

BU-24
OUTFALL 4 SEWER

THE STANDARD SPECIFICATIONS OF THE STATE OF OHIO, DEPARTMENT OF TRANSPORTATION, INCLUDING CHANGES AND SUPPLEMENTAL SPECIFICATIONS LISTED IN THE PROPOSAL SHALL GOVERN THIS IMPROVEMENT.



SIGNED: _____
DATE: _____

1111 SUPERIOR AVENUE EAST, SUITE 2300
CLEVELAND, OHIO 44114

[illegible]

0	2020-04-15	RFC
NO.	DATE	DESCRIPTION
ISSUE RECORD		

**CUY-IR490/ SR010-
2.09 / 19.28**

RECORD PLANS

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2	2024-09-10	RECORD DRAWINGS
1	2021-03-08	DC051
0	2020-04-15	RFC
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OWNERSHIP AND MAINTENANCE RESPONSIBILITY

ONCE CONSTRUCTION IS COMPLETE, ALL STORM, SANITARY, AND COMBINED SEWERS DEPICTED IN THESE PLANS SHALL BE OWNED AND MAINTAINED BY THE CITY OF CLEVELAND, DEPARTMENT OF WATER POLLUTION CONTROL, UNLESS NOTED OTHERWISE IN THE PLANS.

CLEVELAND WATER POLLUTION CONTROL

THE CONTRACTOR SHOULD NOTIFY THE DIVISION OF WATER POLLUTION CONTROL (WPC) PRIOR TO START OF CONSTRUCTION OF ANY CITY OF CLEVELAND SEWERS. CALL THE ENGINEERING OFFICE AT (216) 664-2756 OR (216) 664-3638 TO COORDINATE THE SEWER WORK.

THE CONTRACTOR IS REQUIRED TO SUBMIT SEWER SHOP DRAWINGS TO WPC PRIOR TO ANY CITY SEWER INSTALLATION. THE DRAWINGS SHOUD INCLUDE THE SEWER PIPES, MANHOLES, CATCH BASINS AND OTHER SEWER APPURTENANCES.

ANY PROPOSED CITY OF CLEVELAND SEWERS SHOULD BE CONSTRUCTED IN ACCORDANCE TO THE PLANS AND SPECIFICATIONS APPROVED BY WPC. ANY DEVIATIONS FROM THE APPROVED PLANS OR SPECIFICATIONS REQUIRE A NEW PLAN SUBMITTAL REFLECTING THE CHANGES. UPON REVIEW OF THE REVISED ITEMS, WPC WILL RE-ISSUE A NEW APPROVAL. IT IS STRICTLY PROHIBITED TO CONSTRUCT ANY CITY OF CLEVELAND SEWERS UNLESS THEY ARE APPROVED BY WPC.

UPON COMPLETION OF ANY CITY OF CLEVELAND SEWER INSTALLATION, THE CONTRACTOR IS REQUIRED TO SUBMIT A HARD COPY AND AN ELECTRONIC COPY OF AS-BUILT PLANS, AND A CCTV COPY OF THE NEW CITY SEWERS. WPC RESERVES THE RIGHT NOT TO APPROVE ANY SEWER THAT DOES NOT MEET THE CITY REQUIREMENTS.

ITEM 611 - CATCH BASIN, NO. 2-3, AS PER PLAN

CATCH BASINS, NO. 2-3, SHALL BE CONSTRUCTED IN ACCORDANCE WITH O.D.O.T. STANDARD DETAIL CB-1.2 WITH THE ADDITION OF A 12" TRAP AND 2' SUMP.

ITEM 611 - MANHOLE, NO. 3, AS PER PLAN

MANHOLE NO. 3, SHALL BE CONSTRUCTED IN ACCORDANCE WITH O.D.O.T. STANDARD DETAIL MH-1.2 WITH THE CITY OF CLEVELAND MH-1 FRAME AND LID.

DOGHOUSE MANHOLE CONSTRUCTION NOTES:

- THE CONTRACTOR SHALL PROVIDE STAMPED PRE-CAST MH SHOP DRAWINGS, INCLUDING:
- 1.) CONCRETE MIN. 5,000 PSI @ 28 DAYS
 - 2.) REINFORCING GRADE 60 ASTM A615-A617 60,000 PSI YIELD STRENGTH
 - 3.) HS-20 LOADING
 - 4.) ALL MANHOLE SECTIONS SHALL CONFORM TO THE PROVISIONS OF ASTM C-478
 - 5.) RUBBER GASKETED JOINTS SHALL CONFORM TO THE PROVISIONS OF ASTM C-443
 - 6.) LANDING RISERS SHALL BE INTSALLED PER THE DETAILS SHOWN ON SHEET 22
 - 7.) D-273A - EX. 36" DIA. SEWER SIZE, COMPOSITION AND WALL THICKNESS TO BE FIELD VERIFIED

CITY OF CLEVELAND STANDARD DRAWINGS

THE APPLICABLE STANDARD DRAWINGS AND DETAILS OF THE CITY OF CLEVELAND HAVE BEEN INCORPORATED AS MISCELLANEOUS DETAILS, WATERWORK DETAILS AND POWER DISTRIBUTION DETAILS WITHIN THE PLAN SET. THESE DRAWINGS AND DETAILS REPRESENT THE MOST CURRENT VERSIONS APPROVED BY THE CITY OF CLEVELAND AND HAVE BEEN INCLUDED TO DEPICT THE INTENT OF THE PARTICULAR CONSTRUCTION FEATURES, HOWEVER THEY HAVE NOT BEEN UPDATED FOR CONFORMANCE WITH THE 2016 ODOT CMS. WHEN REFERENCES TO NON-CURRENT CMS ITEMS ARE ENCOUNTERED WITHIN THE DETAILS (I.E. "ITEM 604" OR "CLASS C CONCRETE") THE CURRENT SECTION OF THE CMS (I.E. "ITEM 611 OR "CLASS QC-1 CONCRETE") SHALL APPLY. INTERPRETATIONS REGARDING THE APPLICABLE SECTIONS OF THE 2016 CMS SHALL BE AT THE DIRECTION OF THE ENGINEER.

GENERAL DRAINAGE REQUIREMENTS

THE DBT SHALL REMOVE SEDIMENT AND DEBRIS FROM EXISTING DRAINAGE CONDUITS (MAINLINE AND LATERAL STORM AND COMBINED SEWERS) AND DRAINAGE STRUCTURES AS FOLLOWS:

- 1. ANY DRAINAGE STRUCTURE TO WHICH THE DBT CONNECTS
- 2. ANY DRAINAGE STRUCTURE RECEIVING RUNOFF DURING CONSTRUCTION FROM AREAS DISTURBED BY THE WORK.
- 3. THE ADJACENT DRAINAGE CONDUIT EXTENDING FROM THESTRUCTURE IDENTIFIED IN CONDITIONS (1) OR (2) TO THE NEXT DOWNSTREAM DRAINAGE STRUCTURE.
- 4. ALL MATERIALS REMOVED SHALL BE DISPOSED OF AS PER C&MS 105.16 AND 105.17.

THE CONTRACTOR IS RESPONSIBLE FOR ALL DAMAGE RESULTING FROM CONSTRUCTION ACTIVITIES, PRIOR TO ACCEPTANCE OF WORK.

CONTRACTOR SHALL PREVENT ANY DEBRIS FROM ENTERING THE SEWERS OR THE DIVERSION STRUCTURE. ANY DEBRIS ENTERING THE SEWER OR DIVERSION STRUCTURE SHALL BE REMOVED BY THE CONTRACTOR.

NEW CONNECTIONS TO REINFORCED CONCRETE OR VITRIFIED CLAY PIPE SHALL HAVE A MANUFACTURED BOOT THAT MAKES A WATERTIGHT CONNECTION.

ITEM SPECIAL - FILL AND PLUG EXISTING CONDUIT

THIS ITEM SHALL CONSIST OF THE CONSTRUCTION OF BULKHEADS IN EXISTING CONDUITS AND FILLING THE INSIDE AREA TO SEAL THE CONDUITS OFF WITH ITEM 613, SAND OR OTHER MATERIAL APPROVED BY THE ENGINEER.

PIPES 10 INCHES THROUGH 24 INCHES IN DIAMETER OR RISE WITH LESS THAN 3 FEET OF FINAL COVER SHALL BE REMOVED; WITH MORE THAN 3 FEET OF FINAL COVER THEY MAY BE ABANDONED IN PLACE BY FILLING AND PLUGGING. PIPES OVER 24 INCHES IN DIAMETER OR RISE SHALL BE REMOVED. PRIOR TO FILLING AND PLUGGING, CONDUIT SHALL BE VIDEOTAPED TO ENSURE THAT UNKNOWN CONNECTIONS ARE NOT IMPACTED.

BULKHEADS SHALL BE LOCATED AT THE LIMITS OF THE AREA TO BE FILLED AS INDICATED ON THE PLANS. THE BULKHEADS SHALL CONSIST OF BRICK OR CONCRETE MASONRY WITH A MINIMUM THICKNESS OF 12 INCHES.

THE FILL MATERIAL SHALL BE PUMPED INTO PLACE, OR PLACED BY OTHER MEANS APPROVED BY THE ENGINEER, SO THAT, AFTER SETTLEMENT, AT LEAST 90 PERCENT OF THE CROSS SECTIONAL AREA OF THE CONDUIT, FOR ITS ENTIRE LENGTH, SHALL BE FILLED. THE LENGTH OF FILLED AND PLUGGED CONDUIT TO BE PAID FOR SHALL BE THE ACTUAL NUMBER OF FEET (MEASURED ALONG THE CENTERLINE OF EACH CONDUIT FROM OUTER FACE TO OUTER FACE OF BULKHEADS) FILLED AND PLUGGED AS DESCRIBED ABOVE.

THE LENGTH, MEASURED AS PROVIDED ABOVE, SHALL BE PAID FOR AT THE CONTRACT PRICE PER FOOT FOR, ITEM SPECIAL, FILL AND PLUG EXISTING CONDUIT.

UNRECORDED STORM WATER DRAINAGE

FURNISH A CONTINUANCE FOR ALL UNRECORDED STORM WATER DRAINAGE, SUCH AS ROOF DRAINS, FOOTER DRAINS, OR YARD DRAINS, DISTURBED BY THE WORK. FURNISH EITHER AN OPEN CONTINUANCE OR AN UNOBSTRUCTED CONTINUANCE BY CONNECTING A CONDUIT THROUGH THE CURB OR INTO A DRAINAGE STRUCTURE. THE LOCATION, TYPE, SIZE AND GRADE OF THE NEEDED CONDUIT TO REPLACE OR EXTEND AN EXISTING DRAIN WILL BE DETERMINED BY THE ENGINEER.

NORTH EAST OHIO REGIONAL SEWER DISTRICT (NEORSD)

THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ANY AND ALL PERMITS REQUIRED FOR THE WORK.

A 72-HOUR NOTICE SHALL BE PROVIDED TO MAINTENANCE SERVICES - TECHNICAL SUPPORT AT PERMITS@NEORSD.ORG TO SCHEDULE AN NEORSD INSPECTOR FOR THE CONNECTION TO NEORSD OWNED SEWERS.

UNRECORDED ACTIVE SANITARY SEWER CONNECTIONS

FURNISH A CONTINUANCE FOR ALL UNRECORDED ACTIVE SANITARY SEWER CONNECTIONS SUCH AS SANITARY, WASTEWATER, CURTAIN/GRADIENT DRAINS, AND FOUNDATION FLOOR DRAINS DISTURBED BY THE WORK. FURNISH AN UNOBSTRUCTED CONTINUANCE OF THE UNRECORDED ACTIVE SANITARY SEWER CONNECTIONS TO THE SATISFACTION OF THE ENGINEER. ALL SANITARY AND SANITARY WASTEWATER CONTINUANCE MAY REQUIRE A NPDES PERMIT FROM THE OHIO ENVIRONMENTAL PROTECTION AGENCY. REPORT ALL CONTINUANCE TO THE LOCAL HEALTH DEPARTMENT.

MISCELLANEOUS METALS

FOR ADJUSTMENT OR REPLACEMENT OF EXISTING DRAINAGE STRUCTURE CASTINGS TO BE RETAINED IN THE ROADWAYS, A CONTINGENCY QUANTITY OF 25,000 POUNDS OF MISCELLANEOUS METAL PER CMS 611 HAS BEEN INCLUDED WITHIN THE LUMP SUM BID FOR DRAINAGE WORK. THIS WORK SHALL BE AS DIRECTED BY THE DEPARTMENT. IF THE QUANTITY EXCEEDS 25,000 POUNDS, THE DEPARTMENT WILL PAY THE ADDITIONAL QUANTITIES IN ACCORDANCE WITH THE CONTRACT.

EXISTING CASTINGS

CASTINGS TO REMAIN AFTER EXISTNG ROADWAY AND PAVEMENT REMOVALS SHALL BE RAISED TO 1.0' ABOVE THE FINISHED GRADE UNLESS ADJACENT TO PAVED AREAS.

UNLESS OTHERWISE SPECIFIED IN THESE PLANS, IN AREAS OF PAYMENT REMOVAL, THE PAVEMENT AND BASE COURSE REMOVAL WILL BE FILLED AS NECESSARY TO REESTABLISH EXISTING GRADE. THIS WILL INCLUDE 4" OF TOPSOIL AND SEEDING TO MEET EXISTING GRADE.

TRENCH BACKFILLING

UNLESS OTHERWISE SPECIFIED, ALL BACKFILLING OF TRENCHES WITHIN PAVEMENT LIMITS, WITH THE EXCEPTION OF UNDERDRAINS, SHALL BE BACKFILLED TO THE TOP OF THE TRENCH OR BOTTOM OF SUBGRADE, WHICHEVER IS LOWER, WITH LOW STRENGTH MORTAR (LSM) PER CITY OF CLEVELAND SPECIFICATIONS. LSM SHALL CONSIST OF THE FOLLOWING:

CEMENT (ASTM C-150, TYPE 1): 50 LBS

SAND (PER C&MS 703.03, SSD): 2475 LBS

WATER: 25 GALLONS

ADMIXTURE (AIR): 3 OZ.

APPROVED ADMIXTURES: MASTER BUILDERS-RHEOFILL, AXIM-FLOW AIR, W.R. GRACE-DARAFILL (AN EQUAL MAY BE USED ONLY WITH DEPARTMENT APPROVAL)

USE OF FLY ASH, SPENT FOUNDRY SAND OR CORE SAND IS STRICTLY PROHIBITED.

ITEM SPECIAL - PRE AND POST CONSTRUCTION VIDEOTAPING

EXISTING TRUNK SEWERS IMPACTED BY THE ZONE OF INFLUENCE OF CONSTRUCTION ACTIVITY SHALL BE VIDEO INSPECTED PER C&MS 611 TWICE IN THE COURSE OF THIS PROJECT: FIRST, BEFORE CONSTRUCTION BEGINS; AND SECOND, AFTER CONSTRUCTION IS COMPLETED AND PRIOR TO FINAL ACCEPTANCE OF THE WORK. CONSTRUCTION ACTIVITY AS IT RELATES TO STORM SEWER INSPECTION SHALL BE DEFINED AS RETAINING WALL, BRIDGE, OR ROADWAY CONSTRUCTION ACTIVITY CROSSING OR ADJACENT TO AN EXISTING STORM OR COMBINED SEWER. THE ZONE OF INFLUENCE AREAS SHALL BE DETERMINED BY THE DBT AND APPROVED BY THE GOVERNING AGENCY. THE VIDEO INSPECTION REQUIREMENT SHALL APPLY TO ALL IMPACTED TRUNK SEWERS REGARDLESS OF SIZE, DEPTH, OR TYPE.

UNLESS OTHERWISE SPECIFIED IN THIS SCOPE DOCUMENT, VIDEO INSPECTION LIMITS SHALL INCLUDE THE LENGTH OF SEWER WITHIN THE INFLUENCE AREA AND EXTEND 50 FEET UPSTREAM AND DOWNSTREAM BEYOND THE INFLUENCE AREA LIMITS. VIDEO INSPECTION LIMITS SHALL BE APPROVED BY THE DEPARTMENT AND THE MAINTAINING AGENCY OF THE SEWER PRIOR TO COMMENCEMENT OF WORK. THE DBT SHALL PROVIDE DVD COPIES OF ALL VIDEO/INSPECTION REPORTS TO THE DEPARTMENT OF ALL INSPECTIONS PERFORMED.

SEWERS TO BE VIDEO INSPECTED SHALL BE CLEANED TO FACILITATE THE VIDEO INSPECTION.

SANITARY

ROOF DRAINS, FOUNDATION DRAINS, AND OTHER CLEAN WATER CONNECTIONS TO THE SANITARY SEWER SYSTEM ARE PROHIBITED.

ALL SANITARY SEWERS 18" DIAMETER AND SMALLER SHALL BE CLAY PIPE PER ASTM C-700, JOINTS PER ASTM C-425 AND INSTALLED PER ASTM C-12. ALL SANITARY SEWERS SHALL PASS THE AIR-ACCEPTANCE PRIOR TO ACCEPTANCE BY THE CITY OF CLEVELAND. THIS APPLIES TO ALL PROPOSED SANITARY SEWERS OF 18" DIAMETER AND SMALLER. TESTING OF THE SANITARY SEWER SHALL MEET ASTM C-828 REQUIREMENTS.

ALL PROPOSED CONDUIT 21" AND LARGER SHALL BE REINFORCED CONCRETE PIPE WITH PREMIUM JOINTS (CMS 706.02 & 706.III).

WHERE INLET AND OUTLET PIPES CONNECT TO MANHOLES, A FLEXIBLE WATERTIGHT JOINT IS REQUIRED. FLEXIBLE MANHOLE CONNECTIONS SHALL MEET ASTM C-923. PRECAST MANHOLE CONSTRUCTION SHALL MEET ASTM C-478 WITH JOINTS PER ASTM C-443. ALL NEW SEWER MANHOLES SHALL BE VACUUM TESTED IN ACCORDANCE WITH THE PROCEDURES OF ASTM C-1244.

ALL SANITARY SEWERS AND APPURTENANCES SHALL BE CONSTRUCTED IN STRICT ACCORDANCE WITH THESE PLANS, THE CURRENT STANDARDS AND SPECIFICATIONS OF THE NORTHEAST OHIO REGIONAL SEWER DISTRICT AND CITY OF CLEVELAND, AND IN ACCORDANCE WITH THE CURRENT UNIFORM STANDARDS FOR SEWERAGE IMPROVEMENTS.

UNDERDRAINS, TYPE F CONDUIT

WHEN A PIPE UNDERDRAIN SPANS THE TRENCH OF A LOWER CONDUIT (UTILITY, STORM SEWER, ETC.) AND THE VERTICAL DISTANCE BETWEEN THE LOWER CONDUIT AND THE UNDERDRAIN IS LESS THAN OR EQUAL TO 12 INCHES, TYPE F CONDUIT SHALL BE USED TO SPAN THE LOWER TRENCH. USE A MINIMUM OF 10 FEET OF THE TYPE F CONDUIT, CENTERED OVER THE LOWER TRENCH.

NORFOLK SOUTHERN CONTACT INFORMATION

ELDRIDGE W. CHAMBERS
CELL: (470)-728-5546
TEL: (404)-529-1436
ATLANTA, GEORGIA 30309
1200 PEACHTREE STREET, N.E.
NORFOLK SOUTHERN CORPORATION
ENGINEER PUBLIC IMPROVEMENTS
ELDRIDGE.CHAMBERS@NSCORP.COM

NORFOLK SOUTHERN GENERAL NOTES

1. CONTRACTOR SHALL FOLLOW ALL REQUIREMENTS OF NORFOLK SOUTHERN'S NSCE-8 SPECIFICATIONS.

2. PIPELINE AND CROSSING TO BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH LAST APPROVED AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION SPECIFICATIONS FOR PIPELINES CONVEYING FLAMMABLE AND NON-FLAMMABLE SUBSTANCES

3. BLASTING NOT PERMITTED

REFERENCE:

BU-09 FOR SANITARY SEWER
BU-10 FOR WATER LINES
BU-11 FOR CPP DUCT BANKS
BU-15 FOR ROADWAY, PAVEMENT & GRADING
BU-19 FOR BRIDGE - GCRTA BLUE/GREEN & CATENARY MODIFICATIONS
BU-20 FOR WALLS 4AB - 4CD
BU-22 FOR BRIDGE NSRR
BU-23 FOR WALLS 5A - 5D
BU-27 FOR STREET LEVEL LIGHTING

1	2024-09-10	RECORD DRAWINGS
0	2020-04-15	RFC
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Ref. No.	Station	Offset (ft)	Side	Alignment	604/605 Item	Grate/Rim Elev.	603 Item		Length (ft)	Slope (%)	Upstream		Downstream		
							Size (in)	Type			Ref. No.	Invert	Ref. No.	Invert	
D-274	18+47.39	0	-	NS STORM	DOGHOUSE MH	674.00	-	-	-	-	D-274	645.52	-	-	
D-273A	18+05.03	10.08	LT	NS STORM	DOGHOUSE MH	665.00	36	C	47	2.09%	D-273A	650.02	D-273	649.04	
D-273	18+51.48	16.9	LT	NS STORM	DOGHOUSE MH	671.00	-	-	-	-	D-273	645.46	-	-	
D-272	16+00.00	0	-	NS STORM	MH-1	687.77	36	C	248	3.25%	D-272	654.78	D-274	646.72	
D-271A	12+99.25	16.63	RT	NS STORM	CB-2-3, APP	684.89	12	C	17	39.47%	D-271A	678.89	D-271	672.18	
D-271	13+00.00	0	-	NS STORM	MH-1	687.10	36	C	300	0.61%	D-271	662.18	D-272	660.35	
D-270A	9+52.80	18.62	RT	NS STORM	CB-2-3, APP	684.00	12	C	51	8.10%	D-270A	678.00	D-270	673.87	
D-270	10+00.00	0	-	NS STORM	MH-1	688.55	36	C	300	0.56%	D-270	663.87	D-271	662.18	
D-269	189+06.00	26	LT	OC	MH-3, APP	678.51	36	B	100	0.46%	D-269	664.33	D-270	663.87	Structure Paid for in BU-21

TOTALS		
Item 611, CB-2-3, APP	2	EA
City of Cleveland MH-1	3	EA
Doghouse MH	3	EA
Item 611, 12" Conduit Type C	68	FT
Item 611, 36" Conduit Type C	895	FT
Item 611, 36" Conduit Type B	100	FT
Item 611, 54" Conduit, Bored or Jacked	200	FT

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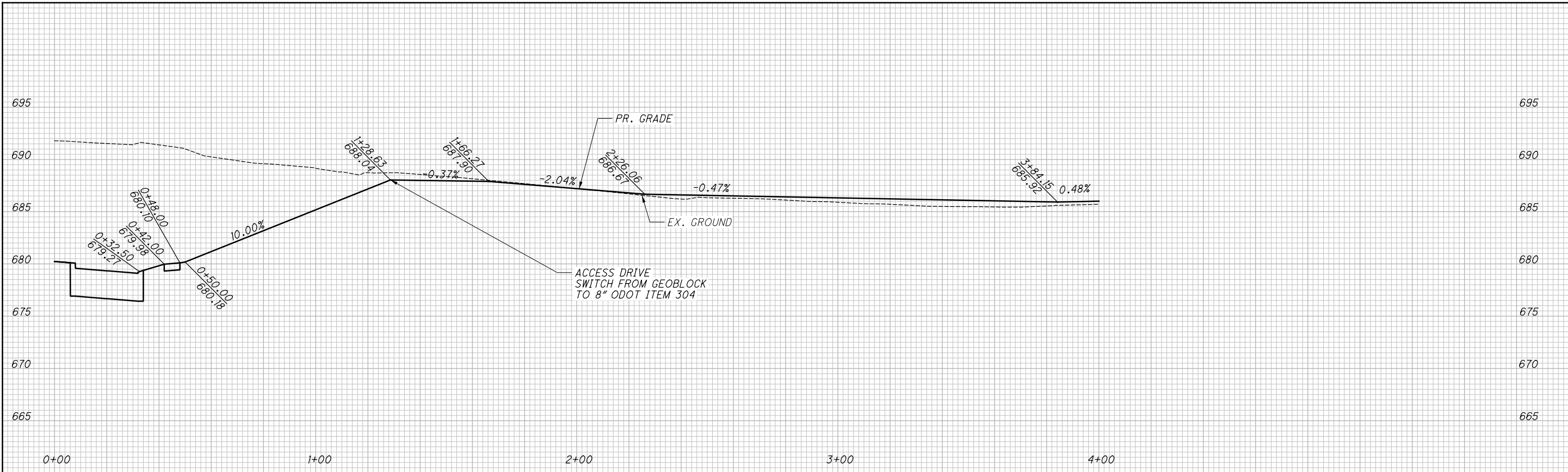
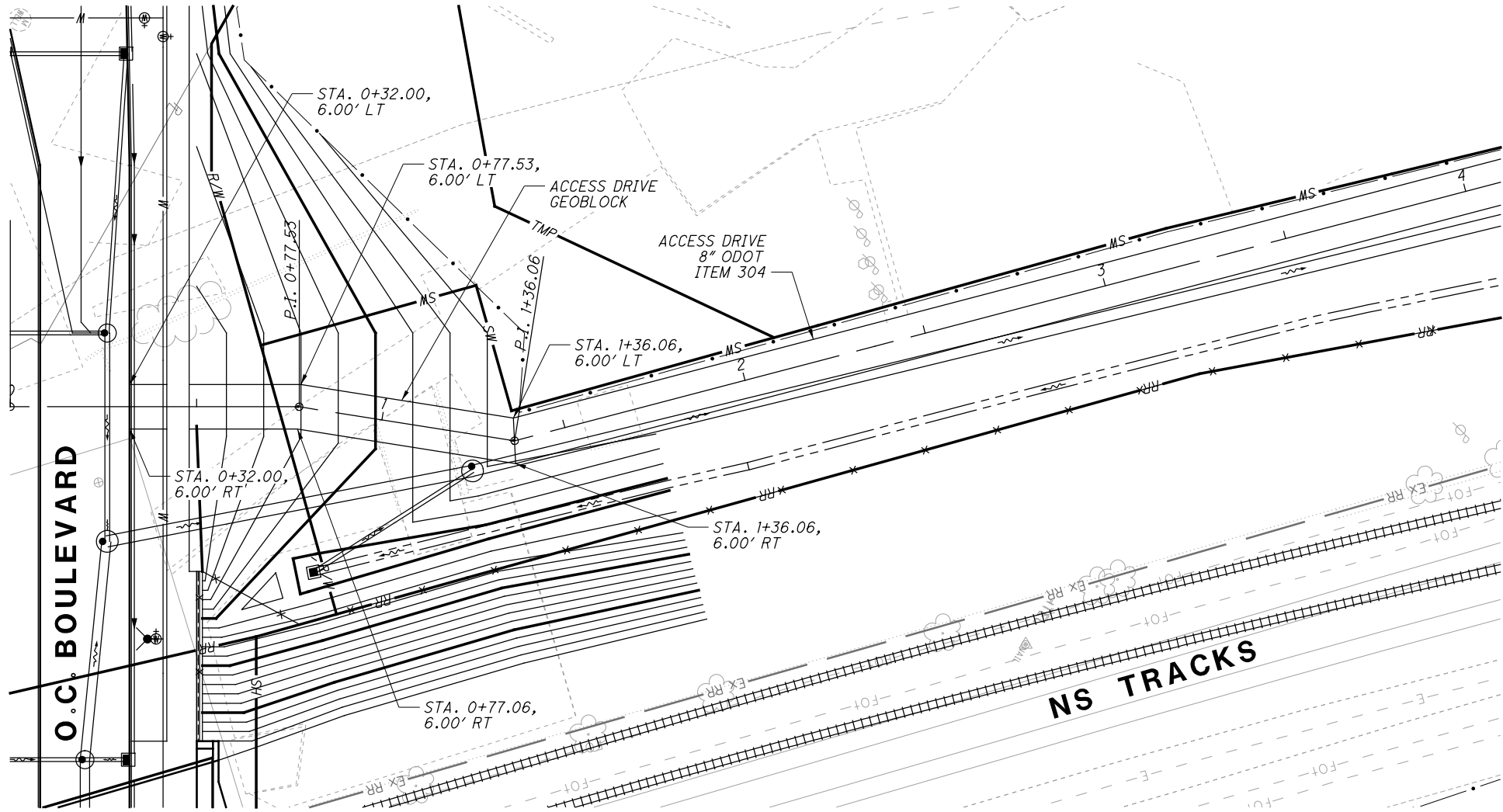
ALL SEWERS OWNED BY WPC, UNLESS NOTED OTHERWISE



CALCULATED	
JTS	
CHECKED	
KMD	



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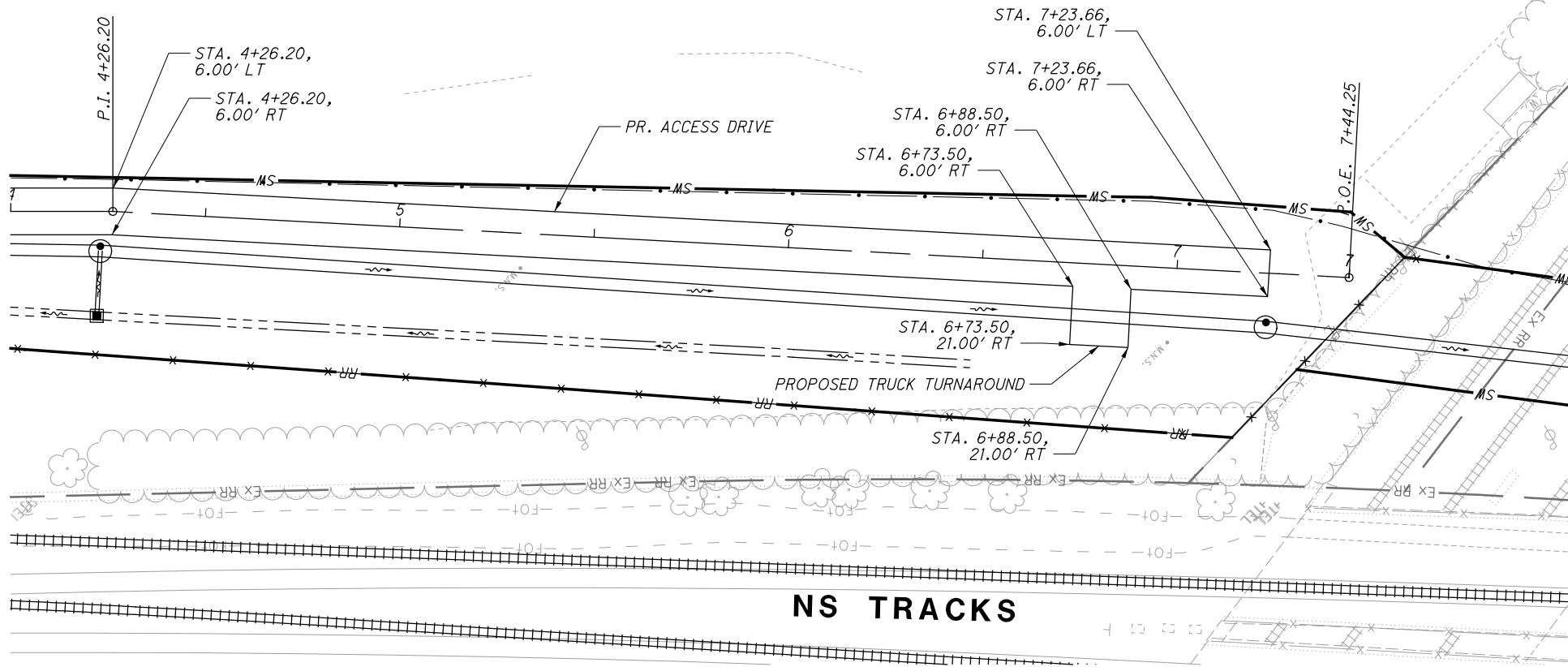
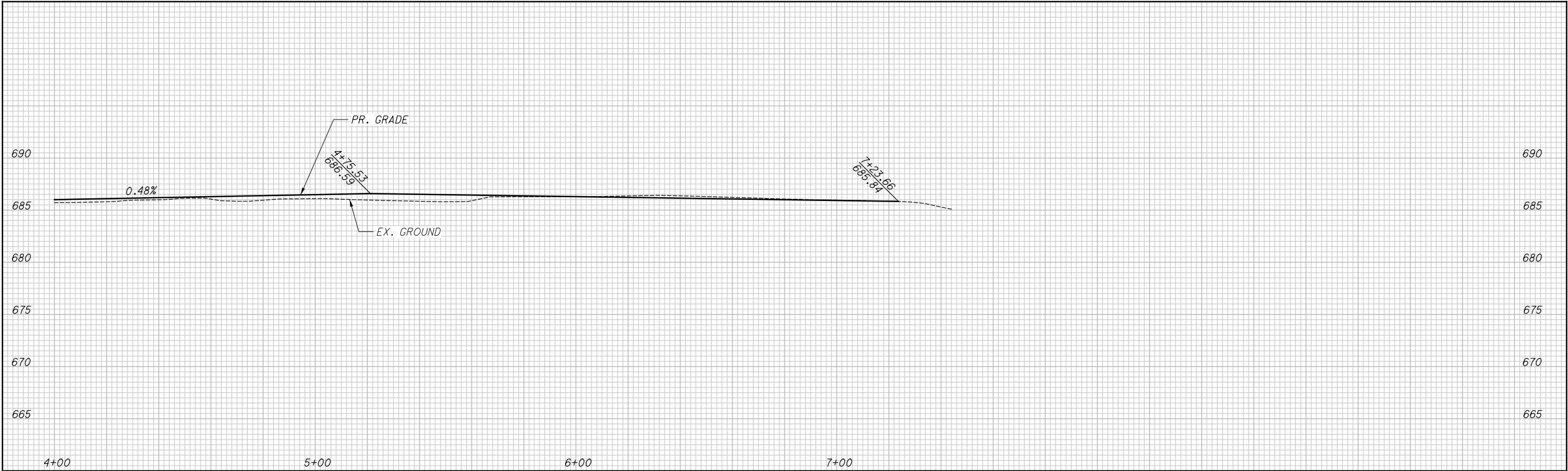
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ISSUE RECORD		
NO.	DATE	DESCRIPTION
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WPC ACCESS DRIVE
STA. 4+00.00 TO END

CUY-IR490 / SR010-
2.09 / 19.28

8
22

CALCULATED
JTS

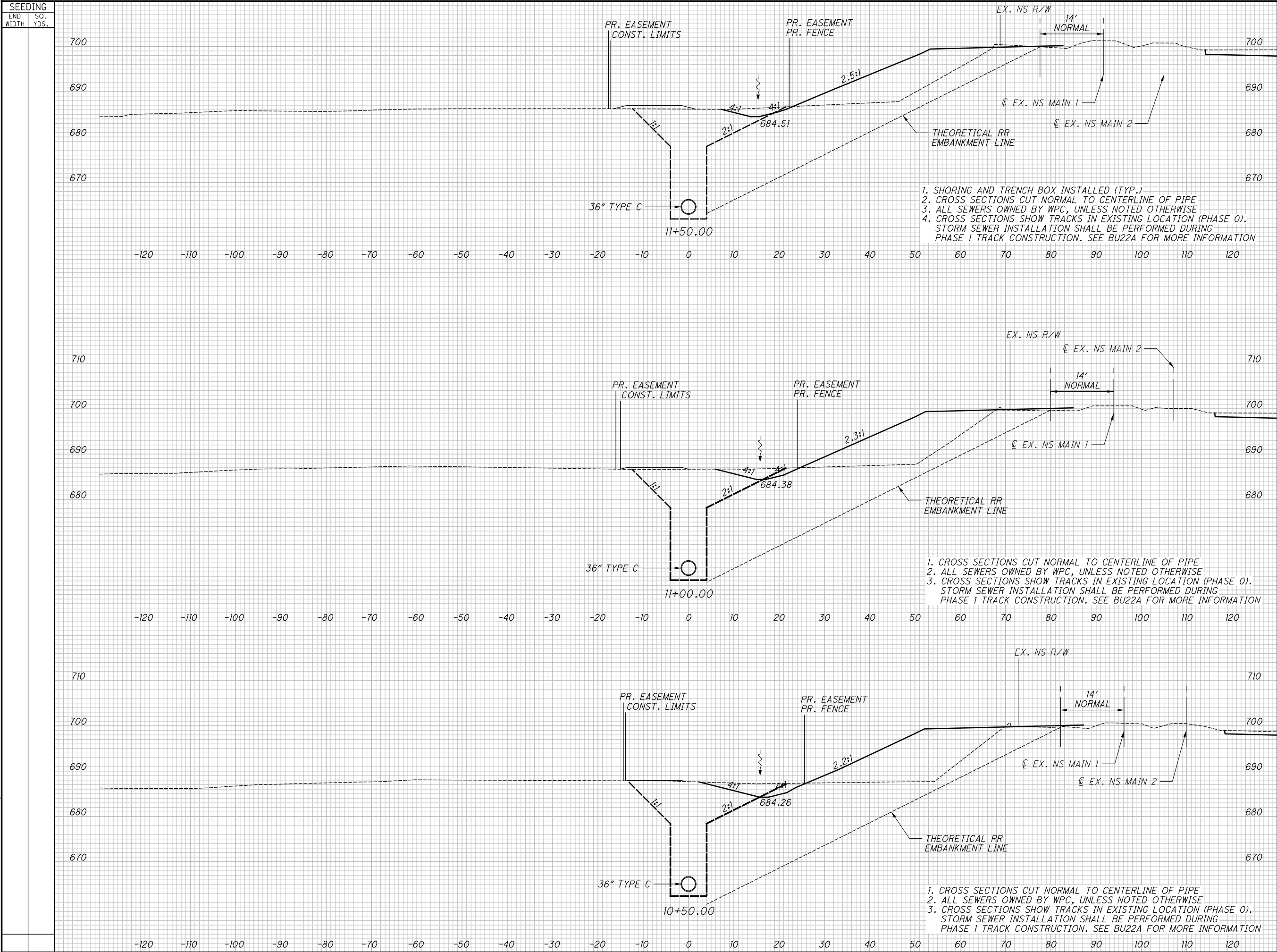
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RECORD PLANS

RECORD PLANS

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SEEDING		END AREA		VOLUME		CALCULATED JTS	CHECKED KMD
END WIDTH	SO. YDS.	CUT	FILL	CUT	FILL		
CROSS SECTIONS - OUTFALL #4 STORM SEWER							
STA. 10+50.00 TO STA. 11+50.00							
RECORD PLANS							
CUY-IR490/ SR010-		RECORD PLANS					
2.09 / 19.28		RECORD PLANS					
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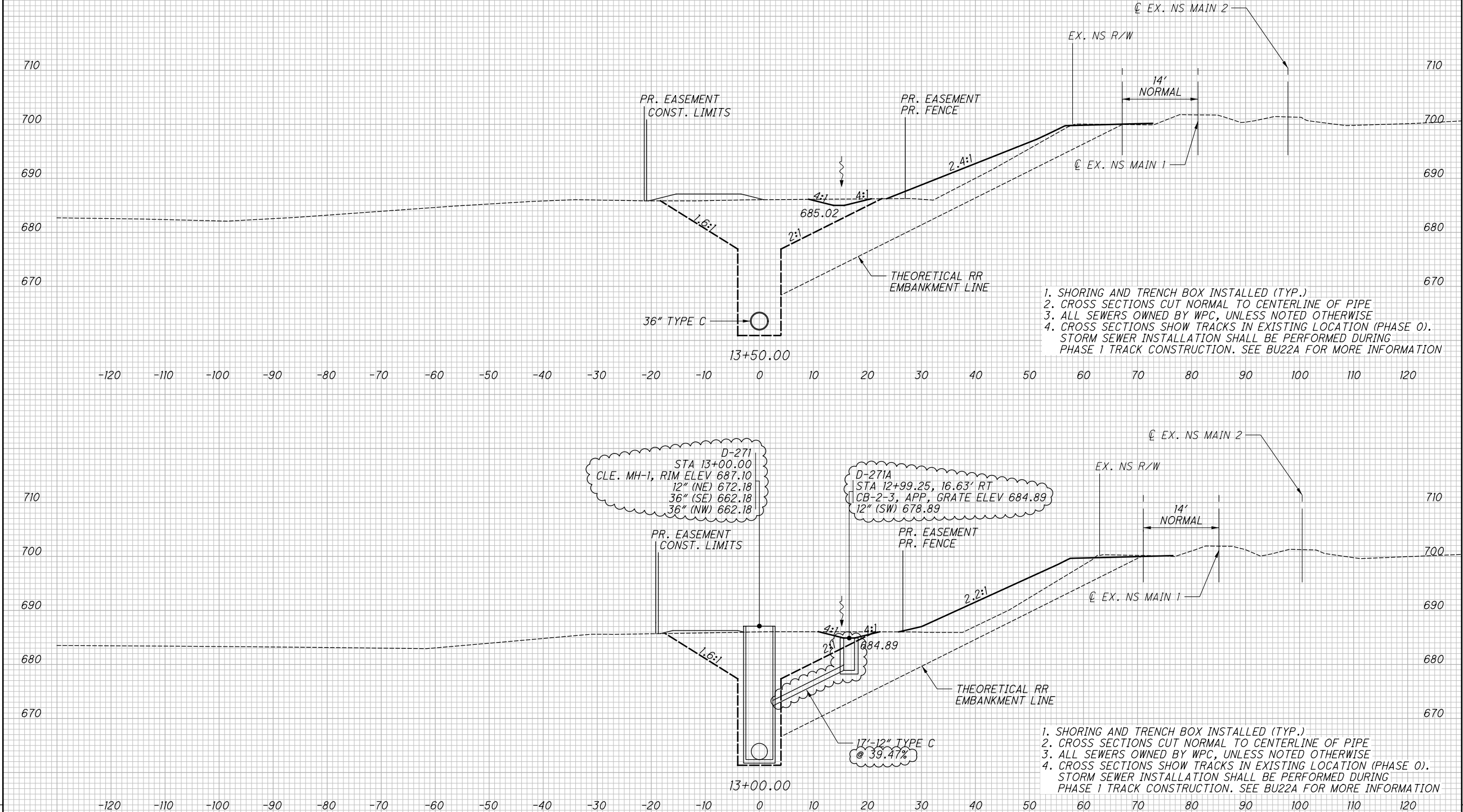
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WIDTH		CUT		FILL		CUT		FILL		CUT		FILL		CUT	
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CROSS SECTIONS - OUTFALL #4 STORM SEWER															
STA. 12+00.00 TO STA. 12+50.00															
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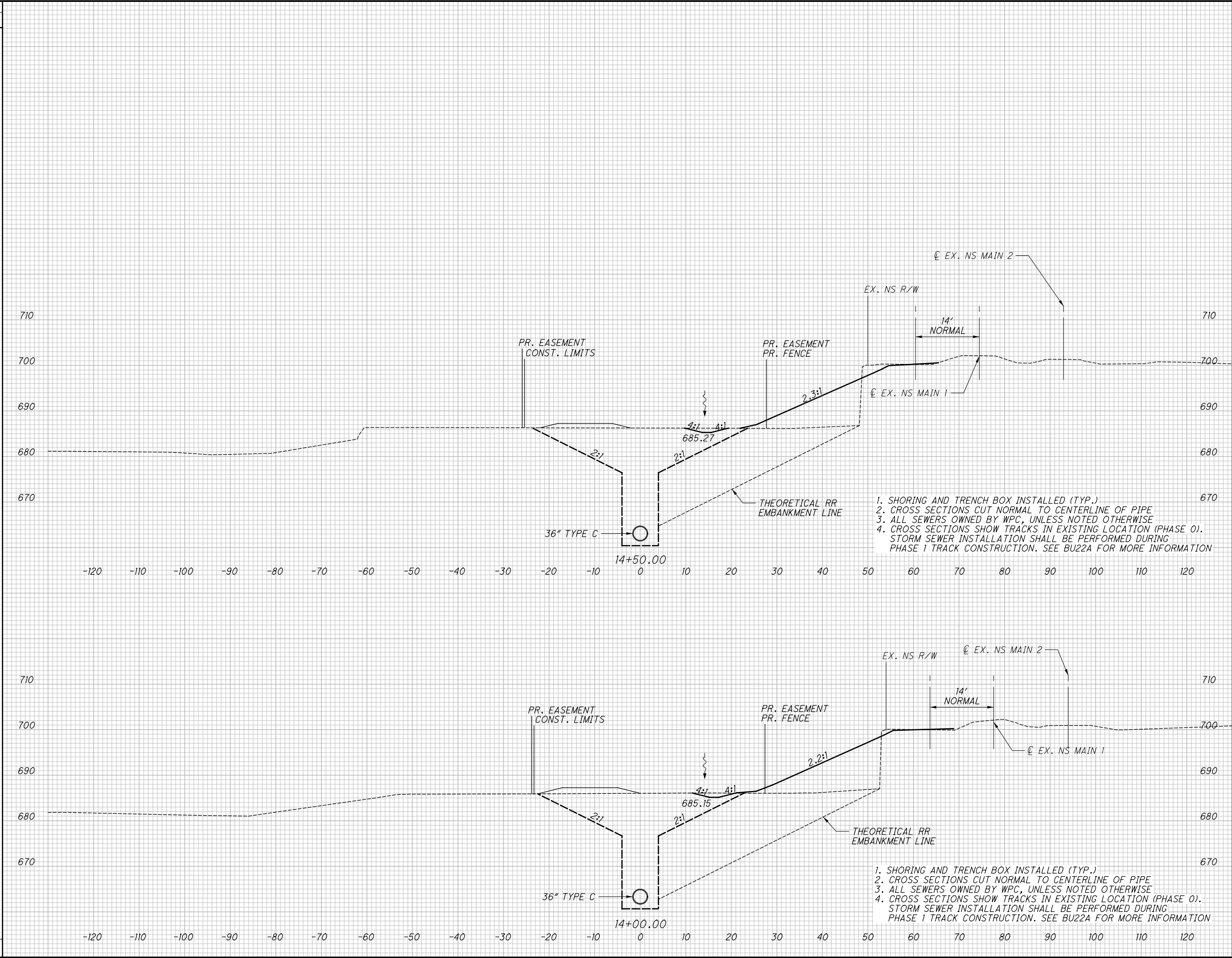
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CUT	FILL	CUT	FILL		

CROSS SECTIONS - OUTFALL #4 STORM SEWER
STA. 13+00.00 TO STA. 13+50.00

CUY-IR490/ SR010-
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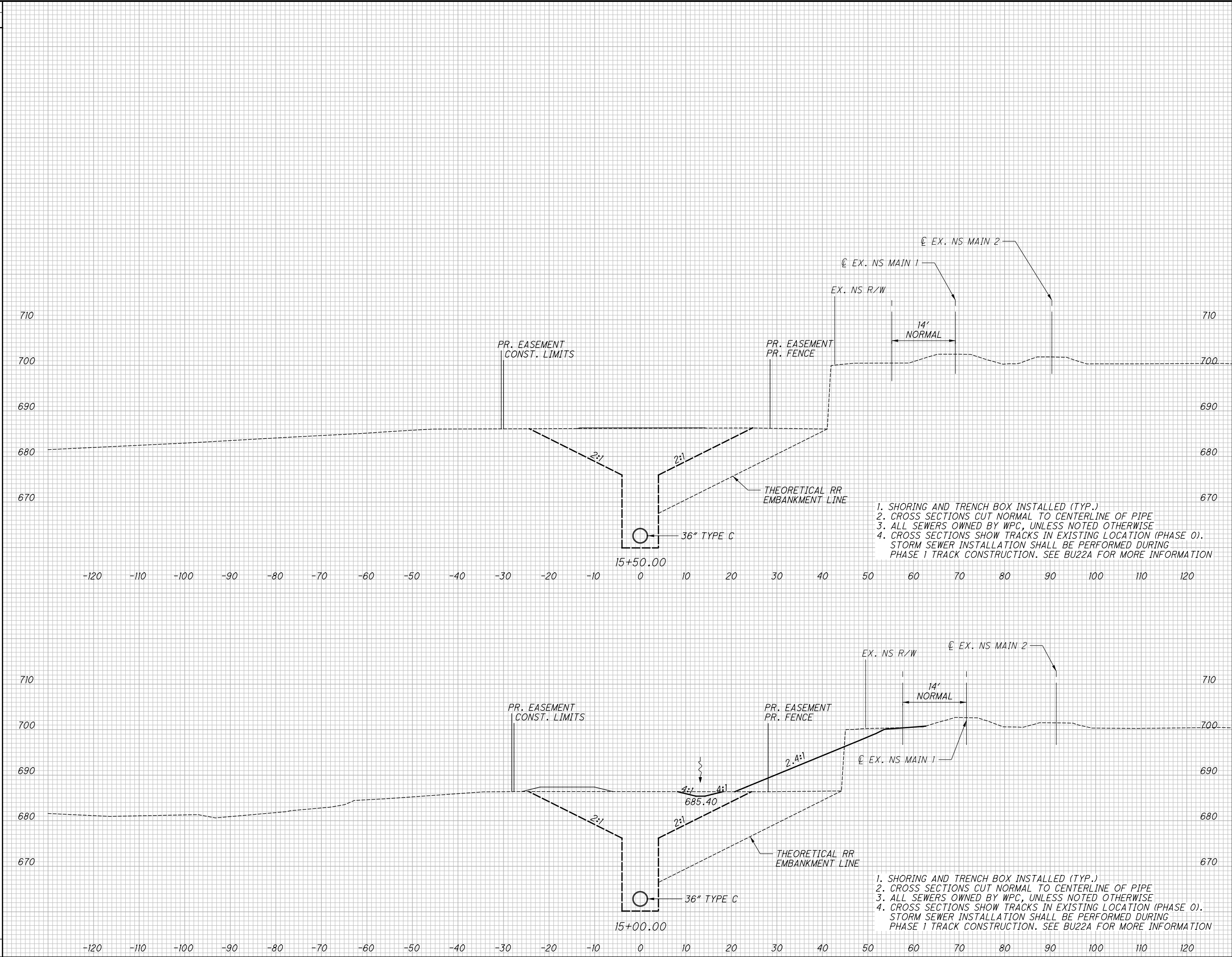


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END AREA		VOLUME		CALCULATED JTS	CHECKED KMD
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CROSS SECTIONS - OUTFALL #4 STORM SEWER					
STA. 14+00.00 TO STA. 14+50.00					
RECORD PLANS					
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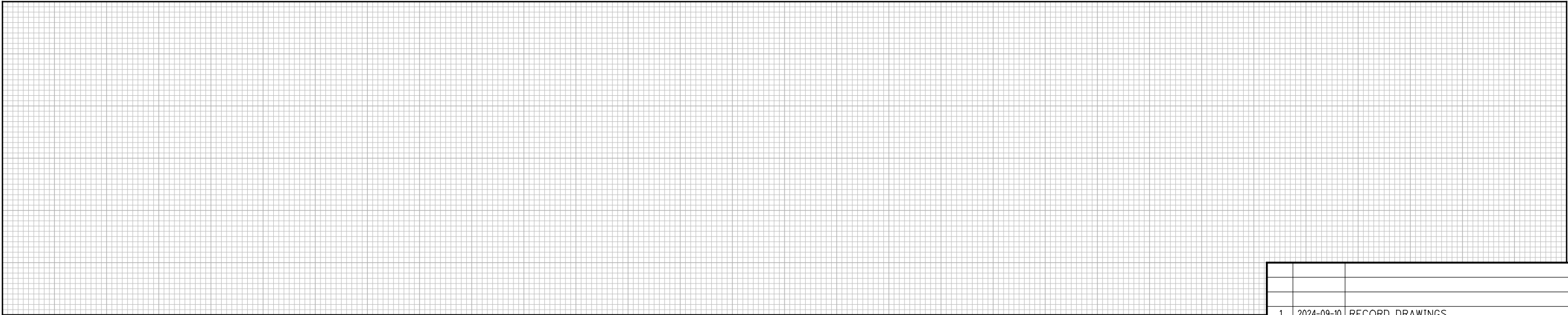
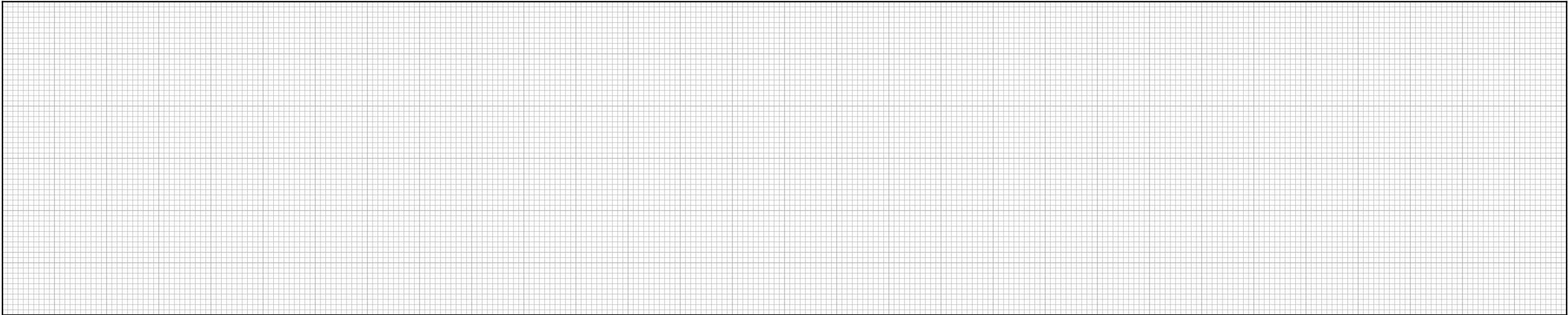
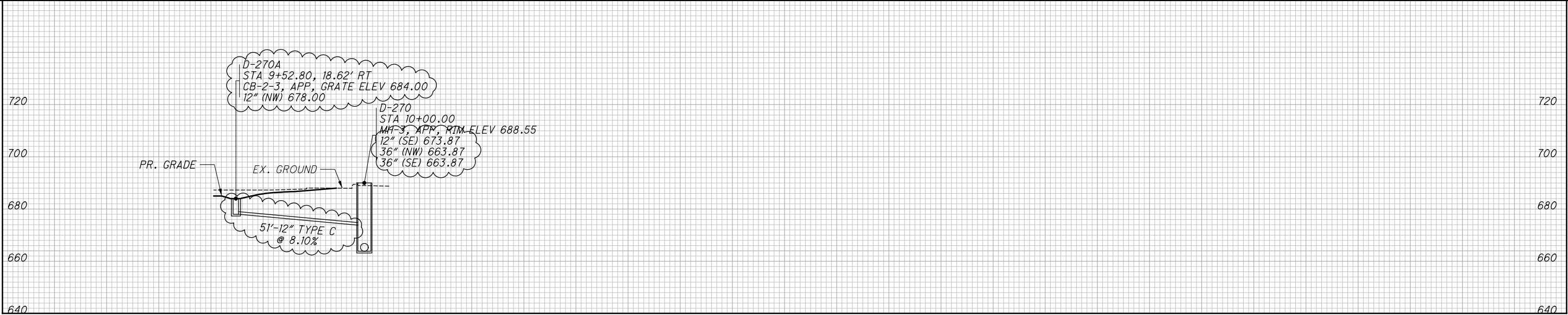


END AREA		VOLUME		CALCULATED JTS	CHECKED KMD
CUT	FILL	CUT	FILL		
CROSS SECTIONS - OUTFALL #4 STORM SEWER					
STA. 15+00.00 TO STA. 15+50.00					
RECORD PLANS					
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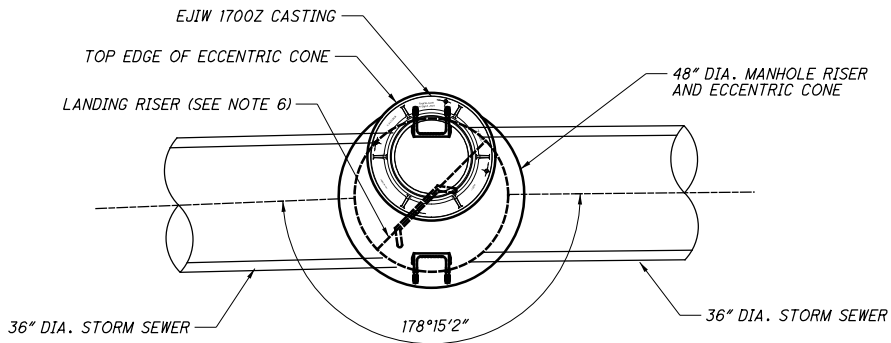
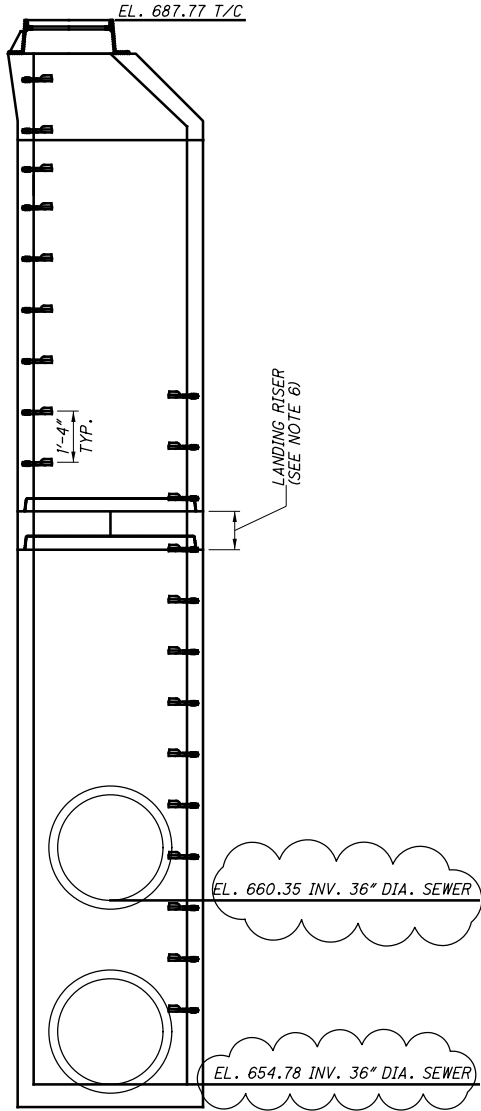
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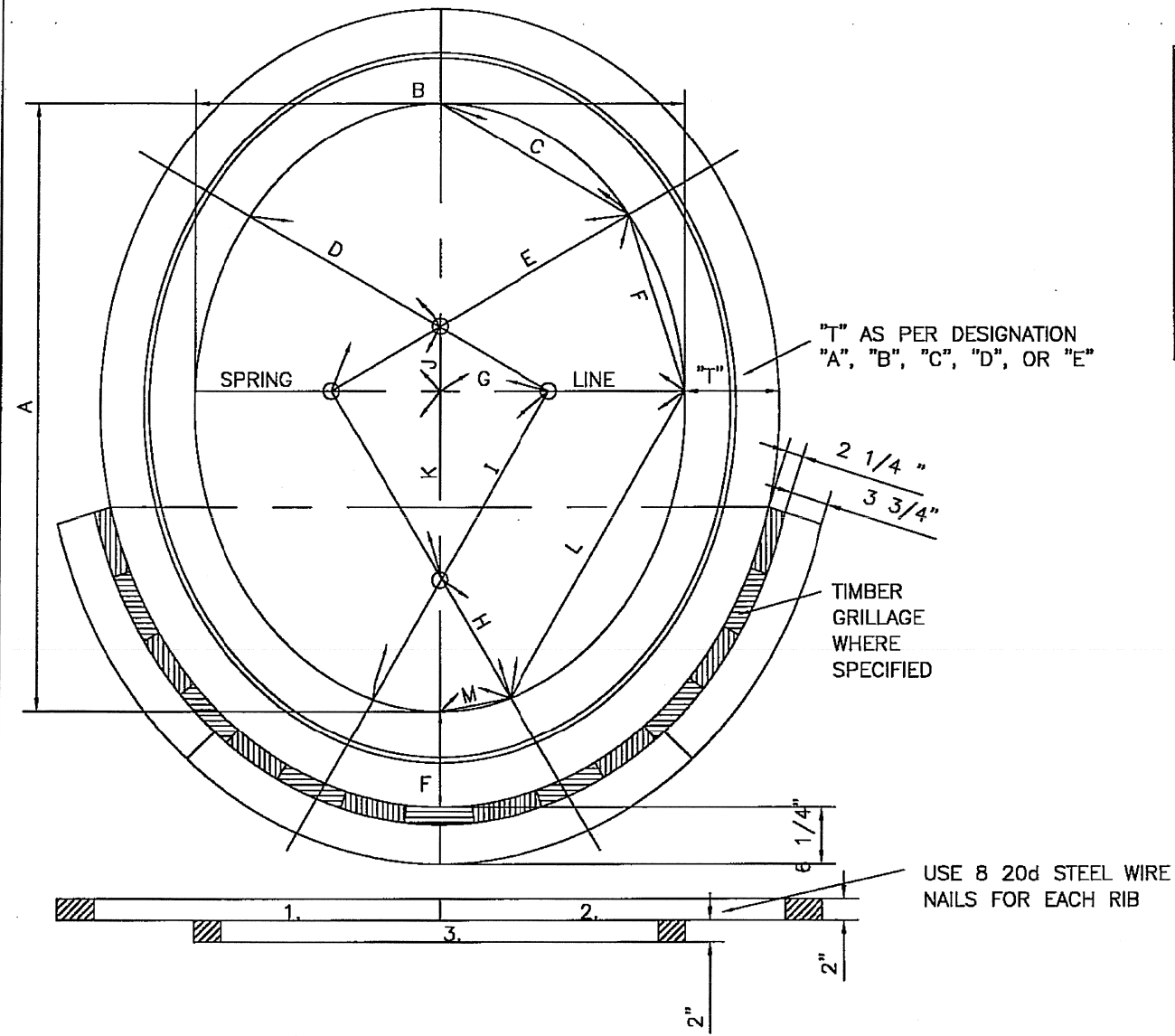
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NOTES:
1.) CONCRETE MIN. 5,000 PSI @ 28 DAYS
2.) REINFORCING GRADE 60 ASTM A615-A617 60,000 PSI YIELD STRENGTH
3.) HS-20 LOADING
4.) ALL MANHOLE SECTIONS SHALL CONFORM TO THE PROVISIONS OF ASTM C-478
5.) RUBBER GASKETED JOINTS SHALL CONFORM TO THE PROVISIONS OF ASTM C-443.
6.) LANDING RISERS SHALL BE INSTALLED PER THE DETAILS SHOWN ON SHEET 22

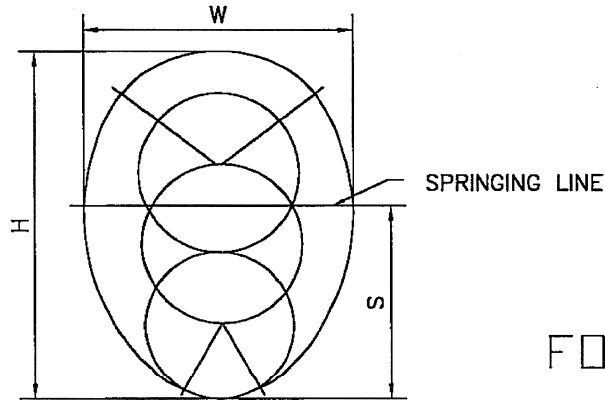
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ISSUE RECORD		



EGG SHAPED SEWERS					NO.	H FEET	W FEET	S FEET	AREA SQ. FT.	NO.	H FEET	W FEET	S FEET	AREA SQ. FT.
NO.	H FEET	W FEET	S FEET	AREA SQ. FT.	8	5.12	4.04	2.71	16.00	15	7.79	6.14	4.12	36.99
2	2.25	1.94	1.28	3.41	9	5.54	4.37	2.93	18.72	16	8.13	6.41	4.30	40.32
3	2.75	2.23	1.64	4.75	10	5.94	4.69	3.14	21.54	17	8.47	6.68	4.47	43.71
4	3.23	2.54	1.70	6.35	11	6.33	4.99	3.35	24.46	18	8.79	6.94	4.65	47.17
5	3.74	2.95	1.98	8.55	12	6.71	5.29	3.55	27.47	19	9.12	7.19	4.82	50.70
6	4.23	3.34	2.23	10.90	13	7.08	5.58	3.74	30.57	20	9.43	7.44	4.98	54.29
7	4.69	3.70	2.48	13.39	14	7.44	5.87	3.93	33.74					

TYPES OF EGG SHAPED SEWERS

- "A"—1 RING OF BRICK ALL AROUND.
"B"—1 RING OF BRICK ALL AROUND & 1 RING EXTRA ON ARCH.
"C"—2 RINGS OF BRICK ALL AROUND .
"D"—2 RINGS OF BRICK ALL AROUND & 1 RING EXTRA ON ARCH.
"E"—3 RINGS OF BRICK ALL AROUND.



FOR RECORD ONLY

TABULAR DIMENSIONS FOR EGG SHAPED SEWERS NO.2 TO NO. 8													
NO.	A	B	C	D	E	F	G	H	I	J	K	L	M
2	2'-3"	1'-11 1/4"					6 3/8"	9"	1'-6"		6 3/8"		
3	2'-9"	2'-2 3/4"					10 5/8"	9"	2'-0"		10 5/8"		
4	3'-2 3/4"	2'-6 5/8"	1'-2 1/8"	1'-2 1/8"	1'-10 1/2"	11 1/2"	7 3/16"	8 1/8"	1'-10 1/2"	4 1/16"	12 3/16"	1'-10 1/2"	4 1/4"
5	3'-9"	2'-11 3/8"	1'-4 3/8"	1'-4 3/8"	2'-1 7/8"	1'-1 3/8"	8 3/16"	9 1/2"	2'-1 7/8"	4 3/4"	1'-2 1/4"	2'-1 7/8"	4 7/8"
6	4'-2 3/4"	3'-4"	1'-6 1/2"	1'-6 1/2"	2'-5 1/4"	1'-3 1/8"	9 1/4"	10 3/4"	2'-5 1/4"	5 3/8"	1'-4 1/8"	2'-5 1/4"	5 1/2"
7	4'-8 1/4"	3'-8 3/8"	1'-8 1/2"	1'-8 1/2"	2'-8 1/2"	1'-4 3/4"	10 5/16"	11 7/8"	2'-8 1/2"	5 15/16"	1'-5 13/16"	2'-8 1/2"	6 1/8"
8	5'-1 1/2"	4'-0 1/2"	1'-10 1/2"	1'-10 1/2"	2'-11 1/2"	1'-6 1/4"	11 1/4"	1'-1"	2'-11 1/2"	6 1/2"	1'-7 1/2"	2'-11 1/2"	6 3/4"

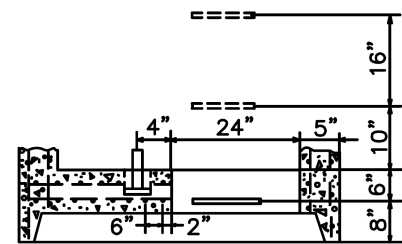
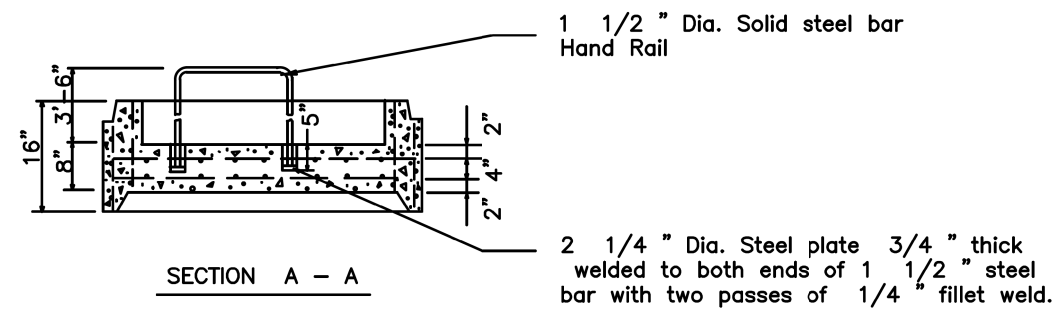
CITY OF CLEVELAND
DEPARTMENT OF PUBLIC SERVICE
DIVISION OF ENGINEERING & CONSTRUCTION
JOMARIE WASIK—DIRECTOR OF PUBLIC SERVICE
STANDARD CONSTRUCTION DRAWING
STANDARD PLAN FOR EGG SHAPED SEWERS
DIMENSIONS & AREAS
NOT TO SCALE

DRAWN BY: R. PLIODZINSKAS DATE: 4/8/08
SUBMITTED BY: W. McLAUGHLIN DATE: 4/8/08

APPROVED: [Signature] DATE: 7-8-08
COMMISSIONER OF ENGINEERING & CONSTRUCTION

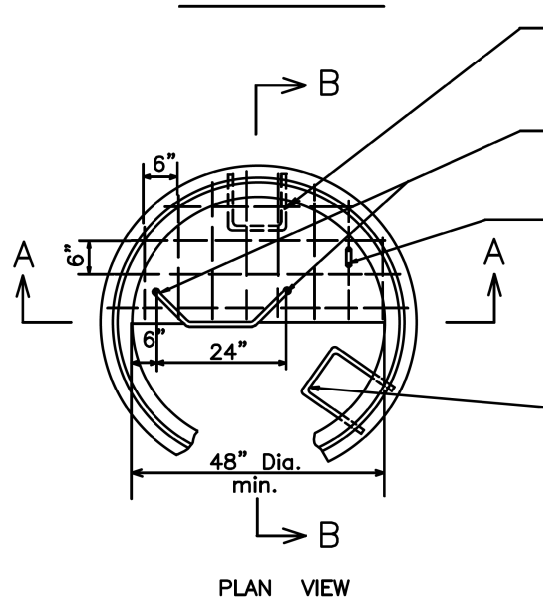
FILE NO. 73M 24

0	2020-04-15	RFC
NO.	DATE	DESCRIPTION
		ISSUE RECORD



NOTE:

Landing Platforms as shown on the Landing Details shall be installed in manholes that are over 28 feet deep to the invert with a maximum vertical spacing of 20 feet.



Manhole steps start 12" to 16" above landing platform floor and continue vertically above to the next landing platform or top outlet

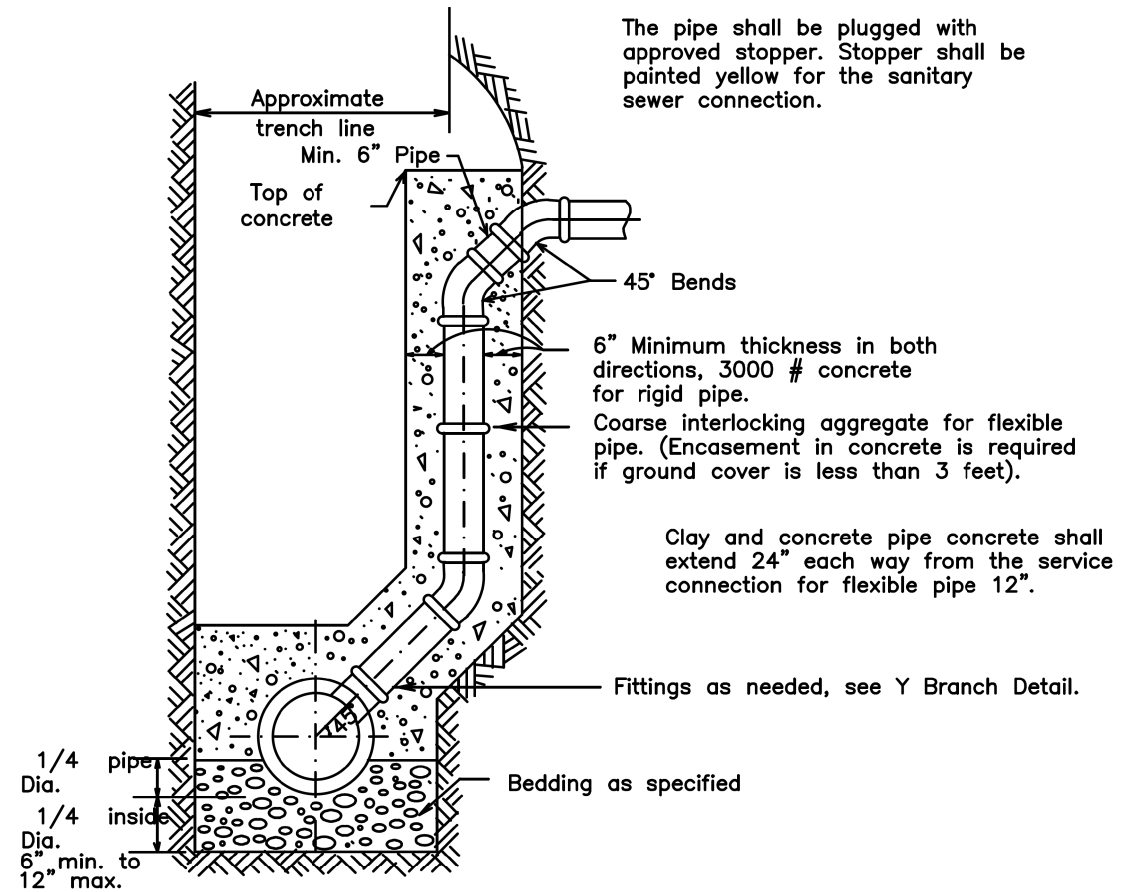
Two 2 1/2 " Dia. Precast openings 5" deep.

Typical bar placement in landing riser
- #4 Rebar.

If multiple landings are required
rotate adjacent landings 90°
A 90° clear opening must be seen
from top to bottom of manhole.

Manhole steps stop 4' above top
of landing platform.

16" LANDING RISER
DETAIL
FOR PRECAST MANHOLE



The pipe shall be plugged with approved stopper. Stopper shall be painted yellow for the sanitary sewer connection.

- 6" Minimum thickness in both directions, 3000 # concrete for rigid pipe.
- Coarse interlocking aggregate for flexible pipe. (Encasement in concrete is required if ground cover is less than 3 feet).

Clay and concrete pipe concrete shall extend 24" each way from the service connection for flexible pipe 12".

— Fittings as needed, see Y Branch Detail.

- Bedding as specified

TYPICAL
RISER DETAIL

REVISIONS:

SCALE
NO SCALE

DATE : DEC. 1998

REVISIONS:


SCALE
NO SCALE

DATE : APRIL 2015

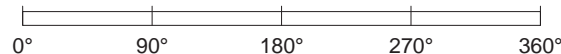
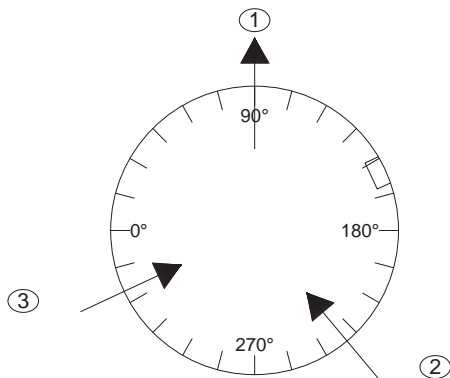
CUYAHOGA COUNTY DEPARTMENT OF PUBLIC WORKS – SANITARY DEPARTMENT DETAIL

Sheet No. 9-A/27

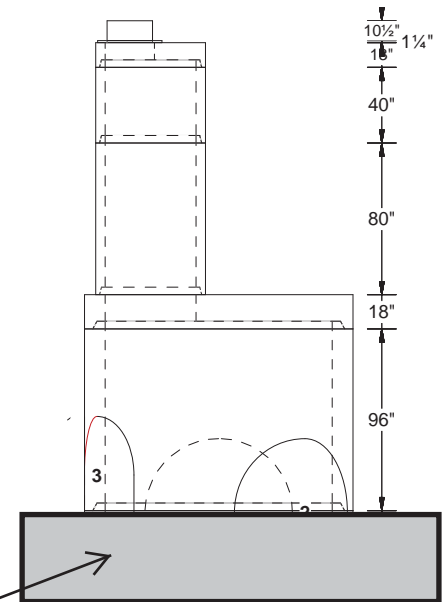
0	2020-04-15	RFC
NO.	DATE	DESCRIPTION
ISSUE RECORD		

Customer: INDEPENDENCE EXCAVATING, INC. Job Name: ODOT 173000 - Opp Corridor Ph 3 Job #: 173408 Structure ID: D-274 BU-24 Station: July 15, 2020 Type: ODOT Storm Doghouse Manhole SalesPerson: Ralph Hastings	Description	UOM	Quantity	Weight	 1-800-837-7788 6845 Erie Ave. N.W. PO Box 578 Canal Fulton, Ohio 44614
	Stock 48"Ø Flat Top W/ 26"Ø Hole	EA	1	1185	
	48"Ø Manhole Riser X 40" Tall	EA	1	2891	
	48"Ø Stock Manhole Riser X 80" Tall	EA	1	5778	
	120"Ø Flat transition to 48"Ø x 18"	EA	1	24750	
	120"Ø Manhole Riser x 96"	EA	1	68312	
	Doghouse Hole	EA	3	0	
Rim: 674.00' Invert: 650.37' Rim to Invert: 23.63' Sump: 1.25'	ODOT MH-3 Mh A.P.P - All D/H holes IX Reviewed - J.P. Sorma PE 7/20/20				

Step Degree: 155



EJIW 1700 by Ind Exc



PipeNum	Elevation	%Grade	Angle	Pipe	Hole or Pipe Seal Type
					D/H Holes in 120"Ø x 96" tall Riser
(1)	650.37	0	90	48" - Brick	78" W x 32" T D/H - from top of mh joint
(2)	650.37	0	230	48" - Brick	78" W x 32" T D/H - from top of mh joint
(3)	652.01	0	335	48" - RCP Co-Pipe	62" W x 44" T D/H - from top of mh joint

Cast in place base by Ind Exc -
up to springline of ex. 48" brick
> Full base pad or strip footers TBD

Strip footers*

Doghouse Hole

07/17/2020

Submittal: 142

Revision:

Date Submitted: 8/10/2021

Response Due By:



Project: 16051 - ODOT 173000 CUY IR 490/SR010 (OC3)

Description: BU-24 611 Installation Plan

To: Mark Gabele, PE
Ohio Department of Transportation - District 12

Email: Mark.Gabele@dot.ohio.gov

From: Jacob Hasselbach
Kokosing Construction Company

Email: jhasselbach@kokosing.biz

Submittal Type:	Submitted For:
<input type="checkbox"/> Engineered Drawings	<input checked="" type="checkbox"/> Approval
<input type="checkbox"/> Shop Drawings	<input type="checkbox"/> Record
<input type="checkbox"/> Working Drawings	<input type="checkbox"/> Other
<input type="checkbox"/> CPM Schedule	
<input type="checkbox"/> Material Certifications / Test Results	Sent Via:
<input type="checkbox"/> Reports	<input checked="" type="checkbox"/> Attached (Electronic)
<input type="checkbox"/> Product Data/Samples	<input type="checkbox"/> Attached (Hard Copy)
<input checked="" type="checkbox"/> Other: 611 Plan	

Submittal #	Copies	Spec #	Rev. #	Description	
142	1			142 – BU-24 611 Installation Plan	

Comments:

Please see attached 611 installation plan for BU-24.

Signed: 



INDEPENDENCE EXCAVATING, INC.

CLEVELAND • PITTSBURGH • MID-ATLANTIC

Setting innovation into motion for 60 years.
www.indexc.com

August 5, 2021

Project: ODOT 173000 - Opportunity Corridor Section 3

Subject: ODOT 611 Conduit Installation Plan

Location: Outfall 4 Sewer – Between Woodland and Grand running alongside E 79th

Buildable Units: BU-24

Contents, based on ODOT CMS 611.04B:

1. Trench and excavation cross-sections with dimensions

Exhibit 1a: Included is 146-ME, the City of Cleveland's Standard Trench details for Pipe Sewers. Work will follow the Typical Section: Pipe Sewers in Ordinary Earth Bedding.

Utility trenches will be installed with an open cut excavation. If over 5ft, trenches will be shored with conventional trench boxes. All shoring systems have tabbed data, will be OSHA compliant. While none are anticipated, any excavations over 20ft will be engineered. If water becomes a concern, water will be pumped out of the work area to complete the installation. Typically, conduit will start from the low-point (down structure) and installed upstream towards higher elevation. Conduit sections will be joined per manufacturer recommendations (included).

D-269 through D-270 to D-271 to D-272: This area will first be benched down +/- 9' before pipe installation. Conventional boxes will be utilized for trenching. See included sealed engineered plan

Exhibit 1b: Structure D-272: This is the receiving pit side for the bore/jack. Conventional boxes will be utilized for trenching. See site specific sealed engineered plan

Exhibit 1c: Structure D-273: This is the launch pit side for the bore/jack.

2. Installation locations

Exhibit 2: Included are plan and profile sheets from each relevant BU-24 plan set.

3. Pipe manufacturer data

Exhibits 3: Also included from each pipe manufacturer are installation recommendations, pipe cut sheets, jointing details, written confirmation of this installation plan and RCP fill height tables. All RCP and VCP conduit will have flexible rubber gasket joints installed during conduit installation.

4. Type of bedding and backfill material used and maximum lift thickness

Bedding: IX will install Type 3 #57 aggregate for structural pipe bedding per City of Cleveland standard trench details. Aggregate will be placed under the haunches of the conduit to provide proper conduit support. IX will also shape the bedding with recesses to receive the bell of the bell-and-spigot

conduit. IX will loosen the bedding in the middle third to seat the conduit. As detailed, aggregate will extend to 12" over the top of the conduit.

Trench Zone Backfill: Per City of Cleveland requirements, trench backfill within pavement areas will be with CLSM-50.

IX will backfill the trench zone (in green sheet 33) with #57 limestone in 12" lifts. IX will crown the upper half of the green zone on (sheet 33) with fabric to create layer between embankment and #57's. The top bench area (in yellow sheet 33) will be backfilled with onsite suitable soils and be compacted within the trench zone according to CMS 203 as we proceed with conduit installation. Co-Pipe's letter confirming the trench to be backfilled with #57 limestone acceptable, attached (sheet 34,35).

5. Precast structure installation

Manhole boxes will be utilized to shore the excavation per OSHA standards. Engineering evaluation will also take into account structure excavations over 20ft, see included engineer plan. 6" of bedding will be placed/graded for the manhole base.

Precast sections will be lowered and set into place with a crane or an excavator. Joints will be according to manufacturer, but typically will be sealed with a flexible butyl resin sealant manufactured by Concrete Sealants: CS-102 – 7/8" diameter. Precast structures will follow City of Cleveland standards for pipe connections, unless the plans note otherwise. Stone bedding will follow City of Cleveland standard. Unless aggregate or LSM is utilized, suitable excavated material will be compacted per ODOT CMS 203 for areas outside of pavement.

Separately, precast shop drawings will be submitted to Kokosing and ODOT and/or WPC (depending on ownership) for review.

6. Compaction density requirements for bedding and backfill, compaction equipment

For backfill of trenches outside of pavement unless aggregate or LSM is utilized: See attached City of Cleveland typical trench details/sections for compaction requirements. IX will utilize a smooth drum compactor above the bedding to compact the 203 material. Where a trench is not accessible to a smooth drum compactor, other small compaction equipment will be utilized. IX will provide a QC consultant to perform compaction testing for all other lifts within the zone of 203 backfill.

For trench zone backfill of the open cut conduit from D269 to D272, Structural Backfill Type 3 to be consolidated in lifts with a Ho-Pac excavator attachment. This material is not subject to 203 compaction requirements.

7. CA-P-1A Conduit Installation Plan

Exhibit 7 separately: Worksheet provided for subject scope.

Sincerely,



Matt Gillilan

Project # 17-3000
Date of Plan Mon - 05-18-2020
BU 24

Concrete Manufacturer Co-Pipe
VCP Manufacturer Logan Clay Products
Density testing agency

PID

Location/work description Alongside NSRR tracks and E 79th, between Woodland and Grand

Plan Pg. #	Down Structure	Up Structure	Cond. Size (in.)	Conduit Material	Length (ft.)	Max. Joint Gap (in.)	Cut/Fill	Trench Width (ft.)	Trench Depth (ft.)	Bed Material	Bed Comp. Density	Bed Thickness Below	Stone above Pipe	Bed Max. Lift	Backfill Material (ODOT)			Equipment / Method
															Final Backfill	Comp. Density	Max. Lift	
4	D-270	D-271	36"	RCP	300'	0.75	Fill	8' Top 6" bottom	18'	703.11, Type 3	N/A	6"	12"	6"	Dirt and 57s	98% or 203.07	12"	
	D-270	D-270a	12"	Clay	46'	0.75	Fill	8' Top 6" bottom	18'	703.11, Type 3	N/A	6"	12"	6"	Dirt and 57s	98% or 203.08	12"	
4	D-271A	D-271	12"	Clay	17'	0.75	Fill	8' Top 6" bottom	18'	703.11, Type 3	N/A	6"	12"	6"	Dirt and 57s	98% or 203.07	12"	
4	D-271	D-272	36"	RCP	300	0.75	Fill	8' Top 6" bottom	18'	703.11, Type 3	N/A	6"	12"	6"	Dirt and 57s	98% or 203.07	12"	
4	D-272	D-273	36"	RCP	214	0.75	Fill	8' Top 6" bottom	18'	703.11, Type 3	N/A	6"	12"	6"	Dirt and 57s	98% or 203.07	12"	
4	D-273	D-274	48"	RCP	33	0.75	Fill	8' Top 6" bottom	18'	703.11, Type 3	N/A	6"	12"	6"	Dirt and 57s	98% or 203.07	12"	
4	D-273A	D-273	36"	RCP	9	0.75	Fill	8' Top 6" bottom	18'	703.11, Type 3	N/A	6"	12"	6"	Dirt and 57s	98% or 203.07	12"	
4	D-269	D-270	36"	RCP	100	1.75	Fill	8' Top 6" bottom	18'	703.11, Type 4	N/A	6"	12"	6"	Dirt and 57s	98% or 203.08	12"	

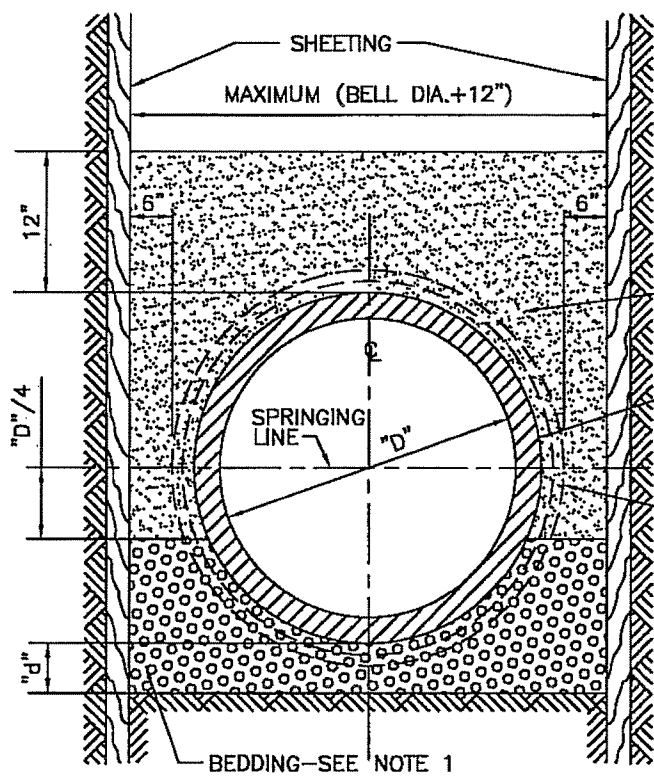
1a. Trench and excavation
cross-sections with dimensions

NOTES:

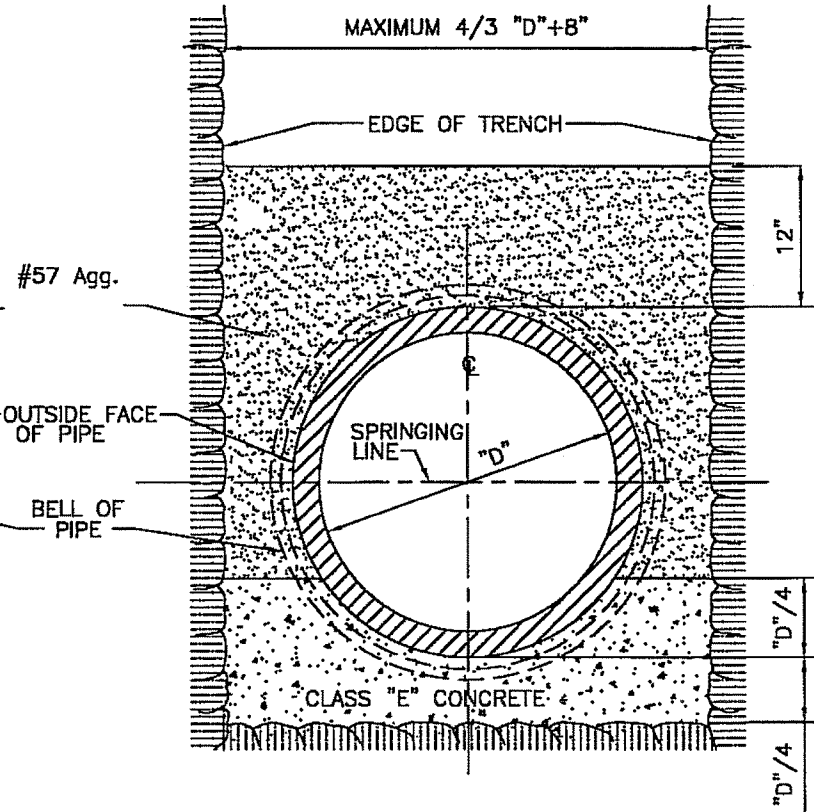
1. THE PIPE BEDDING MATERIAL SHALL BE COARSE NATURAL AGGREGATE COMPLYING WITH 703.01 WITH THE FOLLOWING PROVISIONS:

- (A) 4" BEDDING DEPTH "d" OF NO. 57 GRANULAR MATERIAL FOR 8" TO 24" PIPE
- (B) 6" BEDDING DEPTH "d" OF NO. 5 GRANULAR MATERIAL FOR 27" TO 60" PIPE
- (C) 8" BEDDING DEPTH "d" OF NO. 4 GRANULAR MATERIAL FOR PIPE SIZES GREATER THAN 60". THE MINIMUM DEPTH OF THE BEDDING SHALL BE 2" BELOW THE PIPE BELLS, IF ANY, BUT IN NO CASE SHALL THE BEDDING BE LESS THAN 8"
- (D) SERVICE CONNECTIONS SHALL HAVE A 3" MINIMUM BEDDING DEPTH OF NO. 57 GRANULAR MATERIAL.

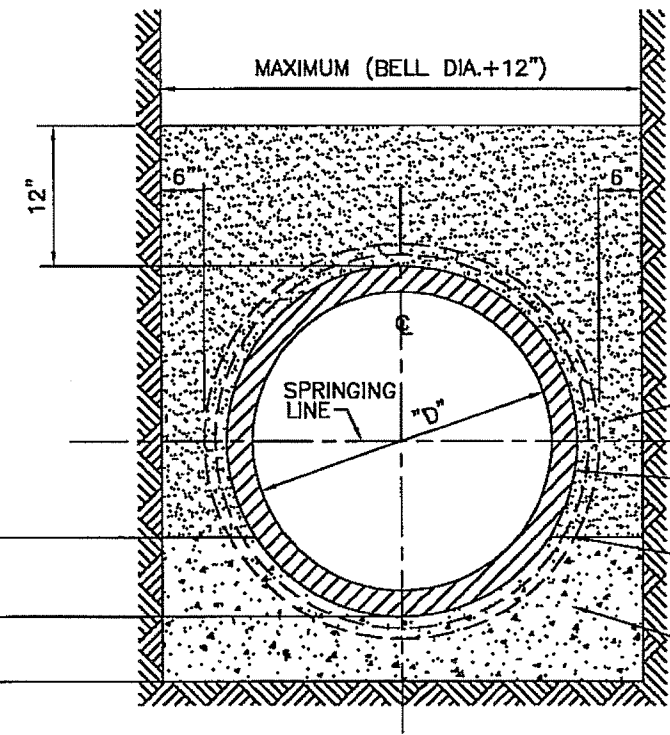
2. TRENCH BACKFILL SHALL IN PAVED AREAS SHALL BE CLEVELAND 50 LSM AND OUTSIDE OF PAVED AREAS ORIGINAL TRENCH EXCAVATION MAY BE USED, PROPERLY COMPACTED.



TYPICAL SECTION
PIPE SEWERS IN
ORDINARY EARTH BEDDING



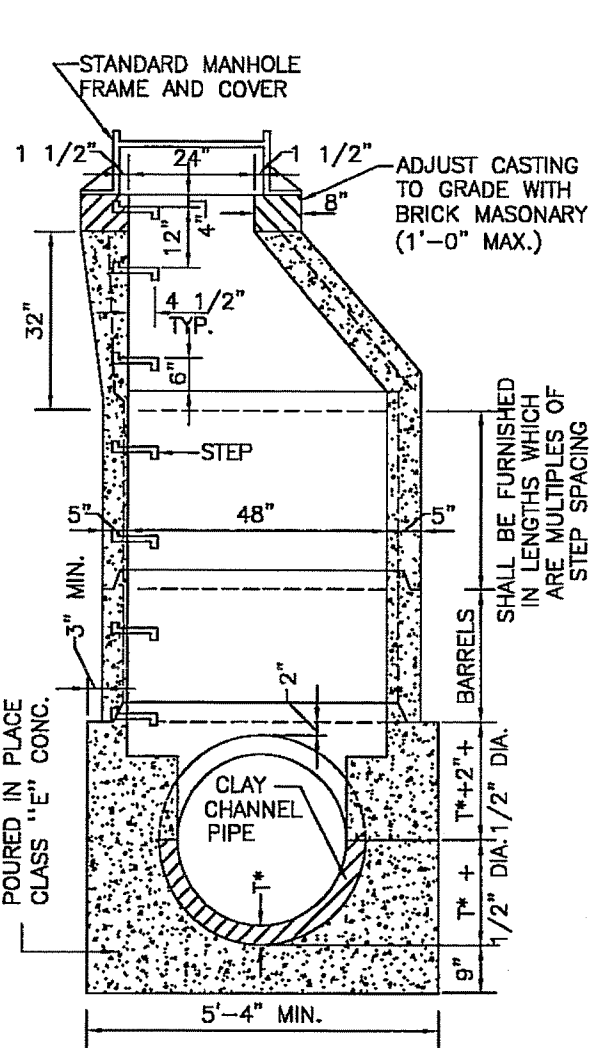
TYPICAL SECTION
PIPE SEWER IN ROCK
AND OR SHALE
WHERE DIRECTED



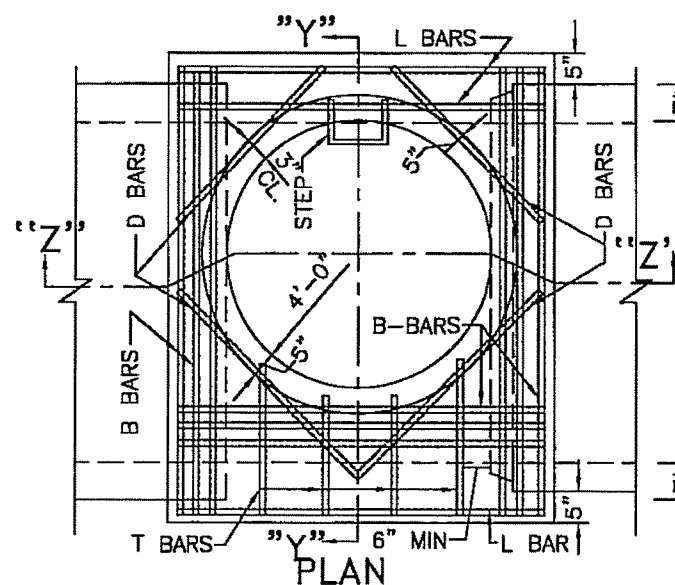
TYPICAL SECTION
PIPE SEWER IN
CONCRETE CRADLE

THOROUGHLY COMPACTED
#57 AGGREGATE
OUTSIDE FACE OF PIPE
BELL OF PIPE
CLASS "E" CONCRETE

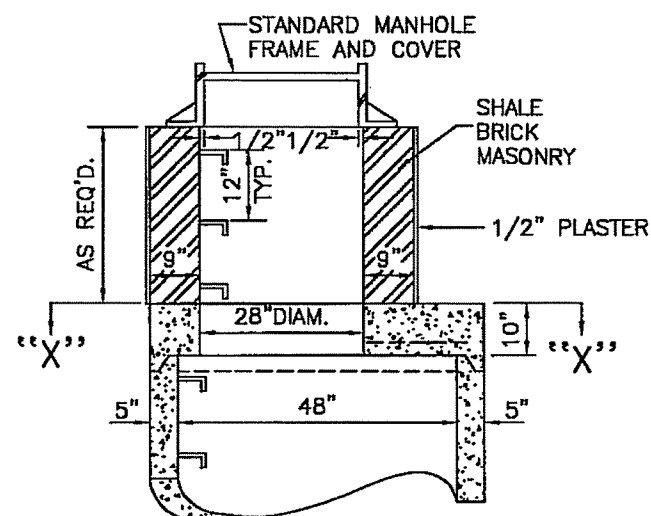
CITY OF CLEVELAND
DEPARTMENT OF PUBLIC SERVICE
DIVISION OF ENGINEERING & CONSTRUCTION
JOMARIE WASIK—DIRECTOR OF PUBLIC SERVICE
STANDARD CONSTRUCTION DRAWING
STANDARD TRENCH FOR PIPE SEWERS
NOT TO SCALE
DRAWN BY: R. PLIODZINSKAS — DATE: 8/28/07
SUBMITTED BY: W. MCLAUGHLIN — DATE: 8/28/07
APPROVED: *Rausch* DATE: 7-8-08
COMMISSIONER OF ENGINEERING & CONSTRUCTION



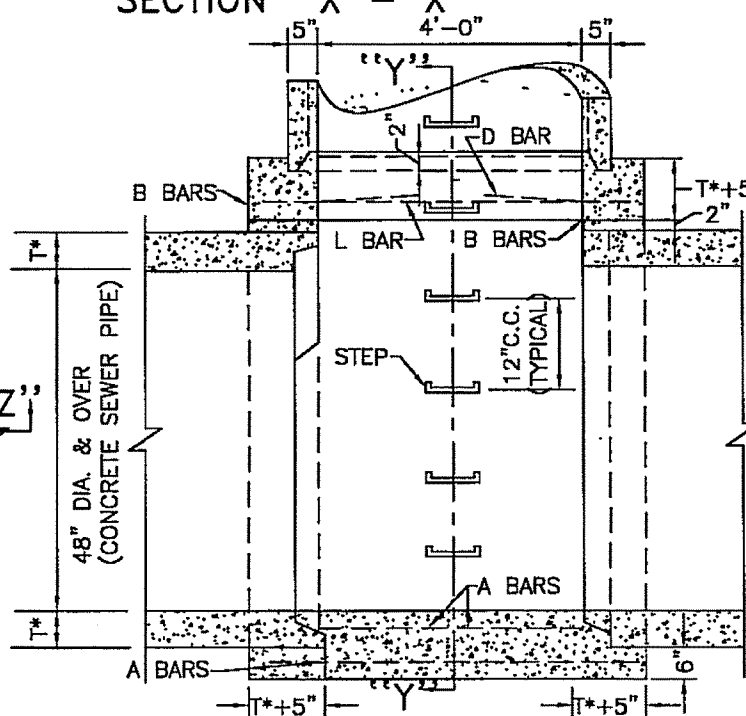
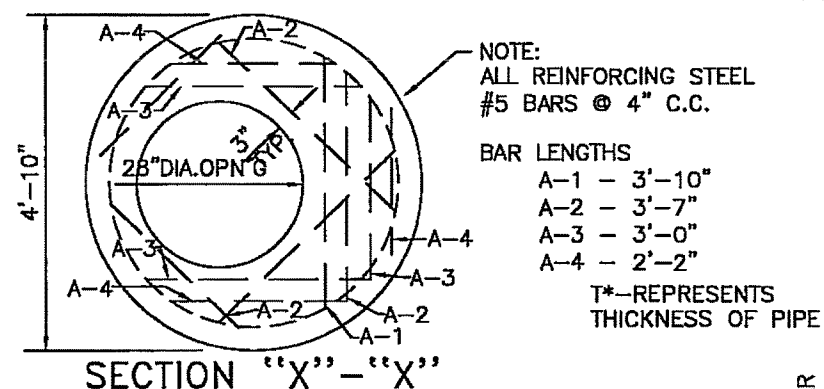
SEWERS 42" AND UNDER



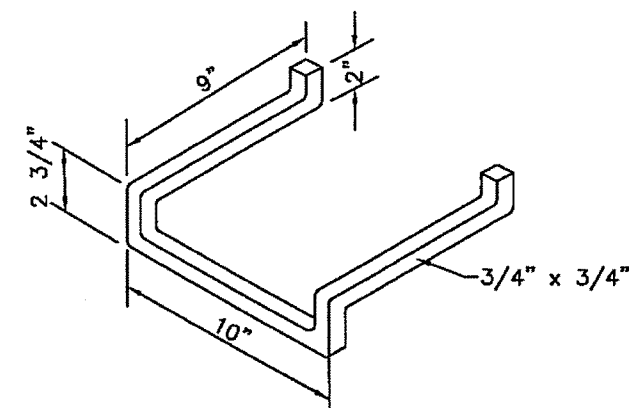
CONNECTION BOX FOR PRECAST MANHOLES ON SEWERS 48" AND OVER



ALTERNATE DOME



SECTION "Z"-"Z"



STEP DETAIL

NOTE:
STEPS SHALL BE CAST IRON AS
PER ASTM A 48 CLASS 3D GRAY
IRON OR ALUMINUM AS PER
ASTM B 221,6061-T6

NOTES:

NO HOLES FOR 12" INLET OR CATCH BASIN CONNECTIONS SHALL BE CUT IN ANY SECTION LESS THAN 36" MANHOLE BARREL. NOT MORE THAN 2 INLET CONNECTIONS SPACED 2± FEET APART HORIZONTALLY PERMITTED IN 3 OR 4 FOOT MANHOLE SECTIONS.

ALL JOINTS AND PIPE OPENINGS IN THE MANHOLE SHALL BE THOROUGHLY CALKED WITH 1:3 CEMENT MORTAR HAVING A 1/2" MINIMUM THICKNESS.

PRECAST REINFORCED CONCRETE MANHOLE SECTIONS SHALL COMPLY WITH THE REQUIREMENTS OF ASTM DESIGNATION C 478-06a: MINIMUM WALL THICKNESS SHALL BE 5 INCHES.

CONNECTION BOXES FOR SEWERS 48" AND OVER IN DIAMETER SHALL BE REINFORCED AS SHOWN AND AS SPECIFIED BELOW:

A) BARS SHALL BE SPACED AT 12" CENTERS IN BOTH DIRECTIONS.

B) BARS SHALL BE SPACED AT 3" CENTERS IN BOTH DIRECTIONS.

A, B & L BARS SIZES:

5/8" DIAM. FOR 48" TO 60" SEWERS.

3/4" DIAM. FOR 66" TO 78" SEWERS.

7/8" DIAM. FOR 84" TO 96" SEWERS.

C) T BARS SHALL BE 5/8" DIAM. SPACED AT 12" CENTERS.

D) BARS SHALL BE 5/8" DIAMETER EPOXY COATED REINFORCING STEEL SHALL HAVE 2" CLEARANCE EXCEPT WHERE OTHERWISE SPECIFIED.

E) STANDARD MANHOLE FRAME AS PER A-503 (SHEET 61) AND COVER AS PER A-605 (SHEET 62) OR A-695 (SHEET 63)

CITY OF CLEVELAND

DEPARTMENT OF PUBLIC SERVICE
DIVISION OF ENGINEERING & CONSTRUCTION
JOMARIE WASIK-DIRECTOR OF PUBLIC SERVICE
STANDARD CONSTRUCTION DRAWING
DETAIL PLAN OF PRECAST CONCRETE MANHOLE
NOT TO SCALE

DRAWN BY: R. PLIODZINSKAS DATE: 8/28/07

SUBMITTED BY: W. MCLAUGHLIN DATE: 8/28/07

APPROVED: *[Signature]* DATE: 7-8-08
COMMISSIONER OF ENGINEERING & CONSTRUCTION

Jack and Bore Launch Location
(near proposed structures D-273/D-274)



INDEPENDENCE EXCAVATING, INC.
5720 Schaaf Road
Independence, Ohio 44131
Industrial & Commercial

Phone 216-524-1700
Fax 216-524-1701

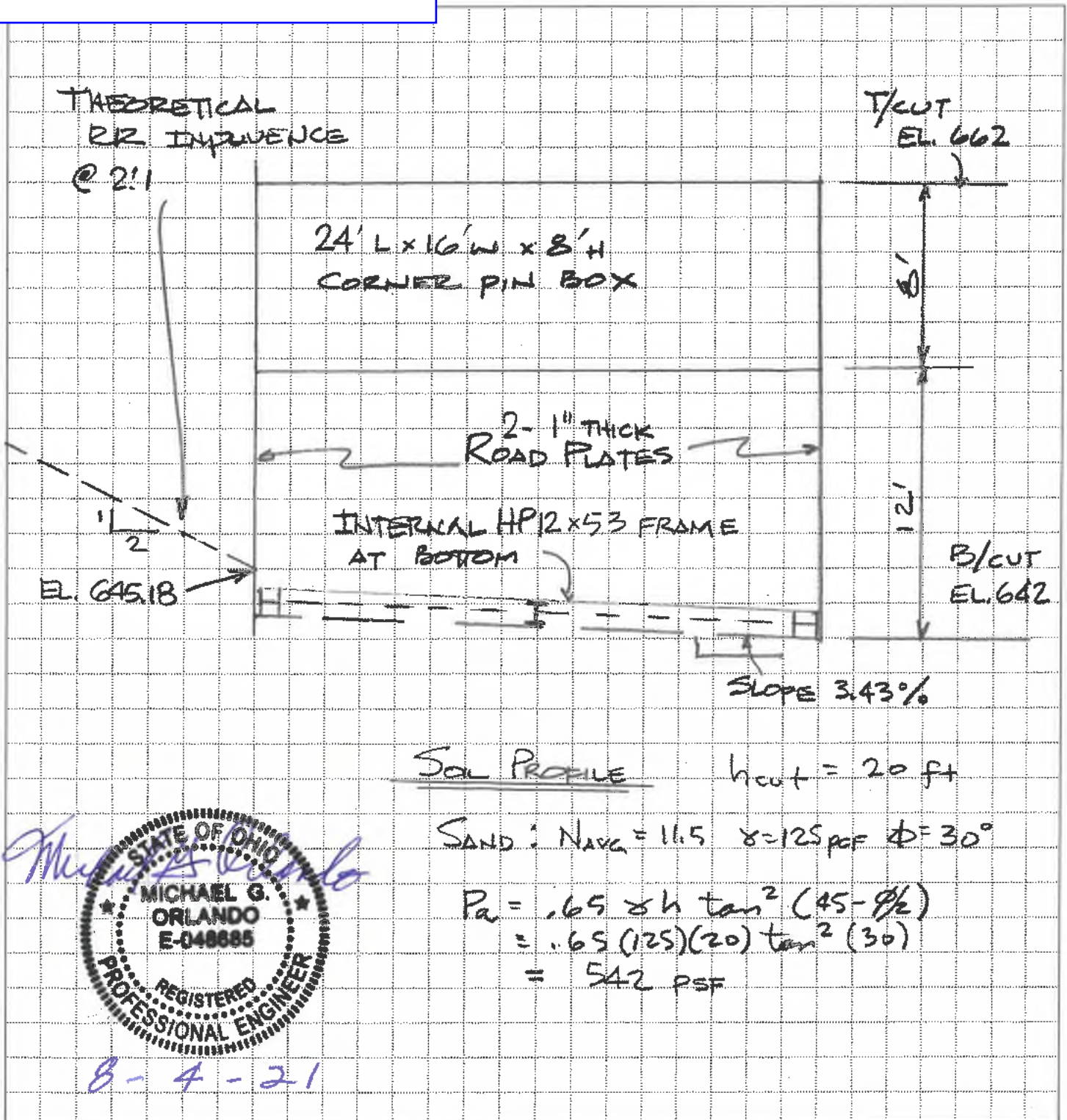
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LAUNCH PIT EXCAVATION

Project OC 3-D274 Date 8-4-21

Jack/Bore Launch Pit (near proposed structures D273-D274.

Submitted by MC70 Page 1 of 6 Pages





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Independence, Ohio 44131
Industrial & Commercial

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Fax 216-524-1701

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Jack/Bore Launch Pit (near proposed
structures D273-D274.

ate 8-4-21

Submitted by MGO Page 2 of 6 Pages

Added surcharge from RR Loading

T/RAIL = 665.47 ϕ TRACK TO FACE OF S.O.E = 52'

2:1 INFLUENCE LINE BEGINS 3'-7 1/4" BELOW T/RAIL
AND 14'-0 FROM ϕ TRACK

BEGIN INFLUENCE AT $665.47 - 3'-7 1/4" = 661.87$

SINCE S.O.E. AND RR @ 58.6° TO EACH OTHER

CLOSEST S.O.E. TO RR IS WEST CORNER OF PIT

DISTANCE = $52' - 14' - \frac{16'}{2} / \tan 58.6^\circ = 33.38 \text{ FT}$

@ 2:1 slope $\Delta_h = \frac{661.87 - 33.38}{2} = 645.18$

BOTTOM OF CUT @ NORTH FACE OF BOX IS $(42 + 24(.0343))$
 $= 642.82$

RR INFLUENCE INTERSECTS S.O.E. @ 2.36 FT ABOVE
BOTTOM OF CUT

SEE ATTACHED BOUSSINESQ CALCULATION FOR

RESULTING SURCHARGE PRESSURE

ϕ TRACK TO FACE S.O.E = $52 - \frac{16}{2} / \tan 58.6^\circ = 47.12 \text{ FT}$



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Jack/Bore Launch Pit (near proposed
structures D273-D274.

B-4-21

Submitted by MGO Page 3 of 6 Pages

Max. Lateral Pressure = 140.48 psf

Use 80% as uniform lateral pressure = 112.38 psf

TOTAL DESIGN PRESSURE =
542
+ 113
655 psf

PRESSURE ON CORNER PIN BOXES

= 8 FT + $\frac{1}{2}$ (DISTANCE FROM BOTTOM OF BOX TO
BOTTOM OF CUT)

= 8 FT + $\frac{12}{2}$ = 14 FT

LOAD ON BOX = $\frac{14 \times 655}{8}$ = 1146 psf USE MINIMUM BOX
RATING = 1146 psf

✓ REQUIRED PLATE THICKNESS

SPAN = 20' CUT - 8' BOX = 12'

$M = .655 \times 12^2 / 8 = 11.79 \text{ FT-K}$

$S_{REQ} = \frac{11.79 \times 12}{.6(36)} = 6.55 \text{ in}^3 = \frac{bd^2}{6}$

$d = \text{PLATE THICKNESS} = \sqrt{\frac{6 \times 6.55}{12}} = 1.8 \text{ USE } 2 - 1" \text{ PLATES}$



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Jack/Bore Launch Pit (near proposed
structures D273-D274.

Date 8-4-21

Submitted by MGO Page 4 of 6 Pages

TOE FRAME DESIGN

$$W = 655 \text{ PSF} \times 6' \text{ TRIB AREA} = 3,93 \text{ K/FT}$$

$$\text{SPAN} = 16' \quad M = \frac{3,93 \times 16^2}{8} = 125,76 \text{ FT-K}$$

$$SREQ = \frac{125,76 \times 12}{33} = 45,73$$

ASSUME BRACE AT MID-SPAN OF 24' SPAN

$$\text{AXIAL LOAD ON 16' LONG BEAM} = 6 \times 3,93 = 23,58 \text{ K}$$

$$\text{TRY HP 12x53} \quad A = 15,5 \quad r = 2,86 \quad S = 66,8$$

$$KL/r = \frac{16 \times 12}{2,86} = 67,13 \quad F_a = 21,467$$

$$\begin{aligned} F_a/F_a + F_b/F_b &= \frac{23,58}{15,5 \times 21,467} + \frac{45,73 \times 12}{33 \times 66,8} \\ &= 0,07 + 0,249 = 0,319 < 1,0 \text{ OK} \end{aligned}$$

✓ HP 12x53 AS CENTER STRUT

$$M = \phi \quad \text{AXIAL} = 3,93 \times 12 = 47,16 \text{ K} \quad \frac{KL}{r} = 67,13 \quad F_a = 21,467$$

$$F_a = \frac{47,16}{15,5} = 3,04 < 21,467 \text{ OK}$$

$L_2 = 51.37$ $L_1 = 42.87$

$$b = \tan^{-1}(L_2/H) - \tan^{-1}(L_1/H)$$

$q = 1882$ psf

Lateral pressure at depth below bottom of RR ties

H	$\tan^{-1}(L_2/H)$	$\tan^{-1}(L_1/H)$	b	br	sinb	a	cosa	br-sinbcosa	2q/p	SH
1	88.8848	88.6637	0.2210	0.0039	0.0039	88.7743	-0.9991	0.0077	1198.1184	9.24
2	87.7704	87.3289	0.4415	0.0077	0.0077	87.5497	-0.9963	0.0154	1198.1184	18.43
3	86.6577	85.9970	0.6607	0.0115	0.0115	86.3274	-0.9918	0.0230	1198.1184	27.52
4	85.5476	84.6694	0.8781	0.0153	0.0153	85.1085	-0.9855	0.0304	1198.1184	36.46
5	84.4407	83.3476	1.0932	0.0191	0.0191	83.8941	-0.9774	0.0377	1198.1184	45.20
6	83.3381	82.0327	1.3053	0.0228	0.0228	82.6854	-0.9676	0.0448	1198.1184	53.70
7	82.2403	80.7263	1.5140	0.0264	0.0264	81.4833	-0.9561	0.0517	1198.1184	61.93
8	81.1483	79.4296	1.7187	0.0300	0.0300	80.2889	-0.9431	0.0583	1198.1184	69.83
9	80.0627	78.1437	1.9190	0.0335	0.0335	79.1032	-0.9285	0.0646	1198.1184	77.38
10	78.9842	76.8698	2.1144	0.0369	0.0369	77.9270	-0.9125	0.0706	1198.1184	84.55
11	77.9136	75.6090	2.3047	0.0402	0.0402	76.7613	-0.8951	0.0762	1198.1184	91.32
12	76.8515	74.3622	2.4893	0.0434	0.0434	75.6069	-0.8764	0.0815	1198.1184	97.66
13	75.7985	73.1305	2.6681	0.0466	0.0465	74.4645	-0.8565	0.0864	1198.1184	103.56
14	74.7553	71.9146	2.8407	0.0496	0.0496	73.3349	-0.8355	0.0910	1198.1184	109.01
15	73.7222	70.7153	3.0069	0.0525	0.0525	72.2188	-0.8135	0.0952	1198.1184	114.00
16	72.7000	69.5334	3.1666	0.0553	0.0552	71.1167	-0.7905	0.0989	1198.1184	118.54
17	71.6889	68.3693	3.3196	0.0579	0.0579	70.0291	-0.7667	0.1023	1198.1184	122.61
18	70.6896	67.2237	3.4659	0.0605	0.0605	68.9567	-0.7421	0.1054	1198.1184	126.23
19	69.7023	66.0971	3.6052	0.0629	0.0629	67.8997	-0.7169	0.1080	1198.1184	129.40
20	68.7274	64.9897	3.7377	0.0652	0.0652	66.8586	-0.6911	0.1103	1198.1184	132.14
21	67.7653	63.9019	3.8634	0.0674	0.0674	65.8336	-0.6648	0.1122	1198.1184	134.45
22	66.8162	62.8340	3.9822	0.0695	0.0694	64.8251	-0.6381	0.1138	1198.1184	136.36
23	65.8804	61.7862	4.0942	0.0715	0.0714	63.8333	-0.6111	0.1151	1198.1184	137.89

24	64.9581	60.7585	4.1996	0.0733	0.0732	62.8583	-0.5838	0.1160	1198.1184	139.04
25	64.0494	59.7510	4.2984	0.0750	0.0750	61.9002	-0.5563	0.1167	1198.1184	139.84
26	63.1546	58.7638	4.3907	0.0766	0.0766	60.9592	-0.5287	0.1171	1198.1184	140.31
27	62.2736	57.7968	4.4768	0.0781	0.0781	60.0352	-0.5011	0.1172	1198.1184	140.48
28	61.4067	56.8499	4.5568	0.0795	0.0794	59.1283	-0.4734	0.1171	1198.1184	140.35
29	60.5539	55.9231	4.6308	0.0808	0.0807	58.2385	-0.4458	0.1168	1198.1184	139.96
30	59.7151	55.0161	4.6991	0.0820	0.0819	57.3656	-0.4184	0.1163	1198.1184	139.33
31	58.8905	54.1287	4.7618	0.0831	0.0830	56.5096	-0.3910	0.1156	1198.1184	138.47
32	58.0799	53.2608	4.8191	0.0841	0.0840	55.6703	-0.3639	0.1147	1198.1184	137.40
33	57.2834	52.4120	4.8713	0.0850	0.0849	54.8477	-0.3370	0.1136	1198.1184	136.15
34	56.5008	51.5822	4.9186	0.0858	0.0857	54.0415	-0.3104	0.1125	1198.1184	134.74
35	55.7322	50.7711	4.9611	0.0866	0.0865	53.2516	-0.2841	0.1112	1198.1184	133.18
36	54.9773	49.9782	4.9991	0.0873	0.0871	52.4778	-0.2581	0.1097	1198.1184	131.48
37	54.2361	49.2034	5.0328	0.0878	0.0877	51.7197	-0.2324	0.1082	1198.1184	129.67
38	53.5085	48.4462	5.0623	0.0884	0.0882	50.9774	-0.2071	0.1066	1198.1184	127.76
39	52.7943	47.7064	5.0879	0.0888	0.0887	50.2503	-0.1822	0.1050	1198.1184	125.76
40	52.0934	46.9835	5.1099	0.0892	0.0891	49.5384	-0.1578	0.1032	1198.1184	123.69
41	51.4055	46.2773	5.1283	0.0895	0.0894	48.8414	-0.1337	0.1015	1198.1184	121.56
42	50.7306	45.5873	5.1433	0.0898	0.0896	48.1590	-0.1100	0.0996	1198.1184	119.37
43	50.0685	44.9133	5.1552	0.0900	0.0899	47.4909	-0.0868	0.0978	1198.1184	117.15
44	49.4189	44.2547	5.1642	0.0901	0.0900	46.8368	-0.0641	0.0959	1198.1184	114.90
45	48.7817	43.6114	5.1703	0.0902	0.0901	46.1966	-0.0418	0.0940	1198.1184	112.63
46	48.1567	42.9829	5.1738	0.0903	0.0902	45.5698	-0.0199	0.0921	1198.1184	110.34
47	47.5436	42.3688	5.1748	0.0903	0.0902	44.9562	0.0015	0.0902	1198.1184	108.05
48	46.9424	41.7688	5.1735	0.0903	0.0902	44.3556	0.0225	0.0883	1198.1184	105.75
49	46.3527	41.1826	5.1700	0.0902	0.0901	43.7676	0.0430	0.0864	1198.1184	103.47
50	45.7743	40.6098	5.1645	0.0901	0.0900	43.1920	0.0631	0.0845	1198.1184	101.19
										5449.42

[illegible]

Jack/Bore Launch Pit (near proposed structures D273-D274.

PID: 96833	STR ID:	PROJECT: CUY-10-21.49	STATION / OFFSET: 89+02, 246' LT.			START:														
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS		SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	BACK FILL
		657.7								GR	CS	FS	SI	CL	LL	PL	PI			
LOOSE TO MEDIUM DENSE, BROWN AND DARK BROWN, COARSE AND FINE SAND , LITTLE FINES, LITTLE CINDERS, FILL, MOIST (continued)		654.2	W	31																
				32																
				33																
MEDIUM DENSE, DARK BROWN AND BLACK, SLAG AND CINDERS WITH SAND , LITTLE FINES, FILL, WET		649.2		34	3	4	13	89	SS-9	--	40	12	28	17	3	NP	NP	NP	26	A-1-b (0)
				35		7														
				36																
				37																
		649.2		38																
STIFF TO HARD, GRAY, PLASTIC SILT , "AND" CLAY, TRACE SAND, TRACE STONE FRAGMENTS, WET TO MOIST				39	3	4	12	89	SS-10	1.00	-	-	-	-	-	-	-	22	A-4b (V)	
				40		6														
				41																
				42																
				43																
@43.5'; STIFF, MOIST			▼	44																
@43.5'; PUSHED SHELBY TUBE, MOIST				45			96		ST-11	--	1	0	8	56	35	24	16	8	17	A-4b (8)
				46																
				47																
				48																
@48.5'; HARD, MOIST				49	12	17	44	100	SS-12	3.50	-	-	-	-	-	-	-	-	16	A-4b (V)
		637.7	EOB	50		20														

NOTES: GROUNDWATER WAS ENCOUNTERED AT A DEPTH OF 34.0' DURING DRILLING AND AT 43.9' UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH 2.0 BAGS SOIL CUTTINGS/BENTONITE PELLETS

Excavation for Structure D-273A



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D-273A

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D273-A
DOGHOUSE MANHOLE

Project OC 3

Date 5-28-21

SUPPORT OF EXCAVATION

Submitted by MGO

Page 1 of 4 Pages

CUT EXISTING SLOPE TO BENCH AT ELEV. 664

SOIL PROFILE & JOB CONSTRAINTS

664 - 649 SAND $N=11$ $\phi=30^\circ$ $\gamma=120$

649 - 639 CLAY $N=10$ $C=500$ $\gamma=125$

639 - 609 CLAY $N=32$ $C=1500$ $\gamma=130$

\pm RR IS 16'-0" FROM ^{SOUTH} FACE OF SHEET PILE

T/RAIL IS ELEV. 665.47

INSTALL SHEET PILE 3 SIDES (SOUTH, WEST, EAST)

USE 3" HARDWOOD LAGGING TO SPAN GAP IN

SHEET PILE AT SOUTH FACE (ABOVE EXISTING 36" ϕ

PIPE), LID OF NEW MANHOLE ELEV. 658.

INSTALL WALER @ ELEV. 660. BOTTOM OF CUT 647.





D-273A:

Sheet pile selection formula based on data provided on pages 30 & 31.

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Project D-273 A Date 5-28-21
Submitted by MGO Page 2 of 4 Pages

LOAD ON SHEET PILES 350 IN-KIPS

TRY SKZ 20 GRADE 50 $F_b = 33 \text{ ksi}$ $S = 31.69 \text{ in}^3$

$$f_b = M/S = 350/31.69 = 11.04 \text{ ksi} < 33 \text{ OK}$$

SIZE WALKER

SOUTH WALKER 13.4 K/FT 6'-6" SPAN
+ 13.4 K/FT X 5'-6" AXIAL

$$13.4 \times 6.5^2/8 + 13.4(5.5) = 70.8 \text{ FT-K} + 73.7 \text{ K}$$

TRY HP 12X53 $A = 15.5 \text{ in}^2$ $r = 2.86 \text{ in}$ $S = 66.8 \text{ in}^3$

$$L/r = \frac{6.5 \times 12}{2.86} = 27.27 \quad F_a = 27.48$$

$$\frac{F_a}{F_a} + \frac{F_b}{F_b} < 1 \quad \frac{73.7}{15.5 \times 27.48} + \frac{70.8 \times 12}{33 \times 66.8} = 0.173 + 0.385 = .558 < 1 \text{ OK}$$

TRY HP 10X42 $A = 12.4$ $r = 2.41$ $S = 43.4$

$$L/r = 78/2.41 = 32.365 \quad F_a = 26.85$$

$$\frac{73.7}{12.4 \times 26.85} + \frac{70.8 \times 12}{33 \times 43.4} = .221 + .593 = .814 < 1 \text{ OK} \checkmark$$



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Project OC3
D-273 A Date 5-28-21
Submitted by MGB Page 3 of 4 Pages

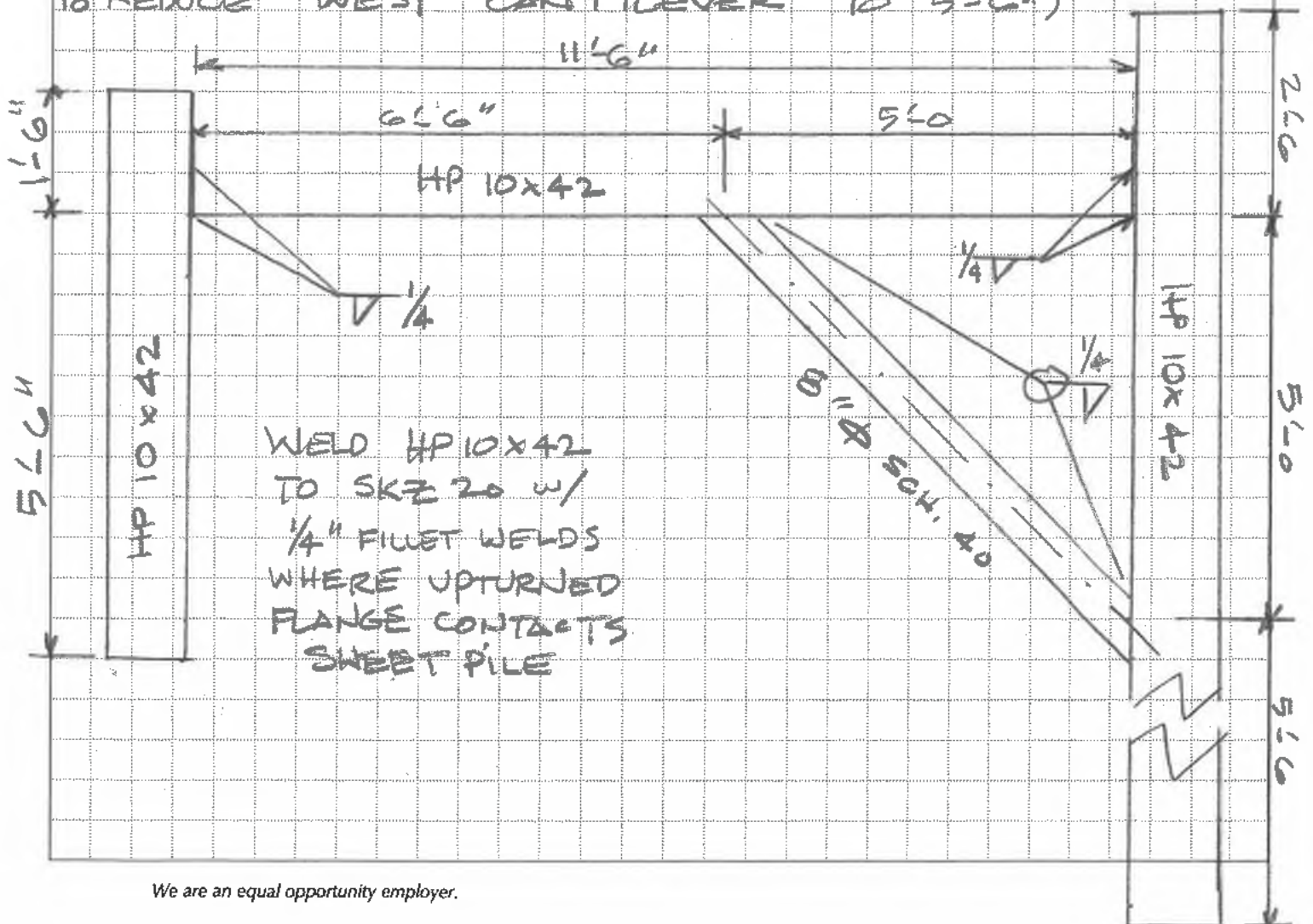
LOAD ON WALER = 13.4 K/FT

SOUTH WALER $L = 13'-6" - 1'-0" - 1'-0" = 11'-6"$

EAST WALER $L = 7'-0"$ (5'-6" IS CANTILEVERED)

WEST WALER $L = 13'-0"$ (10'-6" IS CANTILEVERED)

ADD CORNER BRACE AT S.W. CORNER
TO REDUCE WEST CANTILEVER TO 5'-6"





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Project OC3
D 273 A Date 5-28-21
Submitted by MGO Page 4 of 4 Pages

SIZE STRUT

$$\text{LOAD} = 13.4 \left(\frac{6.5}{2} + \frac{5.0}{2} \right) \sqrt{2} = 109 \text{ kips}$$

$$L = 5\sqrt{2} = 7.07 \text{ FT}$$

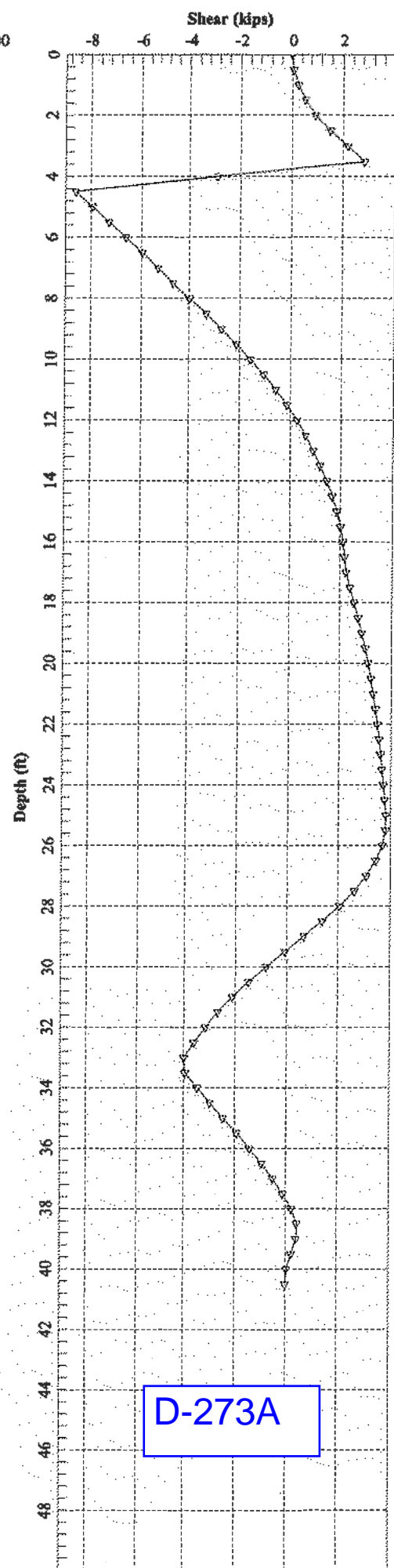
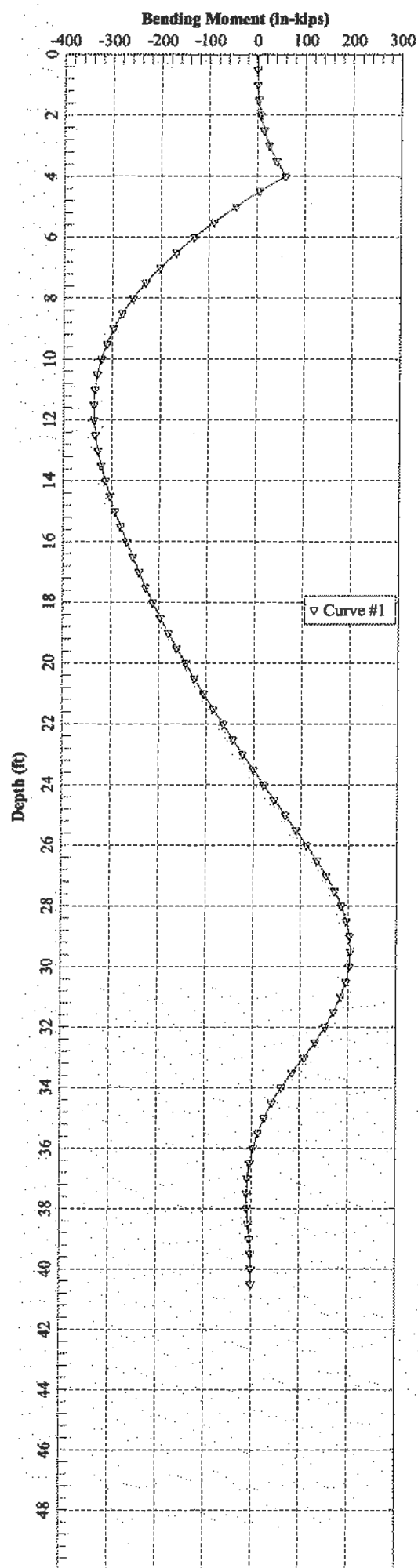
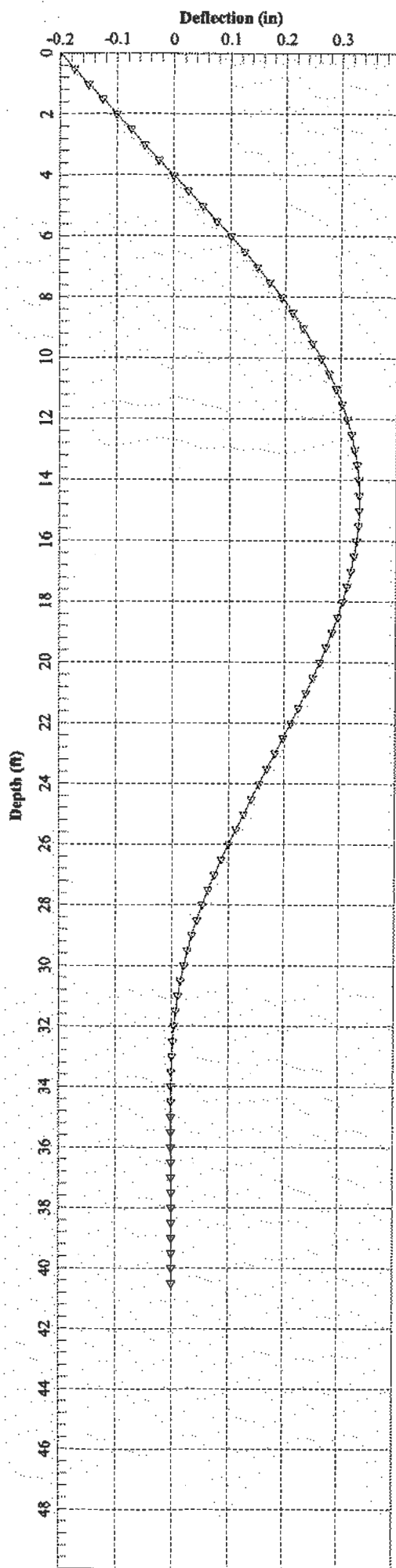
8" ϕ SCH. 40 PIPE OK FOR 106 KIPS @ 8'-0"

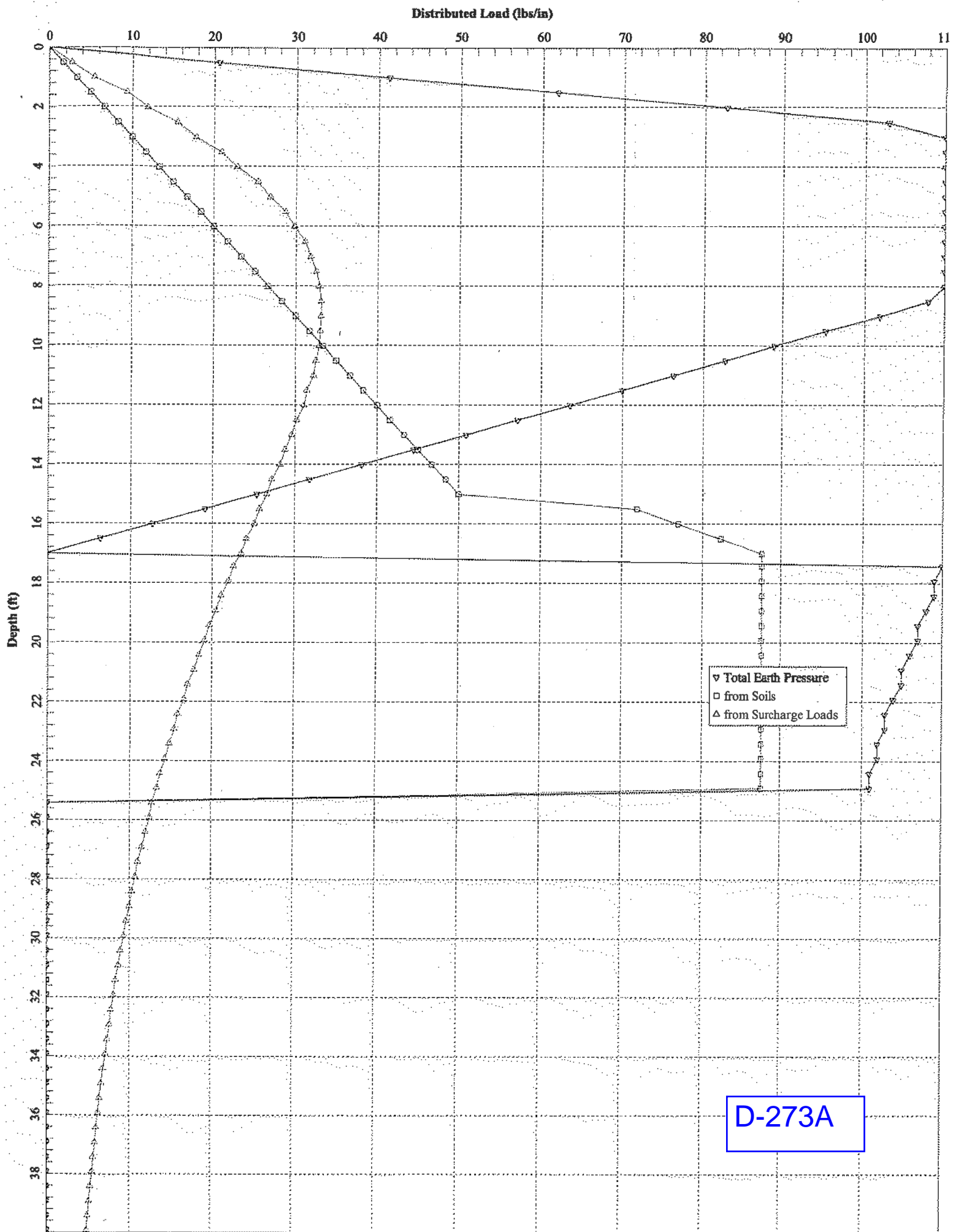
SUMMARY

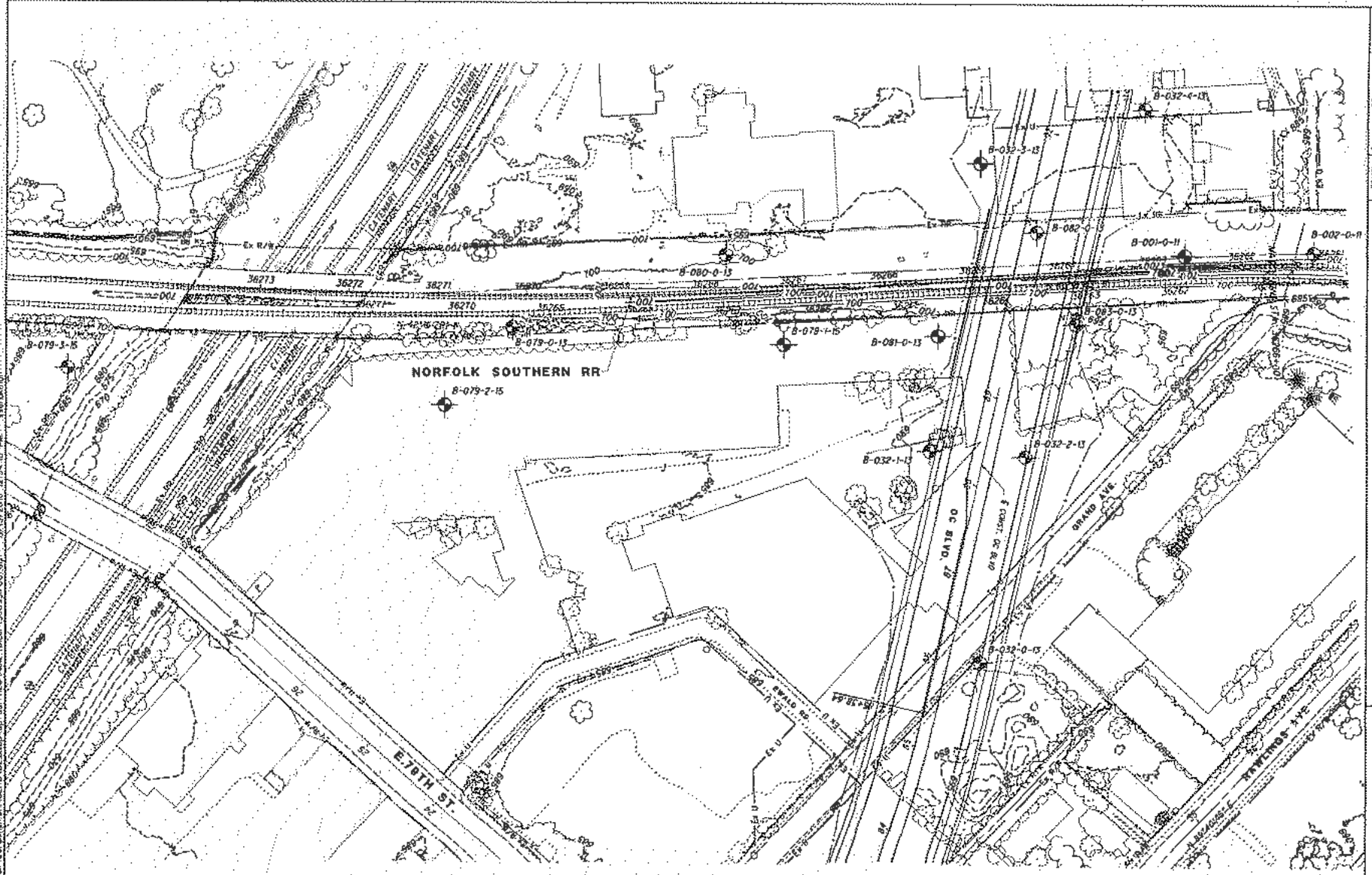
SKZ 20 SHEETS @ 40'-0" LONG

HP 10x42 WALER (WELD TO SHEETS)

8" ϕ SCH. 40 PIPE STRUT







BORING LOCATION PLAN
NORFOLK SOUTHERN RR

CUY-10-21.49

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT GDT - 8/31/18 11:45 - I:\GEO\TECH\SERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\18 PROJECTS\160000 HNTB-OC-

PID: 96833	STR ID:	PROJECT: CUY-10-21.49	STATION / OFFSET: 89+02, 246' LT.			START: 4/12/16	END: 4/12/16	PG 2 OF 2			B-079-3-15											
MATERIAL DESCRIPTION AND NOTES			ELEV.	DEPTHS		SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	BACK FILL	
			657.7								GR	CS	FS	SI	CL	LL	PL	PI	WC			
LOOSE TO MEDIUM DENSE, BROWN AND DARK BROWN, COARSE AND FINE SAND, LITTLE FINES, LITTLE CINDERS, FILL, MOIST (continued)			654.2	w	31																	
					32																	
					33																	
					34	3	4	13	89	SS-9	-	40	12	28	17	3	NP	NP	NP	26	A-1-b (0)	
MEDIUM DENSE, DARK BROWN AND BLACK, SLAG AND CINDERS WITH SAND, LITTLE FINES, FILL, WET			649.2		35																	
					36																	
					37																	
					38																	
STIFF TO HARD, GRAY, PLASTIC SILT, "AND" CLAY, TRACE SAND, TRACE STONE FRAGMENTS, WET TO MOIST			637.7	v	39	3	4	12	89	SS-10	1.00	-	-	-	-	-	-	-	22	A-4b (V)		
					40		6															
					41																	
					42																	
					43																	
@43.5'; STIFF, MOIST					44				96	ST-11	-	1	0	8	56	35	24	16	8	17	A-4b (8)	
@43.5'; PUSHED SHELBY TUBE, MOIST					45																	
					46																	
					47																	
					48																	
@48.5'; HARD, MOIST			49	12	17	44	100	SS-12	3.50	-	-	-	-	-	-	-	-	16	A-4b (V)			
			637.7	FOR	50																	

EOB

NOTES: GROUNDWATER WAS ENCOUNTERED AT A DEPTH OF 34.0' DURING DRILLING AND AT 43.9' UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACK-FILLED WITH 2.0 BAGS SOIL CUTTINGS/BENTONITE PELLETS



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OC3-

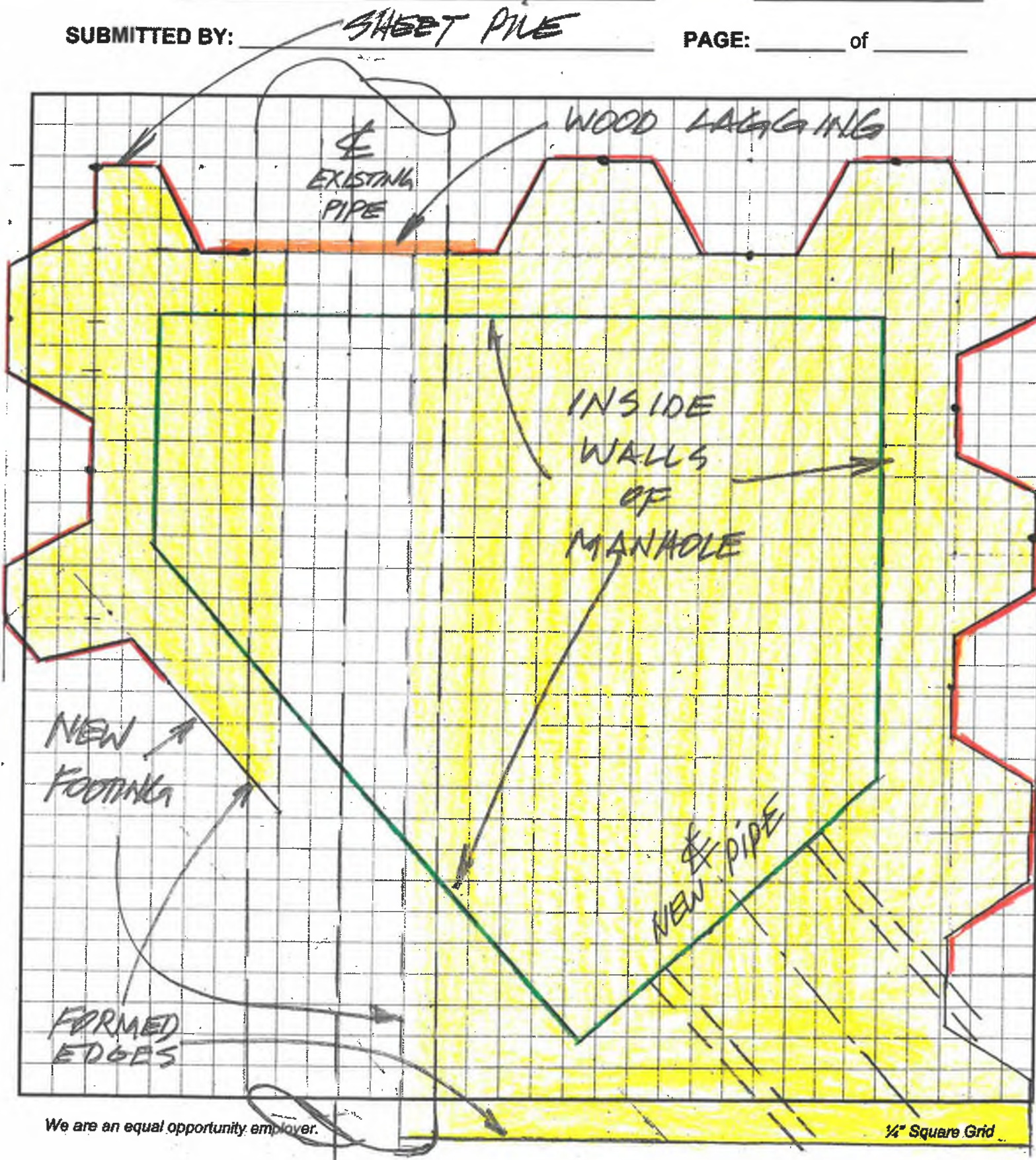
D-273A

PROJECT: _____

DATE: _____

SUBMITTED BY: _____

PAGE: _____ of _____



Norfolk Southern

Lateral Pressures from Coopers E-80 Train Loads

The Boussinesq Equation for strip loads is shown in the AREMA Manual for Railway Engineering, Chapter 8, Section 20.3.2.2

Boussinesq Equation:

$$P_s = (2q/\pi) \{ \beta + (\sin \beta) (\sin^2 \alpha) - (\sin \beta) (\cos^2 \alpha) \}$$

Where:

P_s = Active Pressure from Surcharge Loading

$\beta = \{ \text{atan}(\text{CLT} + \text{TL}/2) / H_s - \text{atan}(\text{CLT} - \text{TL}/2) / H_s \}$ IN RADIANS

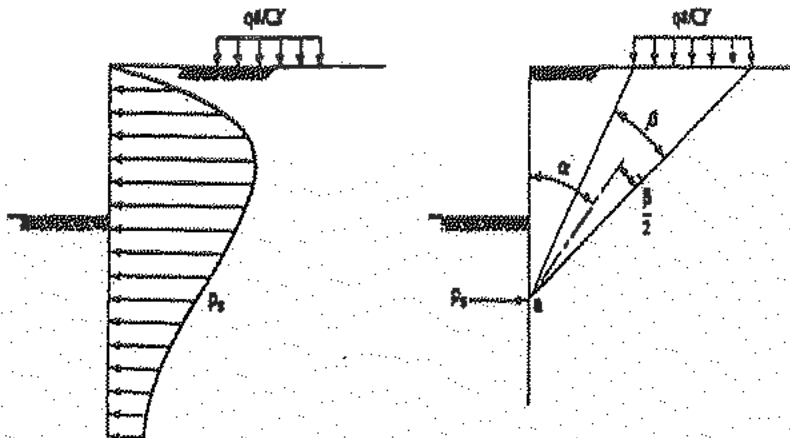
$\alpha = \beta/2 + \text{atan}(\text{CLT} - \text{TL}/2) / H_s$ IN RADIANS

q = uniform surcharge load from trains = 80 kips/(5) (TL)

CLT = Distance from face of retaining wall to centerline of track

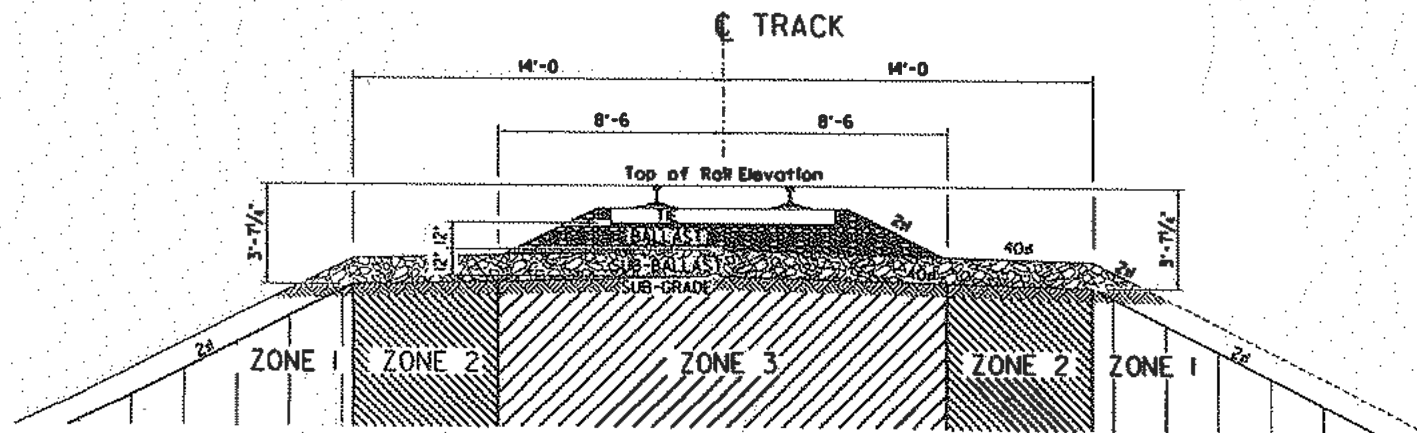
TL = Tie Length = 8.5' standard

H_s = Depth below applied surcharge loading



The attached Table 1 provides the resultant lateral pressures for various depths and distances from centerline of track. Three representative pressure curves are also shown on the attached graph.

For a simplified engineering analysis, the railroad loading surcharge pressure may be assumed rectangular with width (P) equal to 0.8 of the maximum pressure ordinate as given by the appropriate railroad curve.



ROADBED PROFILE - SHORING REQUIREMENTS

- ZONE 1 Excavation within zone 1 will require shoring for the protection of the Railroad
- ZONE 2 Excavation within zone 2 will require shoring consist of interlocking sheeting for the protection of the Railroad
- ZONE 3 NO EXCAVATIONS WILL BE ALLOWED IN ZONE 3

NOTE: Excavations outside of Zone 1 may require shoring for safety. Lateral pressures due to train loadings do not effect shoring design outside of zone 1

NORFOLK SOUTHERN CORP
STANDARD OVERHEAD
BRIDGE DETAILS
 SHORING REQUIREMENTS

OFFICE OF CHIEF ENGINEER BRIDGES & STRUCTURES

FEBRUARY, 1998

SHEET 4

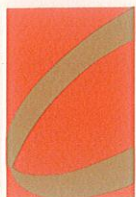
Table 1 - Lateral Pressure from E-80 Train Loads
(From Boussinesq Equation)

		Depth (Feet)											
		0	-2	-4	-6	-8	-10	-12	-14	-16	-18	-20	
"CLT" (Distance From Centertine of Track in Feet)	8	0	0.700	0.346	0.132	0.056	0.039	0.033	0.025	0.019	0.015	0.012	.51
	9	0	0.550	0.246	0.098	0.035	0.024	0.020	0.015	0.011	0.008	0.006	.57
	10	0	0.441	0.190	0.069	0.029	0.018	0.015	0.011	0.008	0.005	0.004	.59
	11	0	0.361	0.155	0.055	0.023	0.014	0.012	0.009	0.006	0.004	0.003	.69
	12	0	0.301	0.132	0.045	0.019	0.011	0.009	0.007	0.005	0.003	0.002	.69
	14	0	0.218	0.098	0.032	0.013	0.008	0.006	0.005	0.003	0.002	0.001	.74
	16	0	0.165	0.074	0.025	0.010	0.006	0.004	0.003	0.002	0.001	0.001	.78
	18	0	0.130	0.059	0.020	0.008	0.005	0.003	0.002	0.001	0.001	0.000	.80
	20	0	0.104	0.046	0.016	0.006	0.004	0.002	0.001	0.001	0.000	0.000	.81
	23	0	0.078	0.034	0.012	0.005	0.003	0.001	0.001	0.000	0.000	0.000	.81
	26	0	0.061	0.027	0.010	0.004	0.002	0.001	0.000	0.000	0.000	0.000	.79
	29	0	0.049	0.021	0.008	0.003	0.001	0.000	0.000	0.000	0.000	0.000	.73
	32	0	0.040	0.017	0.006	0.002	0.001	0.000	0.000	0.000	0.000	0.000	.74
	35	0	0.034	0.014	0.005	0.002	0.001	0.000	0.000	0.000	0.000	0.000	.72
	39	0	0.027	0.011	0.004	0.001	0.000	0.000	0.000	0.000	0.000	0.000	
	43	0	0.022	0.009	0.003	0.001	0.000	0.000	0.000	0.000	0.000	0.000	
	47	0	0.019	0.007	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	
	51	0	0.016	0.006	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	55	0	0.014	0.005	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

All pressures shown are in kips per sq. ft.

Boxed values represent the maximum pressure ordinate for each value of "CLT".

Open Cut installation of Conduit
D-270 to D-271 to D-272



Co-Pipe Products, Inc.

20501 Goddard Road
Taylor, Michigan 48180
Tel. 734•287•1000
800•521•3514
Fax 734•287•8132

August 5, 2021

Independence Excavating, Inc.

5720 E. Schaaf Rd.

Independence, Ohio

44131

ATTENTION: Mr. Matt Gillilan

REFERENCE: ODOT 173000 Opportunity Corridor Section 3 – Outfall #4 Open cut

Dear Mr Gillilan:

As requested we have reviewed your installation and backfill plan using #57 limestone which is attached. We feel that this is acceptable for use in the backfilling of our 36" RCP CL 3.




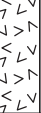



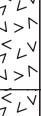


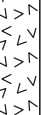





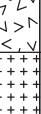








Should you have any questions or require additional information please contact the undersigned.

Yours Truly,

Co-Pipe Products Inc.




Wesley Bailey

PROJECT: <u>OPPORT. CORRIDOR-SECT. 3</u>	DRILLING FIRM / OPERATOR: <u>PGI / ZEKE</u>	DRILL RIG: <u>CME 45B TRUCK</u>	STATION / OFFSET: <u>36270+15, 12' LT.</u>	EXPLORATION ID
TYPE: <u>ROADWAY/SEWER</u>	SAMPLING FIRM / LOGGER: <u>PGI / S. PRATT</u>	HAMMER: <u>CME AUTOMATIC</u>	ALIGNMENT: <u>PHA 3 NS TRACK WEST BL</u>	B-079-0-13
PID: <u> </u> STR ID: <u> </u>	DRILLING METHOD: <u>3.25" HSA</u>	CALIBRATION DATE: <u>2/17/14</u>	ELEVATION: <u>699.8 (MSL)</u> EOB: <u>20.0 ft.</u>	PAGE
START: <u>6/9/14</u> END: <u>6/9/14</u>	SAMPLING METHOD: <u>SPT</u>	ENERGY RATIO (%): <u>61.8</u>	COORD: <u>41.485678, 81.630845</u>	1 OF 1

MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	BACK FILL		
									GR	CS	FS	SI	CL	LL	PL	PI					
TOPSOIL (6" THICK)		699.8 699.3	W	1		6	11	33	SS-1	--	-	-	-	-	-	-	-	13	A-3a (V)		
MEDIUM DENSE, BLACK, COARSE AND FINE SAND , (FOUNDRY SAND), LITTLE FINES, FILL, MOIST		696.3		2																	5
VERY LOOSE, LIGHT GRAY, NON-PLASTIC SANDY SILT , TRACE STONE FRAGMENTS, FILL, DAMP		693.8		3		2	4	22	SS-2	--	-	-	-	-	-	-	-	4	A-4a (V)		
		691.3		4																	3
VERY LOOSE, DARK BROWN, STONE AND BRICK FRAGMENTS WITH SAND , LITTLE FINES, FILL, WET		691.3		5		3	4	56	SS-3	--	49	17	18	11	5	NP	NP	NP	21	A-1-b (0)	
		683.8		6																	
VERY LOOSE, RED, BRICK FRAGMENTS , FILL, WET		683.8		7		3	3	61	SS-4	--	-	-	-	-	-	-	-	20	A-1-a (V)		
		681.3		8																	2
@11.0'; LOOSE, WITH SAND LAYER		681.3		9		4	5	61	SS-5	--	-	-	-	-	-	-	-	22	A-1-a (V)		
		679.8		10																	3
@13.5'; LOOSE		679.8		11		3	6	17	SS-6	--	-	-	-	-	-	-	-	21	A-1-a (V)		
		677.8		12																	4
LOOSE, BROWN, NON-PLASTIC SILT , SOME SAND, WET		677.8		13		1	6	100	SS-7	--	0	0	26	67	7	NP	NP	NP	24	A-4b (8)	
		675.8		14																	
DENSE, BROWN, COARSE AND FINE SAND , LITTLE FINES, WET		675.8		15		13	34	100	SS-8	--	-	-	-	-	-	-	-	20	A-3a (V)		
		673.8		16																	18

NOTES: GROUNDWATER WAS ENCOUNTERED AT A DEPTH OF 6.0' DURING DRILLING AND AT 19.0' UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH SOIL CUTTINGS

PID: 96833	STR ID:	PROJECT: CUY-10-21.49	STATION / OFFSET: 86+93, 1022' LT.				START: 4/4/16	END: 4/5/16	PG 2 OF 2		B-079-1-15											
MATERIAL DESCRIPTION AND NOTES			ELEV. 655.7	DEPTHS		SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	BACK FILL	
											GR	CS	FS	SI	CL	LL	PL	PI				
STIFF TO HARD, GRAY, SANDY SILT , LITTLE TO "AND" CLAY, W/INTERBEDDED SILT SEEMS, NO TO TRACE STONE FRAGMENTS, MOIST TO DAMP (continued)				31																	<LV>	
				32																	<LV>	
				33																		<LV>
				34	8	10	26	100	SS-9	2.50	1	2	8	44	45	27	17	10	19	A-4a (8)	<LV>	
				35		12															<LV>	
@33.5'; VERY STIFF, "AND" CLAY				36																	<LV>	
				37																	<LV>	
				38																		<LV>
				39	13	16	39	94	SS-10	-	-	-	-	-	-	-	-	12	Rock (V)	<LV>		
				40		17															<LV>	
SHALE, GRAY, SEVERELY WEATHERED.				647.2	TR																<LV>	
				645.7	EOB																<LV>	

NOTES: GROUNDWATER WAS ENCOUNTERED AT A DEPTH OF 13.5' DURING DRILLING AND AT 22.0' UPON COMPLETION OF DRILLING OPERATIONS. AFTER 12.0 HOURS AT 15.0 FEET.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH SOIL CUTTINGS

PROJECT: <u>OPPORT. CORRIDOR-SEC. 3</u>		DRILLING FIRM / OPERATOR: <u>PSI / JR</u>		DRILL RIG: <u>DIEDRICH D-50 TRUCK</u>		STATION / OFFSET: <u>89+51, 80' LT.</u>		EXPLORATION ID <u>B-081-0-13</u>												
TYPE: <u>BRIDGE CONSTRUCTION</u>		SAMPLING FIRM / LOGGER: <u>PGI / W. NAJJAR</u>		HAMMER: <u>DIEDRICH AUTOMATIC</u>		ALIGNMENT: <u>OC BASELINE</u>		PAGE 1 OF 2												
PID: <u>96833</u> STR ID: <u></u>		DRILLING METHOD: <u>3.25" HSA</u>		CALIBRATION DATE: <u>7/10/13</u>		ELEVATION: <u>687.4 (MSL)</u> EOB: <u>43.5 ft.</u>														
START: <u>12/9/13</u> END: <u>12/9/13</u>		SAMPLING METHOD: <u>SPT / ST / NX</u>		ENERGY RATIO (%): <u>98.3</u>		COORD: <u>41.484700, 81.629696</u>														
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS		SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	BACK FILL
		687.4								GR	CS	FS	SI	CL	LL	PL	PI	WC		
CONCRETE PAVEMENT (5" THICK)		687.0																		
VERY DENSE, BROWN AND BLACK, NON-PLASTIC SANDY SILT , LITTLE CINDERS, FILL, DAMP			1		4	51	78	SS-1	--	-	-	-	-	-	-	-	-	14	A-4a (V)	
			2		12	19														
		683.9	3																	
VERY STIFF, MOTTLED GREENISH BROWN AND GRAY, SILTY CLAY , TRACE SAND, TRACE STONE FRAGMENTS, MOIST		682.9	4		4	6	23	100	SS-2A	2.50	1	2	3	64	30	36	16	20	22	A-6b (12)
			5			8			SS-2B	-	-	-	-	-	-	-	-	10	A-4a (V)	
MEDIUM DENSE TO LOOSE, BROWN, NON-PLASTIC SANDY SILT , MOIST TO WET			6		5															
@4.0'; LITTLE STONE FRAGMENTS, WET			7		7	7	23	100	SS-3	3.00	-	-	-	-	-	-	-	19	A-4a (V)	
			8																	
@8.5'; LOOSE, WET			9		2															
			10		2	4	10	100	SS-4	--	0	2	62	33	3	NP	NP	NP	26	A-4a (0)
		676.4	11																	
MEDIUM DENSE, BROWN, FINE SAND , TRACE FINES, TRACE STONE FRAGMENTS, WET			12		4	3	13	100	SS-5	--	1	2	91	5	1	NP	NP	NP	28	A-3 (0)
		673.9	13			5														
VERY LOOSE, GRAY, NON-PLASTIC SILT , TRACE SAND, WET			14		3															
			15		1	1	3	89	SS-6	--	-	-	-	-	-	-	-	26	A-4b (V)	
		671.4	16																	
VERY STIFF, GRAY, PLASTIC SILT , SOME CLAY, TRACE SAND, MOIST			17		6	6	23	100	SS-7	1.00	-	-	-	-	-	-	-	15	A-4b (V)	
			18			8														
VERY STIFF TO HARD, GRAY, SILT AND CLAY , LITTLE SAND, TRACE STONE FRAGMENTS, MOIST TO DAMP		668.9	19		5	5	20	100	SS-8	3.50	-	-	-	-	-	-	-	17	A-6a (V)	
			20			7														
@21.0'; HARD, TRACE SAND, DAMP			21																	
@21.0'; PUSHED SHELBY TUBE, U.C. STRENGTH = 4909 PSF			22					88	ST-9	4.5+	1	3	7	46	43	27	16	11	16	A-6a (8)
		663.9	23																	
HARD, GRAY, SILT AND CLAY , LITTLE SAND, LITTLE SHALE FRAGMENTS, WITH NON-PLASTIC SANDY SILT SEAMS, DAMP			24		7	9	38	100	SS-10	4.5+	-	-	-	-	-	-	-	12	A-6a (V)	
			25			14														
			26																	
			27																	
		658.9	28																	
SHALE , DARK GRAY, SEVERELY WEATHERED.			29		50/3"	-	100	SS-11	--	-	-	-	-	-	-	-	-	3	Rock (V)	

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 10/12/16 18:42 - \\GEOTECHSERVER\SHARED FOLDERS\COMPANY\PUBLIC\PROJECT FILES\13 PROJECTS\G13018G OPPURN

PID: 96833	STR ID:	PROJECT: OPPORT. CORRIDOR-SEC. 3	STATION / OFFSET: 89+51, 80' LT.		START: 12/9/13		END: 12/9/13		PG 2 OF 2		B-081-0-13										
MATERIAL DESCRIPTION AND NOTES			ELEV.	DEPTHS		SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	BACK FILL
			657.4								GR	CS	FS	SI	CL	LL	PL	PI	WC		
SHALE, DARK GRAY, SEVERELY WEATHERED. (continued)			653.9	31																	
NOTE: AUGERED TO 33.5' AND BEGAN CORING ROCK				32																	
				33																	
SHALE, DARK GRAY, HIGHLY TO MODERATELY WEATHERED, SLIGHTLY STRONG, LAMINATED TO VERY THIN BEDDED, HIGHLY TO MODERATELY FRACTURED, TIGHT TO NARROW, SLIGHTLY ROUGH.			643.9	34		33		96	NX-1												CORE
				35																	
				36																	
				37																	
				38																	
				39																	
				40																	
				41																	
				42																	
				43																	
POINT LOAD INDEX = 175 PSI, COMPRESSIVE STRENGTH = 2100 PSI																					

PROJECT: OPPORT. CORRIDOR-SEC. 3		DRILLING FIRM / OPERATOR: PSI / DAVE		DRILL RIG: DIEDRICH D-50 TRUCK		STATION / OFFSET: 88+25, 60' LT.		EXPLORATION ID												
TYPE: ROADWAY/SEWER		SAMPLING FIRM / LOGGER: PGI / W. NAJJAR		HAMMER: DIEDRICH AUTOMATIC		ALIGNMENT: OC BASELINE		B-032-1-13												
PID: 96833 STR ID:		DRILLING METHOD: 3.25" HSA		CALIBRATION DATE: 7/10/13		ELEVATION: 686.7 (MSL) EOB: 35.2 ft.		PAGE												
START: 12/16/13 END: 12/16/13		SAMPLING METHOD: SPT		ENERGY RATIO (%): 98.3		COORD: 41.484482, 81.630058		1 OF 2												
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	BACK FILL	
LOOSE TO DENSE, BLACK TO DARK BROWN, CINDERS AND COAL FRAGMENTS WITH SAND, LITTLE FINES, FILL, MOIST		686.7	1	1																
			2	2	7	100	SS-1	--	-	-	-	-	-	-	-	-	13	A-1-b (V)		
			3																	
@3.5'; DENSE, DARK BROWN			4	11	15	39	100	SS-2	--	-	-	-	-	-	-	-	-	13	A-1-b (V)	
			5	9																
DENSE TO LOOSE, DARK BROWN TO BLACK, CINDERS WITH SAND, LITTLE TO SOME FINES, FILL, MOIST TO WET		680.7	6	12																
			7	15	43	89	SS-3	--	41	21	26	10	2	NP	NP	NP	12	A-1-b (0)		
			8																	
@8.5'; MEDIUM DENSE			9	4	11	89	SS-4	--	39	13	31	13	4	NP	NP	NP	11	A-1-b (0)		
			10	3																
@11.0'; MEDIUM DENSE			11	5																
			12	6	18	83	SS-5	--	-	-	-	-	-	-	-	-	10	A-1-b (V)		
			13																	
			14	9																
@16.0'; BLACK, SOME FINES			15	14	48	100	SS-6	--	-	-	-	-	-	-	-	-	16	A-1-b (V)		
			16	15																
			17	6	31	100	SS-7	--	-	-	-	-	-	-	-	-	15	A-1-b (V)		
			18	11																
@18.5'; LOOSE, BLACK, SOME FINES, WET			19	5	10	100	SS-8	--	40	19	18	20	3	NP	NP	NP	26	A-1-b (0)		
			20	4																
			21																	
@21.0'; BLACK, SOME FINES, WET			22	6	36	89	SS-9	--	-	-	-	-	-	-	-	-	29	A-1-b (V)		
			23	11																
@23.5'; MEDIUM DENSE, BLACK, SOME FINES, WET			24	4	16	100	SS-10	--	-	-	-	-	-	-	-	-	34	A-1-b (V)		
			25	5																
			26	5																
@26.0'; BLACK, SOME FINES, WITH HYDROCARBON ODOR, WET			27	8	34	100	SS-11	--	-	-	-	-	-	-	-	-	40	A-1-b (V)		
			28	12																
			29	9																
LOOSE, DARK BROWN AND BLACK, NON-PLASTIC SANDY SILT, TRACE STONE FRAGMENTS, FILL, WET			658.2	29	2			SS-12A	--	-	-	-	-	-	-	-	35	A-4a (V)		
				2	10	100	SS-12B	--	-	-	-	-	-	-	-	22	A-4a (V)			

Jack and Bore Receiving Location
near D-272

• Design
 Sand/Sandy Silt $N_{avg} = 11$ $\gamma = 125 \text{ pcf}$ $\phi = 30^\circ$

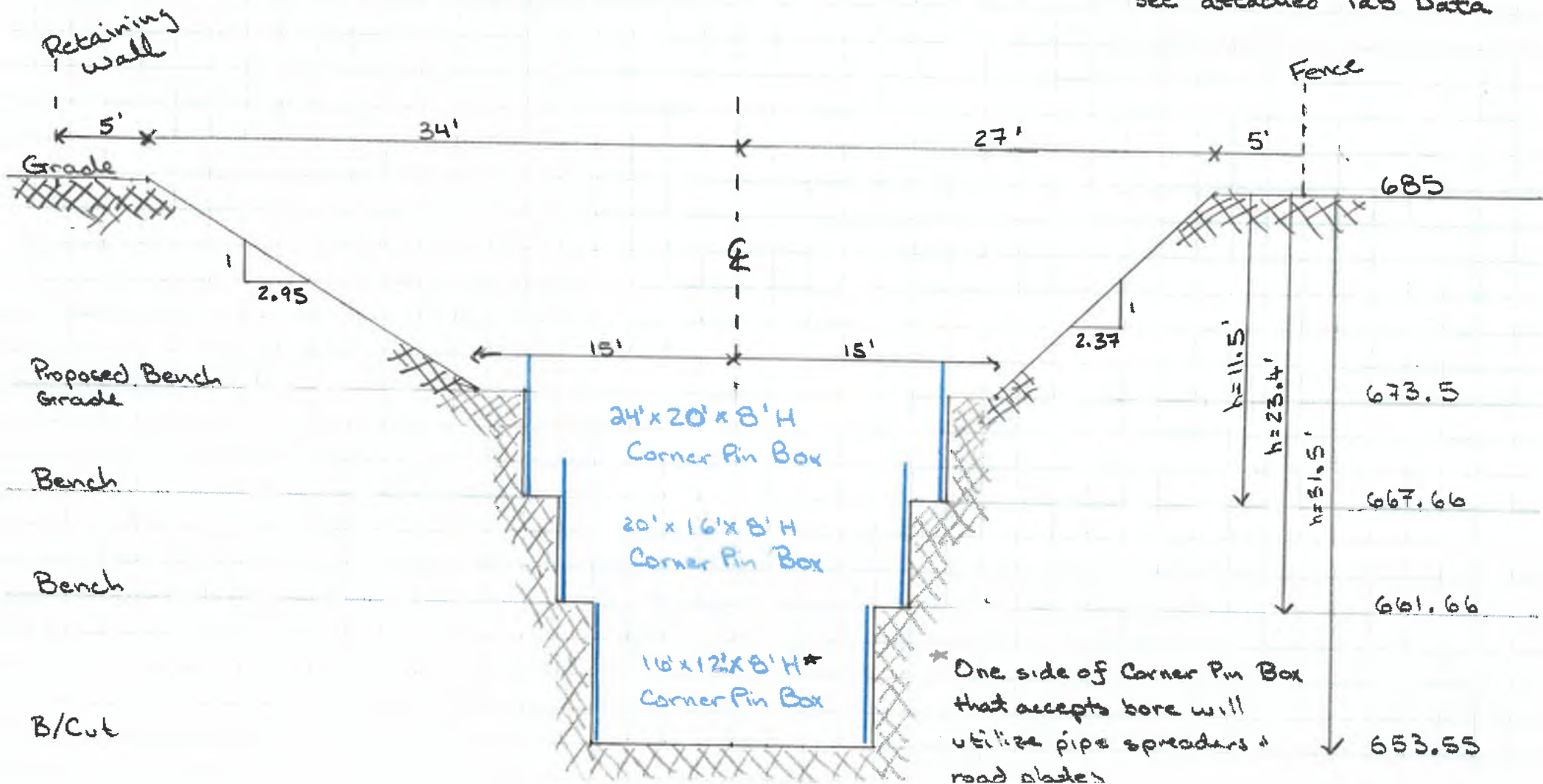
OC3 D272 P.t
 18-1-135 10/20/20
 RGZ 1/1

$$P_a = 0.65 \gamma h \tan^2(45 - \phi/2) = 27.0833 \text{ h}$$

Jack and Bore Receiving Location near D-272

$$P_{box} = 27.0833 (31.5') \approx 854 \text{ pcf Trench Box Min Rating}$$

← see attached Tab Data



PID: 96833	STR ID: _____	PROJECT: _____	CUY-10-21.49	STATION / OFFSET: 87+50, 601' LT.				START: 4/4/16	END: 4/4/16	PG 2 OF 2				B-079-2-15								
MATERIAL DESCRIPTION AND NOTES			ELEV. 656.1	DEPTHS		SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	BACK FILL	
											GR	CS	FS	SI	CL	LL	PL	PI				
MEDIUM DENSE TO DENSE, BROWN TO GRAY, NON-PLASTIC SILT, TRACE SAND, WET (continued)			+++++	31																		
			+++++																			
			+++++																			
STIFF TO VERY STIFF, GRAY, SANDY SILT, "AND" CLAY, TRACE STONE FRAGMENTS, MOIST			+++++	32																		
			+++++																			
			+++++																			
@35.0'; PUSHED SHELBY TUBE, U.C. STRENGTH = 3353 PSF			+++++	33																		
			+++++																			
			+++++																			
@38.5'; VERY STIFF			+++++	34	3	6	13	100	SS-9	1.50	-	-	-	-	-	-	-	-	20	A-4a (V)		
			+++++																			
			+++++																			
			+++++	35		5		100	ST-10	1.50	4	4	9	39	44	27	17	10	18	A-4a (8)		
			+++++																			
			+++++																			
			+++++	36																		
			+++++																			
			+++++																			
			+++++	37																		
			+++++																			
			+++++																			
			+++++	38																		
			+++++																			
			+++++																			
			+++++	39	5	7	19	100	SS-11	2.50	-	-	-	-	-	-	-	-	19	A-4a (V)		
			+++++																			
			+++++																			
			+++++	40		9																
			+++++																			
			+++++																			
			+++++	EOB																		
			+++++																			
			+++++																			

NOTES: GROUNDWATER WAS ENCOUNTERED AT A DEPTH OF 8.5' DURING DRILLING AND AT 25.0' UPON COMPLETION OF DRILLING OPERATIONS.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH SOIL CUTTINGS



Added 7/9/2021:

Supplemental data provided for earth pressures induced by Cooper

E80 Loading for:

Jack and Bore Receiving pit (near D-272)

Mainline 'Open Cut' sewer: D-270 to D-271 to D-272

Phone 216-524-1700

Fax 216-524-1701

www.indexc.com

Project OC3 Date 7-8-21
Submitted by MGO Page 1 of 5 Pages

RESPONSE TO COMMENTS REGARDING S.O.E
FOR RECEIVING PIT AT MANHOLE D-272
AND TRENCH SUPPORT FOR MAINLINE SEWER
EXCAVATION D270 - D271 - D272.

ATTACHED ARE BOUSSINESQ CALCULATIONS
FOR EARTH PRESSURES INDUCED BY COOPER E80
RR SURCHARGE ON BOTH EXCAVATIONS.

FOR MAINLINE SEWER: ADD 83 PSF TO MIN. BOX
RATING OF 760 PSF

REVISED MIN. = 843 PSF

FOR RECEIVING PIT: ADD 98 PSF TO MIN. BOX
RATING OF 854 PSF

REVISED MIN. = 952 PSF



7-8-21

MAINLINE SEWER STA 15+50

$L_2 = 68.25$ $L_1 = 59.75$

$$b = \tan^{-1}(L_2/H) - \tan^{-1}(L_1/H)$$

$q = 1882$ psf

COOPER E-80
RR SURCHARGE

H	$\tan^{-1}(L_2/H)$	$\tan^{-1}(L_1/H)$	b	br	sinb	a	cos2a	br-sinb cos2a	2q/p	sH
1	89.1606	89.0412	0.1194	0.0021	0.0021	89.1009	-0.9995	0.0042	1198.1184	4.99
2	88.3215	88.0829	0.2386	0.0042	0.0042	88.2022	-0.9980	0.0083	1198.1184	9.97
3	87.4831	87.1256	0.3575	0.0062	0.0062	87.3044	-0.9956	0.0125	1198.1184	14.92
4	86.6458	86.1700	0.4758	0.0083	0.0083	86.4079	-0.9921	0.0165	1198.1184	19.82
5	85.8100	85.2165	0.5935	0.0104	0.0104	85.5133	-0.9878	0.0206	1198.1184	24.67
6	84.9759	84.2657	0.7103	0.0124	0.0124	84.6208	-0.9824	0.0246	1198.1184	29.44
7	84.1440	83.3180	0.8260	0.0144	0.0144	83.7310	-0.9762	0.0285	1198.1184	34.13
8	83.3145	82.3740	0.9406	0.0164	0.0164	82.8442	-0.9690	0.0323	1198.1184	38.73
9	82.4879	81.4341	1.0538	0.0184	0.0184	81.9610	-0.9609	0.0361	1198.1184	43.21
10	81.6643	80.4988	1.1655	0.0203	0.0203	81.0816	-0.9519	0.0397	1198.1184	47.57
11	80.8443	79.5686	1.2756	0.0223	0.0223	80.2064	-0.9421	0.0432	1198.1184	51.80
12	80.0279	78.6440	1.3840	0.0242	0.0242	79.3360	-0.9315	0.0467	1198.1184	55.90
13	79.2157	77.7253	1.4904	0.0260	0.0260	78.4705	-0.9201	0.0499	1198.1184	59.84
14	78.4078	76.8129	1.5949	0.0278	0.0278	77.6104	-0.9079	0.0531	1198.1184	63.63
15	77.6046	75.9074	1.6972	0.0296	0.0296	76.7560	-0.8950	0.0561	1198.1184	67.25
16	76.8063	75.0089	1.7974	0.0314	0.0314	75.9076	-0.8814	0.0590	1198.1184	70.71
17	76.0131	74.1179	1.8952	0.0331	0.0331	75.0655	-0.8672	0.0618	1198.1184	73.99
18	75.2254	73.2348	1.9907	0.0347	0.0347	74.2301	-0.8523	0.0643	1198.1184	77.10
19	74.4434	72.3598	2.0836	0.0364	0.0364	73.4016	-0.8368	0.0668	1198.1184	80.02
20	73.6673	71.4932	2.1741	0.0379	0.0379	72.5802	-0.8208	0.0691	1198.1184	82.77
21	72.8973	70.6352	2.2620	0.0395	0.0395	71.7663	-0.8042	0.0712	1198.1184	85.33
22	72.1336	69.7863	2.3473	0.0410	0.0410	70.9599	-0.7871	0.0732	1198.1184	87.71
23	71.3764	68.9464	2.4299	0.0424	0.0424	70.1614	-0.7697	0.0750	1198.1184	89.91
24	70.6259	68.1160	2.5099	0.0438	0.0438	69.3709	-0.7517	0.0767	1198.1184	91.93
25	69.8822	67.2951	2.5871	0.0452	0.0451	68.5886	-0.7335	0.0783	1198.1184	93.77
26	69.1455	66.4839	2.6616	0.0465	0.0464	67.8147	-0.7148	0.0796	1198.1184	95.43
27	68.4160	65.6826	2.7334	0.0477	0.0477	67.0493	-0.6959	0.0809	1198.1184	96.92

T/CUT

MAINLINE SEWER

28	67.6938	64.8913	2.8025	0.0489	0.0489	66.2926	-0.6767	0.0820	1198.1184	98.24
29	66.9790	64.1101	2.8688	0.0501	0.0500	65.5445	-0.6572	0.0830	1198.1184	99.40
30	66.2716	63.3391	2.9325	0.0512	0.0512	64.8054	-0.6376	0.0838	1198.1184	100.40
31	65.5719	62.5784	2.9934	0.0522	0.0522	64.0751	-0.6177	0.0845	1198.1184	101.25
32	64.8798	61.8281	3.0517	0.0533	0.0532	63.3539	-0.5977	0.0851	1198.1184	101.94
33	64.1955	61.0881	3.1074	0.0542	0.0542	62.6418	-0.5776	0.0855	1198.1184	102.49
34	63.5190	60.3585	3.1605	0.0552	0.0551	61.9387	-0.5574	0.0859	1198.1184	102.91
35	62.8503	59.6393	3.2110	0.0560	0.0560	61.2448	-0.5371	0.0861	1198.1184	103.19
36	62.1896	58.9306	3.2590	0.0569	0.0568	60.5601	-0.5168	0.0863	1198.1184	103.35
37	61.5368	58.2323	3.3045	0.0577	0.0576	59.8845	-0.4965	0.0863	1198.1184	103.39
38	60.8920	57.5443	3.3476	0.0584	0.0584	59.2181	-0.4762	0.0862	1198.1184	103.32
39	60.2551	56.8667	3.3884	0.0591	0.0591	58.5609	-0.4559	0.0861	1198.1184	103.14
40	59.6263	56.1994	3.4268	0.0598	0.0598	57.9128	-0.4356	0.0858	1198.1184	102.86
41	59.0054	55.5424	3.4630	0.0604	0.0604	57.2739	-0.4155	0.0855	1198.1184	102.48
42	58.3925	54.8955	3.4970	0.0610	0.0610	56.6440	-0.3954	0.0851	1198.1184	102.02
43	57.7876	54.2587	3.5288	0.0616	0.0616	56.0232	-0.3754	0.0847	1198.1184	101.47
44	57.1906	53.6320	3.5586	0.0621	0.0621	55.4113	-0.3555	0.0842	1198.1184	100.85
45	56.6015	53.0152	3.5863	0.0626	0.0626	54.8084	-0.3357	0.0836	1198.1184	100.15
46	56.0203	52.4082	3.6121	0.0630	0.0630	54.2143	-0.3161	0.0830	1198.1184	99.39
47	55.4470	51.8110	3.6359	0.0635	0.0634	53.6290	-0.2967	0.0823	1198.1184	98.57
48	54.8814	51.2234	3.6580	0.0638	0.0638	53.0524	-0.2774	0.0815	1198.1184	97.70
49	54.3236	50.6454	3.6782	0.0642	0.0642	52.4845	-0.2583	0.0808	1198.1184	96.77
50	53.7735	50.0767	3.6967	0.0645	0.0645	51.9251	-0.2394	0.0800	1198.1184	95.80
										3912.54

BOTTOM OF
CUT

* MAX. PRESSURE DUE TO RR SURCHARGE

103.39 PSF x .80 = 82.71 PSF AVERAGE SURCHARGE FOR DEPTH OF CUT

RECEIVING PIT
STA. 16 + 00

$L_2 = 58.25$ $L_1 = 49.75$

$$b = \tan^{-1}(L_2/H) - \tan^{-1}(L_1/H)$$

$q = 1882$ psf

COOPER E-80
RR SURCHARGE

H	$\tan^{-1}(L_2/H)$	$\tan^{-1}(L_1/H)$	b	br	sinb	a	cos2a	br-sinb cos2a	2q/p	sH
1	89.0165	88.8485	0.1680	0.0029	0.0029	88.9325	-0.9993	0.0059	1198.1184	7.02
2	88.0335	87.6979	0.3356	0.0059	0.0059	87.8657	-0.9972	0.0117	1198.1184	14.02
3	87.0517	86.5492	0.5026	0.0088	0.0088	86.8005	-0.9938	0.0175	1198.1184	20.95
4	86.0717	85.4032	0.6685	0.0117	0.0117	85.7374	-0.9890	0.0232	1198.1184	27.80
5	85.0939	84.2609	0.8330	0.0145	0.0145	84.6774	-0.9828	0.0288	1198.1184	34.54
6	84.1190	83.1232	0.9959	0.0174	0.0174	83.6211	-0.9753	0.0343	1198.1184	41.13
7	83.1475	81.9909	1.1567	0.0202	0.0202	82.5692	-0.9665	0.0397	1198.1184	47.56
8	82.1800	80.8648	1.3152	0.0230	0.0230	81.5224	-0.9565	0.0449	1198.1184	53.81
9	81.2169	79.7458	1.4710	0.0257	0.0257	80.4814	-0.9453	0.0499	1198.1184	59.84
10	80.2588	78.6347	1.6241	0.0283	0.0283	79.4467	-0.9329	0.0548	1198.1184	65.64
11	79.3061	77.5322	1.7739	0.0310	0.0310	78.4192	-0.9194	0.0594	1198.1184	71.20
12	78.3594	76.4389	1.9205	0.0335	0.0335	77.3992	-0.9048	0.0638	1198.1184	76.49
13	77.4191	75.3557	2.0634	0.0360	0.0360	76.3874	-0.8892	0.0680	1198.1184	81.51
14	76.4857	74.2830	2.2026	0.0384	0.0384	75.3843	-0.8727	0.0720	1198.1184	86.24
15	75.5595	73.2215	2.3379	0.0408	0.0408	74.3905	-0.8552	0.0757	1198.1184	90.69
16	74.6409	72.1718	2.4691	0.0431	0.0431	73.4063	-0.8369	0.0791	1198.1184	94.83
17	73.7304	71.1343	2.5961	0.0453	0.0453	72.4323	-0.8178	0.0824	1198.1184	98.67
18	72.8282	70.1094	2.7188	0.0475	0.0474	71.4688	-0.7980	0.0853	1198.1184	102.20
19	71.9347	69.0977	2.8370	0.0495	0.0495	70.5162	-0.7775	0.0880	1198.1184	105.43
20	71.0502	68.0994	2.9508	0.0515	0.0515	69.5748	-0.7564	0.0904	1198.1184	108.36
21	70.1750	67.1149	3.0601	0.0534	0.0534	68.6449	-0.7348	0.0926	1198.1184	110.99
22	69.3093	66.1445	3.1649	0.0552	0.0552	67.7269	-0.7127	0.0946	1198.1184	113.32
23	68.4534	65.1884	3.2651	0.0570	0.0570	66.8209	-0.6901	0.0963	1198.1184	115.37
24	67.6075	64.2468	3.3607	0.0587	0.0586	65.9271	-0.6672	0.0978	1198.1184	117.14
25	66.7717	63.3199	3.4518	0.0602	0.0602	65.0458	-0.6440	0.0990	1198.1184	118.64
26	65.9463	62.4078	3.5385	0.0618	0.0617	64.1771	-0.6205	0.1001	1198.1184	119.88
27	65.1314	61.5107	3.6207	0.0632	0.0632	63.3210	-0.5968	0.1009	1198.1184	120.87

T/CUT ↓

RECEIVING PIT

28	64.3270	60.6286	3.6984	0.0646	0.0645	62.4778	-0.5729	0.1015	1198.1184	121.62
29	63.5334	59.7615	3.7719	0.0658	0.0658	61.6474	-0.5489	0.1019	1198.1184	122.14
30	62.7506	58.9094	3.8412	0.0670	0.0670	60.8300	-0.5249	0.1022	1198.1184	122.45
31	61.9786	58.0723	3.9063	0.0682	0.0681	60.0255	-0.5008	0.1023	1198.1184	122.56 *
32	61.2175	57.2502	3.9673	0.0692	0.0692	59.2339	-0.4767	0.1022	1198.1184	122.47
33	60.4674	56.4430	4.0244	0.0702	0.0702	58.4552	-0.4526	0.1020	1198.1184	122.21
34	59.7283	55.6506	4.0776	0.0712	0.0711	57.6895	-0.4286	0.1016	1198.1184	121.78
35	59.0001	54.8729	4.1272	0.0720	0.0720	56.9365	-0.4047	0.1012	1198.1184	121.20
36	58.2829	54.1098	4.1730	0.0728	0.0728	56.1963	-0.3810	0.1006	1198.1184	120.48
37	57.5766	53.3611	4.2154	0.0736	0.0735	55.4688	-0.3574	0.0998	1198.1184	119.62
38	56.8812	52.6267	4.2544	0.0743	0.0742	54.7539	-0.3339	0.0990	1198.1184	118.65
39	56.1966	51.9064	4.2902	0.0749	0.0748	54.0515	-0.3107	0.0981	1198.1184	117.56
40	55.5228	51.2000	4.3228	0.0754	0.0754	53.3614	-0.2877	0.0971	1198.1184	116.38
41	54.8597	50.5074	4.3524	0.0760	0.0759	52.6835	-0.2650	0.0961	1198.1184	115.11
42	54.2073	49.8282	4.3790	0.0764	0.0764	52.0178	-0.2425	0.0949	1198.1184	113.76
43	53.5654	49.1624	4.4029	0.0768	0.0768	51.3639	-0.2203	0.0938	1198.1184	112.33
44	52.9339	48.5097	4.4241	0.0772	0.0771	50.7218	-0.1984	0.0925	1198.1184	110.85
45	52.3128	47.8699	4.4428	0.0775	0.0775	50.0914	-0.1768	0.0912	1198.1184	109.31
46	51.7019	47.2428	4.4591	0.0778	0.0777	49.4723	-0.1555	0.0899	1198.1184	107.73
47	51.1011	46.6281	4.4730	0.0781	0.0780	48.8646	-0.1345	0.0886	1198.1184	106.10
48	50.5103	46.0256	4.4847	0.0783	0.0782	48.2680	-0.1138	0.0872	1198.1184	104.44
49	49.9294	45.4351	4.4942	0.0784	0.0784	47.6823	-0.0935	0.0858	1198.1184	102.76
50	49.3582	44.8564	4.5018	0.0786	0.0785	47.1073	-0.0735	0.0843	1198.1184	101.05
										4756.71

BOTTOM
OF CUT

* MAX. PRESSURE DUE TO R/R SURCHARGE

$$122.56 \times .80 = 98.05 \text{ PSF AVERAGE SURCHARGE FOR DEPTH OF CUT}$$

L₂= 29.5L₁= 20.5

$$\beta = \tan^{-1}(L_2/H) - \tan^{-1}(L_1/H)$$

$$q = 1778 \text{ psf}$$

H	$\tan^{-1}(L_2/H)$	$\tan^{-1}(L_1/H)$	β	βr	$\sin\beta$	α	$\cos 2\alpha$	$\beta r \sin\beta \cos 2\alpha$	$2q/\pi$	σH
1	88.0585	87.2073	0.8512	0.0149	0.0149	87.6329	-0.9966	0.0297	1131.9100	33.57
2	86.1215	84.4278	1.6937	0.0296	0.0296	85.2746	-0.9864	0.0587	1131.9100	66.46
3	84.1933	81.6743	2.5189	0.0440	0.0439	82.9338	-0.9697	0.0866	1131.9100	98.00
4	82.2782	78.9591	3.3191	0.0579	0.0579	80.6186	-0.9469	0.1127	1131.9100	127.62
5	80.3803	76.2930	4.0872	0.0713	0.0713	78.3367	-0.9183	0.1368	1131.9100	154.83
6	78.5034	73.6861	4.8173	0.0841	0.0840	76.0948	-0.8845	0.1584	1131.9100	179.25
7	76.6513	71.1468	5.5044	0.0961	0.0959	73.8991	-0.8462	0.1772	1131.9100	200.62
8	74.8271	68.6821	6.1450	0.1073	0.1070	71.7546	-0.8040	0.1933	1131.9100	218.81
9	73.0339	66.2974	6.7365	0.1176	0.1173	69.6656	-0.7585	0.2065	1131.9100	233.79
10	71.2742	63.9967	7.2776	0.1270	0.1267	67.6354	-0.7104	0.2170	1131.9100	245.64
11	69.5505	61.7826	7.7678	0.1356	0.1352	65.6665	-0.6604	0.2248	1131.9100	254.50
12	67.8645	59.6568	8.2078	0.1433	0.1428	63.7606	-0.6091	0.2302	1131.9100	260.57
13	66.2180	57.6193	8.5986	0.1501	0.1495	61.9186	-0.5568	0.2333	1131.9100	264.11
14	64.6121	55.6698	8.9423	0.1561	0.1554	60.1409	-0.5043	0.2345	1131.9100	265.38
15	63.0478	53.8068	9.2410	0.1613	0.1606	58.4273	-0.4517	0.2338	1131.9100	264.67
16	61.5258	52.0284	9.4974	0.1658	0.1650	56.7771	-0.3996	0.2317	1131.9100	262.26
17	60.0464	50.3322	9.7142	0.1695	0.1687	55.1893	-0.3482	0.2283	1131.9100	258.42
18	58.6097	48.7153	9.8944	0.1727	0.1718	53.6625	-0.2978	0.2239	1131.9100	253.39
19	57.2157	47.1747	10.0410	0.1752	0.1744	52.1952	-0.2485	0.2186	1131.9100	247.41
20	55.8641	45.7073	10.1567	0.1773	0.1763	50.7857	-0.2006	0.2126	1131.9100	240.69
21	54.5543	44.3097	10.2446	0.1788	0.1779	49.4320	-0.1541	0.2062	1131.9100	233.41
22	53.2858	42.9786	10.3072	0.1799	0.1789	48.1322	-0.1091	0.1994	1131.9100	225.72
23	52.0578	41.7108	10.3471	0.1806	0.1796	46.8843	-0.0657	0.1924	1131.9100	217.78
24	50.8696	40.5028	10.3668	0.1809	0.1799	45.6862	-0.0240	0.1852	1131.9100	209.68
25	49.7201	39.3518	10.3684	0.1810	0.1800	44.5359	0.0162	0.1780	1131.9100	201.53

Max= 265.38 psf
0.8(Max)= 212.3 psf

Trench Box Tab Data

8/5: Comment #3: Locations of proposed boxes listed on each tabulation sheet.

IX-10620

Launch Pit
This shielding or equal

Midwest Underground Equipment, Inc

TW6-0816

CERTIFICATION

This Shield is fabricated of hollow structural shapes (HSS) also called structural steel tubes. The dimension defining the shield wall thickness is 6 inches.

Model: TW6-0816
Dimensions: Height 8 ft
Length 16 ft
Wall Thickness 6 inches
Spreaders: 8" Schedule 80 Pipe - Max Length 16 ft
Uniform Lateral
Pressure Rating: 1500 psf

Maximum Depth Of Excavation -- OSHA Soil Classifications

Soil Type OSHA Class	Equivalent Soil Weight pcf/ ft of depth	Depth Below Grade ft
A	25	61
B	45	36
C	60	28
C	80	22

This certification is for the 6 inch wide wall, structural steel tube, trench shield bearing the mark of the manufacturer TW6-0816.

This tabulated data and certification document are produced under and comply with the requirements of OSHA 29, Part 1926, Subpart P titled Excavations.

Modifications to this product invalidate this certification and make the use of the shield non-compliant with OSHA regulation until the unit is re-certified, taking into account the modifications, which have been made.

This certification remains valid unless the shield is modified or structurally damaged. Extensive corrosion could constitute structural damage.



Midwest Underground Equipment, Inc
800-401-SAFE (7233)

5.1007

Launch Pit
This shielding or equal

IX-635

SPEED SHORE®
PIONEERING TRENCH SAFETY

**TABULATED DATA AND
TRENCH SHIELD CERTIFICATION**

SERIAL NUMBER: U-18-6538-S		MODEL: TS-0824UR6
HEIGHT = 8 feet	LENGTH = 24 feet	THICKNESS = 6 inches
MAXIMUM LATERAL EARTH PRESSURE = 1,066 Pounds per square foot		

MAXIMUM DEPTH OF EXCAVATION		
O.S.H.A. Soil Type	Equivalent Weight Effect (p.c.f.)	Depth "H" (feet)
A	25	44
B	35	32
B	45	26
C	60	21
C	80	16
Spreader Size = 8 inch Schedule 80 Pipe / Maximum Spreader Length = 20 feet		

This shield is manufactured to meet the requirements of O.S.H.A. CFR 29, Part 1926, Subpart P. This shield must be used in a manner consistent with safe working procedures, Federal, State and local regulation and manufacturer's instructions. Contact manufacturer for any non-standard use of this trench shield.

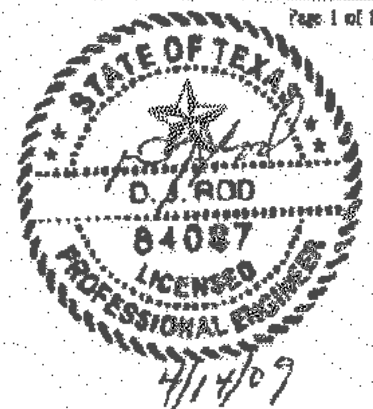
GENERAL NOTES AND INSTRUCTIONS:

1. Contractors must assign a **"competent person"**, knowledgeable and capable of complying with all federal regulations, state and local laws and ordinances. **NOTE:** For copies of applicable federal or state laws contact: Dept. of Labor, Occupational Safety and Health Division
2. A **"competent person"**, trained and experienced in the proper use of trench shields, safe excavation practices and soil classification methods must direct and control the use of this trench shield.
3. This Tabulated Data applies to standard products manufactured exclusively by SPEED SHORE CORPORATION. This data complies with the requirements of federal O.S.H.A. CFR 29, Part 1926, Subpart P-Excavations. Information not found in this data shall be referenced by obtaining copies of the applicable Federal or State laws governing excavation
4. Modifications of this product shall be approved by the manufacturer in writing and shall accompany this Tabulated Data sheet. Any modification not specifically allowed by SPEED SHORE CORPORATION voids this data. **Refer to Speed Shore "UR" Tabulated Data for use guidelines.**

11.24.00

SPEED SHORE CORPORATION

3330 S. Sam Houston Pkwy. East
Houston, Texas 77047
Phone (713) 943-0750 Fax (713) 943-8483



IX-10615

Open Cut
This Shielding or equal

MODEL TW6-824

CERTIFICATION

Trench Shield Fabricated of
Structural Tube Steel of 6 Inch Wall Dimension

Shield Dimensions:	Height: 8 Ft
	Length: 24 Ft
	Wall Thickness: 6 Inches

Uniform Lateral Pressure Rating:

885 PSF

Maximum Depth of Excavation-OSHA Soil Classifications

Soil Type OSHA Class	Equivalent Soil Weight pcf/ft of depth	Depth Below Grade ft
A	25	37
B	35	27
B	45	22
C	60	18
C	80	14

This certification is for the 6 inch wide wall, structural steel tube, trench shield bearing the mark of the manufacturer MODEL TW6-824.

This tabulated data and certification are produced under and comply with the requirements of OSHA CFR 29, Part 1926, Subpart P titled Excavations.

Modifications to this product invalidate this certification and make the use of the shield noncompliant with OSHA regulation until the unit is recertified, taking into account the modifications which have been made.



Manufactured by:

Midwest Underground Equipment, Inc
7007 Wooster Pike Highway, Medina, OH 44256
800-401-SAFE(7233)

Open Cut
This Shielding or equal

1X-633

SPEED SHORE

PIONEERING TRENCH SAFETY

**TABULATED DATA AND
TRENCH SHIELD CERTIFICATION**

SERIAL NUMBER: U-18-6549-S		MODEL: TS-0820UR6
HEIGHT = 8 feet	LENGTH = 20 feet	THICKNESS = 6 inches
MAXIMUM LATERAL EARTH PRESSURE = 1,572 Pounds per square foot		

MAXIMUM DEPTH OF EXCAVATION		
O.S.H.A. Soil Type	Equivalent Weight Effect (p.c.f.)	Depth "H" (feet)
A	25	50
B	35	47
B	45	37
C	60	29
C	80	23
Spreader Size = 8 inch Schedule 80 Pipe / Maximum Spreader Length = 20 feet		

This shield is manufactured to meet the requirements of O.S.H.A. CFR 29, Part 1926, Subpart P. This shield must be used in a manner consistent with safe working procedures, Federal, State and local regulation and manufacturer's instructions. Contact manufacturer for any non-standard use of this trench shield.

GENERAL NOTES AND INSTRUCTIONS:

1. Contractors must assign a **"competent person"**, knowledgeable and capable of complying with all federal regulations, state and local laws and ordinances. **NOTE:** For copies of applicable federal or state laws contact: Dept. of Labor, Occupational Safety and Health Division
2. A **"competent person"**, trained and experienced in the proper use of trench shields, safe excavation practices and soil classification methods must direct and control the use of this trench shield.
3. This Tabulated Data applies to standard products manufactured exclusively by SPEED SHORE CORPORATION. This data complies with the requirements of federal O.S.H.A. CFR 29, Part 1926, Subpart P-Excavations. Information not found in this data shall be referenced by obtaining copies of the applicable Federal or State laws governing excavation
4. Modifications of this product shall be approved by the manufacturer in writing and shall accompany this Tabulated Data sheet. Any modification not specifically allowed by SPEED SHORE CORPORATION voids this data. **Refer to Speed Shore "UR" Tabulated Data for use guidelines.**

11.24.00

SPEED SHORE CORPORATION

3330 S. Sam Houston Pkwy. East
Houston, Texas 77047
Phone (713) 943-0750 Fax (713) 943-8483

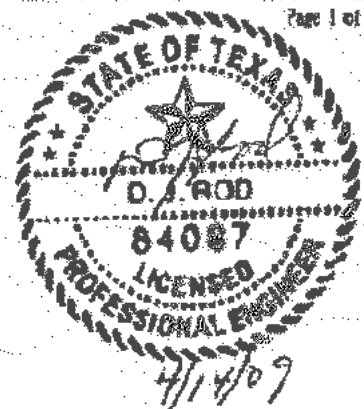


TABLE TS-1

**"DW" MODELS
DOUBLE SKIN PLATE WALLS**

Open Cut
This Shielding or equal

MODEL	CAPACITY	MAXIMUM DEPTH RATING FOR SOIL TYPES FEET					VERTICAL PIPE CLEARANCE INCHES	WEIGHT APPX. POUNDS
	P.S.F.	A-25	B-35	B-45	C-60	C-80		
TS-0408DW4	5,540	50	50	50	50	50	20	2,430
TS-0410DW4	3,510	50	50	50	50	45	20	2,700
TS-0412DW4	2,365	50	50	50	40	31	20	3,125
TS-0416DW4	1,282	50	37	29	22	17	20	3,910
TS-0420DW4	803	31	23	18	14	11	20	4,595
TS-0424DW4	550	21	17	13	10	8	20	5,450
TS-0608DW4	4,240	50	50	50	50	50	42	3,150
TS-0610DW4	3,392	50	50	50	50	45	42	3,850
TS-0612DW4	2,353	50	50	50	41	32	42	4,350
TS-0616DW4	1,276	50	37	30	23	18	42	5,775
TS-0620DW4	889	36	26	21	17	13	42	7,475
TS-0624DW4	609	24	18	15	12	10	42	8,850
TS-0808DW4	2,275	50	50	50	41	32	62	3,950
TS-0810DW4	1,820	50	50	43	33	26	62	4,450
TS-0812DW4	1,517	50	45	36	28	22	62	5,290
TS-0816DW4	1,256	50	38	30	24	19	62	7,400
TS-0820DW4	899	37	27	22	18	14	62	9,650
TS-0824DW4	615	26	20	16	13	11	62	11,260
TS-1010DW4	1,105	46	35	28	22	18	86	5,950
TS-1012DW4	921	39	29	24	19	16	86	6,890
TS-1016DW4	761	33	25	20	16	14	86	9,460
TS-1020DW4	609	26	20	17	14	12	86	12,700
TS-1024DW4	507	22	17	15	12	10	86	15,240
TS-0412DW6	3,890	50	50	50	50	50	20	3,550
TS-0416DW6	2,109	50	50	47	36	27	20	4,500
TS-0420DW6	1,320	50	38	30	23	18	20	5,475
TS-0424DW6	904	35	26	20	16	12	20	6,350
TS-0428DW6	657	25	19	15	12	9	20	7,300
TS-0612DW6	3,814	50	50	50	50	50	42	5,050
TS-0616DW6	2,068	50	50	47	36	28	42	6,650
TS-0620DW6	1,295	50	38	30	23	18	42	8,150
TS-0624DW6	978	39	29	23	18	14	42	9,875
TS-0628DW6	711	29	21	17	14	11	42	11,260
TS-0812DW6	2,649	50	50	50	47	36	65	6,250
TS-0816DW6	2,047	50	50	48	37	29	65	8,350
TS-0820DW6	1,282	50	39	31	24	19	65	9,950
TS-0824DW6	980	40	30	24	19	15	65	12,400
TS-0828DW6	804	33	25	20	16	13	65	15,650
TS-1012DW6	1,629	50	49	40	31	24	86	7,390
TS-1016DW6	1,311	50	40	33	26	20	86	10,150
TS-1020DW6	1,049	44	33	27	21	17	86	12,150
TS-1024DW6	874	37	28	23	18	15	86	14,500
TS-1028DW6	749	32	24	20	16	13	86	17,200

TABLE TS-2

**"DW" MODELS
DOUBLE SKIN PLATE WALLS**

MODEL	CAPACITY	MAXIMUM DEPTH RATING FOR SOIL TYPES					VERTICAL PIPE CLEARANCE	WEIGHT APPX.
	P.S.F.	FEET					INCHES	POUNDS
TS-0420DW8	1,969	A-25 50	B-35 50	B-45 44	C-60 34	C-80 26	20	6,300
TS-0424DW8	1,343	50	37	30	23	18	20	7,525
TS-0428DW8	975	38	29	22	17	13	20	8,500
TS-0430DW8	845	33	24	19	15	12	20	9,075
TS-0432DW8	740	29	21	17	13	10	20	9,550
TS-0620DW8	1,935	50	50	44	34	26	42	9,200
TS-0624DW8	1,320	50	39	31	24	19	42	11,000
TS-0628DW8	1,086	44	32	26	20	16	42	13,000
TS-0630DW8	941	38	29	22	17	14	42	13,900
TS-0632DW8	824	33	24	20	16	12	42	14,850
TS-0820DW8	1,874	50	50	44	34	27	65	11,400
TS-0824DW8	1,279	50	38	31	24	19	65	13,250
TS-0828DW8	1,268	50	40	31	24	19	65	18,675
TS-0830DW8	1,161	48	35	28	22	18	65	19,950
TS-0832DW8	962	40	29	24	19	15	65	20,850
TS-1020DW8	1,347	50	41	33	26	21	86	14,200
TS-1024DW8	1,123	47	35	28	23	18	86	16,850
TS-1028DW8	962	41	30	25	20	16	86	18,900
TS-1030DW8	957	40	30	25	20	16	86	21,640
TS-1032DW8	897	38	29	23	19	15	86	24,490

Notes

- (1) If a specific model DW trench shield is not shown in Table TS-1 or TS-2, the competent person must refer to the trench shield certification to determine capacity and working depths. All other aspects of this tabulated data applies to any DW shield not shown in Tables TS-1 or TS-2.
- (2) Weights are approximate.



Open Cut
This Shielding or equal

1X-10623



**United
Rentals**

TRENCH SHIELD TABULATED DATA

UR6M824NKE

MODEL NO.

UM15122826G

SERIAL NO.

12/09/15

DATE SHIPPED

MAXIMUM DEPTH TABLE

SOIL TYPE	EFP	MAXIMUM DEPTH (FT)
A	25	42'
B	45	25'
C	60	20'
C	80	16'

950 PSF

SHIELD CAPACITY

20 FT

MAX SPREADER
LENGTH

8 IN SCH 80

SPREADER SIZE

CONDITIONS FOR USE OF TABULATED DATA:

1. This Tabulated Data has been prepared by a registered professional engineer as required to comply with the OSHA standard 29 CFR Part 1926, Subpart P.
2. The Soil Types A - 25, B - 45, and C - 80 are as defined in the OSHA Standard. Soil Type C - 80 is a moist, cohesive soil or a moist dense granular soil, which is not flowing or submerged and has an Equivalent Fluid Pressure (EFP) of 60 PSF per foot of depth. The competent person must monitor the excavation for signs of deterioration that may alter soil pressures and produce the Soil Type C - 80 condition. Such signs are indicated by, but not limited to, freely seeping water or flowing soil entering the excavation around or below the shield.
3. Trench Shields shall be used in accordance with the depth chart. The maximum depth is the distance from the surface of the excavation to the bottom of the trench. Depth ratings shown are based upon examples of homogeneous soil conditions. Soil pressures may vary due to non-homogeneous soils, surcharge loads, and slope of embankment (layback). Actual soil pressures should be verified to be sure that the shield capacity is not exceeded.
4. Surcharge loads are not included in the maximum depth table. Surcharge loads are possible due to heavy equipment, vibrations, or soil piles adjacent to the trench. (Adjacent is defined as within a distance equal to the depth of the trench.)
5. Trench Shields are not intended to provide stability to adjacent buildings or other structures.
6. 1 1/2 inch diameter pins furnished by GME shall be placed in all spreader to collar connections.

WARNING!
Use of this equipment not
in accordance with
Manufacturers Tabulated Data
may lead to injury or death.

GENERAL NOTES FOR TRENCH SHIELD USE:

1. Any modifications to shields using parts not manufactured by GME will void Tabulated Data unless otherwise specified or allowed in writing by GME.
2. GME Trench Shields may be stacked provided that appropriate connections are made between stacked shields as specified by GME. Each stacked shield shall have a depth rating equal to or greater than the actual depth at which it is used.
3. Maximum depths are based on shields being in structurally sound condition. Trench Shields should be inspected prior to each use for any damage or deterioration. If a shield has sustained major structural damage or permanent deformation of a structural member or connection, the Tabulated Data is void until repairs are made as specified by a registered professional engineer.
4. The use of GME Trench Shields shall be in accordance with this tabulated data and all requirements of the OSHA standard. Trench Shield usage other than specified or required may create unsafe conditions that could cause a cave-in, structural failure, or collapse resulting in a disabling injury or even death. GME shall not be liable for shield usage other than specified.

FOR UNITED RENTALS, INC.



TRINITY SHORING PRODUCTS, INC.

A TRINITY MINING & CONSTRUCTION EQUIPMENT, INC. COMPANY



Griswold Machine & Engineering
594 Menden Road
Union City, MI 49094
Phone 517 741 4300

IX-10608

Open Cut
This Shielding or equal**SPEED SHORE®**
PIONEERING TRENCH SAFETY**TABULATED DATA AND
TRENCH SHIELD CERTIFICATION**

SERIAL NUMBER: 96-9259		MODEL: TB-824R6TT
HEIGHT = 8 feet	LENGTH = 24 feet	THICKNESS = 6 inches
MAXIMUM LATERAL EARTH PRESSURE = 960 pounds per square foot		

MAXIMUM DEPTH OF EXCAVATION		
O.S.H.A. Soil Type	Equivalent Weight Effect (p.c.f.)	Depth "H" (feet)
A	25	30
B	35	29
B	45	24
C	60	19
C	80	15
Spreader Size = 8 inch Schedule 80 Pipe / Maximum Spreader Length = 20 feet		

This shield is manufactured to meet the requirements of O.S.H.A. CFR 29, Part 1926, Subpart P. This shield must be used in a manner consistent with safe working procedures, Federal, State and local regulation and manufacturer's instructions. Contact manufacturer for any non-standard use of this trench shield.

GENERAL NOTES AND INSTRUCTIONS:

- Contractors must assign a "competent person", knowledgeable and capable of complying with all federal regulations, state and local laws and ordinances. NOTE: For copies of applicable federal or state laws contact: Dept. of Labor, Occupational Safety and Health Division.
- A "competent person", trained and experienced in the proper use of trench shields, safe excavation practices and soil classification methods must direct and control the use of this trench shield.
- This Tabulated Data applies to standard products manufactured exclusively by SPEED SHORE CORPORATION. This data complies with the requirements of federal O.S.H.A. CFR 29, Part 1926, Subpart P-Excavations. Information not found in this data shall be referenced by obtaining copies of the applicable Federal or State laws governing excavation.
- Modifications of this product shall be in writing and shall accompany this Tabulated Data sheet. Any modification not specifically allowed by SPEED SHORE CORPORATION voids this data.

05.29.96R

Page 1 of 3

SPEED SHORE CORPORATION

P.O. Box 262591
Houston, Texas 77207-2591
Phone (713) 943-0750 Fax (713) 943-8483



IX-10614

Open Cut
This Shielding or equal

Midwest Underground Equipment, Inc.

TW6-820

CERTIFICATION

This Shield is fabricated of hollow structural shapes (HSS) also called structural steel tubes. The dimension defining the shield wall thickness is 6 inches.

Model: TW6-820
Dimensions: Height 8 ft
Length 20 ft
Wall Thickness 6 inches
Spreaders: 8" Schedule 80 Pipe - Max Length 16 ft
Uniform Lateral Pressure Rating: 1555 psf

Maximum Depth Of Excavation - OSHA Soil Classifications

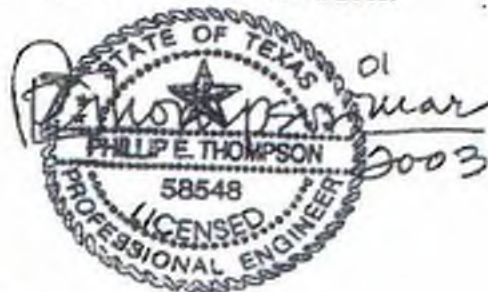
Soil Type OSHA Class	Equivalent Soil Weight pcf/ ft of depth	Depth Below Grade ft
A	25	63
B	35	46
B	45	37
C	60	29
C	80	23

This certification is for the 6 inch wide wall, structural steel tube, trench shield bearing the mark of the manufacturer TW6-820 and the date MARCH 2003.

This tabulated data and certification document are produced under and comply with the requirements of OSHA 29, Part 1926, Subpart P titled Excavations.

Modifications to this product invalidate this certification and make the use of the shield non-compliant with OSHA regulation until the unit is re-certified, taking into account the modifications, which have been made.

This certification is valid for a period of ten (10) years from the effective date unless modified or structurally damaged. Extensive corrosion could constitute structural damage. Effective date: March 2003.



Midwest Underground Equipment, Inc.
800-401-SAFE (7233)

IX-10619

Receiving Pit
This Shielding or equal

TRENCH SHIELD MANUFACTURER'S TABULATED DATA

K812

MODEL NO.

9604605F

SERIAL NO.

06/04/96

DATE SHIPPED

SHORT TERM EXPOSURE DEPTH/CAPACITY CHART

SOIL TYPE	EFP	MAXIMUM DEPTH	SHIELD CAPACITY
A	25	70'	1750
B	45	41'	1845
C	60	32'	1920

Shield capacity is in PSF per foot along the bottom of the Trench Shield

LONG TERM EXPOSURE DEPTH/CAPACITY CHART

SOIL TYPE	EFP	MAXIMUM DEPTH	SHIELD CAPACITY
A	25	53'	1325
B	45	32'	1440
C	60	25'	1500

Shield capacity is in PSF per foot along the bottom of the Trench Shield

CONDITIONS FOR USE OF TABULATED DATA:

1. This Tabulated Data has been prepared by a registered professional engineer as required to comply with the OSHA standard 29 CFR Part 1926, Subpart P.

2. The Soil types A and B are as defined in the OSHA standard. Soil Type C is defined as follows:

Soil cohesive to saturated soil with an Equivalent Fluid Pressure (EFP) or Equivalent Weight Effect of 60 PSF per foot of depth. This type of soil is a clay with an unconfined compressive strength of .5 tons/Sq. Ft., but greater than .25 Tons/SF, saturated sand or clay, or fractured rock that is not stable.

(Note: Soil conditions more severe can be encountered with an EFP greater than 60 PSF/F. These conditions would be submerged soils, flowing mud, or muck. Such severe conditions would require the services of a soils engineer to determine the actual soil pressure. Consult GME when soil pressures exceed the tabulated values.)

3. Trench Shields shall be used in accordance with the depth/capacity charts. The maximum depth is the distance from the surface of the excavation to the bottom of the trench. Depth ratings shown are based upon examples of homogenous soil conditions. Soil pressures may vary due to: non-homogenous soils, surcharge loads, and slope of embankment (layback). Actual soil pressures should be verified to be sure that the shield capacities are not exceeded.

4. Surcharge loads are not accounted for in the maximum depths. Surcharge loads are possible due to: heavy equipment, vibrations, or spoil piles, adjacent to the trench. (Adjacent is defined as within a distance equal to the depth of the trench.)

5. Trench shields are not capable of providing stability to adjacent buildings or other structures. Refer to the OSHA standard for applicable requirements when trenching near buildings and other structures.

6. Long Term exposure is for trench shields used in one position greater than 24 hours. Short Term exposure is for shields used in one position for 24 hours or less. GME recommends that the chart for Long Term exposure be used to maximize protection. However, the chart for Short Term exposure may be used if the criteria for Short Term exposure can be met at all times.

GENERAL NOTES FOR TRENCH SHIELD USE:

1. Trench Shields are to be assembled and installed in accordance with manufacturer's instructions.

2. Any modifications to shields or use of component parts not manufactured by GME will void the tabulated data unless otherwise specified or allowed in writing by GME.

3. GME Trench Shields may be stacked, provided that appropriate connections are made between stacked shields as specified by GME. The stacked shields need only have a depth rating equal to or greater than the actual depth at which it is used.

4. Maximum depths are based on shields being in structurally sound condition. Trench shields should be inspected prior to each use for any damage or deterioration. If a shield has sustained major damage the tabulated data is void until repairs are made as specified by a registered professional engineer.

5. The use of GME Trench Shields shall be in accordance with this tabulated data and all requirements of the OSHA standard. Trench Shield usage other than specified or required may create unsafe conditions that could cause a cave-in, structural failure, or collapse resulting in a disabling injury or even death. GME shall not be liable for shield usage other than specified or required.



Griswold Machine & Engineering, Inc.
594 W. Highway M-60
Union City, MI 49094
Phone 517-741-4300

Receiving Pit
This Shielding or equal

IX-631

SPEED SHORE®
PIONEERING TRENCH SAFETY

**TABULATED DATA AND
TRENCH SHIELD CERTIFICATION**

SERIAL NUMBER: U-18-6536-S		MODEL: TS-0816UR6
HEIGHT = 8 feet	LENGTH = 16 feet	THICKNESS = 6 inches
MAXIMUM LATERAL EARTH PRESSURE = 2,094 Pounds per square foot		

MAXIMUM DEPTH OF EXCAVATION		
O.S.H.A. Soil Type	Equivalent Weight Effect (p.c.f.)	Depth "H" (feet)
A	25	50
B	35	50
B	45	49
C	60	38
C	80	29
Spreader Size = 8 inch Schedule 80 Pipe / Maximum Spreader Length = 20 feet		

This shield is manufactured to meet the requirements of O.S.H.A. CFR 29, Part 1926, Subpart P. This shield must be used in a manner consistent with safe working procedures, Federal, State and local regulation and manufacturer's instructions. Contact manufacturer for any non-standard use of this trench shield.

GENERAL NOTES AND INSTRUCTIONS:

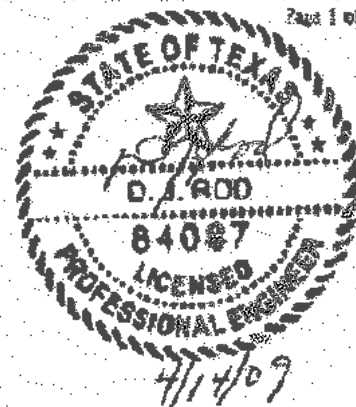
1. Contractors must assign a "**competent person**", knowledgeable and capable of complying with all federal regulations, state and local laws and ordinances. **NOTE:** For copies of applicable federal or state laws contact: Dept. of Labor, Occupational Safety and Health Division
2. A "**competent person**", trained and experienced in the proper use of trench shields, safe excavation practices and soil classification methods must direct and control the use of this trench shield.
3. This Tabulated Data applies to standard products manufactured exclusively by SPEED SHORE CORPORATION. This data complies with the requirements of federal O.S.H.A. CFR 29, Part 1926, Subpart P-Excavations. Information not found in this data shall be referenced by obtaining copies of the applicable Federal or State laws governing excavation
4. Modifications of this product shall be approved by the manufacturer in writing and shall accompany this Tabulated Data sheet. Any modification not specifically allowed by SPEED SHORE CORPORATION voids this data. **Refer to Speed Shore "UR" Tabulated Data for use guidelines.**

11.24.00

Page 1 of 1

SPEED SHORE CORPORATION

3330 S. Sam Houston Pkwy. East
Houston, Texas 77047
Phone (713) 943-0750 Fax (713) 943-8483



Receiving Pit
This Shielding or equal

1X-632

SPEED SHORE®
PIONEERING TRENCH SAFETY
TABULATED DATA AND
TRENCH SHIELD CERTIFICATION

SERIAL NUMBER: U-18-6537-S		MODEL: TS-0816UR6SKE
HEIGHT = 8 feet	LENGTH = 16 feet	THICKNESS = 6 inches
MAXIMUM LATERAL EARTH PRESSURE = 2,094 Pounds per square foot		

MAXIMUM DEPTH OF EXCAVATION		
O.S.H.A. Soil Type	Equivalent Weight Effect (p.c.f.)	Depth "H" (feet)
A	25	50
B	35	50
B	45	49
C	60	38
C	80	29
Spreader Size = 8 inch Schedule 80 Pipe / Maximum Spreader Length = 20 feet		

This shield is manufactured to meet the requirements of O.S.H.A. CFR 29, Part 1926, Subpart P. This shield must be used in a manner consistent with safe working procedures, Federal, State and local regulation and manufacturer's instructions. Contact manufacturer for any non-standard use of this trench shield.

GENERAL NOTES AND INSTRUCTIONS:

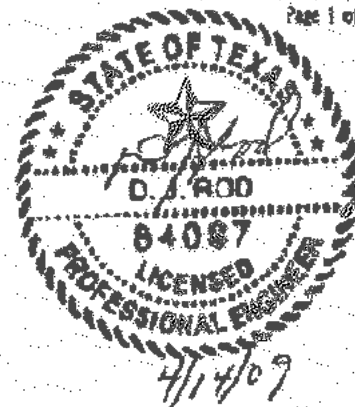
1. Contractors must assign a "**competent person**", knowledgeable and capable of complying with all federal regulations, state and local laws and ordinances. **NOTE:** For copies of applicable federal or state laws contact: Dept. of Labor, Occupational Safety and Health Division
2. A "**competent person**", trained and experienced in the proper use of trench shields, safe excavation practices and soil classification methods must direct and control the use of this trench shield.
3. This Tabulated Data applies to standard products manufactured exclusively by SPEED SHORE CORPORATION. This data complies with the requirements of federal O.S.H.A. CFR 29, Part 1926, Subpart P-Excavations. Information not found in this data shall be referenced by obtaining copies of the applicable Federal or State laws governing excavation
4. Modifications of this product shall be approved by the manufacturer in writing and shall accompany this Tabulated Data sheet. Any modification not specifically allowed by SPEED SHORE CORPORATION voids this data. **Refer to Speed Shore "UR" Tabulated Data for use guidelines.**

11.24.00

Page 1 of 1

SPEED SHORE CORPORATION

3330 S. Sam Houston Pkwy. East
Houston, Texas 77047
Phone (713) 943-0750 Fax (713) 943-8483



IX-10624

Receiving Pit
This Shielding or equal



**United
Rentals**

TRENCH SHIELD TABULATED DATA

UR 6M820 NKE

MODEL NO.

UM15122829G

SERIAL NO.

12/03/2015

DATE SHIPPED

MAXIMUM DEPTH TABLE

SOIL TYPE	EFP	MAXIMUM DEPTH (FT)
A	25	57'
B	45	34'
C	60	26'
C	80	21'

1,333 PSF

SHIELD CAPACITY

20 FT

MAX SPREADER
LENGTH

8 IN SCH 80

SPREADER SIZE

CONDITIONS FOR USE OF TABULATED DATA:

1. This Tabulated Data has been prepared by a registered professional engineer as required to comply with the OSHA standard 29 CFR Part 1926, Subpart P.
2. The Soil Types A - 25, B - 45, and C - 80 are as defined in the OSHA Standard. Soil Type C - 80 is a moist, cohesive soil or a moist dense granular soil, which is not flowing or submerged and has an Equivalent Fluid Pressure (EFP) of 60 PSF per foot of depth. The competent person must monitor the excavation for signs of deterioration that may alter soil pressures and produce the Soil Type C - 80 condition. Such signs are indicated by, but not limited to, freely seeping water or flowing soil entering the excavation around or below the shield.
3. Trench Shields shall be used in accordance with the depth chart. The maximum depth is the distance from the surface of the excavation to the bottom of the trench. Depth ratings shown are based upon examples of homogeneous soil conditions. Soil pressures may vary due to non-homogeneous soils, surcharge loads, and slope of embankment (layback). Actual soil pressures should be verified to be sure that the shield capacity is not exceeded.
4. Surcharge loads are not included in the maximum depth table. Surcharge loads are possible due to heavy equipment, vibrations, or soil piles adjacent to the trench. (Adjacent is defined as within a distance equal to the depth of the trench.)
5. Trench Shields are not intended to provide stability to adjacent buildings or other structures.
6. 2 inch or 1 1/2 diameter pins furnished by GME shall be placed in all spreader to collar connections.

WARNING!
Use of this equipment not
in accordance with
Manufacturers Tabulated Data
may lead to injury or death.

GENERAL NOTES FOR TRENCH SHIELD USE:

1. Any modifications to shields using parts not manufactured by GME will void Tabulated Data unless otherwise specified or allowed in writing by GME.
2. GME Trench Shields may be stacked provided that appropriate connections are made between stacked shields as specified by GME. Each stacked shield shall have a depth rating equal to or greater than the actual depth at which it is used.
3. Maximum depths are based on shields being in structurally sound condition. Trench Shields should be inspected prior to each use for any damage or deterioration. If a shield has sustained major structural damage or permanent deformation of a structural member or connection, the Tabulated Data is void until repairs are made as specified by a registered professional engineer.
4. The use of GME Trench Shields shall be in accordance with this tabulated data and all requirements of the OSHA standard. Trench Shield usage other than specified or required may create unsafe conditions that could cause a cave-in, structural failure, or collapse resulting in a disabling injury or even death. GME shall not be liable for shield usage other than specified.

FOR UNITED RENTALS, INC.
MANUFACTURED BY GRISWOLD MACHINE & ENGINEERING, INC.



Griswold Machine & Engineering, Inc.
594 W. Highway M - 80
Union City, MI 48094
Phone 517 - 741 - 4300

359-10629



TRENCH SHIELD TABULATED DATA

Receiving Pit
This Shielding or equal

A COPY OF THIS SHEET MUST ACCOMPANY EACH
CORRESPONDING TRENCH SHIELD AT EVERY JOB SITE

MODEL NUMBER: PRO6-820DKE

SERIAL NUMBER: 34310

SOIL	MAX DEPTH	*PSF
TYPE A	54 - FT	1,500
TYPE B	32 - FT	
TYPE C60	25 - FT	
TYPE C80	20 - FT	

DATE MANUFACTURED: 03/01/18

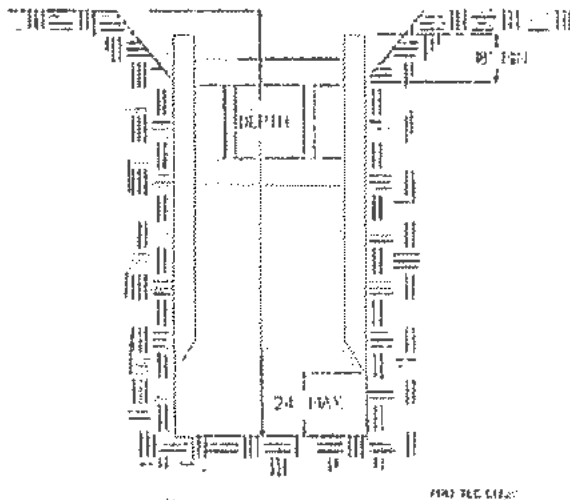
SHIELD SIZE: 8 - FT X 20 - FT

SPREADER SIZE: 8 IN SCH 80

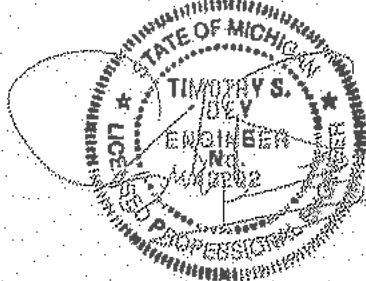
MAX SPREADER LENGTH: 20 - FT

*Shield Capacity based on C60 soil at
bottom of the excavation.

LIMITATIONS:



1. Soil above shield must be sloped according to OSHA Subpart P. Slope must begin no less than 18" below the top of shield.
2. Shield may be suspended no more than 2 feet above bottom of the trench and only if there is no possible loss of soil from behind or below bottom of shield.
3. A minimum of 2 spreader pipes are required on each end with manufacturer approved 1 3/4-in diameter pins and keepers.
4. Repairs and modifications shall be approved in writing by the manufacturer and a registered professional engineer.
5. Shields may be stacked as long as each is rated to the depth it is used and manufacturer approved stack connections are utilized.
6. Surcharge loads have not been included in the above depth ratings. The allowable working depth of the shield must be reduced to account for all surcharge loading which occurs adjacent to the trench. (Adjacent is defined as within a distance equal to the depth of the trench.)
7. The Soil Types A, B, and C - 80 are as defined in the OSHA Standard. Soil Type C - 60 is a moist, cohesive soil or a moist dense granular soil, which is not flowing or submerged and has an Equivalent Fluid Pressure (EFP) of 60 PSF per foot of depth. The competent person must monitor the excavation for signs of deterioration that may alter soil pressures and produce the Soil Type C - 80 condition. Such signs are indicated by, but not limited to, freely seeping water or flowing soil entering the excavation around or below the shield.
8. PRO-TEC trench shields have been designed by a registered professional engineer as required to comply with Occupational Safety and Health Administration (OSHA) standard 29 CFR Part 1926, Subpart P.
9. Maximum depths are based on shields being in structurally sound condition. Trench Shields should be inspected prior to each use for any damage or deterioration. If a shield has sustained major structural damage or permanent deformation of a structural member or connection, the Tabulated Data is void until repairs are made as specified by a registered professional engineer.



TRINITY SHORING PRODUCTS, INC.

A TRINITY MINING & CONSTRUCTION EQUIPMENT, INC. COMPANY

28433

Usage of trench shields other than specified could cause failure or cave-ins resulting in serious injury or death.

Phone (517) 541-0303 • 1-800-292-1225 • Fax (517) 541-0320

Mailing Address: 4837 W. Grand River Drive, Lansing, MI 48905

Receiving Pit
This Shielding or equal

IX-10622



TRENCH SHIELD CERTIFICATION

A COPY OF THIS SHEET MUST ACCOMPANY EACH
CORRESPONDING TRENCH SHIELD AT EVERY JOB SITE

MODEL NUMBER

PRO HD6 - 824D

WEIGHT

14,450

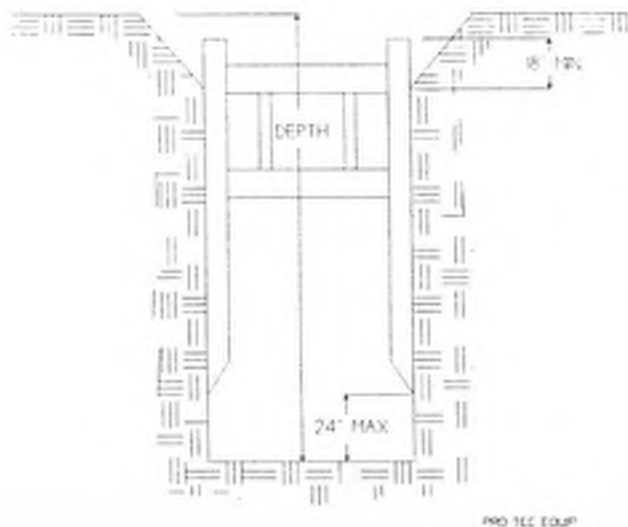
SERIAL NUMBER

29396

SIZE

8' HIGH X 24' LONG

SOIL	MAX DEPTH	PSF	SOIL DESCRIPTION
TYPE A	60 FEET	1500	Stiff Cohesive Soil, 25 PSF per foot, clay, silty clay, clay loam with unconfined compressive strength of 1.5 ton per square foot or greater. See note 7.
TYPE B	33 FEET	1500	Medium Cohesive to granular soil, 45 PSF per foot of depth. Clay with unconfined compressive strength greater than 0.5 TSF but less than 1.5 TSF. Cohesionless gravel, silt, silt loam or sandy loam. See note 8.
TYPE C	25 FEET	1500	Soft Cohesive to Saturated Soil, 60 PSF per foot of depth. Clay with unconfined compressive strength less than 0.5 TSF, saturated sand, clay or fractured rock that is not stable. See note 9.

**LIMITATIONS**

- 1) Soil above shield must be sloped according to OSHA Subpart P. Slope must begin no less than 18" below the top of shield.
- 2) Shield may be suspended no more than 2 feet above bottom of the trench and only if there is no possible loss of soil from behind or below bottom of shield.
- 3) A minimum of 2 spreader pipes are required on each end with manufacturer approved pins and keepers.
- 4) Repairs and modifications must first be approved by manufacturer or registered professional engineer.
- 5) Shields may be stacked as long as each is rated to the depth it is used and manufacturer approved stack connections are utilized to prevent lateral movement of the shields.
- 6) Surcharge loads have not been included in the above depth ratings. The allowable working depth of the shield must be reduced to account for any surcharge loading which occurs within the influence line of the shield.
- 7) Not Type A if fissured. Subject to vibration, previously disturbed or part of a sloped layered system where layers dip into excavation on a slope of four horizontal to one vertical (4H:1V) or greater.
- 8) Previously disturbed soils may be Type B unless they would be classed as Type C. Soil that meets requirements of Type A but is subject to vibration or fissured may be Type B. Dry rock that is not stable or soil that is part of a sloped layered system where layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V) are Type B if material would otherwise be classified as Type B.
- 9) Soil in a sloped layered system where layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or steeper may be Type C. Saturated soil or soils from which water is freely seeping but is not standing in the trench. Conditions more severe would require dewatering or the sealing of four sides of the excavation and pumping the trench. Such severe conditions would require the services of a soils engineer to establish the design pressure. Consult the manufacturer for pressures exceeding tabulated values.
- 10) PRO-TEC trench shields are to be used in accordance with Federal, state and Local laws. Refer to Occupational Safety and Health Administration (OSHA) rules and regulations Vol. 54, No. 209, 10/31/89, Part 1926, Subpart P.



Scott M. Gillett

Usage of trench shields other than specified could cause failure or cave-ins resulting in serious injury or death.

Phone (517) 541-0303 • 1-800-292-1225 • Fax (517) 541-0329

Mailing Address: P.O. Box 130 • Charlotte, MI 48813 • Shipping Address: 1298 Lipsy Drive • Charlotte, MI 48813



20501 Goddard Rd, Taylor, MI 48180

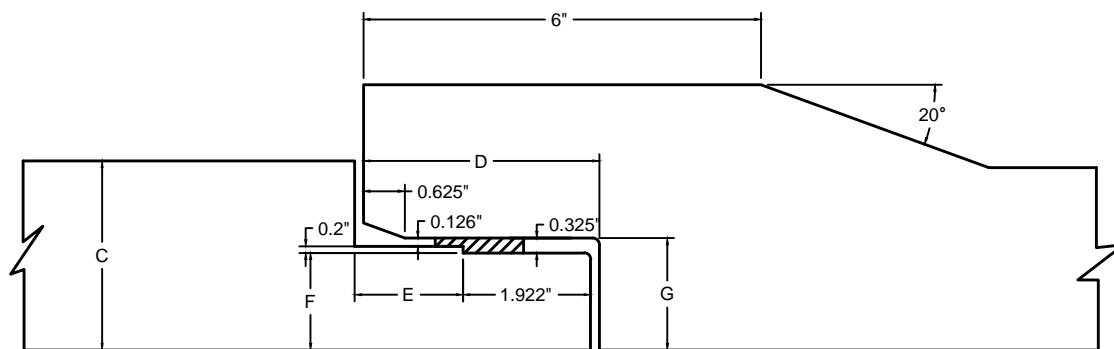
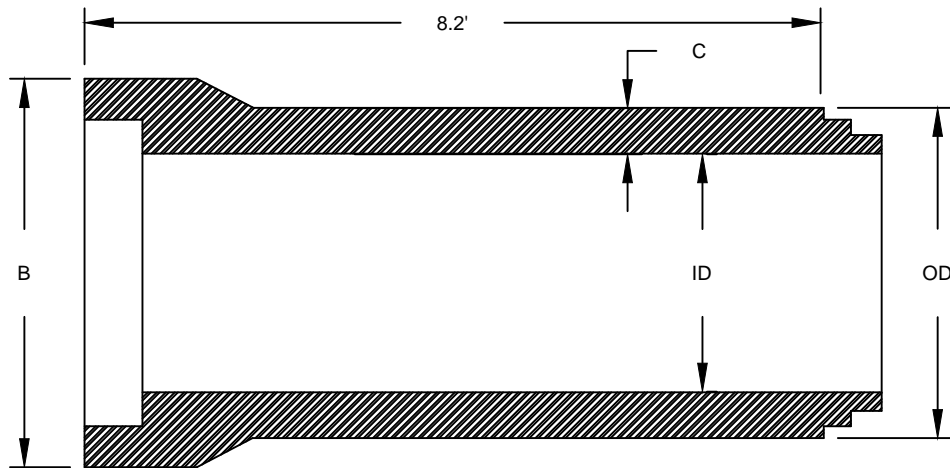
Tel: 1.800.521.3514

734-287-1000

Fax: 734-287-8132

RCP / APPROXIMATE MASS & DIMENSION CHART

INSIDE DIA. (in.)	INSIDE DIA. (mm)	WALL THICKNESS (in.)	OUTSIDE DIA. (in.)	BELL DIA. (in.)	LAY LENGTH (ft)	MASS/PIECE (lbs)
12"	300	2.75	17.5	20	8.2'	1230
15"	375	3	21	23.875	8.2'	1631
18"	450	3.25	24.5	27.625	8.2'	2079
21"	525	3.50	28	31.625	8.2'	2520
24"	600	3.75	31.5	35.625	8.2'	3126
27"	675	4	35	39.625	8.2'	3666
30"	750	4.25	38.5	40.875	8.2'	4162
36"	900	4.75	45.5	48.375	8.2'	5478
42"	1050	5.25	52.5	52.5	8'	6698
48"	1200	5.75	59.5	59.5	8'	8285
54"	1350	6.25	66.5	66.5	8'	10113
60"	1500	6	72	72	8'	11834
66"	1650	6.50	79.0	79.0	8'	14390
72"	1800	7	86	86	8'	15077
78"	1950	7.50	93	93	8'	17569
84"	2100	8	100	100	8'	20095
90"	2250	8.50	107	107	8'	23215
96"	2400	9	114	114	8'	25283
102"	2550	9.5	121	121	8'	27866
108"	2700	10	128	128	8'	30953
114"	2850	10.5	135	135	8'	34512
120"	3000	11	142	142	8'	37873



PIPE SIZE		DELL OD	WALL THICKNESS	SPIGOT LENGTH		GASKET SURFACE DIA.	BELL ID
ID	OD	B	C	D	E	F	G
12	17.5	20	2.75	3.562	1.641	14.722	15.251
15	21.0	23.875	3.00	3.562	1.641	18.222	18.751
18	24.5	27.625	3.25	3.750	1.828	21.847	22.375
21	28	31.625	3.50	3.750	1.828	25.347	25.876
24	31.5	35.625	3.75	3.875	1.953	28.854	29.383
27	35	39.625	4.00	3.875	1.953	32.319	32.848
30	38.5	40.875	4.25	3.875	1.953	34.339	34.868
36	45.5	48.375	4.75	3.875	1.953	40.839	41.368

NOTES:

1. Manufactured in accordance with ASTM C76 and CSA A257.2
2. All dimensions are in inches, unless otherwise shown
3. Super seal gaskets manufactured in accordance with ASTM C443 and CSA A257.3

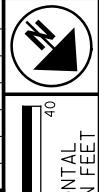



Co-Pipe Products, Inc.
20501 Goddard Rd, Taylor, MI 48180
TEL: 734-287-1000

**JOINT DETAILS (12" to 36")
DIAMETER RCP**

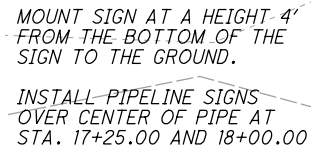
REVISED
JAN.01.2014

2. Installation locations (plan and profiles)

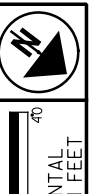


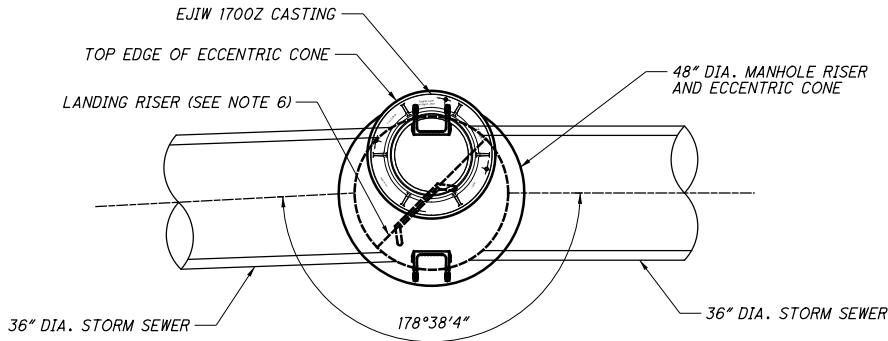
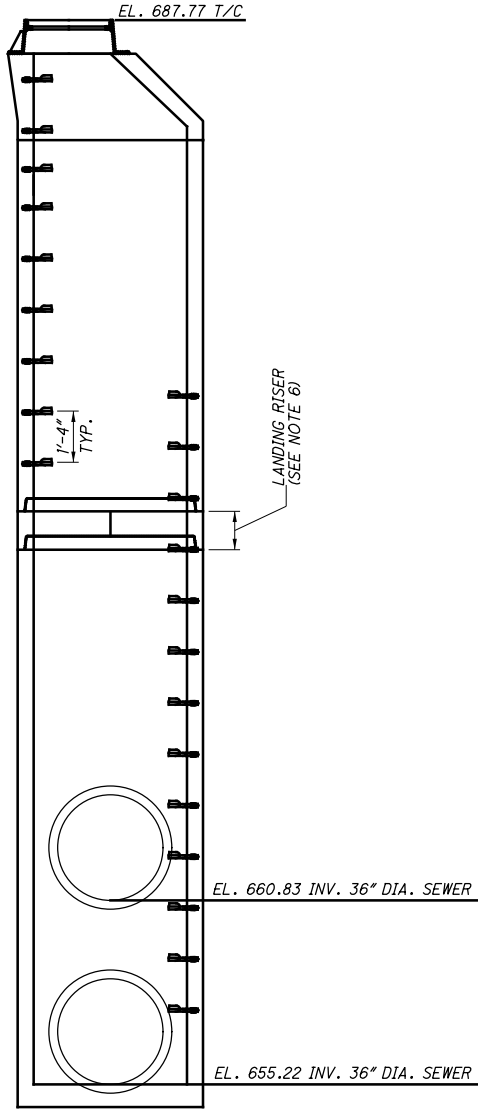
CALCULATED JTS	
CHECKED KMD	





40
NTAL
FEET





- NOTES:
1.) CONCRETE MIN. 5,000 PSI @ 28 DAYS
2.) REINFORCING GRADE 60 ASTM A615-A617 60,000 PSI YIELD STRENGTH
3.) H5-20 LOADING
4.) ALL MANHOLE SECTIONS SHALL CONFORM TO THE PROVISIONS OF ASTM C-478
5.) RUBBER GASKETED JOINTS SHALL CONFORM TO THE PROVISIONS OF ASTM C-443.
6.) LANDING RISERS SHALL BE INSTALLED PER THE DETAILS SHOWN ON SHEET 22

0	2020-04-15	RFC	David & Reinhardt
NO.	DATE	DESCRIPTION	
ISSUE RECORD			

3. Pipe manufacturer data



March 27, 2019

To: Independence Exc.

Project Name: Opportunity Corridor Phase 3-

Re: Co-Pipe Products Inc. Product Certification

To whom it may concern,

This letter is to confirm that Co-Pipe Products Inc. located at 20501 Goddard Road in Taylor Michigan produces precast concrete products which as standard meet or exceed the following requirements.

Reinforced Concrete Pipe & Structures

ASTM C76 – Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe

ASTM C478 – Specification for Precast Reinforced Concrete Manhole Sections

ASTM C443 – Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

Co-Pipe Products Inc. is a member of the Concrete Pipe Association of Michigan (CPAM) maintaining strong compliance with the following agencies; National Precast Concrete Association (NPCA), Ontario Concrete Pipe Association (OCPA), American Concrete Pipe Association (ACPA), U.S DOT such as Ohio Department of Transportation (ODOT), Michigan Department of Transportation (MDOT) and Indiana Department of Transportation (INDOT), and municipalities.

Co-Pipe Products, Inc. fully complies with the Buy America Act, with supporting data on file.

Should there be any questions please contact the undersigned.

Regards,

Brad Mathias

Quality Control

Co-Pipe Products, Inc.

20501 Goddard Rd, Taylor, MI 48180

Phone: 734-287-1000

Fax: 734-287-8132



Co-Pipe Products, Inc.

20501 Goddard Road
Taylor, Michigan 48180
Tel. 734•287•1000
800•521•3514
Fax 734•287•8132

April 9, 2019

Independence Excavating Inc.

5720 E. Schaaf Rd. Independence, Ohio 44131

RE: ODOT Project # 173000

Attn: Jad Solh / Project Engineer

Jad,

As per your request, this letter is to certify that all of the reinforced concrete pipe that Co-Pipe Products has delivered or will deliver to the Opportunity Corridor project #173000, meets the following size and strength class requirements.

All of the pipe 12" to 72" diameter, Class III, IV, V, are manufactured per ASTM C-76 specification. In addition, the pipe joint and gasket material are manufactured to ASTM C-443 specification.

After reviewing Independence Excavating Installation plan, Co-Pipe agrees that the minimum installation techniques for a successful installation have been met.

If you have any questions or require any additional info, please contact me at your convenience.

Sincerely,

Brad Mathias

Quality Control Manager

Co-Pipe Products, Inc.



Co-Pipe Products, Inc.

20501 Goddard Road
Taylor, Michigan 48180
Tel. 734•287•1000
800•521•3514
Fax 734•287•8132

April 9, 2019

Independence Excavating Inc.
5720 E. Schaaf Rd.
Independence, Ohio
44131

RE: ODOT Project # 173000

Attn: Jad Solh / Project Engineer

Jad,

Please find the following Conduit joining information needed for the installation plan:

The pipe ODOT project #173000 has a single offset joint and will be joined using a self-lubricated Tylox rubber gasket.

The maximum joint gap permitted for the installed pipe is $\frac{3}{4}$ "

If you have any questions or require any additional info, please contact me at your convenience.

Sincerely,

A handwritten signature in black ink that reads "Brad Mathias" followed by the initials "(acm)" in parentheses.

Brad Mathias
Quality Control Manager



INDEPENDENCE EXCAVATING, INC.

CLEVELAND • PITTSBURGH • MID-ATLANTIC

Setting innovation into motion for 60 years.

www.indexc.com

RCP Installation Process

1. Line & Grade- Pipe laser will be utilized to establish the reference line for pipe installation.
2. Bedding prior to pipe install- Utilize #57 limestone & install the 6" of bedding material uniformly across the full width of the flat trench bottom. Hand dig bell holes before pipe is laid. The bell holes should be just deep enough to run your fingers under the entire bell after pipe is laid.
3. Placement of pipe (jointing) – Placement of pipe should start at the outlet end of the line of pipe section. The bell end should point upstream and the spigot or tongue should point downstream. This help prevent bedding material from being forced into the bell during jointing and enables easier coupling of pipe sections.
 - a- Carefully clean spigot or tongue end of pipe, including the gasket recess.
 - b- Install the gasket carefully. Equalize the rubber gasket stretch by running a smooth, round object between the gasket and spigot, around the entire circumference several times.
 - c- Align bell & spigot of pipe to be jointed. Before homing the joint, check that the gasket is in contact with the entry taper around the entire circumference.

4- joint procedures- joints for pipe sizes up to 24 inch in diameter can usually be assembled by means of bar and wooden block. The wood block is placed horizontally across the end of the pipe to act as a fulcrum point & to protect the joint end during assembly. By pushing the top of the vertical bar forward, lever action pushes the pipe into a homed position. Larger pipe diameter may need to be installed utilizing a cable wrapped around the barrel of the pipe with a lever assembly to the installed pipe several sections back. Where necessary, bell and spigot to be lubricated with manufacturer recommended pipe lube.

5- After installation, shovel slice bedding material into the pipe haunches (not under the bell) for the entire length of the pipe to ensure uniform support.

6- Install the remainder of the #57 limestone to a minimum of at least the spring line of the pipe and to a maximum of 12" above the top of pipe according to City of Cleveland standards.

7- Back fill the remainder of the trench to bottom of subbase elevation per the city of Cleveland standards, to desired backfill heights according to the prepared 611 tables. As outlined elsewhere, within pavement limits the trench zone will be backfilled with CLSM-50. For trenches outside of pavement, backfill will be compacted according to ODOT CMS 203. Independence excavating will install in 1'-2' lifts compacting to 98% standard dry density.

GASKET INSTALLATION

Jointing of concrete pipe is the process of connecting one pipe to another in order to create a pipe system. This is accomplished by homing the spigot of one pipe into the bell of another pipe.

Normal convention is to have pipe installation start at the outlet end of the line of pipe sections and work upstream. Similarly the bell end typically should point upstream and the spigot or tongue should point downstream. This helps prevent bedding material from being forced into the bell during jointing and enables easier coupling of pipe sections. However there are situations where it makes sense to either lay the pipe downstream to make the joint pushing the bell end onto the spigot or both. With proper installation practices of maintaining the required grade and careful homing of the pipe joint, concrete pipe or box culvert pipeline sections laid downstream, and with bell inserted into the spigot, will function identically to those sections laid the other way and should not be prohibited when site conditions dictate this installation method.

Several types of joints and sealant materials are utilized for precast concrete pipe, and maintenance structures, to satisfy a wide range of performance requirements. All of the joints are designed for ease of installation. Rubber gaskets are the most common sealant material and are used in sanitary and storm sewer systems to provide a soil and water tight joint.

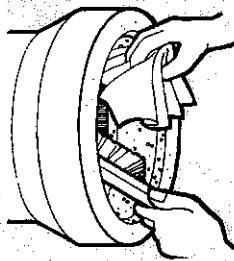
Commonly used rubber gaskets include:

- Self-lubricating
- "O" Ring
- Roll-on
- Single Offset (Profiles)

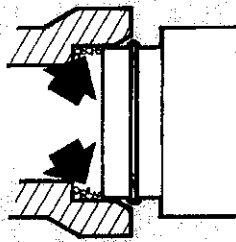


Except for the roll-on and pre-lubricated types, the gasket and bell should be coated with a lubricant recommended by the manufacturer. The lubricant must be clean and be applied with a brush,

CLEAN BELL

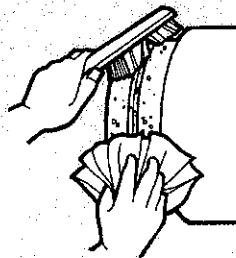


Carefully clean all dirt and foreign substances from the jointing surface of the bell or groove end of pipe.

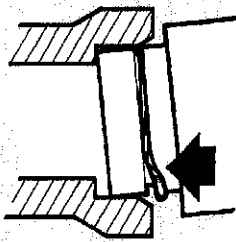


Improperly prepared bell jointing surface may prevent homing of the pipe.

CLEAN SPIGOT

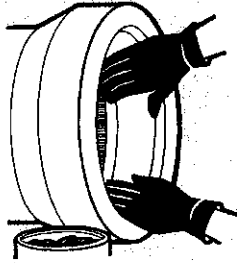


Carefully clean spigot or tongue end of pipe, including the gasket recess.

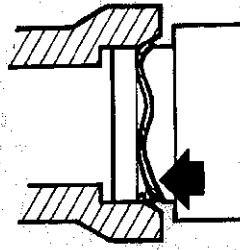


Improperly prepared spigot and gasket recess may prevent gasket from sealing correctly.

LUBRICATE BELL

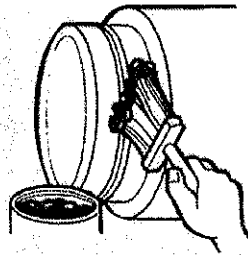


Lubricate bell jointing surface liberally. Use a brush, cloth, sponge or gloves to cover entire surface. Only approved lubricant should be used.

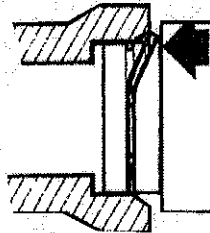


A bell not lubricated or improperly lubricated may cause gasket to roll and possibly damage the bell.

LUBRICATE SPIGOT



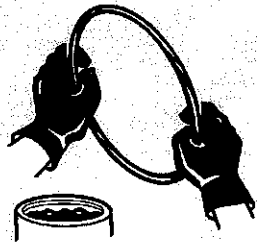
Lubricate the spigot or tongue end of pipe, especially the gasket recess.



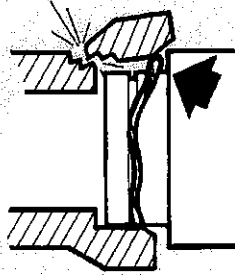
Gasket may twist out of recess if lubricant in recess is lacking or insufficient.



LUBRICATE GASKET

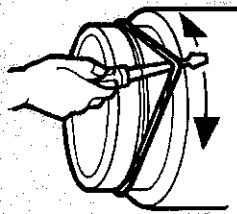


Lubricate the gasket thoroughly before it is placed on the spigot or tongue.

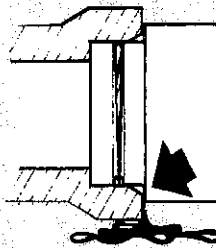


Excess force will be required to push the pipe to the home position if gasket is not well lubricated.

INSTALL GASKET

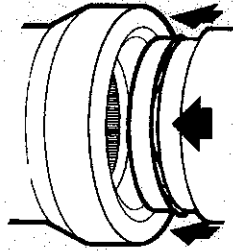


Fit the gasket carefully. Equalize the rubber gasket stretch by running a smooth, round object, inserted between gasket and spigot, around the entire circumference several times.

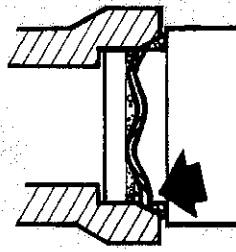


Unequal stretch could cause bunching of gasket and may cause leaks in the joint or crack the bell.

ALIGN PIPE



Align bell and spigot of pipes to be jointed. Before homing the joint, check that the gasket is in contact with the entry taper around the entire circumference.



Improper alignment can dislodge gasket causing leaks or possibly break the bell.

cloth pad, sponge or glove. For "O" Ring gasket joints, the gasket recess must also be lubricated prior to the placement of the gasket.

Gaskets are required to be stored in a controlled environment at the manufacturer's location, as well as on the job site. They need to be protected from prolonged exposure to sunlight, extreme heat in the summer, and extreme cold, snow and ice in the winter. Proper care of the gaskets prior to installation will ensure maximum ease of installation, and maximum sealing properties of the gaskets.

Gaskets are generally formulated for maximum sealing performance in a standard sewer installation carrying primarily storm water or sanitary sewage. Custom rubber formulations are available for special situations, where specific elements are being carried in the effluent which are deleterious to normal gasket materials. The rubber gaskets uti-





August 21, 2019

Ferguson Waterworks
Att: John Masters
3750 Valley Road
Cleveland, OH 44109

Re: Independence Excavating
ODOT 173000 Project
Opportunity Corridor

Dear Customer:

This is to certify that the vitrified clay sewer pipe furnished by The Logan Clay Products Company of Logan, Ohio, is manufactured in accordance with and conforms to ASTM Specification C-700 Extra Strength. O/Ring joints will conform to ASTM C-425, latest editions.

Sincerely,

Richard H. Brandt
Chairman

STATE OF OHIO)
)
COUNTY OF HOCKING) ss:

The above statement signed and sworn to in my presence on this _____ 21st
day of August _____, 2019.

Jane Ann Weiland
Notary Public, State of Ohio
My Commission Expires August 28, 2023



Logan Clay Products LLC
201 S. Walnut St. • Logan, Ohio 43138
800-848-2141 • 740-385-2184 local • 740-385-9336 fax
info@loganclaypipe.com • www.loganclaypipe.com • www.loganmachineshop.com

ASTM C700 Extra-Strength Clay Pipe Specification Data

Specify Logan Clay Pipe

Over the Long-Term, VCP is the Best Value.

- **Longevity & Sustainability** – A demonstrated service life of over 200-years in the U.S. is the longest proven service life in the industry.
- **Operations & Maintenance** – Aggressive cleaning options reduce annual maintenance costs by reducing SSOs and dig-ups over the service life of the installation.
- **Accept No Substitute** – Specify Vitrified Clay Pipe according to ASTM C700.



120-year-old pipe recently replaced to upsize the service line.

Dimensions of Extra-Strength Logan Clay Pipe (ASTM C700)

Pipe Size (I.D.)		Available Lengths							Average O.D.*		Crushing Strength**		Nominal Length of Ys & Ts
Inches	MM	1'	2'	3'	4'	5'	6'	7'	Bell	Spigot	Lbs. per Linear Ft	KN per Linear M	
4"	100	✓	✓		✓				7.05	4.81	2000	29.2	2'
6"	150	✓	✓	✓	✓				10.51	7.48	2000	29.2	2'
8"	200	✓	✓	✓		✓			12.60	9.69	2200	32.1	2'
10"	250	✓	✓	✓		✓			15.46	12.12	2400	35.0	2'
12"	300	✓	✓	✓			✓		18.15	14.54	2600	37.9	2'
15"	375	✓	✓	✓				✓	22.28	18.14	2900	42.3	3'
18"	450	✓	✓	✓				✓	26.91	21.59	3300	48.2	3'
21"	525	✓	✓	✓				✓	31.20	25.48	3850	56.2	3'
24"	600	✓	✓	✓				✓	35.45	29.05	4400	64.2	3'

✓ = Standard length for each dimension

✓ = Also available in these lengths

* All measurements are +/- 2%

** Minimum crushing strength per ASTM C700

Product Variance Data

Pipe Size	Limit of Minus Variation (per foot)	Max. Difference in Length of Opposite Sides	I.D. Limit of Minus Variation from Nominal Size
4"	1/4"	5/16"	3/16"
6"	1/4"	3/8"	1/4"
8"	1/4"	7/16"	5/16"
10"	1/4"	7/16"	3/8"
12"	1/4"	7/16"	7/16"
15"	1/4"	1/2"	9/16"
18"	1/4"	1/2"	11/16"
21"	1/4"	9/16"	13/16"
24"	3/8"	9/16"	15/16"



Logan Clay Products LLC

loganclay.com • loganclaypipe.com • loganclaymasonry.com • no-digpipe.com

info@loganclay.com • 800-848-2141 • 740-385-2184 • Fax: 740-385-9336



LOGAN

Today's Clay Pipe

1219REV

Logan's ASTM C425 O-Ring Joint

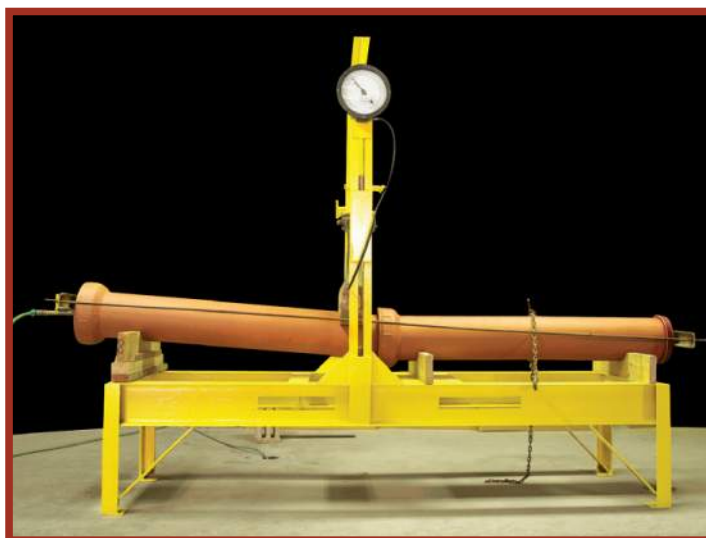
Field Tested – Field Proven

The clay pipe sewers installed early in our nation's history were not supplied with a joint. The installers joined pipe by applying tar or mortar in the trench. These joints allowed significant infiltration which was beneficial as it diluted the effluent and cleaned the lines. These sewers generally discharged into waterways without treatment.

As cities began treating sewage, infiltration became an expense. Logan Clay responded by introducing factory applied joints. Each generation of factory applied joints improved upon the last until the O-Ring joint was developed, achieving the leak-free performance that communities require.

The O-Ring joints on Logan Clay Pipe Products meet or exceed the standards established in ASTM C425 *Standard Specification for Compression Joints Vitrified Clay Pipe and Fittings*. This standard requires that the joint be "leak-free."

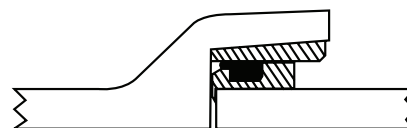
The Logan O-Ring joint has proven to be a reliable, watertight joint for more than 50 years. When installed in accordance with ASTM C12 specifications, our pipe and O-Ring joints eliminate the infiltration that was prevalent in early clay pipe lines.



For this test of 8-inch pipe, the pipe on the right provides the basis of a straight pipeline. The pipe on the left is intentionally misaligned to simulate a deflected joint. The bell end is 2 1/2 inches higher than the spigot end (1/2-inch deflection per foot length). The spigot end is unsupported while a shear load of 1,200 lbs. (150 lbs. per inch diameter or 150 x 8 = 1,200 lbs.) is then applied from above. This combination simulates a field condition of both misalignment of the joint and improper support of the barrel. In this condition, the joint must withstand the 1,200 lbs. shear load while maintaining 4.3 psi of water pressure (10 ft. head) without leaking.

Deflection Allowed by ASTM Specification

Normal Diameter	Deflection of Pipe
4-12" (101-305 mm), inclusive	1/2" (42 mm)
15-24" (381-610 mm), inclusive	3/8" (31 mm)



Vitrified
Clay



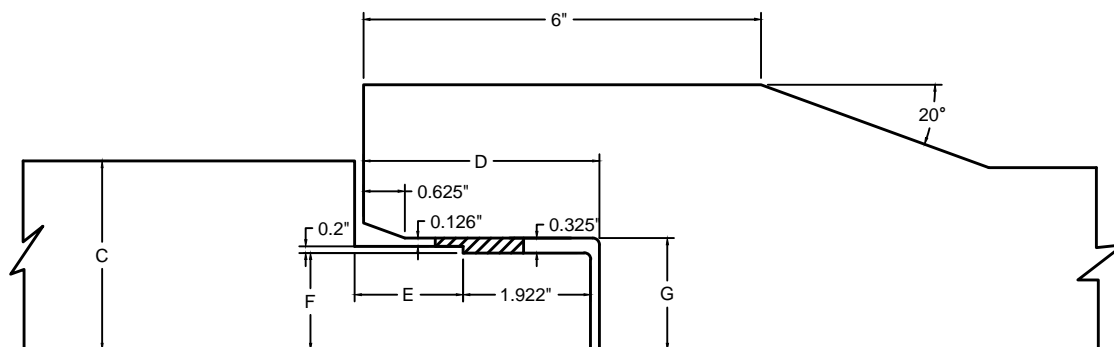
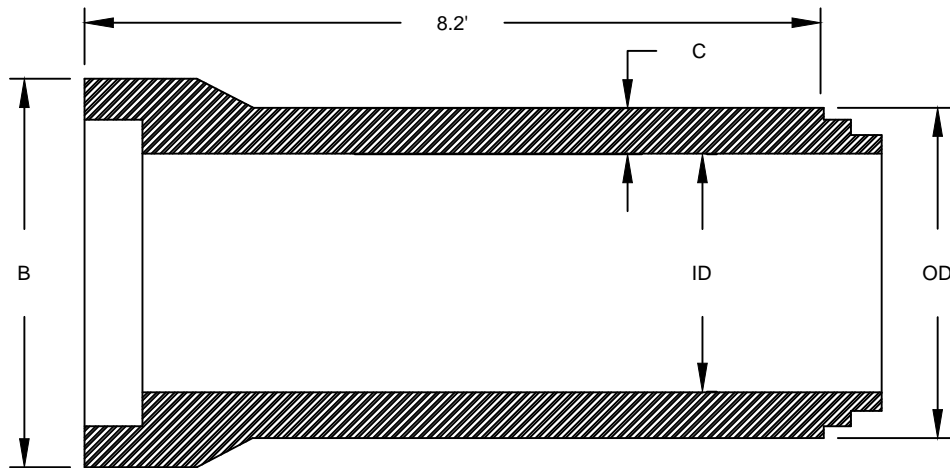
Factory-
Applied
Polyester
Joint



Rubber
Compression
Gasket

Logan Clay Products LLC

loganclay.com • loganclaypipe.com • loganclaymasonry.com • no-digpipe.com
info@loganclay.com • 800-848-2141 • 740-385-2184 • Fax: 740-385-9336



PIPE SIZE		DELL OD	WALL THICKNESS	SPIGOT LENGTH		GASKET SURFACE DIA.	BELL ID
ID	OD	B	C	D	E	F	G
12	17.5	20	2.75	3.562	1.641	14.722	15.251
15	21.0	23.875	3.00	3.562	1.641	18.222	18.751
18	24.5	27.625	3.25	3.750	1.828	21.847	22.375
21	28	31.625	3.50	3.750	1.828	25.347	25.876
24	31.5	35.625	3.75	3.875	1.953	28.854	29.383
27	35	39.625	4.00	3.875	1.953	32.319	32.848
30	38.5	40.875	4.25	3.875	1.953	34.339	34.868
36	45.5	48.375	4.75	3.875	1.953	40.839	41.368

NOTES:

1. Manufactured in accordance with ASTM C76 and CSA A257.2
2. All dimensions are in inches, unless otherwise shown
3. Super seal gaskets manufactured in accordance with ASTM C443 and CSA A257.3

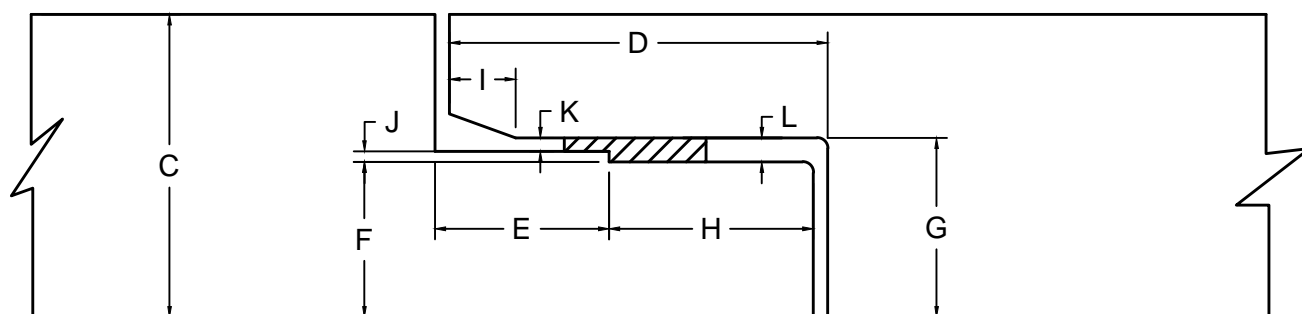
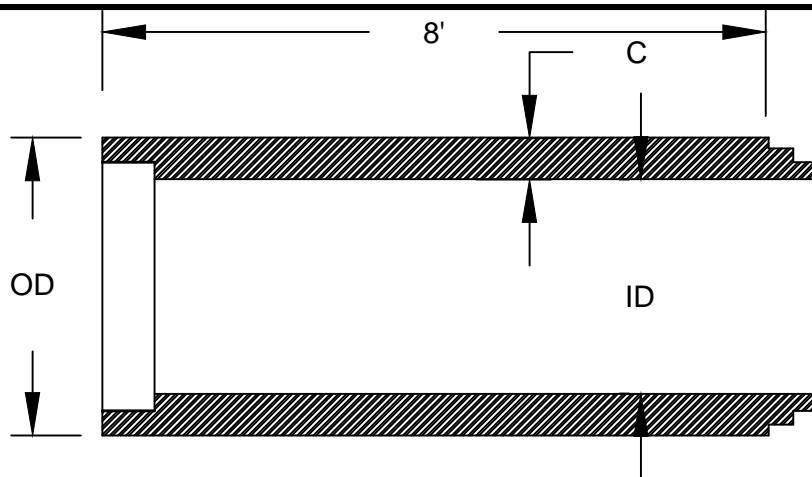


Co-Pipe Products, Inc.

20501 Goddard Rd, Taylor, MI 48180
TEL: 734-287-1000

**JOINT DETAILS (12" to 36")
DIAMETER RCP**

REVISED
JAN.01.2014



IMPERIAL											
PIPE SIZE		WALL THICK.	SPIGOT LENGTH							GASKET SURFACE DIA.	BELL ID
ID	OD	C	D	E	H	I	J	K	L	F	G
42	52.5	5.25	4.25	1.75	2.50	0.75	0.30	0.15	0.44	46.170	46.887
48	59.5	5.75	4.25	1.75	2.50	0.75	0.30	0.15	0.44	52.170	53.887
54	66.5	6.25	4.25	1.75	2.50	0.75	0.30	0.15	0.44	57.879	58.596
60	72	6.00	4.75	2.25	2.50	0.88	0.30	0.15	0.44	64.379	65.096
66	78.5	6.50	5.00	2.50	2.50	0.88	0.30	0.15	0.44	70.879	71.596
72	86	7.00	5.00	2.50	2.50	1.25	0.30	0.15	0.44	77.158	77.875
78	93	7.50	5.00	2.50	2.50	1.25	0.35	0.15	0.50	83.420	84.470
84	100	8.00	5.00	2.50	2.50	1.25	0.35	0.15	0.50	89.920	90.970
90	107	8.50	5.00	2.50	2.50	1.25	0.35	0.15	0.50	96.420	97.470
96	114	9.00	5.00	2.50	2.50	1.25	0.35	0.15	0.50	102.920	103.970
102	121	9.50	5.00	2.50	2.50	1.25	0.35	0.15	0.50	109.420	110.470
108	128	10.00	5.00	2.50	2.50	1.25	0.35	0.15	0.50	115.920	116.970
114	135	10.50	6.00	3.25	2.75	1.25	0.35	0.18	0.53	121.793	122.843
120	142	11.00	6.00	3.25	2.75	1.25	0.35	0.18	0.53	127.671	128.721

NOTES:

1. Manufactured in accordance with ASTM C76 and CSA A257.2
2. All dimensions are in inches, unless otherwise shown
3. Super seal gaskets manufactured in accordance with ASTM C443 and CSA A257.3



Co-Pipe Products, Inc.

20501 Goddard Rd, Taylor, MI 48180
TEL: 734-287-1000

JOINT DETAILS
(42" to 120") DIA. RCP

REVISED
JAN.20.2017

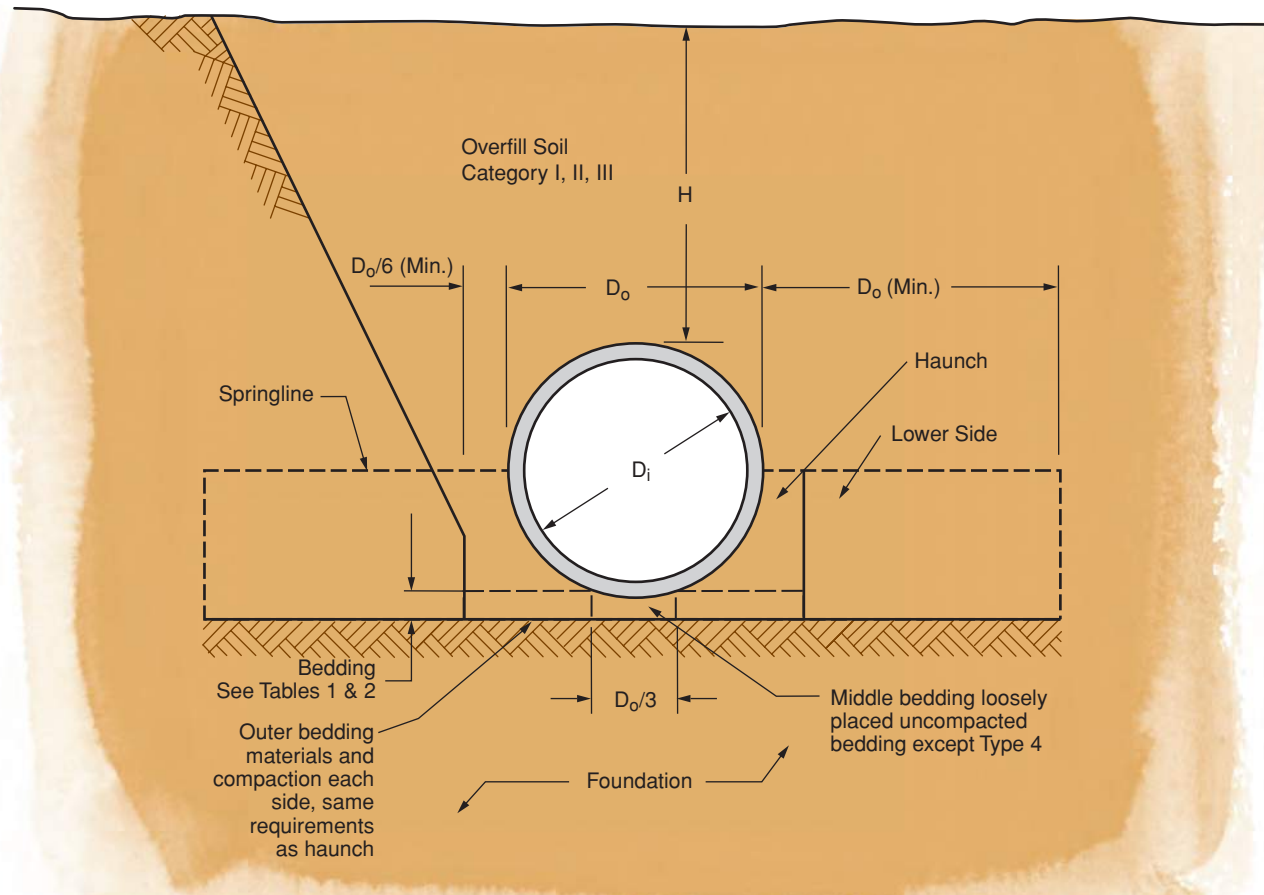
FILL HEIGHT TABLES FOR PRECAST CONCRETE PIPE



American
Concrete Pipe
Association

Standard Trench/Embankment Installation

Concrete pipe should be installed in accordance with the AASHTO LRFD Bridge Construction Specifications, Section 27 or ASTM C1479. Figure 1 shows the basic pipe and soil terminology.



There are four types of Standard Installations, each with its own soil and compaction requirements. Type 1 bedding provides the most support using highly compacted granular material, while Type 4 provides for less support allowing the use of silts and clay soils with little or no compaction. These four choices provide flexibility and versatility for the designer and contractor, as well as performance and economy for the owner that are not available with other types of pipe.

The soil and compaction requirements are provided in Table 1. Table 2 shows

the equivalent soil designations per the Unified Soil Classification System (USCS) and AASHTO.

To facilitate your selection of the proper reinforced concrete pipe using the most beneficial Standard Installation for the conditions at the site, fill height tables are provided on the following pages. The required 0.01 inch crack D-Loads are provided numerically and the class of pipe meeting this requirement is designated by color of the cell.

Table 1: Standard Installation Soils and Minimum Compaction Requirements

Installation Type	Bedding Thickness	Haunch and Outer Bedding	Lower Side
Type 1	D _o /24 minimum, not less than 3" (75 mm) If rock foundation, use D _o /12 minimum, not less than 6" (150 mm)	95% Category I	90% Category I, 95% Category II, or 100% Category III
Type 2	D _o /24 minimum, not less than 3" (75 mm) If rock foundation, use D _o /12 minimum, not less than 6" (150 mm)	90% Category I or 95% Category II	85% Category I, 90% Category II, or 95% Category III
Type 3	D _o /24 minimum, not less than 3" (75 mm) If rock foundation, use D _o /12 minimum, not less than 6" (150 mm)	85% Category I, 90% Category II, or 95% Category III	85% Category I, 90% Category II, or 95% Category III
Type 4	No bedding required except if rock foundation, use D _o /12 minimum, not less than 6" (150 mm)	No compaction required, except if Category III, use 85%	No compaction required, except if Category III, use 85%

Reference: ASCE 15-98, "Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)", 1998.

NOTES:

1. Compaction and soil symbols – i.e. "95% Category I" refers to Category I soil material with a minimum Standard Proctor compaction of 95%. See Table 2 for equivalent Modified Proctor values.
2. Soil in the outer bedding, haunch, and lower side zones shall be compacted to at least the same compaction as the majority of soil in the overfill zone.

Table 2: Equivalent USCS and AASHTO Soil Classifications for SIDD Soil Designations

Representative Soil Types			Percent Compaction	
SIDD	USCS	AASHTO	Standard Proctor	Modified Proctor
Gravelly Sand (Category I)	SW, SP, GW, GP	A1, A3	100	95
			95	90
			90	85
			85	80
			80	75
			61	59
Sandy Silt (Category II)	GM, SM, ML, Also GC, SC with less than 20% passing #200 sieve	A2, A4	100	95
			95	90
			90	85
			85	80
			80	75
			49	46
Silty Clay (Category III)	CL, MH, GC, SC	A5, A6	100	90
			95	85
			90	80
			85	75
			80	70
			45	40
	CH	A7	100	90
			95	85
			90	80
			45	40

Reference: ASCE 15-98, "Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations (SIDD)", 1998.

Fill Height Tables are based on:

1. A soil weight of 120 lbs/ft³
2. AASHTO HS20 live load
3. Embankment installation

Type 1 Bedding

	Class I		Class IV
	Class II		Class V
	Class III		Special Design

Pipe i.d. (inches)	Fill Height (feet)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
12	1125	600	425	375	375	400	400	475	500	550	575	625	675	725	750
15	1050	575	400	375	375	400	425	450	500	525	575	625	650	700	750
18	1000	550	400	375	375	400	425	450	500	525	575	600	650	700	750
21	950	525	375	350	375	400	425	450	475	525	575	600	650	700	750
24	925	525	375	350	375	400	425	450	475	525	575	625	650	700	750
27	875	500	375	350	375	400	425	450	500	525	575	625	675	700	750
30	825	500	375	350	375	400	425	450	500	525	575	625	675	725	775
33	775	475	375	350	375	400	425	450	500	525	575	625	675	725	775
36	750	475	350	350	375	400	425	450	500	550	600	625	675	725	775
42	650	475	350	350	375	400	425	450	500	550	600	650	675	725	775
48	600	450	350	350	375	400	425	450	500	550	600	650	700	750	800
54	575	400	350	350	375	400	425	475	500	550	600	650	700	750	800
60	550	400	350	350	375	400	425	475	500	550	600	650	700	750	800
66	525	375	325	350	375	400	425	475	525	575	625	650	700	750	800
72	525	375	325	350	375	400	425	475	525	575	625	675	725	775	825
78	475	375	325	350	375	425	450	475	525	575	625	675	725	775	825
84	450	375	325	350	375	425	450	475	525	575	625	675	725	775	825
90	400	375	325	350	375	425	450	500	525	600	625	675	725	775	825
96	375	375	325	350	375	425	450	500	550	600	650	700	750	800	850

Fill Height Tables are based on:

1. A soil weight of 120 lbs/ft³
2. AASHTO HS20 live load
3. Embankment installation

Type 1 Bedding

	Class I		Class IV
	Class II		Class V
	Class III		Special Design

Pipe i.d. (inches)	Fill Height (feet)														
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
12	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500
15	800	850	900	950	975	1025	1075	1125	1175	1225	1275	1325	1375	1425	1475
18	800	850	900	925	975	1025	1075	1125	1175	1225	1275	1325	1375	1425	1475
21	800	850	900	925	975	1025	1075	1125	1175	1225	1275	1325	1375	1425	1450
24	800	850	900	950	975	1025	1075	1125	1175	1225	1275	1325	1375	1425	1475
27	800	850	900	950	1000	1025	1075	1125	1175	1225	1275	1325	1375	1425	1475
30	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1325	1375	1425	1475
33	800	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500
36	825	875	925	975	1025	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500
42	825	875	925	975	1025	1075	1125	1175	1225	1275	1325	1375	1425	1475	1525
48	825	875	925	975	1025	1075	1125	1175	1225	1275	1325	1375	1425	1475	1525
54	825	875	925	975	1025	1075	1125	1175	1225	1275	1325	1375	1425	1475	1525
60	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	1550
66	850	900	950	1000	1050	1100	1150	1200	1250	1300	1350	1400	1450	1500	1550
72	850	925	950	1000	1050	1100	1150	1200	1250	1300	1375	1425	1475	1525	1575
78	875	925	975	1025	1075	1125	1175	1225	1275	1325	1375	1425	1475	1525	1575
84	875	925	975	1025	1075	1125	1175	1225	1275	1325	1375	1425	1475	1525	1575
90	875	925	975	1025	1075	1125	1175	1225	1275	1325	1375	1425	1475	1525	1600
96	875	925	975	1025	1075	1125	1175	1250	1300	1350	1400	1450	1500	1550	1600

Fill Height Tables are based on:

1. A soil weight of 120 lbs/ft³
2. AASHTO HS20 live load
3. Embankment installation

Type 1 Bedding







	Class I		Class IV
	Class II		Class V
	Class III		Special Design

Pipe i.d. (inches)	Fill Height (feet)														
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
12	1550	1600	1650	1700	1725	1775	1825	1875	1925	1975	2025	2075	2125	2175	2225
15	1525	1575	1625	1675	1725	1750	1800	1850	1900	1950	2000	2050	2100	2150	2200
18	1500	1550	1600	1650	1700	1750	1800	1850	1900	1950	2000	2050	2100	2150	2200
21	1500	1550	1600	1650	1700	1750	1800	1850	1900	1950	2000	2050	2100	2150	2175
24	1525	1575	1600	1650	1700	1750	1800	1850	1900	1950	2000	2050	2100	2150	2200
27	1525	1575	1625	1675	1725	1775	1825	1875	1900	1950	2000	2050	2100	2150	2200
30	1525	1575	1625	1675	1725	1775	1825	1875	1925	1975	2025	2075	2125	2175	2225
33	1550	1600	1650	1700	1750	1800	1850	1900	1950	1975	2025	2075	2125	2175	2225
36	1550	1600	1650	1700	1750	1800	1850	1900	1950	2000	2050	2100	2150	2200	2250
42	1575	1625	1675	1700	1750	1800	1850	1900	1950	2000	2050	2100	2150	2200	2250
48	1575	1625	1675	1725	1775	1825	1875	1925	1975	2025	2075	2125	2175	2225	2275
54	1575	1625	1675	1725	1775	1825	1875	1925	1975	2025	2075	2125	2175	2225	2275
60	1600	1650	1700	1750	1800	1850	1900	1950	2000	2050	2100	2150	2200	2250	2300
66	1600	1650	1700	1750	1800	1850	1900	1950	2000	2050	2100	2150	2200	2250	2325
72	1625	1675	1725	1775	1825	1875	1925	1975	2025	2075	2125	2175	2225	2275	2325
78	1625	1675	1725	1775	1825	1875	1925	1975	2025	2075	2125	2175	2225	2300	2350
84	1625	1675	1725	1775	1825	1900	1950	2000	2050	2100	2150	2200	2250	2300	2350
90	1650	1700	1750	1800	1850	1900	1950	2000	2050	2100	2150	2200	2250	2300	2350
96	1650	1700	1750	1800	1850	1900	1950	2000	2050	2100	2175	2225	2275	2325	2375

Fill Height Tables are based on:

1. A soil weight of 120 lbs/ft³
2. AASHTO HS20 live load
3. Embankment installation

Type 1 Bedding

	Class I		Class IV
	Class II		Class V
	Class III		Special Design

Pipe i.d. (inches)	Fill Height (feet)														
	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
12	2275	2325	2375	2425	2475	2525	2575	2625	2675	2725	2775	2825	2875	2925	2975
15	2250	2300	2350	2400	2450	2500	2550	2600	2650	2700	2725	2775	2825	2875	2925
18	2225	2275	2325	2375	2425	2475	2525	2575	2625	2675	2725	2775	2825	2875	2925
21	2225	2275	2325	2375	2425	2475	2525	2575	2625	2675	2725	2775	2825	2875	2925
24	2250	2300	2350	2375	2425	2475	2525	2575	2625	2675	2725	2775	2825	2875	2925
27	2250	2300	2350	2400	2450	2500	2550	2600	2650	2700	2750	2775	2825	2875	2925
30	2275	2325	2375	2425	2450	2500	2550	2600	2650	2700	2750	2800	2850	2900	2950
33	2275	2325	2375	2425	2475	2525	2575	2625	2675	2725	2775	2825	2875	2925	2975
36	2300	2350	2400	2450	2500	2550	2600	2650	2700	2750	2800	2850	2900	2950	3000
42	2300	2350	2400	2450	2500	2550	2600	2650	2700	2750	2800	2850	2900	2950	3000
48	2325	2375	2425	2475	2525	2575	2625	2675	2725	2775	2825	2875	2925	2975	3025
54	2325	2375	2425	2475	2525	2575	2625	2675	2725	2775	2825	2875	2925	2975	3025
60	2350	2400	2450	2500	2550	2600	2650	2700	2750	2800	2850	2900	2950	3000	3050
66	2375	2425	2475	2525	2575	2625	2675	2725	2775	2825	2875	2925	2975	3025	3075
72	2375	2425	2475	2525	2575	2625	2675	2750	2800	2850	2900	2950	3000	3050	3100
78	2400	2450	2500	2550	2600	2650	2700	2750	2800	2850	2900	2950	3000	3050	3100
84	2400	2450	2500	2550	2600	2650	2700	2750	2800	2850	2900	2975	3025	3075	3125
90	2400	2450	2525	2575	2625	2675	2725	2775	2825	2875	2925	2975	3025	3075	3125
96	2425	2475	2525	2575	2625	2675	2725	2775	2825	2875	2925	2975	3050	3100	3150

Fill Height Tables are based on:

1. A soil weight of 120 lbs/ft³
2. AASHTO HS20 live load
3. Embankment installation

Type 2 Bedding







	Class I		Class IV
	Class II		Class V
	Class III		Special Design

Pipe i.d. (inches)	Fill Height (feet)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
12	1150	650	475	475	500	525	575	650	700	750	825	900	950	1025	1100
15	1075	625	475	450	475	525	575	625	700	750	825	875	950	1025	1075
18	1025	600	450	450	475	525	575	625	700	750	825	875	950	1025	1075
21	1000	575	450	450	475	525	575	625	700	750	825	875	950	1025	1075
24	950	575	450	450	475	525	575	650	700	775	825	900	950	1025	1100
27	900	550	450	450	475	525	575	650	700	775	825	900	975	1025	1100
30	850	550	450	450	475	525	575	650	700	775	825	900	975	1025	1100
33	800	550	425	450	475	525	575	650	700	775	850	900	975	1050	1100
36	775	525	425	450	475	525	600	650	725	775	850	900	975	1050	1125
42	675	525	425	450	475	525	600	650	725	775	850	925	975	1050	1125
48	625	500	425	450	475	550	600	650	725	775	850	925	975	1050	1125
54	600	475	425	450	500	550	600	650	725	800	850	925	1000	1050	1125
60	575	450	425	450	500	550	600	675	725	800	850	925	1000	1075	1125
66	575	450	400	450	500	550	600	675	725	800	875	950	1000	1075	1150
72	575	450	400	450	500	550	600	675	750	800	875	950	1025	1075	1150
78	525	450	400	450	500	550	625	675	750	800	875	950	1025	1075	1150
84	475	425	400	450	500	550	625	675	750	825	875	950	1025	1075	1150
90	450	425	400	450	500	550	625	675	750	825	875	950	1025	1100	1150
96	425	425	400	450	500	550	625	675	750	825	875	950	1025	1100	1175

Fill Height Tables are based on:

1. A soil weight of 120 lbs/ft³
2. AASHTO HS20 live load
3. Embankment installation

Type 2 Bedding

	Class I		Class IV
	Class II		Class V
	Class III		Special Design

Pipe i.d. (inches)	Fill Height (feet)														
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
12	1150	1225	1275	1350	1425	1500	1550	1625	1700	1750	1825	1900	1975	2050	2125
15	1150	1200	1275	1325	1400	1475	1550	1625	1675	1750	1825	1875	1950	2025	2100
18	1150	1200	1275	1350	1400	1475	1550	1600	1675	1750	1825	1875	1950	2025	2100
21	1150	1200	1275	1350	1400	1475	1550	1625	1675	1750	1825	1900	1975	2025	2100
24	1150	1225	1300	1350	1425	1500	1550	1625	1700	1775	1850	1900	1975	2050	2125
27	1150	1225	1300	1350	1425	1500	1575	1625	1700	1775	1850	1925	1975	2050	2125
30	1150	1225	1300	1350	1425	1500	1575	1650	1700	1775	1850	1925	2000	2050	2125
33	1150	1225	1300	1375	1425	1500	1575	1650	1725	1800	1850	1925	2000	2075	2150
36	1175	1250	1300	1375	1450	1525	1600	1650	1725	1800	1875	1950	2000	2075	2150
42	1175	1250	1325	1375	1450	1525	1600	1675	1725	1800	1875	1950	2025	2075	2150
48	1175	1250	1325	1400	1450	1525	1600	1675	1725	1800	1875	1950	2025	2100	2150
54	1175	1250	1325	1400	1450	1525	1600	1675	1750	1825	1875	1950	2025	2100	2175
60	1200	1250	1325	1400	1475	1550	1600	1675	1750	1825	1900	1975	2050	2100	2175
66	1200	1275	1350	1400	1475	1550	1625	1700	1775	1825	1900	1975	2050	2125	2200
72	1200	1275	1350	1425	1500	1550	1625	1700	1775	1850	1925	2000	2050	2125	2200
78	1200	1275	1350	1425	1500	1575	1625	1700	1775	1850	1925	2000	2050	2125	2200
84	1225	1275	1350	1425	1500	1575	1625	1700	1775	1850	1925	2000	2075	2125	2200
90	1225	1275	1350	1425	1500	1575	1650	1700	1775	1850	1925	2000	2075	2125	2200
96	1225	1300	1350	1425	1500	1575	1650	1700	1775	1850	1925	2000	2075	2150	2200

Fill Height Tables are based on:

1. A soil weight of 120 lbs/ft³
2. AASHTO HS20 live load
3. Embankment installation

Type 2 Bedding

	Class I		Class IV
	Class II		Class V
	Class III		Special Design

Pipe i.d. (inches)	Fill Height (feet)														
	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
12	2175	2250	2325	2400	2450	2525	2600	2675	2750	2800	2875	2950	3025	3100	3150
15	2150	2225	2300	2375	2450	2500	2575	2650	2725	2775	2850	2925	3000	3075	3125
18	2150	2225	2300	2375	2450	2500	2575	2650	2725	2775	2850	2925	3000	3050	3125
21	2175	2250	2300	2375	2450	2525	2600	2650	2725	2800	2875	2925	3000	3075	3150
24	2200	2250	2325	2400	2475	2550	2600	2675	2750	2825	2900	2950	3025	3100	3175
27	2200	2275	2325	2400	2475	2550	2625	2675	2750	2825	2900	2975	3025	3100	3175
30	2200	2275	2350	2400	2475	2550	2625	2700	2750	2825	2900	2975	3050	3125	3175
33	2200	2275	2350	2425	2500	2575	2625	2700	2775	2850	2925	2975	3050	3125	3200
36	2225	2300	2375	2425	2500	2575	2650	2725	2800	2850	2925	3000	3075	3150	3225
42	2225	2300	2375	2450	2500	2575	2650	2725	2800	2850	2925	3000	3075	3150	3225
48	2225	2300	2375	2450	2525	2575	2650	2725	2800	2875	2950	3000	3075	3150	3225
54	2250	2300	2375	2450	2525	2600	2675	2725	2800	2875	2950	3025	3100	3175	3225
60	2250	2325	2400	2475	2525	2600	2675	2750	2825	2900	2975	3025	3100	3175	3250
66	2275	2325	2400	2475	2550	2625	2700	2775	2825	2900	2975	3050	3125	3200	3275
72	2275	2350	2425	2500	2575	2625	2700	2775	2850	2925	3000	3075	3125	3200	3275
78	2275	2350	2425	2500	2575	2625	2700	2775	2850	2925	3000	3075	3125	3200	3275
84	2275	2350	2425	2500	2575	2625	2700	2775	2850	2925	3000	3075	3125	3200	3275
90	2275	2350	2425	2500	2575	2625	2700	2775	2850	2925	3000	3075	3125	3200	3275
96	2275	2350	2425	2500	2575	2625	2700	2775	2850	2925	3000	3075	3125	3200	3275

Fill Height Tables are based on:

1. A soil weight of 120 lbs/ft³
2. AASHTO HS20 live load
3. Embankment installation

Type 3 Bedding

	Class I		Class IV
	Class II		Class V
	Class III		Special Design

Pipe i.d. (inches)	Fill Height (feet)																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
12	1175	700	550	550	600	650	725	800	875	950	1050	1125	1200	1300	1375	1475	1550	1650
15	1100	675	525	550	575	650	700	775	875	950	1025	1100	1200	1275	1375	1450	1525	1600
18	1050	650	525	525	575	650	700	775	850	950	1025	1100	1200	1275	1350	1425	1525	1600
21	1000	625	500	525	575	650	700	775	850	950	1025	1100	1200	1275	1350	1425	1525	1600
24	975	600	500	525	575	650	700	775	850	950	1025	1100	1200	1275	1350	1450	1525	1600
27	925	600	500	525	575	650	700	800	875	950	1025	1125	1200	1275	1375	1450	1525	1600
30	875	600	500	525	575	650	725	800	875	950	1050	1125	1200	1300	1375	1450	1525	1625
33	825	575	500	525	575	650	725	800	875	950	1050	1125	1225	1300	1375	1450	1550	1625
36	800	575	500	525	575	650	725	800	875	975	1050	1150	1225	1300	1400	1475	1550	1650
42	700	575	500	525	600	650	725	800	900	975	1050	1150	1225	1325	1400	1475	1575	1650
48	650	550	500	525	600	650	725	825	900	975	1075	1150	1250	1325	1425	1475	1575	1650
54	625	525	500	525	600	675	750	825	900	1000	1075	1150	1250	1350	1425	1500	1575	1675
60	625	500	500	525	600	675	750	825	925	1000	1075	1175	1250	1350	1425	1500	1600	1700
66	600	500	475	550	600	675	750	850	925	1000	1100	1175	1275	1350	1450	1525	1600	1700
72	600	500	475	550	600	675	775	850	925	1025	1100	1200	1275	1375	1450	1525	1625	1725
78	550	500	475	550	600	675	775	850	925	1025	1100	1200	1300	1375	1475	1550	1625	1725
84	525	500	475	550	625	700	775	850	950	1025	1100	1200	1300	1375	1475	1550	1625	1725
90	475	500	475	550	625	700	775	850	950	1025	1125	1200	1300	1375	1475	1550	1625	1725
96	450	475	475	550	625	700	775	850	950	1025	1125	1200	1300	1375	1475	1550	1650	1725

Fill Height Tables are based on:

1. A soil weight of 120 lbs/ft³
2. AASHTO HS20 live load
3. Embankment installation

Type 3 Bedding

	Class I		Class IV
	Class II		Class V
	Class III		Special Design

Pipe i.d. (inches)	Fill Height (feet)																
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
12	1725	1825	1900	2000	2075	2175	2250	2350	2425	2525	2600	2700	2800	2875	2975	3050	3150
15	1700	1775	1875	1950	2050	2125	2225	2300	2400	2475	2575	2675	2750	2850	2925	3025	3100
18	1675	1775	1850	1950	2025	2125	2200	2300	2375	2475	2550	2650	2725	2825	2900	3000	3075
21	1675	1775	1850	1950	2025	2125	2200	2300	2375	2475	2550	2650	2750	2825	2900	3000	3075
24	1700	1775	1875	1950	2025	2125	2200	2300	2375	2475	2550	2650	2725	2825	2900	3000	3075
27	1700	1775	1875	1950	2050	2125	2225	2300	2400	2475	2575	2650	2750	2825	2925	3000	3100
30	1700	1800	1875	1975	2050	2150	2225	2325	2400	2500	2575	2675	2750	2850	2950	3025	3125
33	1725	1800	1900	1975	2075	2150	2250	2350	2425	2525	2600	2700	2775	2875	2950	3050	3125
36	1750	1825	1925	2000	2100	2175	2275	2350	2450	2525	2625	2725	2800	2900	2975	3075	3150
42	1750	1825	1925	2000	2100	2175	2275	2375	2450	2550	2625	2725	2800	2900	3000	3075	3175
48	1750	1850	1925	2025	2100	2200	2275	2375	2475	2550	2650	2725	2825	2900	3000	3100	3175
54	1750	1850	1950	2025	2125	2200	2300	2400	2475	2575	2650	2750	2850	2925	3025	3100	3200
60	1775	1875	1950	2050	2125	2225	2325	2400	2500	2575	2675	2775	2850	2950	3025	3125	3225
66	1800	1875	1975	2050	2150	2250	2325	2425	2525	2600	2700	2775	2875	2975	3050	3150	3250
72	1800	1900	2000	2075	2175	2250	2350	2450	2525	2625	2725	2800	2900	3000	3075	3175	3250
78	1800	1900	2000	2075	2175	2250	2350	2450	2525	2625	2725	2800	2900	3000	3075	3175	3250
84	1800	1900	2000	2075	2175	2275	2350	2450	2525	2625	2725	2800	2900	3000	3075	3175	3275
90	1825	1900	2000	2075	2175	2275	2350	2450	2550	2625	2725	2800	2900	3000	3075	3175	3275
96	1825	1900	2000	2100	2175	2275	2350	2450	2550	2625	2725	2800	2900	3000	3075	3175	3275

Fill Height Tables are based on:

1. A soil weight of 120 lbs/ft³
2. AASHTO HS20 live load
3. Embankment installation

Type 4 Bedding







	Class I		Class IV
	Class II		Class V
	Class III		Special Design

Pipe i.d. (inches)	Fill Height (feet)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
12	1550	950	750	800	875	950	1075	1200	1325	1450	1575	1700	1825	1950	2100
15	1450	900	750	775	850	950	1050	1150	1275	1400	1525	1650	1775	1900	2050
18	1375	850	725	750	825	925	1050	1150	1250	1375	1500	1625	1750	1900	2025
21	1325	850	700	750	825	925	1025	1125	1250	1375	1500	1600	1750	1875	2000
24	1275	825	700	725	800	900	1000	1125	1250	1350	1475	1600	1725	1850	1975
27	1150	800	700	725	800	900	1000	1125	1225	1350	1475	1600	1725	1850	1975
30	1025	800	675	725	800	900	1000	1100	1225	1350	1475	1600	1700	1850	1950
33	925	775	675	725	800	900	1000	1100	1225	1350	1475	1600	1700	1825	1950
36	850	750	675	725	800	900	1000	1100	1225	1350	1450	1575	1700	1825	1950
42	750	750	650	725	800	900	1000	1100	1225	1350	1450	1575	1700	1825	1950
48	700	675	650	725	800	900	1000	1100	1225	1350	1450	1575	1700	1825	1950
54	675	625	650	725	800	900	1000	1100	1225	1350	1450	1575	1700	1825	1950
60	675	600	650	700	800	900	1000	1100	1225	1350	1450	1575	1700	1825	1950
66	650	575	625	700	800	900	1000	1125	1225	1350	1475	1600	1700	1825	1950
72	650	575	600	700	800	900	1000	1125	1225	1350	1475	1600	1700	1825	1950
78	625	575	600	700	800	900	1000	1125	1250	1350	1475	1600	1700	1825	1950
84	575	575	600	700	800	900	1025	1125	1250	1350	1475	1600	1725	1850	1950
90	550	575	600	700	800	900	1025	1125	1250	1375	1475	1600	1725	1850	1950
96	525	575	600	700	800	925	1025	1150	1250	1375	1500	1600	1725	1850	1975

Fill Height Tables are based on:

1. A soil weight of 120 lbs/ft³
2. AASHTO HS20 live load
3. Embankment installation

Type 4 Bedding

	Class I		Class IV
	Class II		Class V
	Class III		Special Design

Pipe i.d. (inches)	Fill Height (feet)							
	16	17	18	19	20	21	22	23
12	2225	2350	2500	2625	2775	2700	3025	3175
15	2175	2300	2450	2550	2700	2825	2950	3100
18	2125	2275	2400	2525	2650	2775	2900	3050
21	2125	2250	2375	2500	2625	2750	2875	3000
24	2100	2225	2350	2475	2600	2725	2850	2975
27	2075	2200	2325	2450	2575	2700	2825	2950
30	2075	2200	2325	2450	2575	2700	2825	2950
33	2075	2200	2325	2450	2575	2700	2825	2950
36	2075	2200	2325	2450	2550	2675	2800	2925
42	2050	2175	2300	2425	2550	2675	2800	2925
48	2050	2175	2300	2425	2550	2675	2800	2925
54	2050	2175	2300	2425	2550	2675	2800	2925
60	2050	2175	2300	2425	2550	2650	2775	2900
66	2050	2175	2300	2425	2550	2675	2775	2900
72	2050	2175	2300	2425	2550	2675	2800	2900
78	2075	2175	2300	2425	2550	2675	2800	2900
84	2075	2200	2300	2425	2550	2675	2800	2925
90	2075	2200	2325	2425	2550	2675	2800	2925
96	2075	2200	2325	2450	2550	2675	2800	2925

The preceding fill height tables are based on a concrete pipe installed in a positive projecting embankment installation with a soil unit weight of 120 lbs/ft³ and HS 20 live load at the surface. The required classes of pipe do not account for construction loads or any other load induced on the pipe prior to its completed installation, or live load in excess of HS 20.

Dimensions of Circular Concrete Pipe - Metric Units					
Designated Internal Diameter mm	Actual Internal Diameter mm	Wall B		Wall C	
		Minimum Wall Thickness mm	Average Weight kg/m	Minimum Wall Thickness mm	Average Weight kg/m
300	305	50	162	69	197
375	381	57	216	75	262
450	457	63	253	82	335
525	533	69	327	88	417
600	610	75	430	94	505
675	686	82	500	100	602
750	762	88	598	107	708
825	838	94	695	113	821
900	914	100	832	119	940
975	991	113	923	125	1090
1050	1067	117	1057	132	1207
1200	1219	125	1324	144	1504
1350	1372	138	1589	157	1829
1500	1524	150	1927	169	2192
1650	1676	163	2295	182	2582
1800	1829	175	2695	194	2998
1950	1981	188	3125	207	3457
2100	2134	200	3585	219	3943
2250	2286	213	4078	232	4460
2400	2438	225	4598	244	5009
2550	2591	238	5179	257	5595
2700	2743	250	5752	269	6202
3000	3048	279	6344	298	7521
3600	3658	330	8104	349	10,540

Dimensions of Circular Concrete Pipe - Imperial Units						
Internal Diameter inches	Wall A		Wall B		Wall C	
	Minimum Wall Thickness inches	Average Weight pounds per foot	Minimum Wall Thickness inches	Average Weight pounds per foot	Minimum Wall Thickness inches	Average Weight pounds per foot
12	1-3/4	79	2	93	2-3/4	133
15	1-7/8	103	2-1/4	127	3	177
18	2	131	2-1/2	168	3-1/4	226
21	2-1/4	171	2-3/4	214	3-1/2	281
24	2-1/2	217	3	264	3-3/4	341
27	2-5/8	255	3-1/4	322	4	406
30	2-3/4	295	3-1/2	384	4-1/4	476
33	2-7/8	336	3-3/4	451	4-1/2	552
36	3	383	4	524	4-3/4	633
42	3-1/2	520	4-1/2	686	5-1/4	811
48	4	683	5	867	5-3/4	1011
54	4-1/2	864	5-1/2	1068	6-1/4	1232
60	5	1064	6	1295	6-3/4	1473
66	5-1/2	1287	6-1/2	1542	7-1/4	1735
72	6	1532	7	1811	7-3/4	2023
78	6-1/2	1797	7-1/2	2100	8-1/4	2329
84	7	2085	8	2409	8-3/4	2656
90	7-1/2	2395	8-1/2	2740	9-1/4	3004
96	8	2710	9	3090	9-3/4	3374
102	8-1/2	3078	9-1/2	3480	10-1/4	3765
108	9	3446	10	3865	10-3/4	4178
114	9-1/2	3840	10-1/2	4278	11-1/4	4611
120	10	4263	11	4716	11-3/4	5066
126	10-1/2	4690	11-1/2	5175	12-1/4	5542
132	11	5148	12	5655	12-3/4	6040
138	11-1/2	5627	12-1/2	6156	13-1/4	6558
144	12	6126	13	6679	13-3/4	7098
150	12-1/2	6647	13-1/2	7223	14-1/4	7659
156	13	7190	14	7789	14-3/4	8242
162	13-1/2	7754	14-1/2	8375	15-1/4	8846
168	14	8339	15	8983	15-3/4	9471
174	14-1/2	8945	15-1/2	9612	16-1/4	10,117
180	15	9572	16	10,263	16-3/4	10,785



American **Concrete Pipe** Association

222 W. Las Colinas Blvd., Suite 641
Irving, TX 75039-5423
972-506-7216 Fax 972-506-7682
E-mail: info@concrete-pipe.org
www.concrete-pipe.org

End.

Submittal: 110

Revision:

Date Submitted: 10/22/2020

Response Due By:



Project: 16051 - ODOT 173000 CUY IR 490/SR010 (OC3)

Description: Jack and Bore: Outfall #4

To: EW Chambers
Engineer Public Improvements-Norfolk Southern Corp.

From: Nicole DeVille
Kokosing Construction Company, Inc.

Email

Email: nfd@kokosing.biz

Submittal Type:	Submitted For:
<input type="checkbox"/> Engineered Drawings	<input checked="" type="checkbox"/> Approval
<input type="checkbox"/> Shop Drawings	<input type="checkbox"/> Record
<input type="checkbox"/> Working Drawings	<input type="checkbox"/> Other
<input type="checkbox"/> CPM Schedule	
<input type="checkbox"/> Material Certifications / Test Results	Sent Via:
<input type="checkbox"/> Reports	<input checked="" type="checkbox"/> Attached (Electronic)
<input type="checkbox"/> Product Data/Samples	<input type="checkbox"/> Attached (Hard Copy)
<input checked="" type="checkbox"/> Other: Jack and Bore Plan	

Submittal #	Copies	Spec #	Rev. #	Description	
110	1	625.14		110 – Jack and Bore: Outfall #4	

Comments:

Included with this submittal is the following attachment realtered to the construction of the Outfall#4 which will be Jack and Bored under the Norfolk Southern Railroad:

- NSRR/GCRTA Work Plan – Engineering Shoring Plan – Track Monitoring

Signed: Nicole DeVille 10/22/2020



**INDEPENDENCE
EXCAVATING**
A DiGeronimo Company

October 22nd, 2020

Re: ODOT Project 3000(17)

Opportunity Corridor – Section 3

Outfall #4: NSRR/GCRTA Submittal - Work Plan - Engineering Shoring Plan - Track Monitoring

To Whom It May Concern:

As part of the Opportunity Corridor – Section 3 project, IX is to install underground storm sewer within the zone of influence of NSRR and GCRTA rail. For a section of the work, IX will bore under 5 tracks (2 NSRR tracks, 3 RTA tracks) located at E 79th and Woodland area. IX will follow all Norfolk Southern specifications laid out in CA-5 Casing Pipe Installation as well as RFC BU-24 plan set for Outfall #4 Drainage (2020-04-15) being within the Theoretical Embankment line. Below is a breakdown of our work plan.

Phase 1

- Excavate and shore a bore pit on the North West side of the tracks using steel boxes with spreaders and steel plates. Estimated timeframe: 2 full working shifts
- IX will provide an OSHA safe working pit measuring at 24'x14'

Phase 2

- IX will establish monitoring points and capture a baseline along the tracks as outlined in the enclosed plan
- IX will monitor the tracks once during active bore and jack work
- IX will bore 24/7 until the lead edge of 54" casing pipe is past the NS tracks zone of influence and then begin single shift work. Estimated timeframe: 2 weeks or 20 full working shifts
- Kokosing will have NS flaggers scheduled at all times during the bore
- Upon completion of the bore IX will use steel boxes and steel plates on the North West side of the tracks to set 3 precast structures

Phase 3

- IX will excavate and shore a receiving pit on the South East side of the tracks using steel boxes and plates. Estimated timeframe: 3 full working shifts
- IX will set the structure and perform all work needed for tie ins to sewer including open cut by conventional means from D-269 to D-272. Estimated timeframe: 3 weeks or 15 full working shifts

*As identified above, in Phase 2 we will begin our open cut and bore under the tracks. It is understood that the use of the jack and bore equipment may have "the potential to disturb the Railroad track structure" (Public Projects Manual – Appendix E), and must be reviewed by NSRR. A contingency plan is

in place which will anticipate reaching the deflection threshold of the rail. In this case, IX will immediately stop work, assess the situation with NSRR, ODOT, Kokosing, and the design team and come to an agreement on correcting the issue. IX is submitting the following:

1. Track Monitoring Program for review & approval by Norfolk Southern
2. Turnkey Work Plan
3. IX Shoring
 - conventional with boxes D-269 to D-272
 - Launch and receiving pits for bore

From: Hommel, Peter W. <Peter.Hommel2@nscorp.com>
Sent: Wednesday, September 30, 2020 2:20 PM
To: Sorma, J.P. <ipsorma@indexc.com>
Subject: RE: Field meeting - OC3 Bore at E 79th / NS and RTA lower tracks

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

All of this is correct.

PWH

From: Sorma, J.P. <ipsorma@indexc.com>
Sent: Tuesday, September 29, 2020 10:36 AM
To: Hommel, Peter W. <Peter.Hommel2@nscorp.com>
Cc: Gillilan, Matt <mgillilan@indexc.com>; Strunk, Rick <rstrunk@indexc.com>; Wymard, Jesse (Co-Op) <JWymard@indexc.com>
Subject: [EXTERNAL] Field meeting - OC3 Bore at E 79th / NS and RTA lower tracks

Peter,

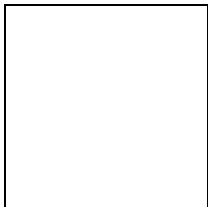
Great talking with you and appreciate your help.

Below are the main points we talked on just want to make sure all is clear:

- IX will not have to worry about any Fiber optic lines for this Bore. You believe there are no utilities below 5' however Tyrone Mcroskey may be better to answer this?
- IX will have to bore 24/7 from the start of the first NS rail until the casing is pushed past the second NS rails ballast before RTA tracks. Once it clears that ballast, the bore does not have to continue 24/7.
- The overhead steel structure below will be removed by IX and the footers will be removed at least 1' under grade.



Again thank you for your time.



J.P. Sorma
Project Engineer

Independence Excavating, Inc.
5720 E. Schaaf Rd. | Independence, OH 44131
216.308.4530 Direct
216.308.4530 Mobile
ipsorma@indexc.com
www.indexc.com

1. Track Monitoring Program.



**INDEPENDENCE
EXCAVATING**
A DiGeronimo Company

NSRR Track Monitoring Program

For Bore & Jack work only , upon completion reporting will cease

Bore CUY-IR490/SR010- 2.09/19.28

- I. Prior to the commencement of any jack and bore work, install survey points along the 2 Norfolk Southern tracks
- II. Record the stationing, offset and elevation for each of the identified survey points
- III. For each day of operation, record survey data daily
- IV. Report data to the Railroad Engineer or representative on a daily basis
- V. Upon completion of the jack and bore operations, record and report survey data on a weekly basis throughout the duration until settlement is complete
- VI. Utilize the attached sheet (or similar format) for Track Monitoring Reporting
- VII. If movement or settlement has been detected, report to the Railroad Engineer immediately!

Sincerely,
Independence Excavating Inc.

J.P. Sorma
Project Engineer

NSRR TRACK MONITORING REPORT

DOT 3000(17) - OPPORTUNITY CORRIDOR 3

SURVEY DATE: _____

SURVEY TIME: _____

PILE-DRIVING OPERATIONS? YES NO (CIRCLE ONE)

MAIN TRACK #1

		BASELINE DATA				DAILY REPORT DATA		
POINT	DISTANCE/SHEETING	STATION	OFFSET	L/R	ELEVATION	OFFSET	L/R	ELEVATION
A								
B								
C								
D								
E								
F								
G								
H								
I								
J								
K								
Record data during initial survey point installation.						Record data daily/weekly.		

MAIN TRACK #2

		BASELINE DATA				DAILY REPORT DATA		
POINT	DISTANCE/SHEETING	STATION	OFFSET	L/R	ELEVATION	OFFSET	L/R	ELEVATION
A								
B								
C								
D								
E								
F								
G								
H								
I								
J								
K								
Record data during initial survey point installation.						Record data daily/weekly.		

NOTES: _____

EMPLOYEE NAME: _____

EMPLOYEE SIGNATURE: _____

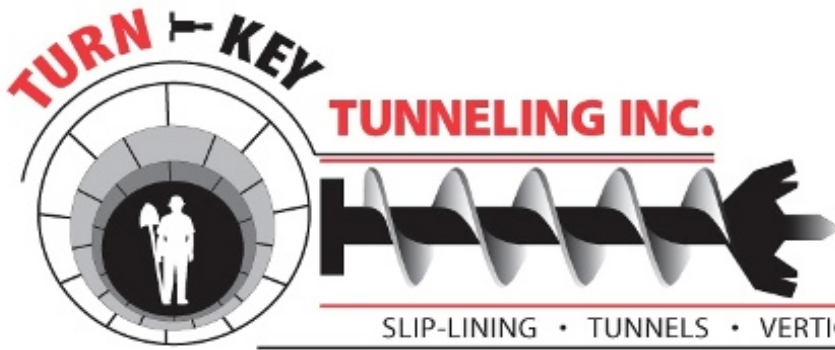
Submit this form to the NSRR Engineer or Representative. Any detection of movement/settlement shall be reported immediately.



Install survey points on side rail or
wooden ties - TBD by NSRR.
(Approx spacing = 25 FT)

Refer to table for survey locations.
Record actual baseline data
(station, offset, elevation) upon
installation.

2. Turn-Key work plan.



1247 Stimmel Road Columbus, Ohio 43223
Phone 614 .275 .4832 Fax 614 .275 .4834
(Equal Opportunity Employer)

OC3 Bore Under NS RTA Tracks

Tunneling Work Plan: The following is our boring work plan which describes all aspects of the proposed tunneling with excavation being performed by jack and bore.

Equipment:

54" Trench-less Installation utilizing jack & boring

- 60" American Auger Machine
- 20 Ton Little Giant Crane
- 2 Each Lincoln Welders – 200 – 300 Amp
- Ram 2500 Foremen's Truck
- Tool Shed
- Vent Pump
- Gas Detector
- Clam Bucket – 5/8 to 3/4 Cubic Yard
- Light Plant
- Airplaco Pressure Grouter Model G-6F Grout Pump, Hose and Piping
- 185 CFM Air Compressor
- 2" Hose and Necessary Piping
- 2" Half-Couplings as Needed for Pressure Grouting
- Wood Timbers 2 x 8 – 12 Each, 8 x 8 – 2 Each

Labor per Shift:

Operator Foremen	1 Each
Operator	1 Each
Laborers	2 Each

Illumination: Illumination will be provided with electrically powered tunnel lights and in strict accordance with OSHA 1926.800 (l)

Ventilation: Equipment required for ventilation will include an 18.25 In. Dayton Blower Model #7H141. This blower provides a minimum of 3892cfm. The required airflow per person is 200cfm, we plan on having a maximum of 2 people in the casing at any time requiring a maximum of 400cfm. An 18" fan line will be mounted on the side of the working shaft and extend to the bottom. As the Casing is advanced, it will be necessary to enter the casing to check line and grade. Air testing will be conducted with a minimum of two (2) each 4 gas detectors which will monitor

OC3 Bore Under NS RTA Tracks

Carbon Monoxide, Methane, Hydrogen Sulfide and Oxygen. Atmosphere monitoring equipment will be a MSA Solaris 4 Gas Detector, or Equal. This monitoring will be performed in accordance with all local, state and federal guidelines and OSHA 1926.800(j).

Schedule for boring work:

Mobilization / setup: 1 Shift
Boring: 20 shifts
Demobilization: 1 Shift

Following initiation of the bore work will progress 24 hours per day 7 days per week until the bore is through the NSRR railroad zone of influence.

Pit excavation, backfill, site restoration, and cleanup to be completed by Independence Excavating

Pipe Lubricants:

Due to the length of this crossing we do not foresee the need for any lubrication on the exterior of the casing pipe.

Information defining the proposed jacking system:

Capacity, number, and arrangement of main jacks:

The boring machine has four (4) ten inch (10”) hydraulic cylinders with a combined total thrust of 1,200,000lbs and travel of 36” under the machine.

Details of thrust ring, jacking controls, pressure gauges & calibration data for jack indicating pressure v. load relationship:

Max thrust:	1,200,000lbs
Max operating pressure:	5,000 psi
Thrust/psi:	240lbs/psi
Maximum jacking force estimated to complete job:	150,000lbs



Materials:

OC3 Bore Under NS RTA Tracks

S&S Pipe Co.

2251-B Freeport Road

Kittanning, PA 16201

(866) 342-0714, (724) 545-2912, (724) 859-2531

Fax: (724) 545-8307

email: steve@sspipe.us

October 22, 2020

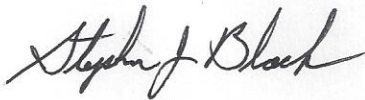
J.P. Sorma
Independence Excavating
3826 Saxonburg Blvd
Cheswick, PA 15024

Re: Steel Casing Pipe for your ODOT Project 3000(17) Opportunity Corridor
– Section 3; Cleveland, OH

MATERIALS CERTIFICATION

We certify that the 54.00"OD x .781" nominal (+/-5%) wall New Domestic Casing Pipe being supplied to the above referenced project will meet and or exceed the physical strength properties of ASTM A139 Grade B, (waiving hydrostatic test). The steel meets 35,000+ PSI MIN YIELD STRENGTH and 60,000+ PSI MIN TENSILE STRENGTH. This steel casing pipe was manufactured in the United States of America, using new American Steel and American labor.

S&S Pipe Company



Stephen J. Black
Quality Control

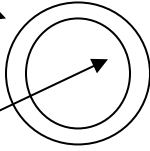
54" x .781" Bare Steel Casing Pipe Supplied by S&S Pipe.

Casing Calculations:

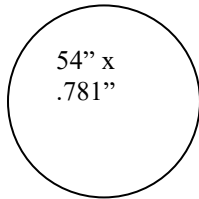
54" OD

Contact area – $2290.22\text{in}^2 - 2159.64\text{in}^2 = 130.58\text{in}^2$
 $130.58\text{in}^2 * 35,000\text{psi} = 4,570,300\text{lbs}$
 Max Thrust (1,200,000lbs) < Min Yield (4,570,300lbs)

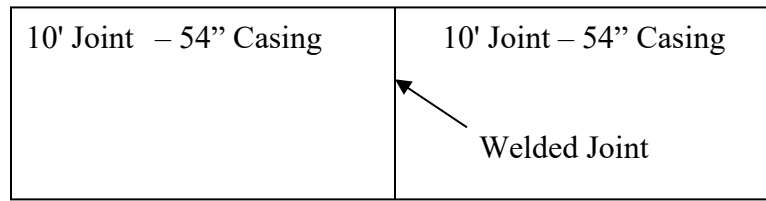
52.438" ID



Casing Pipe Joint Detail



END VIEW



PROFILE VIEW

Welding:

All welding will be performed by skilled welders who have adequate experience in the type of materials being used. All welding will be performed by one of the following ANSI/AWS D1.1 certified welders:

Tim Branham
 Jeremy Blake
 Gary Ison

James Froehlich
 Timothy Wade

John Riffle
 Lee Froehlich

Labor per Shift:

Operator Foremen	1 Each
Operator	1 Each
Laborers	2 Each

Contact Details of Key Personnel

Brian Froehlich	Project Engineer	Cell Number (614) 315 - 2962
Chris Leonard	Project Manager	Cell Number (614) 359 - 2493
Elliot Baum	Project Coordinator	Cell Number (614) 296 - 3457
James Froehlich	General Superintendent	Cell Number (614) 315 - 2495
Tim Wade	Project Foreman	Cell Number (614) 325 - 3668

Emergency Services

All Emergency Services will be dispatched through 911

Each of the personnel listed above meet our criteria as "Competent Person" for our company. If any one of them witnesses anything that is either unacceptable construction practices or unsafe means

OC3 Bore Under NS RTA Tracks

and methods, they have the authority to shut down the project until appropriate measures or remedies have been instituted to correct the problem

Casing Installation: Our procedure to install this crossing is as follows: The grade is set by laying the timbers to grade on a gravel base. The boring machine is set on its track in the boring pit on top of hardwood timbers. The 54" steel casing with 53" auger inserted is lowered into the pit in 10 foot dead lengths and set in front of the boring machine. The Auger is connected to the Hub Drive of the Auger Boring Unit, (ABU). This auger will transfer the cutting torque from the machine to the Dirt Cutting Head.

The head is then turned by the auger inside it and it is engaged into the face. The auger inside the casing then draws the spoil out through the casing and back to the machine. The casing is advanced forward by hydraulic rams at approximately .25' - .5' at a time. The hydraulic rams are repositioned every 2 - 3 feet by using a locking device on the push block. The locking device locks the rams into the track. The machines dirt kickers throw the dirt out a discharge door on the side of the master push ring. The spoils are then removed from the pit by our crane and clam bucket or muck box. The dirt kickers attach to the auger drive shaft and turn at the same rpm as the cutting head and augers. The auger will turn at a variable rate depending on the soil conditions. The minimum rotation is around 7 rpm and the maximum around 30 rpm. The leading edge of the casing is equipped with a positive retention device to prevent any unsupported excavation ahead of the casing, see attachment 2. Due to the soil condition shown in the provided bore logs as dirt at the depth of the bore a dirt cutting head will be utilized for this drive, see attachment 4 for head detail. If an obstruction is encountered the auger and cutting head will be removed from within the casing. Turn-Key will immediately notify NSRR and the casing will be abandoned in place and filled with grout. If there is overcut of greater than 1" the void space outside the casing will be grouted.

As soon as the entire length of casing has been installed, the machine is disconnected from the auger and backed away from the casing. Another 10 foot section of casing (with auger) is connected to the previously bored casing by butt welding the ends of the casing together. The augers are connected prior to welding by inserting the male hex of one auger into the female hex of the other. The two are then pinned together with a 1" diameter auger pin. Alignment is monitored and checked from inside the casing pipe while the casing is advanced. After the welding is completed, the machine is then reattached to the auger and boring resumes as described above. Alignment is monitored and checked from inside the casing pipe while the casing is advanced. A pipe laser, Topcon Model Number PTY0615, or equal, will periodically be installed in the working pit to shine through the casing pipe. This laser will establish our centerline for which Line and Grade will be monitored. If our grade or alignment starts to vary from the design, we will adjust the steering head fins on the casing to account for any misdirection. We will cut out guide "shoes" to steer the casing to achieve the desired alignment.

If an obstruction is encountered that prevents installation of the casing pipe Turn-Key Tunneling will alert NSRR immediately then abandon the casing in place and fill it with non-shrink grout.

Contractor's Experience: Turn - Key Tunneling, Inc. has been in the Trench-less Pipe Installation Industry since 2005. Although our company is newly established, our lead company personnel possess combined trench-less pipe installation experience of over 147 years and 200,000 Linear Feet. We have a 100% record of success with respect to projects of similar construction means and methods. All work on this project will be performed under the supervision of James Froehlich whom has worked in the trench-less field for over eight (8) years. In his absence, John Riffle, whom has worked in the trench-less field for over twenty-eight (28) years, Dave Ratliff whom has worked in the trench-less field for over seventeen (17) years, or Tim Branham whom has worked in the trench-

OC3 Bore Under NS RTA Tracks

less field for over four (4) years will take responsible charge of our forces. Resumes for each of these men are below. Turn – Key Tunneling, Inc. also has a full-time Ohio Registered Professional Engineer (PE) on staff to assist our field personnel along with owners and designers. Turn-Key Tunneling is one of the most experienced contractors' in our specialty field and has been on the forefront of hand mined tunneling. Turn – Key Tunneling is Pre-Qualified in Kentucky, Ohio, Indiana, West Virginia, Virginia, and North Carolina, Tennessee, and Pennsylvania to perform projects of this nature.

Work Shifts: Work Shifts will be as follows:

All Weeks;	Single Shift – Mon–Th During non-boring activities 7 AM – 7 PM
	Day Shift – 24-7 While in the influence of the railroad tracks
	Night Shift –24-7 While in the influence of the railroad tracks

Safety Plan:

Turn – Key Tunneling has a record of Safe Work Practices in which we are extremely proud. We strive to have zero injuries to our workforce and are committed to ensuring their safety. Every year our company has safety meetings which include First Aid and CPR so that in the event of an Accident we can limit the effects of any injury in the field. A complete safety manual will be available in the project trailer and in our foremen's vehicle.
Critical elements for this project include:

Pit entrance / exit: The boring pit will have a ladder fixed in position approximately midway through the length of the pit.

Atmospheric Monitoring: Will be performed by a MSA Solaris 4 Gas Detector – results will be recorded on our daily shift reports.

Electrical Safety: All electrical equipment will be grounded using a 7' long copper ground rod. Circuit breakers and ground fault breakers will be used to ensure that any chance of electrocution is negated.

Restoration and Repair Procedure: If heaving or settling of the ground around the boring takes place the ground will be returned to original conditions via filling, milling, excavating, and grout injection.

If there are any further questions or concerns regarding our experience or planned means and methods, please feel free to contact our office to discuss any items in detail. We look forward to performing this work and trust that all parties involved will benefit from enlisting our services for this project.

**TUNNELING INC.**

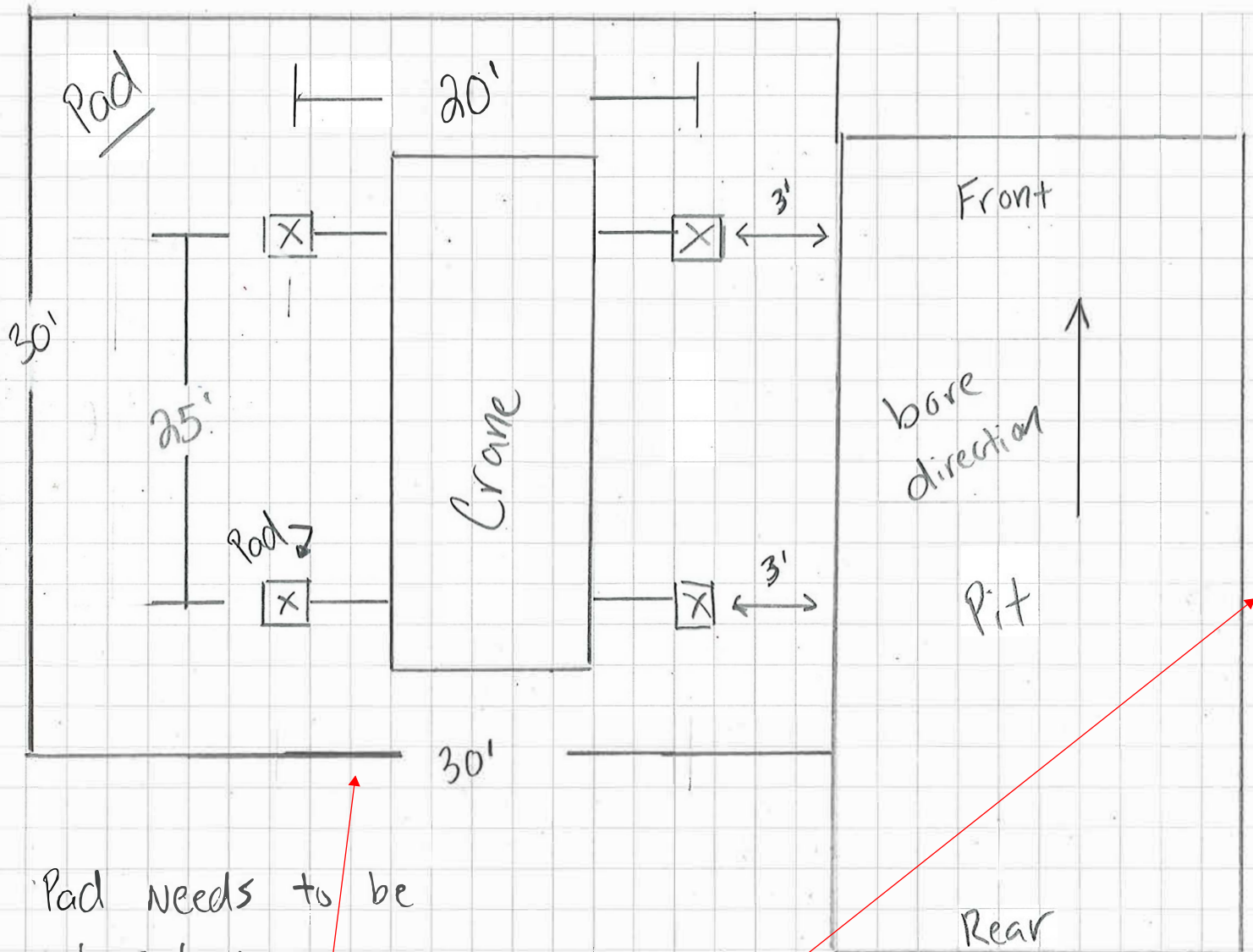
1247 Stimmel Road Columbus, Ohio 43223
 Phone 614.275.4832 Fax 614.275.4834
 Equal Opportunity Employer
 ODOT DBE & EDGE Certified

SLIP-LINING • TUNNELS • VERTICAL SHAFTS • PIPE JACKING • BORING

Date _____

Project _____

By _____



Pad needs to be
 30' x 30' to support crane

Weight of Little Giant Crane = 45,000 Lbs

Option 1 location
 for pad

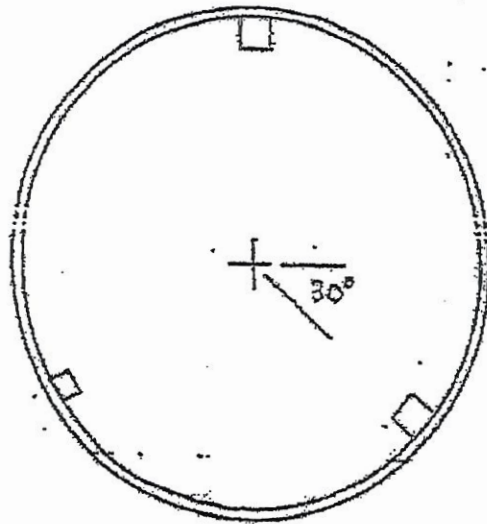
Option 2 location
 for pad

Option 3 location
 for pad

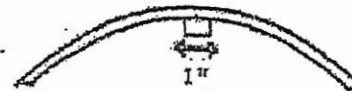
Attachment 2

PAGE 02
PAGE 02

Casing Sizes Thru 24"

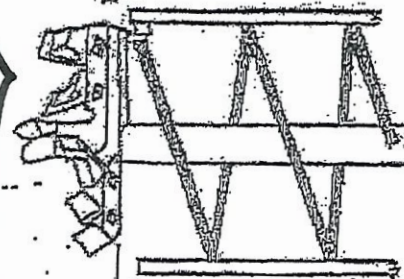


Typical Stop Arrangement
For Casing Sizes Larger than 24" O.D.



End View

1" x 1" steel block



Side View

1" MAX. PROTRUSION OF CUTTING HEAD
BEYOND EDGE END OF CASING PIPE

POSITIVE AUGER STOP DETAILS

08/11/2008 WED 14:03 [TX/RX NO 69791] 002

Typical Stop Arrangement

* ATTACHMENT

Attachment 3

James Froehlich

10 Years of Trenchless Excavation Experience

1247 Stimmel Road, Columbus, Ohio 43223 | 614.275.4832 | www.tunnelit.net

PROFESSIONAL EXPERIENCE

Superintendent/Safety Manager | Turn-Key Tunneling, Inc. | November 2010 - Present

Oversee and manage production and scope of projects, including scheduling of crews and materials. Supervise crews staffed with foreman, operators, laborers, tunnel miners and muckers. Coordinate projects with general contractors. Maintain high safety standards and adhere to all OSHA specifications. Create policies and procedures and implement.

Chief Humane/Safety Agent | Union County, Ohio | 2008 - 2010

Coordinate and conduct investigations in to child and animal abuse. Spearhead campaign to implement new policies and procedures. Manage county OSHA compliance and MSDS.

Squad Leader | US Army | 2005 - 2009

Manage and lead a group of soldiers. Oversee squad readiness and lead missions in infantry operations.

PROJECT EXPERIENCE

AEP Kammer Plant- Moundsville, WV

General Contractor- Par

Scope of Project- Bore and install 900' of 36" casing in 3 runs. Install 300' of 30" and 300' of 24" HDPE Fusion pipe. Install 1800' of 4" electrical conduit. Set and install 6 sets of 8'X10' electric manhole. Bores were completed under rail road tracks and numerous utilizes.

Down Town Storage Basin- Toledo, OH

General Contractor- Kokosing

Scope of Project- Install 750' of 12' rib and lagging tunnel. Install 42' of 32' diameter rib and lagging shaft. Install 42' of 12' diameter liner plate shaft.

Delaware Pedestrian Tunnel- Philadelphia, PA

General Contractor- AP Construction

Scope of Project- Install 140' of 12' liner plate tunnel. Install 4455 cubic feet of ground stabilization to support railroad.

Certifications

Certified Safety Manager

OSHA 30

Certified Welder

CPR/ First Aid

Confined Space

Project Management Certificate

John Riffle

30 Years of Trenchless Excavation Experience

1247 Stimmel Road, Columbus, Ohio 43223 | 614.275.4832 | www.tunnelit.net

PROFESSIONAL EXPERIENCE

Laborer Foreman / Superintendent | Turn-Key Tunneling, Inc. | August 2007 – Present

Supervise crew of laborers, tunnel miners, and muckers. Manage production and scope of project, scheduling of crew and materials. Operate auger boring machine and related equipment. Coordinate project with general contractor. Maintain safety standards per OSHA specifications.

Laborer Foreman | Capitol Tunneling, Inc. | 1990 – August 2007

Tunnel Laborer | Capitol Tunneling, Inc.

General laborer, welding and installation of steel casing and tunnel liner plates. Assist in setting up jobsite pits and working areas, maintain line and grade of bore, support for lead foreman. Supervise crew, manage production of projects. Operate auger boring machine and related equipment. Maintain safety standards per OSHA specifications.

PROJECT EXPERIENCE

Little Cuyahoga Interceptor – Akron, OH - 2014

General Contractor: Vadnais Corporation

Scope of Work: Hand mined an 84" casing 135' to encounter a stuck MTBM. Mined & jacked the casing over top of the MTBM and removed it through the casing piece by piece.

Knowles Avenue Pedestrian Underpass under CSX RR – Glen Olden, PA - 2012

General Contractor: Crossing Construction Company, Inc.

Scope of Work: Install 51.5' of 180" 4-Flange with gaskets, galvanized, and exterior bituminous coated tunnel liner plate structure utilizing a tunnel shield.

Malvern Station Tunnel & Parking Lot Improvement – Malvern, PA - 2010

General Contractor: James J. Anderson Construction Company

Scope of Work: Install 75 linear feet of 180" Tunnel utilizing a tunnel shield for pedestrian tunnel.

McAlpine Creek Relief SS Phase III – Charlotte, NC – 2012

General Contractor: BRS

Scope of Work: 1500' total length of tunnels, 108"-72" for sewers, 72"-42" sewers in 8 runs. Beneath active roadways and railroad tracks.

Nonconnah Interceptor Relocation Tunnel – Memphis, TN – 2011

General Contractor: Nelson, Inc.

Scope of Work: Install 206' of 132" diameter rib and lagging tunnel structure for 96" sewer main utilizing a tunnel shield.

SR 28 ODOT 080532 - Blanchester, Ohio - 2008

General Contractor: Mainline Road & Bridge Construction

Scope of work: Construction of 130 linear feet of 180" galvanized tunnel in a full face of rock with a paved invert for use as a final storm structure. The liner was installed to include grout ports per specifications. Removal of existing water line that was in conflict of tunnel limits.

CERTIFICATIONS

Competent Person Certification

Confined Space Certification

Certified Welder

CPR / First Aid

OSHA 30-hour



Dave Ratliff

18 Years of Trenchless Excavation Experience

1247 Stimmel Road, Columbus, Ohio 43223 | 614.275.4832 | www.tunnelit.net

PROFESSIONAL EXPERIENCE

Foreman | Turn-Key Tunneling, Inc. | February 2004 - Present

Supervise crew of laborers, tunnel miners and muckers. Manage production and scope of project, scheduling of crew and materials. Operate auger boring machine and related equipment. Coordinate project with general contractor and maintain safety standards per OSHA specifications.

Tunnel Laborer | Capital Tunneling, Inc. | 2002 - 2004

General laborer, welding and installation of steel casing and tunnel liner plates. Assist in setting up jobsite pits and working areas, maintain line and grade of bore, support for lead foreman. Operate auger boring machine and related equipment. Maintain safety standards per OSHA specifications.

PROJECT EXPERIENCE

US 250 & McIntire Road – Charlottesville, VA - 2013

General Contractor: General Excavation

Scope of Work: Install 442' of 48" casing for 30" DIP sewer in 3 runs. Install 40' of 36" casing for 24" DIP sewer in 1 run and install 180' of 24" casing for 12" DIP water main in 1 run.

Hays Mine Clearwell- Pittsburgh, PA - 2011

General Contractor: Kokosing Construction

Scope of Work: Installed 540' of 66" casing in mostly rock and split face conditions. The bores were completed in 6 runs in tightly congested urban conditions. Bores were completed for 42" and 48" new water lines. Bores were completed on line and grade and took precise installation due to numerous other utilities in the area.

CERTIFICATIONS

Certified Crane Operator
OSHA 30-hour certification
CPR / First aid
Confined Space
Silica Training
Competent Person

Gary Ison

20 Years of Trenchless Excavation Experience

1247 Stimmel Road, Columbus, Ohio 43223 | 614.275.4832 | www.tunnelit.net

PROFESSIONAL EXPERIENCE

General Superintendent | Turn-Key Tunneling, Inc. | 2006 - Present

Supervise crew of laborers and operators. Operate auger boring machine, welders, air compressors. Manage production and scope of project. Maintain safety standards per OSHA specifications.

Laborer | S.J. Louis Construction | 2005 - 2006

General laborer for installation of steel casing pipe. Operate slurry machine, weld casing joints.

Laborer | Frank Collucio Construction | 2004 - 2005

General laborer for installation of steel casing pipe, weld pipe, tunnel excavation.

Laborer | Modern Continental | 2000 - 2004

General laborer for installation of steel casing pipe, microtunneling method, pipe jacking. Operate slurry machine.

Laborer | Towing Engineering | 1997 - 2000

General laborer for installation of steel casing pipe, microtunneling method, pipe jacking. Operate slurry machine.

PROJECT EXPERIENCE

NEORSD Dugway West Interceptor - Cleveland, OH - 2016

General Contractor: Walsh Contracting

Scope of Work: Construction of 24' diameter shaft 20' deep and a 12' diameter shaft 20' deep- blind-tied into existing sewer which involved 108" casing, 120" tunnel liner plate and chemical stabilization.

NEORSD Dugway East Interceptor Replacement Sewer - Cleveland, OH - 2010

General Contractor: DiGioia - Suburban Excavating, LLC

Scope of Work: Install 140 linear feet of 108" 4-flange tunnel liner plate structure utilizing a tunnel shield. Furnish, install and remove 25 vertical feet of 240" shaft liner plate structure.

Taco Bell Emergency Repairs - Cincinnati, OH - 2016

General Contractor: Turn-Key Tunneling, Inc.

Scope of Work: Shaft Installation, Slip-line 96" CMP, 84" Tunnel Installation.

Holiday Retirement/New England Club - Cincinnati, OH - 2016

General Contractor: Turn-Key Tunneling, Inc.

Scope of Work: Slip-line HDPE liner in current structure w/backfill.

ODOT Piedmont Dam Culvert - Piedmont, OH - 2014

General Contractor: Turn-Key Tunneling, Inc.

Scope of Work: Emergency Culvert Repairs.

James River Interceptor, Division 3A - Lynchburg, VA - 2013

General Contractor: Thalle Construction

Scope of Work: Install 370' of 108" casing.

ODOT Project 614, Wales Rd RR Grade Separation - Northwood, OH - 2012

General Contractor: E.S. Wagner Company

Scope of Work: Used guided 60" boring machine. Installed 146' of 72" bare steel casing pipe for 60" RCP under RR. Install 153' of 66" bare steel casing pipe for 48" RCP under RR. Install 139' of 60" bare steel casing pipe for 42" RCP under RR.

SR 28 ODOT 080532 - Blanchester, OH - 2008

General Contractor: Mainline Road & Bridge Construction

Scope of work: Construction of 130 linear feet of 180" galvanized tunnel in a full face of rock with a paved invert for use as a final storm structure. The liner was installed to include grout ports per specifications. Removal of existing water line that was in conflict of tunnel limits.

CERTIFICATIONS

Ohio Certified Welder

Confined Space Certification

CPR / First Aid

OSHA 30-hour

Competent Person Certification

Attachment 4



3. IX Shoring plan.



INDEPENDENCE EXCAVATING, INC.
 5720 Schaaf Road
 Independence, Ohio 44131
 Industrial & Commercial

Phone 216-524-1700
 Fax 216-524-1701

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OC3 D-273 Pit

Project 18-1-135 Date 9/28/20

Submitted by RGI Page 2 of 7 Pages

Surcharge Scenarios

1) Surcharge from RR Load

- C of track is 28' to face of shoring
- from Sheet $P_{B1} = 212.3 \text{ psf}$

2) Surcharge from Equipment Outrigger

- C of Point Load (20k) is 3' to face of shoring
- from Terzaghi $x = mh$ where $x = 3'$ $h = 14'$ $\therefore m = 0.214$

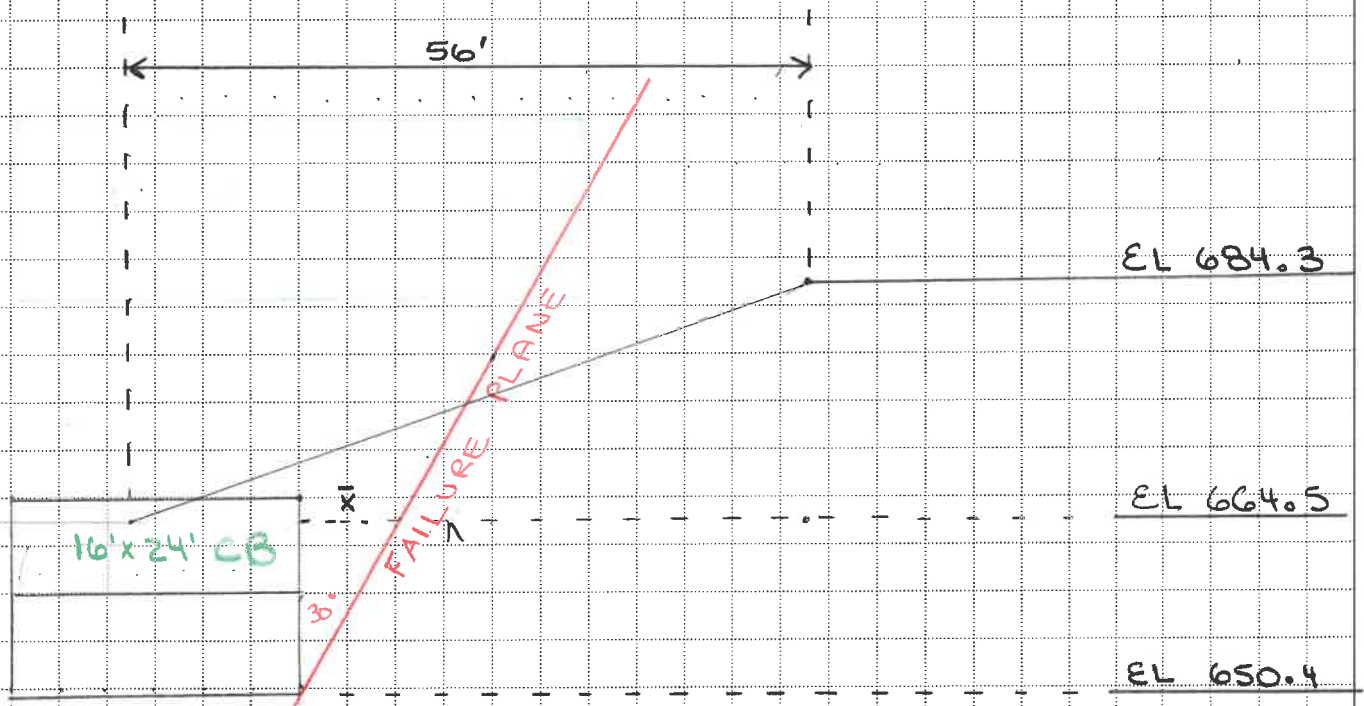
$$L = 0.59h = 0.59(14) = 8.26'$$

$$z = 14 - 8.26 = 5.74'$$

$$z = 5.74' = nh \therefore n = 0.41$$

$$\begin{aligned} \sigma_u &= 0.28 \left(\frac{Q_0}{h^2} \right) \frac{n^2}{(0.16 + n^2)^3} \\ &= 0.28 \left(\frac{20}{14^2} \right) \left(\frac{.41^2}{(0.16 + .41^2)^3} \right) \\ &= 0.1359 \text{ ksf} = P_{B2} = 136 \text{ psf} \end{aligned}$$

3) Surcharge from Back Slope





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$$\tan 30^\circ = \bar{x}/14.4$$
$$\bar{x} = 8.31'$$

IX intends to remove \bar{x} to create a bench to locate equipment needed for excavation

$$P_s = 212.3 \text{ psf controls}$$

$$P_{\text{total}} = P_a + P_s = 380 + 212.3 = 592.3 \text{ psf (14')/8'}$$
$$\approx \boxed{1037 \text{ psf Minimum Box Rating}}$$

Steel Plate + Toe Frame

- Steel Plate "t" required

$$M = w l^2 / 8 = (0.5923) 8^2 / 8 = 4.7384 \text{ ft-k} \times 56.86 \text{ in-k}$$

$$S_{\text{req'd}} = M / \sigma_{\text{all}} = 56.86 / (36 / 1.67) = 2.64 \text{ in}^3 = b d^2 / 6 = 12 d^2 / 6 \quad d = 1.15"$$

use 1 1/4" plate

- Toe Frame Design

$$R = w l / 2 = 0.5923(8) / 2 = 2.37 \text{ k/ft}$$

① $M_{\text{act}} = w l^2 / 8 = 2.37(12)^2 / 8 = 42.66 \text{ ft-k}$
 $P_{\text{act}} = 2.37(6') = 18.96 \text{ k}$
Try HP10x42 $M_{\text{all}} = 111.98 \text{ ft-k}$ for $L = 12'$
 $P_{\text{all}} = 130 \text{ k}$ for $L = 24'$
 $42.66 / 111.98 + 18.96 / 130 = 0.53 < 1.0$ OK

② $M_{\text{act}} = w l^2 / 8 = 2.37(16)^2 / 8 = 75.84 \text{ ft-k}$
 $P_{\text{act}} = 2.37(6') = 14.22 \text{ k}$
 $M_{\text{all}} = 103.55 \text{ ft-k}$ for $L = 16'$
 $P_{\text{all}} = 233 \text{ k}$ for $L = 16'$
 $75.84 / 103.55 + 14.22 / 233 = 0.80 < 1.0$ OK

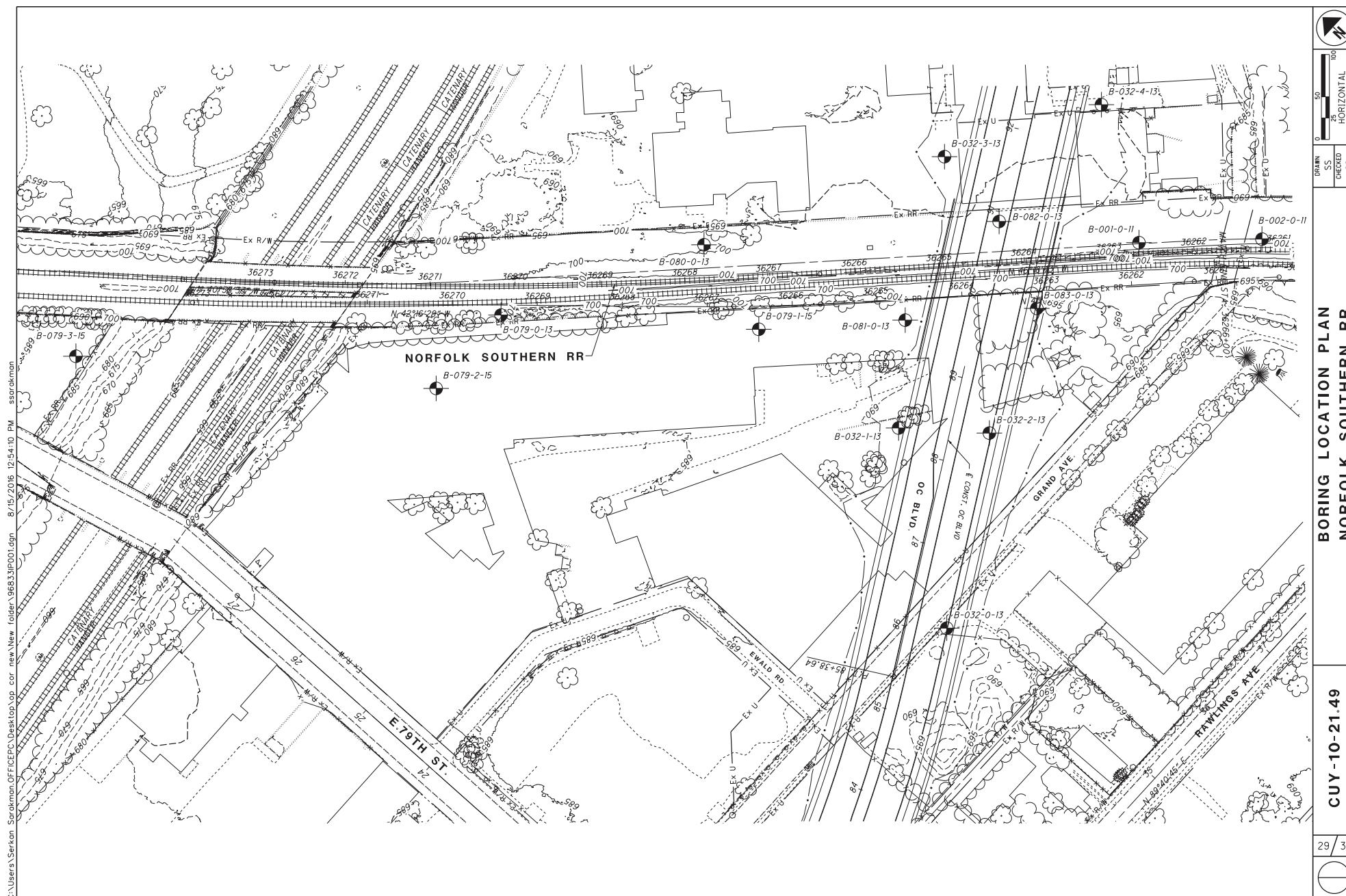
L₂= 29.5L₁= 20.5

$$\beta = \tan^{-1}(L_2/H) - \tan^{-1}(L_1/H)$$

q= 1778 psf

H	$\tan^{-1}(L_2/H)$	$\tan^{-1}(L_1/H)$	β	βr	$\sin\beta$	α	$\cos 2\alpha$	$\beta r \sin\beta \cos 2\alpha$	$2q/\pi$	σH
1	88.0585	87.2073	0.8512	0.0149	0.0149	87.6329	-0.9966	0.0297	1131.9100	33.57
2	86.1215	84.4278	1.6937	0.0296	0.0296	85.2746	-0.9864	0.0587	1131.9100	66.46
3	84.1933	81.6743	2.5189	0.0440	0.0439	82.9338	-0.9697	0.0866	1131.9100	98.00
4	82.2782	78.9591	3.3191	0.0579	0.0579	80.6186	-0.9469	0.1127	1131.9100	127.62
5	80.3803	76.2930	4.0872	0.0713	0.0713	78.3367	-0.9183	0.1368	1131.9100	154.83
6	78.5034	73.6861	4.8173	0.0841	0.0840	76.0948	-0.8845	0.1584	1131.9100	179.25
7	76.6513	71.1468	5.5044	0.0961	0.0959	73.8991	-0.8462	0.1772	1131.9100	200.62
8	74.8271	68.6821	6.1450	0.1073	0.1070	71.7546	-0.8040	0.1933	1131.9100	218.81
9	73.0339	66.2974	6.7365	0.1176	0.1173	69.6656	-0.7585	0.2065	1131.9100	233.79
10	71.2742	63.9967	7.2776	0.1270	0.1267	67.6354	-0.7104	0.2170	1131.9100	245.64
11	69.5505	61.7826	7.7678	0.1356	0.1352	65.6665	-0.6604	0.2248	1131.9100	254.50
12	67.8645	59.6568	8.2078	0.1433	0.1428	63.7606	-0.6091	0.2302	1131.9100	260.57
13	66.2180	57.6193	8.5986	0.1501	0.1495	61.9186	-0.5568	0.2333	1131.9100	264.11
14	64.6121	55.6698	8.9423	0.1561	0.1554	60.1409	-0.5043	0.2345	1131.9100	265.38
15	63.0478	53.8068	9.2410	0.1613	0.1606	58.4273	-0.4517	0.2338	1131.9100	264.67
16	61.5258	52.0284	9.4974	0.1658	0.1650	56.7771	-0.3996	0.2317	1131.9100	262.26
17	60.0464	50.3322	9.7142	0.1695	0.1687	55.1893	-0.3482	0.2283	1131.9100	258.42
18	58.6097	48.7153	9.8944	0.1727	0.1718	53.6625	-0.2978	0.2239	1131.9100	253.39
19	57.2157	47.1747	10.0410	0.1752	0.1744	52.1952	-0.2485	0.2186	1131.9100	247.41
20	55.8641	45.7073	10.1567	0.1773	0.1763	50.7857	-0.2006	0.2126	1131.9100	240.69
21	54.5543	44.3097	10.2446	0.1788	0.1779	49.4320	-0.1541	0.2062	1131.9100	233.41
22	53.2858	42.9786	10.3072	0.1799	0.1789	48.1322	-0.1091	0.1994	1131.9100	225.72
23	52.0578	41.7108	10.3471	0.1806	0.1796	46.8843	-0.0657	0.1924	1131.9100	217.78
24	50.8696	40.5028	10.3668	0.1809	0.1799	45.6862	-0.0240	0.1852	1131.9100	209.68
25	49.7201	39.3518	10.3684	0.1810	0.1800	44.5359	0.0162	0.1780	1131.9100	201.53

Max= 265.38 psf
0.8(Max)= 212.3 psf



[illegible]

NOTES:	GROUNDWATER WAS ENCOUNTERED AT A DEPTH OF 34.0' DURING DRILLING AND AT 43.9' UPON COMPLETION OF DRILLING OPERATIONS.
ABANDONMENT METHODS, MATERIALS, QUANTITIES:	BACKFILLED WITH 2.0 BAGS SOIL CUTTINGS/BENTONITE PELLETS

• Design
 Sand/Sandy Silt $N_{avg} = 11$ $\gamma = 125 \text{ pcf}$ $\phi = 30^\circ$

OC3 D272 P.t

18-1-135

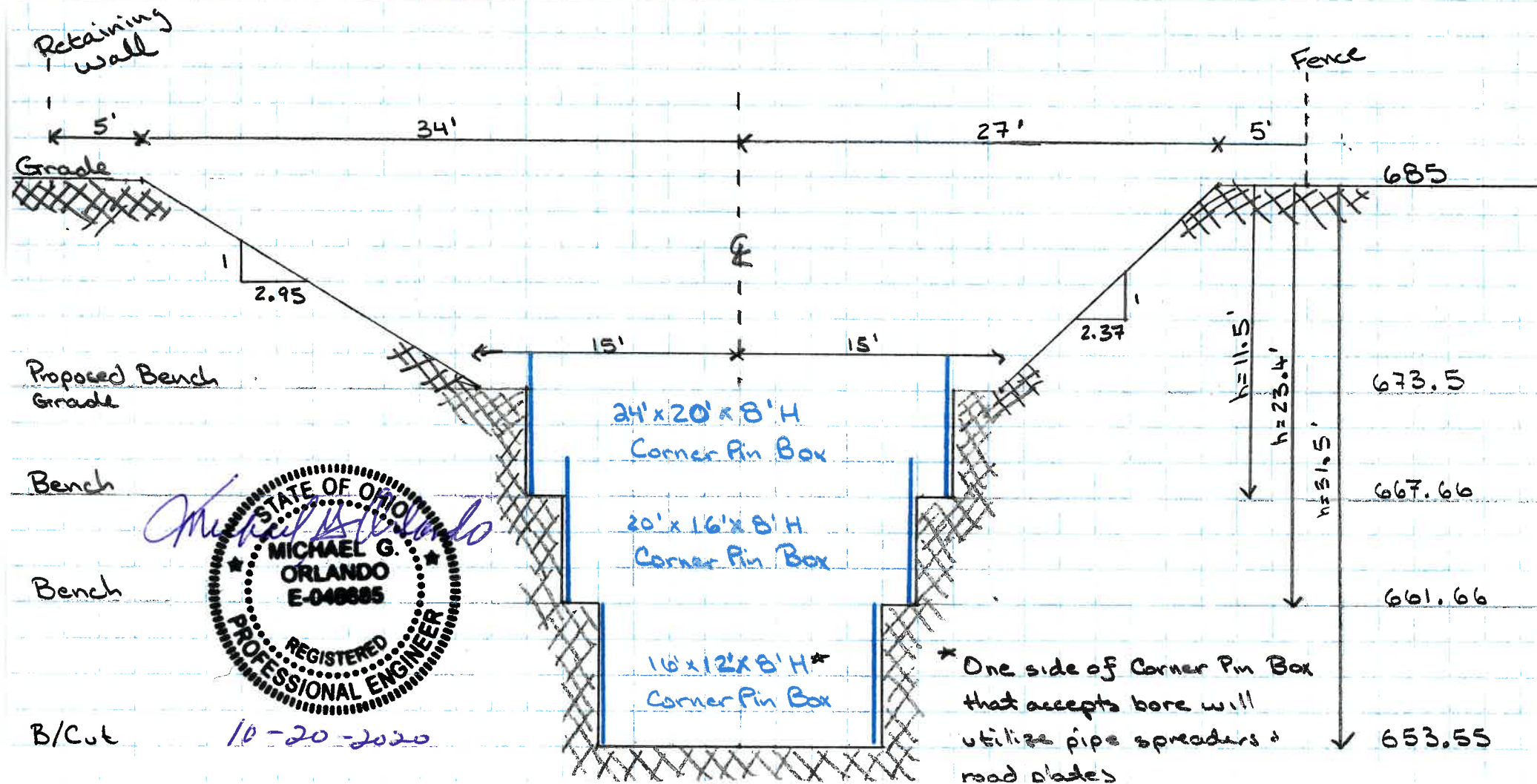
10/20/20

R61

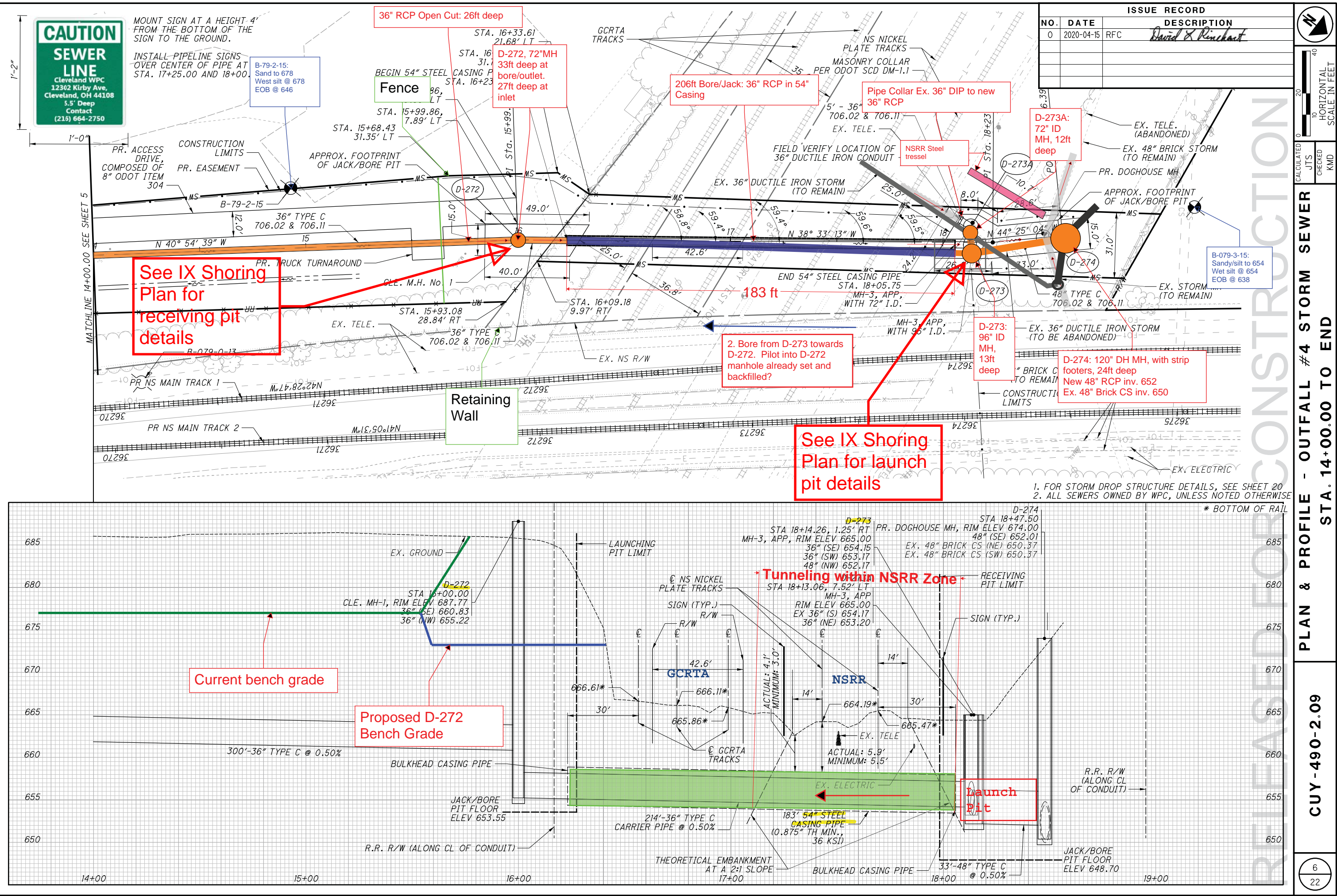
1/1

$$P_a = 0.65 \gamma h \tan^2(45 - \phi/2) = 27.0833 \text{ h}$$

$$P_{box} = 27.0833 (31.5') \approx 854 \text{ pcf Trench Box Min Rating}$$



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INDEPENDENCE EXCAVATING, INC.
5720 Schaaf Road
Independence, Ohio 44131
Industrial & Commercial

Phone 216-524-1700
Fax 216-524-1701

www.indexc.com

OC3 36" RCP Cut

Project 18-1-135 Date 10/20/20

Submitted by RGI Page 1 of 1 Pages

- Location
 - from D-270 to 45' south of D-272
- Design
 - Sand/Sandy Silt $N_{avg} = 12.5$ $\gamma = 125$ $\phi = 30^\circ$
 - $h = 18.6'$ from current Bench Grade
 - worst case $h = 28.0'$ from existing grade

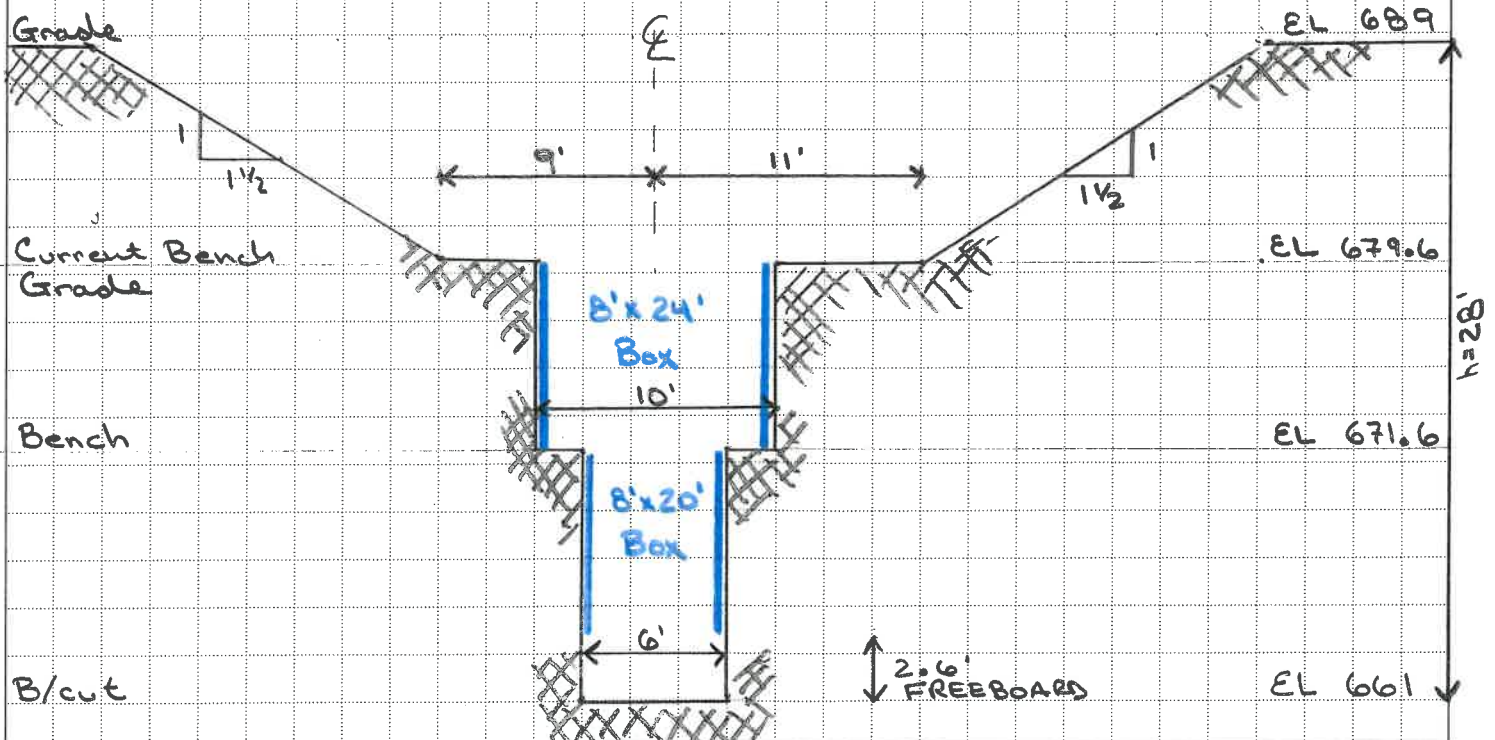


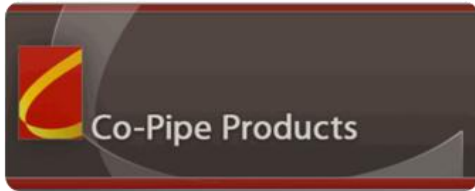
$$P_a = 0.65 \gamma h \tan^2(45 - \phi/2) = 0.65 (125) (28) \tan^2(45 - 30/2)$$

$\approx 760 \text{ psf}$ Minimum Box Rating

10-20-2020

- Option 1 shown below
- Option 2 will utilize same boxes but stacked and both with 6' spreaders





20501 Goddard Rd, Taylor, MI 48180

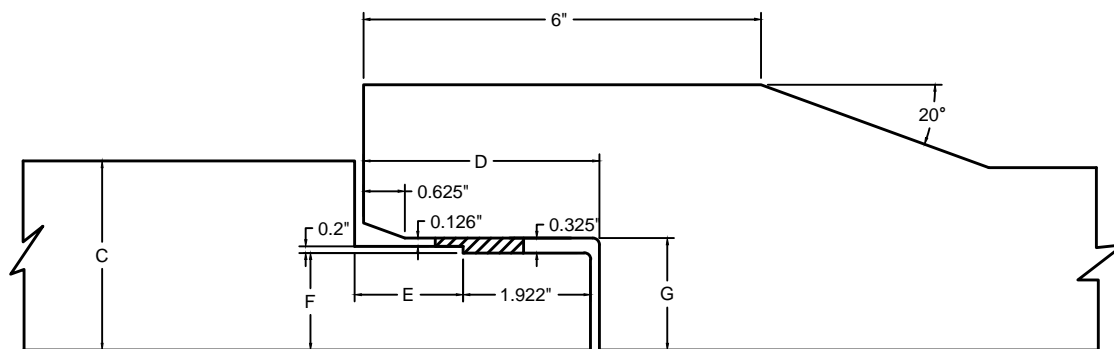
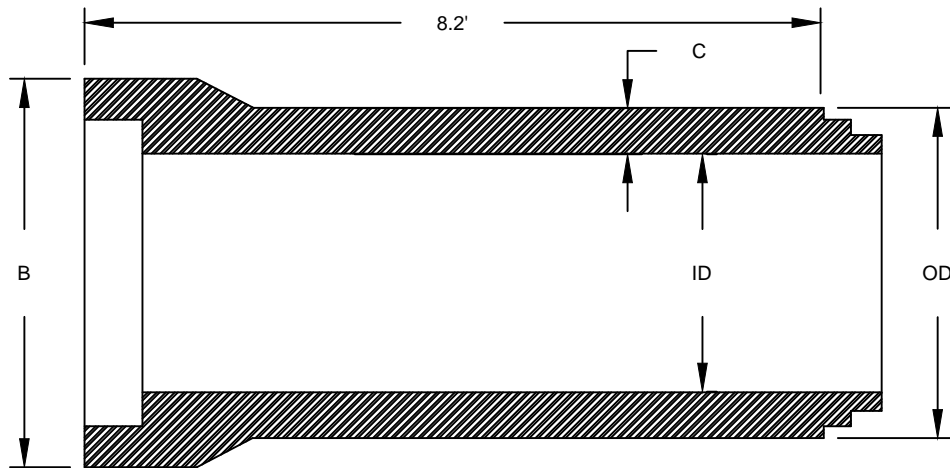
Tel: 1.800.521.3514

734-287-1000

Fax: 734-287-8132

RCP / APPROXIMATE MASS & DIMENSION CHART

INSIDE DIA. (in.)	INSIDE DIA. (mm)	WALL THICKNESS (in.)	OUTSIDE DIA. (in.)	BELL DIA. (in.)	LAY LENGTH (ft)	MASS/PIECE (lbs)
12"	300	2.75	17.5	20	8.2'	1230
15"	375	3	21	23.875	8.2'	1631
18"	450	3.25	24.5	27.625	8.2'	2079
21"	525	3.50	28	31.625	8.2'	2520
24"	600	3.75	31.5	35.625	8.2'	3126
27"	675	4	35	39.625	8.2'	3666
30"	750	4.25	38.5	40.875	8.2'	4162
36"	900	4.75	45.5	48.375	8.2'	5478
42"	1050	5.25	52.5	52.5	8'	6698
48"	1200	5.75	59.5	59.5	8'	8285
54"	1350	6.25	66.5	66.5	8'	10113
60"	1500	6	72	72	8'	11834
66"	1650	6.50	79.0	79.0	8'	14390
72"	1800	7	86	86	8'	15077
78"	1950	7.50	93	93	8'	17569
84"	2100	8	100	100	8'	20095
90"	2250	8.50	107	107	8'	23215
96"	2400	9	114	114	8'	25283
102"	2550	9.5	121	121	8'	27866
108"	2700	10	128	128	8'	30953
114"	2850	10.5	135	135	8'	34512
120"	3000	11	142	142	8'	37873



PIPE SIZE		DELL OD	WALL THICKNESS	SPIGOT LENGTH		GASKET SURFACE DIA.	BELL ID
ID	OD	B	C	D	E	F	G
12	17.5	20	2.75	3.562	1.641	14.722	15.251
15	21.0	23.875	3.00	3.562	1.641	18.222	18.751
18	24.5	27.625	3.25	3.750	1.828	21.847	22.375
21	28	31.625	3.50	3.750	1.828	25.347	25.876
24	31.5	35.625	3.75	3.875	1.953	28.854	29.383
27	35	39.625	4.00	3.875	1.953	32.319	32.848
30	38.5	40.875	4.25	3.875	1.953	34.339	34.868
36	45.5	48.375	4.75	3.875	1.953	40.839	41.368

NOTES:

1. Manufactured in accordance with ASTM C76 and CSA A257.2
2. All dimensions are in inches, unless otherwise shown
3. Super seal gaskets manufactured in accordance with ASTM C443 and CSA A257.3



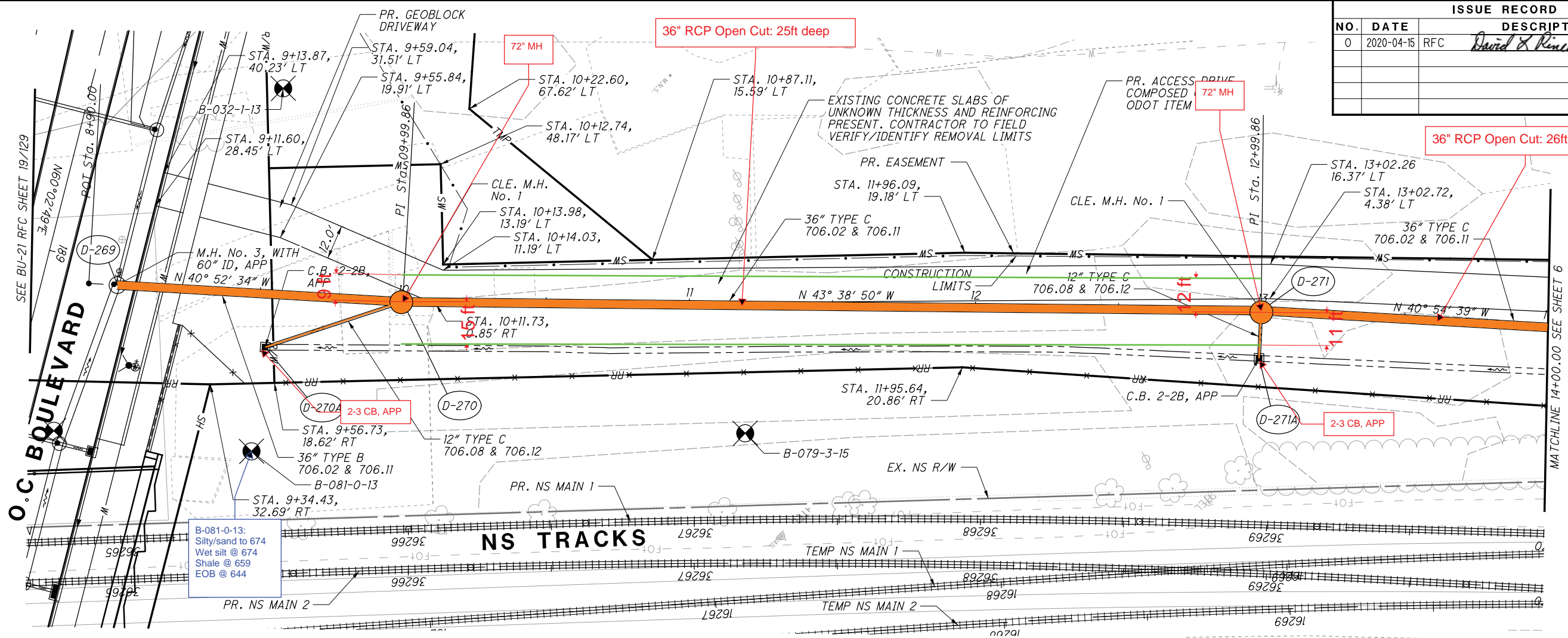
Co-Pipe Products, Inc.

20501 Goddard Rd, Taylor, MI 48180
TEL: 734-287-1000

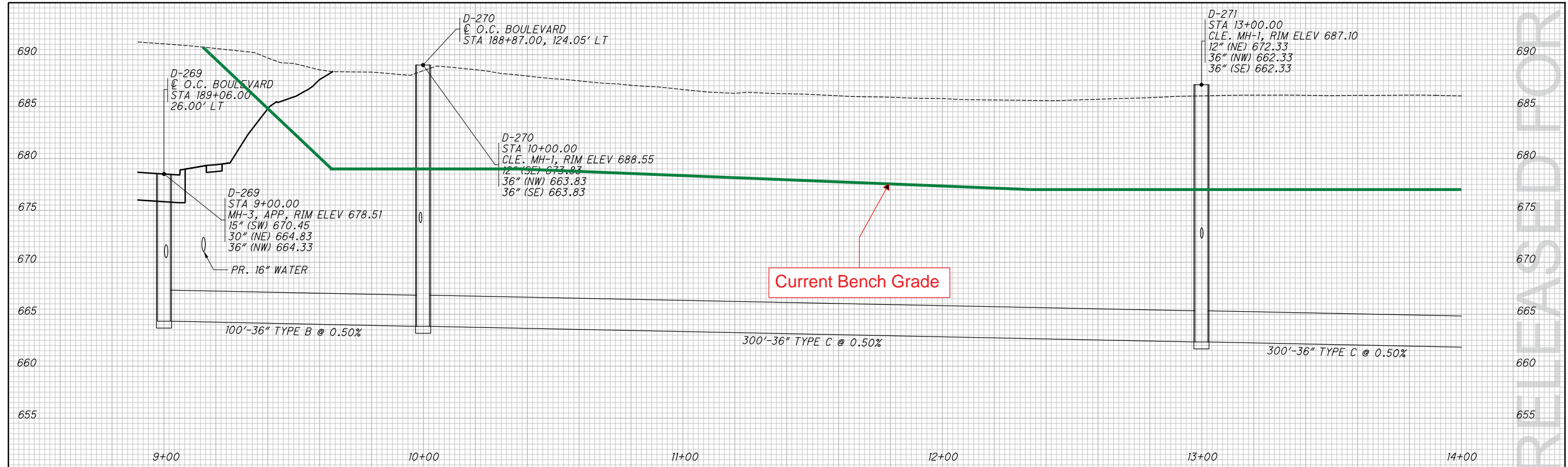
**JOINT DETAILS (12" to 36")
DIAMETER RCP**

REVISED
JAN.01.2014

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ALL SEWERS OWNED BY WPC, UNLESS NOTED OTHERWISE



ISSUE RECORD		
NO.	DATE	DESCRIPTION
0	2020-04-15	RFC David & Rinchart

PLAN & PROFILE - OUTFALL #4 STORM SEWER
BEGIN TO STA. 14+00.00

CUY-490-2.09




5
22

RELEASED FOR CONSTRUCTION

0 20 40
HORIZONTAL
SCALE IN FEET



























































































































































CALCULATED JTS
CHECKED KMD

PROJECT: CUY-10-21.49		DRILLING FIRM / OPERATOR: PGI / ZEKE		DRILL RIG: CME 750 TIRE ATV		STATION / OFFSET: 86+93, 1022' LT.				EXPLORATION ID										
TYPE: STORM SEWER		SAMPLING FIRM / LOGGER: PGI / SHANE		HAMMER: CME AUTOMATIC		ALIGNMENT: OC BASELINE				B-079-1-15										
PID: 96833 STR ID:		DRILLING METHOD: 3.25" HSA		CALIBRATION DATE: 2/11/15		ELEVATION: 685.7 (MSL) EOB: 40.0 ft.				PAGE										
START: 4/4/16 END: 4/5/16		SAMPLING METHOD: SPT / ST		ENERGY RATIO (%): 70.7		COORD: 41.484922, 81.630644				1 OF 2										
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	BACK FILL	
									GR	CS	FS	SI	CL	LL	PL	PI				
CONCRETE PAVEMENT (12" THICK)		685.7																		
MEDIUM DENSE, BROWN AND BLACK, SLAG AND CINDERS , FILL, DAMP		684.7		1	5															
STIFF, BROWN, SANDY SILT , SOME CLAY, LITTLE STONE FRAGMENTS, FILL, MOIST		683.7		2	6	13	100	SS-1A	--	-	-	-	-	-	-	-	13	A-1-a (V)		
					5			SS-1B	2.00	-	-	-	-	-	-	-	14	A-4a (V)		
MEDIUM DENSE, GRAY, LIMESTONE FRAGMENTS , LITTLE SAND, TRACE FINES, FILL, MOIST		682.2		3																
STIFF, BROWN, SANDY SILT , SOME CLAY, TRACE STONE FRAGMENTS, MOIST		679.7		4	5	14	100	SS-2	--	-	-	-	-	-	-	-	15	A-1-b (V)		
				5	7															
		677.2		6	4															
				7	8	19	100	SS-3	3.25	1	0	16	48	35	30	20	10	23	A-4a (8)	
				8																
				9	3															
MEDIUM DENSE, BROWN, COARSE AND FINE SAND , LITTLE FINES, WET				10	5	13	100	SS-4	--	-	-	-	-	-	-	-	26	A-3a (V)		
				11																
				12																
				13																
@13.5'; MEDIUM DENSE			W	14	3															
			▼ 12 hr	15	4	11	100	SS-5	--	-	-	-	-	-	-	-	27	A-3a (V)		
				16	5															
				17																
				18																
				19	4															
STIFF TO HARD, GRAY, SANDY SILT , LITTLE TO "AND" CLAY, W/INTERBEDDED SILT SEEMS, NO TO TRACE STONE FRAGMENTS, MOIST TO DAMP				20	6	15	100	SS-6	2.00	-	-	-	-	-	-	-	23	A-4a (V)		
				21	7															
				22																
			▼	23																
@23.0'; "AND" CLAY, TRACE STONE FRAGMENTS, DAMP @23.0'; PUSHED SHELBY TUBE, U.C. STRENGTH = 3316 PSF				24			100	ST-7	1.00	4	6	12	38	40	27	17	10	17	A-4a (8)	
				25																
				26																
				27																
				28																
				29	7															
@28.5'; "AND" CLAY				10	16	31	100	SS-8	4.00	-	-	-	-	-	-	-	16	A-4a (V)		

PID: 96833	STR ID:	PROJECT: CUY-10-21.49	STATION / OFFSET: 86+93, 1022' LT.			START: 4/4/16	END: 4/5/16	PG 2 OF 2		B-079-1-15											
MATERIAL DESCRIPTION AND NOTES			ELEV. 655.7	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	BACK FILL	
										GR	CS	FS	SI	CL	LL	PL	PI				
STIFF TO HARD, GRAY, SANDY SILT , LITTLE TO "AND" CLAY, W/INTERBEDDED SILT SEEMS, NO TO TRACE STONE FRAGMENTS, MOIST TO DAMP (continued)				31															<LV>		
				32															<LV>		
				33																<LV>	
				34	8	10	26	100	SS-9	2.50	1	2	8	44	45	27	17	10	19	A-4a (8)	<LV>
				35		12															<LV>
@33.5'; VERY STIFF, "AND" CLAY				36															<LV>		
				37																<LV>	
				38																	<LV>
				39	13	16	39	94	SS-10	-	-	-	-	-	-	-	-	-	12	Rock (V)	<LV>
				40		17															<LV>
SHALE, GRAY, SEVERELY WEATHERED.				647.2	TR														<LV>		
				645.7	EOB														<LV>		

NOTES: GROUNDWATER WAS ENCOUNTERED AT A DEPTH OF 13.5' DURING DRILLING AND AT 22.0' UPON COMPLETION OF DRILLING OPERATIONS. AFTER 12.0 HOURS AT 15.0 FEET.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH SOIL CUTTINGS

PROJECT: <u>OPPORT. CORRIDOR-SEC. 3</u>		DRILLING FIRM / OPERATOR: <u>PSI / JR</u>		DRILL RIG: <u>DIEDRICH D-50 TRUCK</u>		STATION / OFFSET: <u>89+51, 80' LT.</u>		EXPLORATION ID <u>B-081-0-13</u>													
TYPE: <u>BRIDGE CONSTRUCTION</u>		SAMPLING FIRM / LOGGER: <u>PGI / W. NAJJAR</u>		HAMMER: <u>DIEDRICH AUTOMATIC</u>		ALIGNMENT: <u>OC BASELINE</u>		PAGE 1 OF 2													
PID: <u>96833</u> STR ID: <u></u>		DRILLING METHOD: <u>3.25" HSA</u>		CALIBRATION DATE: <u>7/10/13</u>		ELEVATION: <u>687.4 (MSL)</u> EOB: <u>43.5 ft.</u>															
START: <u>12/9/13</u> END: <u>12/9/13</u>		SAMPLING METHOD: <u>SPT / ST / NX</u>		ENERGY RATIO (%): <u>98.3</u>		COORD: <u>41.484700, 81.629696</u>															
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	BACK FILL		
		687.4							GR	CS	FS	SI	CL	LL	PL	PI					
CONCRETE PAVEMENT (5" THICK)			687.0	<div>1</div> <div>2</div> <div>3</div> <div>4</div> <div>5</div> <div>6</div> <div>7</div> <div>8</div> <div>9</div> <div>10</div> <div>11</div> <div>12</div> <div>13</div> <div>14</div> <div>15</div> <div>16</div> <div>17</div> <div>18</div> <div>19</div> <div>20</div> <div>21</div> <div>22</div> <div>23</div> <div>24</div> <div>25</div> <div>26</div> <div>27</div> <div>28</div> <div>29</div>		4	51	78	SS-1	--	-	-	-	-	-	-	-	14	A-4a (V)		
VERY DENSE, BROWN AND BLACK, NON-PLASTIC SANDY SILT , LITTLE CINDERS, FILL, DAMP			683.9			12															
						19															
																					
VERY STIFF, MOTTLED GREENISH BROWN AND GRAY, SILTY CLAY , TRACE SAND, TRACE STONE FRAGMENTS, MOIST			682.9			6	23	100	SS-2A	2.50	1	2	3	64	30	36	16	20	22	A-6b (12)	
						8			SS-2B	-	-	-	-	-	-	-	-	-	10	A-4a (V)	
																					
MEDIUM DENSE TO LOOSE, BROWN, NON-PLASTIC SANDY SILT , MOIST TO WET			<div>W</div>			5															
@4.0'; LITTLE STONE FRAGMENTS, WET						7	23	100	SS-3	3.00	-	-	-	-	-	-	-	-	19	A-4a (V)	
																					
																					
@8.5'; LOOSE, WET						2															
						2	10	100	SS-4	--	0	2	62	33	3	NP	NP	NP	26	A-4a (0)	
						4															
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					
																					

PROJECT: OPPORT. CORRIDOR-SEC. 3		DRILLING FIRM / OPERATOR: PSI / DAVE		DRILL RIG: DIEDRICH D-50 TRUCK		STATION / OFFSET: 88+25, 60' LT.		EXPLORATION ID											
TYPE: ROADWAY/SEWER		SAMPLING FIRM / LOGGER: PGI / W. NAJJAR		HAMMER: DIEDRICH AUTOMATIC		ALIGNMENT: OC BASELINE		B-032-1-13											
PID: 96833 STR ID:		DRILLING METHOD: 3.25" HSA		CALIBRATION DATE: 7/10/13		ELEVATION: 686.7 (MSL) EOB: 35.2 ft.		PAGE											
START: 12/16/13 END: 12/16/13		SAMPLING METHOD: SPT		ENERGY RATIO (%): 98.3		COORD: 41.484482, 81.630058		1 OF 2											
MATERIAL DESCRIPTION AND NOTES		ELEV. 686.7	DEPTHS	SPT/ RQD	N ₆₀	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG				ODOT CLASS (GI)	BACK FILL
LOOSE TO DENSE, BLACK TO DARK BROWN, CINDERS AND COAL FRAGMENTS WITH SAND, LITTLE FINES, FILL, MOIST		680.7	1	1															
			2	2	7	100	SS-1	--	-	-	-	-	-	-	-	13	A-1-b (V)		
			3																
@3.5'; DENSE, DARK BROWN			4	11	39	100	SS-2	--	-	-	-	-	-	-	-	13	A-1-b (V)		
			5	15	9														
DENSE TO LOOSE, DARK BROWN TO BLACK, CINDERS WITH SAND, LITTLE TO SOME FINES, FILL, MOIST TO WET		658.2	6	12															
			7	15	43	89	SS-3	--	41	21	26	10	2	NP	NP	NP	12	A-1-b (0)	
			8																
@8.5'; MEDIUM DENSE			9	4	11	89	SS-4	--	39	13	31	13	4	NP	NP	NP	11	A-1-b (0)	
			10	4	3														
@11.0'; MEDIUM DENSE			11	5															
			12	6	18	83	SS-5	--	-	-	-	-	-	-	-	10	A-1-b (V)		
			13																
@16.0'; BLACK, SOME FINES			14	9	48	100	SS-6	--	-	-	-	-	-	-	-	16	A-1-b (V)		
			15	14	15														
@18.5'; LOOSE, BLACK, SOME FINES, WET			16	6															
			17	8	31	100	SS-7	--	-	-	-	-	-	-	-	15	A-1-b (V)		
			18																
@21.0'; BLACK, SOME FINES, WET			19	5	10	100	SS-8	--	40	19	18	20	3	NP	NP	NP	26	A-1-b (0)	
			20	4	2														
@23.5'; MEDIUM DENSE, BLACK, SOME FINES, WET			21	6															
			22	11	36	89	SS-9	--	-	-	-	-	-	-	-	29	A-1-b (V)		
			23																
@26.0'; BLACK, SOME FINES, WITH HYDROCARBON ODOR, WET			24	4	16	100	SS-10	--	-	-	-	-	-	-	-	34	A-1-b (V)		
			25	5	5														
			26	8															
			27	12	34	100	SS-11	--	-	-	-	-	-	-	-	40	A-1-b (V)		
			28																
LOOSE, DARK BROWN AND BLACK, NON-PLASTIC SANDY SILT, TRACE STONE FRAGMENTS, FILL, WET				29	2			SS-12A	--	-	-	-	-	-	-	35	A-4a (V)		
				29	2	10	100	SS-12B	--	-	-	-	-	-	-	22	A-4a (V)		

