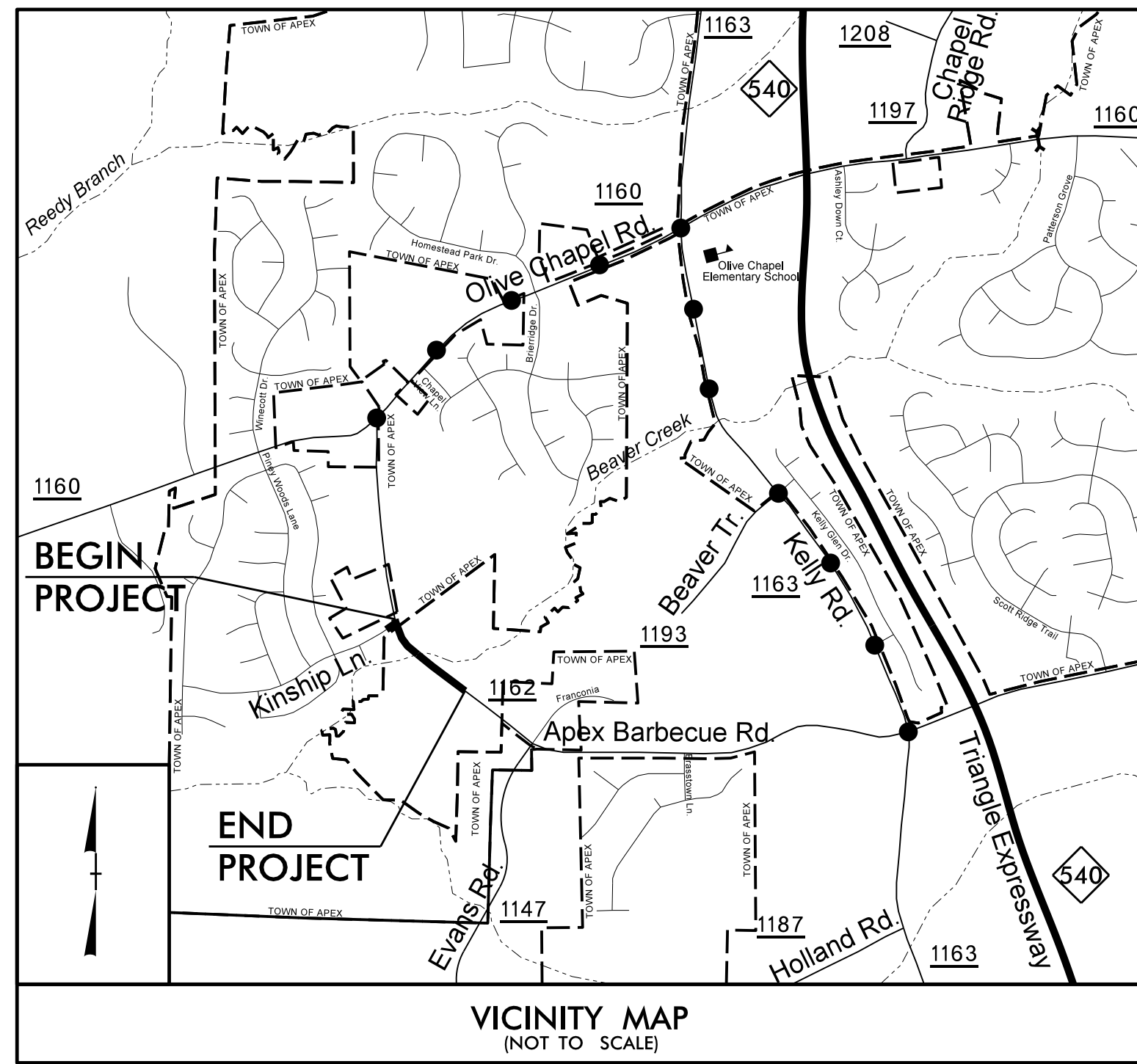


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and sealed by the individuals whose names and license  
numbers appear on each page, on the dates appearing  
with their signature on that page.**

**This file or an individual page  
shall not be considered a certified document.**

**TIP PROJECT: B-5161**

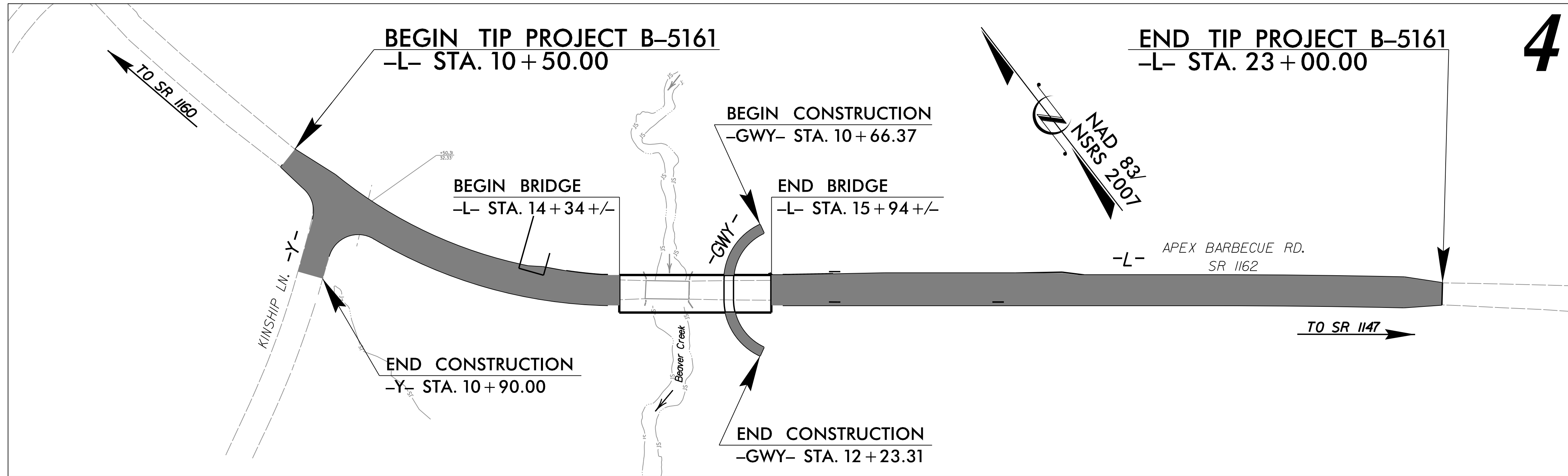


STATE OF NORTH CAROLINA  
DIVISION OF HIGHWAYS

**UTILITY CONSTRUCTION PLANS  
WAKE COUNTY**

**LOCATION: BRIDGE NO. 362 OVER  
BEAVER CREEK ON SR 1162**

**TYPE OF WORK: WATER LINE RELOCATION**



**4**

**DOCUMENT NOT CONSIDERED FINAL  
UNTIL ALL SIGNATURES ARE COMPLETED**

T.I.P. NO. <b>B-5161</b>	SHEET NO. <b>UC-1</b>
-----------------------------	--------------------------

- BUILDING INSPECTIONS  
TOWN OF APEX CERTIFICATION**

This drawing has been reviewed by the Town of Apex Building Inspections Department, and to the best of my knowledge and belief, conforms to the requirements established within the Town's Code of Ordinances and the North Carolina State Building Codes. However, this signature does not constitute a variance from any requirements contained in any Federal, State, or local code, law, specification, rule or ordinance. The developer/engineer/contractor is solely responsible for meeting all applicable requirements.

By: \_\_\_\_\_ Date: \_\_\_\_\_
- ELECTRIC  
TOWN OF APEX CERTIFICATION**

This drawing has been reviewed by the Town of Apex Electric Department, and to the best of my knowledge and belief, conforms to the requirements established within the Standard Specifications and Construction Details and the Unified Development Ordinance of the Town of Apex. However, this signature does not constitute a variance from any requirements contained in any Federal, State, or local code, law, specification, rule or ordinance. The developer/engineer/contractor is solely responsible for meeting all applicable requirements.

By: \_\_\_\_\_ Date: \_\_\_\_\_
- FIRE DEPARTMENT  
TOWN OF APEX CERTIFICATION**

This drawing has been reviewed by the Town of Apex Fire Department, and to the best of my knowledge and belief, conforms to the requirements established within the Town's Standard Specifications, Fire Protection Ordinances, and the North Carolina International Fire Code. However, this signature does not constitute a variance from any requirements contained in any Federal, State, or local code, law, specification, rule or ordinance. The developer/engineer/contractor is solely responsible for meeting all applicable requirements.

By: \_\_\_\_\_ Date: \_\_\_\_\_
- PARKS, RECREATION AND CULTURAL RESOURCES  
TOWN OF APEX CERTIFICATION**

These plans have been reviewed by the Town of Apex, and to the best of my knowledge and belief, conforms to representations made by the developer to myself and the Parks, Recreation, and Cultural Resource Advisory Commission consistent with the project requirements for public Parks and Recreation, either in total or in part, as outlined in Section 7.3 of the Town's Unified Development Ordinance and Article IV, Section 19 of the Town Code. However, this signature does not constitute a variance from any requirements contained in any Federal, State, or local code, law, specification, rule or ordinance. The developer/engineer/contractor is solely responsible for meeting all applicable requirements.

By: \_\_\_\_\_ Date: \_\_\_\_\_
- PLANNING / ZONING  
TOWN OF APEX CERTIFICATION**

This construction drawing has been reviewed by the Town of Apex Planning Department, and to the best of my knowledge and belief, conforms to the Subdivision or Site Plan that was approved by the Town of Apex Board of Commissioners, and meets the Town of Apex Zoning, Subdivision, or Unified Development Ordinance. This signature does not constitute a variance from any requirements of the originally approved Subdivision or Site Plan and above, or any Federal, State, or local code, law, specification, rule, guideline, or ordinance. It is the sole responsibility of the owner/developer, or any of his agents or contract professional to ensure that this construction plan meets all the aforementioned requirements.

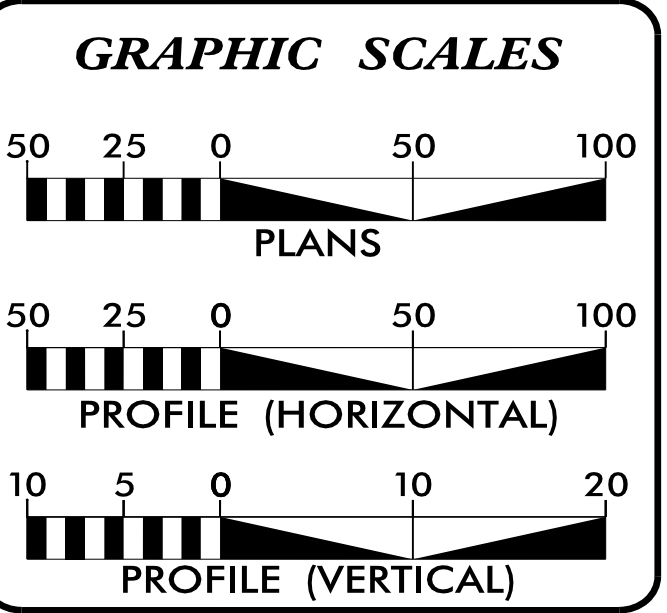
By: \_\_\_\_\_ Date: \_\_\_\_\_
- PUBLIC WORKS TRANSPORTATION  
TOWN OF APEX CERTIFICATION**

This drawing has been reviewed by the Town of Apex, and to the best of my knowledge and belief, provides an acceptable transportation system with consideration for the elements contained within the Transportation Plan conforming to the requirements established in the Standard Specifications of the Town of Apex. However, this signature does not constitute a variance from any requirements contained in any Federal, State or local code, law, specification, rule or ordinance. The developer/engineer/contractor is solely responsible for meeting all applicable requirements.

By: \_\_\_\_\_ Date: \_\_\_\_\_
- WATER RESOURCES UTILITY ENGINEERING  
TOWN OF APEX CERTIFICATION**

This drawing has been reviewed by the Town of Apex Water Resources Department, and to the best of my knowledge and belief, conforms to the requirements established in the Standard Specifications and Construction Details of the Town of Apex. However, this signature does not constitute a variance from any requirements contained in any Federal, State or local code, law, specification, rule or ordinance. The developer/engineer/contractor is solely responsible for meeting all applicable requirements.

By: \_\_\_\_\_ Date: \_\_\_\_\_



**INDEX OF SHEETS**

SHEET NO.:	DESCRIPTION:
UC-1	TITLE SHEET
UC-2	UTILITY SYMBOLOGY
UC-3	NOTES
UC-3A TO UC-3B	DETAILS
UC-4	PLAN AND PROFILE

**WATER AND SEWER OWNERS ON PROJECT**

(A) WATER - TOWN OF APEX

PREPARED IN THE OFFICE OF

**M A Engineering Consultants, Inc.**  
598 East Chatham Street - Suite 137  
Cary, NC 27511  
Phone: 919.297.0220 Fax: 919.297.0221  
NC License: F-0160

FOR

**HDR Engineering, Inc. of the Carolinas**  
555 Fayetteville St., Suite 900 Raleigh, NC 27601  
N.C.B.E.L.S. License Number: F-0116

**KEVIN ZDEB, PE** PROJECT ENGINEER  
**GARY BLUE** PROJECT DESIGNER  
**WEBB WHITE** PROJECT UTILITY COORDINATOR

SEAL

4/3/2018

**DIVISION OF HIGHWAYS UTILITIES UNIT**  
1555 MAIL SERVICES CENTER  
RALEIGH NC 27699-1555  
PHONE (919) 707-6690  
FAX (919) 250-4151

**ALI KOUCHEKI, PE** UTILITIES REGIONAL ENGINEER  
**BERNARD BUMGARDNER** SENIOR UTILITIES ENGINEER  
**TANGA SAMPSON** SENIOR UTILITIES COORDINATOR

5/14/99  
3/30/2016  
Tanga  
REV: 2/1/2012

STATE OF NORTH CAROLINA  
DIVISION OF HIGHWAYS

**UTILITIES PLAN SHEET SYMBOLS**

PROJECT REFERENCE NO. SHEET NO.  
B-5161 UC-2

The signatures affixed below certify that this sheet has been reviewed and approved solely per the certifications signed on the cover sheet of these construction plans.

PW - Transportation	Date	WR - Stormwater	Date
Building Inspections	Date	Planning	Date
WR - Utility Engineering	Date	Planning - Transportation	Date
Electric	Date	Fire	Date
WR - S&E	Date	Parks, Recreation & Cult. Res.	Date

**PROPOSED WATER SYMBOLS**

Water Line (Sized as Shown)	
11¼ Degree Bend	
22½ Degree Bend	
45 Degree Bend	
90 Degree Bend	
Plug	
Tee	
Cross	
Reducer	
Gate Valve	
Butterfly Valve	
Tapping Valve	
Line Stop	
Line Stop with Bypass	
Blow Off	
Fire Hydrant	
Relocate Fire Hydrant	
Remove Fire Hydrant	REM FH
Water Meter	
Relocate Water Meter	
Remove Water Meter	REM WM
Water Pump Station	
RPZ Backflow Preventer	
DCV Backflow Preventer	
Relocate RPZ Backflow Preventer	
Relocate DCV Backflow Preventer	

**PROPOSED SEWER SYMBOLS**

Gravity Sewer Line (Sized as Shown)	
Force Main Sewer Line (Sized as Shown)	
Manhole (Sized per Note)	
Sewer Pump Station	

**PROPOSED MISCELLANEOUS UTILITIES SYMBOLS**

Power Pole	
Telephone Pole	
Joint Use Pole	
Telephone Pedestal	
Utility Line by Others (Type as Shown)	
Trenchless Installation	
Encasement by Open Cut	
Encasement	

Thrust Block	
Air Release Valve	
Utility Vault	
Concrete Pier	
Steel Pier	
Plan Note	
Pay Item Note	

NOTE  
PAY ITEM

**EXISTING UTILITIES SYMBOLS**

Power Pole		*Underground Power Line	
Telephone Pole		*Underground Telephone Cable	
Joint Use Pole		*Underground Telephone Conduit	
Utility Pole		*Underground Fiber Optics Telephone Cable	
Utility Pole with Base		*Underground TV Cable	
H-Frame Pole		*Underground Fiber Optics TV Cable	
Power Transmission Line Tower		*Underground Gas Pipeline	
Water Manhole		Aboveground Gas Pipeline	
Power Manhole		*Underground Water Line	
Telephone Manhole		Aboveground Water Line	
Sanitary Sewer Manhole		*Underground Gravity Sanitary Sewer Line	
Hand Hole for Cable		Aboveground Gravity Sanitary Sewer Line	
Power Transformer		*Underground SS Forced Main Line	
Telephone Pedestal		Underground Unknown Utility Line	
CATV Pedestal		SUE Test Hole	
Gas Valve		Water Meter	
Gas Meter		Water Valve	
Located Miscellaneous Utility Object		Fire Hydrant	
Abandoned According to Utility Records	AATUR	Sanitary Sewer Cleanout	
End of Information	E.O.I.		

\*For Existing Utilities  
Utility Line Drawn from Record (Type as Shown)  
Designated Utility Line (Type as Shown)

# UTILITY CONSTRUCTION

## GENERAL NOTES:

1. THE PROPOSED UTILITY CONSTRUCTION SHALL MEET THE APPLICABLE REQUIREMENTS OF THE NC DEPARTMENT OF TRANSPORTATION'S "STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES" DATED JANUARY 2018.
2. THE EXISTING WATER LINE UTILITIES BELONG TO THE TOWN OF APEX.  
  
CONTACT: RICKY TEMPLE  
PHONE: 919-249-3524
3. ALL WATER LINES TO BE INSTALLED WITHIN COMPLIANCE OF THE RULES AND REGULATIONS OF THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL AND NATURAL RESOURCES, DIVISION OF ENVIRONMENTAL HEALTH.
4. THE UTILITY OWNER OWNS THE EXISTING UTILITY FACILITIES AND WILL OWN THE NEW UTILITY FACILITIES AFTER ACCEPTANCE BY THE DEPARTMENT. THE DEPARTMENT OWNS THE CONSTRUCTION CONTRACT AND HAS ADMINISTRATIVE AUTHORITY. COMMUNICATIONS AND DECISIONS BETWEEN THE CONTRACTOR AND UTILITY OWNER ARE NOT BINDING UPON THE DEPARTMENT OR THIS CONTRACT UNLESS AUTHORIZED BY THE ENGINEER. AGREEMENTS BETWEEN THE UTILITY OWNER AND CONTRACTOR FOR THE WORK THAT IS NOT PART OF THIS CONTRACT OR IS SECONDARY TO THIS CONTRACT ARE ALLOWED, BUT ARE NOT BINDING UPON THE DEPARTMENT.
5. PROVIDE ACCESS FOR THE DEPARTMENT PERSONNEL AND THE OWNER'S REPRESENTATIVES TO ALL PHASES OF CONSTRUCTION. NOTIFY DEPARTMENT PERSONNEL AND THE UTILITY OWNER TWO WEEKS PRIOR TO COMMENCEMENT OF ANY WORK AND ONE WEEK PRIOR TO SERVICE INTERRUPTION. KEEP UTILITY OWNERS' REPRESENTATIVES INFORMED OF WORK PROGRESS AND PROVIDE OPPORTUNITY FOR INSPECTION OF CONSTRUCTION AND TESTING. CONTACT UTILITY OWNER REPRESENTATIVE DEWAYNE CARLYLE AT 919-249-3386 OR 919-337-7877 TO SCHEDULE A PRE-CONSTRUCTION MEETING AND ALL INSPECTIONS.

6. THE PLANS DEPICT THE BEST AVAILABLE INFORMATION FOR THE LOCATION, SIZE, AND TYPE OF MATERIAL FOR ALL EXISTING UTILITIES. MAKE INVESTIGATIONS FOR DETERMINING THE EXACT LOCATION, SIZE, AND TYPE MATERIAL OF THE EXISTING FACILITIES AS NECESSARY FOR THE CONSTRUCTION OF THE PROPOSED UTILITIES AND FOR AVOIDING DAMAGE TO EXISTING FACILITIES. REPAIR ANY DAMAGE INCURRED TO EXISTING FACILITIES TO THE ORIGINAL OR BETTER CONDITION AT NO ADDITIONAL COST TO THE DEPARTMENT.
7. MAKE FINAL CONNECTIONS OF THE NEW WORK TO THE EXISTING SYSTEM WHERE INDICATED ON THE PLANS, AS REQUIRED TO FIT THE ACTUAL CONDITIONS, OR AS DIRECTED.
8. MAKE CONNECTIONS BETWEEN EXISTING AND PROPOSED UTILITIES AT TIMES MOST CONVENIENT TO THE PUBLIC, WITHOUT ENDANGERING THE UTILITY SERVICE, AND IN ACCORDANCE WITH THE UTILITY OWNER'S REQUIREMENTS. MAKE CONNECTIONS ON WEEKENDS, AT NIGHT, AND ON HOLIDAYS IF NECESSARY. ENSURE SUFFICIENT EQUIPMENT AND PERSONNEL ARE ON SITE TO FACILITATE THE TIE-IN IS DONE IN THE SHORTEST TIME POSSIBLE. TIE-INS SHALL BE COMPLETED WITHIN FOUR (4) HOURS.
9. ALL UTILITY MATERIALS SHALL BE APPROVED PRIOR TO DELIVERY TO THE PROJECT. SEE 1500-7, " SUBMITTALS AND RECORDS" IN SECTION 1500 OF THE STANDARD SPECIFICATIONS.
10. CONTRACTOR SHALL NOT OPERATE ANY VALVES ON THE EXISTING UTILITY SYSTEMS. CONTRACTOR SHALL CONTACT THE UTILITY OWNER REPRESENTATIVE JIMMY CORNELL AT 919-249-3536 TO CONDUCT STRATEGIC OPERATION OF VALVES FOR SERVICE INTERRUPTION IN ORDER TO PERFORM SPECIFIC WORK.

## PROJECT SPECIFIC NOTES:

1. PROPOSED WATER LINE TO BE INSTALLED SHALL BE 8-INCH CLASS 350 DUCTILE IRON FACTORY RESTRAINED JOINT PIPE.
2. PROPOSED WATER LINE TO BE INSTALLED INSIDE THE PROPOSED ENCASEMENT PIPE SHALL BE 8-INCH CLASS 350 DUCTILE IRON FACTORY RESTRAINED JOINT PIPE.
3. ALL WATER LINE FITTINGS, 4-INCHES THROUGH 12-INCHES IN DIAMETER, SHALL BE PRESSURE CLASS 350, DUCTILE IRON FACTORY RESTRAINED JOINT FITTINGS. THE ONLY EXCEPTION SHALL BE AT THE TIE-IN POINTS WHERE A STANDARD MJ BEND FITTING MAY BE USED WITH A JOINT RESTRAINT DEVICE AS APPROVED BY THE UTILITY OWNER.
4. ALL PROPOSED FITTINGS (BENDS, TEES, CROSSES, REDUCERS, PLUGS, ETC.) SHALL BE ADEQUATELY RESTRAINED FURTHER BY THE USE OF CAST IN PLACE CONCRETE THRUST RESTRAINTS (AS DETAILED ON THESE DRAWINGS) AS DIRECTED BY THE RESIDENT ENGINEER AND UTILITY OWNER REPRESENTATIVE.
5. ALL WATER LINE TO BE INSTALLED BY OPEN TRENCH CONSTRUCTION SHALL HAVE 4 FEET MINIMUM COVER TO TOP OF PIPE.
6. OPEN TRENCH CONSTRUCTION SHALL HAVE A MINIMUM TRENCH WIDTH OF 16" PLUS THE O.D. OF THE PIPE AND A MAXIMUM TRENCH WIDTH OF 24" PLUS THE O.D. OF THE PIPE, UNLESS OTHERWISE APPROVED BY THE RESIDENT ENGINEER AND THE UTILITY OWNER REPRESENTATIVE.
7. IN TRENCHES WHERE WATER IS PRESENT OR WHERE DEWATERING IS REQUIRED, THE TRENCH BOTTOM SHALL BE STABILIZED WITH # 67 OR #57 STONE OR OTHER MATERIAL APPROVED BY THE RESIDENT ENGINEER AND UTILITY OWNER REPRESENTATIVE.
8. ALL PROPOSED VALVES SHALL BE GATE VALVES.
9. ALL WATER LINES TO BE ABANDONED OUTSIDE OF THE ROADWAY SECTION AND WITHIN THE NCDOT RIGHT-OF-WAY SHALL EITHER BE REMOVED OR COMPLETELY FILLED WITH FLOWABLE FILL AS DIRECTED BY THE RESIDENT ENGINEER, AND APPROVED BY THE UTILITY OWNER REPRESENTATIVE, IN ACCORDANCE WITH THE NCDOT STANDARD SPECIFICATIONS.
10. CONTRACTOR'S ATTENTION IS DIRECTED TO SECTIONS 102, 107, AND 1550 OF THE STANDARD SPECIFICATIONS CONCERNING TRENCHLESS INSTALLATION. IT IS CONTRACTOR'S RESPONSIBILITY TO HAVE BORE DESIGNED AND SEALED BY A LICENSED NORTH CAROLINA PROFESSIONAL ENGINEER. NO DAMAGE IS ALLOWED TO RIVER, STREAM, CREEK, WETLANDS, OR BUFFER ZONES.
11. ALL NEW WATER LINES SHALL BE PIGGED AS PART OF THE TESTING PROCEDURE. PIGGING SHALL TAKE PLACE AT THE CONCLUSION OF PIPE INSTALLATION UTILIZING THE INITIAL WATER FILL OR LOADING OF THE PIPE. PIGGING SHALL TAKE PLACE PRIOR TO ANY INTRODUCTION OF CHLORINE SOLUTION TO THE PIPE. THE CONTRACTOR SHALL USE A 5 POUNDS PER CUBIC FOOT DENSITY POLYETHYLENE PIG AND WRITE HIS COMPANY NAME AND STREET NAME WHERE THE WORK IS TAKING PLACE IN A PERMANENT MANOR ON THE PIG.

PROJECT REFERENCE NO. B-5161	SHEET NO. UC-3
DESIGNED BY: GJB	
DRAWN BY: GJB	
CHECKED BY: KCZ	
APPROVED BY: KCZ	
REVISED:	
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION UTILITIES ENGINEERING SEC. PHONE: (919) 707-6690 FAX: (919) 250-4151	UTILITY CONSTRUCTION PLANS ONLY
<b>UTILITY CONSTRUCTION</b>	
<b>DOCUMENT NOT CONSIDERED FINAL UNTIL ALL SIGNATURES ARE COMPLETED</b>	

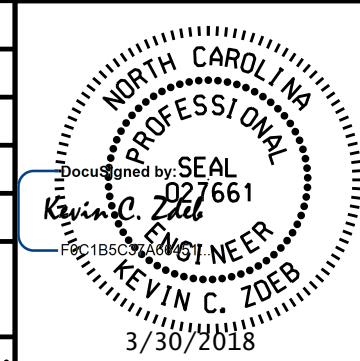

## PROJECT QUANTITIES

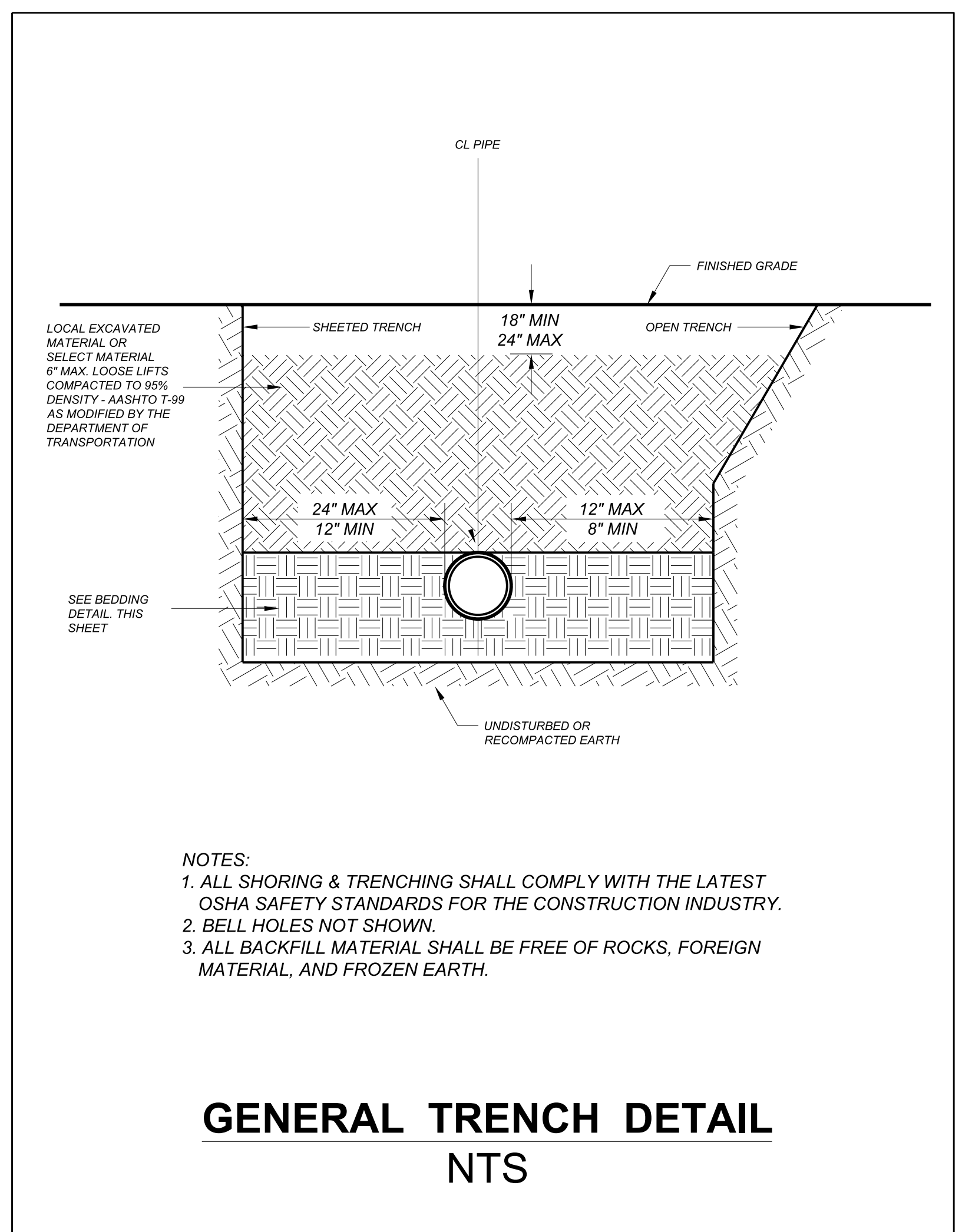
ITEM NUMBER	DESCRIPTION	QUANTITY	
5325800000-E	8" WATER LINE	537	LF
5329000000-E	DUCTILE IRON WATER PIPE FITTINGS	1,210	POUNDS
5801000000-E	ABANDON 8" UTILITY PIPE	531	LF
5835800000-E	18" ENCASEMENT PIPE	149	LF
5872500000-E	BORE AND JACK OF 18"	149	LF

The signatures affixed below certify that this sheet has been reviewed and approved solely per the certifications signed on the cover sheet of these construction plans.			
PW - Transportation	Date	WR - Stormwater	Date
Building Inspections	Date	Planning	Date
WR - Utility Engineering	Date	Planning - Transportation	Date
Electric	Date	Fire	Date
WR - S&E	Date	Parks, Recreation & Cult. Res.	Date

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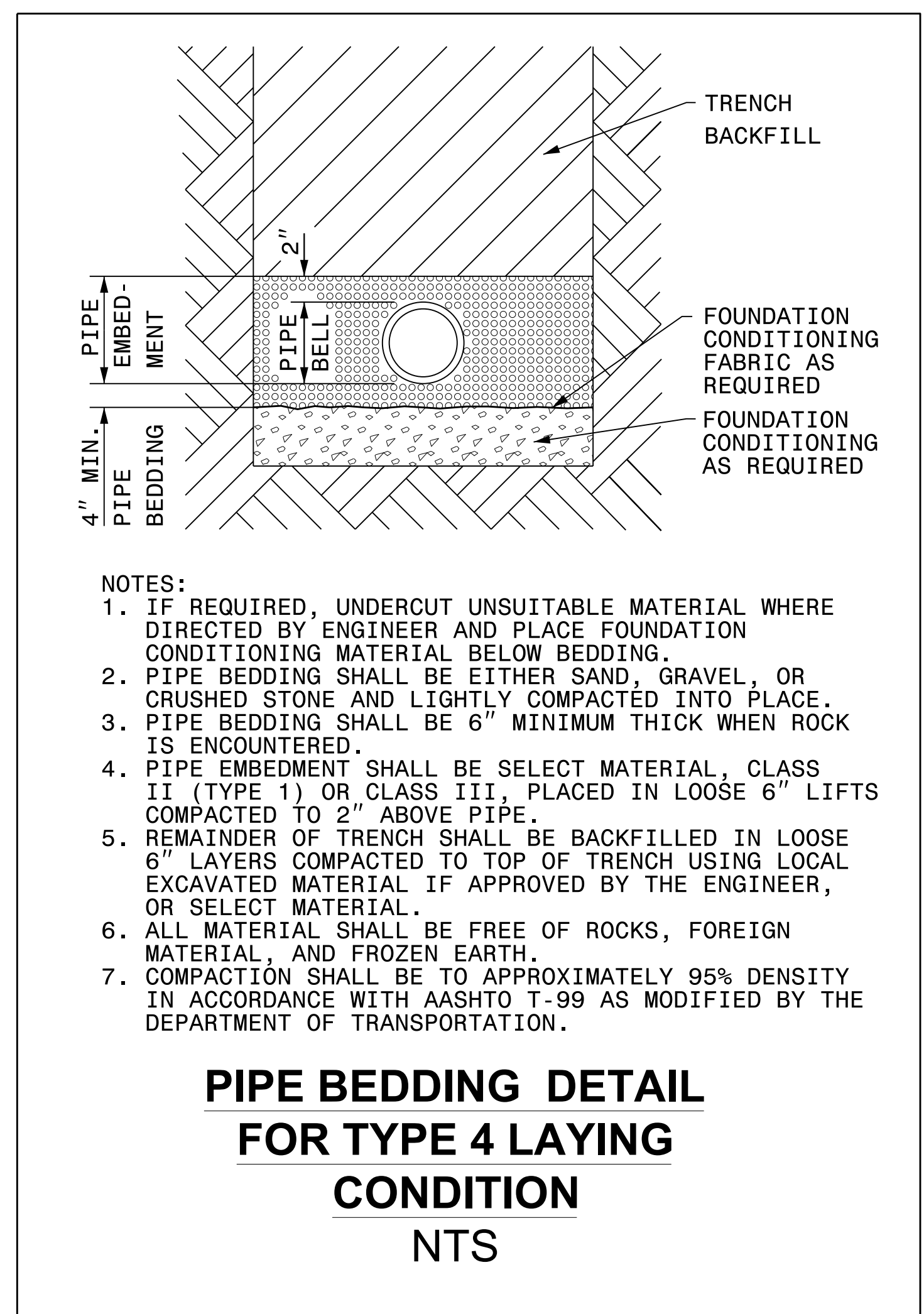
5/14/99  
3/30/2006  
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PROJECT REFERENCE NO. <b>B-5161</b>	SHEET NO. <b>UC-3A</b>
DESIGNED BY: <b>GJB</b>	
DRAWN BY: <b>GJB</b>	
CHECKED BY: <b>KCZ</b>	
APPROVED BY: <b>KCZ</b>	
REVISED:	
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION UTILITIES ENGINEERING SEC. PHONE: (919) 707-6690 FAX: (919) 250-4151 UTILITY CONSTRUCTION PLANS ONLY	
<b>UTILITY CONSTRUCTION</b>	
	
<b>DOCUMENT NOT CONSIDERED FINAL UNTIL ALL SIGNATURES ARE COMPLETED</b>	



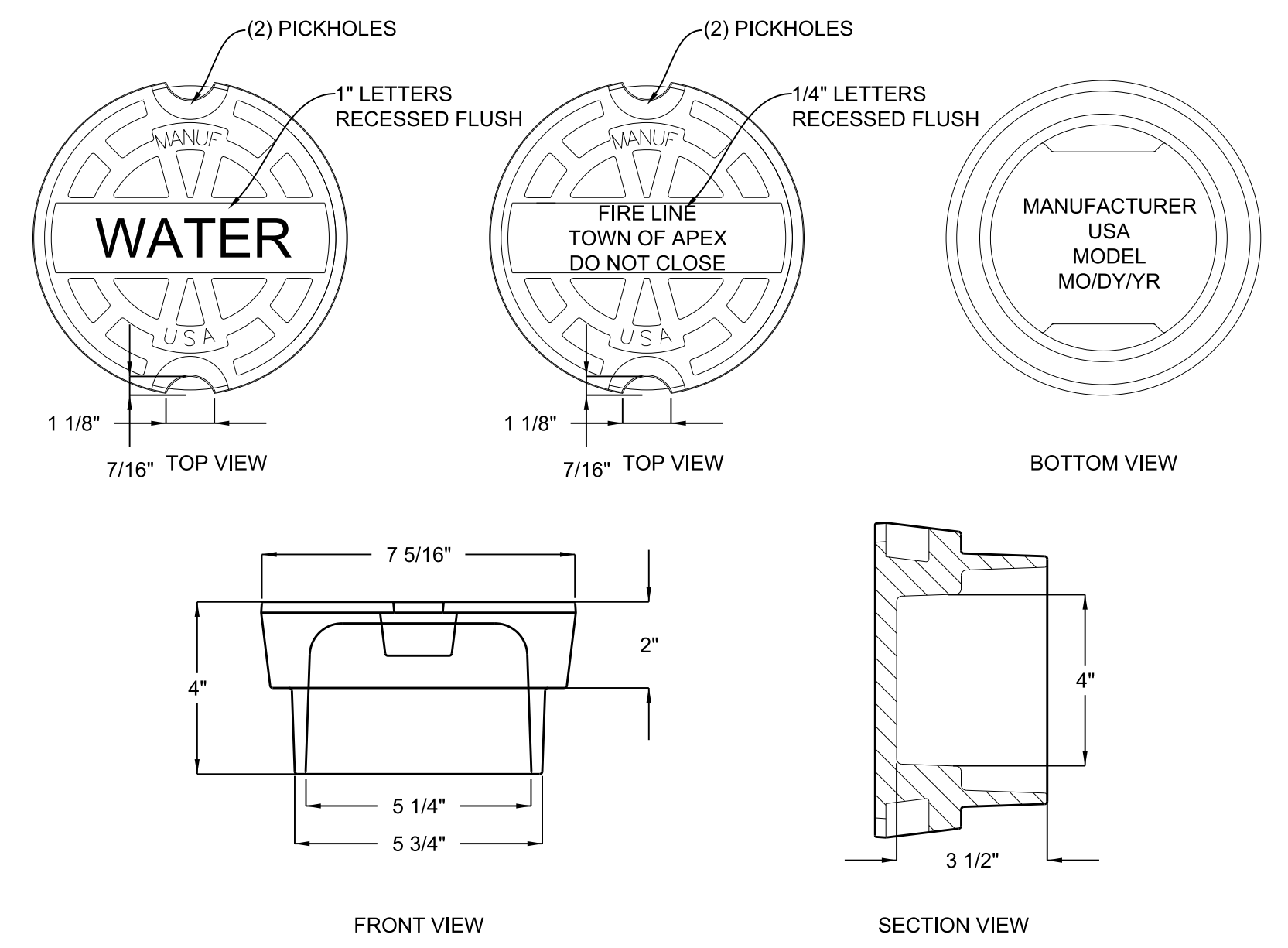
- NOTES:**
1. ALL SHORING & TRENCHING SHALL COMPLY WITH THE LATEST OSHA SAFETY STANDARDS FOR THE CONSTRUCTION INDUSTRY.
  2. BELL HOLES NOT SHOWN.
  3. ALL BACKFILL MATERIAL SHALL BE FREE OF ROCKS, FOREIGN MATERIAL, AND FROZEN EARTH.

**GENERAL TRENCH DETAIL  
NTS**



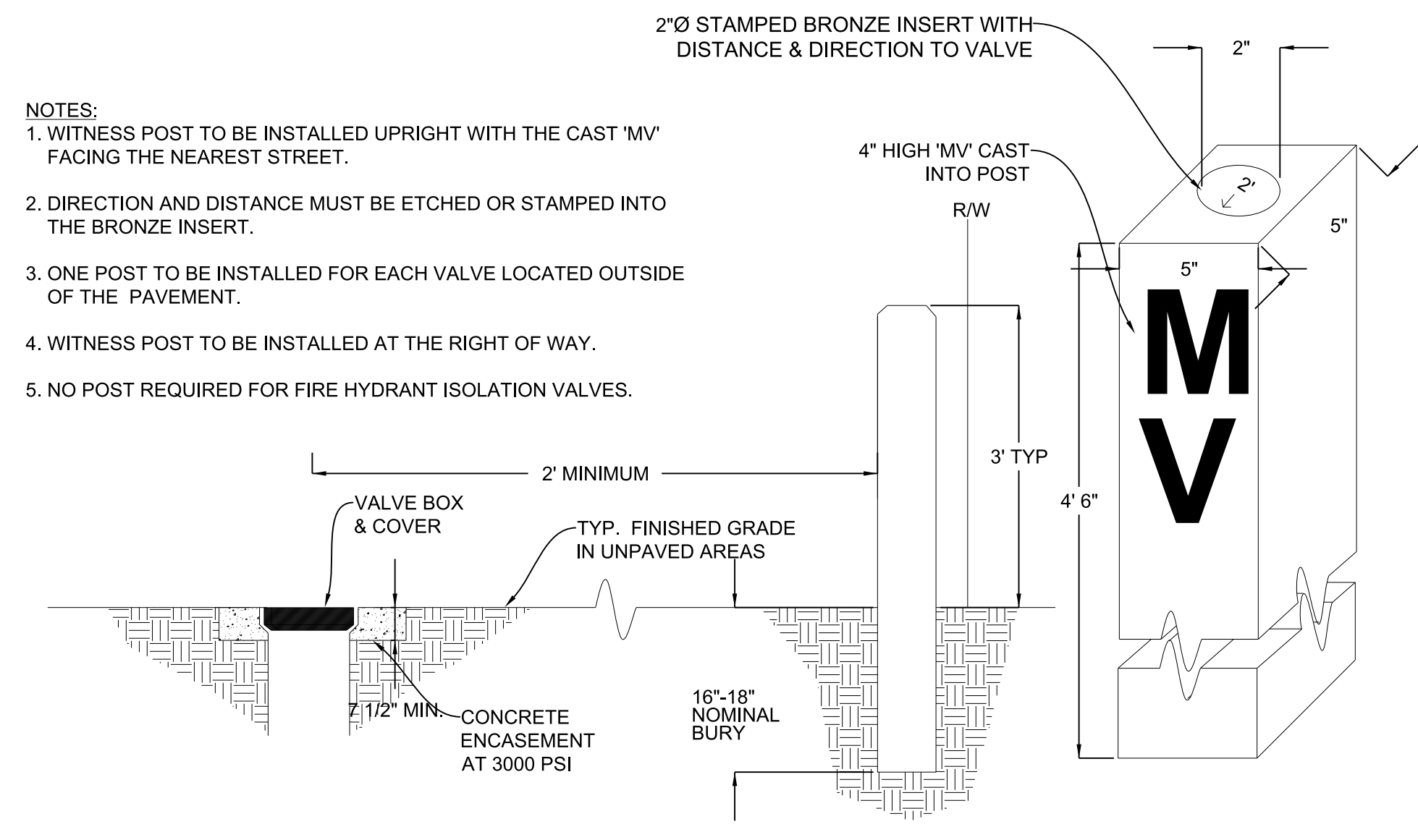
- NOTES:**
1. IF REQUIRED, UNDERCUT UNSUITABLE MATERIAL WHERE DIRECTED BY ENGINEER AND PLACE FOUNDATION CONDITIONING MATERIAL BELOW BEDDING.
  2. PIPE BEDDING SHALL BE EITHER SAND, GRAVEL, OR CRUSHED STONE AND LIGHTLY COMPACTED INTO PLACE.
  3. PIPE BEDDING SHALL BE 6" MINIMUM THICK WHEN ROCK IS ENCOUNTERED.
  4. PIPE EMBEDMENT SHALL BE SELECT MATERIAL, CLASS II (TYPE 1) OR CLASS III, PLACED IN LOOSE 6" LIFTS COMPACTED TO 2" ABOVE PIPE.
  5. REMAINDER OF TRENCH SHALL BE BACKFILLED IN LOOSE 6" LAYERS COMPACTED TO TOP OF TRENCH USING LOCAL EXCAVATED MATERIAL IF APPROVED BY THE ENGINEER, OR SELECT MATERIAL.
  6. ALL MATERIAL SHALL BE FREE OF ROCKS, FOREIGN MATERIAL, AND FROZEN EARTH.
  7. COMPACTION SHALL BE TO APPROXIMATELY 95% DENSITY IN ACCORDANCE WITH AASHTO T-99 AS MODIFIED BY THE DEPARTMENT OF TRANSPORTATION.

**PIPE BEDDING DETAIL  
FOR TYPE 4 LAYING  
CONDITION  
NTS**



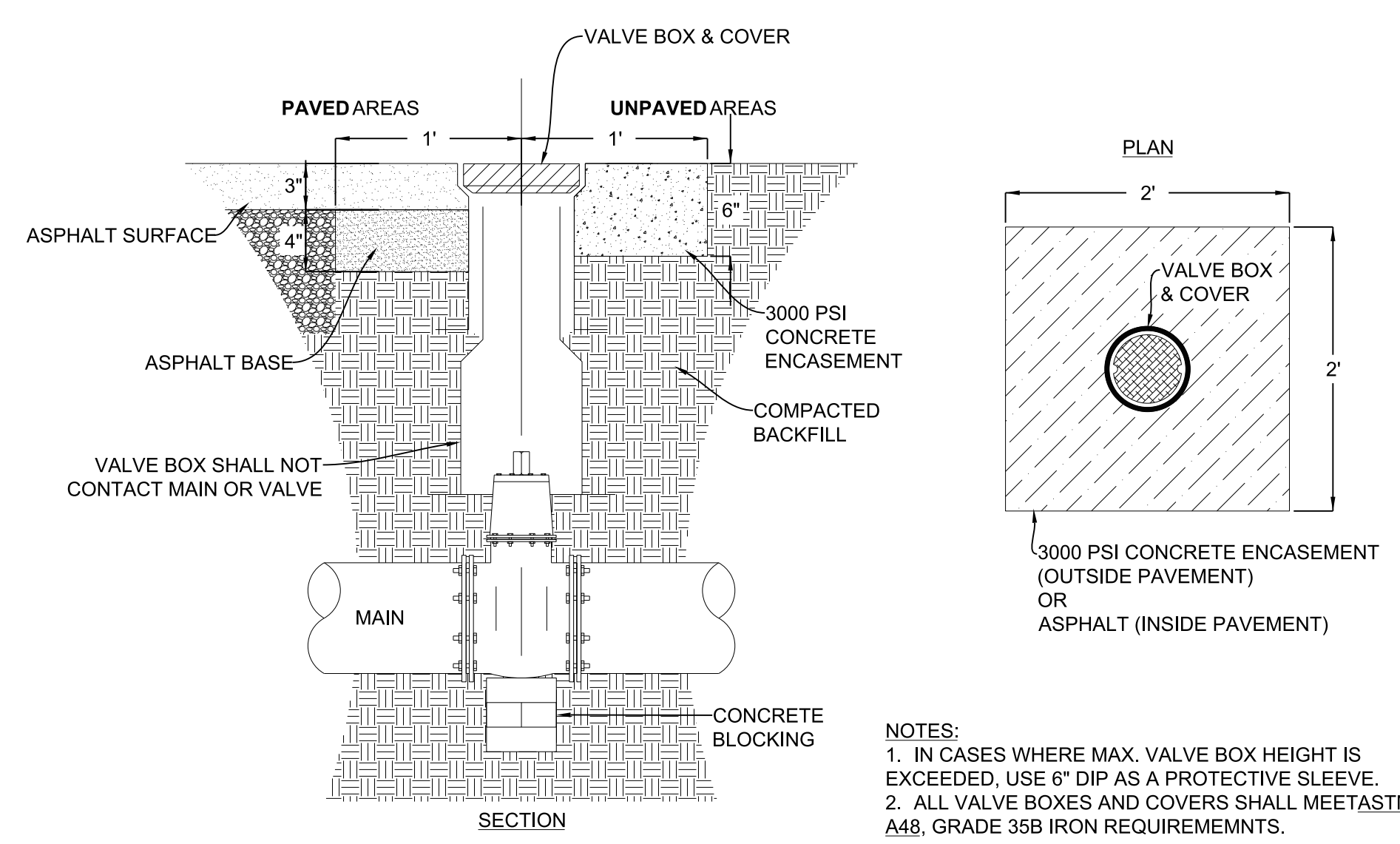
**VALVE COVER**

COVER WEIGHT: 16 LBS



- NOTES:**
1. WITNESS POST TO BE INSTALLED UPRIGHT WITH THE CAST 'MV' FACING THE NEAREST STREET.
  2. DIRECTION AND DISTANCE MUST BE ETCHED OR STAMPED INTO THE BRONZE INSERT.
  3. ONE POST TO BE INSTALLED FOR EACH VALVE LOCATED OUTSIDE OF THE PAVEMENT.
  4. WITNESS POST TO BE INSTALLED AT THE RIGHT OF WAY.
  5. NO POST REQUIRED FOR FIRE HYDRANT ISOLATION VALVES.

**VALVE BOX MARKER FOR UNPAVED AREAS**



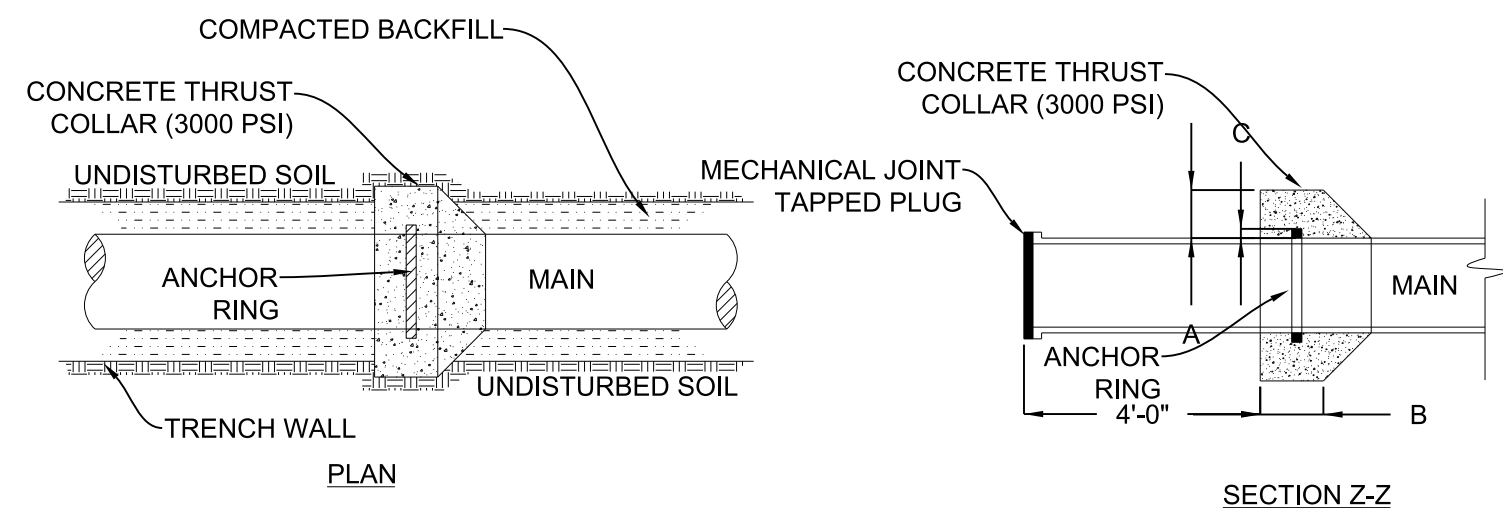
- NOTES:**
1. IN CASES WHERE MAX. VALVE BOX HEIGHT IS EXCEEDED, USE 6" DIP AS A PROTECTIVE SLEEVE.
  2. ALL VALVE BOXES AND COVERS SHALL MEET ASTM A48, GRADE 35B IRON REQUIREMENTS.

**VALVE BOX INSTALLATION**

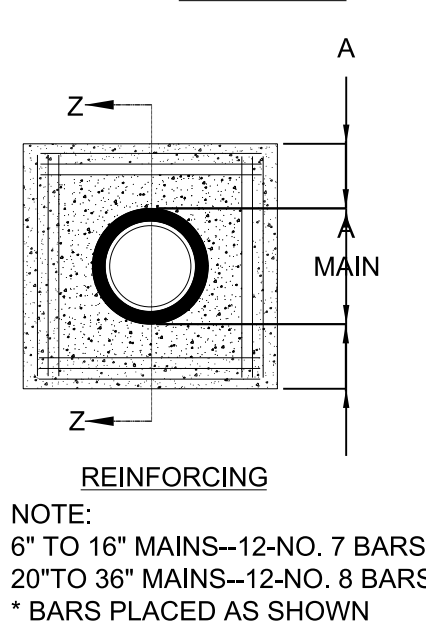
The signatures affixed below certify that this sheet has been reviewed and approved solely per the certifications signed on the cover sheet of these construction plans.

PW - Transportation	Date	WR - Stormwater	Date
Building Inspections	Date	Planning	Date
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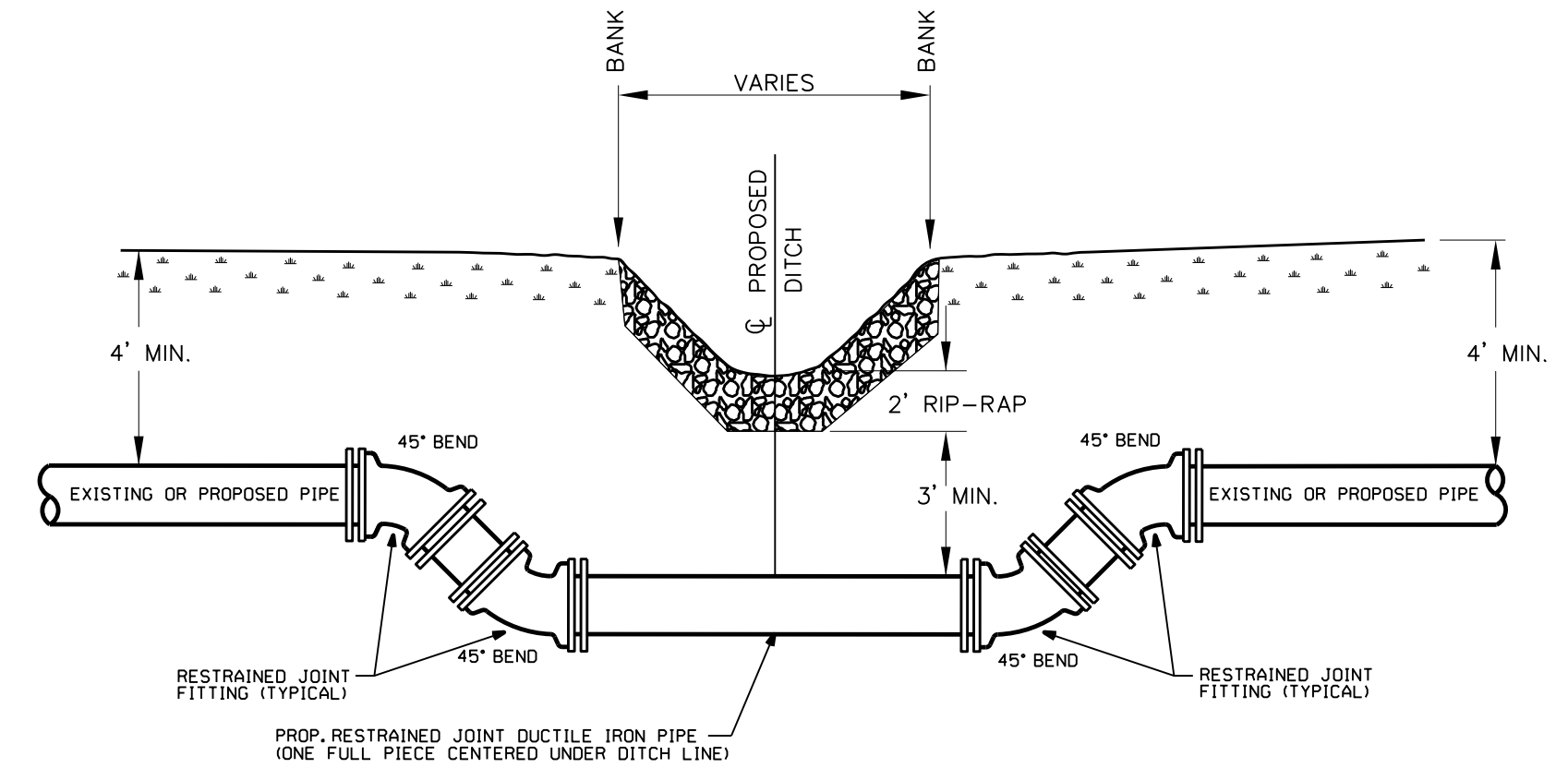
5/14/09



PIPE DIAMETER	CONCRETE THRUST COLLAR		ANCHOR RING	RINGS REQUIRED
	A	B		
6"/8"/12"	1'-0"	1'-0"	2"	ONE
16"	1'-4"	1'-0"	2"	ONE
20"	1'-4"	1'-0"	3"	ONE
24"	1'-4"	1'-0"	3"	TWO
30"	1'-4"	1'-2"	4"	TWO
36"	1'-4"	1'-4"	4"	TWO

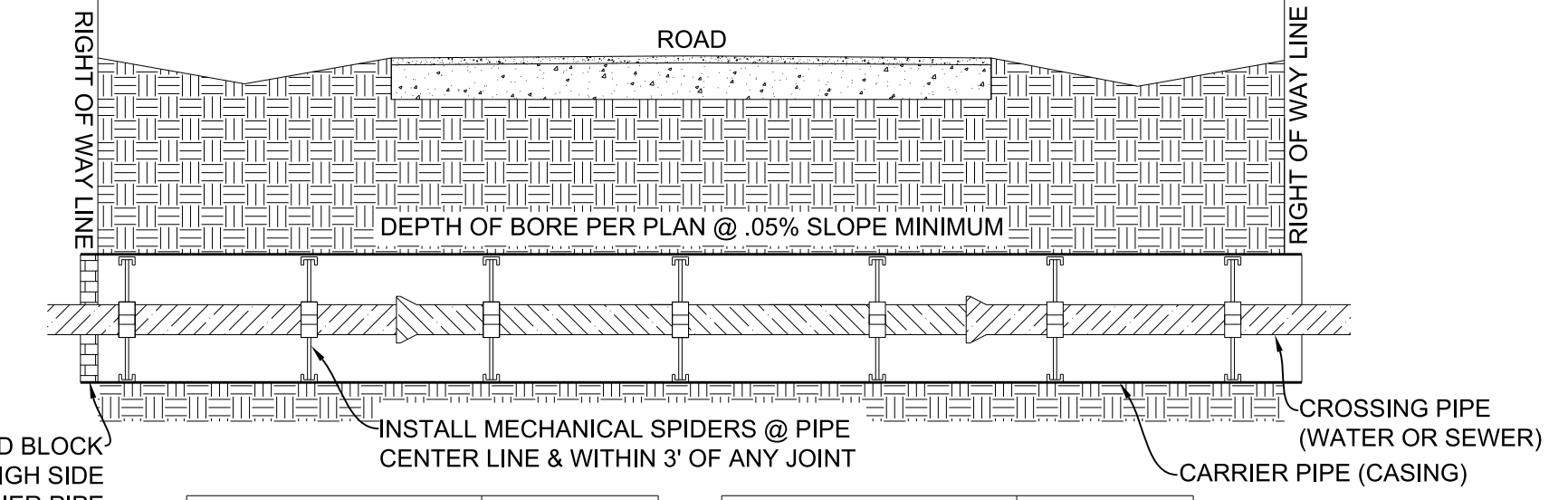


**THRUST COLLAR INSTALLATION**



- NOTES:  
 1. ALL BEND FITTINGS SHALL BE DUCTILE IRON RESTRAINED JOINT FITTINGS.  
 2. ALL PROPOSED PIPE SHALL BE DUCTILE IRON RESTRAINED JOINT.

**DOWN AND UNDER DITCH CROSSING DETAIL**



WATER		WALL THICKNESS (IN.)	SEWER		WALL THICKNESS (IN.)
PIPE	CASING		PIPE	CASING	
6-8	18	0.150	4-12	24	0.188
10-12	24	0.188	16-24	36	0.250
16-18	36	0.250	30	42	0.312
20-24	42	0.312	36	48	0.375
30-36	48	0.432	42	54	0.432
			48	60	0.432

- NOTES:  
 1. CASING SHALL BE UNCOATED SPIRAL WELDED STEEL MEETING ASTM A-139, GRADE B WITH A YIELD STRENGTH OF 35,000 PSI.  
 2. CROSSINGS ON NCDOT MAINTAINED ROADS TO BE IN ACCORDANCE WITH CURRENT NCDOT STANDARDS AND APPROVED ENCROACHMENT AGREEMENT.  
 3. RESTRAINED JOINT PIPE ONLY. MEGA-LUGS ARE NOT PERMITTED.  
 4. FOR STREAM CROSSINGS, THE CASING PIPE SHALL BE INSTALLED WITH 5 FEET MINIMUM COVER FROM THE STREAM BOTTOM TO TOP OF CASING.

**BORE & JACK DETAIL**

FITTING	REQUIRED RESTRAINED LENGTH (FT) OF BARE D.I. PIPE BY DEPTH OF COVER							
	3 FT	4 FT	5 FT	6 FT	7 FT	8 FT	9 FT	10 FT
<b>HORIZONTAL BENDS</b>								
8 INCH DIA - 11.25 DEG	3	3	2	2	2	2	2	2
8 INCH DIA - 22.5 DEG	7	6	5	5	4	4	3	3
8 INCH DIA - 45 DEG	14	12	10	9	8	8	7	7
8 INCH DIA - 90 DEG	33	29	25	23	20	19	17	16

VERTICAL DOWN BENDS	3 FT	4 FT	5 FT	6 FT	7 FT	8 FT	9 FT	10 FT
	8 INCH DIA - 11.25 DEG	10	8	7	6	6	5	5
8 INCH DIA - 22.5 DEG	19	17	15	13	12	11	10	9
8 INCH DIA - 45 DEG	40	35	30	27	25	22	21	19

VERTICAL UP BENDS	3 FT	4 FT	5 FT	6 FT	7 FT	8 FT	9 FT	10 FT
	8 INCH DIA - 11.25 DEG	3	3	2	2	2	2	2
8 INCH DIA - 22.5 DEG	7	6	5	5	4	4	3	3
8 INCH DIA - 45 DEG	14	12	10	9	8	8	7	7

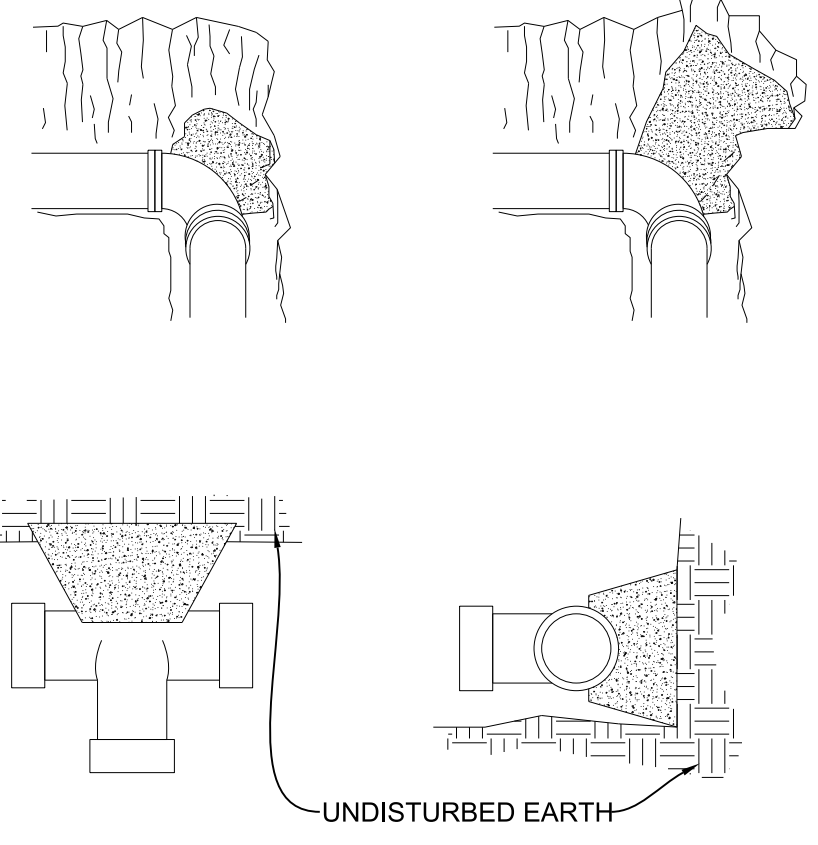
DEAD ENDS / VALVES	3 FT	4 FT	5 FT	6 FT	7 FT	8 FT	9 FT	10 FT
	8 INCH DIA	65	59	54	50	46	43	40

**ASSUMPTIONS**

LAYING CONDITION = TYPE 4  
 SOIL DESIGNATION = GC = COHESIVE-GRANULAR  
 DESIGN PRESSURE = 200 PSI (TEST PRESSURE)  
 SAFETY FACTOR = 1.5

**NOTES**

- RESTRAINED LENGTH IS MEASURED FROM THE CENTER OF THE BEND AS FOLLOWS:  
 A. HORIZONTAL AND VERTICAL BENDS: ALONG EACH SIDE OF BEND.  
 B. HORIZONTAL AND VERTICAL BENDS - OFFSET OR COMBINED: ALONG THE OUTER SIDE OF EACH BEND.  
 ALL PIPE BETWEEN THE TWO BENDS SHALL BE RESTRAINED JOINT WHEN THE DISTANCE BETWEEN THEM IS EQUAL TO OR LESS THAN THE REQUIRED RESTRAINED LENGTH. WHEN THE DISTANCE BETWEEN BENDS IS LESS THAN REQUIRED, THE BALANCE OF THE REQUIRED RESTRAINED LENGTH SHALL BE ADDED ON TO THE LENGTH ALONG THE OUTSIDE OF EACH BEND RESPECTIVELY TO MAKE UP FOR THE DEFICIENCY IN THAT DIRECTION.  
**HORIZONTAL BEND EXAMPLE...**  
 INSTALL A 8 INCH 45 DEG BEND AND A 22.5 DEG BEND WITH 10 FEET BETWEEN BENDS AND 4 FEET OF COVER. THE CONTRACTOR SHALL PROVIDE AN ADDITIONAL 1 FOOT OF RESTRAINED LENGTH BEYOND THE 45 DEGREE BEND (FOR A TOTAL OF 13 FEET) AND AN ADDITIONAL 7 FEET OF RESTRAINED LENGTH BEYOND THE 22.5 DEGREE BEND (FOR A TOTAL OF 13 FEET).
- WHEN IT IS NOT POSSIBLE TO INSTALL THE RESTRAINED LENGTHS AS NOTED BY THIS TABLE, THE CONTRACTOR SHALL INSTALL THE APPROPRIATE CONCRETE THRUST RESTRAINTS AS PER THE DETAILS HEREIN.



MINIMUM CONCRETE BLOCKING (C.Y.)*					
NOM. PIPE DIA. (INCHES)	TEES & DEAD ENDS	90° BEND	45° BEND	22-1/2° BEND	11-1/4° BEND
4	0.1	0.1	0.1	0.1	0.1
6	0.2	0.2	0.1	0.1	0.1
8	0.2	0.3	0.2	0.1	0.1
10	0.3	0.5	0.3	0.2	0.2
12	0.4	0.6	0.5	0.3	0.3
14	0.7	0.9	0.6	0.5	0.5
16	0.7	0.9	0.6	0.5	0.5
18	0.9	1.2	0.7	0.6	0.6
20	1.1	1.6	1.1	0.7	0.7
24	1.7	2.3	1.6	0.9	0.9

\* CONCRETE SHALL BE 3000 PSI

NOTE: WRAP FITTINGS IN 6 MIL PLASTIC BEFORE POURING CONCRETE

**THRUST BLOCKING**

PROJECT REFERENCE NO. <b>B-5161</b>	SHEET NO. <b>UC-3B</b>
DESIGNED BY: <b>GJB</b>	
DRAWN BY: <b>GJB</b>	
CHECKED BY: <b>KCZ</b>	
APPROVED BY: <b>KCZ</b>	
REVISED:	
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION UTILITIES ENGINEERING SEC. PHONE: (919) 707-6690 FAX: (919) 250-4151 UTILITY CONSTRUCTION PLANS ONLY	
<b>UTILITY CONSTRUCTION</b>	
M A Engineering Consultants, Inc. 598 East Chatham Street - Suite 137 Cary, NC 27511 Phone: 919.292.0220 Fax: 919.297.0221 NC License: F-0160	
<b>DOCUMENT NOT CONSIDERED FINAL UNTIL ALL SIGNATURES ARE COMPLETED</b>	

The signatures affixed below certify that this sheet has been reviewed and approved solely per the certifications signed on the cover sheet of these construction plans.

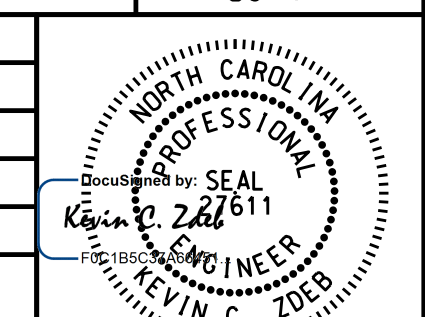
PW - Transportation	Date	WR - Stormwater	Date
Building Inspections	Date	Planning	Date
WR - Utility Engineering	Date	Planning - Transportation	Date
Electric	Date	Fire	Date
WR - S&E	Date	Parks, Recreation & Cult. Res.	Date

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PROJECT REFERENCE NO.		SHEET NO.	
B-5161		UC-4	
DESIGNED BY: GJB			
DRAWN BY: GJB			
CHECKED BY: KCZ			
APPROVED BY: KCZ			
REVISED:			
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION		UTILITIES ENGINEERING SECTION	
PHONE: (919) 707-6690		FAX: (919) 250-4151	
UTILITY CONSTRUCTION PLANS ONLY			

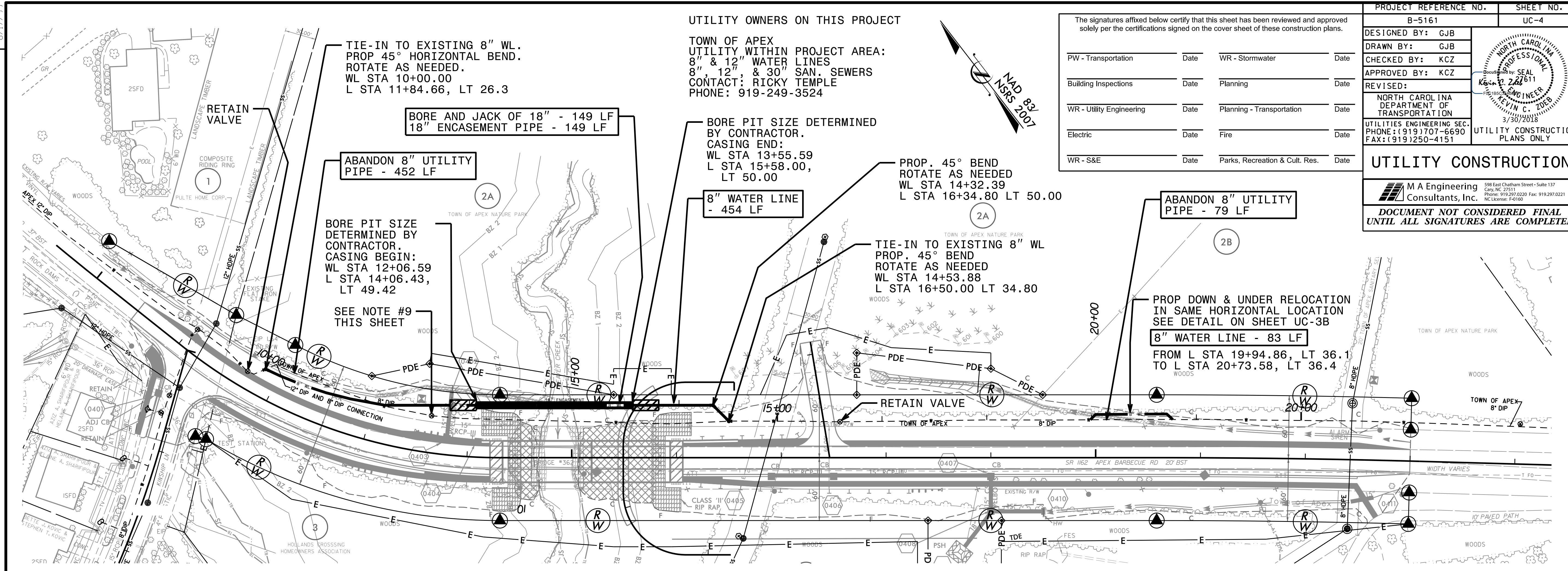
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PW - Transportation	Date	WR - Stormwater	Date
Building Inspections	Date	Planning	Date
WR - Utility Engineering	Date	Planning - Transportation	Date
Electric	Date	Fire	Date
WR - S&E	Date	Parks, Recreation & Cult. Res.	Date



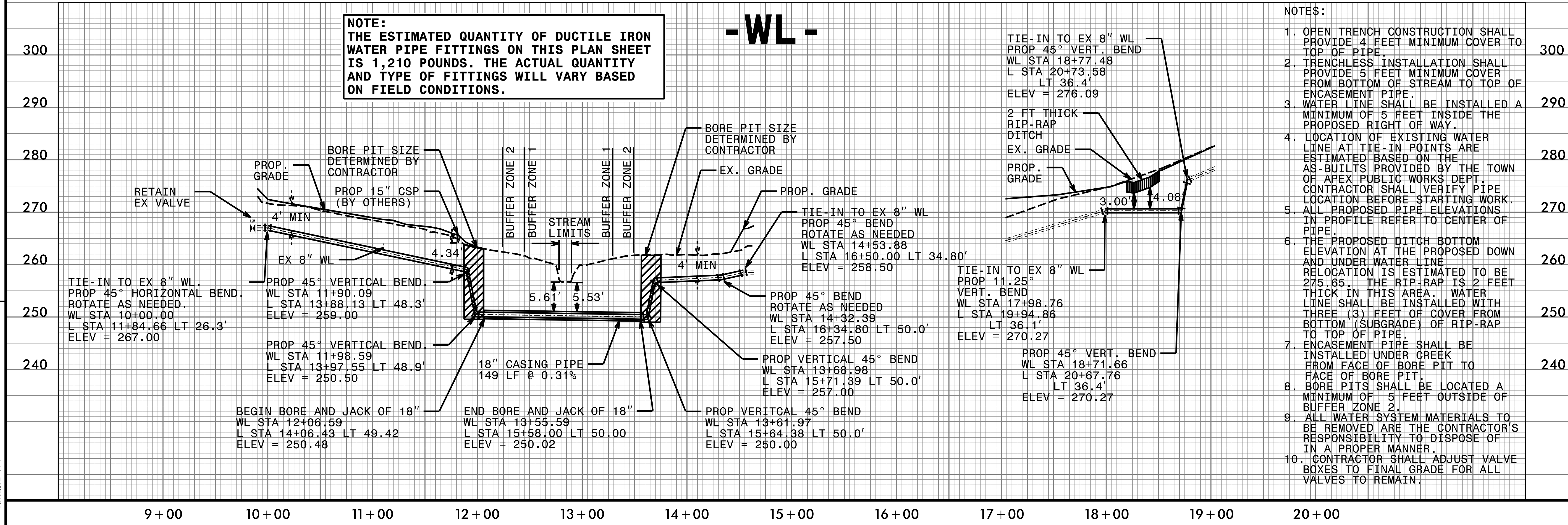
**UTILITY OWNERS ON THIS PROJECT**

TOWN OF APEX  
 UTILITY WITHIN PROJECT AREA:  
 8" & 12" WATER LINES  
 8", 12", & 30" SAN. SEWERS  
 CONTACT: RICKY TEMPLE  
 PHONE: 919-249-3524



**NOTE:**  
 THE ESTIMATED QUANTITY OF DUCTILE IRON WATER PIPE FITTINGS ON THIS PLAN SHEET IS 1,210 POUNDS. THE ACTUAL QUANTITY AND TYPE OF FITTINGS WILL VARY BASED ON FIELD CONDITIONS.

**-WL-**



- NOTES:**
- OPEN TRENCH CONSTRUCTION SHALL PROVIDE 4 FEET MINIMUM COVER TO TOP OF PIPE.
  - TRENCHLESS INSTALLATION SHALL PROVIDE 5 FEET MINIMUM COVER FROM BOTTOM OF STREAM TO TOP OF ENCASEMENT PIPE.
  - WATER LINE SHALL BE INSTALLED A MINIMUM OF 5 FEET INSIDE THE PROPOSED RIGHT OF WAY.
  - LOCATION OF EXISTING WATER LINE AT TIE-IN POINTS ARE ESTIMATED BASED ON THE AS-BUILTS PROVIDED BY THE TOWN OF APEX PUBLIC WORKS DEPT. CONTRACTOR SHALL VERIFY PIPE LOCATION BEFORE STARTING WORK.
  - ALL PROPOSED PIPE ELEVATIONS IN PROFILE REFER TO CENTER OF PIPE.
  - THE PROPOSED DITCH BOTTOM ELEVATION AT THE PROPOSED DOWN AND UNDER WATER LINE RELOCATION IS ESTIMATED TO BE 275.65'. THE RIP-RAP IS 2 FEET THICK IN THIS AREA. WATER LINE SHALL BE INSTALLED WITH THREE (3) FEET OF COVER FROM BOTTOM (SUBGRADE) OF RIP-RAP TO TOP OF PIPE.
  - ENCASEMENT PIPE SHALL BE INSTALLED UNDER CREEK FROM FACE OF BORE PIT TO FACE OF BORE PIT.
  - BORE PITS SHALL BE LOCATED A MINIMUM OF 5 FEET OUTSIDE OF BUFFER ZONE 2.
  - ALL WATER SYSTEM MATERIALS TO BE REMOVED ARE THE CONTRACTOR'S RESPONSIBILITY TO DISPOSE OF IN A PROPER MANNER.
  - CONTRACTOR SHALL ADJUST VALVE BOXES TO FINAL GRADE FOR ALL VALVES TO REMAIN.

REVISIONS

3/30/2018  
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