE SIZE** 6.5 inches
DRILLING CONTRACTOR Applus RTD
GROUND WATER LEVELS:
DRILLING METHOD 4.25-inch ID HSA
▽ **AT TIME OF DRILLING** 9.75 ft Before coring
LOGGED BY Jason Tojdowski **CHECKED BY** _____
▼ **AT END OF DRILLING** 6.75 ft After coring
NOTES Sunny 75
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS S-1	83	4-6-8-12 (14)			Topsoil (0.5 ft)
						2.0 Light brown SAND and Gravel (GP)
	SS S-2	50	2-3-3-2 (6)	SP		(SP) Light brown SAND, wet
						7.0 ▽▼
10	SS S-3	100	7-25-50 (75)	CL		(CL) Grey SILTY CLAY with gray Weathered SHALE fragments
						12.0 Black SHALE, very thinly bedded, very fine, hydrocarbon smell when fractured
	R-1	93 (65)				Weak Bedding
						Becomes Brown and Black, low hydrocarbon trace smell
20	R-2	100 (58)				
						Weak bedding
	R-3	100 (98)				Occasional microcrystalline, thinly bedded Black SHALE with thing grey beds, smooth texture
30	R-4	100 (87)				
	R-5	100 (78)				Becomes dark grey thinly bedded SHALE; smooth texture
40	R-6	100 (83)				Becomes black , microcrystalline, very thin to slightly massive bedding
50						

(Continued Next Page)

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 119+60N

CLIENT Hanover Engineering **PROJECT NAME** NRG - 1003

PROJECT NUMBER 07.011295/006 **PROJECT LOCATION** Dunkirk NY

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
50						Black SHALE, very thinly bedded, very fine, hydrocarbon smell when fractured *(continued)*
60	R-7	100 (95)				
	R-8	100 (98)				Becomes very thinly bedded -Depth: 61.3ft; Corrected Peak Stress, PSI: 6092 -Depth: 62.1ft; Corrected Peak Stress, PSI: 2774 -Depth: 64.11ft; Corrected Peak Stress, PSI: 3783
70	R-9	100 (100)				Thin grey layer from 66.6 ft to 66.8 ft -Depth: 67.8ft; Corrected Peak Stress, PSI: 5382 -Depth: 69.6ft; Corrected Peak Stress, PSI: 4736 -Depth: 71.2ft; Corrected Peak Stress, PSI: 2947
80	R-10	100 (100)				-Depth: 76.11ft; Corrected Peak Stress, PSI: 3908
81.0						-Depth: 80.4ft; Corrected Peak Stress, PSI: 7510 Bottom of borehole at 81.0 feet.

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 123+80N

CLIENT Hanover Engineering
PROJECT NAME NRG - 1003
PROJECT NUMBER 07.011295/006
PROJECT LOCATION Dunkirk NY
DATE STARTED 07/28/14 **COMPLETED** 07/29/14
GROUND ELEVATION _____ **HOLE SIZE** 6.5 inches
DRILLING CONTRACTOR Applus RTD
GROUND WATER LEVELS:
DRILLING METHOD 4.25-inch ID HSA
▽ **AT TIME OF DRILLING** 7.80 ft
LOGGED BY Jason Tojdowski **CHECKED BY** _____
▼ **AT END OF DRILLING** 0.00 ft
NOTES Rain 60 on 7/28, clouds 60 on 7/29
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						▼
	SS S-1	56	1-1-2-1 (3)	SM		(SM) SAND and Silt, wet
2.0						
	SS S-2	0	16-14-12-10 (26)			-No Recovery
7.0						▽
10	SS S-2	8	50			Moderately weathered SHALE Rock becomes black, finely crystalline, well lithified with slight hydrocarbon trace, thin bedding with some brown color beds expressed, some crystalline structure expressed
	R-1	82 (100)				
	R-2	100 (68)				Occasional hydrocarbon crystal/solid thin bed at 15.4 ft -Depth: 15.4ft; Corrected Peak Stress, PSI: 3430 -Depth: 17.6ft; Corrected Peak Stress, PSI: 3103 -Depth: 19ft; Corrected Peak Stress, PSI: 2787
20						
	R-3	85 (64)				-Depth: 23.3ft; Corrected Peak Stress, PSI: 4127
25.3						Bottom of borehole at 25.3 feet.

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 197+30N

CLIENT Hanover Engineering
PROJECT NAME NRG - 1003
PROJECT NUMBER 07.011295/006
PROJECT LOCATION Dunkirk NY
DATE STARTED 07/23/14 **COMPLETED** 07/23/14
GROUND ELEVATION _____ **HOLE SIZE** 6.5 inches
DRILLING CONTRACTOR Applus RTD
GROUND WATER LEVELS:
DRILLING METHOD 4.25-inch ID HSA
▽ **AT TIME OF DRILLING** 7.58 ft -Before Coring
LOGGED BY Jason Tojdowski **CHECKED BY** _____
AT END OF DRILLING ---
NOTES Cloudy
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0						
	SS S-1	75	2-2-4-4 (6)	SP		Topsoil (0.5 ft) Light brown SAND, moist (SP)
					2.0	
	SS S-2	100	3-4-5-6 (9)	SP-SC		(SP-SC) Gray Silty CLAY and brown Sand, moist
					7.0	▽
10	SS S-3	46	1-17-14-10 (31)	CH		(CH) Grey Silty CLAY and moderately weathered Shale, moist
					12.0	
	SS S-4	63	7-12-14-13 (26)	ML		(ML) Weathered SHALE and Silt
					17.0	
20						
	SS S-5	17	50			Black, very fine SHALE, fine lamination with little to no hydrocarbon trace, inter-layered thin grey and brown layers
					20.4	
	R-1	80 (81)				
	R-2	100 (74)				Contoured bedding profiles at 28.2 ft
30					30.3	

Bottom of borehole at 30.3 feet.

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 202+30S

CLIENT Hanover Engineering
PROJECT NAME NRG - 1003
PROJECT NUMBER 07.011295/006
PROJECT LOCATION Dunkirk NY
DATE STARTED 07/22/14 **COMPLETED** 07/22/14
GROUND ELEVATION _____ **HOLE SIZE** 6.5 inches
DRILLING CONTRACTOR Applus RTD
GROUND WATER LEVELS:
DRILLING METHOD 4.25-inch ID HSA
▽ **AT TIME OF DRILLING** 11.30 ft
LOGGED BY Jason Tojdowski **CHECKED BY** _____
AT END OF DRILLING ---
NOTES Sunny, hot
▼ **AFTER DRILLING** 4.75 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS S-1	83	1-1-2-4 (3)	SM		Topsoil (0.5 ft) Brown Silty SAND, moist (SM)
					2.0	
	SS S-2	92	2-2-5-6 (7)	ML		(ML) Becomes gray-brown
					7.0	
10	SS S-3	67	3-5-7-14 (12)	ML		(ML) Gray SILT and weathered SHALE, moist
					12.0	
	SS S-4	71	31-14-18-21 (32)	CL-ML		(CL-ML) Gray Silty CLAY and weathered Shale, wet
					17.0	
20						
	SS S-4	17	50			Black SHALE, very fine, hydrocarbon traces when fractured, fine lamination
	R-1	82 (52)				-Depth 22.6ft; Corrected Peak Stress, PSI: 1717 -Depth: 23.9ft; Corrected Peak Stress, PSI: 2544 -Depth: 25.3ft; Corrected Peak Stress, PSI: 2283
	R-2	100 (71)				-Depth: 27.5ft; Corrected Peak Stress, PSI: 1914
30						
					30.3	Bottom of borehole at 30.3 feet.

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 207+30N

CLIENT Hanover Engineering
PROJECT NAME NRG - 1003
PROJECT NUMBER 07.011295/006
PROJECT LOCATION Dunkirk NY
DATE STARTED 07/21/14 **COMPLETED** 07/21/14
GROUND ELEVATION _____ **HOLE SIZE** 6.5 inches
DRILLING CONTRACTOR Applus RTD
GROUND WATER LEVELS:
DRILLING METHOD 4.25-inch ID HSA
▽ **AT TIME OF DRILLING** 4.50 ft
LOGGED BY Jason Tojdowski **CHECKED BY** _____
AT END OF DRILLING ---
NOTES Sunny 75
AFTER DRILLING ---

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY %	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS S-1	67	1-3-4-5 (7)	SP		Topsoil (1 ft) Light brown SAND, moist (SP)
						2.0
	SS S-2	92	2-5-7-8 (12)	SW-SM		▽ (SW-SM) SAND, Contains Shale fragments and gray Silt
						7.0
10	SS S-3	100	8-12-15-16 (27)			(ML) SILT and weathered Shale fragments
	SS S-4	67	11-16-22-27 (38)	ML		
20	SS S-5	58	6-17-22-24 (39)			
						23.6
	SS S-6	17	50			Gray-black SHALE with thin-fine laminae and small brown oxidized layers some weak inter-layer bedding
						Weak bedding from 28.2 - 28.8 ft
30						Weak bedding from 29.7 - 30.6 ft Slight hydrocarbon trace odor from 30.6 - 34.7 ft
						-Depth: 33ft; Corrected Peak Stress, PSI: 2882
						-Depth: 34.3ft; Corrected Peak Stress, PSI: 3011
						-Depth: 36.2ft; Corrected Peak Stress, PSI: 2257 -Depth: 37.1ft; Corrected Peak Stress, PSI: 1805 A very thin, highly fissile, weak Shale bed at 37.6 ft
40						-Depth: 40.4ft; Corrected Peak Stress, PSI: 2849
						-Depth: 42.8ft; Corrected Peak Stress, PSI: 1974
						44.6
						-Depth: 44.4ft; Corrected Peak Stress, PSI: 3193 Bottom of borehole at 44.6 feet.

BORING NUMBER 211+50S

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

CLIENT Hanover Engineering
PROJECT NAME NRG - 1003
PROJECT NUMBER 07.011295/006
PROJECT LOCATION Dunkirk NY
DATE STARTED 07/21/14 **COMPLETED** 07/22/14
GROUND ELEVATION _____ **HOLE SIZE** 6.5 inches
DRILLING CONTRACTOR Applus RTD
GROUND WATER LEVELS:
DRILLING METHOD 4.25-inch ID HSA
AT TIME OF DRILLING ---
LOGGED BY Jason Tojdowski **CHECKED BY** _____
AT END OF DRILLING ---
NOTES Sunny 88
AFTER DRILLING 3.00 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS S-1	71	3-4-5-7 (9)	SM		Topsoil (0.58 ft) (SM) Light brown Silty SAND, moist
					2.0	
	SS S-2	100	2-8-10-14 (18)	CL-ML		(CL-ML) Gray Silty CLAY, weathered Shale, moist
10	SS S-3	100	11-12-23-33 (35)		12.0	
	SS S-4	83	8-18-38-31 (56)	ML		(ML) Gray brown SILT and weathered Shale, moist
20	SS S-5	58	6-20-28-21 (48)		23.1	
	R-1	50 (92)				Black SHALE grading to gray, fine grained, very thin laminae
	R-2	100 (88)				
30	R-3	97 (73)				Weakly graded section at 29.8 ft to 31.2 ft
					34.7	

Bottom of borehole at 34.7 feet.

BORING NUMBER 232+00N

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

CLIENT Hanover Engineering
PROJECT NAME NRG - 1003
PROJECT NUMBER 07.011295/006
PROJECT LOCATION Dunkirk NY
DATE STARTED 07/18/14 **COMPLETED** 07/18/14
GROUND ELEVATION _____ **HOLE SIZE** 6.5 inches
DRILLING CONTRACTOR Applus RTD
GROUND WATER LEVELS:
DRILLING METHOD 4.25-inch ID HSA
AT TIME OF DRILLING ---
LOGGED BY Jason Tojdowski **CHECKED BY** _____
AT END OF DRILLING ---
NOTES Sunny 75
AFTER DRILLING 3.70 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS S-1	63	2-2-3-3 (5)	SP-SM		Topsoil (0.4 ft) (SP-SM) Brown Silty SAND and Gravel, moist
2.0						
	SS S-2	79	2-2-4-5 (6)	ML		(ML) Brown SILT and Shale fragments, moist
7.0						
10	SS S-3	79	19-40-50 (90)	CL-ML		(CL-ML) Brown SILT and Clay, moist
12.0						
	SS S-4	63	7-40-50 (90)	ML		(ML) Gray SILT and Shale fragments, moist
20	SS S-5	75	12-10-8-12 (18)			
23.2	SS S-6	42	50/2"			
	R-1	92 (82)				Black SHALE, fine, massively bedded
30	R-2	98 (89)				
33.2						Bottom of borehole at 33.2 feet.

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 242+00S

CLIENT Hanover Engineering
PROJECT NAME NRG - 1003
PROJECT NUMBER 07.011295/006
PROJECT LOCATION Dunkirk NY
DATE STARTED 07/17/14 **COMPLETED** 07/17/14
GROUND ELEVATION _____ **HOLE SIZE** 6.5 inches
DRILLING CONTRACTOR Applus RTD
GROUND WATER LEVELS:
DRILLING METHOD 4.25-inch ID HSA
AT TIME OF DRILLING ---
LOGGED BY Jason Tojdowski **CHECKED BY** _____
AT END OF DRILLING ---
NOTES Sunny 70
AFTER DRILLING 4.80 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS S-1	88	1-1-1-7 (2)	SP-SM		Topsoil (0-1 ft) (SP-SM) Brown SILT and fine Sand, little Clay, trace organic, moist
2.0						
	SS S-2	92	1-2-3-4 (5)	SP-SM		(SP-SM) Brown SILT and fine Sand, wet
7.0						
10	SS S-3	100	1-2-3-5 (5)	ML		(ML) Brown SILT, some fine Sand, little Clay, wet
12.0						
	SS S-4	33	1-5-10-11 (15)	CL-ML		(CL-ML) Gray brown SILT, some Clay, little fine Sand, with weathered Shale fragments
17.0						
20	SS S-5	75	11-12-13-15 (25)	SM		(SM) Gray brown medium SAND and Silt, trace clay, with weathered Shale frfagments, dry
25.4	SS S-6	17	50			
	R-1	95 (83)				Very fine black SHALE, thinly laminated, with brown layers and occasionally gray clay layers -Depth: 25.6ft; Corrected Peak Stress, PSI: 3745 -Depth: 27.1ft; Corrected Peak Stress, PSI: 2666 -Depth: 27.8ft; Corrected Peak Stress, PSI: 3092 -Depth: 28.11ft; Corrected Peak Stress, PSI: 1790
30	R-2	100 (83)				Thin laminae of grey clay between 31.3 and 31.4 ft -Depth: 32.1ft; Corrected Peak Stress, PSI: 3768
	R-3	100 (93)		SM		-Depth: 33.9ft; Corrected Peak Stress, PSI: 2707 Thin laminae at 36.4-37.2 ft -Depth: 38.1ft; Corrected Peak Stress, PSI: 2552
40	R-4	100 (24)				Grades to massive fractured bedding at 40.9 ft and continues to end of run. Some fractures and crystalline structures
45.4						Bottom of borehole at 45.4 feet.

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 245+00S

CLIENT Hanover Engineering
PROJECT NAME NRG - 1003
PROJECT NUMBER 07.011295/006
PROJECT LOCATION Dunkirk NY
DATE STARTED 07/16/14 **COMPLETED** 07/16/14
GROUND ELEVATION _____ **HOLE SIZE** 6.5 inches
DRILLING CONTRACTOR Applus RTD
GROUND WATER LEVELS:
DRILLING METHOD 4.25-inch ID HSA
AT TIME OF DRILLING ---
LOGGED BY Jason Tojdowski **CHECKED BY** _____
AT END OF DRILLING ---
NOTES Sunny 70
AFTER DRILLING 2.67 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS S-1	58	3-4-5-5 (9)	ML		Topsoil (1 ft) (ML) Yellowish brown SILT, trace fine sand, moist
2.0						
	SS S-2	79	3-3-3-4 (6)	ML		(ML) Brown SILT, moist
7.0						
10	SS S-3	96	7-12-12-16 (24)			Gray TILL with Shale fragments
	SS S-4	75	10-12-13-21 (25)			
20	SS S-5	83	10-24-24-35 (48)			
24.6						
	SS S-6	8	50			Black SHALE, moderately weathered Grades to fine black SHALE with very fine laminae -Depth: 26.5ft; Corrected Peak Stress, PSI: 3554
	R-1	100 (80)				
30						-Depth: 29.7ft; Corrected Peak Stress, PSI: 3043
	R-2	100 (100)				-Depth: 32.2ft; Corrected Peak Stress, PSI: 3444
34.6						-Depth: 34.2ft; Corrected Peak Stress, PSI: 2365

Bottom of borehole at 34.6 feet.

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 400+00N

CLIENT Hanover Engineering
PROJECT NAME NRG - 1003
PROJECT NUMBER 07.011295/006
PROJECT LOCATION Dunkirk NY
DATE STARTED 08/12/14 **COMPLETED** 08/13/14
GROUND ELEVATION _____ **HOLE SIZE** 6.5 inches
DRILLING CONTRACTOR Applus RTD
GROUND WATER LEVELS:
DRILLING METHOD 4.25-inch ID HSA
AT TIME OF DRILLING ---
LOGGED BY Jason Tojdowski **CHECKED BY** _____
AT END OF DRILLING ---
NOTES Sunny 80
AFTER DRILLING 4.17 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS S-1	50	2-2-3-4 (5)	CL-ML		(CL-ML) Gray brown Silty CLAY, moist
2.0						
	SS S-2	75	11-19-34-50 (53)	ML		(ML) Weathered SHALE, some Silt, moist
7.0						
10	SS S-3	63	15-34-45-50 (79)			Black SHALE with interbedded quartz Sandstone
	R-1	96 (17)				
	R-2	100 (40)				Becomes bioturbated with dark gray Siltstone
20	R-3	100 (52)				
	R-4	100 (58)				
30	R-5	100 (76)				
34.0						Bottom of borehole at 34.0 feet.

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 405+00N

CLIENT Hanover Engineering
PROJECT NAME NRG - 1003
PROJECT NUMBER 07.011295/006
PROJECT LOCATION Dunkirk NY
DATE STARTED 08/07/14 **COMPLETED** 08/12/14
GROUND ELEVATION _____ **HOLE SIZE** 6.5 inches
DRILLING CONTRACTOR Applus RTD
GROUND WATER LEVELS:
DRILLING METHOD 4.25-inch ID HSA
AT TIME OF DRILLING ---
LOGGED BY Jason Tojdowski **CHECKED BY** _____
AT END OF DRILLING ---
NOTES Sunny 75
AFTER DRILLING 41.58 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS S-1	50	4-4-5-5 (9)	CL-ML		Topsoil (0.1 ft) (CL-ML) Grayish brown Silty CLAY, moist
2.0						
	SS S-2	79	20-23-27-22 (50)			-Gray brown SHALE Fragments and Silt, moist
7.0						
10	SS S-3	25	26-50			Green SILTSTONE (crystalline) interbedded with cross-bedded gray SANDSTONE
11.0	R-1	43 (4)				Black SHALE, interbedded with the gray Sandstone
	R-2	94 (66)				Weak bedding from 15.5 to 16.8 ft
20	R-3	100 (84)				
	R-4	100 (54)				Interbedded black SHALE, gray SILTSTONE and light gray fine SANDSTONE with crossbedding and erosinal surfaces
30	R-5	100 (70)				
	R-6	100 (48)				
40	R-7	100 (84)				Weak bedding from 41.6 - 42.1 ft
	R-8	100 (78)				
50						

(Continued Next Page)

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 405+00N

CLIENT Hanover Engineering **PROJECT NAME** NRG - 1003

PROJECT NUMBER 07.011295/006 **PROJECT LOCATION** Dunkirk NY

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
50						51.0
	R-9	100 (96)				52.0 Interbedded massive SANDSTONE
						54.6
						Interbedded massive SANDSTONE
	R-10	100 (98)				57.0
60						Interbedded Black SHALE, gray fine SANDSTONE, and dark gray SILTSTONE with crossbedding and surface erosion features
	R-11	100 (74)				65.5
						Massive SANDSTONE bedding from 65.5 - 67.5
	R-12	100 (66)				67.5
70						Interbedded Black SHALE, gray fine SANDSTONE, and dark gray SILTSTONE with crossbedding and surface erosion features
	R-13	100 (96)				No hydrocarbon trace
	R-14	100 (72)				80.0
80						Massive SANDSTONE bedding from 80 - 82 ft
	R-15	100 (88)				82.0
						Interbedded Black SHALE, with gray SILTSTONE, fine SANDSTONE with crossbedding and bioturbation No hydrocarbon trace
	R-16	100 (58)				87.3
90						Grey SHALE with interbedded Black SHALE, some organic traces
	R-17	100 (54)				-Depth: 89.2ft; Corrected Peak Stress, PSI:2255 Coarse crossbedding at 89.3 - 89.9 ft
						-Depth: 91.4ft; Corrected Peak Stress, PSI: 3575
	R-18	100 (96)				-Depth: 93.9ft; Corrected Peak Stress, PSI: 2312
100						101.8
	R-19	100 (56)				-Depth: 101.5ft; Corrected Peak Stress, PSI: 3169
						Fine interbedded Black SHALE and gray Silty SANDSTONE with crossbedding and erosional surfaces -Depth: 102.11ft; Corrected Peak Stress, PSI: 2809

(Continued Next Page)

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 405+00N

CLIENT Hanover Engineering **PROJECT NAME** NRG - 1003

PROJECT NUMBER 07.011295/006 **PROJECT LOCATION** Dunkirk NY

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
110	R-20	100 (56)				Fine interbedded Black SHALE and gray Silty SANDSTONE with crossbedding and erosional surfaces *(continued)*
	R-21	100 (80)				-Depth: 110.1ft; Corrected Peak Stress, PSI: 2787 -Depth: 112.9ft; Corrected Peak Stress, PSI: 2780
						115.5 Interbedded Black SHALE and very fine grained SANDSTONE with small scale crossbedding, crystalline
120	R-22	100 (100)				-Depth: 117.7ft; Corrected Peak Stress, PSI: 3541 -Depth: 119.4ft; Corrected Peak Stress, PSI: 2965
	R-23	100 (98)				Weak bedding from 124 - 124.5 ft -Depth: 124.1ft; Corrected Peak Stress, PSI: 3575
130	R-24	100 (88)				130.4 Interbedded black organic SHALE beds to gray non-organic SHALE beds
	R-25	100 (78)				
140	R-26	100 (87)				
	R-27	100 (62)				145.5 Weak bedding from 144.5 to 145.5 ft
150	R-28	92 (72)				Interbedded Black SHALE, Gray fine SANDSTONE and dark Gray SILTSTONE with crossbedding and erosional surfaces
						150.5 Bottom of borehole at 150.5 feet.

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 413+00N

CLIENT Hanover Engineering
PROJECT NAME NRG - 1003
PROJECT NUMBER 07.011295/006
PROJECT LOCATION Dunkirk NY
DATE STARTED 08/01/14 **COMPLETED** 08/06/14
GROUND ELEVATION _____ **HOLE SIZE** 6.5 inches
DRILLING CONTRACTOR Applus RTD
GROUND WATER LEVELS:
DRILLING METHOD 4.25-inch ID HSA
AT TIME OF DRILLING ---
LOGGED BY Jason Tojdowski **CHECKED BY** _____
AT END OF DRILLING ---
NOTES Sunny
AFTER DRILLING 11.58 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS S-1	54	6-3-3-3 (6)	CL-ML		Topsoil (0.33 ft)
2.0						(CL-ML) Brown Silty CLAY and weathered Shale fragments, moist
	SS S-2	88	9-18-25-18 (43)			Brown/gray SHALE, moderately weathered, moist
10	SS S-3	58	13-25-47-50 (72)			
14.5	SS S-4	25	27-50			Weathered Interbedded black SHALE and gray SILTSTONE
	R-1	100 (25)				
20	R-2	95 (77)				Small scale crossbedding with bedding surface erosion featuires
	R-3	97 (92)				
30	R-4	100 (86)				
	R-5	100 (62)				
40	R-6	100 (50)				
	R-7	100 (40)				
						Weak bedding at 47.3 - 48.6 ft
50						

(Continued Next Page)

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 413+00N

CLIENT Hanover Engineering **PROJECT NAME** NRG - 1003

PROJECT NUMBER 07.011295/006 **PROJECT LOCATION** Dunkirk NY

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
50	R-8	100 (70)				Weathered Interbedded Black SHALE and gray SILTSTONE *(continued)*
						Weak bedding at 52.5 - 53 ft
	R-9	100 (98)				Interbedded Black SHALE, dark gray SILTSTONE, gray fine quartzose SANDSTONE with bedding surface erosion and crossbeding
						57.0
60	R-10	100 (94)				Gray SANDSTONE
	R-11	100 (90)				
70	R-12	100 (60)				Becomes massive bedding at 71.5 to 72.5
	R-13	100 (86)				Interbedded black SHALE, dark gray SILTSTONE, grey SANDSTONE, with crossbedding and erosional surfaces Massive SANDSTONE bedding at 75 - 77 ft
80	R-14	100 (84)				Massive SANDSTONE bedding at 81.5 - 83 ft
	R-15	100 (98)				Thick SANDSTONE bedding at 84 - 84.4 ft
90	R-16	100 (64)				
	R-17	100 (92)				
100	R-18	100 (100)				102.3
						Contains crossbedded Silty SANDSTONE, very fine, quartzose
	R-19	92 (89)				105.5

(Continued Next Page)

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

BORING NUMBER 413+00N

CLIENT Hanover Engineering **PROJECT NAME** NRG - 1003

PROJECT NUMBER 07.011295/006 **PROJECT LOCATION** Dunkirk NY

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
						Gray Crosbedded fine silty SANDSTONE with erosional surfaces and quartzose grains with interbedded black SHALE *(continued)*
110	R-20	100 (96)				
	R-21	100 (62)				
						117.7 Interbedded black SHALE and gray SANDSTONE with crossbedding and erosional planes between Sandstone and Shale beds
120	R-22	100 (82)				
	R-23	100 (68)				
130	R-24	100 (68)				131.3 Interbedded black SHALE and gray fine Silty SANDSTONE with crossbedding and erosional surfaces
	R-25	100 (84)				
140	R-26	100 (48)				-Depth: 141.2ft; Corrected Peak Stress, PSI: 2618
	R-27	100 (88)				-Depth: 144ft; Corrected Peak Stress, PSI: 1911
150	R-28	100 (100)				150.5 Bottom of borehole at 150.5 feet.

BORING NUMBER 418+00S

Applus RTD
4400 Broadway
Depew, NY 14043
Telephone: 716-686-3710

CLIENT Hanover Engineering
PROJECT NAME NRG - 1003
PROJECT NUMBER 07.011295/006
PROJECT LOCATION Dunkirk NY
DATE STARTED 07/30/14 **COMPLETED** 07/30/14
GROUND ELEVATION _____ **HOLE SIZE** 6.5 inches
DRILLING CONTRACTOR Applus RTD
GROUND WATER LEVELS:
DRILLING METHOD 4.25-inch ID HSA
AT TIME OF DRILLING ---
LOGGED BY Jason Tojdowski **CHECKED BY** _____
AT END OF DRILLING ---
NOTES Sunny
AFTER DRILLING 11.42 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0	SS S-1	25	1-2-4-7 (6)	SP		Topsoil (0.33 ft)
					2.0	(SP) Light brown SAND, moist
	SS S-2	83	7-20-24-33 (44)			Brown-grey SHALE, moderately weathered
10	SS S-3	69	14-21-34-50 (55)		11.0	
	R-1	58 (50)			15.5	Gray crossbedded SANDSTONE, crystalline, quartzose
	R-2	90 (29)				Black SHALE interbedded with gray SANDSTONE and crossbedded with erosional surfaces
20	R-3	100 (20)				Weak bedding from 20.5 - 22.8 ft
	R-4	100 (68)				
30	R-5	98 (35)			34.0	
					34.8	Finely crystalline massive SANDSTONE
					35.5	Black SHALE with interbedded gray SANDSTONE

Bottom of borehole at 35.5 feet.

Laboratory Evaluation of Construction Materials
Field Testing & Observation
Subsurface Investigations
Geotechnical Engineering

John H. Robinson Testing
1319 Sassafras Street
Erie, Pennsylvania 16501-1720
Telephone: 814.454.0195
Facsimile: 814.453.2020

Member: ASTM, ACI, ACIL
AAP AASHTO R18 Accredited
USACOE Validated

Date: September 10, 2014

Client: Applus RTD
4400 Broadway
Depew, NY 14043
Attn.: Andrew Kucserik, CPG, PG

Re: Compression Testing of Rock Cores
Project # 2014605001.020

Lab Reference: G-14-0159
Received: 09-08-2014
Examined with the following results:

NRG SAMPLES: *119+60*

Run Number	8	8	8	9	9
Depth	61.3	62.10	64.11	67.8	69.6
Diameter, in.	2.00	2.00	2.00	2.00	2.00
Tested Length, in:	4.00	4.00	4.00	4.00	4.00
Length/Diameter Ratio:	2.00	2.00	2.00	2.00	2.00
Correction Factor:	1.00	1.00	1.00	1.00	1.00
Peak Load, Pounds:	19,130	8,710	11,880	16,900	14,870
Area, si	3.14	3.14	3.14	3.14	3.14
Corrected Peak Stress, PSI:	6,092	2,774	3,783	5,382	4,736

Run Number	9	10	10
Depth	71.2	76.11	80.4
Diameter, in.	2.00	2.00	2.00
Tested Length, in	3.00	4.00	4.00
Length/Diameter Ratio:	2.00	2.00	2.00
Correction Factor:	0.96	1.00	1.00
Peak Load, Pounds:	9,640	12,270	23,580
Area, si	3.14	3.14	3.14
Corrected Peak Stress, PSI:	2,947	3,908	7,510

Respectfully submitted,

Dennis R. Smale 9/10/14

Dennis R. Smale,
Laboratory Superintendent

Laboratory Evaluation of Construction Materials
Field Testing & Observation
Subsurface Investigations
Geotechnical Engineering

John H. Robinson Testing
1319 Sassafras Street
Erie, Pennsylvania 16501-1720
Telephone: 814.454.0195
Facsimile: 814.453.2020

Member: ASTM, ACI, ACIL
AAP AASHTO R18 Accredited
USACOE Validated

Date: September 10, 2014

Client: Applus RTD
4400 Broadway
Depew, NY 14043
Attn.: Andrew Kucserik, CPG, PG

Re: Compression Testing of Rock Cores
Project # 2014605001.020

Lab Reference: G-14-0159
Received: 09-08-2014
Examined with the following results:

NRG SAMPLES: 202-30

Run Number	1	1	2	2
Depth	22.6	23.9	25.3	27.5
Diameter, in.	2.00	2.00	2.00	2.00
Tested Length, in:	4.00	3.50	4.00	4.00
Length/Diameter Ratio:	2.00	1.75	2.00	2.00
Correction Factor:	1.00	0.98	1.00	1.00
Peak Load, Pounds:	5,390	8,150	7,170	6,010
Area, si	3.14	3.14	3.14	3.14
Corrected Peak Stress, PSI:	1,717	2,544	2,283	1,914

Respectfully submitted,

Dennis R. Smale 9/10/14

Dennis R. Smale,
Laboratory Superintendent

Laboratory Evaluation of Construction Materials
Field Testing & Observation
Subsurface Investigations
Geotechnical Engineering

John H. Robinson Testing
1319 Sassafras Street
Erie, Pennsylvania 16501-1720
Telephone: 814.454.0195
Facsimile: 814.453.2020

Member: ASTM, ACI, ACIL
AAP AASHTO R18 Accredited
USACOE Validated

Date: September 10, 2014

Client: Applus RTD
4400 Broadway
Depew, NY 14043
Attn.: Andrew Kucserik, CPG, PG

Re: Compression Testing of Rock Cores
Project # 2014605001.020

Lab Reference: G-14-0159
Received: 09-08-2014
Examined with the following results:

NRG SAMPLES: 242-005

Run Number	1	1	1	1	2
Depth	25.6	27.1	27.8	28.11	32.1
Diameter, in.	2.00	2.00	2.00	2.00	2.00
Tested Length, in:	4.00	4.00	4.00	4.00	4.00
Length/Diameter Ratio:	2.00	2.00	2.00	2.00	2.00
Correction Factor:	1.00	1.00	1.00	1.00	1.00
Peak Load, Pounds:	11,760	8,370	9,710	5,620	11,830
Area, si	3.14	3.14	3.14	3.14	3.14
Corrected Peak Stress, PSI:	3,745	2,666	3,092	1,790	3,768

Run Number	2	3
Depth	33.9	38.1
Diameter, in.	2.00	2.00
Tested Length, in	3.00	2.00
Length/Diameter Ratio:	2.00	1.00
Correction Factor:	0.96	0.87
Peak Load, Pounds:	8,500	9,210
Area, si	3.14	3.14
Corrected Peak Stress, PSI:	2,707	2,552

Respectfully submitted,

Dennis R. Smale 9/10/14

Dennis R. Smale,
Laboratory Superintendent

Laboratory Evaluation of Construction Materials
Field Testing & Observation
Subsurface Investigations
Geotechnical Engineering

John H. Robinson Testing
1319 Sassafras Street
Erie, Pennsylvania 16501-1720
Telephone: 814.454.0195
Facsimile: 814.453.2020

Member: ASTM, ACI, ACIL
AAP AASHTO R18 Accredited
USACOE Validated

Date: September 10, 2014

Client: Applus RTD
4400 Broadway
Depew, NY 14043
Attn.: Andrew Kucserik, CPG, PG

Re: Compression Testing of Rock Cores
Project # 2014605001.020

Lab Reference: G-14-0159
Received: 09-08-2014
Examined with the following results:

NRG 1003 SAMPLES: B245-005

Run Number	1	2	2	2
Depth	26.5	29.7	32.2	34.2
Diameter, in.	2.00	2.00	2.00	2.00
Tested Length, in:	4.00	3.00	4.00	4.00
Length/Diameter Ratio:	2.00	1.50	2.00	2.00
Correction Factor:	1.00	0.96	1.00	1.00
Peak Load, Pounds:	11,160	9,960	10,820	7,430
Area, si	3.14	3.14	3.14	3.14
Corrected Peak Stress, PSI:	3,554	3,043	3,444	2,365

Respectfully submitted,

Dennis R. Smale 9/10/14

Dennis R. Smale,
Laboratory Superintendent

Laboratory Evaluation of Construction Materials
Field Testing & Observation
Subsurface Investigations
Geotechnical Engineering

John H. Robinson Testing
1319 Sassafras Street
Erie, Pennsylvania 16501-1720
Telephone: 814.454.0195
Facsimile: 814.453.2020

Member: ASTM, ACI, ACIL
AAP AASHTO R18 Accredited
USACOE Validated

Date: September 10, 2014

Client: Applus RTD
4400 Broadway
Depew, NY 14043
Attn.: Andrew Kucserik, CPG, PG

Re: Compression Testing of Rock Cores
Project # 2014605001.020

Lab Reference: G-14-0159
Received: 09-08-2014
Examined with the following results:

NRG 1003 SAMPLES: B111+00

Run Number	2	2	2	3
Depth	11.9	13.4	14.7	16.4
Diameter, in.	2.00	2.00	2.00	2.00
Tested Length, in:	3.00	3.50	4.00	4.00
Length/Diameter Ratio:	1.50	1.75	2.00	2.00
Correction Factor:	0.96	0.98	1.00	1.00
Peak Load, Pounds:	6,450	11,720	8,250	7,700
Area, si	3.14	3.14	3.14	3.14
Corrected Peak Stress, PSI:	1,971	3,656	2,626	2,451

Respectfully submitted,

Dennis R. Smale 9/15/14

Dennis R. Smale,
Laboratory Superintendent

Laboratory Evaluation of Construction Materials
Field Testing & Observation
Subsurface Investigations
Geotechnical Engineering

John H. Robinson Testing
1319 Sassafras Street
Erie, Pennsylvania 16501-1720
Telephone: 814.454.0195
Facsimile: 814.453.2020

Member: ASTM, ACI, ACIL
AAP AASHTO R18 Accredited
USACOE Validated

Date: September 10, 2014

Client: Applus RTD
4400 Broadway
Depew, NY 14043
Attn.: Andrew Kucserik, CPG, PG

Re: Compression Testing of Rock Cores
Project # 2014605001.020

Lab Reference: G-14-0159
Received: 09-08-2014
Examined with the following results:

NRG 1003 SAMPLES: B123+80N

Run Number	2	2	2	3
Depth	15.4	17.6	19.0	23.3
Diameter, in.	2.00	2.00	2.00	2.00
Tested Length, in:	4.00	3.50	4.00	4.00
Length/Diameter Ratio:	2.00	1.75	2.00	2.00
Correction Factor:	1.00	0.98	1.00	1.00
Peak Load, Pounds:	10,770	9,940	8,750	12,960
Area, si	3.14	3.14	3.14	3.14
Corrected Peak Stress, PSI:	3,430	3,103	2,787	4,127

Respectfully submitted,

Dennis R. Smale 9/10/14

Dennis R. Smale,
Laboratory Superintendent

Laboratory Evaluation of Construction Materials
Field Testing & Observation
Subsurface Investigations
Geotechnical Engineering

John H. Robinson Testing
1319 Sassafras Street
Erie, Pennsylvania 16501-1720
Telephone: 814.454.0195
Facsimile: 814.453.2020

Member: ASTM, ACI, ACIL
AAP AASHTO R18 Accredited
USACOE Validated

Date: September 10, 2014

Client: Applus RTD
4400 Broadway
Depew, NY 14043
Attn.: Andrew Kucserik, CPG, PG

Re: Compression Testing of Rock Cores
Project # 2014605001.020

Lab Reference: G-14-0159
Received: 09-08-2014
Examined with the following results:

NRG 1003 SAMPLES: 207+30

Run Number	3	3	4	4	5
Depth	33.0	34.3	36.2	37.11	40.4
Diameter, in.	2.00	2.00	2.00	2.00	2.00
Tested Length, in:	4.00	4.00	4.00	4.00	3.00
Length/Diameter Ratio:	2.00	2.00	2.00	2.00	1.50
Correction Factor:	1.00	1.00	1.00	1.00	0.96
Peak Load, Pounds:	9,050	9,460	7,090	5,670	8,950
Area, si	3.14	3.14	3.14	3.14	3.14
Corrected Peak Stress, PSI:	2,882	3,011	2,257	1,805	2,849

Run Number	5	5
Depth	42.8	44.4
Diameter, in.	2.00	2.00
Tested length, in.	4.00	4.00
Length/Diameter Ratio:	2.00	2.00
Correction Factor	1.00	1.00
Peak Load, Pounds:	6,200	10,030
Area, si	3.14	3.14
Corrected Peak Stress, PSI	1,974	3,193

Respectfully submitted,

Dennis R. Smale 9/10/14

Dennis R. Smale,
Laboratory Superintendent

Laboratory Evaluation of Construction Materials
Field Testing & Observation
Subsurface Investigations
Geotechnical Engineering

John H. Robinson Testing
1319 Sassafras Street
Erie, Pennsylvania 16501-1720
Telephone: 814.454.0195
Facsimile: 814.453.2020

Member: ASTM, ACI, ACIL
AAP AASHTO R18 Accredited
USACOE Validated

Date: September 10, 2014

Client: Applus RTD
4400 Broadway
Depew, NY 14043
Attn.: Andrew Kucserik, CPG, PG

Re: Compression Testing of Rock Cores
Project # 2014605001.020

Lab Reference: G-14-0159
Received: 09-08-2014
Examined with the following results:

NRG 1003 SAMPLES: B405+00N

Run Number	16	16	17	19	19
Depth	89.2	91.4	93.9	101.5	102.11
Diameter, in.	2.00	2.00	2.00	2.00	2.00
Tested Length, in:	4.00	2.00	4.00	4.00	4.00
Length/Diameter Ratio:	2.00	1.00	2.00	2.00	2.00
Correction Factor:	1.00	0.87	1.00	1.00	1.00
Peak Load, Pounds:	7,080	12,901	7,260	9,950	8,820
Area, si	3.14	3.14	3.14	3.14	3.14
Corrected Peak Stress, PSI:	2,255	3,575	2,312	3,169	2,809

Run Number	21	21	22	22	23
Depth	110.1	112.9	117.7	119.4	124.1
Diameter, in.	2.00	2.00	2.00	2.00	2.00
Tested length, in.	4.00	4.00	4.00	3.50	4.00
Length/Diameter Ratio:	2.00	2.00	2.00	1.75	2.00
Correction Factor	1.00	1.00	1.00	0.98	1.00
Peak Load, Pounds:	8,750	8,730	11,120	9,500	10,580
Area, si	3.14	3.14	3.14	3.14	3.14
Corrected Peak Stress, PSI	2,787	2,780	3,541	2,965	3,575

Respectfully submitted,

Dennis R. Smale 9/10/14

Dennis R. Smale,
Laboratory Superintendent

Laboratory Evaluation of Construction Materials
Field Testing & Observation
Subsurface Investigations
Geotechnical Engineering

John H. Robinson Testing
1319 Sassafras Street
Erie, Pennsylvania 16501-1720
Telephone: 814.454.0195
Facsimile: 814.453.2020

Member: ASTM, ACI, ACIL
AAP AASHTO R18 Accredited
USACOE Validated

Date: September 10, 2014

Client: Applus RTD
4400 Broadway
Depew, NY 14043
Attn.: Andrew Kucserik, CPG, PG

Re: Compression Testing of Rock Cores
Project # 2014605001.020

Lab Reference: G-14-0159
Received: 09-08-2014
Examined with the following results:

NRG 1003 SAMPLES: B413+00N

Run Number	26	27
Depth	141.2	144.0
Diameter, in.	2.00	2.00
Tested Length, in:	4.00	2.00
Length/Diameter Ratio:	2.00	2.00
Correction Factor:	1.00	1.00
Peak Load, Pounds:	8,220	6,000
Area, si	3.14	3.14
Corrected Peak Stress, PSI:	2,618	1,911

Respectfully submitted,

Dennis R. Smale 9/10/14

Dennis R. Smale,
Laboratory Superintendent

APPENDIX I

GAS PIPELINE CONSTRUCTION SEQUENCE WHEN PARALLELING OR CROSSING HIGH VOLTAGE ELECTRIC TRANSMISSION LINES

Gas Pipeline Construction Sequence when Paralleling or Crossing High Voltage Electric Transmission Lines

Prepared for:

National Grid

Date:

08/29/2014

Revision:

0

The following construction specification applies to pipeline construction that takes place within 500 feet of an energized electric transmission line. These specifications represent the minimum requirements that must be followed during all construction related activities.

When metallic piping is laid under overhead A. C. electric lines, the pipe is subject to induced voltages and currents that are the result of electric power flowing through the transmission line. Induced voltages and currents can potentially damage the pipe coating and corrosion protection system. Induced voltages and current can be hazardous to personnel and equipment working under or in the vicinity of high voltage electric power transmission lines. Lightning strikes in the vicinity of high voltage electric transmission lines can also be dangerous.

A. Electrical Clearance of Equipment from Power Lines- Critical Clearances
   All activities conducted by the company and contractor who will be working within a National Grid transmission right-of-way shall comply with all applicable Federal, State and local laws, statutes, regulations and safety codes and guidelines.

    a. NY High Voltage Proximity Act – Prior to performing any work within proximity of a high-voltage line, the employer or contractor shall promptly notify the owner or person in charge of the high-voltage line in writing at least five normal work days before such approach is to be made.

    b. OSHA Standard 29 CFR 1926.550 – The OSHA regulations govern the minimum working clearances from energized lines. OSHA 1926.1408 establishes the minimum clearance distances based on the voltage of the AC transmission line.

    c. National Grid Requirements – The specific requirements are detailed in the National Grid Engineering Document – Conditions for Proposed Activities Within Transmission Line Rights-of-Way. This document spells out the minimum conditions for work within National Grid electric transmission line rights-of-way. Additional requirements include:

        i. The contractor shall not place or store any items within the right-of-way, including construction materials or debris, excavated soil, trailers, or storage containers.

        ii. The contractor shall not unload or load vehicles or equipment within the right-of-way.

        iii. Protection of Transmission Line Facilities – the contractor shall, at all times, protect transmission line facilities from damage.

1. The contractor shall operate equipment and vehicles or perform any excavation at least 50 feet horizontally away from any transmission line pole, tower, guy wire or guy anchor. Exhibits 1, 2, and 3 provide further details on equipment

2. The contractor shall not store or use explosives within the right-of-way.

3. The contractor shall locate all ground wires buried in areas to be excavated and shall protect them against damage.

iv. ROW Access

1. The contractor shall not at any time block or impede access to or along the right-of-way.

2. The contractor shall not damage roads or trails used to gain access to or along the right-of-way.

v. Deviations

1. Any deviation from National Grid's General Requirements requires a written approval from National Grid prior to commencing construction.

2. See Figures 8 through 29 for proposed detailed crossing plans in which a deviation from National Grid's General Requirements are required.

B. Safety Requirements

a. Electrical – All power lines shall be treated as energized unless both of the following have been verified:

i. Official notification is received from the National Grid Line Supervisor or designee.

ii. Visible grounds are observed on the power line structures on both ends of the pipeline construction area. If visible grounds cannot be seen on the power line structures, the line MUST be treated as being energized. If pipeline construction proceeds past the power line grounds, the power line must be treated as energized.

b. The contractor shall designate an Electric Safety Supervisor who will be on site throughout the entire construction process. The Electric Safety Supervisor shall be experienced and knowledgeable in electrical safety requirements. The Electric Safety Supervisor is responsible for:

    i. Daily communication with National Grid representatives regarding the operating conditions of the electric transmission lines. The Supervisor shall obtain confirmation that automatic re-closer devices are deactivated during pipeline construction activities.

    ii. Ensuring that all electrical safety requirements and devices are fully understood by all contractor employees. Employees who perform grounding shall be familiar with AC mitigation procedures and completed training in accordance with applicable codes and standards.

    iii. Conducting introductory and ongoing safety training of contractor employees working or visiting the site.

    iv. Ensure that daily job briefings are completed by each contractor crew.

    v. Ensure compliance with minimum clearance requirements for machinery and personnel.

    vi. Ensure that all safety equipment is kept in working condition. All insulating rubber gloves that are damaged shall be immediately replaced. Grounding equipment shall be checked for damage and poor electrical conductivity and replaced as required.

    vii. Take or direct all pipeline voltage measurements as required.

c. The contractor is responsible for marking all critical clearance areas in the field and maintain the marking. Critical Clearance areas are defined as any area on the pipeline right-of-way where equipment capable of reaching overhead (backhoes, side-booms, cranes, excavators etc) could penetrate the 20 foot power line wire clearance zone. See Figures 1 & 2.

d. Throughout construction, the clearances between construction equipment and power lines must be continuously reviewed throughout the day. It must be noted that the elevation of the conductor will change with changes in temperature, wind, solar heating and electric line power flows.

e. When operating equipment in marked critical clearance areas or anywhere the operating equipment could get within 20 feet of a power line, one or more of the following procedures must be utilized:

    i. Assign an additional person to act as a spotter and guide the operator of each individual piece of equipment capable of reaching above 15 feet. It is mandatory that the spotter be in place with direct ability to observe the lines and potential points of contact. The spotter shall have a functioning air horn in hand during excavation for use to stop work. All personnel on site shall have "Stop Work Authority".

    ii. Lock out equipment to preclude raising booms above 15 feet.

    iii. Use equipment whose maximum vertical is 15 feet or less.

f. Work Stoppage – All construction work shall be suspended in the area of overhead high voltage electric lines during any thunderstorm activity, high winds (>30 MPH) or during electrical emergencies declared by National Grid.

g. Warning Signs – The contractor shall post adequate signage warning of possible electrical hazards at each access to the right-of-way.

    i. Warning signs shall be posted on all excavators, cranes and other hoisting equipment. Signs shall be in plain view of the operator and state "Danger, do not operate any part of this equipment within 20 feet of High Voltage Lines".

    ii. Warning signs restricting vehicle operations shall be posted in the field to define Critical Clearance Areas near electric transmission lines. In areas where the pipeline will parallel the transmission lines, signs shall be placed every 100 feet. Where the pipeline is crossing the transmission line, signs shall be placed at 25 foot intervals, with a minimum of 3 signs on each side of the crossing.

C. Grounding and Bonding – Each person involved in installing or removing the pipe or equipment grounds is required to wear 600 volt class rubber insulating gloves.

    a. Each continuous length of pipe shall be grounded at 2 separate points. A ground shall be established by driving one or more ground rods to a minimum depth of 4 feet. A jumper cable (minimum #2 A. W.G. stranded copper cable) with suitable connectors is connected to the pipe and the ground rods. See Figures 3 & 4 for

typical grounding and bonding details. When grounding is no longer required, disconnect the ground using insulated rubber gloves as follows:

i. Disconnect ground cable from clamp.

ii. Disconnect ground cable from ground rod.

iii. Remove grounding clamp from pipe.

b. In the event that the pipe-to-ground AC voltage exceeds 15 volts RMS, additional measures, including installation of additional ground rods as required, shall be taken to bring the pipe-to-ground voltage to 15 volts RMS or less.

c. Grounding of Rubber Tired Vehicles and Equipment

i. All rubber tire vehicles and rubber tired equipment operated on or parked on a power line right-of-way shall be grounded to mitigate the charge of static electricity induced by the electric transmission line.

ii. A ground strap or chain shall be attached to each rubber tired vehicle or piece of equipment, with a secure electrical connection to provide a ground contact during both mobile and stationary operations. The grounding strap or chain shall be sufficient length to provide three (3) feet of earth contact immediately after the vehicle comes to a stop.

d. Refueling – Motor vehicles and construction equipment should not be fueled within 100 yards of any electric overhead transmission facility. If fueling must be done within 100 yards, the fuel truck shall be grounded and an electrical bond made between the fuel truck and the equipment to be fueled. The bond must be made prior to initiation of refueling. The bond shall be checked for electrical continuity and shall not be removed until all refueling operations are completed.

e. Handling, Moving, Storage and Stringing of Individual Pipe Sections

i. Prior to any activity involving contact with steel pipe, the pipe-to-ground voltage shall be measured using the appropriate device. All readings shall be recorded and maintained.

ii. Each piece of equipment utilized to handle pipe shall be equipped with a cable assembly capable of grounding the sections of pipe to the piece of equipment handling the pipe.

iii. Before any section of pipe is picked up or moved, it shall be bonded to the equipment moving the pipe.

iv. When pipe is laid or stacked on along the right-of-way, is shall be grounded as noted above. All pipe lengths in a stack shall be bonded together and connected to the ground.

v. During the stringing operation, a single ground can be used to connect two adjacent lengths of pipe.

f. Assembling, Welding, Coating and Lowering-In

i. At all locations where pipe sections are being welded together, temporary grounding mats for personal protection shall be installed and connected to both sections of pipe. Grounding mats shall extend a minimum of 3 feet in all directions outside the work area. There shall be no contact between persons on the grounding mat and persons not on the mat, including the handing over of tools, instruments and materials. See Figure 5 for Typical Portable Ground Mat Details.

ii. It may be necessary to utilize straight polarity welding for stringer bead in the case where the electromagnetic field induced by the electric transmission lines causes the pipe to become magnetized.

iii. Insulating joints shall be left un-bonded as pipeline welding progresses. Final electrical connections at test stations across the insulating joints shall not be made until all pipeline construction is completed and the pipeline is buried. The final connections shall be made using insulating rubber gloves.

iv. All pipe at tie-ins shall be bonded across the gap. All piping at cut-outs shall be bonded across before the cut-out process is started. Before installing the bond, each side shall be properly grounded.

v. The pipeline shall not be bonded or grounded to foreign structures without permission of the Owner of the structure. Bonding connections shall not be made between the pipeline and electric transmission line grounds.

D. Construction Sequence – Prior to commencement of construction activities, warning signs shall be posted at each access to the National Grid right-of-way and completion of

any other measures required to prevent public access to temporary grounding installations.

a. Clearing - Clearing of the ROW may be performed by both the use of hand tools and mechanical means. The work area will be cleared of vegetation and obstacles (e.g. trees, logs, brush, and rocks). Small tire/track equipment with rotary mowers or brush hogs are generally used for areas within established electric ROW's.

b. Grading - All grading activities shall be limited to the right-of-way limits and temporary or permanent workspace as stipulated on alignment sheets. Grading shall be done in such a way as to provide a reasonably level work surface and to mitigate the necessity of abrupt over-bends or sag-bends. Any topsoil and subsoil that is stripped shall be stockpiled to an area outside the critical clearance area of the electric transmission lines.

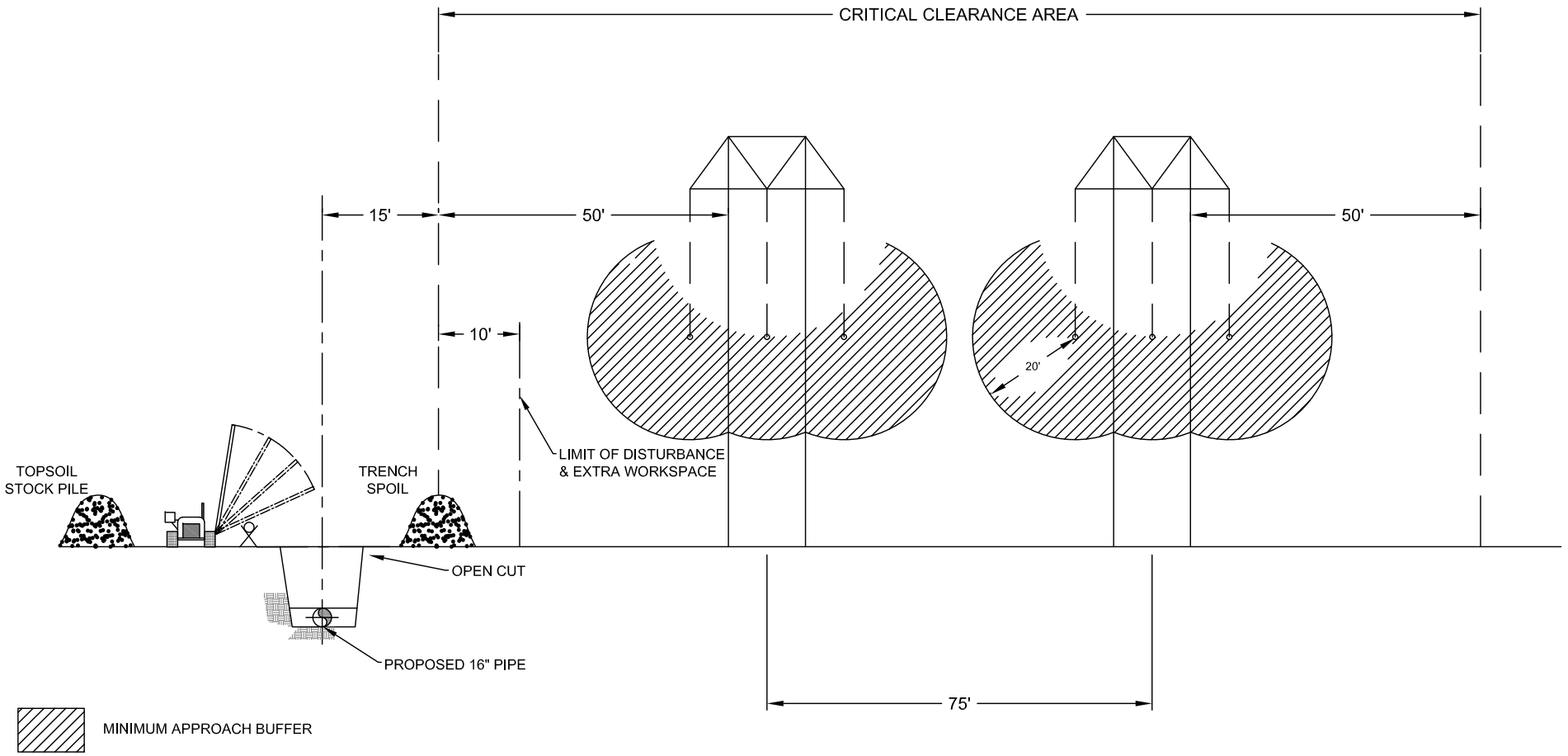
c. Trenching - The trench shall be excavated to a depth to provide at least 5 ft. of cover within the electric transmission ROW. The trenching crew may use a trencher or excavator to dig the pipe trench. Prior to any trenching the electric conductors shall be clearly marked as to warn the equipment operators of the presence of electric lines. Refer to Figures 6 & 7 for typical crossing plans. See Exhibits 1 & 2 for dimensions of excavation equipment that may be utilized.

d. Stringing, Welding, and Coating - Prior to trenching, the pipe joints shall be strung together, welded, and coated. Work associated with preparing the pipe string, including X-Ray testing can be performed prior to moving the pipe string into place.

e. Lowering - Moving the pipe into place and lowering the welded string into the trench demands close coordination of skilled equipment operators. Before any sections of pipe is to be moved, it shall be bonded to the equipment moving the pipe. By using a series of side-booms and/or excavators, operators simultaneously lift the pipe into position and carefully lower the welded sections into the trench. Non-conductive slings are used to protect the pipe and its coating as it is being moved into position. See Exhibit 3 for dimensions of equipment that may possibly be used to lower the pipe into the trench.

f. Backfill - The trench is then backfilled using the excavated material. The soil is returned to the trench in the reverse order, with the subsoil put back first followed by the topsoil. The subsoil and topsoil are returned to its original grade

by using a backhoe or excavator. After backfilling, final cleanup begins as soon as practical. The crews will restore the work area to preconstruction contours.



NOTE:
1. STOCK PILING OF TOPSOIL WITHIN CRITICAL CLEARANCE AREA IS PROHIBITED.
2. TRENCH SPOILS SHALL BE BACKFILLED AT THE END OF EVERY WORKING DAY WITHIN CRITICAL CLEARANCE AREAS, STOCK PILES ARE NOT PROHIBITED TO BE KEPT OVERNIGHT IN THESE AREAS.

FIGURE 1 MINIMUM APPROACH BUFFER
NTS

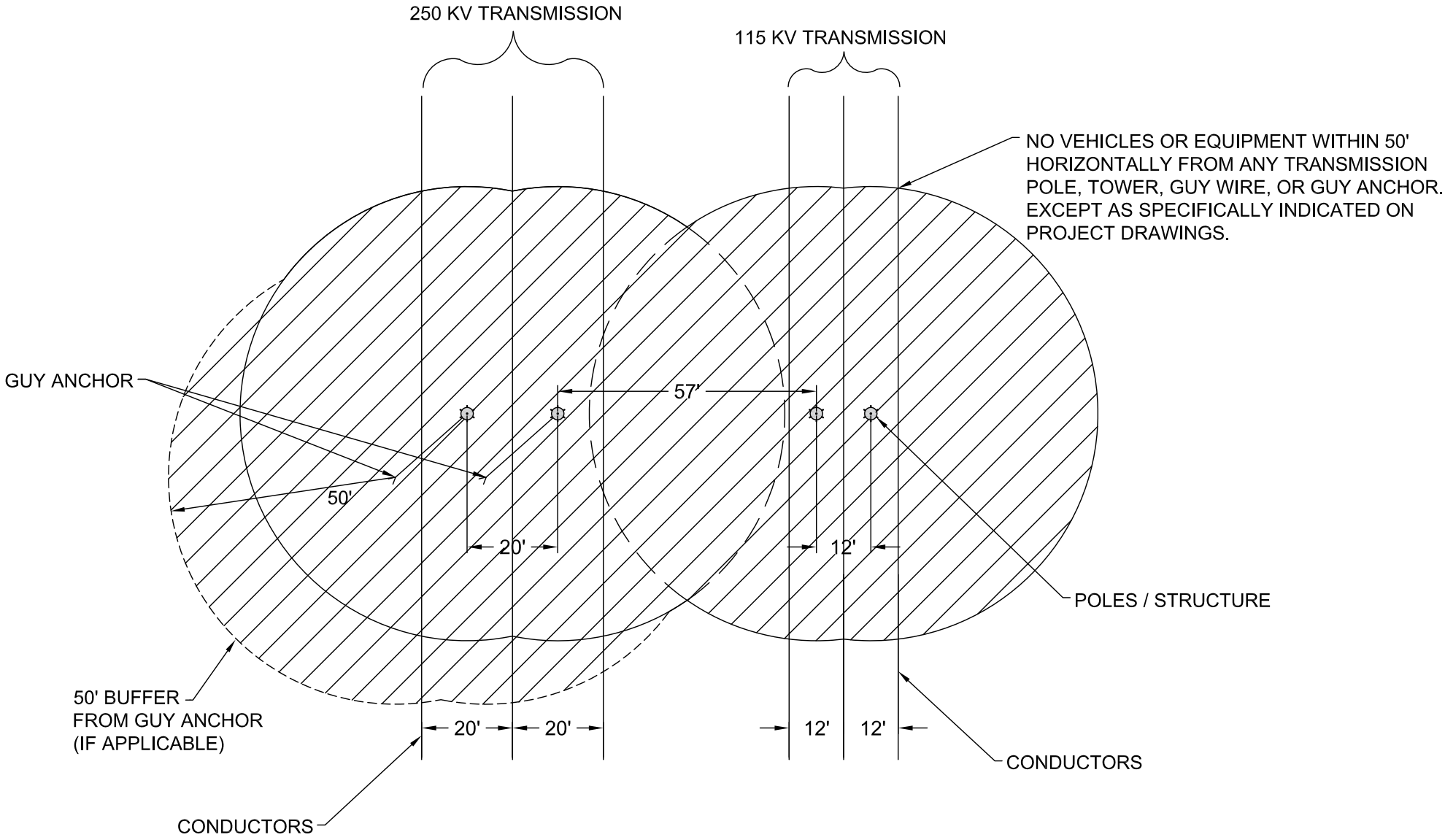
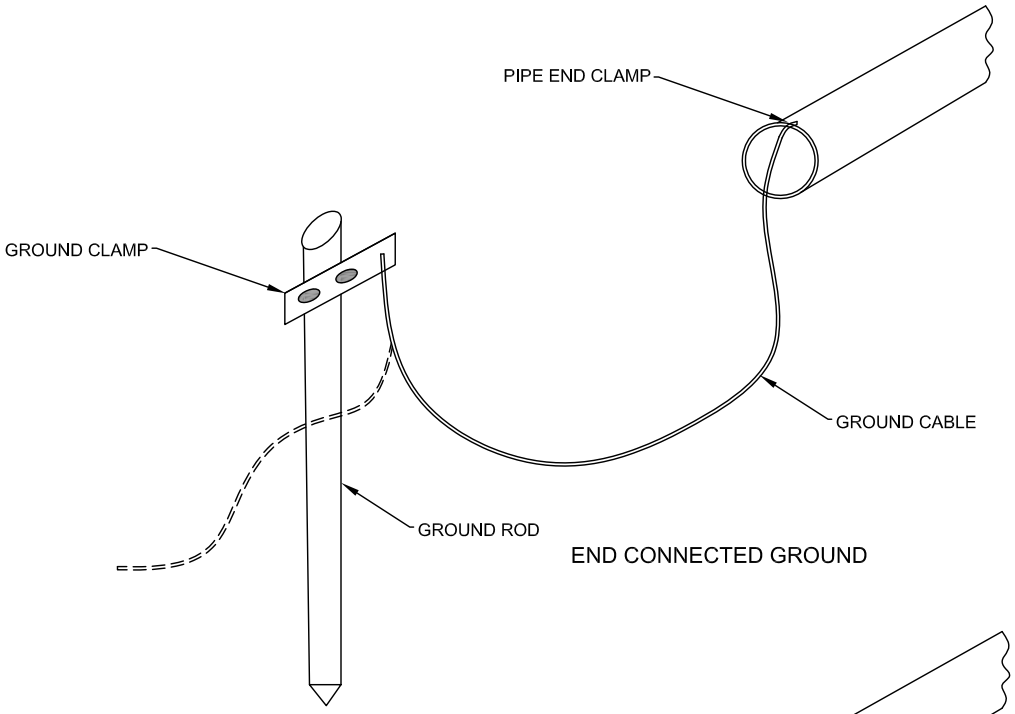
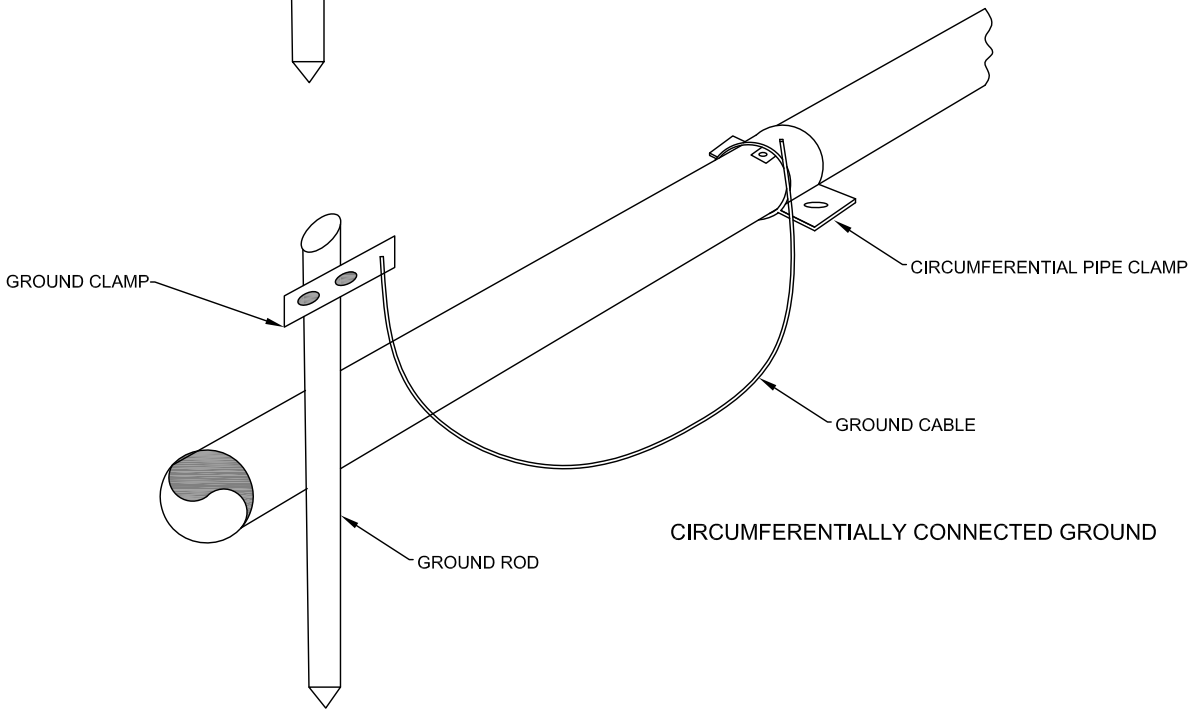


FIGURE 2 PROTECTION OF TRANSMISSION LINE FACILITIES
NTS

CRITICAL CLEARANCE BUFFER



END CONNECTED GROUND



CIRCUMFERENTIALLY CONNECTED GROUND

FIGURE 3 PIPE GROUNDING DETAILS

NTS

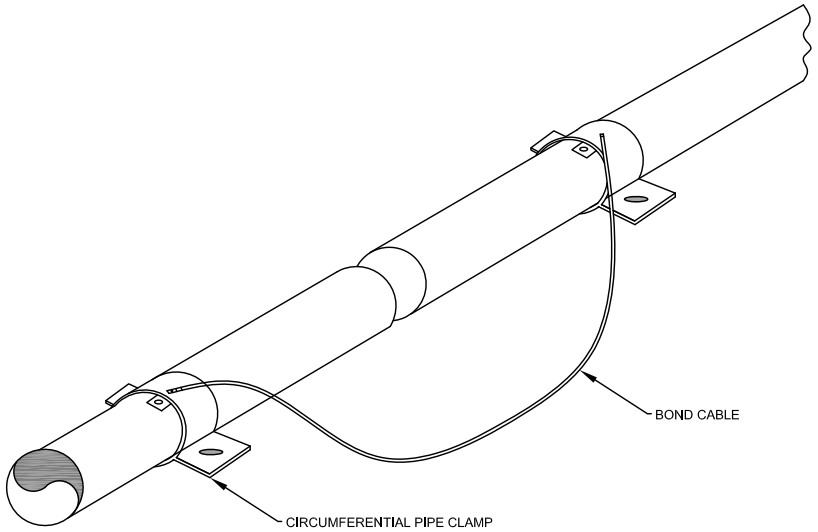
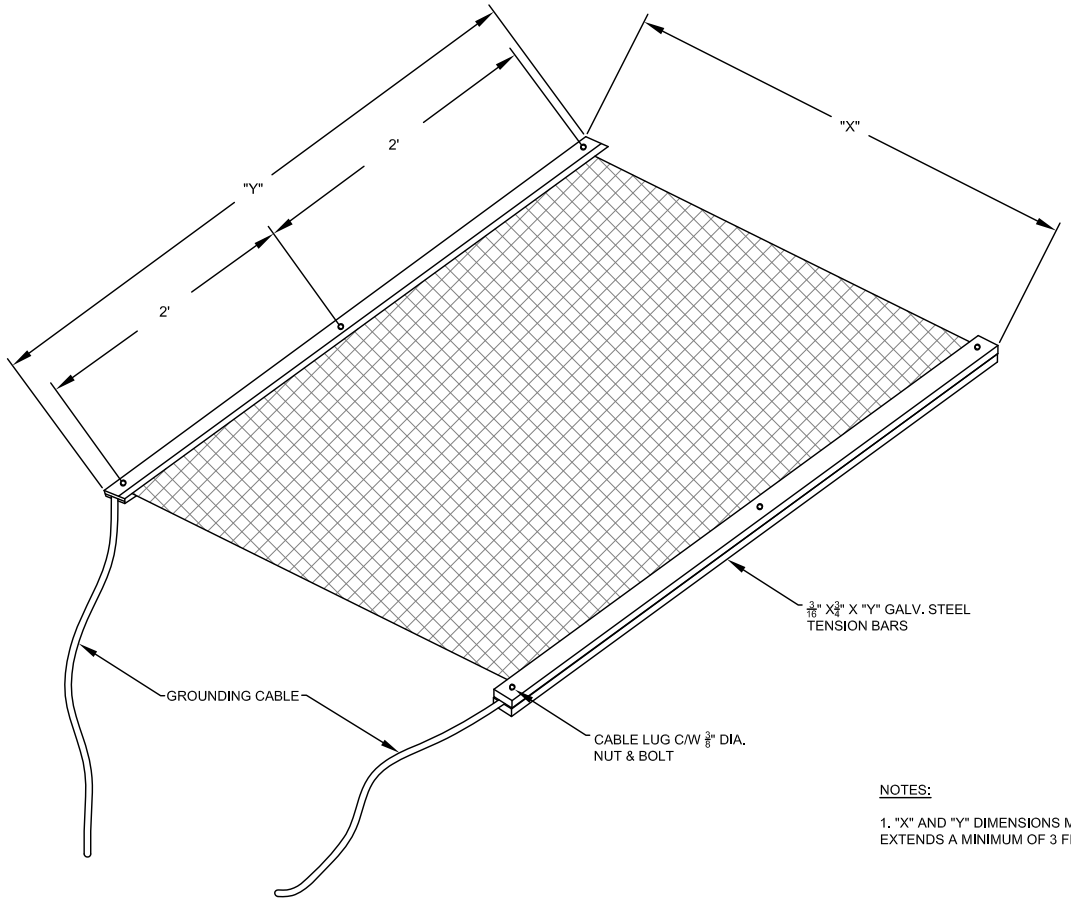


FIGURE 4 PIPE BONDING ACROSS SECTIONS TO BE WELDED

NTS



NOTES:

1. "X" AND "Y" DIMENSIONS MUST BE SUCH THAT MAT EXTENDS A MINIMUM OF 3 FEET BEYOND WORK AREA.

FIGURE 5 TYPICAL PORTABLE GROUND MAT

NTS

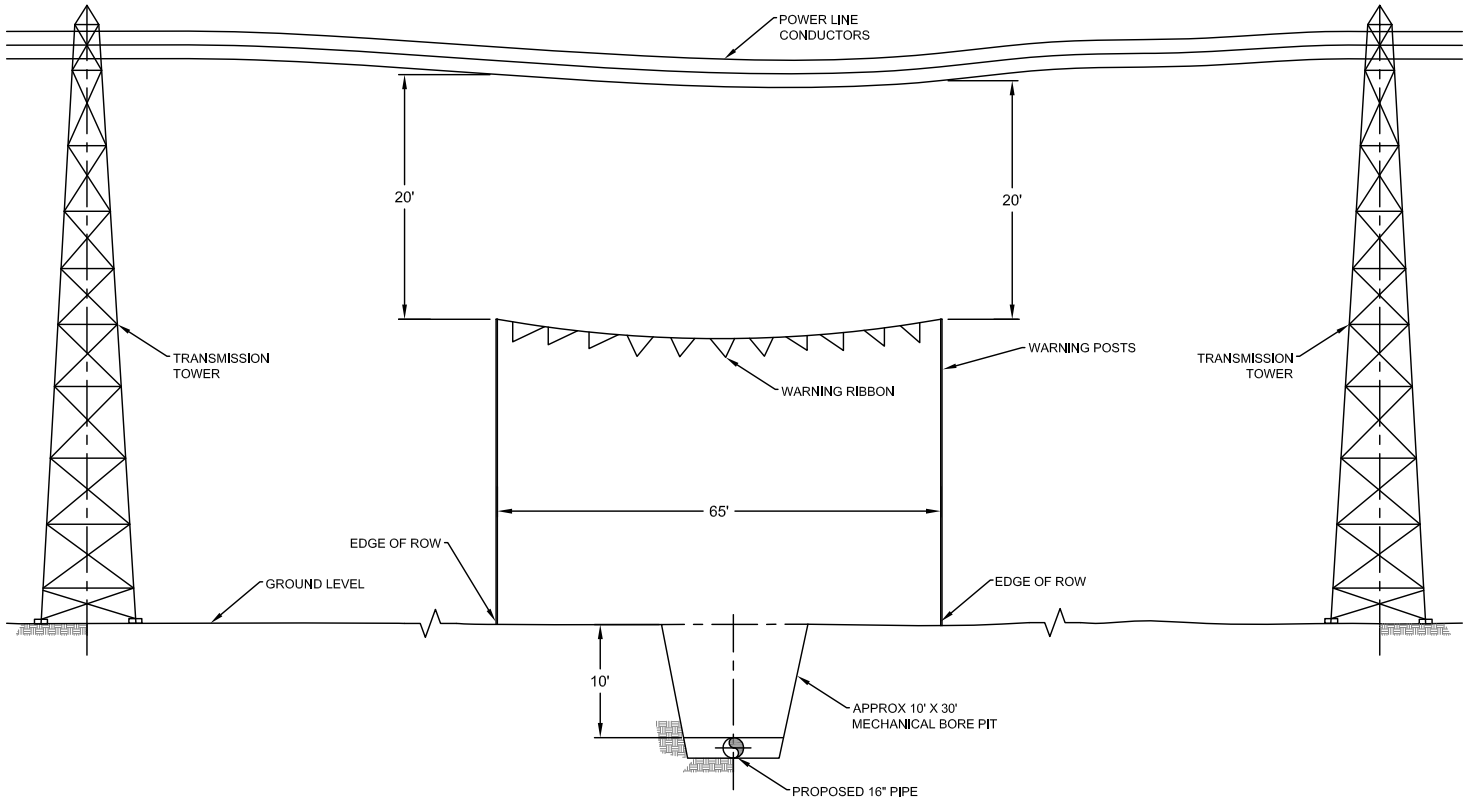
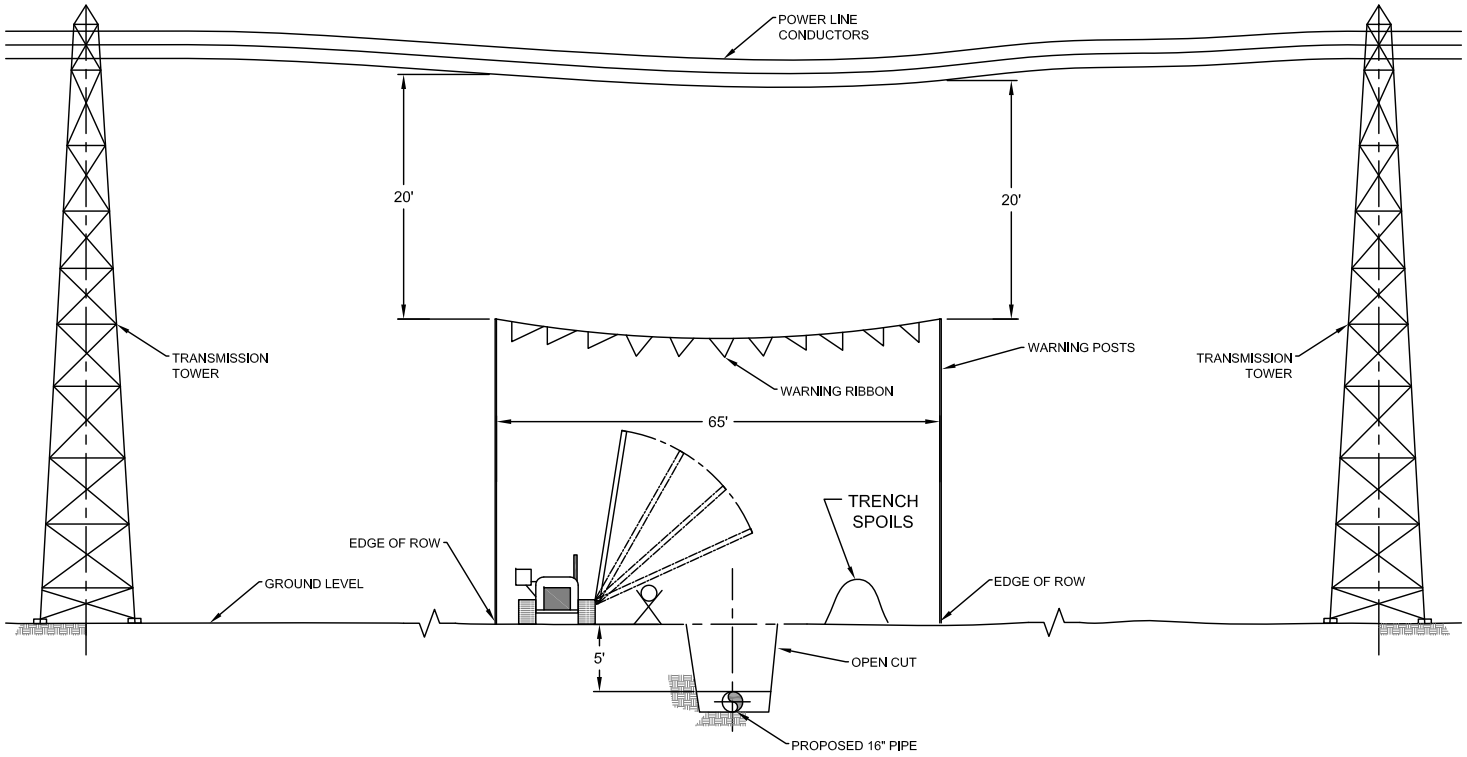


FIGURE 6 CROSS SECTION - MECHANICAL BORE

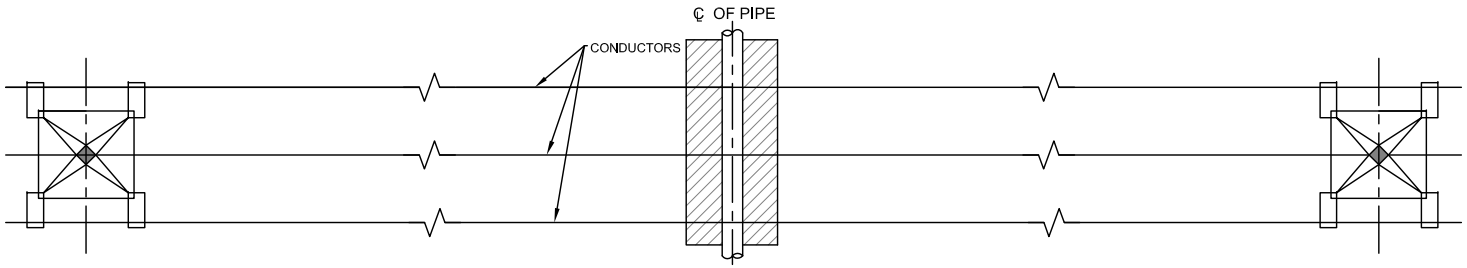
NTS

NOTE:
1. STOCK PILING OF TOPSOIL WITHIN CRITICAL CLEARANCE AREA IS PROHIBITED.
2. TRENCH SPOILS SHALL BE BACKFILLED AT THE END OF EVERY WORKING DAY WITHIN CRITICAL CLEARANCE AREAS, STOCK PILES ARE NOT PROHIBITED TO BE KEPT OVERNIGHT IN THESE AREAS.

NOTE:
REFER TO MINIMUM APPROACH BUFFER DETAIL FIGURE 1 AND PROTECTION OF TRANSMISSION LINE FACILITIES DETAIL FIGURE 2.



SECTION

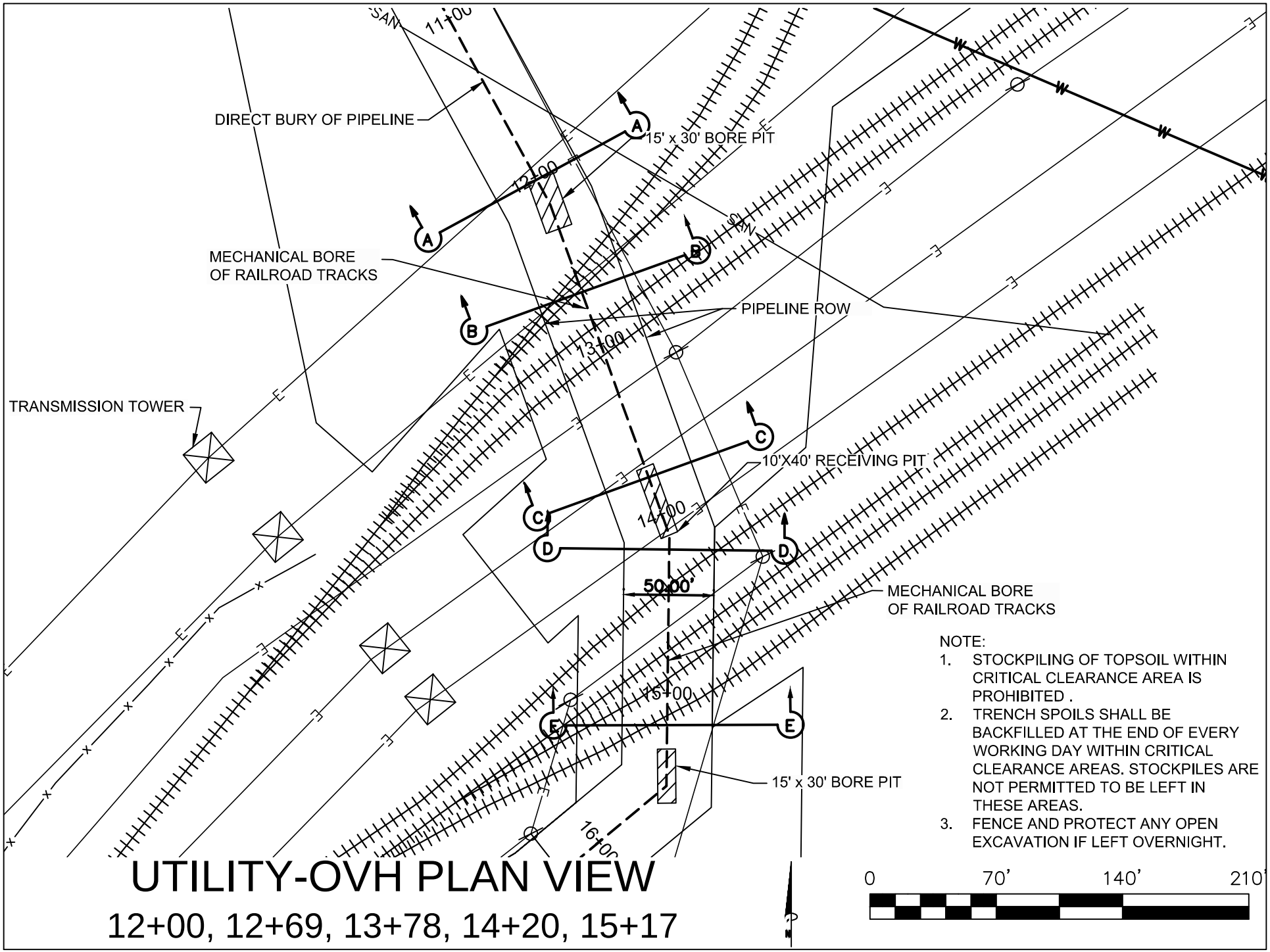


PLAN

FIGURE 7 CROSS SECTION - OPEN TRENCH METHOD
NTS

NOTE:
REFER TO MINIMUM APPROACH BUFFER DETAIL FIGURE 1 AND PROTECTION OF TRANSMISSION LINE FACILITIES DETAIL FIGURE 2.

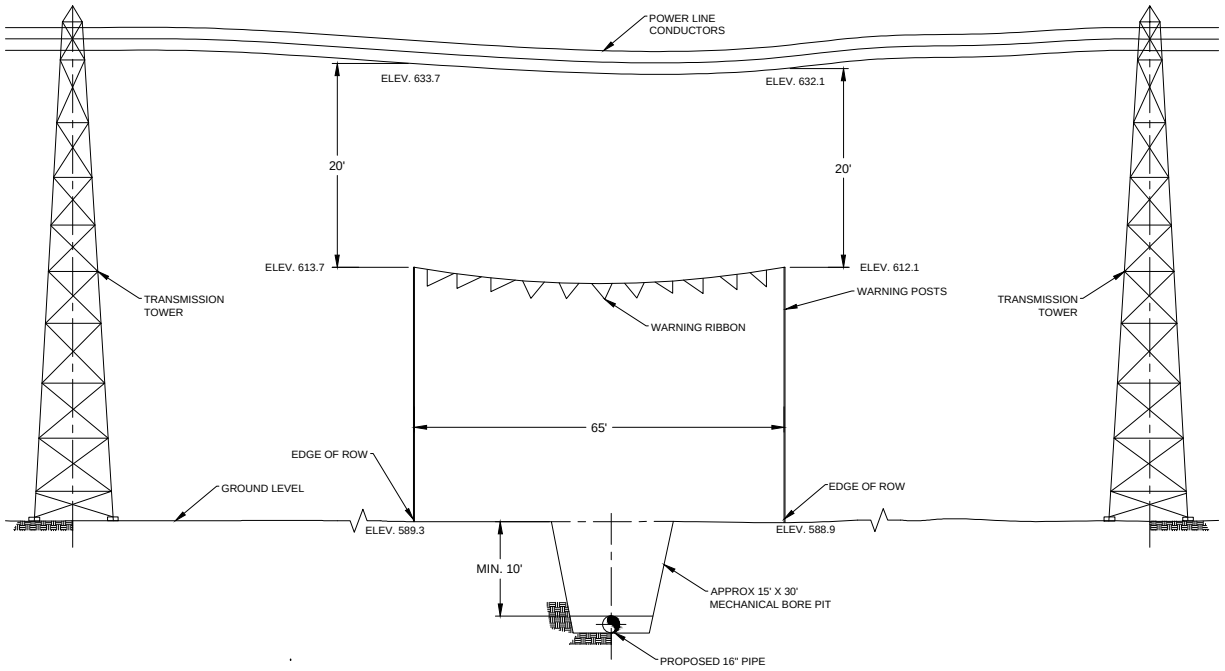
NOTE:
1. STOCK PILING OF TOPSOIL WITHIN CRITICAL CLEARANCE AREA IS PROHIBITED.
2. TRENCH SPOILS SHALL BE BACKFILLED AT THE END OF EVERY WORKING DAY WITHIN CRITICAL CLEARANCE AREAS, STOCK PILES ARE NOT PROHIBITED TO BE KEPT OVERNIGHT IN THESE AREAS.



UTILITY-OVH PLAN VIEW

12+00, 12+69, 13+78, 14+20, 15+17

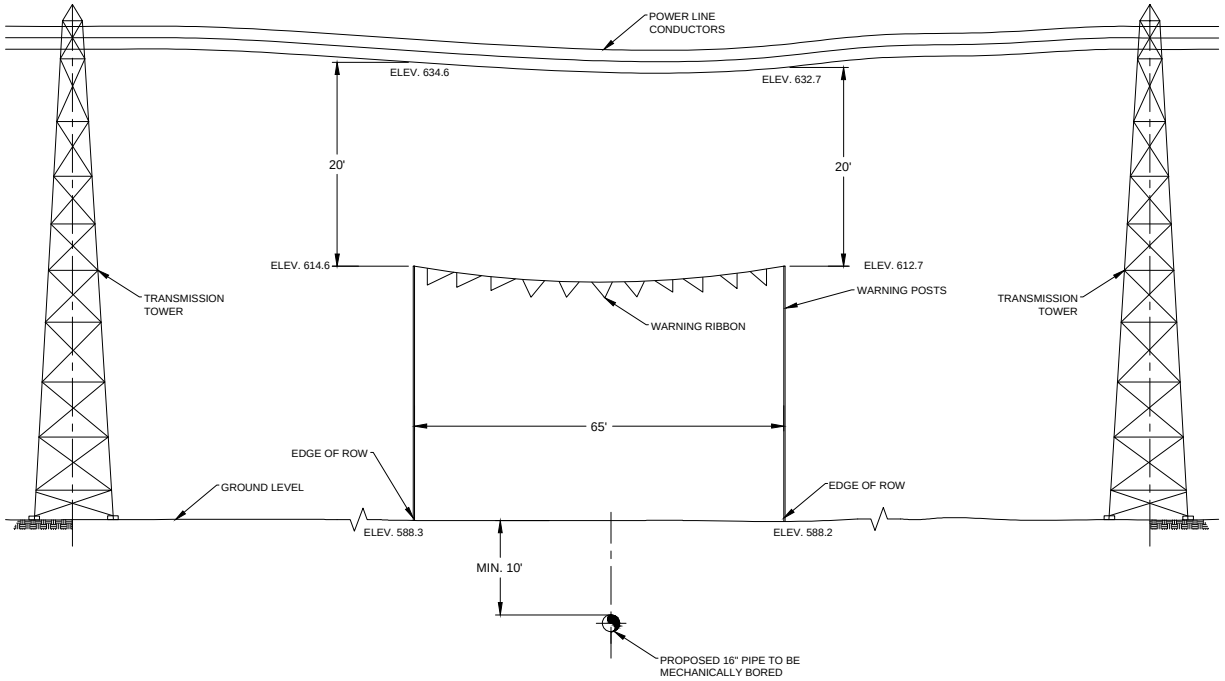
FIGURE 8



SECTION A-A

12+00

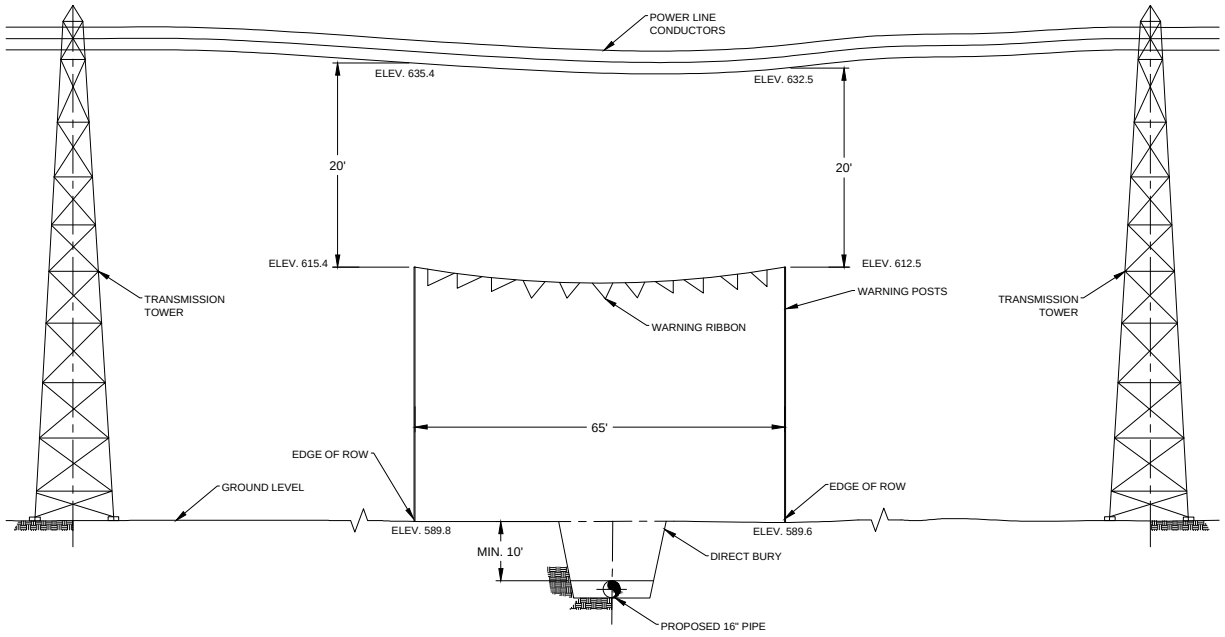
FIGURE 9



SECTION B-B

12+69

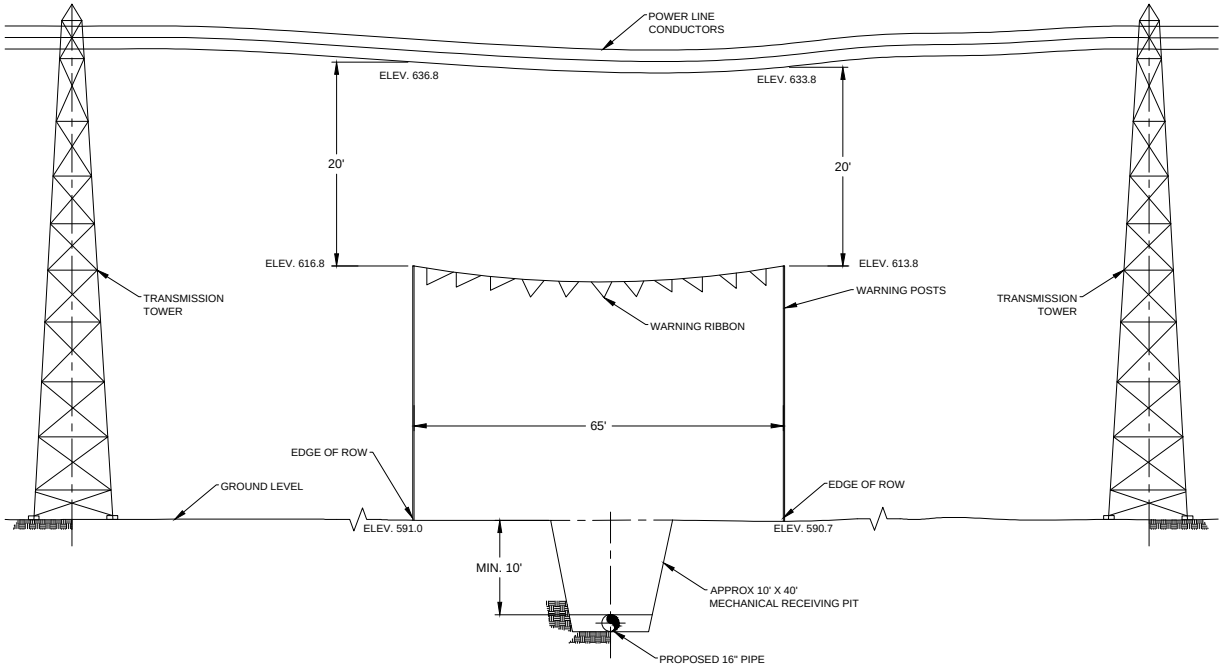
FIGURE 10



SECTION C-C

13+78

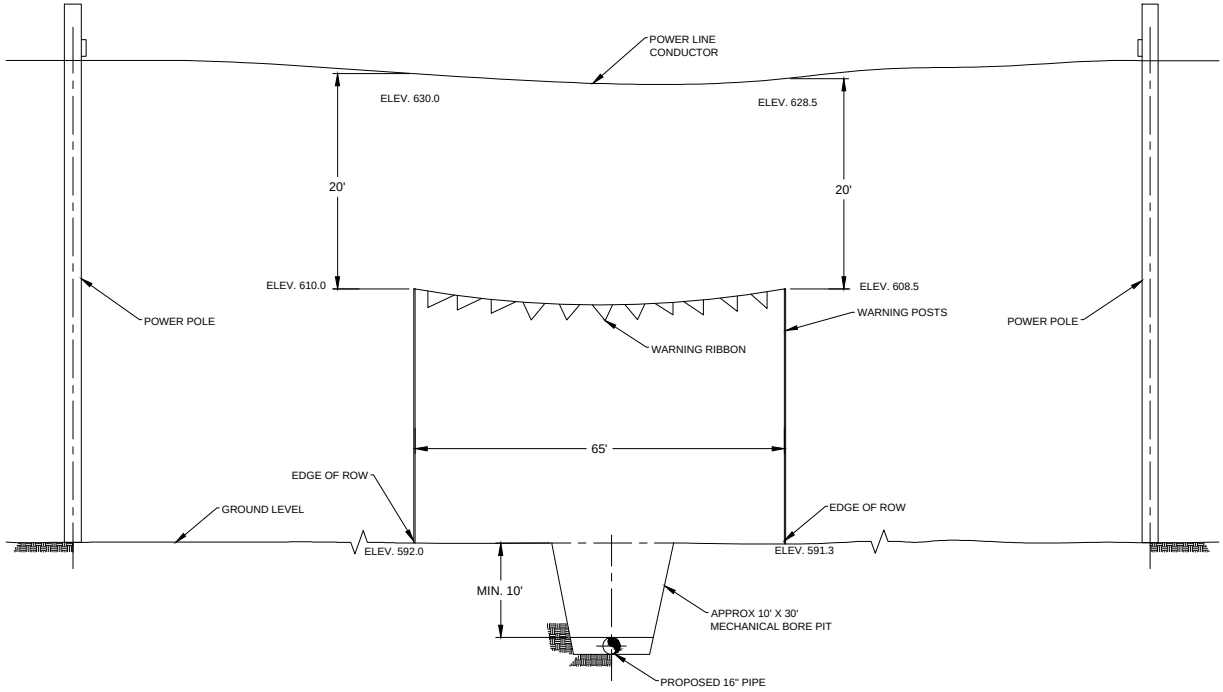
FIGURE 11



SECTION D-D

14+20

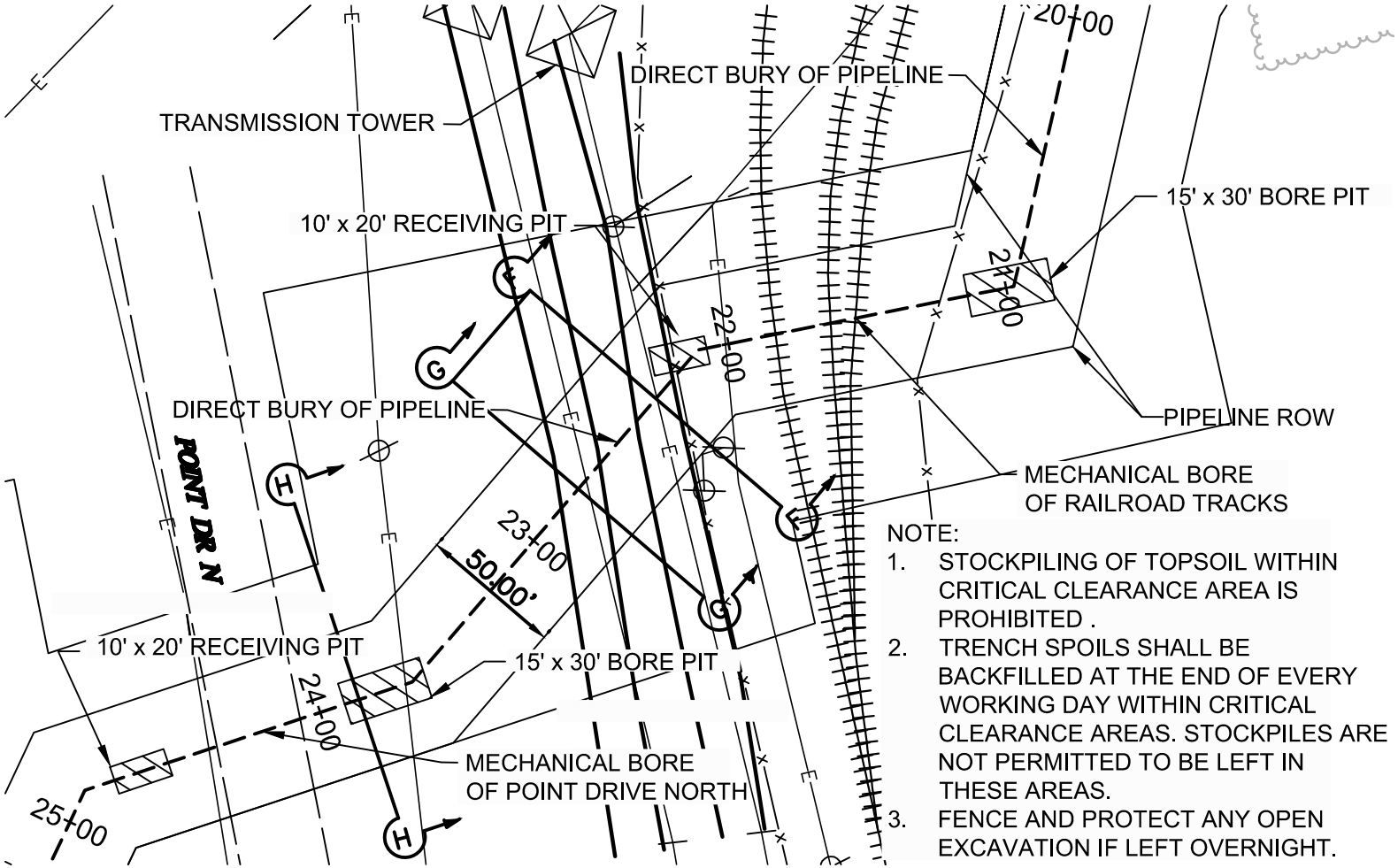
FIGURE 12



SECTION E-E

15+17

FIGURE 13

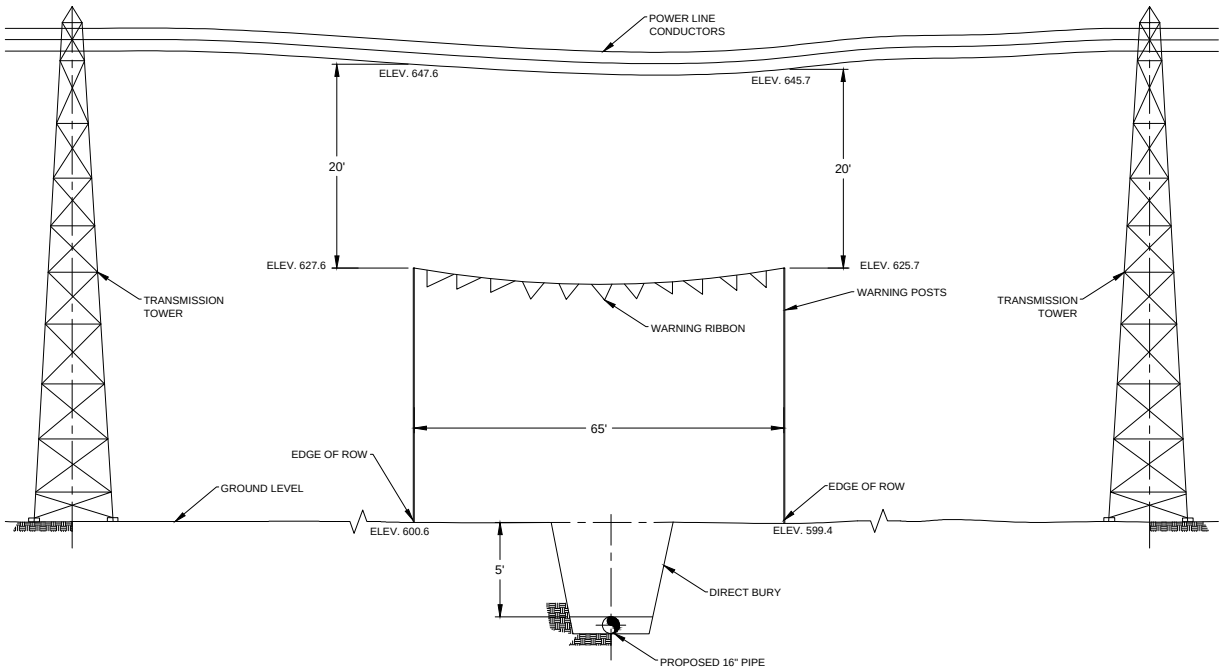


UTILITY-OVH PLAN VIEW

22+33, 22+76, 23+86

0 60' 120' 180'

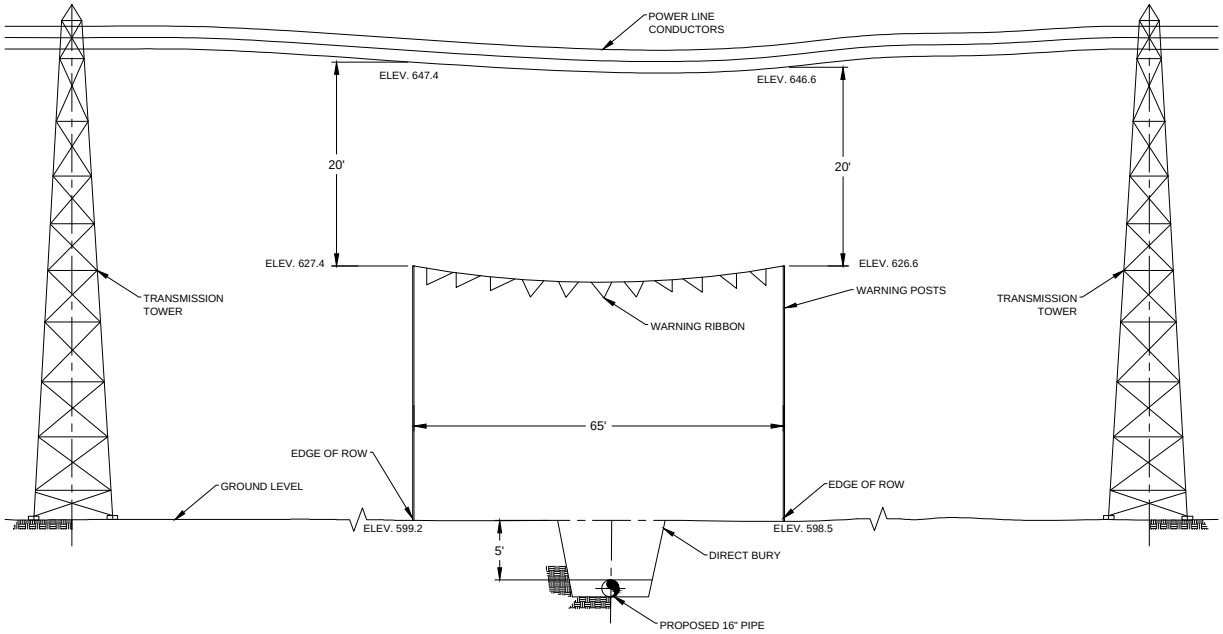
FIGURE 14



SECTION F-F

22+33

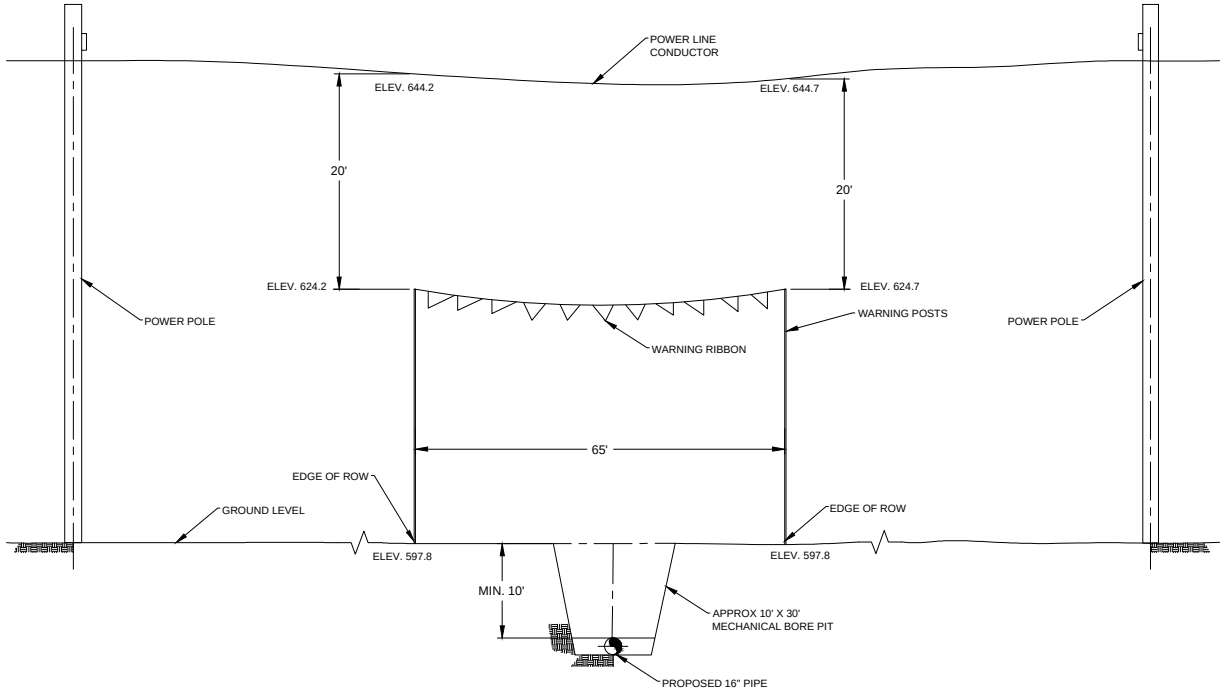
FIGURE 15



SECTION G-G

22+76

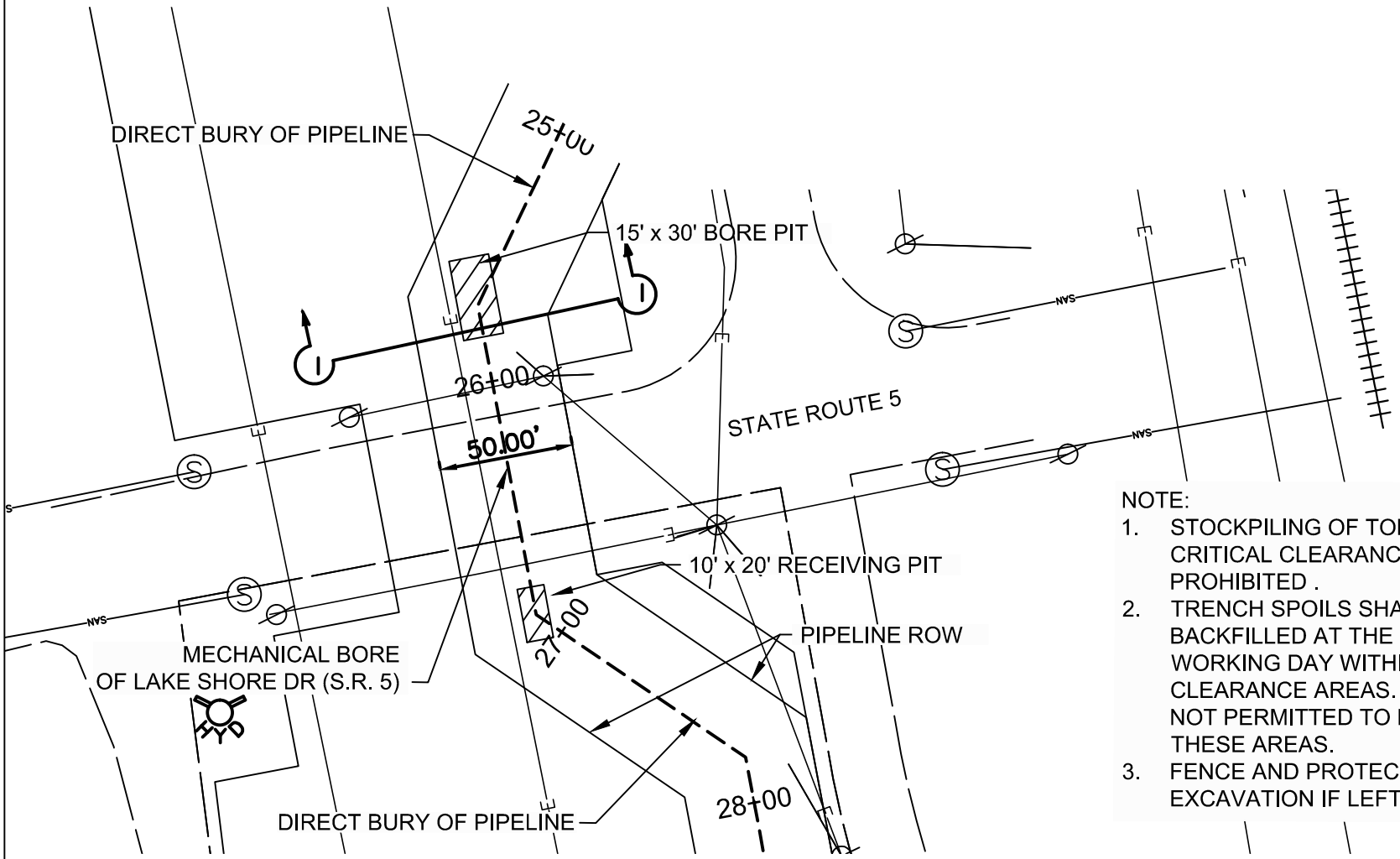
FIGURE 16



SECTION H-H

23+86

FIGURE 17



NOTE:

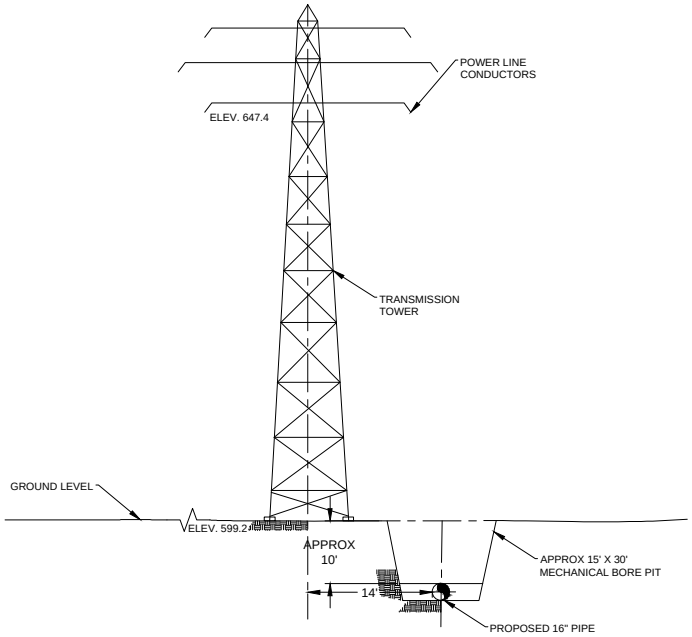
1. STOCKPILING OF TOPSOIL WITHIN CRITICAL CLEARANCE AREA IS PROHIBITED .
2. TRENCH SPOILS SHALL BE BACKFILLED AT THE END OF EVERY WORKING DAY WITHIN CRITICAL CLEARANCE AREAS. STOCKPILES ARE NOT PERMITTED TO BE LEFT IN THESE AREAS.
3. FENCE AND PROTECT ANY OPEN EXCAVATION IF LEFT OVERNIGHT.

UTILITY-OVH PLAN VIEW

25+80

0 60' 120' 180'

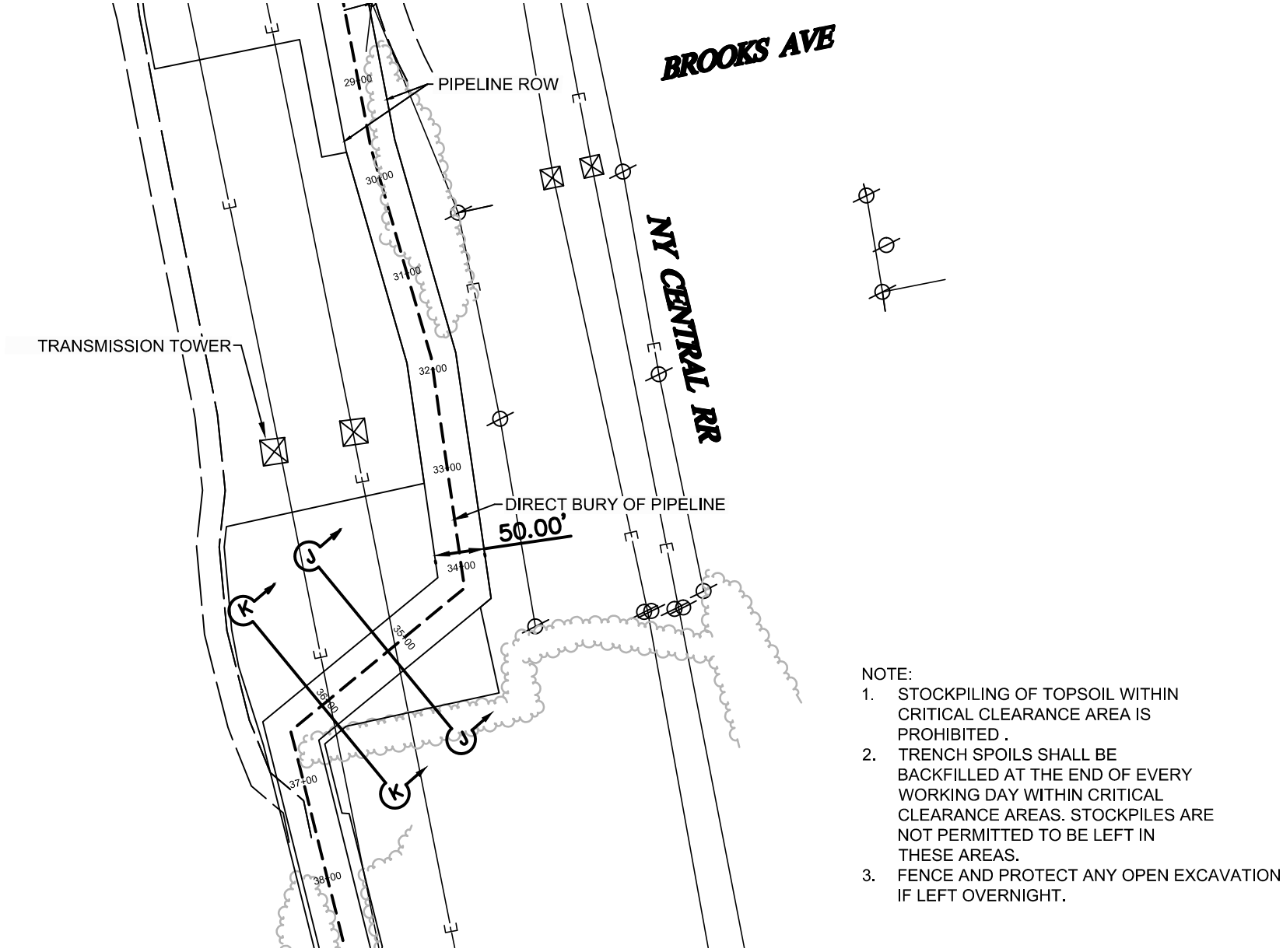
FIGURE 18



SECTION I-I

25+80

FIGURE 19



NOTE:

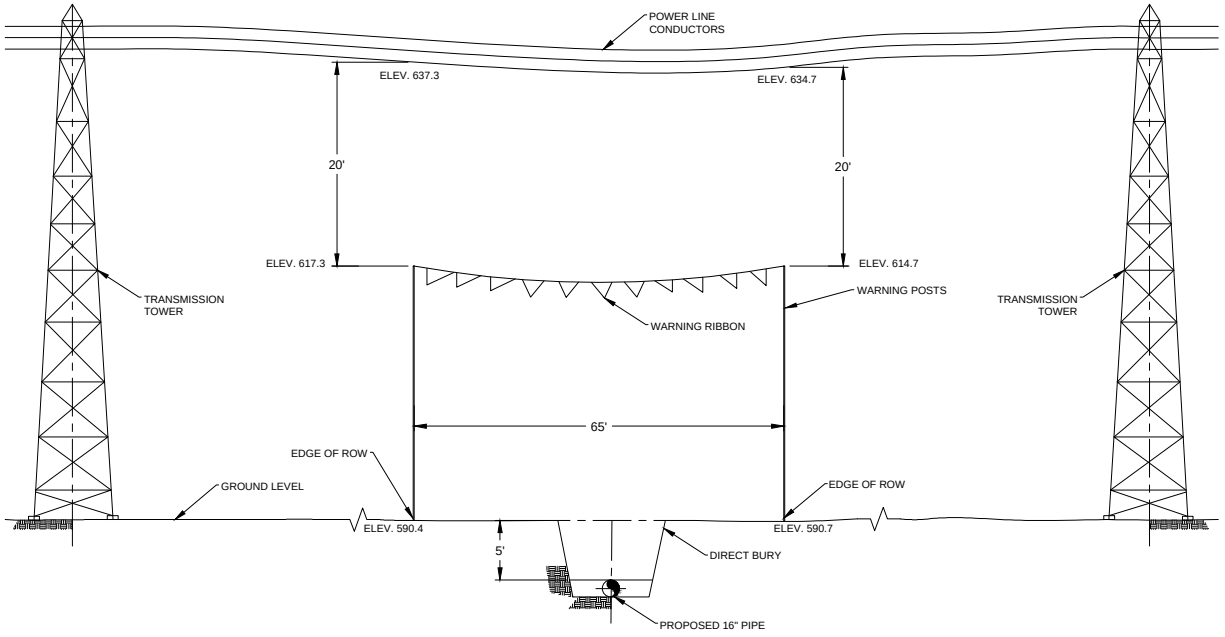
1. STOCKPILING OF TOPSOIL WITHIN CRITICAL CLEARANCE AREA IS PROHIBITED .
2. TRENCH SPOILS SHALL BE BACKFILLED AT THE END OF EVERY WORKING DAY WITHIN CRITICAL CLEARANCE AREAS. STOCKPILES ARE NOT PERMITTED TO BE LEFT IN THESE AREAS.
3. FENCE AND PROTECT ANY OPEN EXCAVATION IF LEFT OVERNIGHT.

UTILITY-OVH PLAN VIEW

35+21, 36+07

0 150' 300' 450'

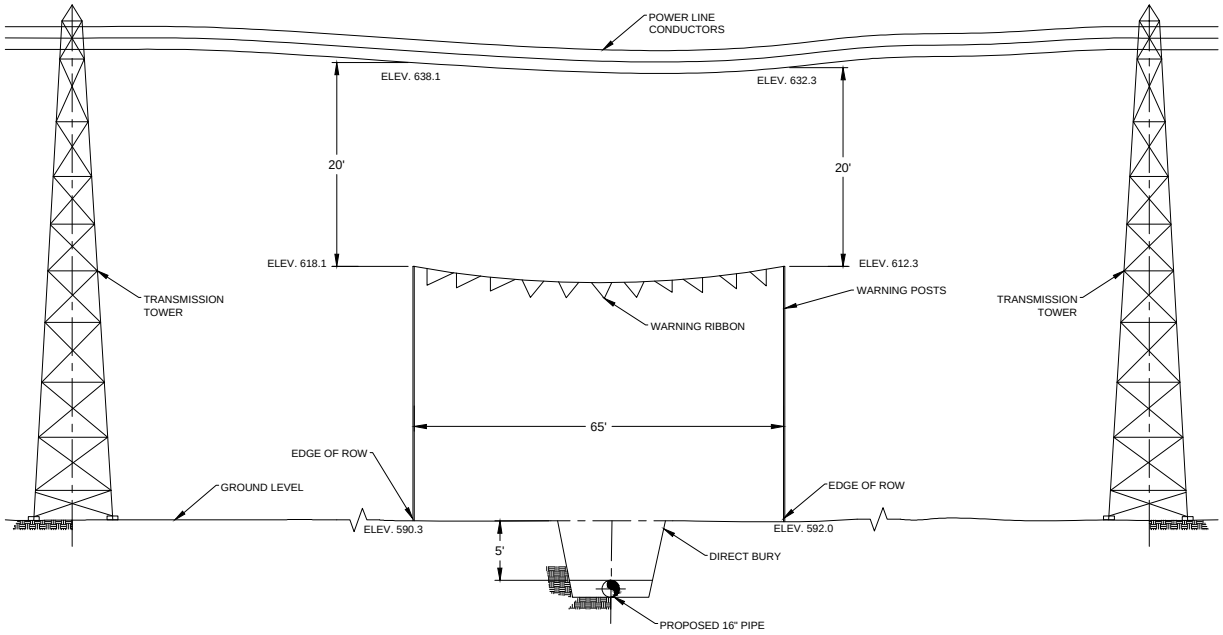
FIGURE 20



SECTION J-J

35+21

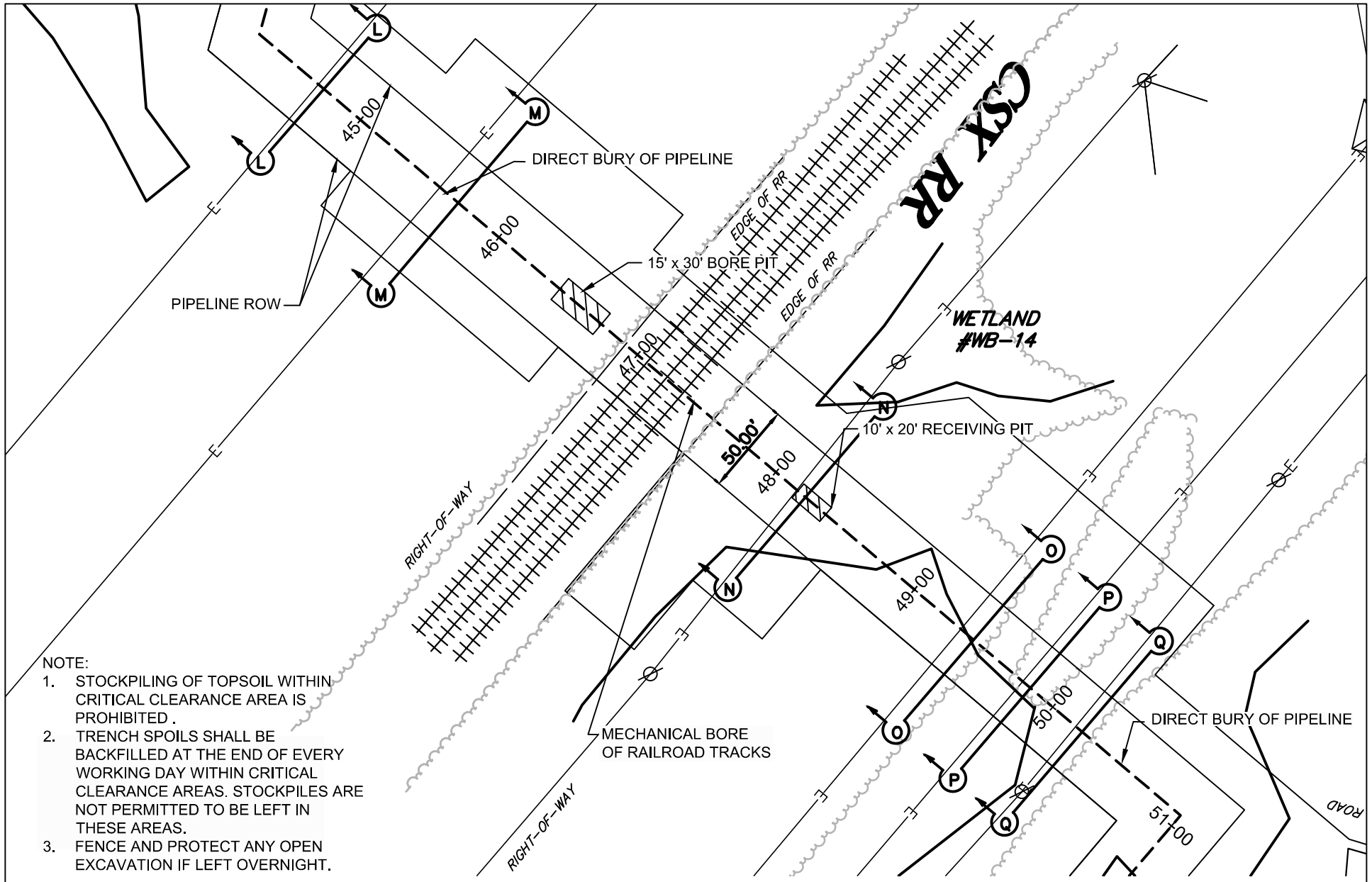
FIGURE 21



SECTION K-K

36+07

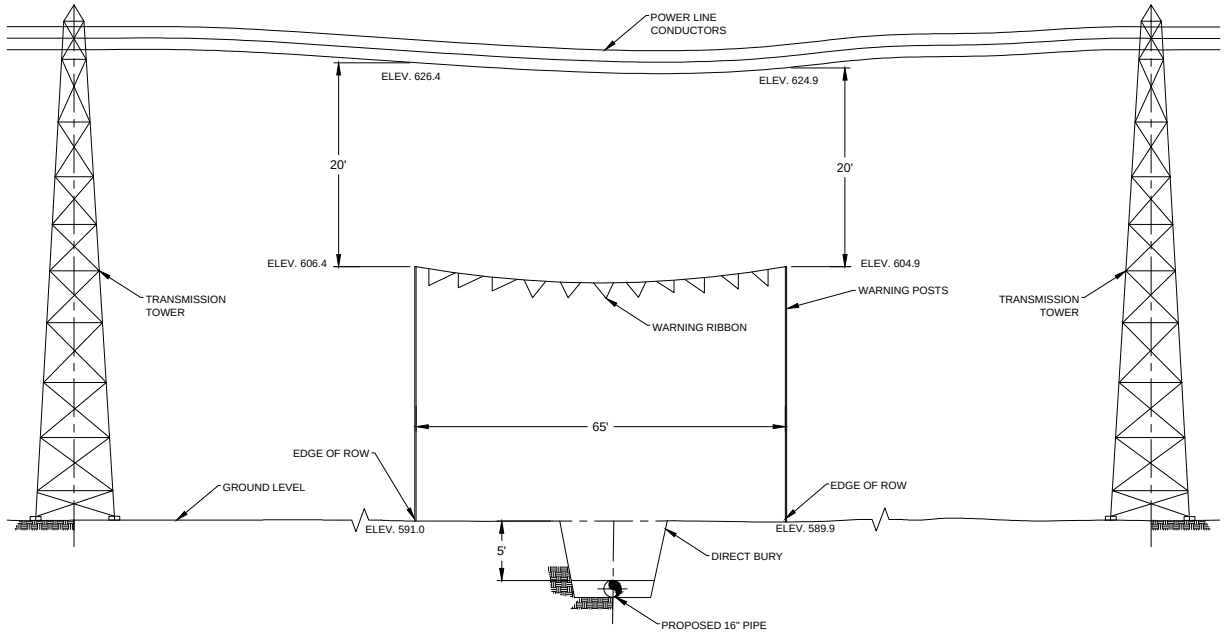
FIGURE 22



UTILITY-OVH PLAN VIEW

44+74, 45+71, 48+21, 49+43, 49+84, 50+21

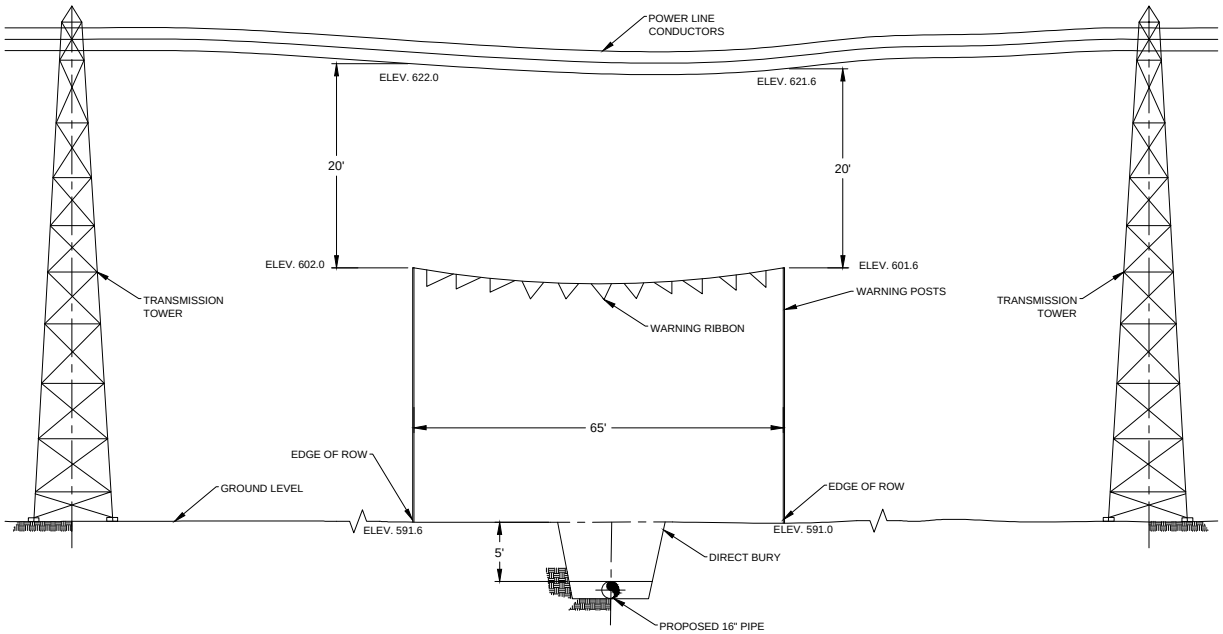
FIGURE 23



SECTION L-L

44+74

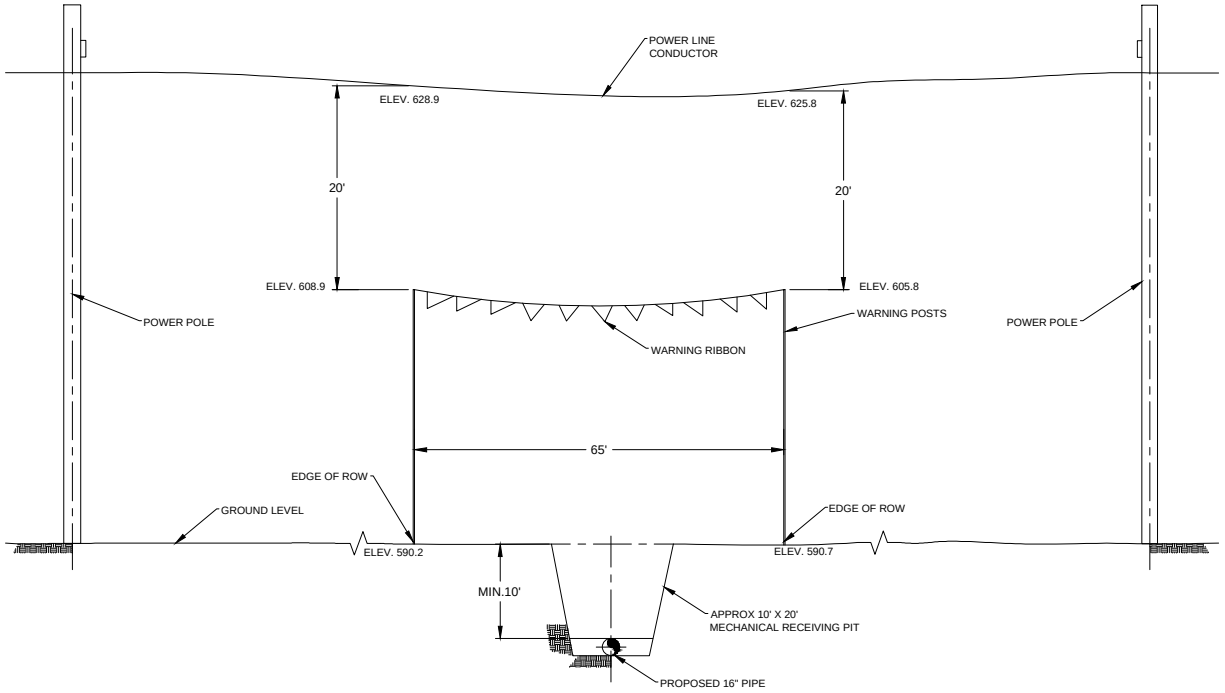
FIGURE 24



SECTION N-N
STATION 45+75

SECTION M-M
45+71

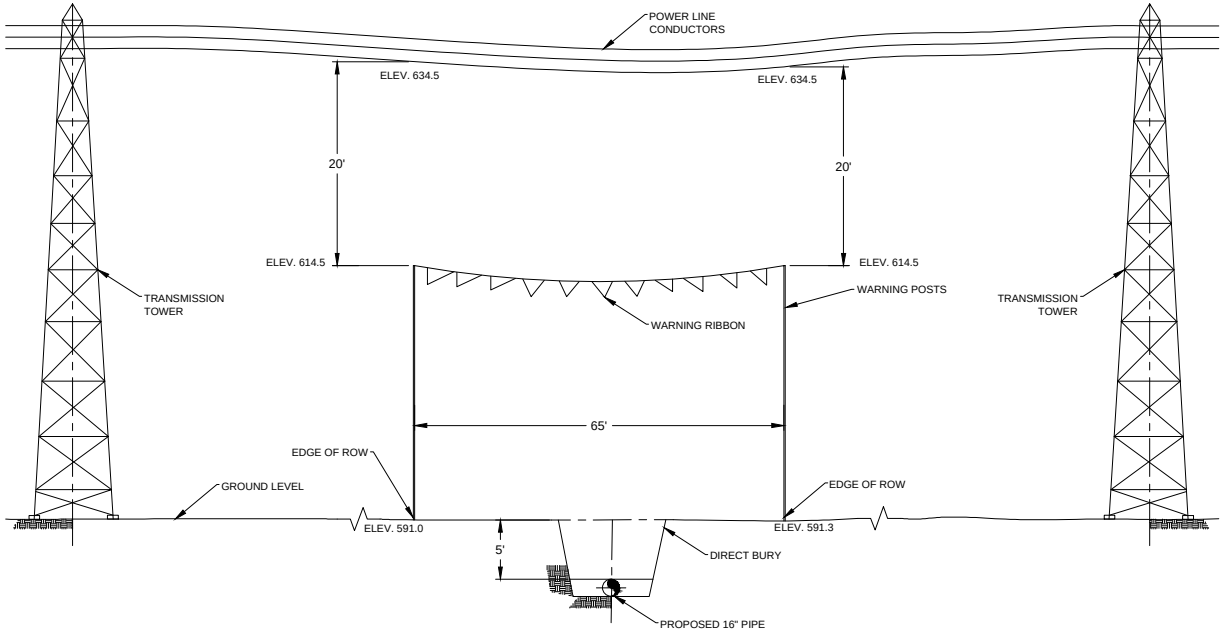
FIGURE 25



SECTION N-N

48+21

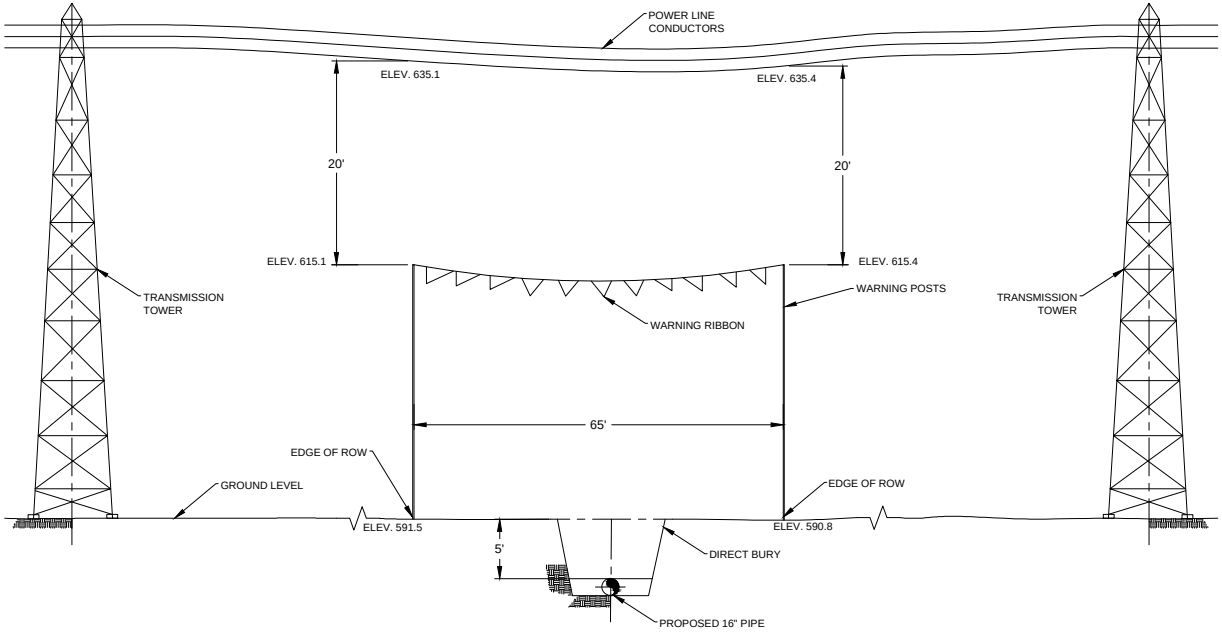
FIGURE 26



SECTION O-O

49+43

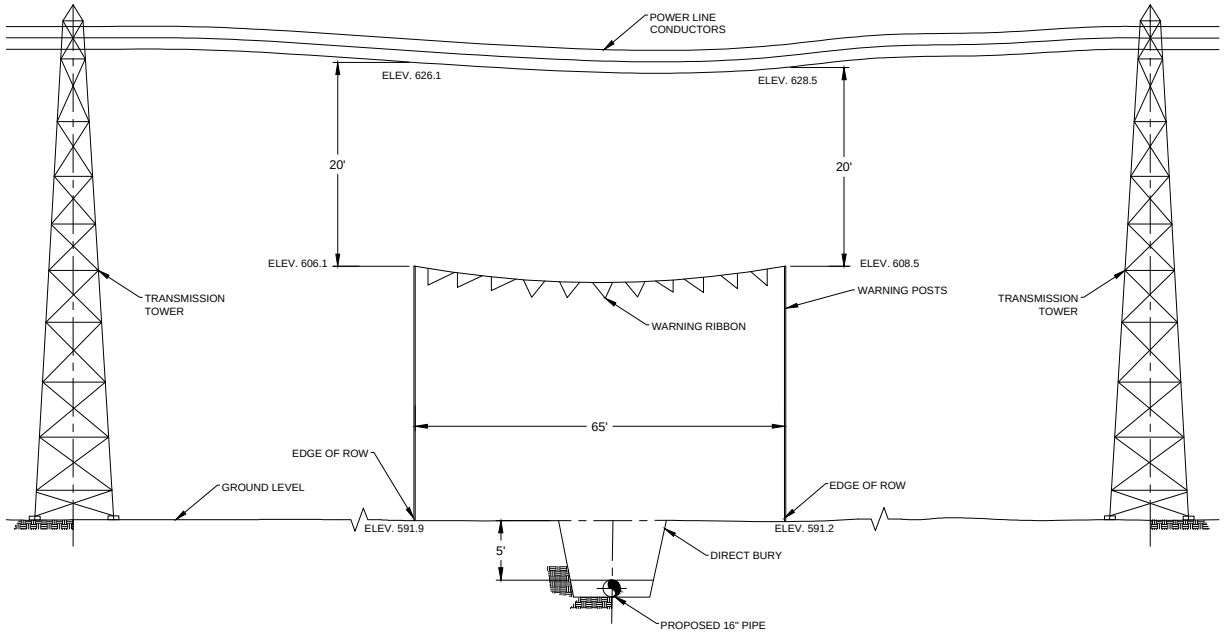
FIGURE 27



SECTION P-P

49+84

FIGURE 28



SECTION Q-Q

50+21

FIGURE 29

Exhibit 1

Vermeer®

Hydrostatic Trencher

T555

COMMANDER 3

COMMANDER® 3

T555

Come up Big on Your Toughest Jobs

When it comes to heavy duty trenching, one name alone stands for performance and reliability on jobsites around the world: Vermeer. The T555 COMMANDER® 3 is no exception. Equipped with innovative features, the T555 is ready for the most demanding trenching conditions.

Powered by a smooth-running John Deere PowerTech E Tier 3 diesel engine providing 185 hp (138 kW), the T555 COMMANDER 3 is available with a 4', 5', 6', or 8' (1.2 m, 1.5 m, 1.8 m, or 2.4 m) trencher boom capable of trenching widths up to 24" (61 cm).

The tractor is also available with a hydrostatic rockwheel attachment which is able to cut depths up to 36" (91 cm) in some of the toughest rock conditions. Designed for quick access to the engine and pump drive during attachment changeover, the T555 is equipped with a modular power pak.

Optional Auto-tilt Track *utilizes an oscillating track frame that allows the track to follow the ground's contour, ensuring a vertical trench on slopes up to 10 degrees. Plus, the Vermeer exclusive linkage design eliminates binding and improves depth control, so operators can attack hills and slopes as never before.*

TEC 2000® Trencher Electronic Control. *This exclusive Vermeer system integrates separate, stand-alone components into a few simple controls. It automatically adjusts the tractor to varying conditions and equalizes track speed for straight tracking in both directions, in all speed ranges. It also monitors trenching operations and displays useful data on an LCD readout. Machine system conditions are monitored to simplify troubleshooting; valuable maintenance data is logged.*

The hydrostatic rockwheel attachment *features the ability to cut a trench up to 36" (91 cm) in depth and 6" (15 cm) in width. The attachment is powered by a hydrostatic motor that powers through some of the toughest rock conditions.*

T555 COMMANDER 3 Specifications

Transport Dimensions
Approach angle: 35°
Height: 118" (299.7 cm)
Length: 149" – 292" (378 cm – 742 cm)
Weight range: 24,000 lb – 32,000 lb (10,886 kg – 14,515 kg)
Width: 97" – 99" (246 cm – 251 cm)

Engine
Make and model: John Deere 6068 HF285 PowerTech E 6.8 L Tier 3
Gross horsepower: 185 hp (138 kW)
Rated engine rpm: 2400
Number of cylinders: 6
Fuel tank capacity: 80 gal (302.8 L)
Operating range: 7.8 hr
Fuel consumption @ full load: 10.2 gph (38.6 L/h)
Max engine operating angle: 25°
Air cleaner: Dry-type exhaust-aspirated
Aspiration: Turbocharged and air-to-air aftercooled (ATAAC)
Cooling medium: Liquid
Electrical system: 12 V DC
Oil filter: Full-flow

Tracks
Auto self-level: Yes
Ground pressure: 4.5 – 9.6 psi (.32 – .67 kg/cm^2)
Tilt track available: Yes
Tilt track max angle: 10°
Track drive type: Dual-path hydrostatic w/ planetary transmission
Track length: 106" (269.2 cm)
Track pad type: Single, triple, or rubber grouser
Track pad width range: 20", 24" or 15" (51 cm, 61 cm, or 38 cm) rubber
Track size: FL6
Travel speed max (high range): 161 fpm (49.1 m/min)
Travel speed max (low range): N/A
Parking and emergency brake: Spring-applied, hydraulic release, wet disc brake
Service brakes: Hydrostatic

Conveyor
Belt width: 24" (61 cm)
Conveyor belt speed range: 835 fpm (254.5 m/min)
Conveyor belt style: Cleated or finger type, sidewall, center guide
Conveyor length: 91", 144" (231.1 cm, 365.8 cm)
Conveyor shift available: Yes
Conveyor shift distance: 14" (35.6 cm)
Conveyor style: Flat
Discharge direction: Right or left
Discharge height: 42" (107 cm)

Cab
Air conditioner / heater: Yes w/ cab option only
Air suspension seat: No
AM / FM stereo w/ weather band: Optional w/ cab only
Elevating: No
Pressurized / filtered air: Yes w/ cab option only
Roll Over Module (ROM): No
ROPS Platform: Standard (platform or cab)

Hydraulic System
Oil tank capacity: 60 gal (227 L)
Oil type: Vermeer HyPower 68 or Vermeer HyPower 100
Pressure setting: 2500 psi (172.4 bar)
Pump flow max: 27 gpm (102.2 L/m)
Type: Pressure and flow compensated (load sensing)

Trencher Attachment
Boom depth options: 4', 5', 6', 8' (1.2 m, 1.5 m, 1.8 m, 2.4 m)
Boom top rollers: Optional
Chain speed range: 406 – 692 fpm (124 – 211 m/min)
Cutting width range: 6" – 24" (15 – 61 cm)
End idler diameter: 20", 40" (50.8 cm, 101.6 cm)
Trencher drive type: Hydrostatic, single low speed, high torque motor

Rockwheel Attachment
Weight of rockwheel (w/ stub): 9000 lb (4082 kg)
Max cutting depth: 36" (91.4 cm)
Cutting width: 4.75", 6" (12 cm, 15.2 cm)
Drive type: Hydrostatic, single low speed, high torque motor
Max wheel speed: 1050 fpm (320 m/min)

Vermeer™

Your Complete Global Service Provider for Quality Parts and Service

Get the parts and service edge. In addition to providing quality equipment, Vermeer delivers top-quality parts and superior services. Vermeer parts are manufactured to exacting specifications to help keep your Vermeer equipment running trouble-free and at OEM specifications.

Vermeer offers factory-certified training programs to its dealer network to ensure that the most current service procedures are presented to the service personnel of your Vermeer dealer.

Standard Warranty / Vantage Track / Vantage Track II. Vermeer has confidence in its track trenchers. That's why Vermeer offers a 1-year / 1,000-hour standard limited warranty on the T555.

Vantage Track offers a 3-year / 3,000-hour Extended-Care Service Program for the components of the closed-loop hydrostatic systems.

Vantage Track II offers a 5-year / 5,000-hour Extended-Care Service Program for the components of the closed-loop hydrostatic systems.

Vermeer™

Vermeer Manufacturing Company
1210 Vermeer Road East
P.O. Box 200
Pella, Iowa 50219 U.S.A.
Phone: (641) 628-3141
Fax: (641) 621-7773
International fax: +1 (641) 621-7730
www.vermeer.com

Call toll-free 1-888-VERMEER
1-888-837-6337 (U.S.A. only)

Europe, Middle East, and Africa:
P.O. Box 323
4460 AS Goes
Netherlands
Phone: +31 113 272700
Fax: +31 113 272727

06/07.1K

PN 115153237

Exhibit 2

336D L

Hydraulic Excavator

Engine		
Engine Model	Cat® C9 with ACERT™ Technology	
Net Flywheel Power	200 kW	268 hp
Weights		
Minimum Weight	35 668 kg	78,634 lb
Maximum Weight	37 631 kg	82,962 lb

336D L Hydraulic Excavator

The D Series incorporates innovations for improved performance and versatility.

C9 with ACERT™ Technology

✔ ACERT™ Technology works at the point of combustion to optimize engine performance and provide low exhaust emissions to meet U.S. EPA Tier 3 emission regulations, with exceptional performance capabilities and proven reliability. **pg. 4**

Hydraulics

The hydraulic system has been designed to provide reliability and outstanding controllability. An optional Tool Control System provides enhanced flexibility. **pg. 5**

Operator Station

✔ Provides maximum space, wider visibility and easy access to switches. The monitor is a full-color graphical display that allows the operator to understand the machine information easily. Overall, the new cab provides a comfortable environment for the operator. **pg. 6**

Versatility

Caterpillar offers a wide variety of factory-installed attachments that enhance performance and job site management. **pg. 11**

Service and Maintenance

Fast, easy service has been designed in with extended service intervals, advanced filtration, convenient filter access and user-friendly electronic diagnostics for increased productivity and reduced maintenance costs. **pg. 12**

Structures

Caterpillar® design and manufacturing techniques assure outstanding durability and service life from these important components. **pg. 8**

Booms, Sticks and Attachments

Built for good performance and long service life, Caterpillar® booms and sticks are large, welded, stress relieved, box-section structures with thick, multi-plate fabrications to resist high stress. The bucket linkage pins have been enlarged to improve reliability and durability. **pg. 9**

Work Tools – Attachments

✔ A variety of work tools, including buckets, couplers, hammers, and shears are available through Cat Work Tools. **pg. 10**

Complete Customer Support

Your Cat® dealer offers a wide range of services that can be set up under a customer support agreement when you purchase your equipment. The dealer will help you choose a plan that can cover everything from machine configuration to eventual replacement. **pg. 13**

✔ *New Feature*

C9 with ACERT™ Technology

The Cat® C9 gives the 336D L exceptional power and fuel efficiency unmatched in the industry for consistently high performance in all applications.

Cat C9. The Cat C9 with ACERT™ Technology introduces a series of evolutionary, incremental improvements that provide breakthrough engine technology. The building blocks of ACERT Technology are fuel delivery, air management and electronic control. ACERT Technology optimizes engine performance while meeting U.S. EPA Tier 3 engine emission regulations for off-road applications.

Performance. The 336D L, equipped with the C9 engine with ACERT™ Technology, provides 9% more horsepower as compared to the C9 in the 330C L.

Automatic Engine Speed Control. The two-stage, one-touch control maximizes fuel efficiency and reduces sound levels.

ADEM™ A4 Engine Controller. The ADEM A4 electronic control module manages fuel delivery to get the best performance per liter of fuel used. The engine management system provides flexible fuel mapping, allowing the engine to respond quickly to varying application needs. It tracks engine and machine conditions while keeping the engine operating at peak efficiency.

Electronic Control Module. The Electronic Control Module (ECM) works as the "brain" of the engine's control system, responding quickly to operating variables to maximize engine efficiency. Fully integrated with sensors in the engine's fuel, air, coolant, and exhaust systems, the ECM stores and relays information on conditions such as rpm, fuel consumption, and diagnostic information.

Fuel Delivery. The Cat C9 features electronic controls that govern the unit fuel injection system. Multiple injection fuel delivery involves a high degree of precision. Precisely shaping the combustion cycle lowers combustion chamber temperatures, generating fewer emissions and optimizing fuel combustion. This translates into more work output for your fuel cost.

Cooling System. The cooling fan is hydraulically driven and controlled by the ECM. The optimum fan speed is calculated based on the ambient temperature, coolant temperature and hydraulic oil temperature. This unique feature assists in the management of engine power and improves noise efficiency. Cat C9 delivered a completely new layout that separates the cooling system from the engine compartment.

Air Cleaner. The radial seal air filter features a double-layered filter core for more efficient filtration and is located in a compartment behind the cab. A warning is displayed on the monitor when dust accumulates above a preset level.

Noise Reduction Technologies. The engine mounts are rubber-isolating mounts matched with the engine package. Further noise reduction has been achieved through design changes to the isolated top cover, oil pan, multiple injection strategy, insulated timing cover, sculpted crankcase and gear train refinements.

Hydraulics

Cat® hydraulics deliver power and precise control to keep material moving.

Component Layout. The component location and hydraulic system design provide the highest level of system efficiency. The main pumps, control valves and hydraulic tank are located close together to allow for shorter tubes and lines between components reducing friction loss and pressure drops in the lines. The layout further provides greater operator comfort by placing the radiator on the cab side of the upper structure. This allows incoming air to enter the engine compartment from the operator side and hot air and corresponding engine sound to exit on the opposite side away from the operator. This reduces engine compartment heat and sound transmitted to the operator.

Pilot System. The pilot pump is independent from the main pumps and controls the front linkage, swing and travel operations. The pilot control valve operation is proportional to control lever movement delivering outstanding controllability.

Hydraulic Cross Sensing System. The hydraulic cross sensing system utilizes each of two hydraulic pumps to 100 percent of engine power, under all operating conditions. This improves productivity with faster implement speeds and quicker, stronger pivot turns.

Boom and Stick Regeneration Circuit. Boom and stick regeneration circuit saves energy during boom-down and stick-in operation. This increases efficiency, reduces cycle times and pressure loss for higher productivity, lower operating costs and increased fuel efficiency.

Auxiliary Hydraulic Valve. The auxiliary valve is standard on the 336D L. Control Circuits are available as attachments, allowing for operation of high and medium pressure tools such as shears, grapples, hammers, pulverizers, multi-processors and vibratory plate compactors.

Hydraulic Cylinder Snubbers. Snubbers are located at the rod-end of the boom cylinders and both ends of the stick cylinders to cushion shocks while reducing sound levels and extending component life.

Operator Station

Designed for comfort, simple and easy operation, the 336D L allows the operator to focus on production.

Operator Station. The workstation is spacious, quiet and comfortable, assuring high productivity during a long work day. The air conditioner and attachment switches are conveniently located on the right-hand wall, and the key switch and throttle dial are on the right-hand console. The monitor is easy to see and maximizes visibility.

Monitor. The monitor is a full color 400x234 pixels Liquid Crystal Display (LCD) graphic display. The monitor angle is adjustable to minimize sun glare and is capable of displaying information in twenty-seven different languages.

Pre-Start Check. Prior to starting the machine, the system will check for low fluid levels for the engine oil, hydraulic oil and engine coolant and warn the operator through the monitor in the event display area.

Gauge Display. Fuel level, hydraulic oil temperature and coolant temperature are displayed in this area by analog gauges.

Event Display. An icon and the selected language display the machine information in this area.

Multi-information Display. This area is reserved for displaying various forms of operator information. The "CAT" logo is displayed when no information is available to be displayed.

Standard Cab Equipment. To enhance operator comfort and productivity, the cab includes a lighter, drink holder, coat hook, service meter, literature holder, magazine rack and storage compartment.

Seat. A new optional air suspension seat is available in the 336D L. The standard and optional seats provide a variety of adjustments to suit the operator's size and weight including fore/aft, height and weight. Wide adjustable armrests and a retractable seat belt are also included.

Joystick Control. Joystick controls have low lever effort and are designed to match the operator's natural wrist and arm position. The operator can operate joystick controls with an arm on the armrest and the horizontal and vertical strokes have been designed to reduce operator fatigue.

Hydraulic Activation Control Lever. For added safety, this lever must be in the operate position to activate the machine control functions.

Automatic Climate Control. Fully automatic climate control adjusts temperature and flow, and determines which air outlet is best in each situation with a touch of a button.

Console. Redesigned consoles feature a simple, functional design to reduce operator fatigue, ease of switch operation and excellent visibility. Both consoles have attached armrests with height adjustments.

Cab Exterior. The exterior design uses thick steel tubing along the bottom perimeter of the cab, improving the resistance of fatigue and vibration. This design allows the FOGS to be bolted directly to the cab, at the factory or as an attachment later, enabling the machine to meet specifications and job site requirements.

Cab Mounts. The cab shell is attached to the frame with viscous rubber cab mounts, which dampen vibrations and sound levels while enhancing operator comfort.

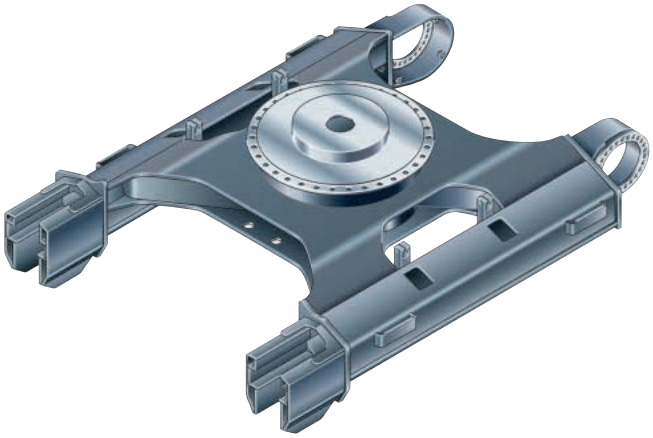
Windows. All glass is affixed directly to the cab for excellent visibility eliminating window frames. The upper front windshield opens, closes and stores on the roof above the operator with a one-touch action release system.

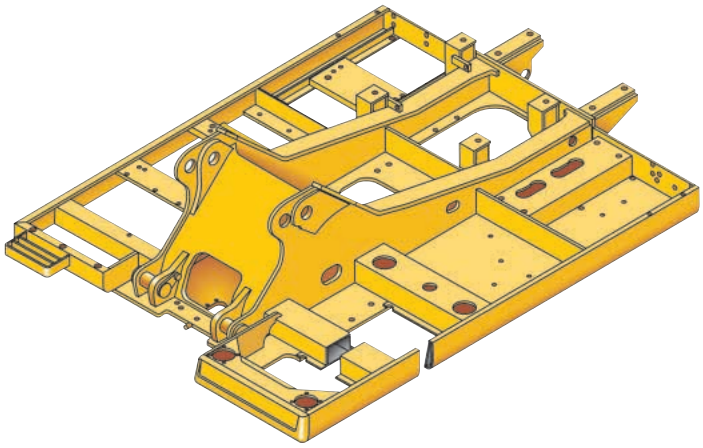
Wipers. Pillar-mounted wipers increase the operator's viewing area and offer continuous and intermittent modes.

Skylight. An enlarged skylight with sunshade provides excellent visibility and ventilation.

Structures

336D L structural components and undercarriage are the backbone of the machine's durability.





Robotic Welding. Up to 95% of the structural welds on a Caterpillar® Excavator are completed by robots. Robotic welds achieve over three times the penetration of manual welds.

Carbody Design and Track Roller Frames. X-shaped, box-section carbody provides excellent resistance to torsional bending. Robot-welded track roller frames are press-formed, pentagonal units to deliver exceptional strength and service life.

Main Frame. Rugged main frame is designed for maximum durability and efficient use of materials.

Undercarriage. Durable Cat® undercarriage absorbs stresses and provides excellent stability.

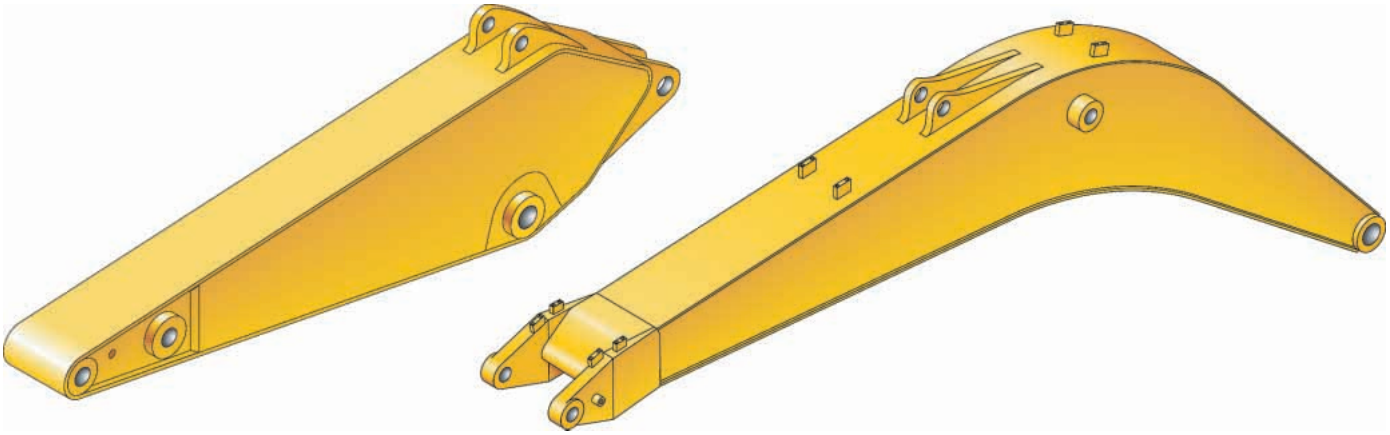
Swing Bearing. The swing bearing utilizes cross roller bearings versus the traditional ball bearing design. The cross roller bearing design allows for more surface contact to absorb the stresses that are a result of the high swing torque that Cat offers. It provides exceptional machine stability and reduces machine pitching during boom down operation.

Rollers and Idlers. Sealed and lubricated track rollers, carrier rollers, and idlers provide excellent service life, to keep the machine in the field longer.

Long Undercarriage. The long (L) undercarriage maximizes stability and lift capacity. This long, wide, and sturdy undercarriage offers a very stable work platform.

Booms, Sticks and Attachments

Designed for maximum flexibility, productivity and high efficiency on all jobs, the 336D L offers a wide range of configurations suitable for a variety of applications.



Reach Boom. The reach boom features an optimum design that maximizes digging envelopes with two stick choices:

R3.9DB, R3.2DB Sticks

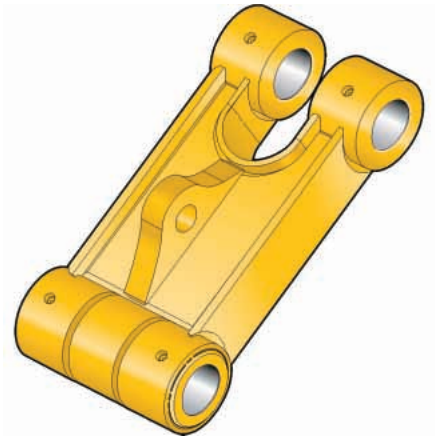
- The DB-family bucket associated with these sticks have enough capacity for excellent reach and depth in trenching and general construction applications.

Mass Excavation Boom. The mass excavation boom maximizes productivity. The mass version offers significantly higher digging forces and allows use of larger buckets.

M2.55TB1 Stick

- The TB1 Stick use a TB-family bucket and were designed for high volume earth moving, powerful digging force and a large capacity bucket. Combined with a Mass boom, these sticks deliver outstanding productivity.

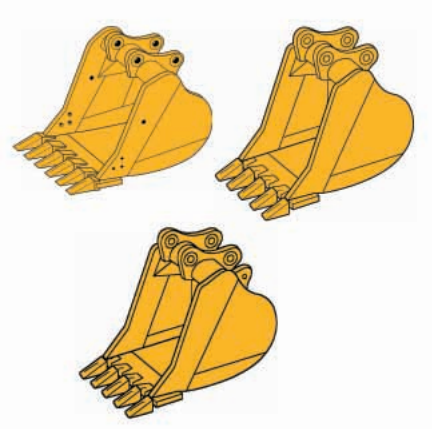
Linkage Pins. The bucket linkage pins have been enlarged to improve reliability and durability. All the pins in the front linkages have thick chrome plating, giving them high wear and corrosion resistance.



Bucket Linkage. The power link improves durability, increases machine-lifting capability in key lifting positions and is easier to use than compared to the previous lifting eye.

Work Tools – Attachments

The 336D L has an extensive selection of work tools to optimize machine performance.



Heavy Duty Buckets. Heavy-duty buckets are used for a wide range of moderately abrasive applications such as mixed dirt, clay and rock. HD buckets have best loading and dumping characteristics and will empty easier in cohesive material. More robust construction than the GP buckets.

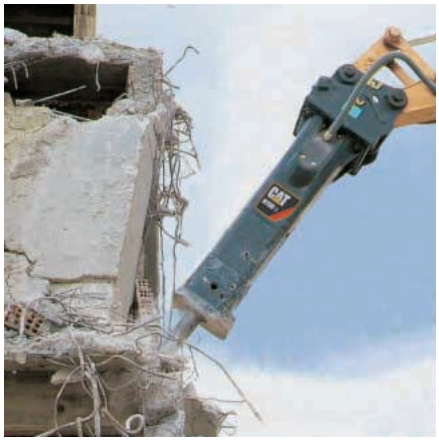
General Purpose Capacity (GP-C) Buckets. General purpose capacity buckets are best for digging in soft to hard ground with low to moderately abrasive materials.

Heavy-Duty Power (HDP) Buckets. Heavy-duty power buckets are for use in moderately abrasive applications where breakout force and cycle times are critical. Maximizes tip force and improves cycle times in most materials.

Heavy Duty Rock (HDR) Buckets. Heavy-duty rock buckets are for use in aggressive bucket loading in highly abrasive application such as shot rock and granite. HDR buckets include thicker bottom wear plates and longer side wear plates to extend the life of bucket in these severe applications.

Caterpillar Ground Engaging Tools (GET). All buckets in the DB/TB Family utilize the Caterpillar K Series® GET. This GET system uses a vertical retainer that is easier to remove and install than the Cat J Series pin. The tip shapes are more aggressive and offer better penetration than the previous generation of tips. There are also a variety of side cutters and sidebar protectors to match operating conditions.

Dedicated Quick Coupler. Quick Couplers increase the versatility of Cat excavators; allowing the ease of changing work tools to meet job requirements at hand in a matter of minutes or seconds. Dedicated quick coupler buckets have no loss of tip radius, and develop maximum breakout force.



Hammer

Cat Hydraulic Hammers are precisely matched to Cat machines for optimum performance in a wide variety of demolition and construction applications.

Thumb

Cat® thumbs multiply the capabilities of your excavator. This highly flexible tool works in conjunction with the bucket to transform an excavator into a highly versatile material-handling machine.

Multi-processor

Multi-processors do the work of many types of demolition tools by use of interchangeable jaw sets. Changing jaws allows a single unit to crush, pulverize and perform a variety of specialized cutting tasks, such as cutting steel rebar and tanks.

Versatility

A wide variety of optional factory installed attachments are available to enhance performance and improve job site management

Tool Control System. This system offers the most flexibility and versatility of the auxiliary options offered. This system is available in two configurations, as a stand-alone system or with a medium pressure circuit and third pump. This system is capable of running either one-way or two-way tools and one-pump or two pump tools. The addition of the medium pressure circuit allows use of tools that rotate such as grapples, shears or multi-processors. Up to 10 different tool settings can be pre-programmed and selected through the monitor.

Auxiliary Hydraulic Options. There are four different options that can be factory installed to meet the various demands for hydra-mechanical tools.

- Single-Function
- Double-Function
- Tool Control System without Medium Pressure
- Tool Control System with Medium Pressure

Single-Function Auxiliary Hydraulics. This circuit utilizes one-way flow with two pumps and can run tools such as hammers and vibratory plate compactors.

Double-Function Auxiliary Hydraulics. This circuit utilizes two-way flow and one pump and is capable of running tools such as a thumb, tilt-bucket or non-rotating grapples or shears.

Hydraulic Kits. Field installed hydraulic kits are available that are identical to the factory installed version in both component and functionality. The flexibility of the base hydraulic design allows for upgradeability to any auxiliary hydraulic option.

Machine Security. An optional Machine Security System is available from the factory on the 336D L. This system controls when the machine can be operated and utilizes specific keys to prevent unauthorized machine use, a significant theft deterrent.

Product Link. Product Link 321 is now standard on the 336D L. The optional levels of service, including Asset Watch, Maintenance Watch, and Health Watch allow you to monitor and maintain your equipment for the lowest operating cost.

Pin Grabber Plus Hydraulic Pin Grabber

Increases versatility of the excavator by allowing the machine to pick up a wide variety of work tools without leaving the cab.

360° Scrap Shear

Caterpillar Scrap Shears feature 360° rotation and high force-to-weight ratio. Used for demolishing steel structures and preparing bulk scrap (such as cars, farm machinery and railroad cars) for further processing.

Service and Maintenance

Simplified service and maintenance features save you time and money.

Ground Level Service. The design and layout of the 336D L was made with the service technician in mind. Many service locations are easily accessible at ground level allowing critical maintenance to get done quickly and efficiently.

Air Filter Compartment. The air filter features a double-element construction for superior cleaning efficiency. When the air cleaner plugs, a warning is displayed on the monitor screen inside the cab.

Pump Compartment. A service door on the right side of the upper structure allows ground-level access to the pump and pilot filter.

Radiator Compartment. The left rear service door allows easy access to the engine radiator, oil cooler and air-to-air-after-cooler. A reserve tank and drain cock are attached to the radiator for simplified maintenance.

Greasing Points. A concentrated remote greasing block on the boom delivers grease to hard-to-reach locations on the front.

Capsule Filter. The hydraulic return filter, a capsule filter, is situated outside the hydraulic tank. This filter prevents contaminants from entering the system when hydraulic oil is changed and keeps the operation clean.

Fan Guard. Engine radiator fan is completely enclosed by fine wire mesh, reducing the risk of an accident.

Anti-Skid Plate. Anti-skid plate covers top of storage box and upper structure to prevent slipping during maintenance.

Diagnostics and Monitoring. The 336D L is equipped with S•O•S℠ sampling ports and hydraulic test ports for the hydraulic system, engine oil, and for coolant. A test connection for the Cat Electronic Technician (Cat ET) service tool is located in the cab.

Complete Customer Support

Cat® dealer services help you operate longer with lower costs.

Product Support. You will find nearly all parts at our dealer parts counter. Cat dealers utilize a worldwide computer network to find in-stock parts to minimize machine down time. Save money with remanufactured components.

Machine Selection. Make detailed comparisons of the machines you are considering before you buy. What are the job requirements, machine attachments and operating hours? What production is needed? Your Cat dealer can provide recommendations.

Customer Support Agreements. Cat dealers offer a variety of product support agreements, and work with customers to develop a plan the best meets specific needs. These plans can cover the entire machine, including attachments, to help protect the customer's investment.

Operation. Improving operating techniques can boost your profits. Your Cat dealer has videotapes, literature and other ideas to help you increase productivity, and Caterpillar offers certified operator training classes to help maximize the return on your investment.

Maintenance Services. Repair option programs guarantee the cost of repairs up front. Diagnostic programs such as Scheduled Oil Sampling, Coolant Sampling and Technical Analysis help you avoid unscheduled repairs.

Replacement. Repair, rebuild, or replace? Your Cat dealer can help you evaluate the cost involved so you can make the right choice.

SAFETY.CAT.COM™.

Engine

Engine Model	Cat C9 with ACERT™ Technology	
Net Flywheel Power	200 kW	268 hp
Net Power – ISO 9249	200 kW	268 hp
Net Power – SAE J1349	198 kW	266 hp
Net Power – EEC 80/1269	200 kW	268 hp
Bore	112 mm	4.4 in
Stroke	149 mm	5.87 in
Displacement	8.8 L	537 in^3

- The 336D L meets U.S. EPA Tier 3 and EU Stage IIIA exhaust emission requirements.
- Net power advertised is the power available at the flywheel when the engine is equipped with fan, air cleaner, muffler and alternator.
- No engine power derating required below 2300 m (7,500 ft).

Weights

Operating Weight	36 498 kg	80,464 lb

- HD Reach boom, R3.9DB (12 ft 6 in) Stick, 1.19 m^3 (1.56 yd^3) GP Bucket, 800 mm (32 in) Shoe

Service Refill Capacities

Fuel Tank Capacity	620 L	163.8 gal
Cooling System	40 L	10.6 gal
Engine Oil	40 L	10.6 gal
Swing Drive	19 L	5 gal
Final Drive (each)	8 L	2.1 gal
Hydraulic System (including tank)	410 L	108.3 gal
Hydraulic Tank	175 L	46.2 gal

Swing Mechanism

Swing Speed	10 RPM	
Swing Torque	108.7 kN·m	80,142 lb ft

Drive

Maximum Drawbar Pull	300 kN	67,443 lb
Maximum Travel Speed	5 km/h	3.1 mph

Hydraulic System

Main Implement System – Maximum Flow (2x)	280 L/min	74 gal/min
Max. pressure – Equipment	35 000 kPa	5,076 psi
Max. pressure – Equipment – Heavy	36 000 kPa	5,221 psi
Max. pressure – Travel	35 000 kPa	5,076 psi
Max. pressure – Swing	28 000 kPa	4,061 psi
Pilot System – Maximum flow	43 L/min	11.4 gal/min
Pilot System – Maximum pressure	4000 kPa	565.7 psi
Boom Cylinder – Bore	150 mm	5.9 in
Boom Cylinder – Stroke	1440 mm	56.7 in
Stick Cylinder – Bore	170 mm	6.7 in
Stick Cylinder – Stroke	1738 mm	68.4 in
DB Family Bucket Cylinder – Bore	150 mm	5.9 in
DB Family Bucket Cylinder – Stroke	1151 mm	45.3 in
TB1 Family Bucket Cylinder – Bore	160 mm	6.3 in
TB1 Family Bucket Cylinder – Stroke	1356 mm	53.4 in

Sound Performance

Performance	ANSI/SAE J1166 OCT 98

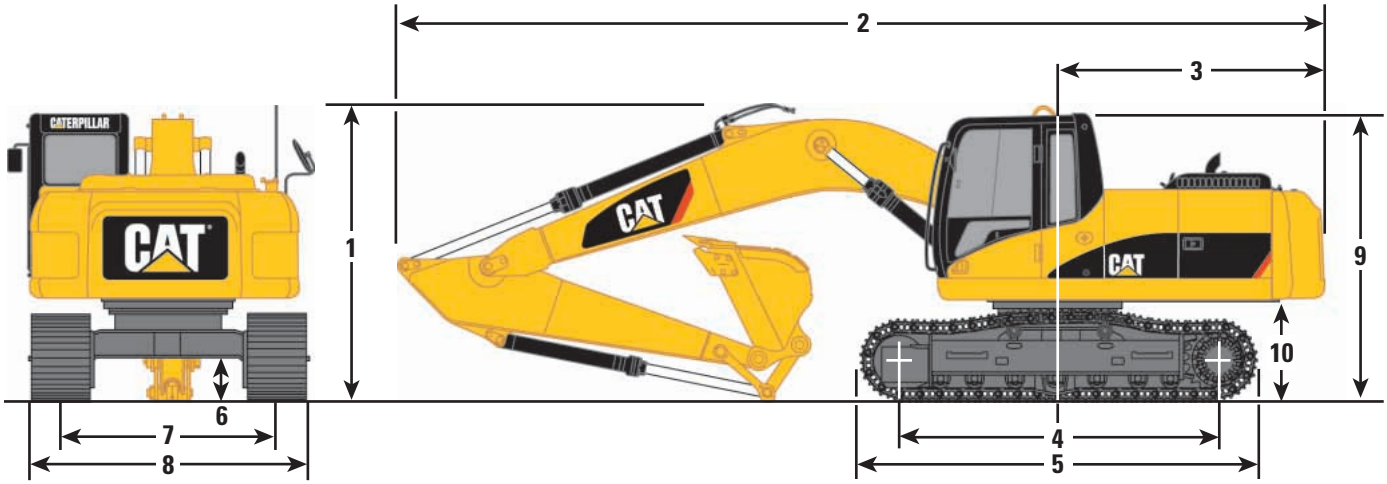
- When properly installed and maintained, the cab offered by Caterpillar, when tested with doors and windows closed according to ANSI/SAE J1166 OCT 98, meets OSHA and MSHA requirements for operator sound exposure limits in effect at time of manufacture.
- Hearing protection may be needed when operating with an open operator station and cab (when not properly maintained or doors/windows open) for extended periods or in noisy environment.

Standards

Brakes	SAE J1026 APR90
Cab/FOGS	SAE J1356 FEB88

Dimensions

All dimensions are approximate.

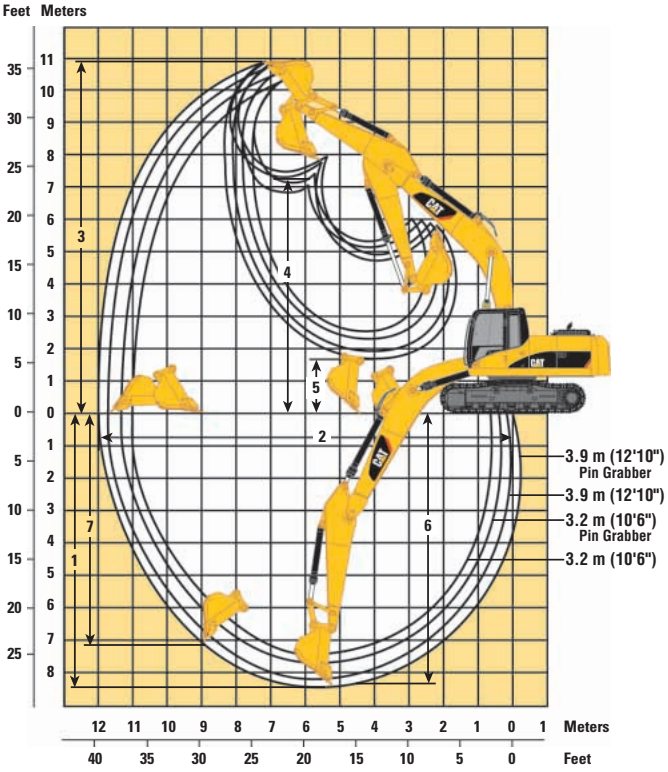


Boom Options		Reach Boom 6.5 m (21'4")		Mass Boom 6.18 m (20'3")
Stick Options		**R3.9DB (12'10")**	**R3.2DB (10'6")**	**M2.55TB1 (8'4")**
1	Shipping height*	3630 mm (11'11")	3350 mm (11'0")	3580 mm (11'9")
2	Shipping length	11 200 mm (36'9")	11 150 mm (36'7")	10 910 mm (35'10")
3	Tail swing radius	3500 mm (11'6")	3500 mm (11'6")	3500 mm (11'6")
4	Length to center of rollers	4040 mm (13'3")	4040 mm (13'3")	4040 mm (13'3")
5	Track length	5020 mm (16'6")	5020 mm (16'6")	5020 mm (16'6")
6	Ground clearance**	450 mm (1'6")	450 mm (1'6")	450 mm (1'6")
7	Track gauge	2590 mm (8'6")	2590 mm (8'6")	2590 mm (8'6")
8	Transport width			
	800 mm (32") shoes (standard)	3390 mm (11'1")	3390 mm (11'1")	3390 mm (11'1")
	700 mm (28") shoes (optional)	3290 mm (10'10")	3290 mm (10'10")	3290 mm (10'10")
	850 mm (34") shoes (optional)	3440 mm (11'3")	3440 mm (11'3")	3440 mm (11'3")
9	Cab height	3140 mm (10'4")	3140 mm (10'4")	3140 mm (10'4")
10	Counterweight clearance*	1220 mm (4'0")	1220 mm (4'0")	1220 mm (4'0")

* Includes 30 mm (13⁄16 in) lug height. R3.9 increase to 3700 mm (12'2") with medium pressure and/or drain auxiliary lines.
** Without 30 mm (13⁄16 in) shoe lug height.

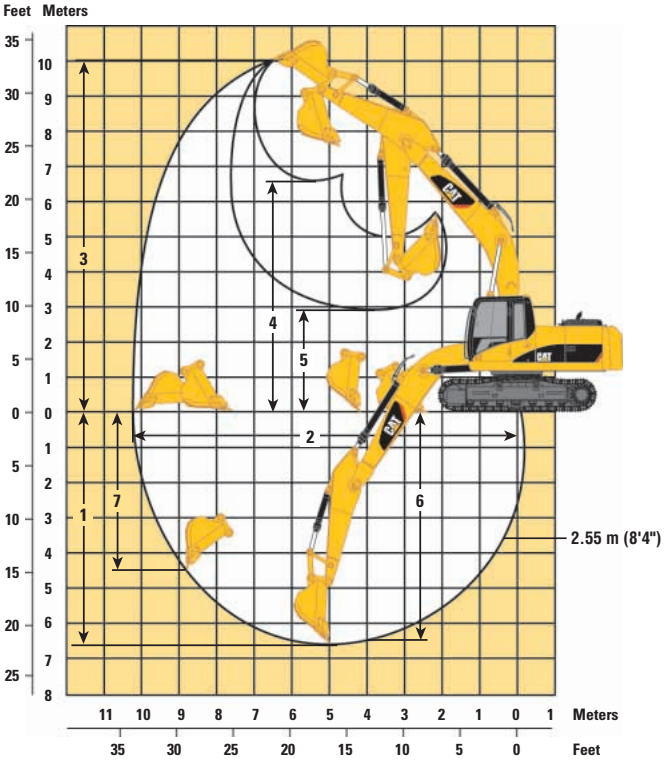
Reach Excavator Working Ranges

Reach (R) boom configuration



Mass Excavator Working Ranges

Mass (M) boom configuration



Boom Options		Reach Boom 6.5 m (21'4")				Mass Boom 6.18 m (20'3")
Stick Options		**R3.9DB (12'10")**	**R3.2DB (10'6")**	**R3.9DB (12'10")**	**R3.2DB (10'6")**	**M2.55TB1 (8'4")**
Bucket Options		**GP 1.19 m³ (1.56 yd³)**	**GP 1.19 m³ (1.56 yd³)**	**GP 1.19 m³ (1.56 yd³) with Pin Grabber Coupler**	**GP 1.19 m³ (1.56 yd³) with Pin Grabber Coupler**	**GP 1.19 m³ (1.56 yd³)**
1	Maximum digging depth	8185 mm (26'10")	7485 mm (24'7")	8461 mm (27'9")	7760 mm (25'6")	6633 mm (21'9")
2	Maximum reach at ground level	11 714 mm (38'5")	11 007 mm (36'1")	12 005 mm (39'5")	11 294 mm (37'1")	10 242 mm (33'7")
3	Maximum cutting height	10 749 mm (35'3")	10 272 mm (33'8")	10 909 mm (35'9")	10 413 mm (34'2")	10 023 mm (32'11")
4	Maximum loading height	7542 mm (24'9")	7108 mm (23'4")	7266 mm (23'10")	6833 mm (22'5")	6629 mm (21'9")
5	Minimum loading height	1911 mm (6'3")	2611 mm (8'7")	1635 mm (5'4")	2336 mm (7'8")	2937 mm (9'8")
6	Maximum depth cut for 2440 mm (8') level bottom	8052 mm (26'5")	7326 mm (24'0")	8338 mm (27'4")	7612 mm (25'0")	6459 mm (21'2")
7	Maximum vertical wall digging depth	7152 mm (23'6")	6131 mm (20'1")	5747 mm (18'10")	4826 mm (15'10")	4421 mm (14'6")

Bucket and Stick Forces

Stick Options	R3.9DB		R3.9DB with Pin Grabber Coupler		R3.2DB		R3.2DB with Pin Grabber Coupler		M2.55TB1	
	kN	lb	kN	lb	kN	lb	kN	lb	kN	lb
DB-Family Buckets										
Heavy Duty-Power										
Bucket Digging Force (ISO)	238.3	53,572	198.2	44,557	237.7	53,437	197.4	44,377		
Stick Digging Force (ISO)	151.9	34,148	144.9	32,575	170.0	38,218	160.1	35,992		
Bucket Digging Force (SAE)	208.6	46,895	180.8	40,645	208.0	46,760	180.0	40,466		
Stick Digging Force (SAE)	147.8	33,227	141.9	31,900	164.6	37,004	156.3	35,138		
Heavy Duty										
Bucket Digging Force (ISO)	214.3	48,177	187.4	42,129	213.6	48,019	186.7	41,972		
Stick Digging Force (ISO)	149.3	33,564	142.2	31,968	166.6	37,453	156.8	35,250		
Bucket Digging Force (SAE)	188.5	42,376	171.0	38,442	187.9	42,242	170.4	38,307		
Stick Digging Force (SAE)	145.0	32,597	139.1	31,271	161.0	36,194	152.8	34,351		
General Purpose										
Bucket Digging Force (ISO)	213.8	48,064	188.6	42,399	213.3	47,952	187.8	42,219		
Stick Digging Force (ISO)	149.3	33,564	142.6	32,058	166.8	37,498	157.4	35,385		
Bucket Digging Force (SAE)	191.1	42,961	174.4	39,207	190.6	42,849	173.9	39,094		
Stick Digging Force (SAE)	145.9	32,800	140.2	31,518	162.3	36,486	154.2	34,666		
TB-Family Buckets										
Heavy Duty										
Bucket Digging Force (ISO)									271.0	60,923
Stick Digging Force (ISO)									195.2	43,883
Bucket Digging Force (SAE)									239.6	53,864
Stick Digging Force (SAE)									188.0	42,264

Major Component Weights*

	kg	lb
Base machine with counterweight (without front linkage)		
With 800 mm (32") shoe	29 117	64,192
Two boom cylinders (each)	674	1,486
Counterweight		
Standard counterweight	6020	13,272
Boom (includes lines, pins and stick cylinder)		
HD Reach boom 6.5 m (20'3")	3495	7,705
Mass boom 6.18 m (20'4")	3283	7,238
Stick (includes lines, pins, bucket cylinder and linkage)		
R3.9 (12'10")	2012	4,436
R3.2 (10'6")	1867	4,116
M2.55 (8'5")	2079	4,583

* All weights are approximate.

Bucket Specifications and Compatibility

Bucket Type	Adaptor	Capacity*		Width		Tip Radius		Teeth	Total Weight		Reach Boom Stick		Mass Boom Stick
		m^3	yd^3	mm	in	mm	in	Qty	kg	lb	R3.9DB	R3.2DB	M2.55TB
DB Family Buckets													
General Purpose	K100	0.94	1.23	762	30	1753.4	69.0	3	993	2,189	●	●	
	K100	1.19	1.56	914	36	1753.4	69.0	4	1088	2,398	●	●	
	K100	1.46	1.91	1067	42	1753.4	69.0	5	1200	2,646	●	●	
	K100	1.73	2.26	1219	48	1753.4	69.0	5	1288	2,839	◓	●	
	K100	2.00	2.62	1372	54	1753.4	69.0	6	1401	3,089	◒	◓	
	K100	2.27	2.97	1524	60	1753.4	69.0	7	1515	3,339	○	◒	
	K100	2.55	3.34	1676	66	1753.4	69.0	7	1602	3,532	∴	○	
Heavy Duty	K110	0.74	0.97	762	30	1779.1	70.0	3	1070	2,358	●	●	
	K110	0.95	1.24	914	36	1779.1	70.0	4	1216	2,682	●	●	
	K110	1.18	1.54	1067	42	1779.1	70.0	4	1310	2,889	●	●	
	K110	1.41	1.84	1219	48	1779.1	70.0	5	1441	3,178	●	●	
	K110	1.64	2.15	1372	54	1779.1	70.0	5	1539	3,393	◓	●	
	K110	1.87	2.45	1524	60	1779.1	70.0	6	1672	3,686	◒	◒	
	K110	2.10	2.75	1676	66	1779.1	70.0	7	1805	3,979	○	◒	
	K110	2.34	3.06	1829	72	1779.1	70.0	7	1904	4,197	∴	○	
Heavy Duty Rock	K110	0.74	0.97	762	30	1779.1	70.0	3	1131	2,493	●	●	
	K110	0.95	1.24	914	36	1779.1	70.0	4	1293	2,849	●	●	
	K110	1.18	1.54	1067	42	1779.1	70.0	4	1400	3,086	●	●	
	K110	1.41	1.84	1219	48	1779.1	70.0	5	1547	3,411	◓	●	
	K110	1.64	2.15	1372	54	1779.1	70.0	5	1660	3,659	◒	●	
Heavy Duty Power	K110	0.95	1.24	914	36	1681.8	66.2	4	1192	2,628	●	●	
	K110	1.40	1.83	1219	48	1681.8	66.2	5	1421	3,132	●	●	
	K110	1.63	2.13	1372	54	1681.8	66.2	5	1518	3,346	◓	●	
	K110	1.86	2.43	1524	60	1681.8	66.2	6	1650	3,637	◒	◓	
Ditch Cleaning	N/A	1.63	2.13	1524	60	1410.0	55.5	–	1088	2,399	◓	●	
	N/A	1.91	2.50	1830	72	1410.0	55.5	–	1217	2,683	◒	◓	
TB Family Buckets													
Heavy Duty	K110	2.40	3.14	1676	66	1869	73.6	7	2211	2358			◒
	K110	2.70	3.53	1829	72	1869	73.6	7	2355	4197			○

Assumptions for maximum material density rating:
1. Front linkage fully extended at ground line
2. Bucket curled
3. 100% bucket fill factor

***** Capacities based on SAE J296. Some calculations of capacity fall on borderlines. Rounding may allow two buckets to have the same English rating but different metric ratings.

● 2100 kg/m^3 (3,500 lb/yd^3) max material density
◓ 1800 kg/m^3 (3,000 lb/yd^3) max material density
◒ 1500 kg/m^3 (2,500 lb/yd^3) max material density
○ 1200 kg/m^3 (2,000 lb/yd^3) max material density
∴ 900 kg/m^3 (1,500 lb/yd^3) max material density

336D L Work Tool Matching Guide

Boom Options	Reach Boom 6.5 m (21'4")		Mass Boom 6.18 m (20'4")
Stick Options	**R3.9DB (12'10")**	**R3.2DB (10'6")**	**M2.55TB (8'4")**
Hydraulic Hammer	H130s/ H140Ds/ H160Ds	H130s/ H140Ds/ H160Ds	H130s/ H140Ds/ H160Ds
Multi-Processor	MP20 MP40 (Boom Mount)	MP20/MP30 MP40 (Boom Mount)	MP30 N/A
360° Scrap Shear	S320/S325* S365B (Boom Mount)	S320/S325* S365B (Boom Mount)	S325 N/A
Mechanical Shear	S128	S128	S128
Mechanical Pulverizer	P130	P130	P130
Trash Grapple**	Available as field installed attachment only		
Contractors' Grapple**	Available as field installed attachment only		
Rotating Sorting/Demolition Grapple	G320/G330	G320/G330	G320/G330
Vibratory Plate Compactor	CVP110	CVP110	CVP110
Hydraulic Thumb**	Available as field installed attachment only		
Dedicated Quick Coupler**	Available as field installed attachment only		
Pin-Grabber Quick Coupler	Available as factory or field installed attachment		N/A

* S325 only without PG Coupler.
** Contact Cat Work Tools for availability and proper matching.

Reach Boom Lift Capacities

 Load Point Height

 Load Radius Over Front

 Load Radius Over Side

 Load at Maximum Reach – Bucket Curled

 Load at Maximum Reach – Bucket Extended

BOOM – 6.5 m (21'4")
STICK – 3.9 m (12'10")
COUNTERWEIGHT – 6000 kg (13,228 lb)

BUCKET – HDR 1.22 m³ (1.6 yd³)
900 mm (36")
1078.6 kg (2,378 lb)

SHOES – 800 mm (32") triple grouser
UNDERCARRIAGE – LC-Fix
HEAVY LIFT – On

		1.5 m (5.0 ft)		3.0 m (10.0 ft)		4.5 m (15.0 ft)		6.0 m (20.0 ft)		7.5 m (25.0 ft)		9.0 m (30.0 ft)							
																m ft			m ft
9.0 m	kg													*4390	*4390	7.84	*3260	*3260	9.36
30.0 ft	**lb**													***10,800**	***10,800**	**24.92**	***7,250**	***7,250**	**30.30**
7.5 m	kg													*4090	*4070	8.96	*3080	*3080	10.39
25.0 ft	**lb**													***10,050**	***10,050**	**28.85**	***6,800**	***6,800**	**33.87**
6.0 m	kg											*6140	4720	*3970	3960	9.73	*3030	*3030	11.07
20.0 ft	**lb**									***13,650**	***13,650**	***13,500**	**10,050**	***9,800**	**9,000**	**32.02**	***6,700**	***6,700**	**36.20**
4.5 m	kg									*6970	6490	*6470	4610	*4000	3490	10.22	*3060	2900	11.47
15.0 ft	**lb**									***15,150**	**13,950**	***14,150**	**9,850**	***9,900**	**7,900**	**33.21**	***6,750**	**6,400**	**37.58**
3.0 m	kg					*12 520	*12 520	*9480	8890	*7910	6140	*6990	4420	*4150	3230	10.47	*3180	2730	11.62
10.0 ft	**lb**					***26,900**	***26,900**	***20,500**	**19,150**	***17,150**	**13,200**	***15,200**	**9,450**	***10,350**	**7,250**	**34.09**	***7,000**	**6,050**	**38.12**
1.5 m	kg					*15 620	12 760	*11 150	8220	*8870	5770	7150	4220	*4440	3130	10.50	*3390	2690	11.54
5.0 ft	**lb**					***33,700**	**27,500**	***24,100**	**17,700**	***19,250**	**12,400**	**15,350**	**9,050**	***11,100**	**7,000**	**34.21**	***7,450**	**5,950**	**37.88**
Ground	kg			*7700	*7700	*17 490	11 890	*12 400	7710	9330	5460	6960	4040	*4900	3160	10.32	*3720	2780	11.23
Line	**lb**			***17,550**	***17,550**	***37,800**	**25,600**	***26,850**	**16,600**	**20,050**	**11,750**	**14,950**	**8,650**	***12,350**	**7,100**	**33.59**	***8,200**	**6,150**	**36.85**
–1.5 m	kg	*7090	*7090	*11 250	*11 250	*18 060	11 520	*13 020	7410	9110	5270	6840	3930	*5620	3360	9.90	*4220	3040	10.66
–5.0 ft	**lb**	***15,850**	***15,850**	***25,450**	***25,450**	***39,100**	**24,750**	**28,000**	**15,950**	**19,600**	**11,300**	**14,700**	**8,450**	**13,150**	**7,550**	**32.17**	***9,350**	**6,700**	**34.94**
–3.0 m	kg	*11 300	*11 300	*16 070	*16 070	*17 580	11 460	*12 910	7310	9030	5200	6830	3930	6600	3790	9.22	*5030	3560	9.78
–10.0 ft	**lb**	***25,300**	***25,300**	***36,350**	***36,350**	***38,050**	**24,650**	**27,750**	**15,700**	**19,450**	**11,200**	**14,700**	**8,450**	**14,800**	**8,550**	**29.85**	***11,150**	**7,900**	**31.99**
–4.5 m	kg	*16 260	*16 260	*21 170	*21 170	*16 000	11 650	*11 890	7400	*8970	5280			*7650	4650	8.20			
–15.0 ft	**lb**	***36,550**	***36,550**	***47,200**	***47,200**	***34,500**	**25,050**	***25,600**	**15,950**	***19,100**	**11,400**			***17,350**	**10,550**	**26.39**			
–6.0 m	kg			*17 860	*17 860	*12 820	12 110	*9300	7730					*7640	6580	6.71			
–20.0 ft	**lb**			***38,000**	***38,000**	***27,200**	**26,100**	***19,400**	**16,700**					***17,500**	**15,350**	**21.22**			

* Limited by hydraulic capacity rather than tipping load. The above loads are in compliance with SAE hydraulic excavator lift capacity rating standard J1097. They do not exceed 87% of hydraulic lifting capacity or 75% of tipping capacity. Weight of all lifting accessories must be deducted from the above lifting capacities.

Always refer to the appropriate Operation and Maintenance Manual for specific product information.

Reach Boom Lift Capacities

 Load Point Height

 Load Radius Over Front

 Load Radius Over Side

 Load at Maximum Reach – Bucket Curled

 Load at Maximum Reach – Bucket Extended

BOOM – 6.5 m (21'4")
STICK – 3.2 m (10'6")
COUNTERWEIGHT – 6000 kg (13,228 lb)

BUCKET – HDR 1.22 m³ (1.6 yd³)
900 mm (36")
1078.6 kg (2,378 lb)

SHOES – 800 mm (32") triple grouser
UNDERCARRIAGE – LC-Fix
HEAVY LIFT – On

		1.5 m (5.0 ft)		3.0 m (10.0 ft)		4.5 m (15.0 ft)		6.0 m (20.0 ft)		7.5 m (25.0 ft)		9.0 m (30.0 ft)							
																m ft			m ft
9.0 m **30.0 ft**	kg **lb**																*4130 ***9,200**	*4130 ***9,200**	8.42 **27.16**
7.5 m **25.0 ft**	kg **lb**									*6820 ***15,100**	6680 **14,250**			*4090 ***11,950**	*4070 ***11,950**	8.96 **26.32**	*3920 ***8,650**	*3920 ***8,650**	9.58 **31.18**
6.0 m **0.0 ft**	kg **lb**									*7060 ***15,450**	6610 **14,150**			*3970 ***11,600**	3960 **10,350**	9.73 **29.22**	*3870 ***8,550**	3720 **8,250**	10.32 **33.74**
4.5 m **15.0 ft**	kg **lb**							*8850 ***19,150**	*8850 ***19,150**	*7730 ***16,800**	6370 **13,700**	*7110 ***15,550**	4530 **9,700**	*4000 ***11,750**	3490 **9,000**	10.22 **31.04**	*3940 ***8,650**	3320 **7,350**	10.75 **35.22**
3.0 m **10.0 ft**	kg **lb**					*14 230 ***30,550**	13 580 **29,300**	*10 460 ***22,600**	8680 **18,700**	*8590 ***18,650**	6050 **13,000**	7310 **15,700**	4380 **9,400**	*4150 ***12,300**	3230 **8,250**	10.47 **31.98**	*4110 ***9,050**	3120 **6,900**	10.92 **35.81**
1.5 m **5.0 ft**	kg **lb**					*16 890 ***36,400**	12 380 **26,700**	*11 950 ***25,850**	8080 **17,400**	*9440 ***20,450**	5730 **12,300**	7130 **15,300**	4220 **9,050**	*4440 ***13,300**	3130 **7,950**	10.50 **32.11**	*4400 ***9,700**	3080 **6,800**	10.83 **35.55**
Ground Line	kg **lb**			*7130 ***16,350**	*7130 ***16,350**	*18 080 ***39,150**	11 760 **25,300**	*12 920 ***27,950**	7660 **16,500**	9330 **20,050**	5470 **11,800**	6990 **15,000**	4090 **8,750**	*4900 ***13,950**	3160 **8,100**	10.32 **31.44**	*4860 ***10,700**	3210 **7,100**	10.49 **34.43**
–1.5 m **–5.0 ft**	kg **lb**	*8530 ***19,050**	*8530 ***19,050**	*12 500 ***28,300**	*12 500 ***28,300**	*18 060 ***39,150**	11 580 **24,900**	13 090 **28,100**	7460 **16,050**	9180 **19,750**	5340 **11,500**	6930	4030	*5620 ***15,000**	3360 **8,700**	9.90 **29.93**	*5570 ***12,300**	3550 **7,850**	9.87 **32.35**
–3.0 m **–10.0 ft**	kg **lb**	*13 870 ***31,050**	*13 870 ***31,050**	*18 930 ***42,400**	*18 930 ***42,400**	*17 040 ***36,900**	11 660 **25,050**	*12 710 ***27,450**	7450 **16,050**	9180 **19,750**	5340 **11,500**			6600 **17,250**	3790 **10,050**	9.22 **27.42**	*5550 ***12,100**	4270 **9,500**	8.90 **29.09**
–4.5 m **–15.0 ft**	kg **lb**			*20 410 ***44,000**	*20 410 ***44,000**	*14 830 ***31,950**	11 970 **25,750**	*11 110 ***23,800**	7640 **16,450**					*7650 ***18,600**	4650 **13,000**	8.20 **23.59**			
–6.0 m **–20.0 ft**	kg **lb**					*10 490 ***21,850**	*10 490 ***21,850**							*7650 ***18,350**	*6580 ***18,350**	6.67 **17.19**			

* Limited by hydraulic capacity rather than tipping load. The above loads are in compliance with SAE hydraulic excavator lift capacity rating standard J1097. They do not exceed 87% of hydraulic lifting capacity or 75% of tipping capacity. Weight of all lifting accessories must be deducted from the above lifting capacities.

Always refer to the appropriate Operation and Maintenance Manual for specific product information.

Reach Boom Lift Capacities

 Load Point Height

 Load Radius Over Front

 Load Radius Over Side

 Load at Maximum Reach – Coupler Curled

BOOM – 6.5 m (21'4")
STICK – 3.9 m (12'10")
COUNTERWEIGHT – 6000 kg (13,228 lb)

BUCKET – No Bucket, Bare Coupler Only 556 kg (1,226 lb)

SHOES – 800 mm (32") triple grouser
UNDERCARRIAGE – LC-Fix
HEAVY LIFT – On

		1.5 m (5.0 ft)		3.0 m (10.0 ft)		4.5 m (15.0 ft)		6.0 m (20.0 ft)		7.5 m (25.0 ft)		9.0 m (30.0 ft)				
																m ft
9.0 m **30.0 ft**	kg **lb**													*4770 ***12,200**	*4770 ***12,200**	7.88 **24.84**
7.5 m **25.0 ft**	kg **lb**													*4430 ***9,800**	*4430 ***9,800**	9.00 **29.29**
6.0 m **20.0 ft**	kg **lb**									* ***14,400**	* ***14,400**	*6510 ***14,350**	5070 **10,850**	*4300 ***9,500**	4280 ***9,500**	9.77 **31.92**
4.5 m **15.0 ft**	kg **lb**									*7310 ***15,900**	6800 **14,600**	*6840 ***14,950**	4940 **10,600**	*4330 ***9,500**	3820 **8,450**	10.26 **33.59**
3.0 m **10.0 ft**	kg **lb**					*12 770 ***27,500**	*12 770 ***27,500**	*9790 ***21,200**	9180 **19,800**	*8250 ***17,900**	6440 **13,850**	*7350 ***16,050**	4740 **10,200**	*4430 ***9,750**	3560 **7,850**	10.51 **34.46**
1.5 m **5.0 ft**	kg **lb**					*15 930 ***34,350**	13 050 **28,150**	*11 480 ***24,850**	8520 **18,350**	*9220 ***20,000**	6080 **13,100**	7460 **16,050**	4540 **9,750**	*4690 ***10,300**	3450 **7,600**	10.54 **34.58**
Ground Line	kg **lb**			*8110 ***18,500**	*8110 ***18,500**	*17 850 ***38,600**	12 210 **26,300**	*12 750 ***27,600**	8010 **17,250**	9630 **20,700**	5770 **12,450**	7270 **15,650**	4360 **9,400**	*5110 ***11,250**	3480 **7,650**	10.35 **33.96**
–1.5 m **–5.0 ft**	kg **lb**	*7370 ***16,450**	*7370 ***16,450**	*11 620 ***26,250**	*11 620 ***26,250**	*18 460 ***40,000**	11 840 **25,450**	13 330 **28,650**	7710 **16,600**	9410 **20,250**	5570 **12,000**	7150 **15,400**	4250 **9,150**	*5780 ***12,800**	3670 **8,100**	9.93 **32.57**
–3.0 m **–10.0 ft**	kg **lb**	*11 590 ***25,950**	*11 590 ***25,950**	*16 410 ***37,100**	*16 410 ***37,100**	*17 990 ***38,950**	11 780 **25,300**	13 210 **28,400**	7610 **16,400**	9330 **20,100**	5500 **11,850**	7140 **15,400**	4240 **9,150**	6870 **15,200**	4090 **9,050**	9.26 **30.28**
–4.5 m **–15.0 ft**	kg **lb**	*16 550 ***37,200**	*16 550 ***37,200**	*23 010 ***50,500**	*23 010 ***50,500**	*16 420 ***35,400**	11 940 **25,700**	*12 290 ***26,450**	7690 **16,600**	*9370 ***20,000**	5580 **12,050**			*7970 ***17,600**	4920 **10,950**	8.25 **26.87**
–6.0 m **–20.0 ft**	kg **lb**			*18 350 ***39,050**	*18 350 ***39,050**	*13 250 ***28,200**	12 360 **26,650**	*9720 ***20,400**	8000 **17,300**					*7950 ***17,600**	6790 **15,400**	6.77 **21.81**

* Limited by hydraulic capacity rather than tipping load. The above loads are in compliance with SAE hydraulic excavator lift capacity rating standard J1097. They do not exceed 87% of hydraulic lifting capacity or 75% of tipping capacity. Weight of all lifting accessories must be deducted from the above lifting capacities.

Always refer to the appropriate Operation and Maintenance Manual for specific product information.

Reach Boom Lift Capacities

 Load Point Height

 Load Radius Over Front

 Load Radius Over Side

 Load at Maximum Reach – Coupler Curled

BOOM – 6.5 m (21'4")
STICK – 3.2 m (10'6")
COUNTERWEIGHT – 6000 kg (13,228 lb)

BUCKET – No Bucket, Bare Coupler Only 556 kg (1,226 lb)

SHOES – 800 mm (32") triple grouser
UNDERCARRIAGE – LC-Fix
HEAVY LIFT – On

		1.5 m (5.0 ft)		3.0 m (10.0 ft)		4.5 m (15.0 ft)		6.0 m (20.0 ft)		7.5 m (25.0 ft)		9.0 m (30.0 ft)				
																m ft
9.0 m **30.0 ft**	kg **lb**													*6150	*5640	6.89
7.5 m **25.0 ft**	kg **lb**									*7190 ***15,900**	7030 **15,050**			*5690	*6150	8.15
6.0 m **20.0 ft**	kg **lb**									*7410 ***16,250**	6930 **14,900**			*5530 ***12,200**	5690 **11,050**	8.99 **29.35**
4.5 m **15.0 ft**	kg **lb**							*9150 ***19,800**	*9150 ***19,800**	*8070 ***17,550**	6680 **14,350**	*7480 ***16,400**	4860 **10,400**	*5570 ***12,250**	4950 **9,700**	9.52 **31.17**
3.0 m **10.0 ft**	kg **lb**					*14 510 ***31,200**	13 850 **29,900**	*10 780 ***23,300**	8970 **19,350**	*8930 ***19,400**	6350 **13,700**	7630 **16,400**	4710 **10,100**	*5790 ***12,750**	4370 **8,950**	9.79 **32.10**
1.5 m **5.0 ft**	kg **lb**					*17 230 ***37,150**	12 700 **27,400**	*12 280 ***26,550**	8380 **18,050**	*9790 ***21,250**	6030 **13,000**	7450 **16,000**	4540 **9,750**	*6190 **13,650**	4050 **8,650**	9.82 **32.23**
Ground Line	kg **lb**			*7480 ***17,100**	*7480 ***17,100**	*18 480 ***40,000**	12 110 **26,050**	*13 280 ***28,750**	7970 **17,200**	9630 **20,700**	5780 **12,450**	7300 **15,700**	4400 **9,450**	6600 **14,550**	3920 **8,750**	9.62 **31.57**
–1.5 m **–5.0 ft**	kg **lb**	*8720 ***19,450**	*8720 ***19,450**	*12 800 ***28,950**	*12 800 ***28,950**	*18 480 ***40,050**	11 920 **25,650**	13 380 **28,750**	7770 **16,750**	9470 **20,400**	5640 **12,150**	7240 **15,600**	4350 **9,350**	7050 **15,550**	3970 **9,350**	9.17 **30.06**
–3.0 m **–10.0 ft**	kg **lb**	*14 080 ***31,550**	*14 080 ***31,550**	*19 210 ***43,500**	*19 210 ***43,500**	*17 470 ***37,850**	11 980 **25,750**	*13 100 ***28,300**	7750 **16,700**	9470 **20,400**	5640 **12,150**			8010 ***17,750**	4230 **10,650**	8.43 **27.56**
–4.5 m **–15.0 ft**	kg **lb**			*20 930 ***45,100**	*20 930 ***45,100**	*15 260 ***32,850**	12 250 **26,400**	*11 510 ***24,650**	7920 **17,100**					*8740 ***19,250**	7810 **13,500**	7.31 **23.75**
–6.0 m **–20.0 ft**	kg **lb**					*10 940 ***22,850**	*10 940 ***22,850**							*8370 ***18,450**	*8370 ***18,450**	5.57 **17.74**

* Limited by hydraulic capacity rather than tipping load. The above loads are in compliance with SAE hydraulic excavator lift capacity rating standard J1097. They do not exceed 87% of hydraulic lifting capacity or 75% of tipping capacity. Weight of all lifting accessories must be deducted from the above lifting capacities.

Always refer to the appropriate Operation and Maintenance Manual for specific product information.

Mass Boom Lift Capacities

 Load Point Height

 Load Radius Over Front

 Load Radius Over Side

 Load at Maximum Reach – Bucket Curled

 Load at Maximum Reach – Bucket Extended

BOOM – 6.18 m (20'3")
STICK – 2.55 m (8'4")

BUCKET – TB 36" HD
with General Duty Tips (x4)
1819.8 kg (4,012 lb)

SHOES – 800 mm (32") triple grouser
UNDERCARRIAGE – Long
HEAVY LIFT – On

		3.0 m (10.0 ft)		4.5 m (15.0 ft)		6.0 m (20.0 ft)		7.5 m (25.0 ft				m ft			m ft
9.0 m **30.0 ft**	kg **lb**												*4220 ***9,400**	*4220 ***9,400**	7.32 **23.47**
7.5 m **25.0 ft**	kg **lb**									*5880 ***13,050**	*5880 ***13,050**	7.11 **23.00**	*3900 ***8,600**	*3900 ***8,600**	8.65 **28.12**
6.0 m **20.0 ft**	kg **lb**					*8030 ***17,450**	*8030 ***17,450**	*7460 ***16,350**	5940 **12,650**	*5680 ***12,550**	5060 **11,300**	8.06 **26.27**	*3810 ***8,400**	3750 **8,350**	9.47 **30.93**
4.5 m **15.0 ft**	kg **lb**			*11 540 ***24,800**	*11 540 ***24,800**	*9170 ***19,850**	8710 **18,700**	*7930 ***17,250**	5770 **12,350**	*5750 ***12,650**	4260 **9,450**	8.64 **28.29**	*3860 ***8,500**	3260 **7,200**	9.93 **32.51**
3.0 m **10.0 ft**	kg **lb**			*14 560 ***31,300**	12 800 **27,650**	*10 600 ***22,900**	8070 **17,400**	*8640 ***18,750**	5480 **11,750**	*6070 ***13,350**	3860 **8,500**	8.94 **29.32**	*4050 ***8,900**	3030 **6,700**	10.09 **33.09**
1.5 m **5.0 ft**	kg **lb**			*16 800 ***36,250**	11 620 **25,050**	*11 870 ***25,650**	7490 **16,100**	9080 **19,500**	5190 **11,150**	*6640 ***14,600**	3710 **8,200**	8.98 **29.46**	*4390 ***9,650**	3020 **6,650**	9.97 **32.73**
Ground Line	kg **lb**			*17 550 ***38,000**	11 090 **23,850**	*12 570 ***27,200**	7110 **15,300**	8840 **19,000**	4980 **10,700**	6850 **15,100**	3810 **8,400**	8.76 **28.73**	*4930 ***10,850**	3240 **7,150**	9.57 **31.41**
–1.5 m **–5.0 ft**	kg **lb**	*15 590 ***35,300**	*15 590 ***35,300**	*17 070 ***37,000**	11 020 **23,650**	*12 530 **27,050**	6970 **15,000**	8760 **18,850**	4900 **10,550**	7530 **16,650**	4210 **9,300**	8.26 **27.06**	*5800 ***12,800**	3780 **8,350**	8.85 **28.99**
–3.0 m **–10.0 ft**	kg **lb**	*19 920 ***44,150**	*19 920 ***44,150**	*15 480 ***33,450**	11 230 **24,150**	*11 510 ***24,750**	7070 **15,200**			*8440 ***18,600**	5110 **11,350**	7.42 **24.25**			
–4.5 m **–15.0 ft**	kg **lb**	*16 420 ***35,200**	*16 420 ***35,200**	*12 240 ***26,100**	11 750 **25,300**	*8580	7480								

* Limited by hydraulic capacity rather than tipping load. The above loads are in compliance with SAE hydraulic excavator lift capacity rating standard J1097. They do not exceed 87% of hydraulic lifting capacity or 75% of tipping capacity. Weight of all lifting accessories must be deducted from the above lifting capacities.

Always refer to the appropriate Operation and Maintenance Manual for specific product information.

Standard Equipment

Standard equipment may vary. Consult your Caterpillar dealer for details.

Electrical
- 65 ampere alternator
- Base machine light (frame)
- Lights, cab mounted (Two)
- Horn
- Pre-Start monitoring system – checks for low fluids (engine oil, coolant, hydraulic oil) prior to starting machine

Operator Environment
- Air conditioner, heater, defroster with automatic climate control
- AM/FM radio with antenna and 2 speakers
- Ashtray with 24 volt lighter
- Beverage/cup holder
- Bolt-on Falling Object Guarding System (FOGS) capability
- Cab Glass
  - Openable and retractable two-piece front windshield
  - Sky-light, pop-up, polycarbonate
- Coat hook
- Floor mat
- Instrument panel and gauges
- Joysticks, console mounted, pilot operated
- Light – interior
- Literature compartment
- Monitor, full graphic color display
  - Multi-language capability
  - Warning, filter/fluid change, working hour information, Machine condition, error code, tool mode setting
  - Full time clock on monitor (no less than one week)
- Neutral lever (lock out) for all controls
- Polycarbonate side windows
- Positive filtered ventilation
- Pressurized cab
- Seat, suspension, with high back and head rest
- Seat belt, retractable (76 mm [3 in])
- Storage compartment suitable for lunch box cooler
- Sun shade (for skylight)
- Travel control pedals with removable hand levers
- Windshield wiper and washer (upper and lower)

Engine/Power Train
- C9 with ACERT™ Technology
  - 2300 m (7,500 ft) altitude capability without derate
  - 24V electric starting
  - Air intake heater
  - U.S. EPA Tier 3 emission compliant
  - HEUI™ Injectors
  - Water separator in fuel line
  - Electric priming pump
- Cooling Package
  - High ambient, 52° C (126° F) with VSF
- Radial seal air filter
- Automatic engine speed control with one-touch low idle
- Two speed auto-shift travel

Undercarriage
- Grease lubricated track
- Hydraulic track adjusters
- Idler and center section track guards
- Heavy-duty track rollers

Other Standard Equipment
- Automatic swing parking brake
- Auxiliary hydraulic valve
- Capability of stackable valves (max of 3) for main valve
- Capability of auxiliary circuit
- Counterweight with lifting eyes
- Door locks, cap locks, and Caterpillar® one key security system
- Fine swing control
- Fully pressurized hydraulic system
- Heavy lift
- Mirrors (frame-right, cab-left)
- S•O•S℠ quick sampling valves for engine and hydraulic oil
- Travel alarm
- Product Link PL321SR

Optional Equipment

Optional equipment may vary. Consult your Caterpillar dealer for details.

- Front linkage
  - Booms
    - Reach 6.5 m (21 ft 4 in)
    - Mass 6.18 m (20 ft 4 in)
  - Sticks
    - Reach 3.9 m (12 ft 10 in)
    - Reach 3.2 m (10 ft 6 in)
    - Mass 2.55 m (8 ft 5 in)
  - Bucket Linkage
    - DB family w/lifting eye
    - TB1 family w/lifting eye
  - Boom lowering control device
- Electrical
  - AccuGrade ARO
  - Machine Security System (MSS)
  - Power supply (12V-10 Amp)
- Guarding
  - Falling Object Guarding System (FOGS)
  - Front Windshield Guard
    - Full length, wire mesh
  - Heavy-duty bottom guards
  - Rubber bumpers (side)
  - Track Guiding Guards
    - Sprocket end, idler end guard two-piece full length (center guard removed)
  - Vandalism guards
- Operator Environment
  - Hand control pattern changer (ISO-SAE)
  - Rear window, secondary exit
  - Sun screen – roller type
  - Seat, high back with air suspension and heater
  - Third pedal, straight travel
- Engine/Power Train
  - Prefilter, air
  - Cold Weather Starting Package
    - Two additional maintenance free batteries
    - High capacity starter motor
    - Heavy-duty cable
    - Jump-start receptacle
    - Ether aid
    - Block heater
- Undercarriage
  - Track Shoes
    - 700 mm (28 in) triple grouser
    - 800 mm (32 in) triple grouser
    - 850 mm (34 in) triple grouser
    - 850 mm (34 in) heavy-duty triple grouser
- Auxiliary Hydraulics
  - Hammer Circuit
    - For single function (1 way/2 pump) hydraulic tools
  - Thumb Circuit
    - For double function (2 way/1 pump) hydraulic tools
  - Tool Control System
    - For single or double function, (1 or 2 way, 1 or 2 pump) hydraulic tools
    - Joysticks with additional switches
    - Program up to 10 tools in memory
    - Capability of adding medium pressure
    - Medium Pressure Circuit for tools requiring medium pressure
  - Hydraulic pin grabber quick coupler and controller
  - Lines for booms and sticks
- Work Tools
  - Wide offering of buckets, tips and sidecutters

Notes

336D L Hydraulic Excavator

For more complete information on Cat products, dealer services, and industry solutions, visit us on the web at **www.cat.com**

Materials and specifications are subject to change without notice. Featured machines in photos may include additional equipment. See your Caterpillar dealer for available options.

AEHQ5990-02 (2-09)

Replaces AEHQ5990-01

NACD

CATERPILLAR®

Exhibit 3

Engine		
Engine Model	Cat® C15 ACERT™	
Gross Power	259 kW	347 hp
Flywheel Power	231 kW	310 hp

- Engine ratings at 1,850 RPM

Weights		
Operating Weight	45 359 kg	100,000 lb
Shipping Weight	44 906 kg	99,000 lb

- Operating weight includes all shipping weights plus full fuel tank and operator.
- Shipping weight includes: lubricants, coolant, 10% fuel, hydraulic controls and fluids, backup alarm, seat belt, 710 mm (28") grouser shoes, drawbar and counterweight.

Operating Specifications		
Lifting Capacity	63 504 kg	140,000 lb

583T Pipelayer

The 583T Pipelayer offers outstanding productivity.

Pipelayer

Fully hydraulic load line and boom winches provide excellent controllability for precise pipe placement. Counterweight and frame design provides excellent stability. **pg. 4**

Structure

Mainframe is heavy, strong and durable. Full box sections, steel castings and continuous rolled rails provide durable support to the undercarriage, elevated final drives and other integral frame components. **pg. 5**

Operator Station

✔ Designed for operator comfort, convenience and productivity. Machine control and vital information is provided at the operator's fingertips. A full day of work is no problem in this efficient work place. **pg. 6**

Undercarriage

The proven elevated sprocket undercarriage isolates the drive train components from ground-induced impacts. Designed to optimize machine balance for best possible performance and extended component life. **pg. 11**

Serviceability and Customer Support

Combining easy to access, modular components with your Caterpillar® Dealer's advanced rebuild and repair capabilities ensures rapid component replacement and minimum downtime. **pg. 12**

Engineered for reliable production in the toughest conditions.
The 583T's high horsepower and rugged components are designed for tough and varied working conditions. This machine offers the reliability and durability expected from Cat® Pipelayers.

Optional Enclosed Cab

✔ The optional enclosed cab offers operator comfort in any climate. The operator enjoys excellent visibility in all directions because the cab was designed with maximum glass area and includes a skylight window to view the boom and upper block. **pg. 7**

Power Train

✔ The rugged, easy-to-service Cat® C15 engine with ACERT™ Technology has a high torque rise and meets worldwide emissions regulations. **pg. 8**

Drive Train

✔ The electronically controlled power shift transmission, efficient differential steering and durable planetary final drives deliver outstanding power transfer and long life to ensure maximum productivity. **pg. 10**

✔ *New Feature*

Pipelayer

Caterpillar pipelayer system includes winch, boom, hook, counterweight and frame.

Winches.

- Boom and hook drawworks are driven by independent hydraulic winches.
- Oil-disc brakes provide smooth operation and positive retention of boom and hook positions.
- Modular design allows fast replacement, easy field service and testing.
- High parts interchangeability between hook and boom winch assemblies.
- Infinitely variable speed controls for both boom and hook allow precise control.
- Quick drop function on hook line control allows the operator to drop the load quickly.

Counterweight and Frame.

- Counterweight is extended hydraulically for improved load balance and clearance.
- Counterweight segments are contoured to provide a low center of gravity and enhanced forward and right side viewing area. Segments are splined to the counterweight assembly for ease of assembly and disassembly.

Drawbar.

- Able to tow wide range of attachments.

Blocks and Hook. Heavy-duty lifting components include the following: Load and boom blocks, forged hook with latch, serviceable handle, roller bearings and ductile iron sheaves with sealed roller bearings. Also includes high performance cable for improved life, crush resistance, flexibility and strength.

Boom.

- 7.3 m (24 ft) Boom is standard equipment with large box section.
- Replaceable, boom-mount bearings.
- High tensile strength steel construction.
- Allows for smaller sections for improved visibility.
- Lighter weight for increased payload.
- Durable for long life.

Structure

Engineered to provide durability and the solid support necessary for maximum production and service life in the most demanding conditions.

Mainframe Strength. The 583T mainframe is built to absorb high impact shock loads and twisting forces.

Frame Rails. Full box section, designed to keep components rigidly aligned.

Heavy Steel Castings. Adds strength to the main case, center saddle and front cross member.

Top and Bottom Rails. Continuous rolled sections, with no machining or welding, to provide superior mainframe durability.

Main Case. Elevates the final drives well above the ground level work area to protect them from impact loads, abrasion and contaminants.

Robotic Welding. Caterpillar uses robotic welding techniques in the assembly of the case and frames. This insures quality and reliability throughout the structure. Robotic welding provides deep penetration and consistency for long life, and reduces the chance for errors that may be made during manual welding.

Roller Frames. Roller frames are tubular, to resist bending and twisting, with reinforcement where operating stresses are the highest.

- Non-oscillating roller frames for greater stability in pipelaying applications.
- The recoil system is sealed and lubricated.

Front Bumper. A front bumper is pinned on the frame rails and provides both protection and a towing device. Pipelayer frame mounts are also an integral part of the frame.

Optional Rollover Protective Structure. Provides increased operator protection.

- Available with or without cab.

Operator Station

Excellent operator visibility with ergonomically designed operator station for maximum comfort and productivity.

Clear Full-Circle View. A tapered hood and "notched" fuel tank give the operator a clear line of sight to the front, rear and side work areas. The new streamlined design of the Caterpillar 583T Pipelayer offers several operator visibility improvements for more precise maneuvering and placement of pipe.

Steering Control. Dual-twist tiller control with standard differential steering controls direction and degree of turns, forward-reverse shifting, and gear selection in a single control handle. One hand steering enhances operator comfort.

Cat Comfort Series Seat. Ergonomically designed and fully adjustable for maximum comfort.

- Seat cushion reduces the pressure on the lower back and thighs while allowing unrestricted arm and leg movement.
- Seat is raised and moved to the left providing improved all around visibility.

Ergonomic Work Tool Controls. Pipelayer controls are low effort and allow simultaneous, precise positioning of the load line and boom with one hand.

Monitoring System. Provides the operator instant feedback on the condition of operating systems and records such performance data as high/low gauge readings to help diagnose problems and manage undercarriage. Has gauges that monitor the temperature of the engine coolant, hydraulic oil and power train oil, plus the fuel level. Also has a digital and gauge type tachometer.

Access Ladder. Direct access to the operator's station utilizing ladder on left side of the machine.

Variable Load Line Speed Range. Allows the operator to regulate line speed.

Power Supply. The voltage converter provides two 12-volt power supplies.

Counterweight Control. Adjusts the position of the counterweight for added machine stability.

Engine Speed Control. A rocker switch and decelerator pedal control engine speed. Idle can be set to desired level. High or low idle is delivered with a touch of the finger.

Optional Enclosed Cab

Caterpillar® offers an optional enclosed cab to maximize operator comfort in any climate.

Optional Enclosed Cab. Designed for operator comfort and productivity in any climate. Fully insulated with a heater. Air conditioning and ROPS available as additional options.

Excellent Visibility. The optional cab provides excellent visibility, designed with the maximum glass area. There is also an additional option of dual pane windows available for cold weather environments.

Skylight Window. The cab is equipped with a skylight window to view the boom and upper block.

Screened Side Windows. The side windows are screened to allow better ventilation and ground communication.

Wipers. The optional cab is equipped with wipers on the front, rear and door windows to provide a clearer view during inclement weather.

Lights. Eight additional halogen lights come with the cab arrangement, 3 facing forward, 2 to the rear, 2 to the boom side and 1 to the winch side.

Power Train

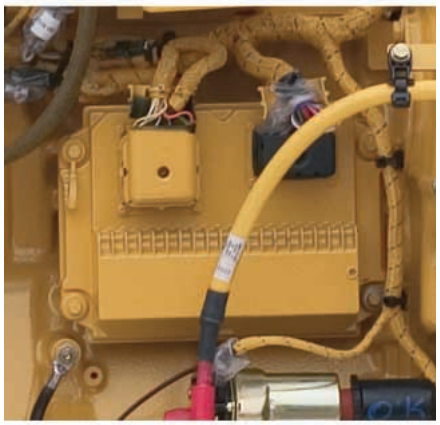
The rugged, easy-to-service Cat C15 engine with ACERT™ Technology has a high torque rise and meets worldwide emissions regulations.

Engine. The Cat C15 engine with ACERT™ Technology provides the power for the 583T. Performing at full-rated net power of 231 kW (310 hp) at 1,850 rpm, the large displacement and high torque rise provides the 583T the power needed on challenging jobs. Matched to the high-efficiency torque divider and electronically controlled power shift transmission, it will provide years of dependable service.

C15 Block. The one-piece, grey iron block features generous ribbing for stiffness and heavy bearing bulkheads for rigidity and strength. Incorporation of straight o-ring connection points reduces the loss of engine oil and fluids.

Constant Net Horsepower.

- Constant net horsepower allows the operator to maintain high standards of performance and response, even when parasitic loads, such as the on-demand cooling fan, are applied.
- Engine automatically adjusts to maintain power output and conversely lowers output when demands are low.
- Significant fuel savings in cooler climates and during long engine idle times typical of pipeline applications.



ADEM™ A4 Engine Controller.
The ADEM A4 electronic control module manages fuel delivery to get the best performance per liter (gal) of fuel used. It provides flexible fuel mapping, allowing the engine to respond quickly to varying application needs. It tracks engine and machine conditions while keeping the engine operating at peak efficiency.

Fuel Delivery. Multiple injection fuel delivery involves a high degree of precision. Precisely shaping the combustion cycle lowers combustion chamber temperatures generating fewer emissions and optimizing fuel combustion; translating into more work output for your fuel cost.

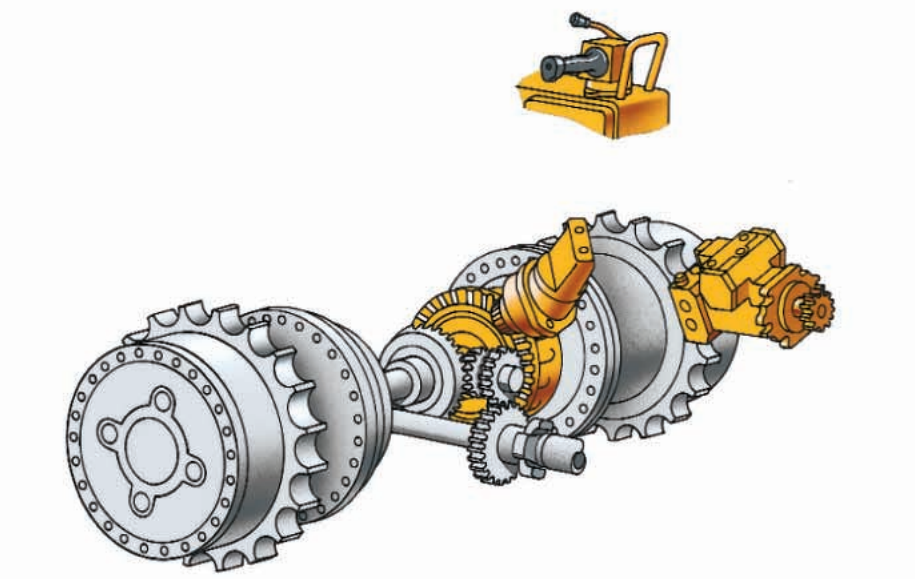
MEUI Fuel System. A highly evolved fuel system with a proven record of reliability in the field. MEUI combines the technical advancement of an electronic control system with the simplicity of direct mechanically controlled unit fuel injection. The MEUI system excels in its ability to control injection pressure over the entire engine operating speed range. These features allow the C15 to have complete control over injection timing, duration, and pressure.

ATAAC and Turbocharging.
Air-to-air aftercooling keeps air intake temperatures down and, in concert with the tight tolerance combustion chamber components, maximizes fuel efficiency and minimizes emissions. Significant improvements in air flow are generated by a water-cooled turbocharger, unique cross-flow head and single overhead cam.

Service. Easier maintenance and repair through monitoring key functions and logging critical indicators. Electronic diagnostic access is possible with a single tool, the Cat Electronic Technician.

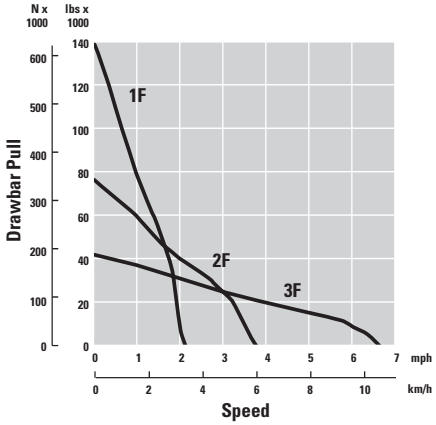
Drive Train

The drive train provides maximum efficiency in combination with the C15 engine with ACERT™ Technology.



Torque Divider. A high efficiency torque divider with freewheel stator provides high torque multiplication while shielding the drive train from sudden torque shocks and vibration.

Power Shift with Differential Steer



Drawbar vs. Speed. As loads on the tractor increase, the 583T offers unmatched lugging capability and smooth shifting as the need occurs to change gears under varying loads. The 3-speed forward, 3-speed reverse transmission, backed by differential steering, offers excellent runout speeds and accurate steering capability under load.

Differential Steering System. A planetary differential turns the machine by speeding up one track and slowing the other, while maintaining full power to both. The system consists of three planetary gear sets.

- Provides enhanced side slope capability.
- Two planetary gear sets (steering and drive) make up the "dual differential," which performs the traditional drive function (forward or reverse). Unlike competitive machines, the differential also performs a steering function with input from the steering motor.
- A third planetary gear set, the "equalizing planetary," resides inside the transmission case. It is connected to the dual differential, which provides a maximum speed difference between the right and left final drives during a turn.
- A dedicated variable-displacement hydraulic pump.
- A bi-directional, fixed-displacement steering motor.
- Heavy-duty steering drive gears.

Planetary Power Shift Transmission. Three speeds forward and three speeds reverse, utilizing large diameter, high capacity, oil-cooled clutches.

- Modulation system permits fast speed and direction changes.
- Modular transmission and differential slide into rear case for servicing ease.
- Oil-to-water cooler for maximum cooling capacity.
- Forced oil flow lubricates and cools clutch packs to provide maximum clutch life.

Elevated Final Drives.

- Isolated from ground and equipment induced impact loads for extended power train life.
- Crown-shaved drive gears provide smooth, quiet, low maintenance operation.
- Splash lubrication and Duo-Cone™ Seals extend service life

Undercarriage

The Caterpillar elevated sprocket undercarriage is designed for optimized machine balance and best possible performance and extended component life.

Final Drives. Final drives and associated power train components are raised above the work area, isolating them from ground induced impact loads, as well as pipelayer loads, extending power train component life.

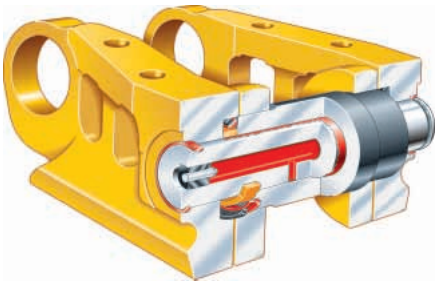
Sprockets. Sprocket position keeps sprocket teeth, bushings and final drives away from the abrasive materials and moisture, resulting in longer final drive gear and seal life.

Rollers and Idlers. Feature symmetric Duo-Cone seals for long sealing life to prevent oil loss and dirt entry. Toric rings maintain performance over a wide range of temperatures. Rollers and idlers are serviceable and rebuildable to provide value.

Roller Frames. Roller frames are tubular to resist bending and twisting, with added reinforcement where operating loads are highest.

Sprocket Segments. Made exclusively of Caterpillar Tough Steel™ for longer wear life and precision machined after heat treat for proper fit. Segments can be removed or replaced without breaking the track.

Track Shoes. Track shoes are 710 mm (28 in) single grouser design and made from heat treated, rolled steel for added strength. Wide track and clipped shoes are available as an option to match working conditions. Long track frame and wide gauge enhance track contact area, providing a stable working base.



Positive Pin Retention (PPR) Sealed and Lubricated Track. Designed for high-impact and high load applications. The PPR exclusive Caterpillar design locks the link to the pin.

Serviceability and Customer Support

World-class product support. The most serviceable machines from the most committed dealers. The Cat Dealer network trained experts keep your fleet up and running, maximizing your equipment investments. Caterpillar. The difference counts.™

Serviceability. Minimizes maintenance and repair downtime. New sight gauges, filter locations, improved access to oil and coolant sampling ports, and an engine compartment mounted work lamp, make daily and periodic service faster and easier.

Engine Oil Filter. Engine oil filter is located on the engine for easy servicing access and minimal downtime. Save further time with the optional quick oil change attachments.

Water Separator and Fuel Filter. Easily located just inside the engine access panel, the water separator functions as the primary fuel filter, just ahead of the secondary fuel filter.

Quick Disconnect Fittings. Allow for fast diagnosis of the power train, hydraulics and attachment oil systems.

S•O•S℠ Analysis. Scheduled Oil Sampling made easier through live sampling ports for the engine oil, hydraulics and coolant.

Caterpillar Product Link PL300 (optional). This option allows the customer or dealer to obtain machine diagnostics and location information from their offices. Product Link PL300 provides updates on service meter hours, machine condition and machine location, as well is integrated mapping/route planning. Built-in flexibility allows for future technology development.

Purchase. Consider the financing options available, as well as day-to-day operating costs. This is also the time to look at dealer services that can be included in the cost of the machine to yield lower equipment owning and operating costs over the long run.

Product Support. Plan for effective maintenance before buying equipment. Choose from your dealer's wide range of maintenance services at the time you purchase your machine. Programs such as Custom Track Service (CTS), S•O•S analysis, Technical Analysis and guaranteed maintenance contracts give peak life and performance to your machine.

Parts Program. You will find nearly all parts at your dealer parts counter. Cat Dealers use a worldwide computer network to find in-stock parts to minimize machine downtime. Ask about your Cat Dealer's exchange program for major components. This can shorten repair time and lower costs.

Remanufactured Components. Genuine Cat Remanufactured parts save you money. You receive the same warranty and reliability as new products at cost savings of 40 to 70 percent. Components available for the drive train, engine, and hydraulics.

Engine

Engine Model	Cat® C15 ACERT™	
Gross Power	259 kW	347 hp
Flywheel Power	231 kW	310 hp
Net Power – Cat	231 kW	310 hp
Net Power – ISO 9249	231 kW	310 hp
Net Power – SAE J1349	229 kW	307 hp
Net Power – EU 80/1269	231 kW	310 hp
Bore	137 mm	5.4 in
Stroke	172 mm	6.75 in
Displacement	15.2 L	928 in^3

- Engine ratings at 1,850 RPM
- Net power advertised is the power available at the flywheel when the engine is equipped with fan, air cleaner, muffler and alternator
- No engine derating required up to 3658 m (12,000 ft). Automatic derating occurs beyond that altitude.

Undercarriage

Shoe Type	Moderate Service	
Width of standard shoes	710 mm	28 in
Number of shoes (each side)	47	
Grouser Height	78 mm	3 in
Track gauge	2337 mm	92 in
Length of track on ground	3587 mm	141 in
Ground contact area with 710 mm (28") shoes	5.1 m^2	7,896 in^2
Number of rollers (each side)	9	
Number of Carrier Rollers	1 per side	

- Positive pin retention track

Hydraulic System

Pump Type	Piston-type, Variable, two section	
Pump output – max	540 L/min	142 gal/min
Relief Valve Setting – Counterweight	17 225 kPa	3,000 psi
Pump output – steering	27.6 L/min	7.3 gal/min
Pump Output – Counterweight (gear)	98 L/min	25.9 gal/min

Service Capacities

Fuel Tank	408.8 L	108 gal
Crankcase and filter	38 L	10 gal
Final drive (each side)	12.8 L	3.4 gal
Cooling system	77 L	20.3 gal
Hydraulic tank	96.5 L	25.5 gal
Power Train	155 L	41 gal
Roller Frames (each)	71.9 L	19 gal
Variable Fan Hub	3.1 L	0.82 gal

Operating Specifications

Lifting Capacity	63 504 kg	140,000 lb

Weights

Operating Weight	45 359 kg	100,000 lb
Shipping Weight	44 906 kg	99,000 lb

- Operating weight includes all shipping weights plus full fuel tank and operator.
- Shipping weight includes: lubricants, coolant, 10% fuel, hydraulic controls and fluids, backup alarm, seat belt, 710 mm (28") grouser shoes, drawbar and counterweight.

Transmission

1 Forward	3.4 km/h	2.1 mph
2 Forward	6.1 km/h	3.8 mph
3 Forward	10.6 km/h	6.6 mph
1 Reverse	4.5 km/h	2.8 mph
2 Reverse	8 km/h	5 mph
3 Reverse	14.2 km/h	8.8 mph
1F – Drawbar Pull	618.5 N	139 lbf
2F – Drawbar Pull	338.2 N	76 lbf
3F – Drawbar Pull	186.9 N	42 lbf

Standards

Brakes	Brakes meet the standard SAE J/ISO 10265 March99
ROPS	Optional ROPS (Rollover Protection Structure) meets the standards SAE J397 OCT95, SAE J1040 MAY94, ISO 3164 1995 and ISO 3471-1

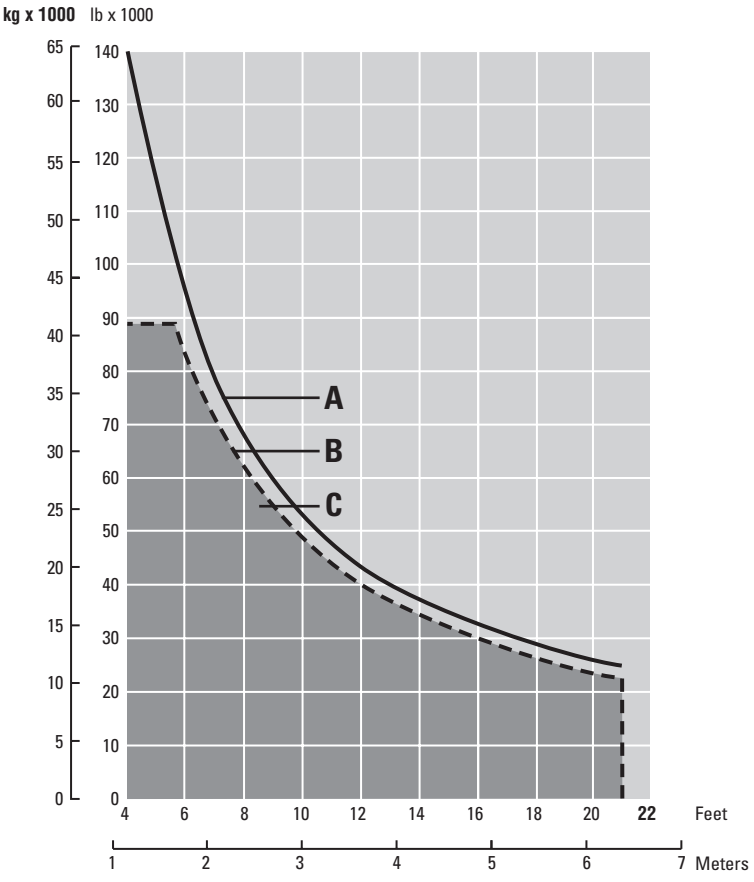
Pipelaying Equipment

Hydraulic Power – 540 L/min at 18 259 kPa/183 bar (143 gpm at 2,650 psi) and 2,100 rpm pump speed independent of torque converter.

Planetary Hydraulic Winches

	Hook		Boom	
Drum diameter	317 mm	12.5 in	317 mm	12.5 in
Flange diameter	610 mm	24 in	610 mm	24 in
Drum length	338 mm	13.3 in	338 mm	13.3 in
Capacity – 19 mm (3/4" diameter)	181 m	595 ft	181 m	595 ft
Wire rope installed – 19 mm (3/4" diameter)	102 m	336 ft	102 m	336 ft
Hook speed (raise) with 6 part line	22 m/min	72.1 ft/min		
Boom – square section standard	7.32 m	24 ft		
Removable counterweight 13 segments, 2 @	300 kg	662 lb		
6 @	535 kg	1,180 lb		
5 @	430 kg	948 lb		
Total weight extendible	9036 kg	19,920 lb		

Lifting Capacity



583T LIFT CAPACITY

Specified Equipment:

19 mm (3/4") diameter wire rope
26 672 kg (58,800 lb) minimum breaking strength

6 part load line
5 part boom line

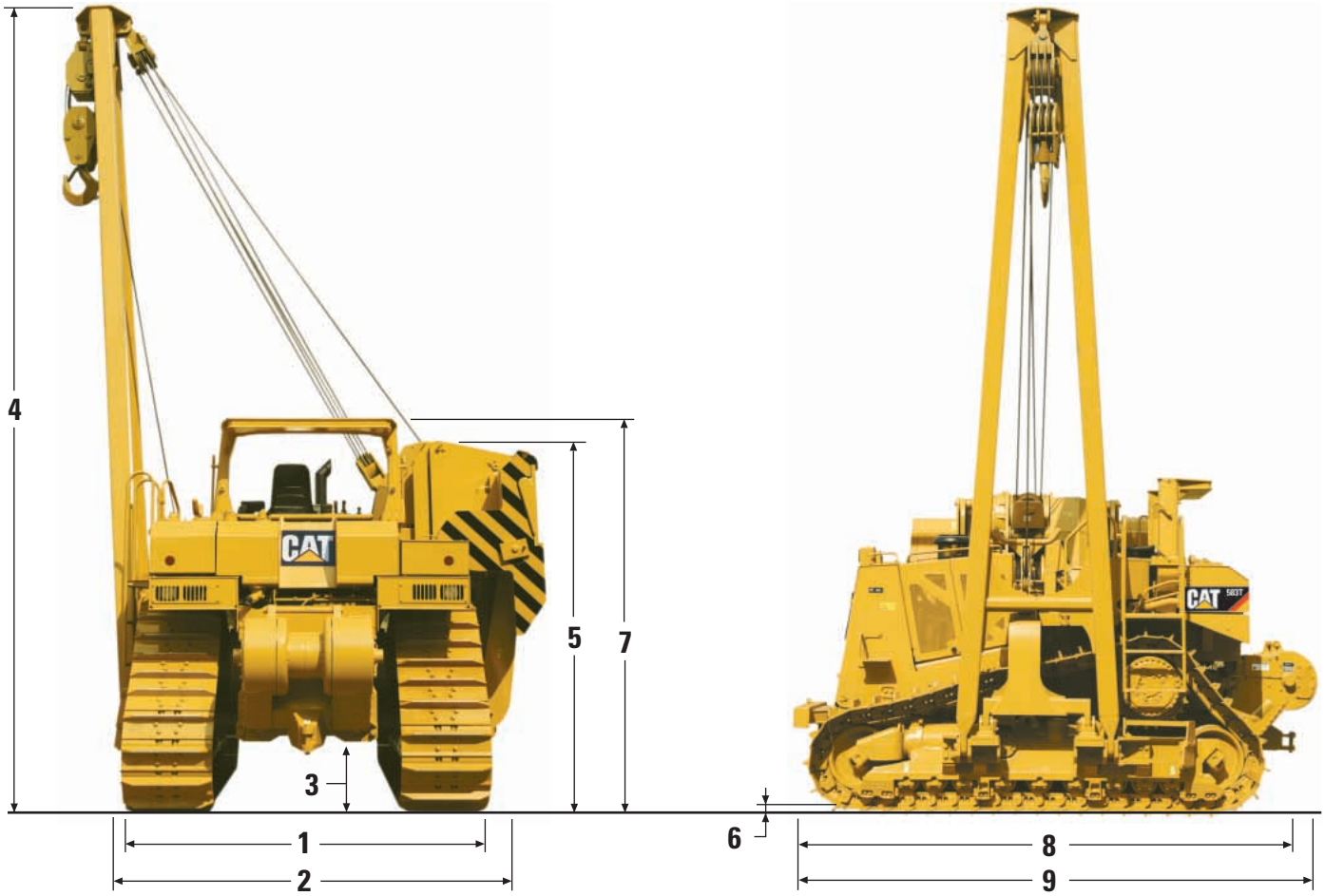
9036 kg (19,920 lb) counterweight extended
boom 7.3 m (24 ft) standard
Total operating weight 45 359 kg (100,000 lb)

A Lift capacity at tipping point*
B Rated load capacity*
C Working range*

* Per ISO 8813:1992

Dimensions

(approximate)



1	Width to outside of track	3047 mm	(10'0")
2	Minimum shipping width (counterweight frame, counterweight mounting brackets, boom and boom mounting brackets removed)	3070 mm	(10'1")
	Shipping width (boom and counterweight removed)	3598 mm	(11'10")
3	SAE ground clearance (face of shoe)	497 mm	(19.6")
4	Boom height – vertical		
	7.3 m (24') boom	8102 mm	(26'7")
	8.5 m (28') boom	9308 mm	(30'6")
5	Height (ROPS and boom removed)	3520 mm	(11'6")
6	Grouser height	78 mm	(3.1")
7	Height to top of optional ROPS (boom removed)	3728 mm	(12'3")
8	Operating length (with rear drawbar)	5231 mm	(17'2")
9	Operating length (with optional winch)	5385 mm	(17'8")

Standard Equipment

Standard equipment may vary. Consult your Caterpillar dealer for details.

ELECTRICAL
- Alarm, Back up
- Alternator, 95-amp
- Batteries, 4, maintenance free
- Converter, 12V, 10 amp with 1 outlet
- Diagnostic connector (starting and charging system)
- Horn, forward warning
- Lights, halogen, 2 front – 2 rear
- Starting receptacle

OPERATOR ENVIRONMENT
- Armrest, adjustable
- Deactivation switch, hydraulic controls
- Pedal, Decelerator
- Pedal, Dual brake
- Horn
- Hour meter
- Monitoring System, electronic warning
- Gauge package:
  - Coolant temperature
  - Power train oil temperature
  - Hydraulic oil temperature
- Governor switch, electronic
- Key start, single
- Seat, vinyl suspension
- Seat belt, retractable
- Service indicator, air cleaner
- Steering system, differential
- Storage compartment

PIPELAYING EQUIPMENT
- Block and Hook, Heavy duty with roller bearings
- Boom, 7.3 m (24 ft)
- Counter weight, extendible segmented 9036 kg (19,920 lb)
- Drawworks, hydraulically actuated and controlled
- Hook with latch

POWER TRAIN
- Advanced Modular Cooling System (AMOCS)
- Aftercooler, air to air (ATAAC)
- Engine, C15 with ACERT™ Technology
- Coolant, extended life with protection to –37° C (–34° F)
- Filter, air with electronic service indicator
- Electric starting, 24 volt direct
- Fan, hydraulically driven (suction)
- Final drives, four planet, double-reduction planetary
- Fuel priming pump, electric
- Muffler
- Parking brake, electronic
- Precleaner with dust ejector
- Prescreener
- Ether starting aid
- Torque divider
- Transmission, electronically-controlled powershift, 3F/3R
- Transmission control module, electronic
- Turbocharger, wastegate
- Water separator

UNDERCARRIAGE
- Carrier roller
- Undercarriage, non-suspended with 9-roller, tubular track roller frame
- Lifetime Lubricated rollers and idlers
- Sprocket, segmented
- Track:
  - Adjuster, hydraulic
  - Carrier rollers
  - Sealed and Lubricated with PPR, medium service, single grouser track shoes, 47 section, 710 mm (28 in)
  - Two piece master link

OTHER STANDARD EQUIPMENT
- Bumper, front with towing device
- Drawbar, rigid
- Ecology drains
- Diagnostic pressure taps
- Guards:
  - Crankcase
  - Power train, hinged
  - Radiator, hinged
  - Track guiding
- Hydraulics, pilot operated, pipelayer system
- Parts book, CD rom
- Oil cooler, hydraulic
- Product link ready
- S•O•S℠ sampling ports
- Steering, electronically controlled power differential
- Vandalism protection for fluid compartments
- Enclosure, Perforated engine door
- Hood, Perforated

Optional Equipment

Optional equipment may vary. Consult your Caterpillar dealer for details.

ELECTRICAL
- Alternator, 150 amp
- Batteries, heavy duty

OPERATOR ENVIRONMENT
- Air conditioning
- Cab (includes)
  - Lights, 8 additional
  - Sliding windows
  - Heater
  - Roof window
  - Rear pop-out window
  - 3 wipers, (front, rear, door)
- Dual pane cab windows

PIPELAYING EQUIPMENT
- Boom, 8.5 m (28 ft) and cables
- Protection pads, boom and load

POWER TRAIN
- Enclosures, arctic engine
- Fan, auto reversible
- Fast Fuel System
- Heater, engine coolant, 120 volt
- Heater, diesel fuel
- Hood, solid
- Starting, low temperature
- Oil change system, quick
- Prelube, engine, automatic
- Coolant, Extended life –50° C (–58° F)

UNDERCARRIAGE
- Tracks, pair, Sealed and Lubricated:
  - 762 mm (30 in), PPR Moderate Service

OTHER OPTIONAL EQUIPMENT
- Cold weather arrangement
- Guards:
  - Track roller
  - Radiator core protection grid
- Vandalism Protection
- Tool kit (dealer installed)
- ROPS, roll over protection system
- Product link, PL300
- Drawbar, heavy duty
- Parts Book, paper

Notes

Notes

583T Pipelayer

For more complete information on Cat products, dealer services, and industry solutions, visit us on the web at **www.cat.com**

Materials and specifications are subject to change without notice. Featured machines in photos may include additional equipment. See your Caterpillar dealer for available options.

AEHQ5645-02 (12-06)

Replaces AEHQ5645-01

CATERPILLAR®