

EDGECOMBE COUNTY

NORTH CAROLINA

WATER AND SEWER STANDARD DETAILS

TWC PROJECT NO. 2488 - FW

2012

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DIRECTOR OF WATER AND SEWER WORKS
MICHAEL MATTHEWS



THE WOOTEN COMPANY

ENGINEERING | PLANNING | ARCHITECTURE

301 West 14th Street Greenville NC 27834

252.757.1096 fax 252.757.3221

License Number: F-0115

SHEET NO.	DETAIL NAME
G-1	GRAVITY SEWER - SERVICE
G-2	GRAVITY SEWER - CLEAN OUT
G-3	GRAVITY SEWER - CONNECTION
LP - 1	LOW PRESSURE SEWER - STEP SYSTEM
LP - 2	LOW PRESSURE SEWER - SERVICE VALVE ASSEMBLY
LP - 3	LOW PRESSURE SEWER - TERMINAL CLEAN OUT
LP - 4	LOW PRESSURE SEWER - EXISTING SEPTIC TANK CONVERSION
LP - 5	LOW PRESSURE SEWER - SERVICE LINE TIE - IN
S-1	OIL / GREASE INTERCEPTER (1000 GALLON & LARGER CAPACITY)
S-2	MANHOLE FRAME & COVER
S-3	STANDARD MANHOLE RING AND COVER
S-4	FORCE MAIN CONNECTION TO MANHOLE
S-5	FORCE MAIN DISCHARGE
W-1	1" WATER SERVICE WITH DOUBLE CHECK BLACKFLOW PREVENTER
W-2	3/4" & 1" WATER SERVICE
W-3	FIRE HYDRANT ASSEMBLY
W-4	POST HYDRANT ASSEMBLY
W-5	STANDARD VALVE BOX INSTALLATION
W-6	TERMINATION OF 6" - 12" WATER MAIN
W-7	TERMINATION OF 4" WATER MAIN
W-8	RPZ WITH ABOVE GROUND HEATED ENCLOSURE

EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

INDEX SHEET



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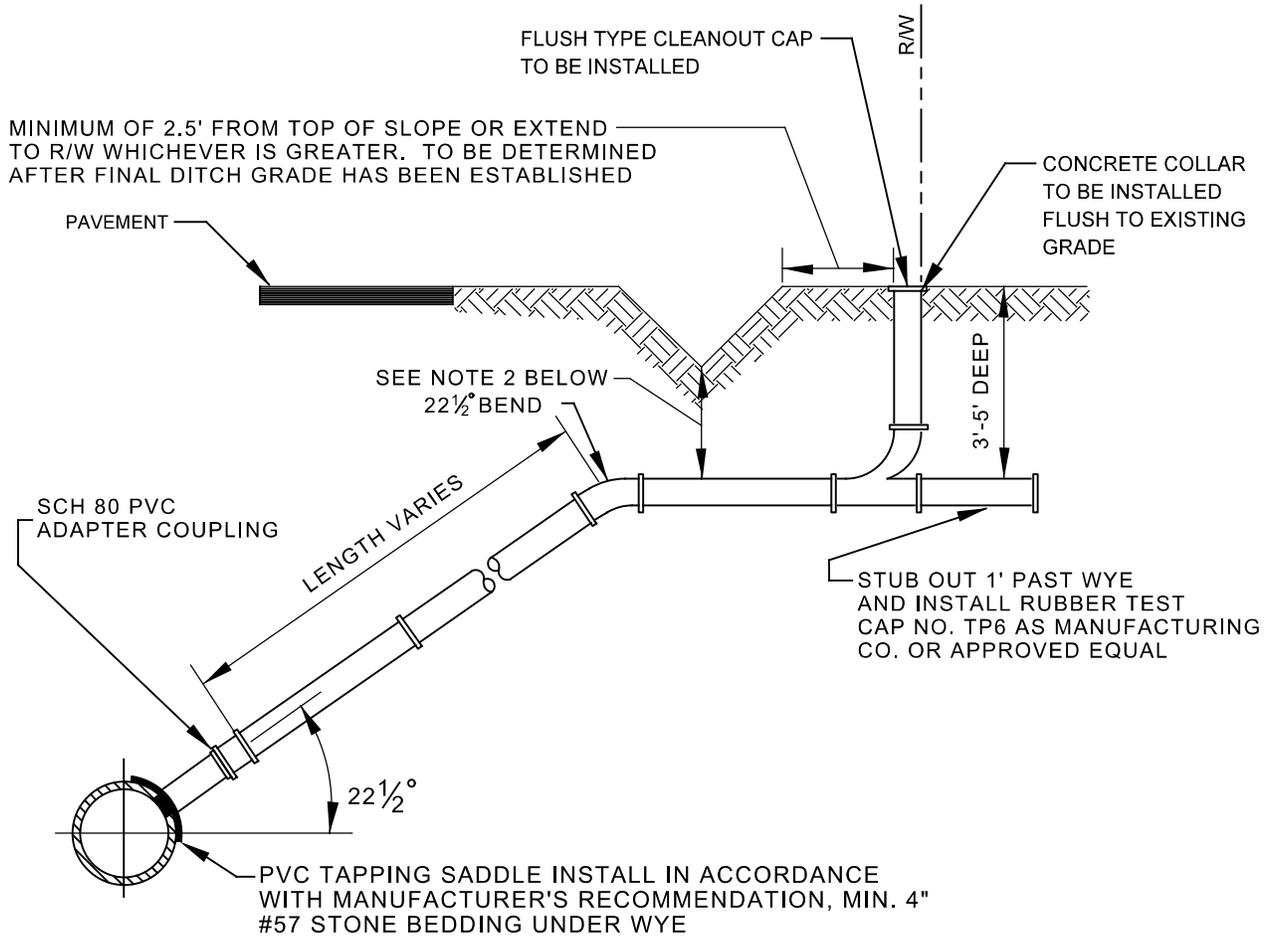
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1-1



NOTES:

1. SCH 40 PVC DWV SEWER SERVICE PIPE AT 1% MIN. GRADE (ASTM D-2665, D-1785)
2. MINIMUM OF 2 FEET OF COVER REQUIRED UNDER DITCH
3. 8"x8"x4" WYE TO BE USED FOR SERVICE CONNECTIONS TO NEW SANITARY SEWER MAINS
4. AFTER SUCCESSFULLY TESTING OF SERVICE LINE, CONTRACTOR TO REMOVE STUB OUT CAP AND INSTALL SERVICE PIPE TO EX. DWELLING PLUMBING CONNECTION.

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WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

GRAVITY SEWER SERVICE



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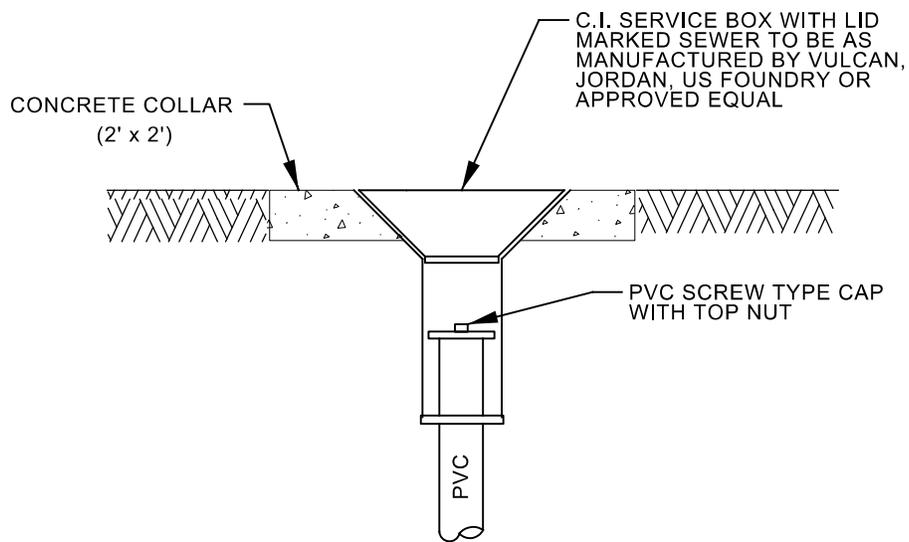
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WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

GRAVITY SEWER - CLEAN-OUT



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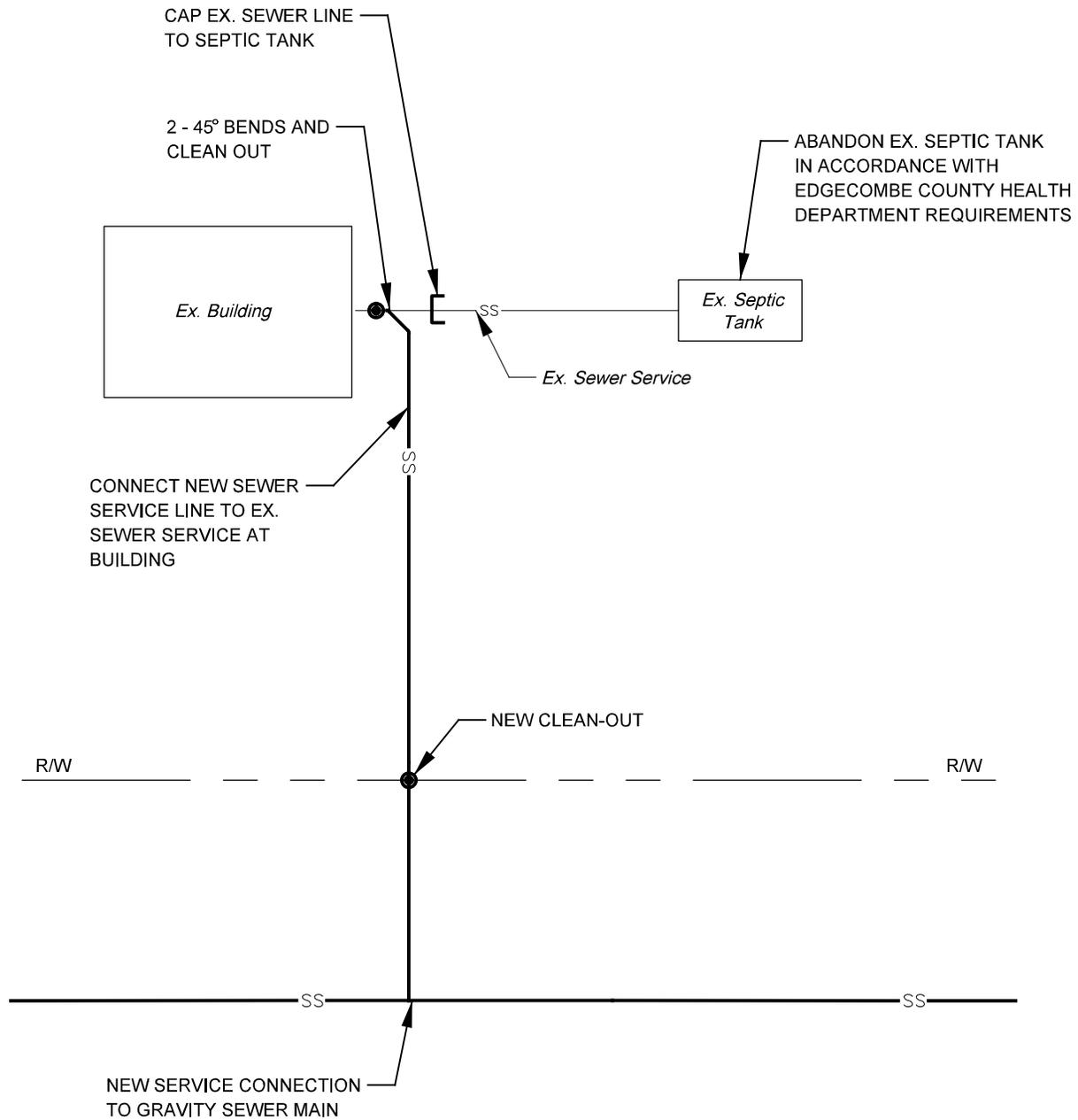
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WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS
GRAVITY SEWER - CONNECTION



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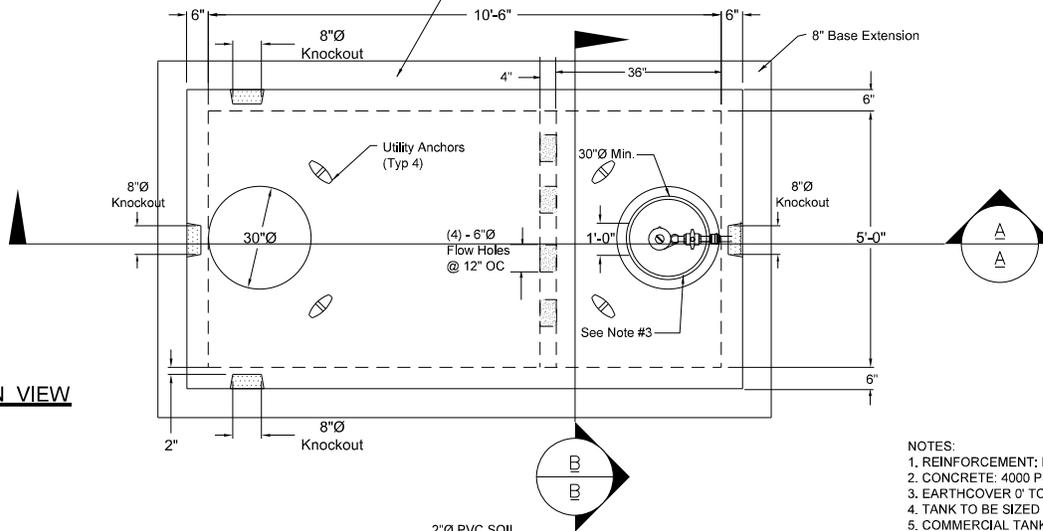
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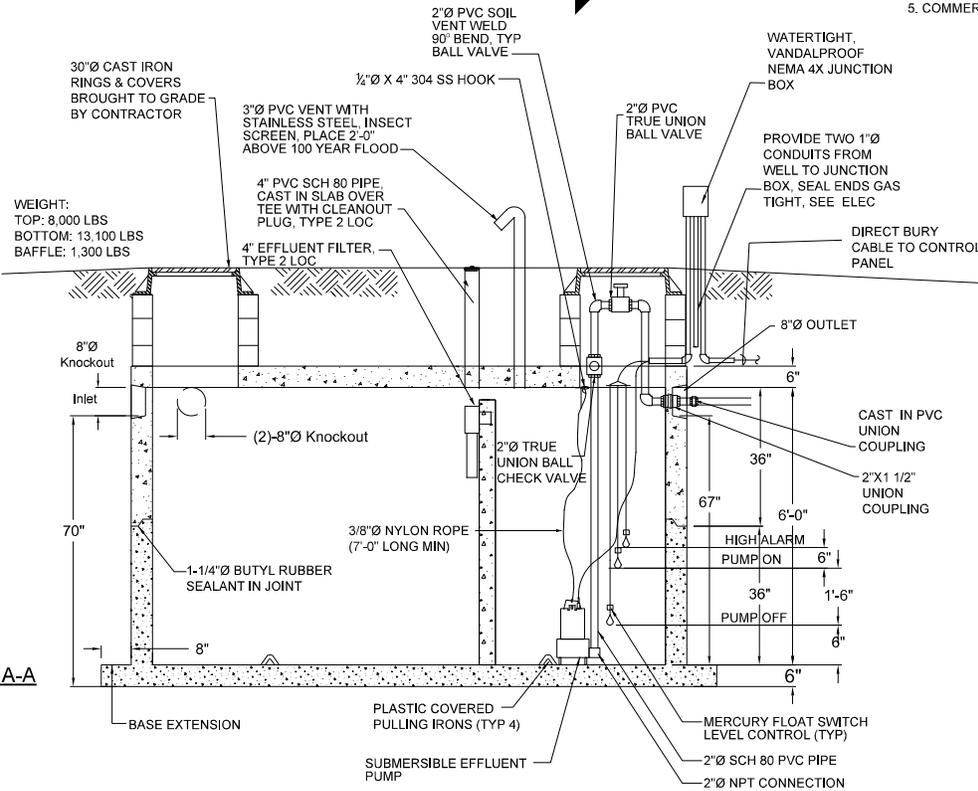
G-3

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2000 GAL
DATE OF MFG

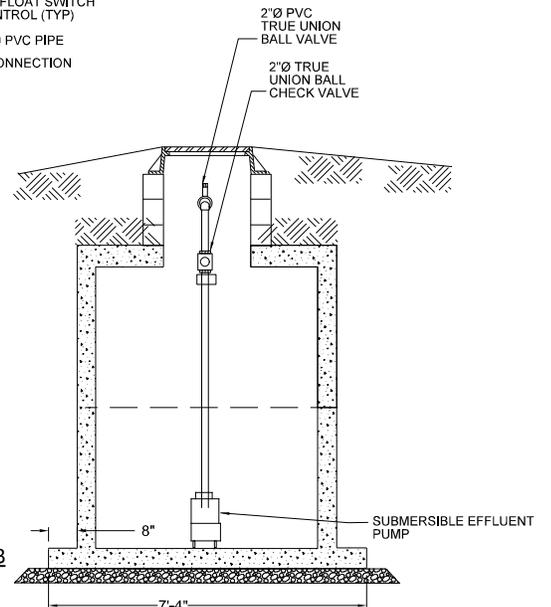


PLAN VIEW

- NOTES:
1. REINFORCEMENT: H-20 BRIDGE LOADING (TRAFFIC RATED)
 2. CONCRETE: 4000 PSI @28 DAYS
 3. EARTHCOVER 0' TO 5' MAX
 4. TANK TO BE SIZED PER DESIGN FLOW
 5. COMMERCIAL TANKS SHALL BE DUPLEX PUMP SYSTEMS.



SECTION A-A



SECTION B-B

EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

LOW PRESSURE SEWER - STEP SYSTEM



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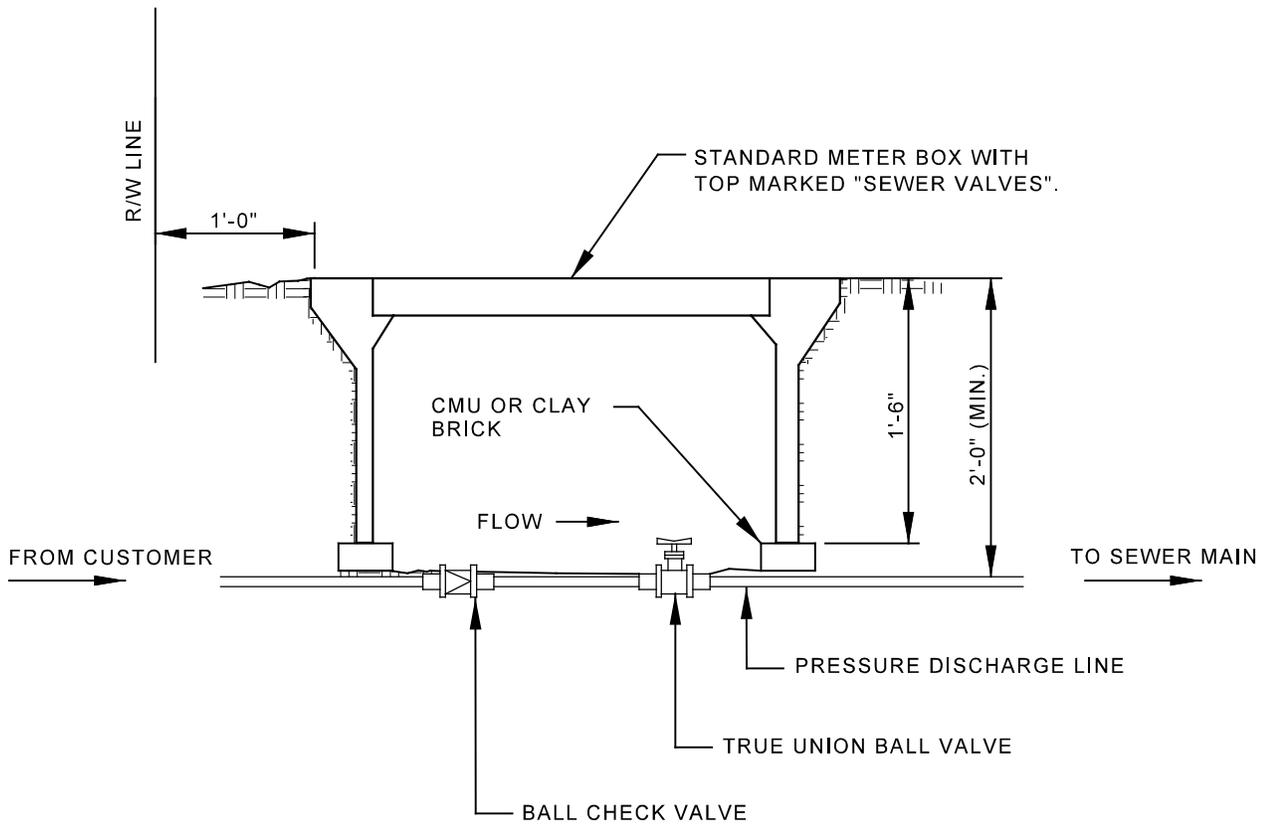
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NOTES:

1. METER BOX FOOTING SHALL NOT REST ON DISCHARGE PIPING. A MINIMUM OF 3 INCHES SHALL BE MAINTAINED BETWEEN BOTTOM OF CMU OR CLAY BRICK AND TOP OF DISCHARGE LINE.
2. BALL VALVE, CHECK VALVE, AND LINE SIZES WILL BE BASED UPON FLOW AND TYPE OF USE (EX. RESIDENTIAL, OR COMMERCIAL) AND SHALL BE APPROVED BY THE COUNTY.
3. LARGER BOX MAY BE NECESSARY FOR LARGER VALVE ASSEMBLIES.

EDGECOMBE COUNTY NORTH CAROLINA

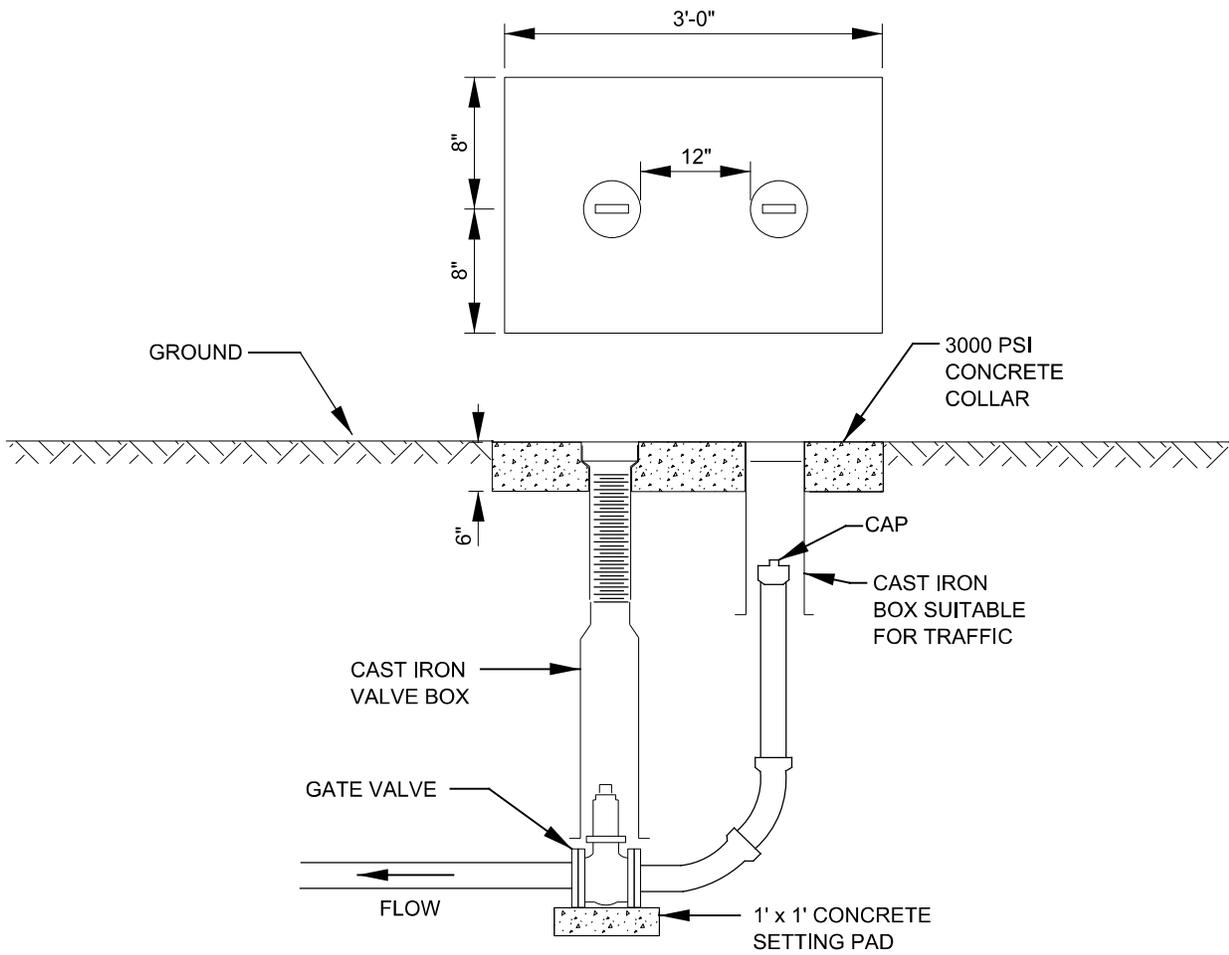
WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

LOW PRESSURE SEWER
SERVICE VALVE ASSEMBLY

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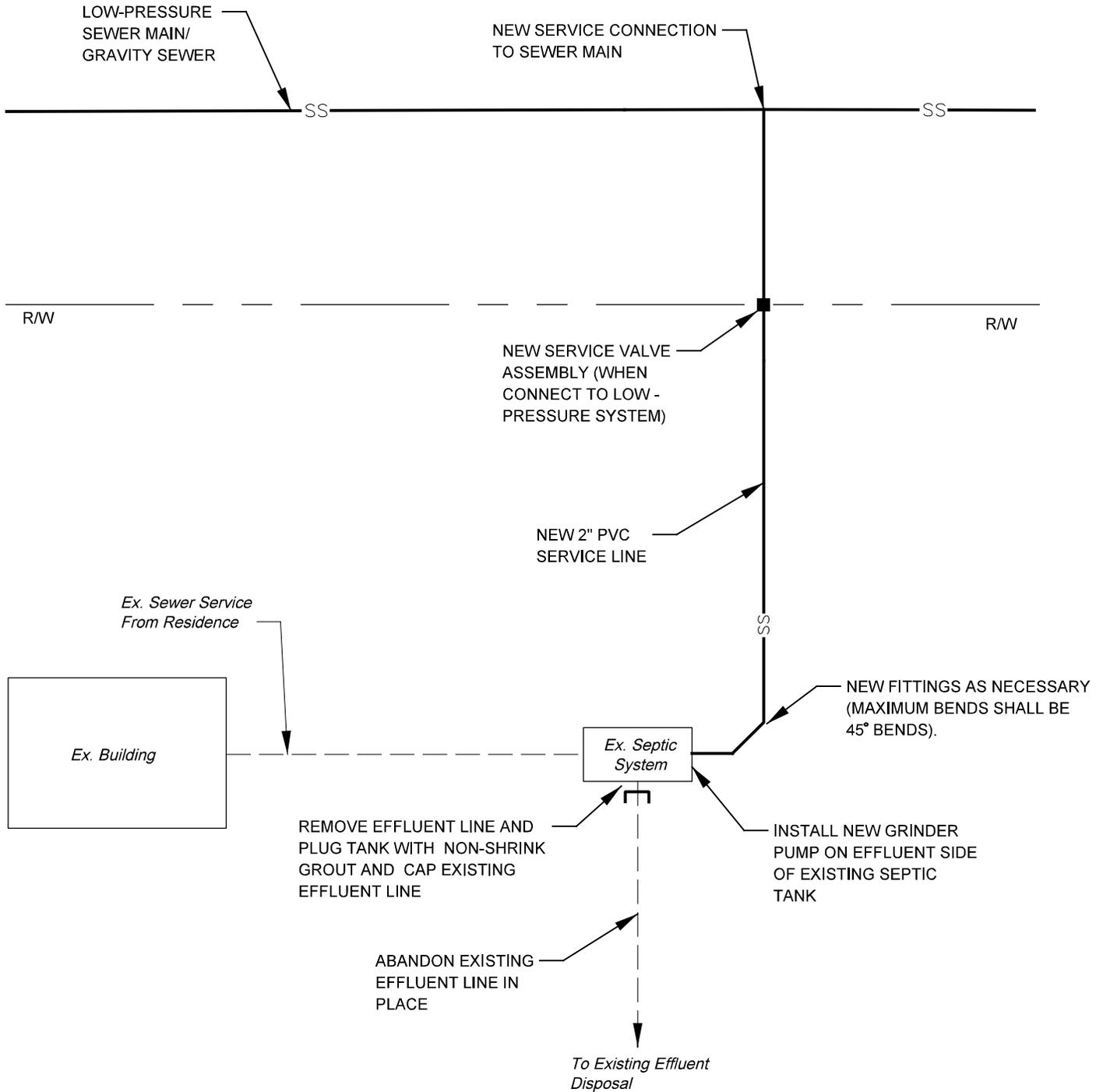
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NOTE:

- 1. WYE CONNECTION & GATE VALVE SHALL BE THE SAME SIZE AS SEWER MAIN.

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WATER AND SEWER STANDARD DETAILS	
LOW PRESSURE SEWER TERMINAL CLEAN-OUT	
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 WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS
 LOW PRESSURE SEWER
 EXISTING SEPTIC TANK CONVERSION

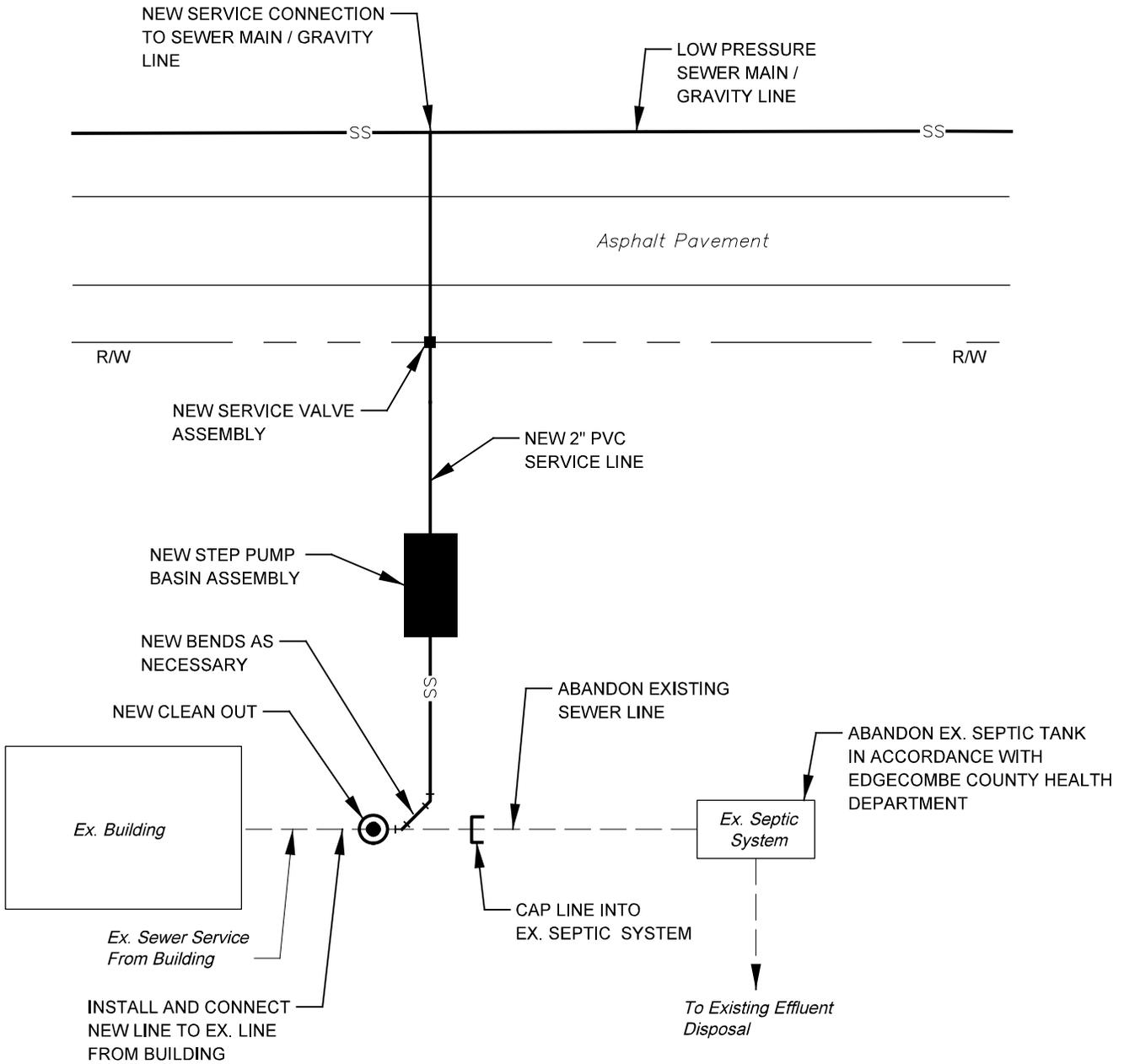


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EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

LOW PRESSURE SEWER
SERVICE LINE TIE-IN



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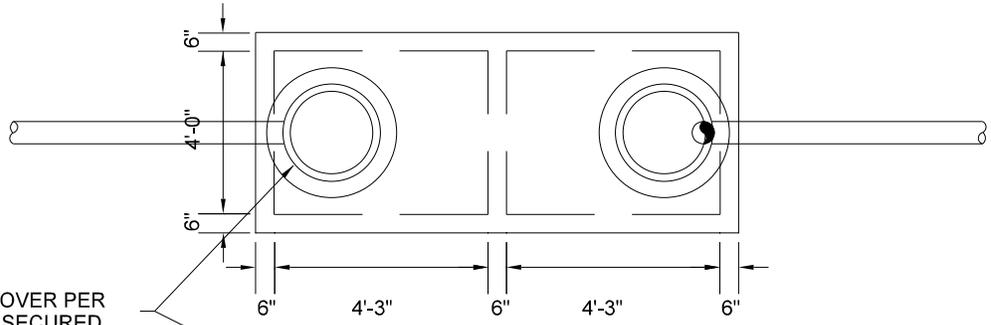
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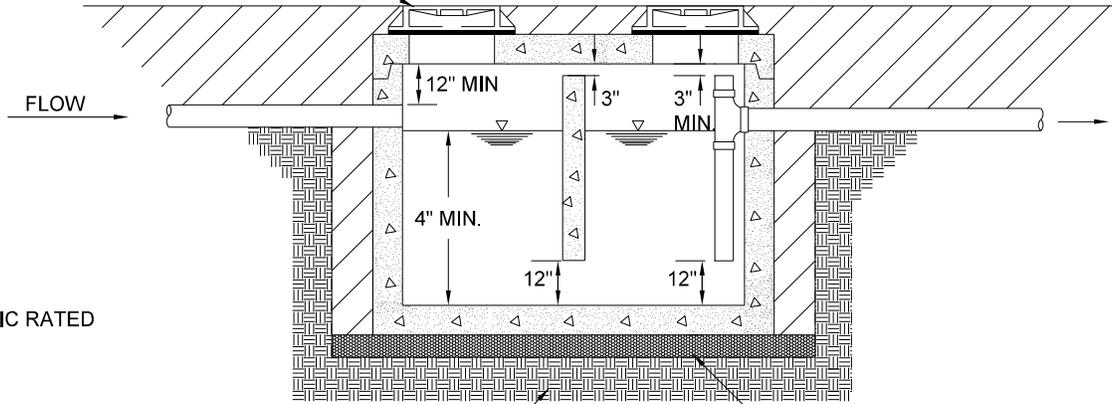
LP-5

PLAN



2 EA. C.I. FRAME & COVER PER
EDGEcombe COUNTY SECURED
WITH MORTAR

ELEVATION



WELL COMPACTED SUBGRADE
(95% MIN. STANDARD PROCTOR)

6" MIN. CLEAN WASHED
STONE BEDDING
(NCDOT #57 OR EQUAL)

NOTE: TO BE TRAFFIC RATED

GENERAL NOTES:

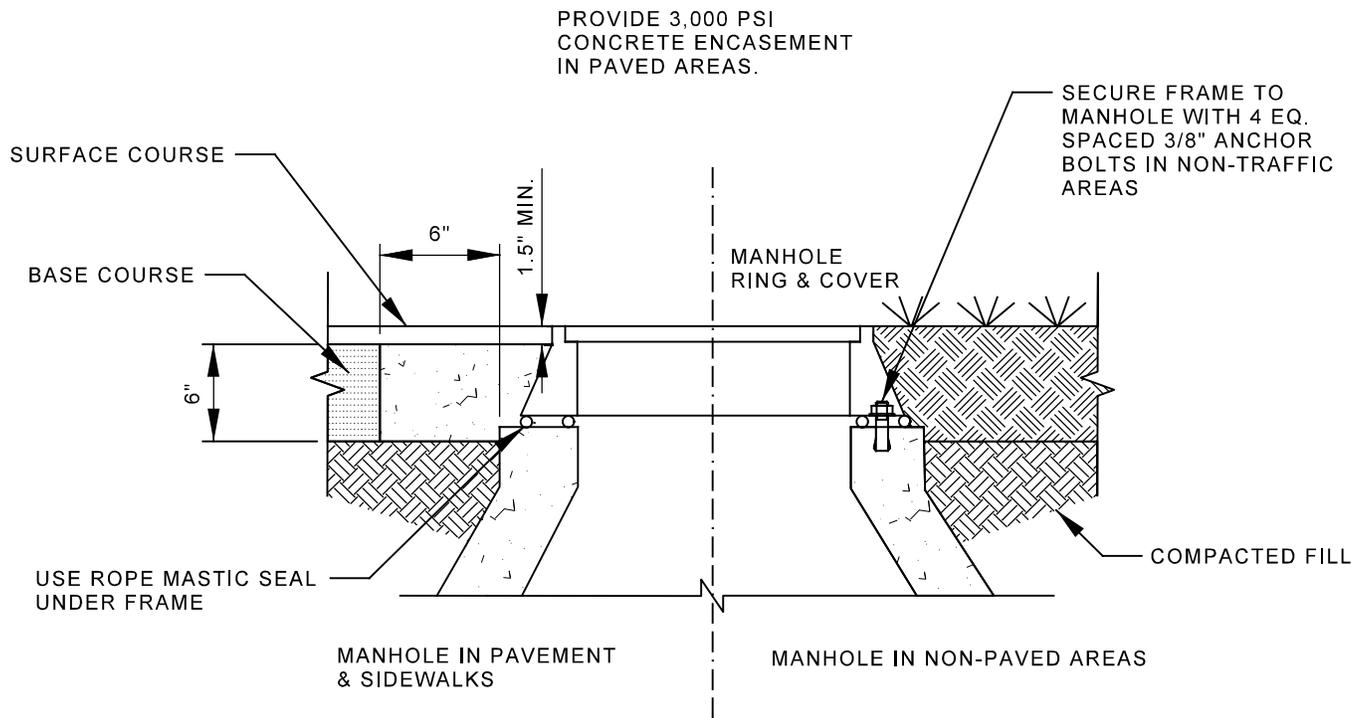
1. REINFORCED CONCRETE SECTIONS SHALL BE MANUFACTURED IN ACCORDANCE WITH ACI 318, LATEST EDITION AND SHALL HAVE 60 KSI MIN. TENSILE STRENGTH REINFORCING STEEL AND 4,000 PSI MIN. COMPRESSIVE STRENGTH CONCRETE.
2. ALL PRECAST CONCRETE MANHOLES SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM C 478, LATEST EDITION.
3. ALL PRECAST CONCRETE VAULTS SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM C 857, LATEST EDITION.
4. ALL MANHOLES, VAULTS, AND CASTINGS EXPOSED TO VEHICULAR TRAFFIC SHALL BE DESIGNED TO WITHSTAND AASHTO H-20 LOADINGS.
5. JOINTS BETWEEN PRECAST CONCRETE SECTIONS SHALL BE SEALED WATERTIGHT USING EITHER O-RING GASKETS CONFORMING TO ASTM C 443 OR BUTYL RESIN CONFORMING WITH AASHTO M 198.
6. A MINIMUM OF SIX (6") INCHES OF CLEAN, WASHED, GRADED STONE MIX SUCH #57 OR #67 SHALL BE PROVIDED FOR SETTING AND LEVELING PRECAST SECTIONS.
7. ALL COMMERCIAL FOOD HANDLING ESTABLISHMENTS SHALL BE REQUIRED TO HAVE AN OIL/GREASE INTERCEPTOR ON SITE. THE INTERCEPTOR SHALL NOT BE PLACED WITHIN PUBLIC RIGHTS OF WAY OR EASEMENTS.
8. THE REQUIRED CAPACITY FOR OIL/GREASE INTERCEPTORS SHALL BE BASED ON TWENTY GALLONS PER RESTAURANT SEAT, BUT SHALL NOT BE LESS THAN A MINIMUM OF FIVE HUNDRED (500) GALLONS. WHERE ON-SITE FOOD PREPARATION OR DISH WASHING OCCUR, A MINIMUM OF ONE THOUSAND (1000) GALLONS OF CAPACITY SHALL BE PROVIDED. ADDITIONAL FLOW AND STORAGE CAPACITY MAY BE REQUIRED WHERE A SUBSTANTIAL PORTION OF THE FOOD PREPARED IS NOT CONSUMED ON SITE (I.E.: "DRIVE-THROUGH," "TAKE-OUT," OR DELIVERY SERVICES.) AND AS REQUIRED PER LOCAL AND STATE REGULATIONS.

EDGEcombe COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS
OIL / GREASE INTERCEPTOR
(1000 GALLON & LARGER CAPACITY)

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EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

MANHOLE FRAME & COVER



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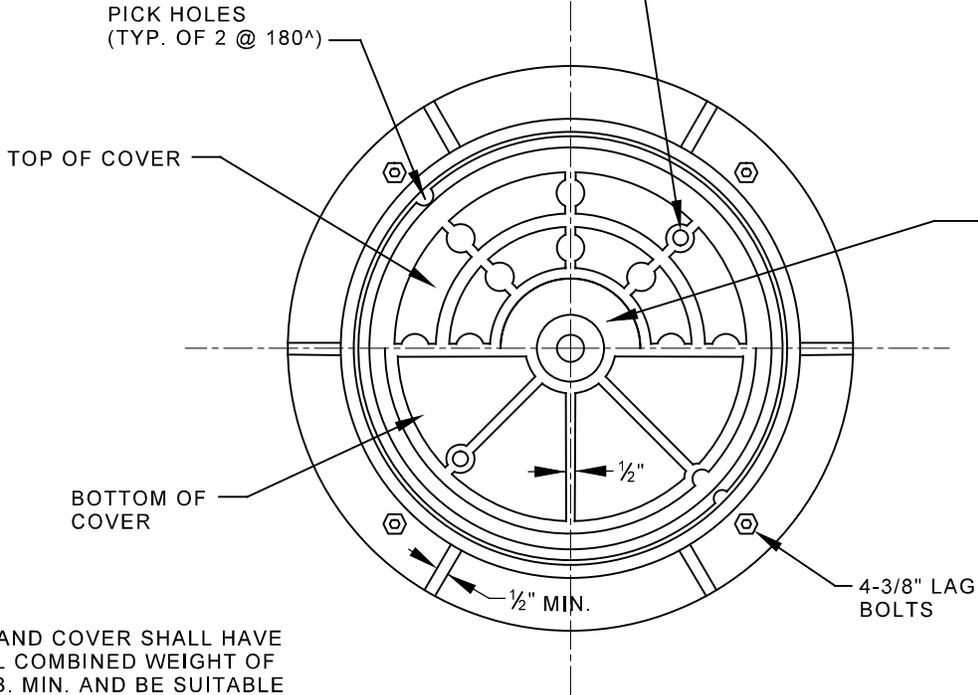
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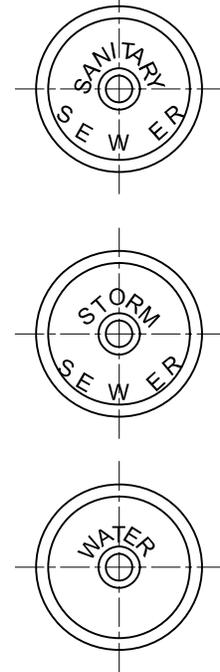
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S-2

2-1" DIA PERFORATIONS REQ'D.
FOR ALL TYPES OF COVERS:
WATER, SANITARY SEWER AND
STORM SEWER. (OMIT FOR
WATERTIGHT MANHOLES)



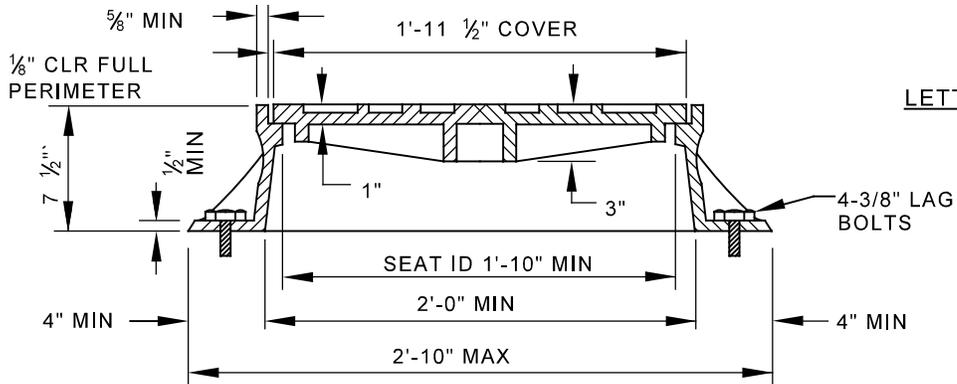
USE TEE FITTING WHERE
PIPE SIZE AND REQ'D DROP
HEIGHT PROHIBIT USE OF
WYE AND 45° BEND



COVER
LETTERING DETAIL

NOTE:

1. RING AND COVER SHALL HAVE TOTAL COMBINED WEIGHT OF 300 LB. MIN. AND BE SUITABLE FOR H-20 LOADING



EDGECOMBE COUNTY NORTH CAROLINA

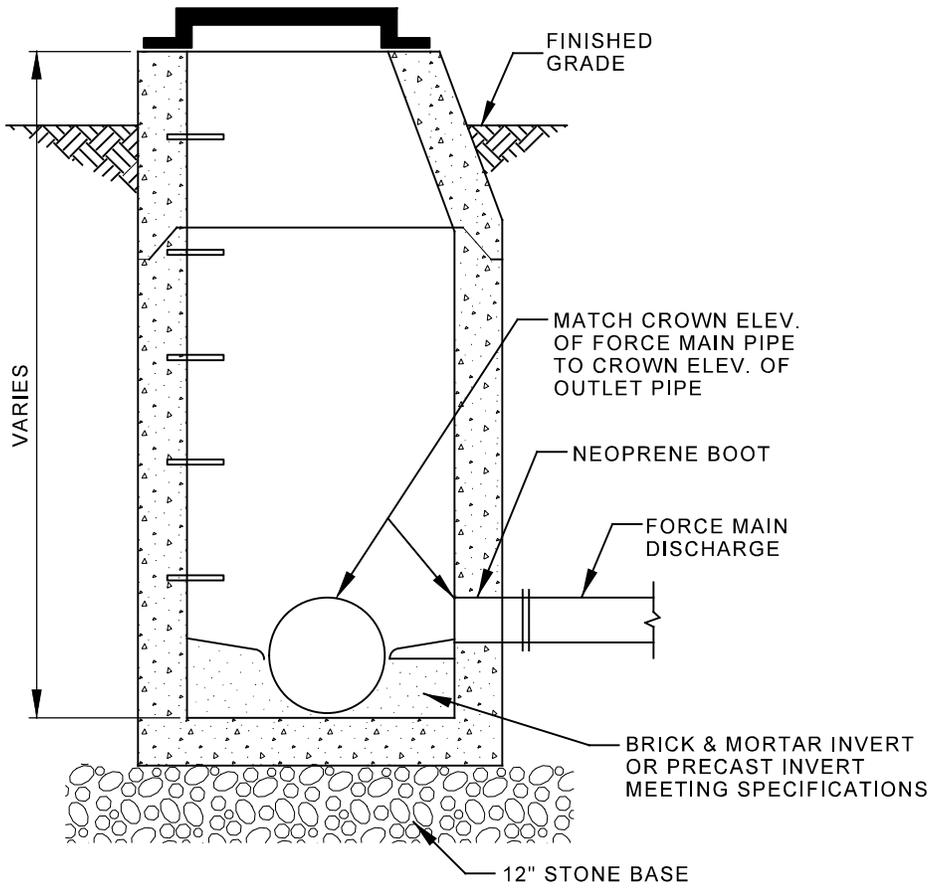
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WATER AND SEWER STANDARD DETAILS

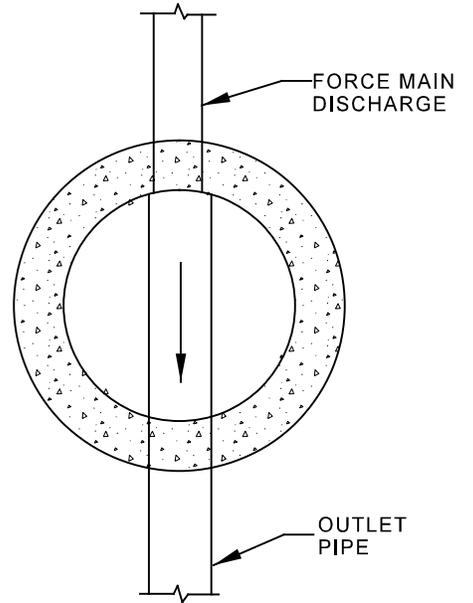
STANDARD MANHOLE RING AND COVER

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SECTION



SECTIONAL PLAN

EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

FORCE MAIN CONNECTION TO MANHOLE



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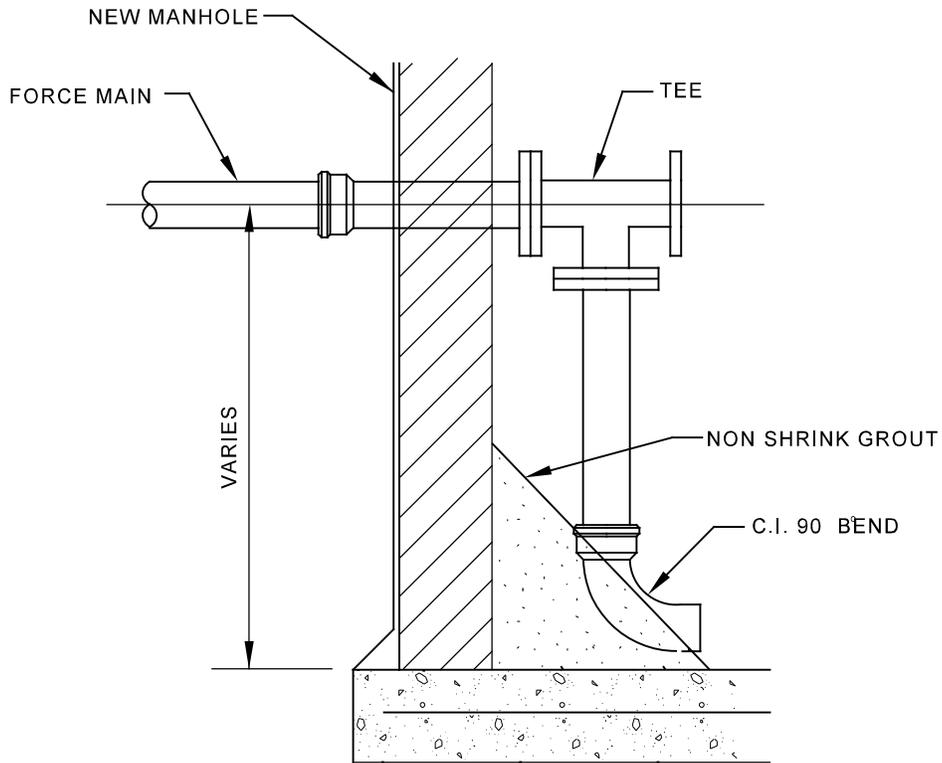
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NOTE:

1. ADD STAINLESS STEEL SUPPORT STRAPS TO DISCHARGE PIPE AS NEEDED.
2. PIPE AND FITTINGS THE SAME SIZE AS THE FORCE MAIN.

EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

FORCE MAIN DISCHARGE



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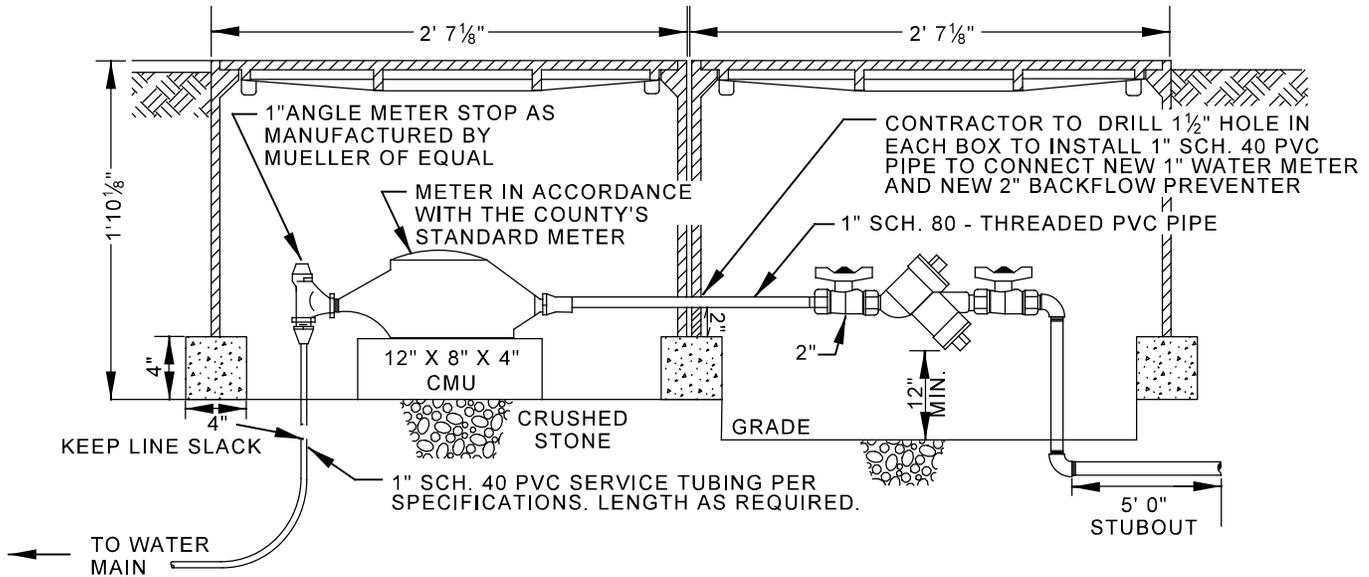
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S-5



NOTES:

1. SERVICES TO BE INSTALLED WITH SERVICE CLAMPS, SERVICE CLAMPS SHALL BE DOUBLE STRAP, HEAVY BRONZE BODY, BRONZE OR STAINLESS STEEL HARDWARE, FULL LENGTH THREADS, AND O-RING GASKET CEMENTED IN PLACE AND CONFINED IN A RETAINING GROOVE.
2. USE TAPPING MACHINE AS RECOMMENDED BY THE MANUFACTURER.
3. CAST IRON BOX SHALL BE DEWEY BROS. INC MBX5A OR EQUAL
4. 2" DOUBLE CHECK BACKFLOW PREVENTER SHALL BE FEBCO MODEL 805Y OR EQUAL.

EDGECOMBE COUNTY NORTH CAROLINA

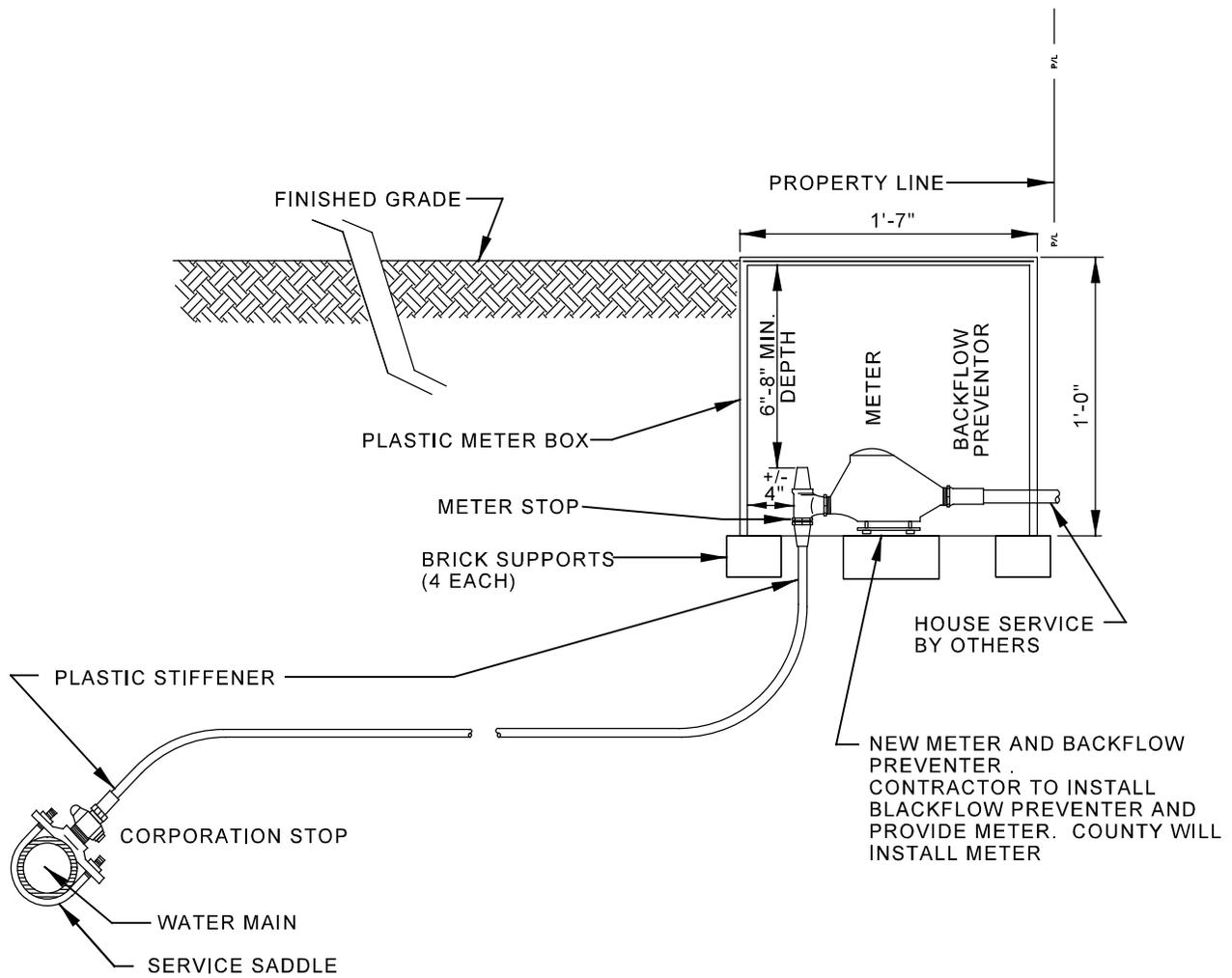
WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

1" WATER SERVICE WITH DOUBLE CHECK BACKFLOW PREVENTER



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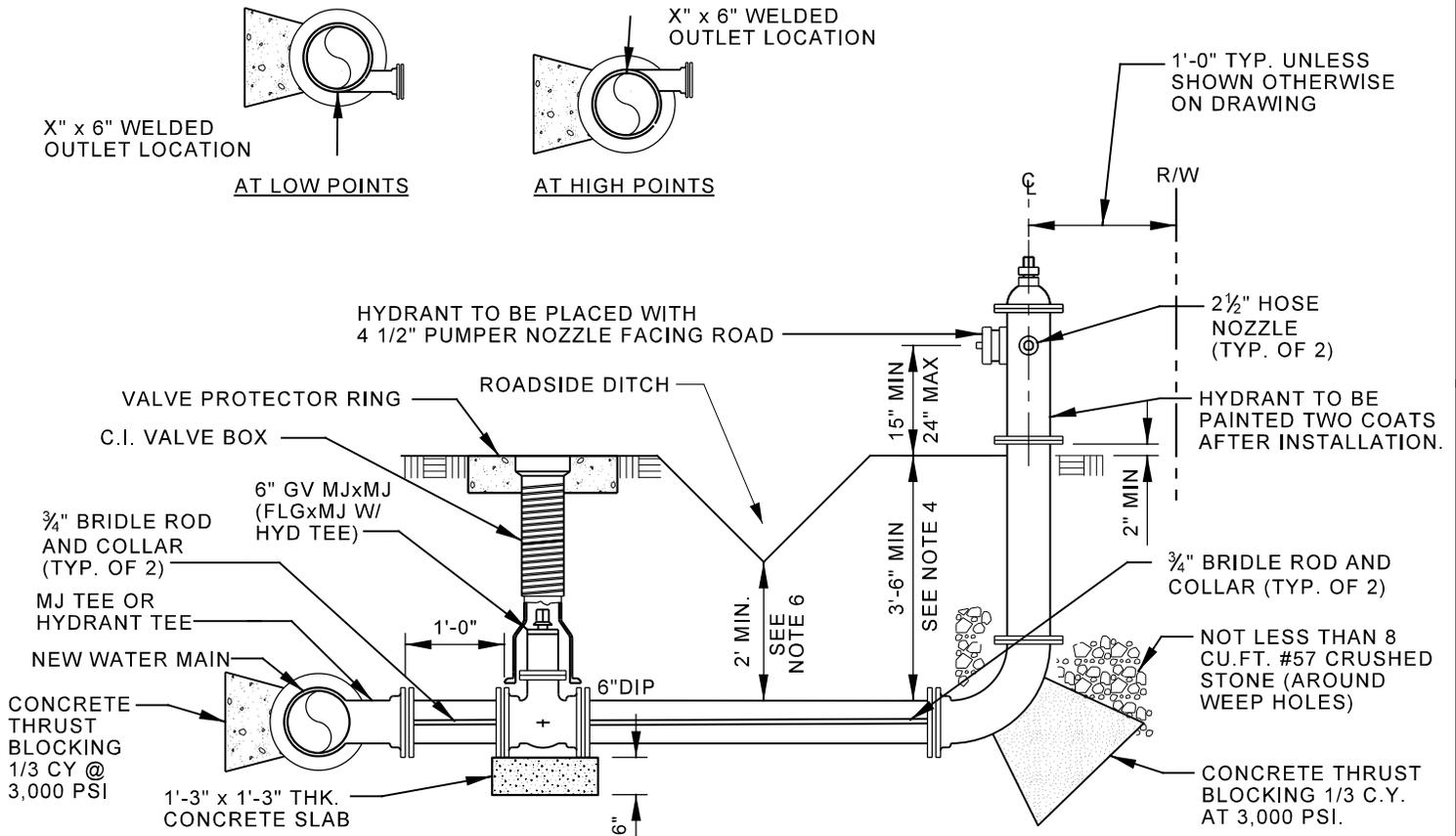
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WATER AND SEWER STANDARD DETAILS

3/4" & 1" WATER SERVICE

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ALTERNATE HYDRANT LEG POSITIONS FOR MAINS LARGER THAN 20":



NOTES:

1. POUR CONCRETE SLAB SO THAT NO FITTING OR FLANGES ARE COVERED. SLAB MAY BE OMITTED IF VALVE IS WELL BEDDED ON 6" MIN. #57 OR #67 STONE.
2. THRUST BLOCKING SHALL BE IN ACCORDANCE WITH STANDARD DETAIL.
3. CONCRETE BLOCKING TO BE 2" FROM HYDRANT WEEP HOLES.
4. HYDRANT STANDPIPE TO BE EXTENDED AS NECESSARY TO SUIT FINAL GROUND ELEVATION.
5. AT LOCATIONS INDICATED ON PLANS FOR MAINS LARGER THAN 20", USE ALTERNATE HYDRANT LEG AS SHOWN ABOVE WITH WELDED OUTLETS IN LIEU OF TEES.
6. 2 FEET MINIMUM SEPARATION FROM BOTTOM OF ROADSIDE DITCH TO TOP OF HYDRANT LEG.

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FIRE HYDRANT ASSEMBLY	

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MUELLER, AMERICAN DARLING ECLIPSE OR APPROVED EQUAL

IF VALVE BOX IS NOT IN PAVED AREA, PROVIDE
A 2'-0" X 2'-0" CONCRETE COLLAR (TYP. OF ALL VALVES)

3/4" BRIDLE RODS
& COLLARS

CONCRETE THRUST
BLOCKING

6"

4" GATE
VALVE W/
VALVE BOX

15" MIN.
20" MAX.

2"

4" DIP PIPE

7.0 CU. FT.
(MIN) CRUSHED
STONE

0.25 CU.
FT. (MIN)
THRUST BLOCK

TEE W/ 4"
BRANCH

4" DIP PIPE

CONCRETE BLOCKING

SEE TYPICAL VALVE BOX
DETAIL FOR BLOCKING
SIZE

VARIES

VARIES

EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

POST HYDRANT ASSEMBLY



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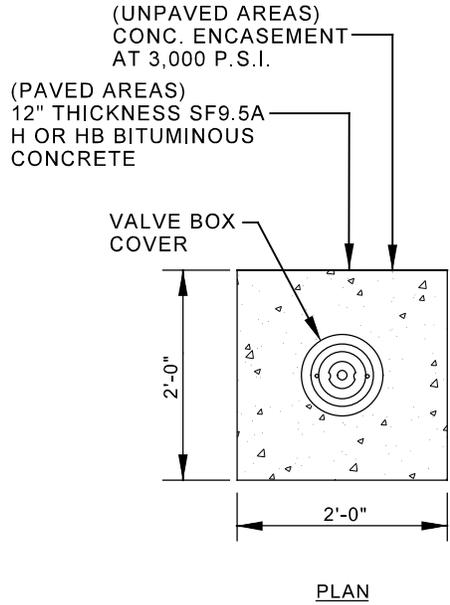
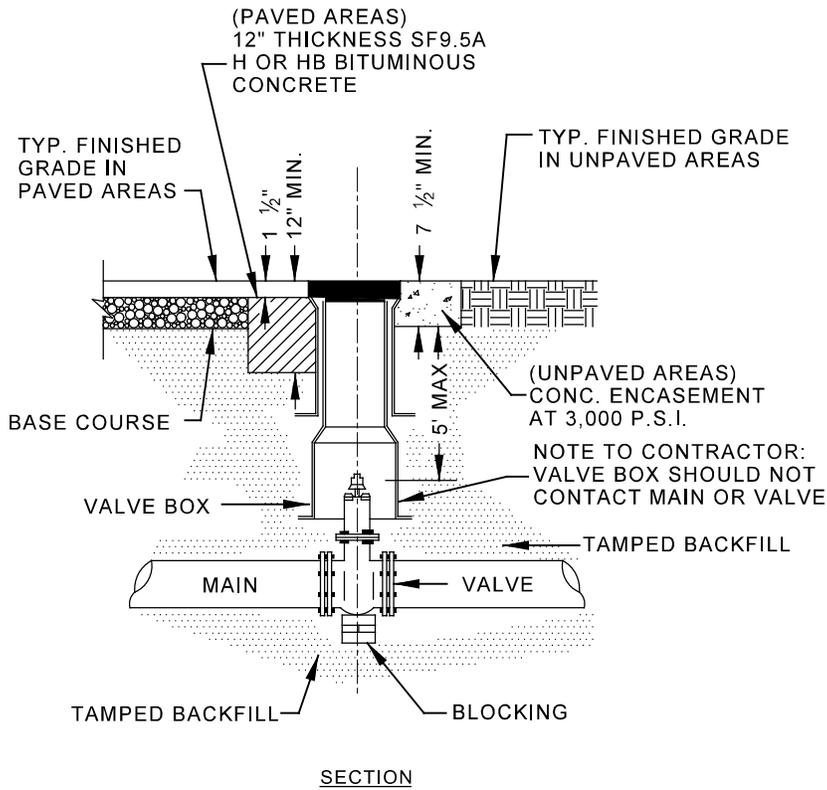
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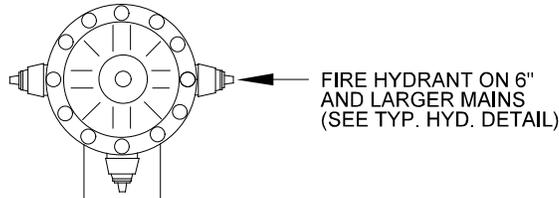


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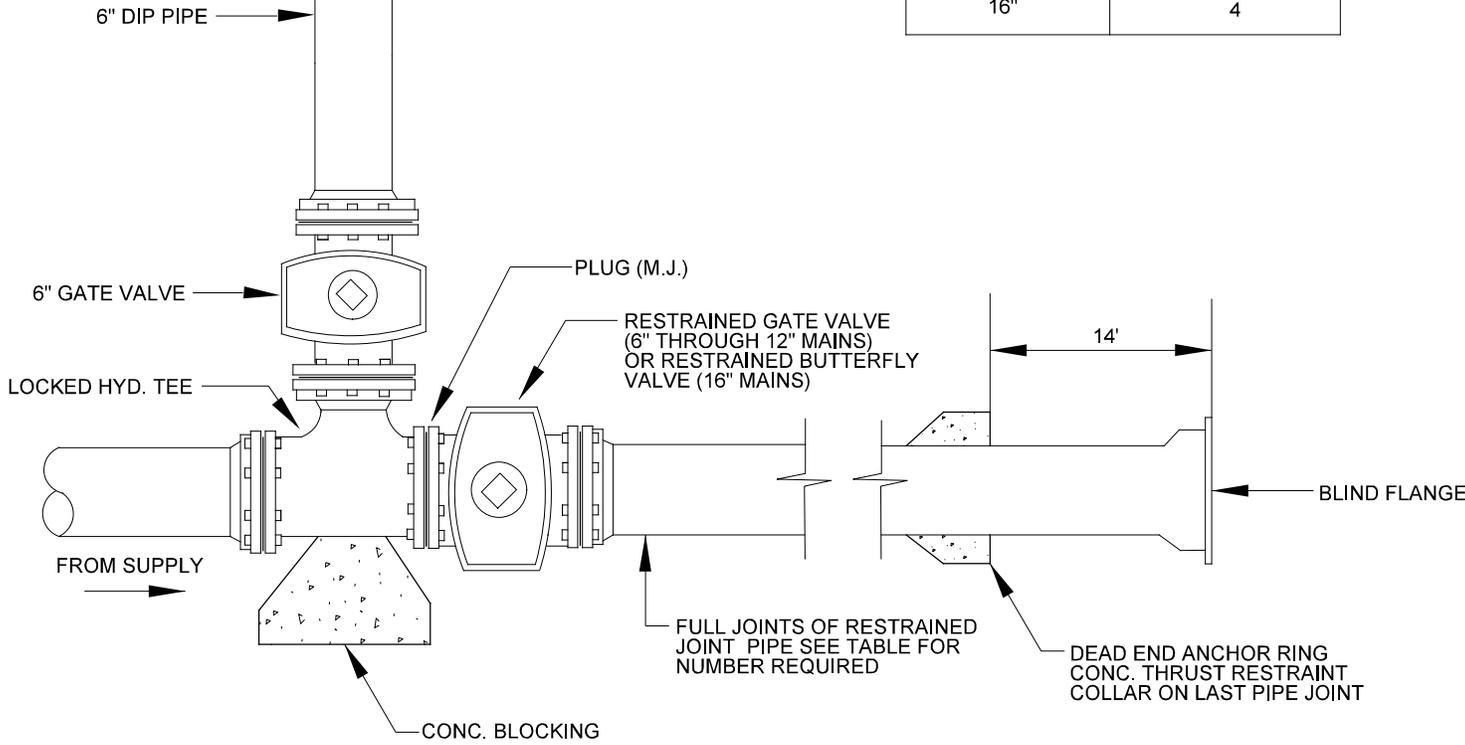
1. D.I.P. MAY BE USED FOR VALVE BOX EXTENSIONS.
2. VALVE OPERATING NUT MUST BE EXTENDED SO THAT THE DEPTH IS NO GREATER THAN 5' FROM THE SURFACE USING A MANUFACTURER APPROVED EXTENSION KIT.
3. PRECAST CONCRETE ENCASEMENT IS ALLOWED OUTSIDE OF PAVED AREAS.

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WATER AND SEWER DEPARTMENT	
WATER AND SEWER STANDARD DETAILS	
STANDARD VALVE BOX INSTALLATION	

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PIPE DIA. (IN.)	MIN. FULL PIPE LENGTHS
6"	2
8"	3
10"	3
12"	3
16"	4

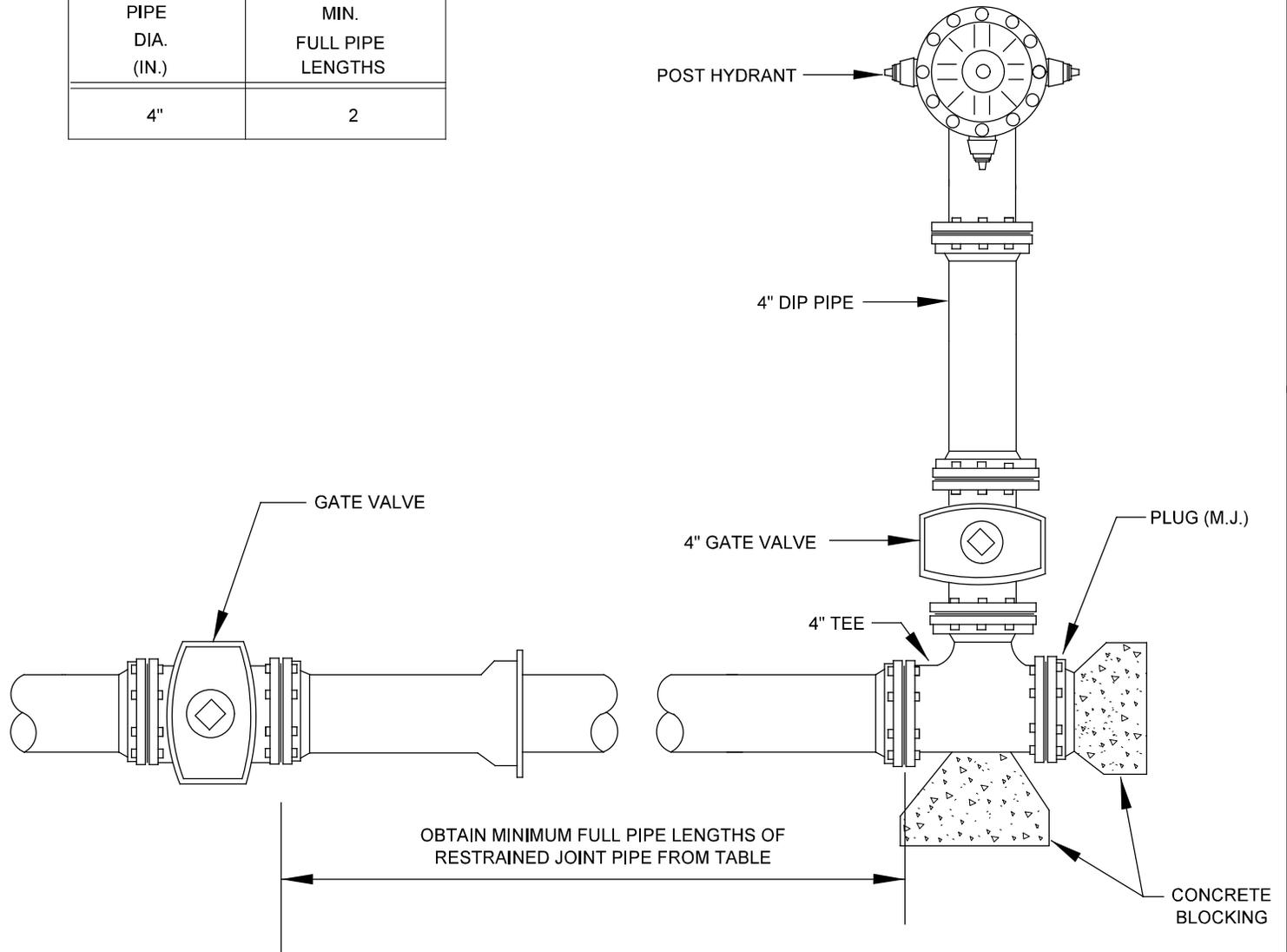


- NOTES:**
1. PLACE CONC. BLOCKING SUCH THAT IT WILL NOT INTERFERE WITH REMOVAL OF BOLTS.
 2. NO SERVICE CAN BE INSTALLED ON THE MAIN BETWEEN THE INLINE GATE VALVE AND THE LOCKED HYDRANT TEE.

EDGECOMBE COUNTY NORTH CAROLINA
 WATER AND SEWER DEPARTMENT
 WATER AND SEWER STANDARD DETAILS
 TERMINATION OF 6" - 12" WATER MAIN

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PIPE DIA. (IN.)	MIN. FULL PIPE LENGTHS
4"	2



NOTES:

1. PLACE CONC. BLOCKING SUCH THAT IT WILL NOT INTERFERE WITH REMOVAL OF BOLTS.
2. NO SERVICE CAN BE INSTALLED ON THE MAIN BETWEEN THE INLINE GATE VALVE AND THE LOCKED HYDRANT TEE.

EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

TERMINATION OF 4" WATER MAIN



THE WOOTEN COMPANY

ENGINEERING | PLANNING | ARCHITECTURE

301 West 14th Street Greenville NC 27834
252.757.1096 fax 252.757.3221
License Number: F-0115

PROJECT NO.:

2488 - FW

SCALE:

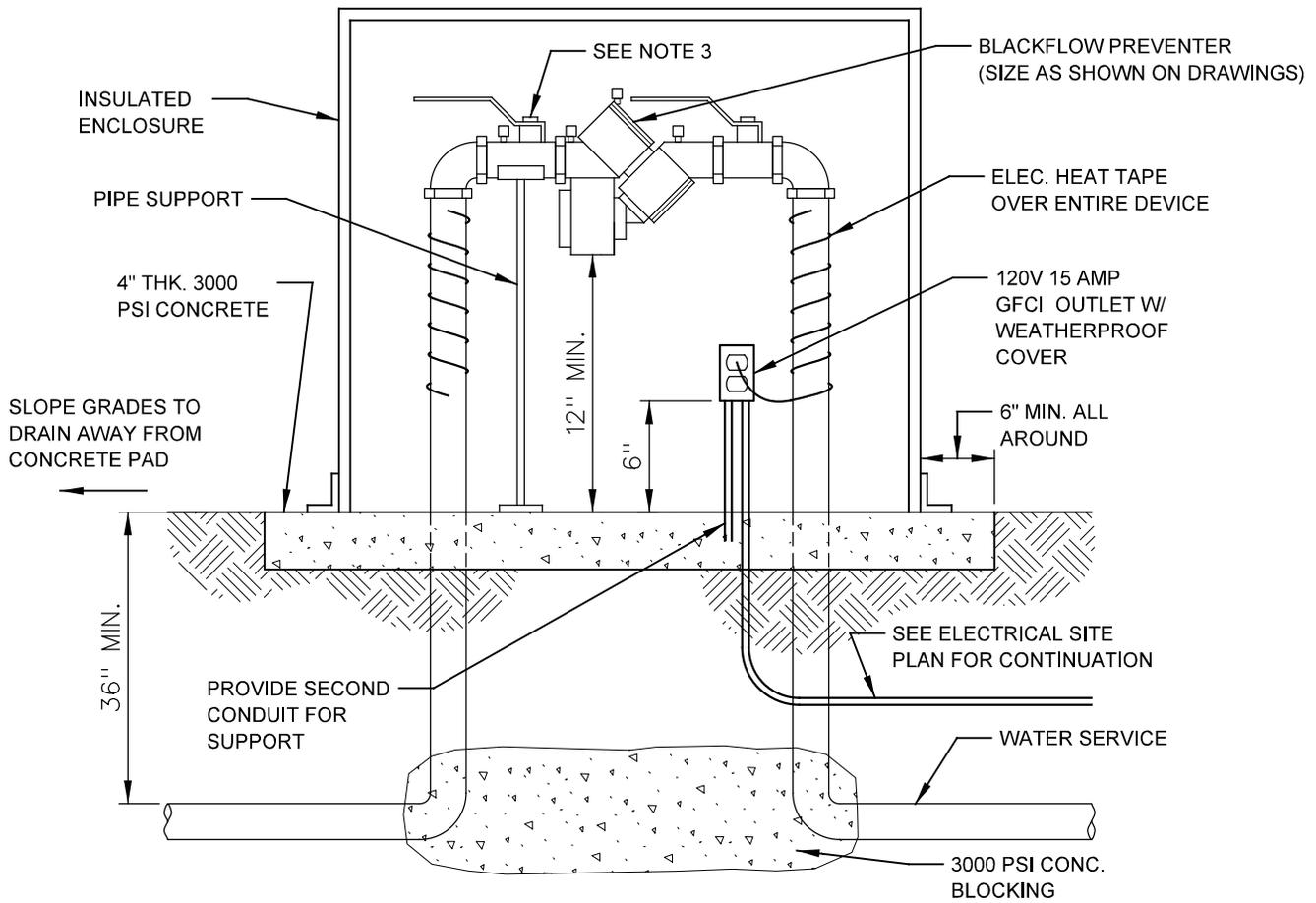
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DRAWING NO.

DATE:

01 / 20 / 2012

W-7



NOTES:

1. FOR PIPE SIZES OF 2" OR LESS, PROVIDE HEAT TAPE AND GFCI AS SHOWN.
2. BACKFLOW PREVENTER FOR BUILDING SERVICES SHALL BE REDUCED PRESSURE ZONE ASSEMBLY, UNLESS OTHERWISE NOTED.
3. FOR PIPE SIZES OF 4" AND LARGER, USE GATE VALVE IN LIEU OF PLUG VALVE.

EDGECOMBE COUNTY NORTH CAROLINA

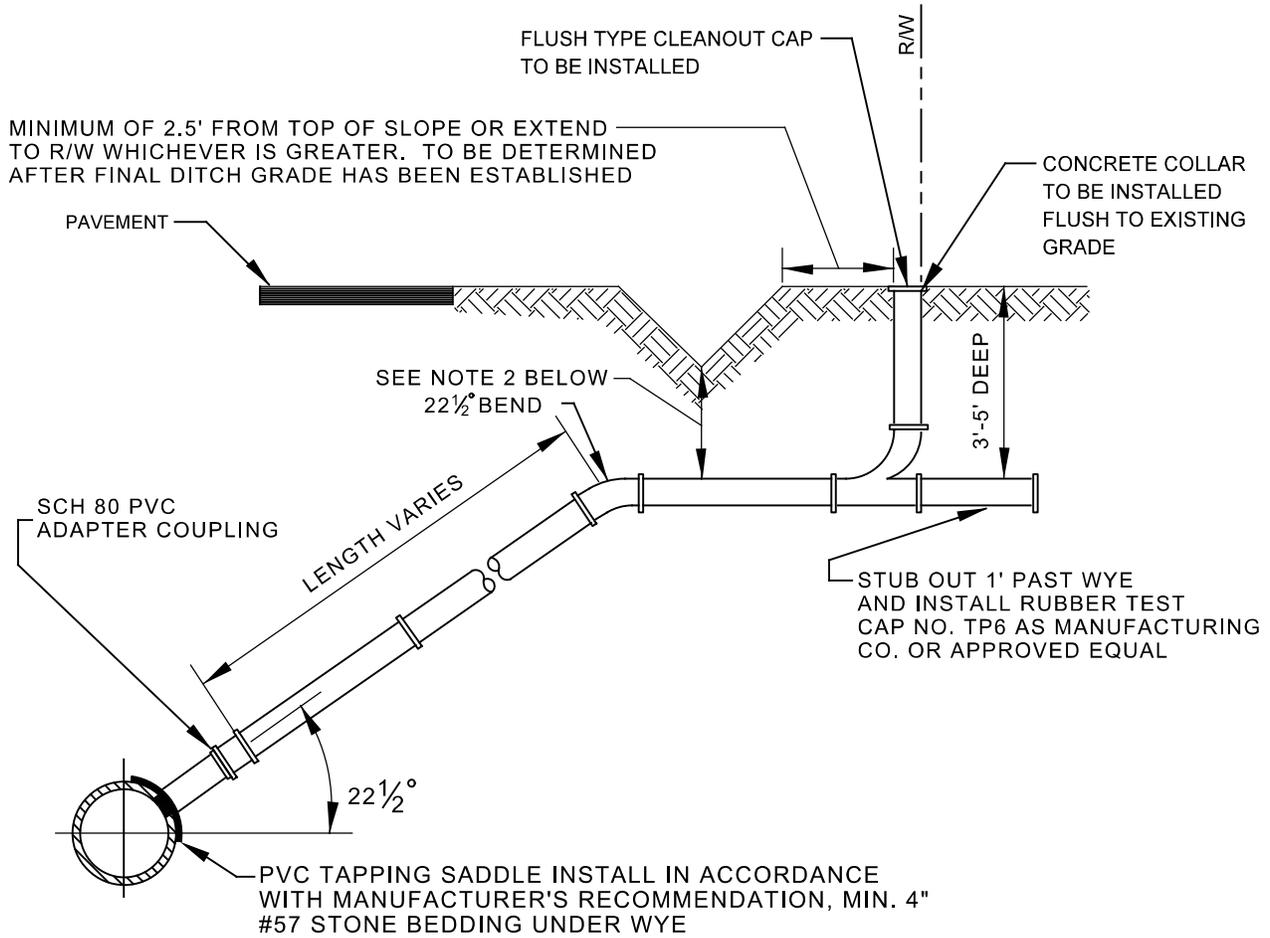
WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

RPZ WITH ABOVE GROUND
HEATED ENCLOSURE



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NOTES:

1. SCH 40 PVC DWV SEWER SERVICE PIPE AT 1% MIN. GRADE (ASTM D-2665, D-1785)
2. MINIMUM OF 2 FEET OF COVER REQUIRED UNDER DITCH
3. 8"x8"x4" WYE TO BE USED FOR SERVICE CONNECTIONS TO NEW SANITARY SEWER MAINS
4. AFTER SUCCESSFULLY TESTING OF SERVICE LINE, CONTRACTOR TO REMOVE STUB OUT CAP AND INSTALL SERVICE PIPE TO EX. DWELLING PLUMBING CONNECTION.

EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

GRAVITY SEWER SERVICE



THE WOOTEN COMPANY

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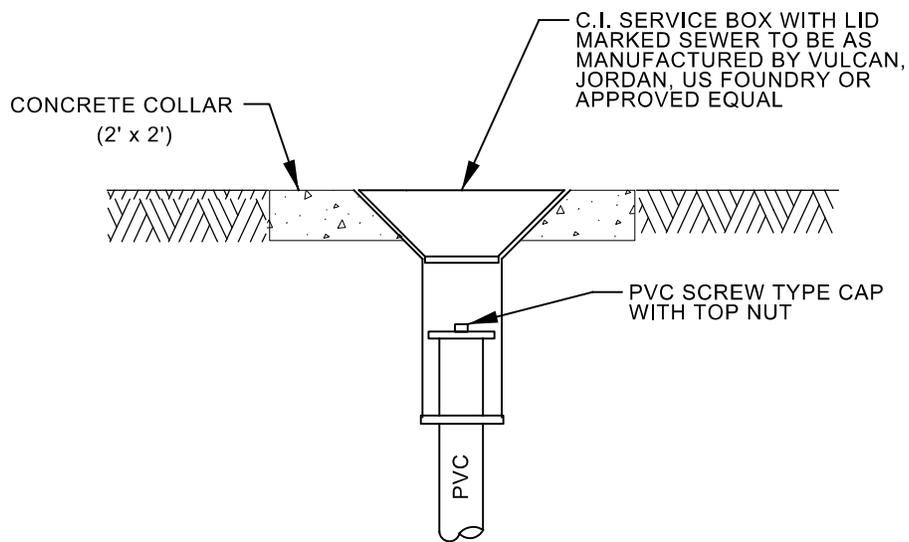
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DATE:

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G - 1



EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

GRAVITY SEWER - CLEAN-OUT



THE WOOTEN COMPANY

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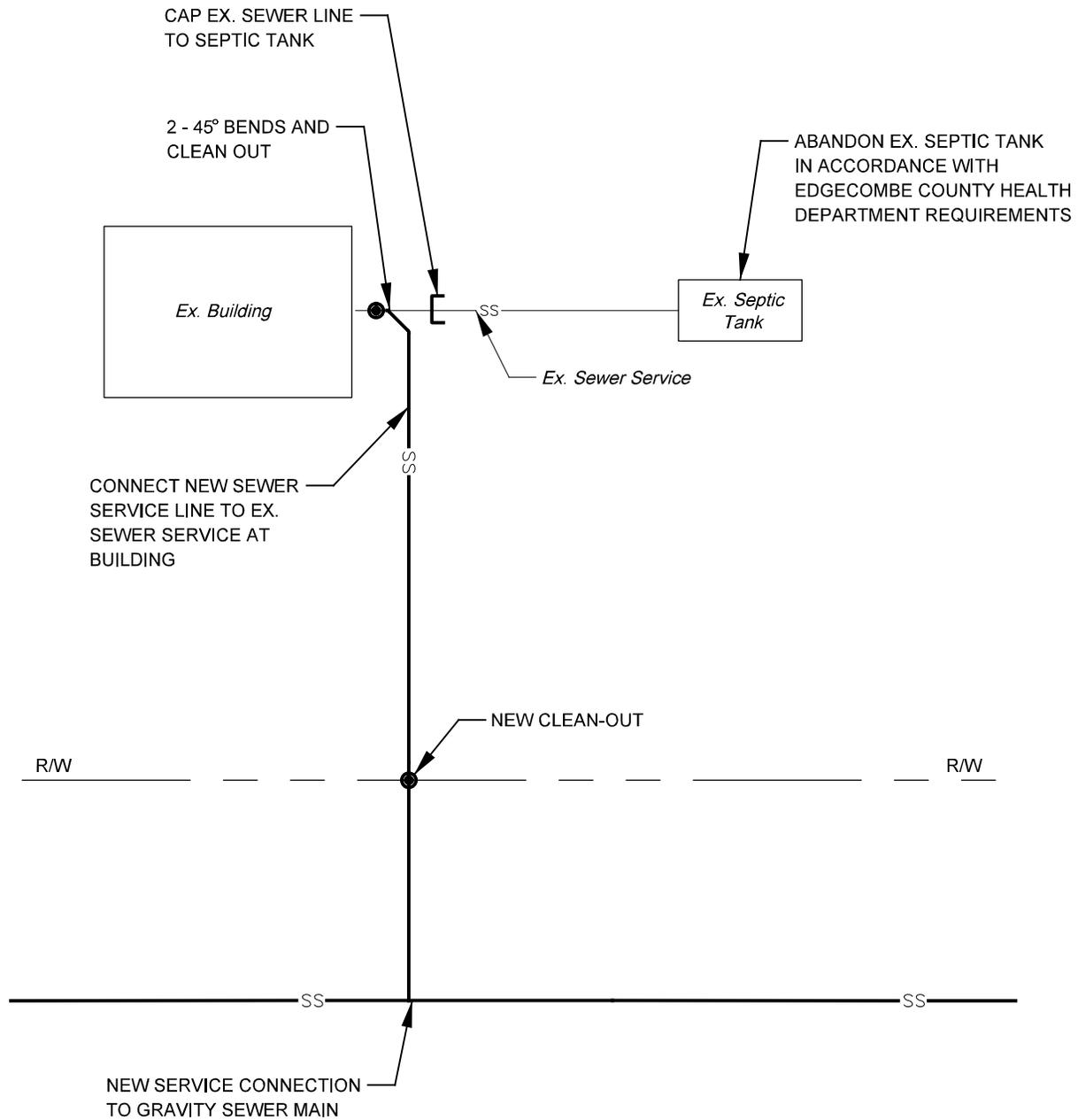
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NO.

DATE:

01 / 20 / 2012

G-2



EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS
GRAVITY SEWER - CONNECTION



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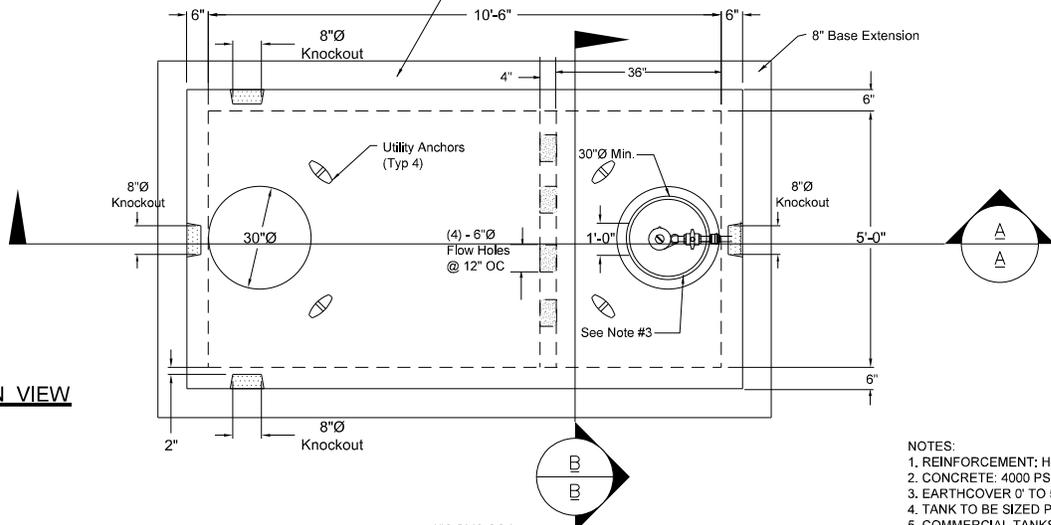
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DATE:
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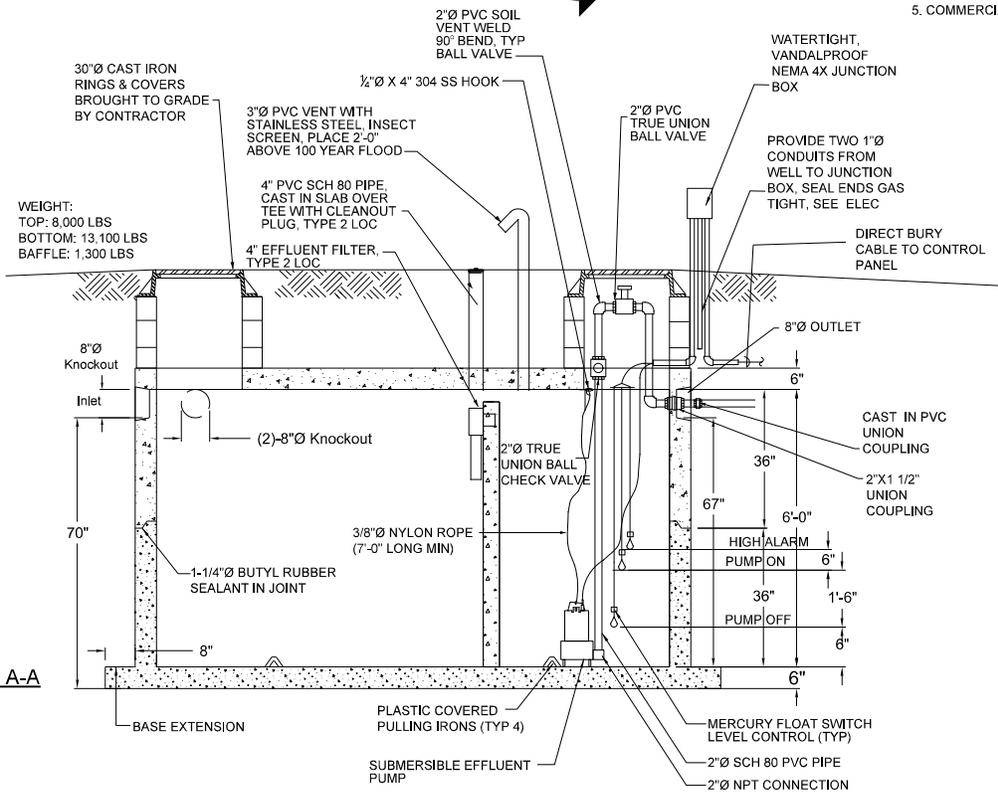
G-3

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SRPC PT-919
2000 GAL
DATE OF MFG

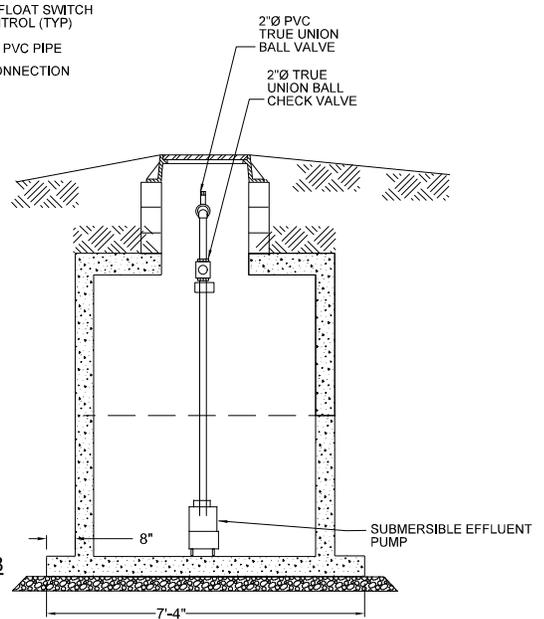


PLAN VIEW

- NOTES:
1. REINFORCEMENT: H-20 BRIDGE LOADING (TRAFFIC RATED)
 2. CONCRETE: 4000 PSI @28 DAYS
 3. EARTHCOVER 0' TO 5' MAX
 4. TANK TO BE SIZED PER DESIGN FLOW
 5. COMMERCIAL TANKS SHALL BE DUPLEX PUMP SYSTEMS.



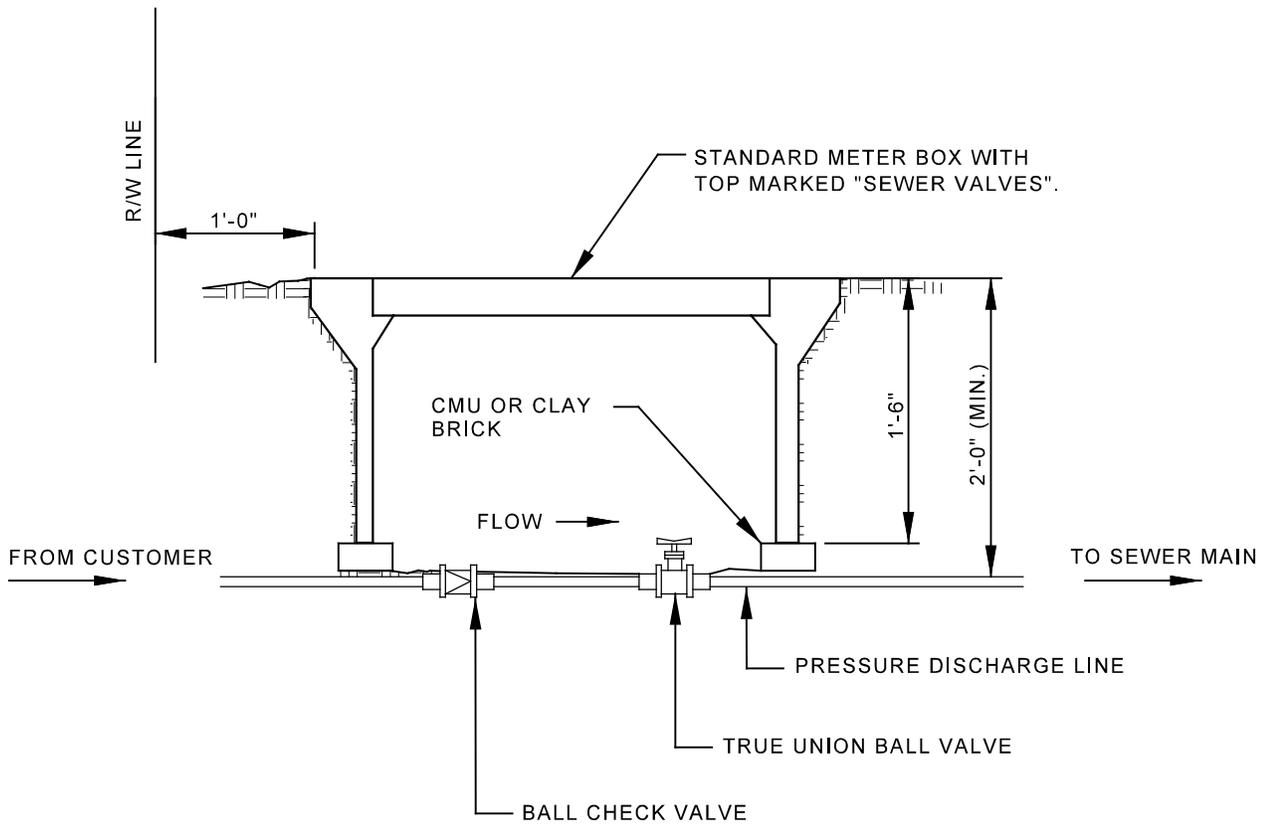
SECTION A-A



SECTION B-B

EDGECOMBE COUNTY NORTH CAROLINA
WATER AND SEWER DEPARTMENT
WATER AND SEWER STANDARD DETAILS
LOW PRESSURE SEWER - STEP SYSTEM

PROJECT NO.: 2488 - FW
SCALE: NOT TO SCALE
DRAWING NO. LP-1
DATE: 01 / 20 / 2012



NOTES:

1. METER BOX FOOTING SHALL NOT REST ON DISCHARGE PIPING. A MINIMUM OF 3 INCHES SHALL BE MAINTAINED BETWEEN BOTTOM OF CMU OR CLAY BRICK AND TOP OF DISCHARGE LINE.
2. BALL VALVE, CHECK VALVE, AND LINE SIZES WILL BE BASED UPON FLOW AND TYPE OF USE (EX. RESIDENTIAL, OR COMMERCIAL) AND SHALL BE APPROVED BY THE COUNTY.
3. LARGER BOX MAY BE NECESSARY FOR LARGER VALVE ASSEMBLIES.

EDGECOMBE COUNTY NORTH CAROLINA

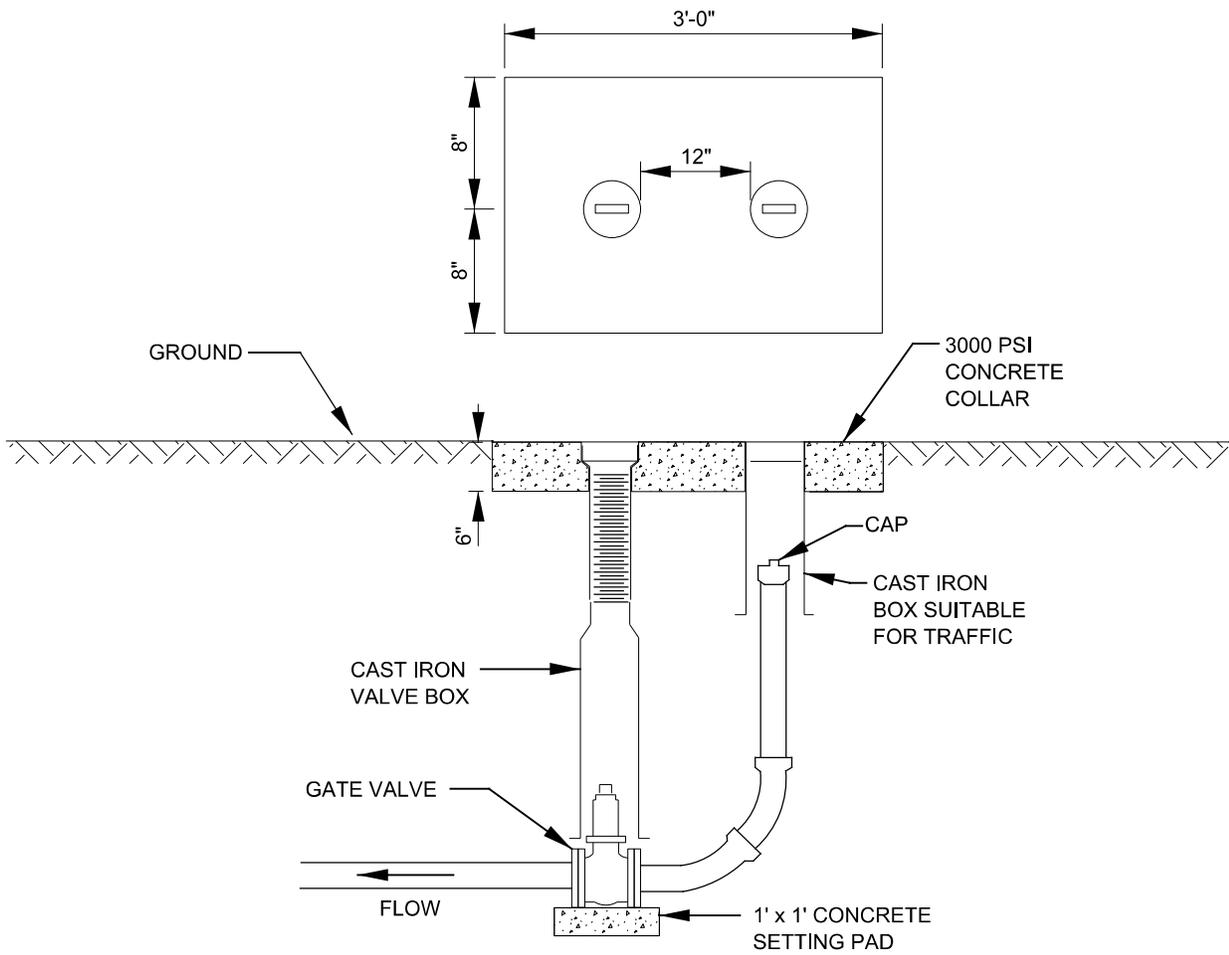
WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

LOW PRESSURE SEWER
SERVICE VALVE ASSEMBLY



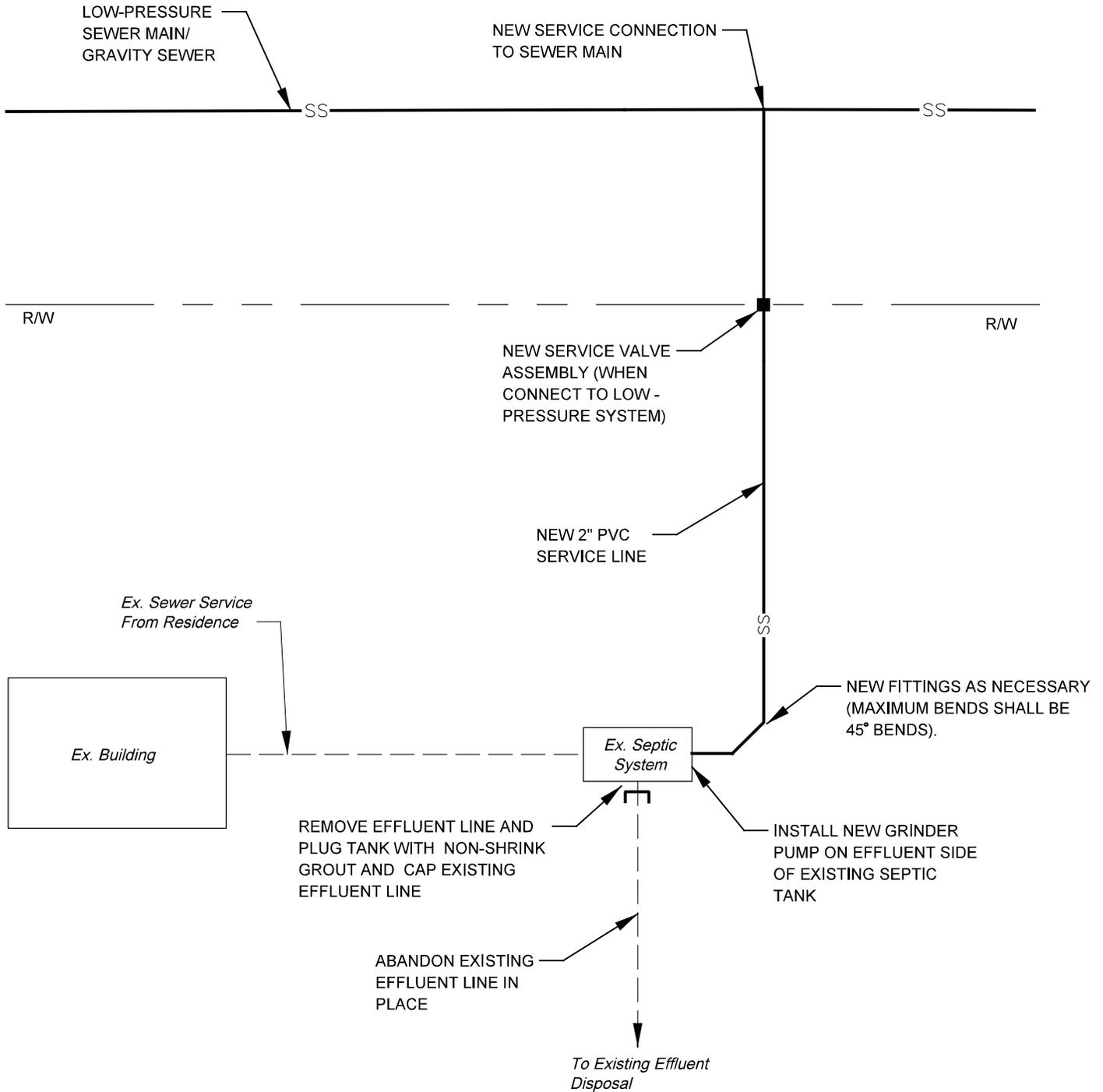
PROJECT NO.:		2488 - FW
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NOTE:

- 1. WYE CONNECTION & GATE VALVE SHALL BE THE SAME SIZE AS SEWER MAIN.

EDGECOMBE COUNTY NORTH CAROLINA	
WATER AND SEWER DEPARTMENT	
WATER AND SEWER STANDARD DETAILS	
LOW PRESSURE SEWER TERMINAL CLEAN-OUT	
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	2488 - FW
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	DRAWING NO.
DATE:	LP-3
01 / 20 / 2012	



EDGECOMBE COUNTY NORTH CAROLINA
 WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS
 LOW PRESSURE SEWER
 EXISTING SEPTIC TANK CONVERSION

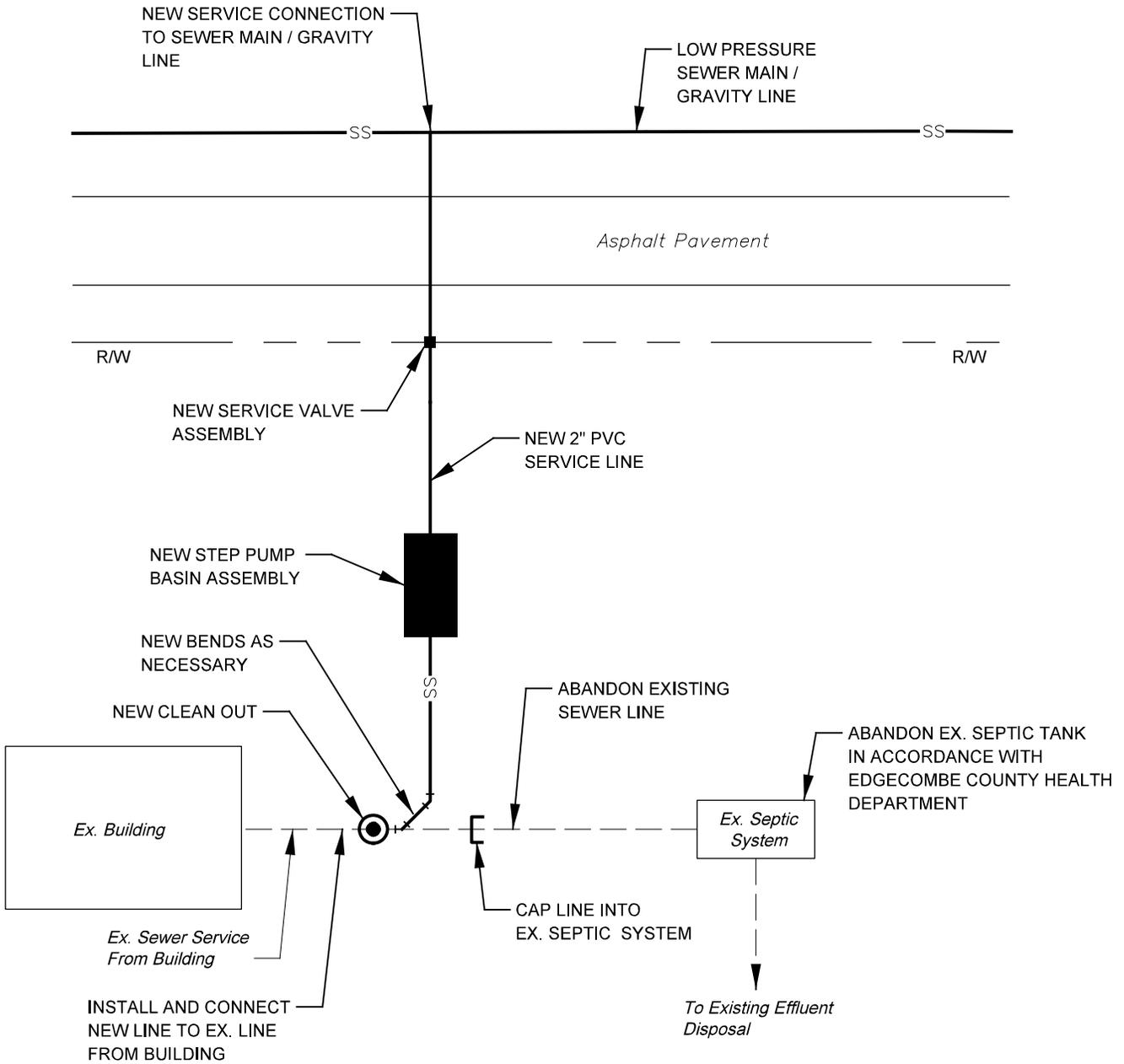


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DATE:
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DRAWING NO.
LP-4



EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

LOW PRESSURE SEWER
SERVICE LINE TIE-IN



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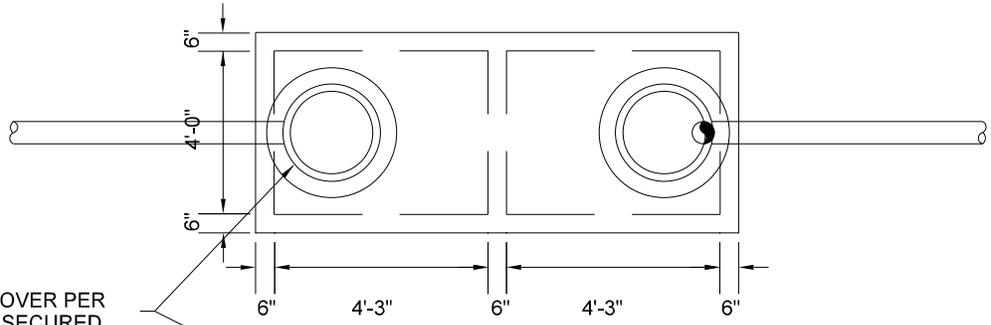
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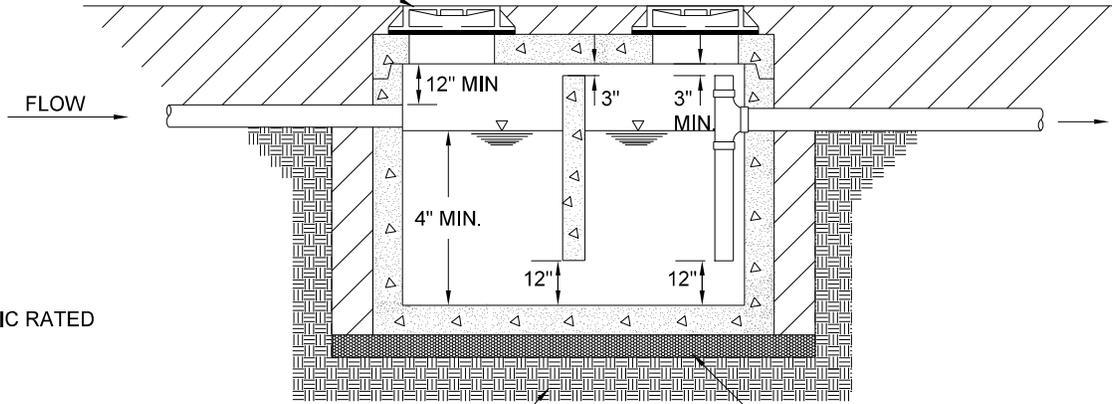
LP-5

PLAN



2 EA. C.I. FRAME & COVER PER
EDGECOMBE COUNTY SECURED
WITH MORTAR

ELEVATION



WELL COMPACTED SUBGRADE
(95% MIN. STANDARD PROCTOR)

6" MIN. CLEAN WASHED
STONE BEDDING
(NCDOT #57 OR EQUAL)

NOTE: TO BE TRAFFIC RATED

GENERAL NOTES:

1. REINFORCED CONCRETE SECTIONS SHALL BE MANUFACTURED IN ACCORDANCE WITH ACI 318, LATEST EDITION AND SHALL HAVE 60 KSI MIN. TENSILE STRENGTH REINFORCING STEEL AND 4,000 PSI MIN. COMPRESSIVE STRENGTH CONCRETE.
2. ALL PRECAST CONCRETE MANHOLES SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM C 478, LATEST EDITION.
3. ALL PRECAST CONCRETE VAULTS SHALL BE MANUFACTURED IN ACCORDANCE WITH ASTM C 857, LATEST EDITION.
4. ALL MANHOLES, VAULTS, AND CASTINGS EXPOSED TO VEHICULAR TRAFFIC SHALL BE DESIGNED TO WITHSTAND AASHTO H-20 LOADINGS.
5. JOINTS BETWEEN PRECAST CONCRETE SECTIONS SHALL BE SEALED WATERTIGHT USING EITHER O-RING GASKETS CONFORMING TO ASTM C 443 OR BUTYL RESIN CONFORMING WITH AASHTO M 198.
6. A MINIMUM OF SIX (6") INCHES OF CLEAN, WASHED, GRADED STONE MIX SUCH #57 OR #67 SHALL BE PROVIDED FOR SETTING AND LEVELING PRECAST SECTIONS.
7. ALL COMMERCIAL FOOD HANDLING ESTABLISHMENTS SHALL BE REQUIRED TO HAVE AN OIL/GREASE INTERCEPTOR ON SITE. THE INTERCEPTOR SHALL NOT BE PLACED WITHIN PUBLIC RIGHTS OF WAY OR EASEMENTS.
8. THE REQUIRED CAPACITY FOR OIL/GREASE INTERCEPTORS SHALL BE BASED ON TWENTY GALLONS PER RESTAURANT SEAT, BUT SHALL NOT BE LESS THAN A MINIMUM OF FIVE HUNDRED (500) GALLONS. WHERE ON-SITE FOOD PREPARATION OR DISH WASHING OCCUR, A MINIMUM OF ONE THOUSAND (1000) GALLONS OF CAPACITY SHALL BE PROVIDED. ADDITIONAL FLOW AND STORAGE CAPACITY MAY BE REQUIRED WHERE A SUBSTANTIAL PORTION OF THE FOOD PREPARED IS NOT CONSUMED ON SITE (I.E.: "DRIVE-THROUGH," "TAKE-OUT," OR DELIVERY SERVICES.) AND AS REQUIRED PER LOCAL AND STATE REGULATIONS.

EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

OIL / GREASE INTERCEPTOR
(1000 GALLON & LARGER CAPACITY)

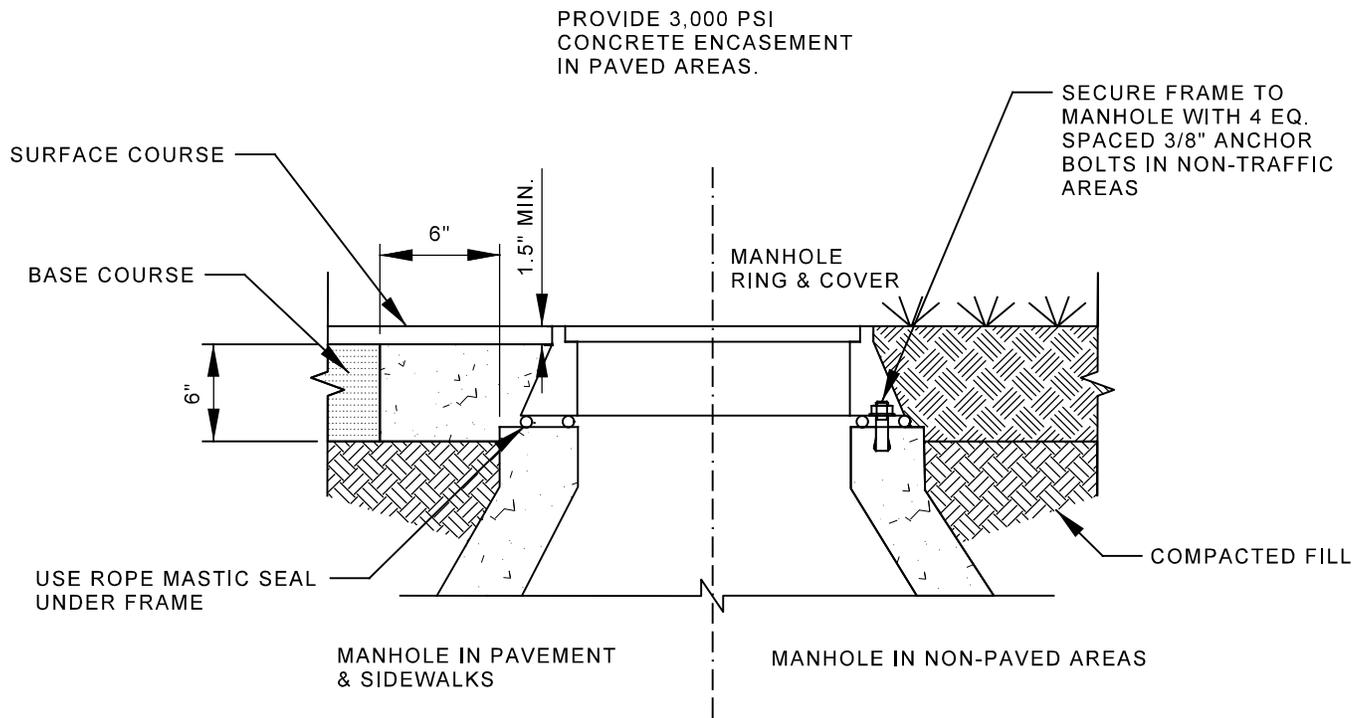
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EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

MANHOLE FRAME & COVER



THE WOOTEN COMPANY

ENGINEERING | PLANNING | ARCHITECTURE

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PROJECT NO.:

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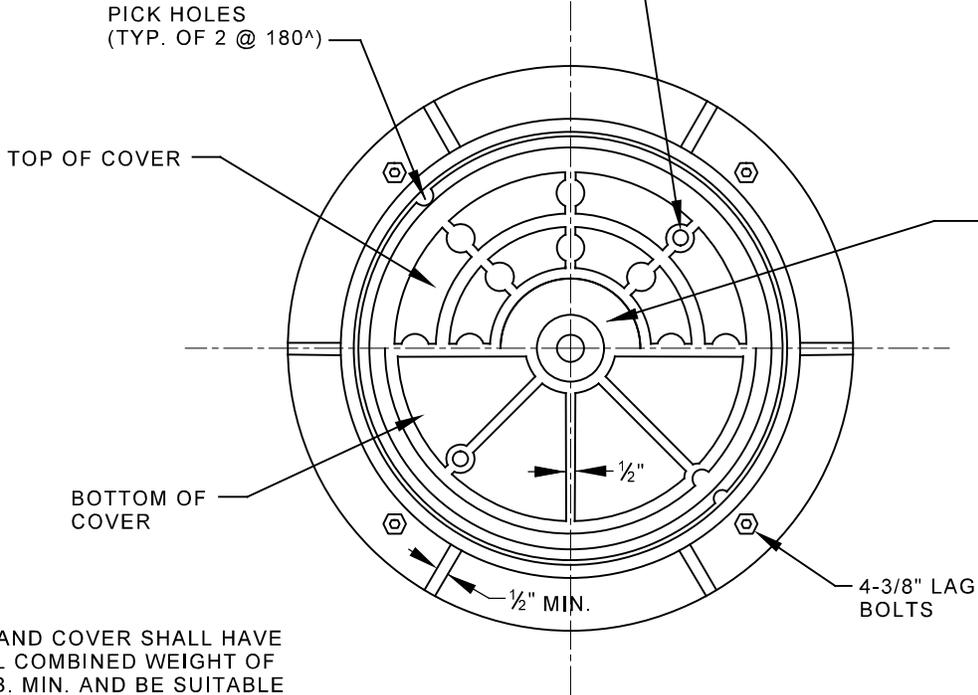
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DATE:

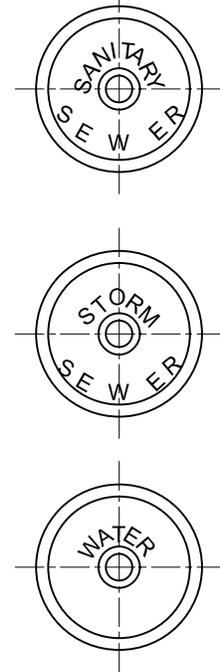
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S-2

2-1" DIA PERFORATIONS REQ'D.
FOR ALL TYPES OF COVERS:
WATER, SANITARY SEWER AND
STORM SEWER. (OMIT FOR
WATERTIGHT MANHOLES)



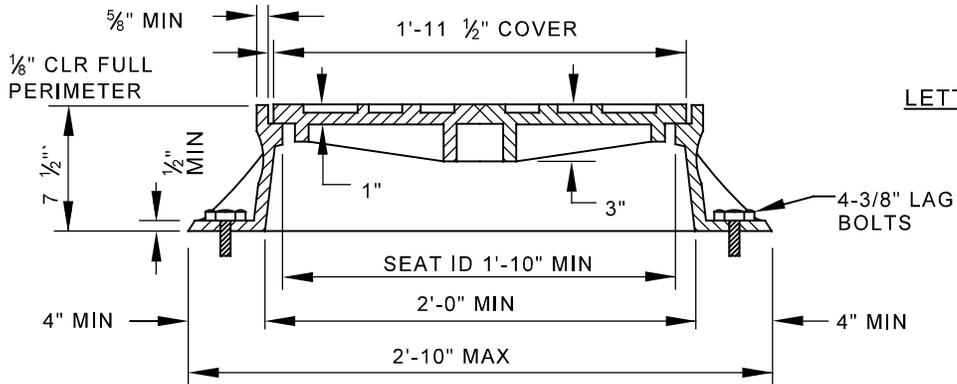
USE TEE FITTING WHERE
PIPE SIZE AND REQ'D DROP
HEIGHT PROHIBIT USE OF
WYE AND 45° BEND



COVER
LETTERING DETAIL

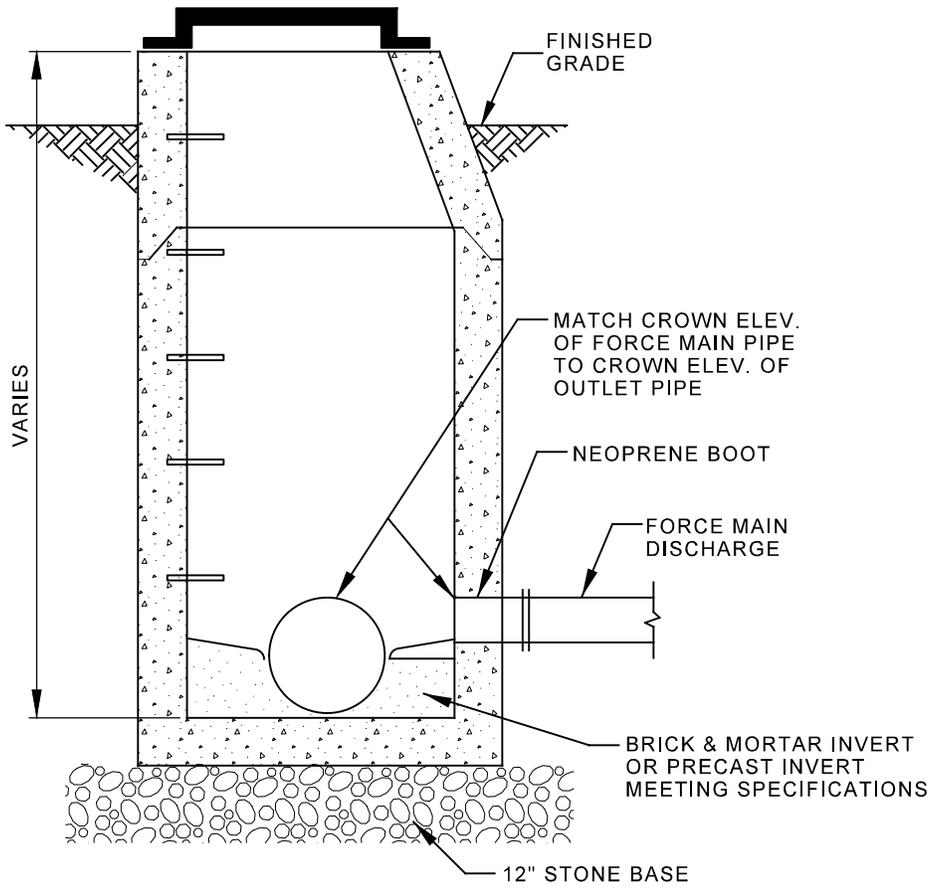
NOTE:

1. RING AND COVER SHALL HAVE TOTAL COMBINED WEIGHT OF 300 LB. MIN. AND BE SUITABLE FOR H-20 LOADING

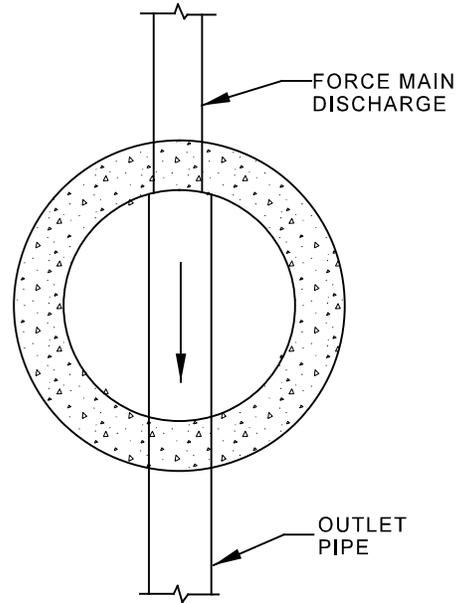


EDGECOMBE COUNTY	NORTH CAROLINA
WATER AND SEWER DEPARTMENT	
WATER AND SEWER STANDARD DETAILS	
STANDARD MANHOLE RING AND COVER	

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	SCALE:	DRAWING NO.
	DATE:	S-3
	01 / 20 / 2012	



SECTION



SECTIONAL PLAN

EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

FORCE MAIN CONNECTION TO MANHOLE



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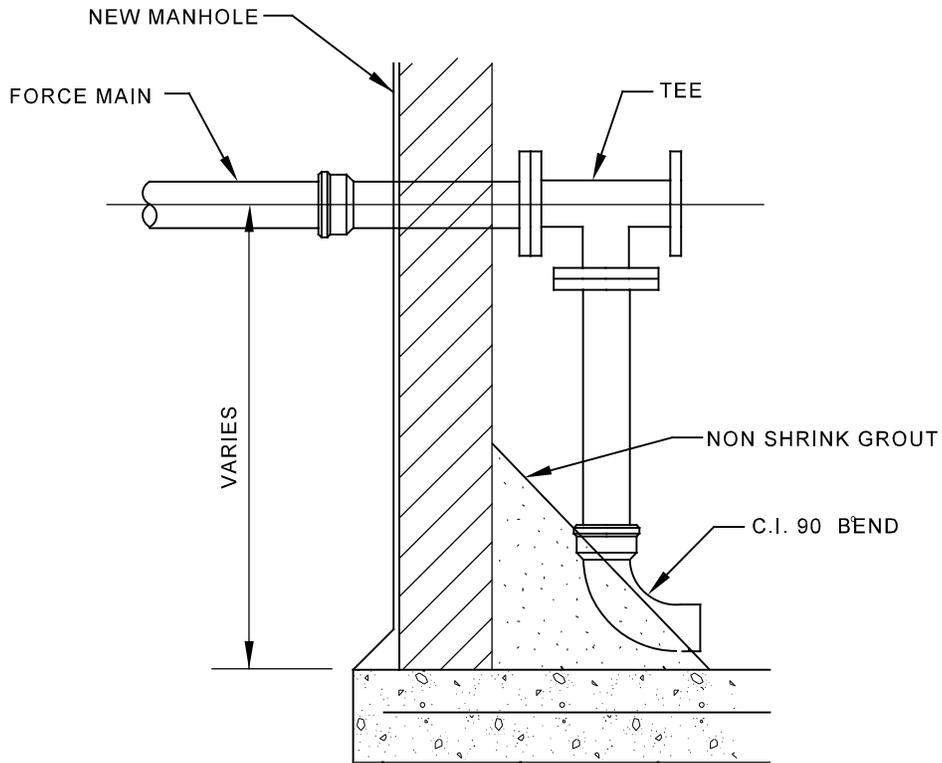
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S-4

DATE:

01 / 20 / 2012



NOTE:

1. ADD STAINLESS STEEL SUPPORT STRAPS TO DISCHARGE PIPE AS NEEDED.
2. PIPE AND FITTINGS THE SAME SIZE AS THE FORCE MAIN.

EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

FORCE MAIN DISCHARGE



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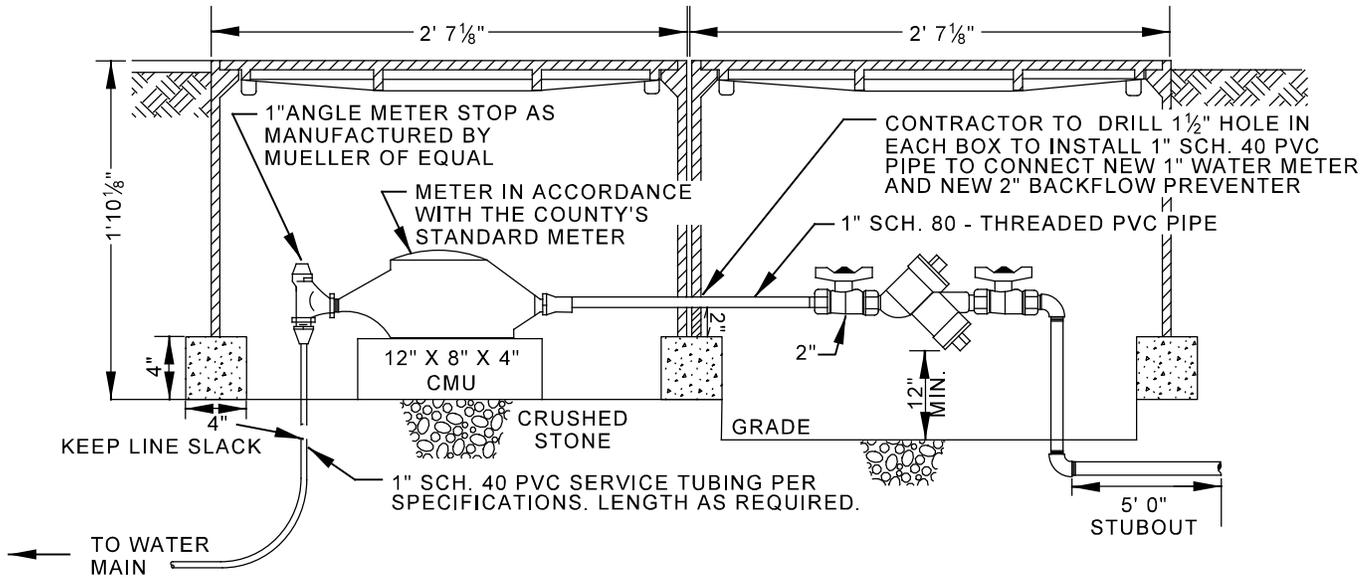
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DATE:

01 / 20 / 2012

S-5



NOTES:

1. SERVICES TO BE INSTALLED WITH SERVICE CLAMPS, SERVICE CLAMPS SHALL BE DOUBLE STRAP, HEAVY BRONZE BODY, BRONZE OR STAINLESS STEEL HARDWARE, FULL LENGTH THREADS, AND O-RING GASKET CEMENTED IN PLACE AND CONFINED IN A RETAINING GROOVE.
2. USE TAPPING MACHINE AS RECOMMENDED BY THE MANUFACTURER.
3. CAST IRON BOX SHALL BE DEWEY BROS. INC MBX5A OR EQUAL
4. 2" DOUBLE CHECK BACKFLOW PREVENTER SHALL BE FEBCO MODEL 805Y OR EQUAL.

EDGECOMBE COUNTY NORTH CAROLINA

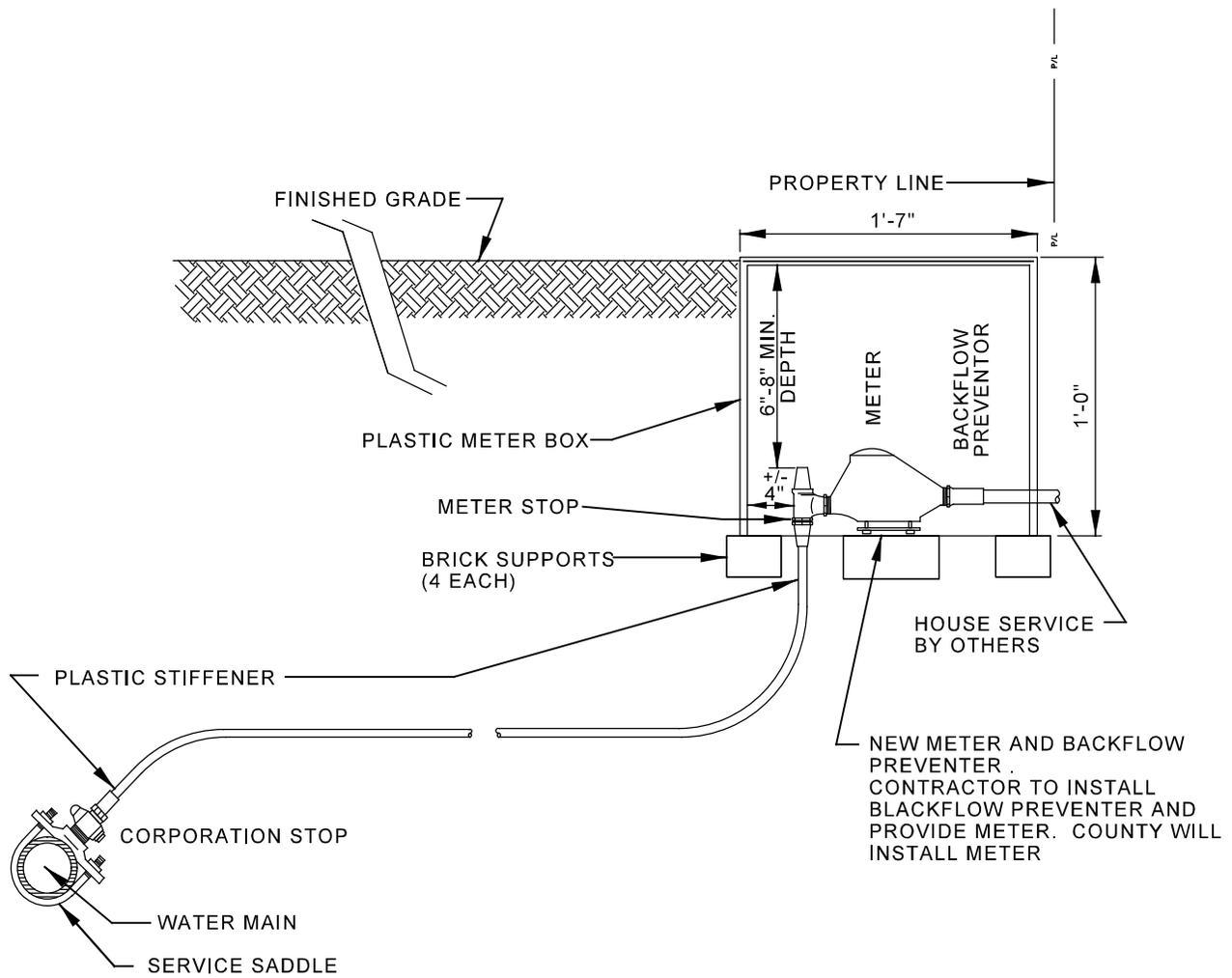
WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

1" WATER SERVICE WITH DOUBLE CHECK BACKFLOW PREVENTER

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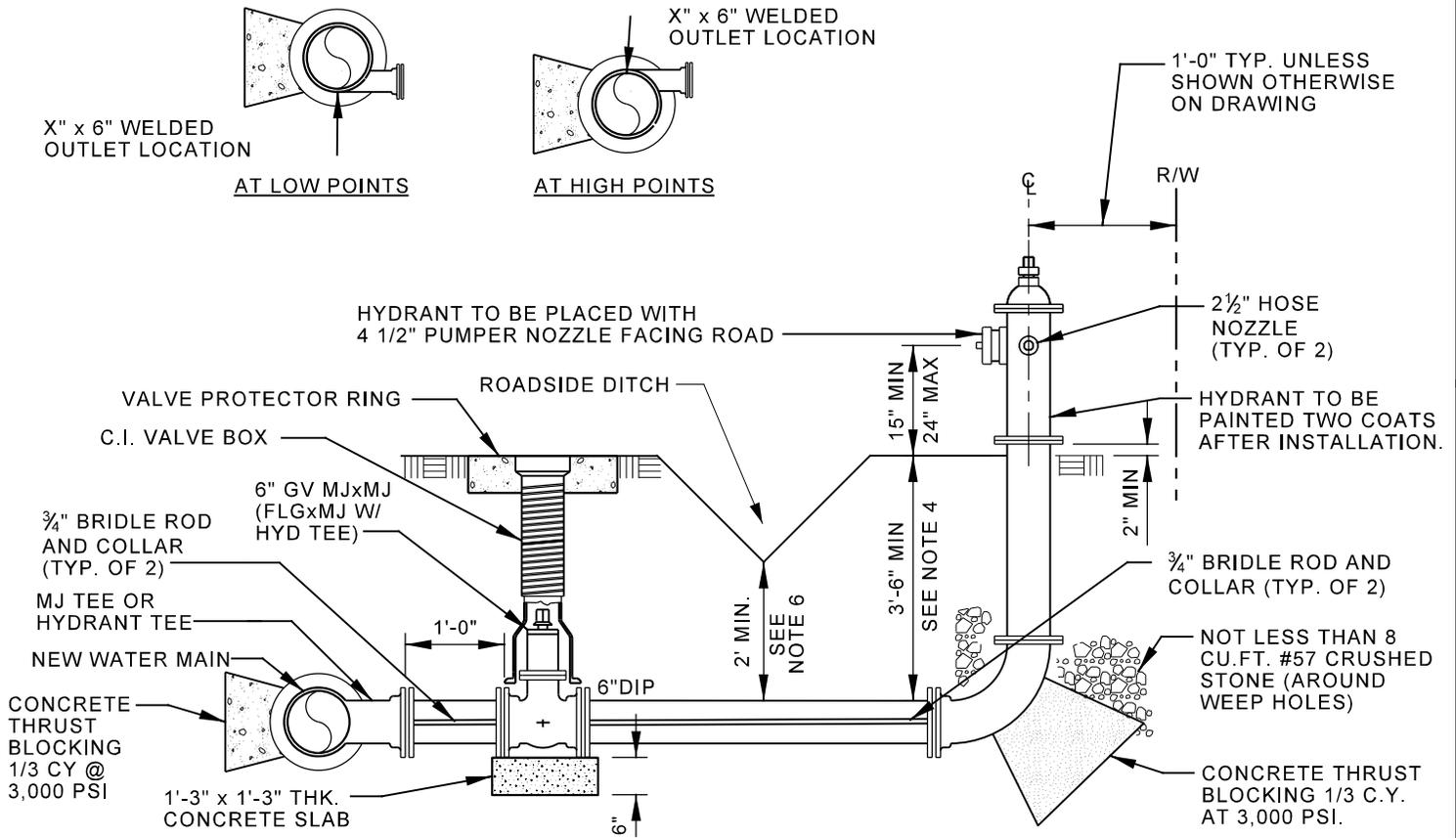
WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

3/4" & 1" WATER SERVICE

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DATE:	W-2	
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ALTERNATE HYDRANT LEG POSITIONS FOR MAINS LARGER THAN 20":



NOTES:

1. POUR CONCRETE SLAB SO THAT NO FITTING OR FLANGES ARE COVERED. SLAD MAY BE OMITTED IF VALVE IS WELL BEDDED ON 6" MIN. #57 OR #67 STONE.
2. THRUST BLOCKING SHALL BE IN ACCORDANCE WITH STANDARD DETAIL.
3. CONCRETE BLOCKING TO BE 2" FROM HYDRANT WEEP HOLES.
4. HYDRANT STANDPIPE TO BE EXTENDED AS NECESSARY TO SUIT FINAL GROUND ELEVATION.
5. AT LOCATIONS INDICATED ON PLANS FOR MAINS LARGER THAN 20", USE ALTERNATE HYDRANT LEG AS SHOWN ABOVE WITH WELDED OUTLETS IN LIEU OF TEES.
6. 2 FEET MINIMUM SEPARATION FROM BOTTOM OF ROADSIDE DITCH TO TOP OF HYDRANT LEG.

EDGECOMBE COUNTY	NORTH CAROLINA
WATER AND SEWER DEPARTMENT	
WATER AND SEWER STANDARD DETAILS	
FIRE HYDRANT ASSEMBLY	

 <p>THE WOOTEN COMPANY ENGINEERING PLANNING ARCHITECTURE</p> <p>301 West 14th Street Greenville NC 27834 252.757.1096 fax 252.757.3221 License Number: F-0115</p>	PROJECT NO.:	2488 - FW
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	DATE:	W-3
	01 / 20 / 2012	

MUELLER, AMERICAN DARLING ECLIPSE OR APPROVED EQUAL

IF VALVE BOX IS NOT IN PAVED AREA, PROVIDE
A 2'-0" X 2'-0" CONCRETE COLLAR (TYP. OF ALL VALVES)

3/4" BRIDLE RODS
& COLLARS

CONCRETE THRUST
BLOCKING

6"

4" GATE
VALVE W/
VALVE BOX

15" MIN.
20" MAX.

2"

4" DIP PIPE

7.0 CU. FT.
(MIN) CRUSHED
STONE

0.25 CU.
FT. (MIN)
THRUST BLOCK

TEE W/ 4"
BRANCH

4" DIP PIPE

CONCRETE BLOCKING

SEE TYPICAL VALVE BOX
DETAIL FOR BLOCKING
SIZE

VARIES

VARIES

EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

POST HYDRANT ASSEMBLY



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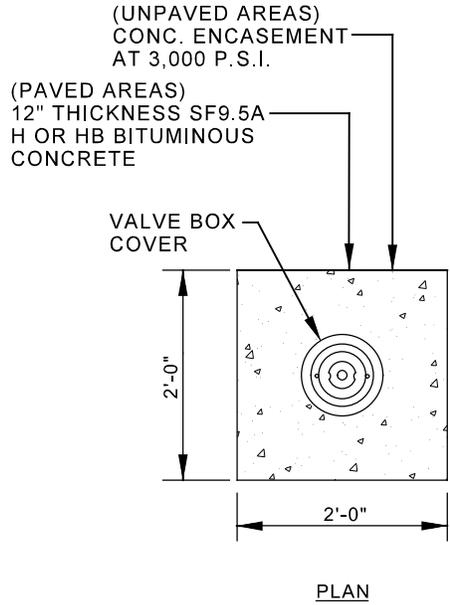
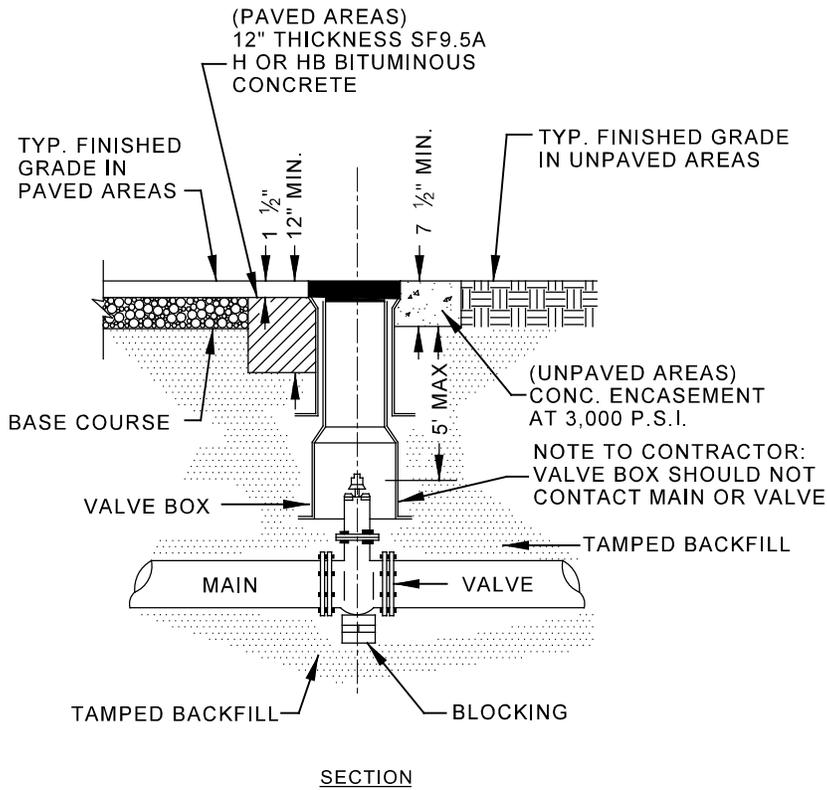
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DATE:

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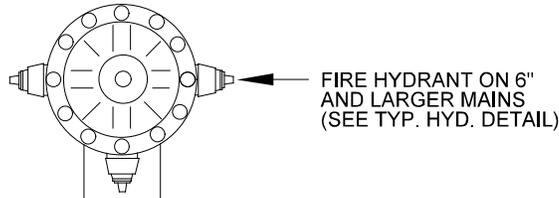


NOTES:

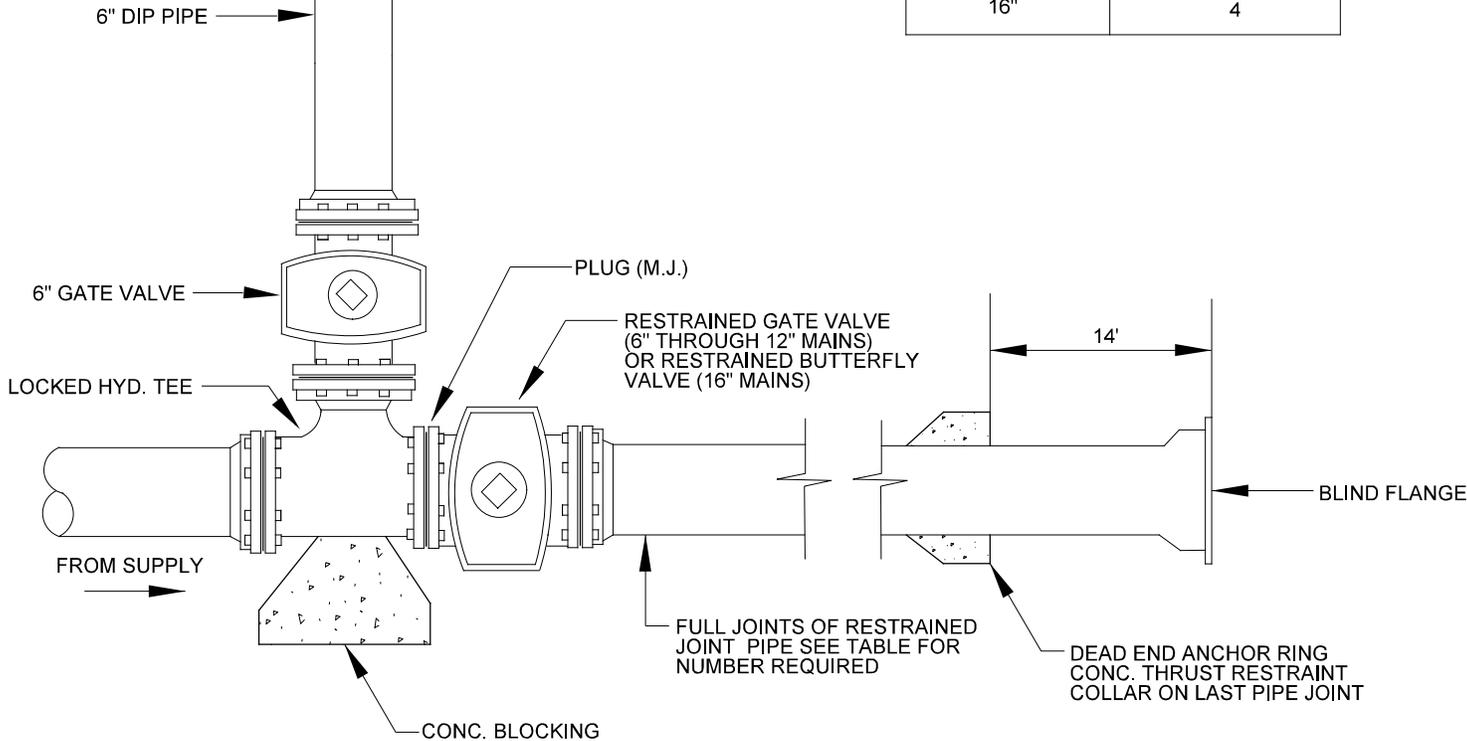
1. D.I.P. MAY BE USED FOR VALVE BOX EXTENSIONS.
2. VALVE OPERATING NUT MUST BE EXTENDED SO THAT THE DEPTH IS NO GREATER THAN 5' FROM THE SURFACE USING A MANUFACTURER APPROVED EXTENSION KIT.
3. PRECAST CONCRETE ENCASEMENT IS ALLOWED OUTSIDE OF PAVED AREAS.

EDGECOMBE COUNTY	NORTH CAROLINA
WATER AND SEWER DEPARTMENT	
WATER AND SEWER STANDARD DETAILS	
STANDARD VALVE BOX INSTALLATION	

 THE WOOTEN COMPANY <small>ENGINEERING PLANNING ARCHITECTURE</small> <small>301 West 14th Street Greenville NC 27834</small> <small>252.757.1096 fax 252.757.3221</small> <small>License Number: F-0115</small>	PROJECT NO.:	2488 - FW
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PIPE DIA. (IN.)	MIN. FULL PIPE LENGTHS
6"	2
8"	3
10"	3
12"	3
16"	4

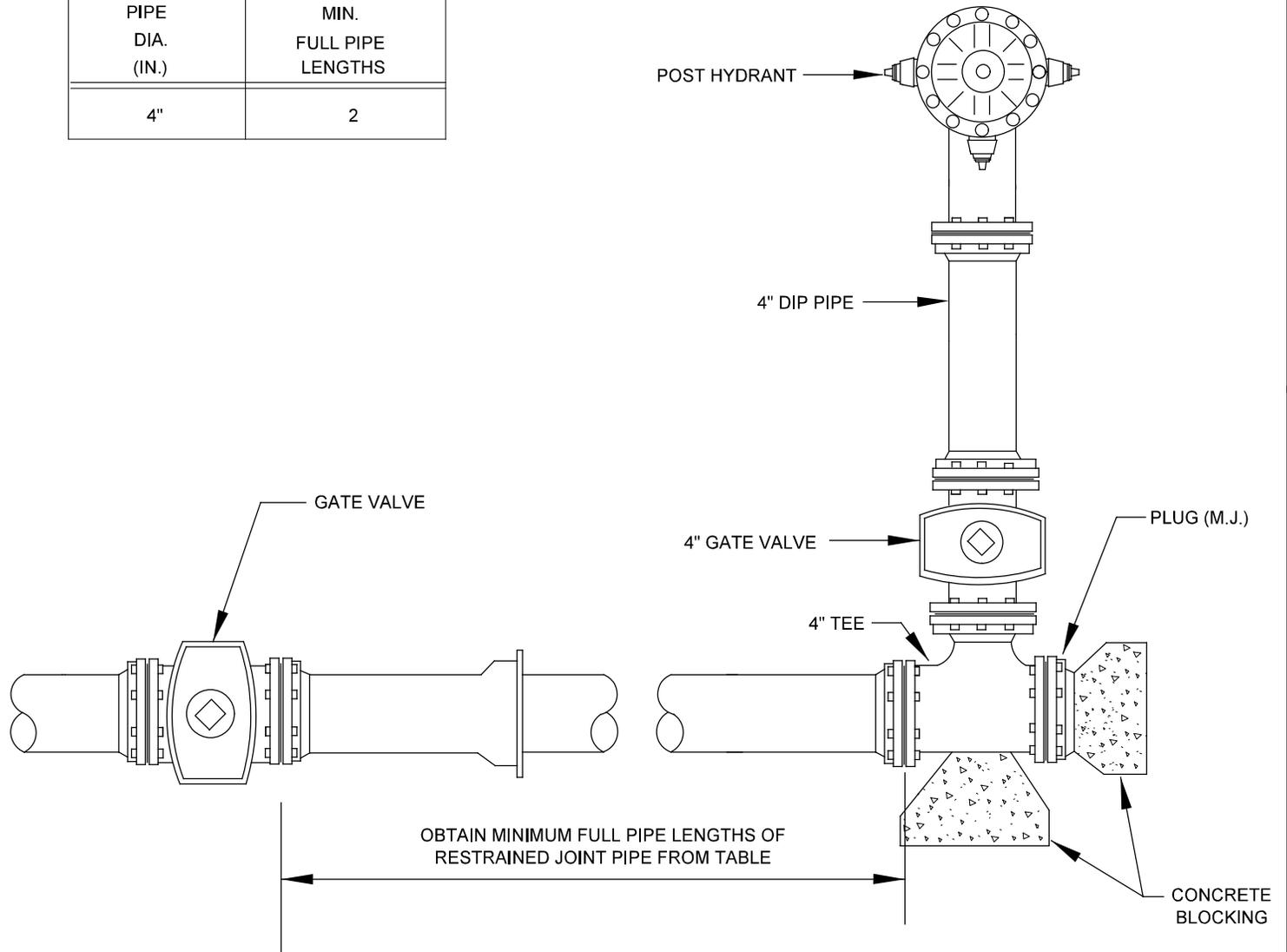


- NOTES:**
1. PLACE CONC. BLOCKING SUCH THAT IT WILL NOT INTERFERE WITH REMOVAL OF BOLTS.
 2. NO SERVICE CAN BE INSTALLED ON THE MAIN BETWEEN THE INLINE GATE VALVE AND THE LOCKED HYDRANT TEE.

EDGECOMBE COUNTY NORTH CAROLINA
 WATER AND SEWER DEPARTMENT
 WATER AND SEWER STANDARD DETAILS
 TERMINATION OF 6" - 12" WATER MAIN

 THE WOOTEN COMPANY <small>ENGINEERING PLANNING ARCHITECTURE</small> <small>301 West 14th Street Greenville NC 27834</small> <small>252.757.1096 fax 252.757.3221</small> <small>License Number: F-0115</small>	PROJECT NO.:	
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	NOT TO SCALE	W-6
DATE:	01 / 20 / 2012	

PIPE DIA. (IN.)	MIN. FULL PIPE LENGTHS
4"	2



NOTES:

1. PLACE CONC. BLOCKING SUCH THAT IT WILL NOT INTERFERE WITH REMOVAL OF BOLTS.
2. NO SERVICE CAN BE INSTALLED ON THE MAIN BETWEEN THE INLINE GATE VALVE AND THE LOCKED HYDRANT TEE.

EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

TERMINATION OF 4" WATER MAIN



THE WOOTEN COMPANY

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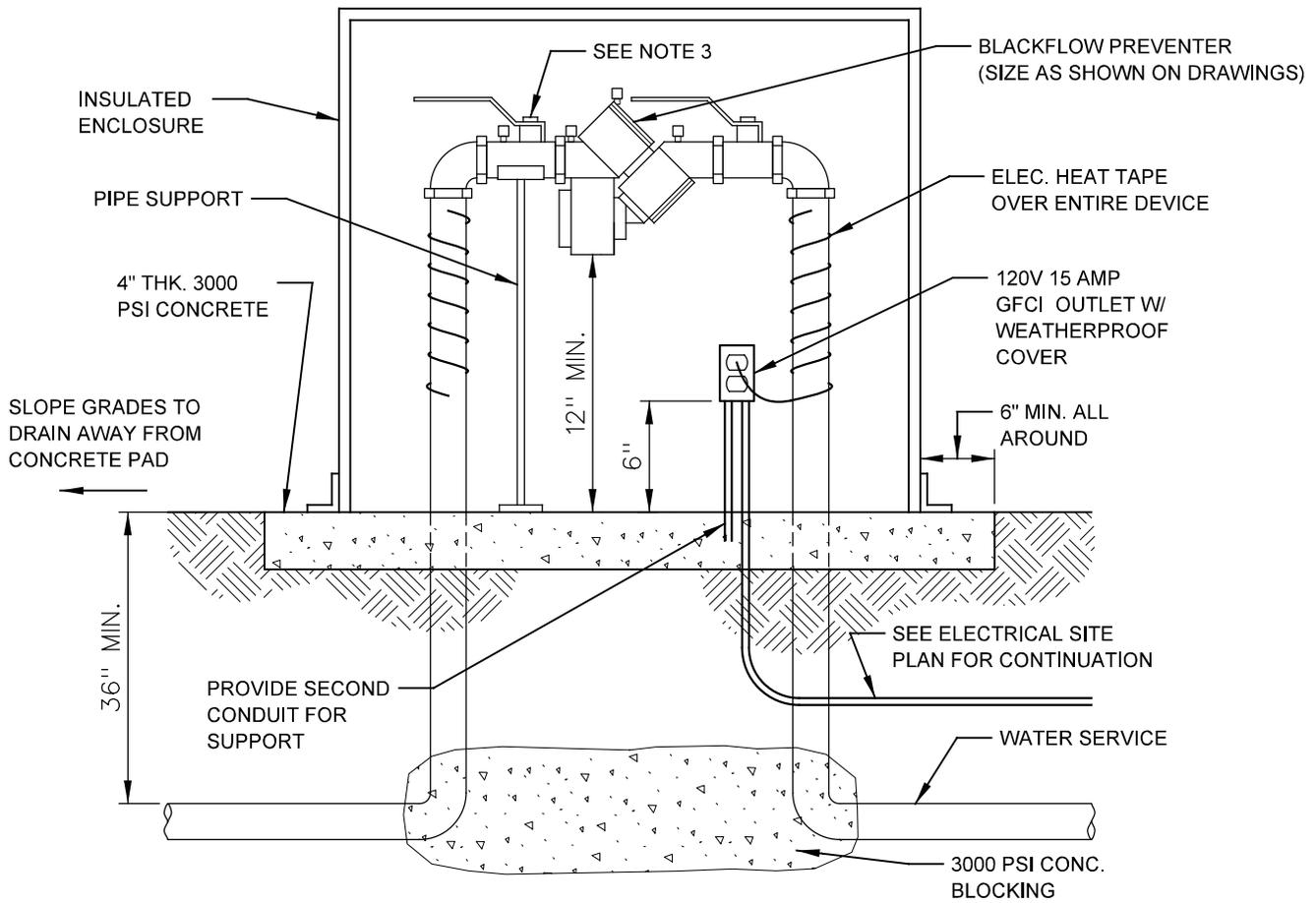
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NOTES:

1. FOR PIPE SIZES OF 2" OR LESS, PROVIDE HEAT TAPE AND GFCI AS SHOWN.
2. BACKFLOW PREVENTER FOR BUILDING SERVICES SHALL BE REDUCED PRESSURE ZONE ASSEMBLY, UNLESS OTHERWISE NOTED.
3. FOR PIPE SIZES OF 4" AND LARGER, USE GATE VALVE IN LIEU OF PLUG VALVE.

EDGECOMBE COUNTY NORTH CAROLINA

WATER AND SEWER DEPARTMENT

WATER AND SEWER STANDARD DETAILS

RPZ WITH ABOVE GROUND
HEATED ENCLOSURE



PROJECT NO.:
2488 - FW

SCALE:
NOT TO SCALE

DRAWING
NO.

DATE:
01 / 20 / 2012

W-8

SECTION 02315

TRENCHING FOR UTILITIES

PART 1 GENERAL

1.01 SCOPE

- A. Provide labor, equipment, and material to perform required excavating, backfilling, and compacting for utilities and related structures as specified herein and indicated on the Drawings. Work shall include, but not be limited to, the following:
1. Survey staking as required for construction.
 2. Protection of existing improvements.
 3. Location of installed utilities.
 4. Use of explosives.
 5. Dewatering.
 6. Excavating, backfilling, and compacting for utilities.
 7. Installation of electronic marker balls.
 8. Installation of warning / identification tape and tracer wire.
 9. Borrow material.
 10. Disposal of surplus material.
 11. Demolition and removal of existing structures.
 12. Soil Testing.

1.02 RELATED SECTIONS

- A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
1. Section 02510 Water Distribution System
 2. Section 02530 Sanitary Sewer System

1.03 REFERENCED STANDARDS

- A. The latest revision, at the time of bidding, of the publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
1. N.C. Department of Transportation - Standard Specifications for Roads and Structures (NCDOT).
 2. American Society of Testing Materials (ASTM)
 - a. D698 Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49 Kg) Rammer and 12-inch Drop (Standard Proctor).
 - b. D1556 Density of Soil in Place by the Sand-Cone Method.
 - c. D1586 Penetration Test and Spilt-Barrel Sampling of Soils.
 - d. D2049 Test for Relative Density of Cohesionless Soils.
 - e. D2216 Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
 - f. D2487 Classification of Soils for Engineering Purposes.
 3. Uni-Bell PVC Pipe Association
 - a. B-5-89 Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Sewer Pipe.

1.04 DEFINITIONS

- A. Backfill: A specified material used in filling the excavated trench and placed at a specified degree of compaction.
1. Materials: Materials listed herein include processed materials plus the soil classifications listed under the Unified Soil Classification System, (USCS) (Method D2487 and Practice D2488). The soil materials are grouped into five broad categories according to their suitability for this application.
 - a. Class I: Angular, 6 to 40-mm (1/4 to 1-1/2-in), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shell.
 - b. Class II: Coarse sands and gravels with maximum particle size of 40 mm (1-1/2 in.), including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class.
 - c. Class III: Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil Types GM, GC, SM, and SC are included in this class.
 - d. Class IV: Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil Types MH, ML, CH and CL are included in this class. These materials shall not be used for bedding, haunching, or initial backfill.
 - e. Class V: This class includes the organic soils OL, OH, and PT as well as soils containing frozen earth, debris, rock larger than 40 mm (1 1/2 in.) in diameter, and other foreign materials. These materials shall not be used for bedding, haunching, or initial backfill.
 2. Backfill Zones: Each backfill zone shall extend the full width of the trench bottom.
 - a. Foundation: Extending down from the bottom of bedding zone as defined below.
 - b. Pipe Embedment
 - 1) Bedding: Extending from 4 inches below the pipe bottom to the pipe bottom for 30-inch diameter and smaller and 6 inches below the pipe bottom for pipes larger than 30 inches in diameter.
 - 2) Haunching: Extending from the bedding (bottom of the pipe) to the pipe spring line.
 - 3) Initial Backfill: Extending from the haunching (pipe spring line) to 1 foot above the top of the pipe.
 - c. Final Backfill: Extending from the initial backfill to the finish ground elevation.
- B. Laying Conditions:
1. Type 1: Flat bottom trench with loose backfill.
 2. Type 2: Flat bottom trench with backfill lightly consolidated to centerline of pipe.
 3. Type 3: Pipe bedded in 4 inches minimum of loose soil and backfill lightly consolidated to top of pipe.
 4. Type 4: Pipe bedded on Class I material to 1/8 pipe diameter (4 inch minimum) Backfill compacted to top of pipe a minimum of 80 percent of standard proctor.
 5. Type 5: Pipe bedded in compacted Class I material to pipe centerline with 4-inch minimum under pipe. Backfill to top of pipe with Class I, II, or III and compact to 90 percent of standard proctor.

- C. Compaction: Process of mechanically stabilizing a material by increasing its density at a controlled moisture condition. "Degree of compaction" shall be expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D698 (Standard Proctor).
- D. Excavation: The removal of soil or rock to obtain a specified depth or elevation.
- E. Hard Material: Solid, homogeneous material which is not included in the definition of "rock" but which may require the use of heavy excavation equipment with ripper teeth. Amount must exceed 1 cubic yard in volume. Material having a standard penetration resistance as determined by ASTM D1586 between 60 and 150 blows per foot is defined as "hard material."
- F. Lift: Layer of soil placed on top of a previously prepared or placed soil.
- G. Rock: Solid, homogeneous material which cannot be removed without the systematic drilling and blasting exceeding 1 cubic yard in volume. Material having a standard penetration resistance as determined by ASTM D1586 greater than 150 blows per foot is defined as "rock." Removal of "hard material" will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.
- H. Pipe Springline: A line running horizontally through the center of the pipe.
- I. Topsoil: Natural, friable soil, representative of productive soils in the vicinity of the site. Topsoil shall be free from roots, stones larger than 1 inch, objectionable weed seeds, toxic substances, and materials that hinder grading, planting, and maintenance operations.

1.05 SUBMITTALS

- A. Submit the following in accordance with Section, Submittal Procedures:
 - 1. Catalog Data: Submit manufacturer's standard drawings or catalog cuts for the following. Clearly indicate equipment to be furnished for the Project including options to be provided.
 - a. Warning / Identification tape.
 - 2. Test Reports: Submit for the following:
 - a. Moisture-density relations of soils.
 - b. Field moisture content.
 - c. Soil classification.
 - d. In-place field density.
 - e. Geotechnical engineer's daily field reports.

PART 2 PRODUCTS

2.01 STONE

- A. Class I material shall be #67 or #78M stone in accordance with NCDOT specifications Section 1005, General Requirements for Aggregate.

2.02 WARNING AND IDENTIFICATION TAPE

- A. Tape shall be a minimum 3-inch wide polyethylene plastic tape manufactured specifically for identification of buried utilities with means of enabling detection by a metal detector to a minimum depth of 3 feet. Tape shall be color coded and continuously imprinted with warning and identification markings in bold black letters

to read "CAUTION - BURIED (utility) LINE BELOW." Color and printing shall be permanent, unaffected by moisture or soil and shall be as follows:

Utility	Color	Marking
1. Water	Blue	Caution - Buried Water Line Below
2. Gravity Sewer	Green	Caution - Buried Sewer Line Below
3. Force Main	Green	Caution - Buried Force Main Below
4. Electric	Red	Caution - Buried Electric Line Below
5. Gas	Yellow	Caution - Buried Gas Line Below
6. Telephone	Orange	Caution - Buried Telephone Line Below
7. SCADA	Orange	Caution - Buried SCADA Line Below

- B. Tape shall be by Blackburn Manufacturing, Joseph G. Pollard Co., or Reef Industries Inc.

2.03 TRACER WIRE

- A. Tracer wire shall be #12 wire.

PART 3 EXECUTION

3.01 PROJECT SAFETY

- A. Contractor is responsible for Project safety.
- B. Perform work in conformance with applicable State and Federal safety regulations including, but not limited, to the following:
 - 1. North Carolina Safety and Health Standards for the Construction Industry (29CFR 1926 Subpart P).
 - 2. NC OSHA Industry Guide No. 14, Excavations.
 - 3. NC OSHA Industry Guide No. 20, Crane Safety.
- C. Provide barriers, warning lights, and other protective devices at excavations as necessary for safety of workers and the public.
- D. Provide sloping of bank, shoring, sheeting, or other means of maintaining the stability of the trench in accordance with the requirements of the Associated Contractor's Manual of Accident Prevention OSHA, Part 1926.P.

3.02 PROTECTION OF UNDERGROUND FACILITIES

- A. Investigate underground facility locations prior to the start of construction.
- B. Repair damage to existing facilities at no additional cost to the Owner.
- C. A change in conditions may be considered due to the location of the existing facilities as allowed in the General Conditions. This does not include the cost for repair of damaged facilities not properly located in advance of construction.
- D. Separation distances shall be in accordance with utilities requirements.

3.03 CONSTRUCTION STAKING

- A. Provide construction staking. Owner will provide key reference points and benchmarks for construction. Contractor shall be responsible for laying out the Work as necessary for construction. Contractor shall protect and preserve the established reference points and property monuments.

- B. Contractor shall be responsible for the accurate replacement or relocation of such reference points or property monuments by a registered professional surveyor in the State of North Carolina.

3.04 LOCATION OF INSTALLED UTILITIES

- A. Contractor shall be responsible for locating contract installed utilities as requested by third parties proposing to dig in the contract area until the date that the entire contract is completed.

3.05 WATER CONTROL

- A. Prevent surface water from entering the trench.
- B. When trench bottom is below the existing ground water table, install a dewatering system to maintain water table 1 foot below trench bottom. Provide a man experienced in dewatering work at the job site.
- C. Maintain dewatering until backfilling has proceeded above the existing ground water level.
- D. Dispose of water from dewatering operations in accordance with the North Carolina Sedimentation Pollution Control Act.

3.06 USE OF EXPLOSIVES

- A. Explosives may not be used on the Project.

3.07 EXCAVATING

- A. Excavation shall be by open cut, unless otherwise indicated on the Drawings or specified herein. Short sections of trench may be tunneled or direct bored with the approval of the County.
- B. Stockpile excavated material in such a manner that it will not obstruct the flow of runoff, streams, endanger Work, impair the use or appearance of existing facilities, or be detrimental to the completed Work.
- C. Contractor shall segregate excavated material so as to maintain material suitable for backfill separate from material that is unsuitable.
- D. Trench dimensions at the pipe embedment and foundation zone unless noted otherwise shall be as follows:
 - 1. Minimum width: Pipe outside diameter plus 18 inches.
 - 2. Maximum width: Pipe outside diameter plus 24 inches.
 - 3. Sides shall be vertical to a minimum of one foot above the top of pipe.
- E. Shape trench bedding to provide uniform bearing for the full pipe length. Bottom shall be free of protrusions that could cause point loading on pipe. Provide bell holes as required for properly making pipe joint.
- F. Do not over excavate. Excavation below grade without approval of Engineer shall be backfilled with Class I material at no additional cost.
- G. Undercut soils that become unsatisfactory by construction activity or by being left exposed to the weather and backfill with Class I material at no additional cost.
- H. Remove shoring, bracing, and sheeting, unless otherwise noted, as the trench is backfilled. Engineer shall have the authority to require that the sheeting be left in place.

- I. Excavation of trench shall not advance more than 200 feet ahead of the installation. In no case should the excavation extend beyond that which can be backfilled by the end of the workday.
- J. Correct unstable soil conditions encountered at trench foundation by one of the following methods:
 - 1. Excavate below grade as approved by Engineer and backfill with Class I material or approved substitute material at unit price bid or the cost to be included in pipe unit bid price as indicated in Section, Unit Prices.
 - 2. Provide piling and / or timber cradles in a manner approved by the Engineer. Payment will be made as a change to the Contract Price.
 - 3. Provide concrete cradle or encasement of concrete at unit price bid or the cost to be included in the lump sum price as indicated in Section, Unit Prices.
- K. Rock and Hard Material
 - 1. Excavate rock and hard material to a minimum depth of 4 inches below the pipe for pipes smaller than 30 inches and 6 inches for pipes 30 inches and larger.
- L. Pressure Lines:
 - 1. Provide a minimum 3 feet of cover, unless indicated otherwise on the Drawings.
 - 2. Excavate trenches to provide vertical curve chords that will not exceed the pipe manufacturer's recommended joint deflection.
 - 3. Provide concrete thrust blocks having a compressive strength of 3,000 psi at 28 days at change in horizontal and vertical direction and reduction in the pipe size, unless other restraint systems are indicated otherwise on the Drawings. Cut trench sides vertical and square to receive concrete. Provide bearing area against trench wall as indicated on the Drawings.
- M. Gravity Lines:
 - 1. Excavate trench to the alignment and grade indicated on the Drawings.
- N. Utility Structures: Provide a minimum of 12 inches below subgrade and backfill with Class I compacted to 95 percent maximum density. If the soil conditions are found to be unsuitable for structural stability of the manhole, Engineer may require additional depth of Class I material.

3.08 BACKFILLING

- A. Weather Limitations: Proceed with backfill operations based on the following weather conditions:
 - 1. Temperature must be above freezing and rising.
 - 2. In windy, hot, or arid conditions with a high rate of evaporation add moisture to the material to maintain the optimum moisture content.
 - 3. Do not proceed in rain or on saturated subgrade.
 - 4. Do not place material on surfaces that are muddy, frozen, or contain frost.
- B. General
 - 1. Maintain backfill operation within 200 feet from pipe laying operation.
 - 2. Backfill trench to existing ground surface with select excavated material at the specified compaction.
 - 3. If excavated material is unsuitable to obtain specified compaction, provide suitable off-site borrow material for backfill.
 - 4. Re-excavate trenches improperly compacted. Backfill and compact as specified.
 - 5. Provide appropriate tamping equipment, and water to obtain proper moisture content, to achieve specified compaction of backfill.

6. Conduct operation of heavy equipment above pipe installation as to prevent damage to pipe.
 7. Install warning / identification tape over utilities. Bury tape one foot below finished grade above the utility.
 8. Install tracer wire for non-metallic pressure pipe. Bury tracer wire with pipe. Wire shall be looped into valve boxes to allow access for direct contact location.
- C. Backfill in pipe embedment zone (bedding, haunching, and initial backfill).
1. General:
 - a. Backfill with material as specified below. Material shall be free from objects larger than 2 inches.
 - b. Where rock and hard material has been excavated below pipe bottom, backfill and compact bedding with Class I material. Class II or III material may be used for bedding with Engineer's approval.
 - c. Place backfill material to assure placement of material under pipe haunches.
 - d. Take care during placement and compacting of material to avoid movement of pipe.
 2. Place backfill in bedding and haunching zones in 6 inch maximum lifts and compact to 90 percent density. Place initial backfill in one lift do not compact. Provide backfill material in pipe embedment zone as specified below.
 - a. Pressure Lines (Flexible and Rigid Pipe)
 - 1) Excavation in Class I, Class II, Class III, and stable Class IV soils suitable for bedding, the bedding surface shall provide a firm foundation of uniform density. Backfill with select excavated material.
 - 2) Excavation in Class V, unstable Class IV soils, running water, and other unstable soil conditions, excavate a minimum of 4 inches below pipe bottom and provide Class I material for bedding and haunch zone. Backfill with Class I, II, or III material in initial backfill.
 - b. Gravity Sewer Lines, Rigid pipe (concrete and ductile iron)
 - 1) Excavation in Class I, Class II, Class III, and stable Class IV soils suitable for bedding, the bedding surface shall provide a firm foundation of uniform density. Backfill with select excavated material.
 - 2) Excavation in Class V, unstable Class IV soils, running water, and other unstable soil conditions, excavate a minimum of 4 inches below pipe bottom and provide Class I material for bedding and haunch zone. Backfill with Class I, II, or III material in initial backfill.
 - 3) Ductile Iron over 16 inch
 - i) Depth 0 - 12 feet: Type 2 laying conditions same as for pressure pipe.
 - ii) Depth over 12 feet: Provide Class I material for bedding and 4 inches up from bottom of pipe.
 - c. Gravity Sewer Lines, Flexible (PVC SDR 35)
 - 1) Depth 0 to 14 ft: Provide Class I material for bedding and haunching. Backfill with Class I, II, or III material in initial backfill.
 - 2) Depth over 14 ft: Provide Class I material for bedding, haunching, and initial backfill.
 - d. Gravity Sewer Lines, Semi-rigid pipe (PVC and ABS Truss Pipe)
 - 1) Depth 0 to 14 ft: Provide Class I material for bedding and haunching. Backfill with Class I, II, or III material in initial backfill.
 - 2) Depth over 14 ft: Provide Class I material for bedding, haunching, and initial backfill.

- D. Final Backfill
1. Backfill with materials free of stones and debris larger than 6 inches in dimension. Place backfill in lifts not exceeding the thickness and compacted to the minimum density specified below.
 2. Trench backfilled with noncohesive materials may be compacted with water flooding; except under roadways, shoulders of roadways, and other areas subject to vehicular movement, provided the method of compaction is approved by the Engineer and provides the degree of compaction required.
 3. Lifts and density:
 - a. Undeveloped areas (i.e., forests, fields, and croplands): Trench may be filled with bulldozer blade provided material fall will not damage pipe. Mound soil over the trench area sufficiently to settle level over time. Degree of compaction shall be 85 percent.
 - b. Lawns: Backfill in 12-inch lifts and compact to 90 percent. Top 12 inches shall be free of material with a dimension over 2 inches.
 - c. Roads (including Rights-of-way), drives, parking areas (including areas within 20 feet), and adjacent to existing utilities: Backfill in 6 inch lifts compact to 95 percent.
 - d. Within 20 feet of foundations: Backfill in 6-inch lifts compacted to 95 percent.
- E. Utility Structures: Bring backfill to grade in even lifts on all sides. Lift depths and compaction densities shall be as specified according to area of installation for pipe above. Backfill against cast-in-place concrete structure only after concrete has attained the specified 28-day compressive strength.

3.09 ANTI-SEEP COLLARS

- A. Anti-seep Collars: Provide anti-seep collars to prevent groundwater flow along pipe in wetlands as indicated on the Drawings. Use select clay material for collars. Collars shall extend past trench walls and bear against undisturbed soils. Dimension of collars shall be as indicated on the Drawings. Do not place stone in area of anti-seep collars.
- B. Concrete Collar: Provide Class B concrete with minimum cement content of 5 sacks per cubic yard (5.5 sacks for angular course aggregate); 6.8 gallons of water per sack water-cement ratio; 2-4 inch slump range; and 28-day strength of 2,500 psi.

3.10 SOIL TESTING

- A. Compaction tests may be made at the option of the County. An independent testing laboratory will perform tests. Owner will pay for cost of the initial tests.
- B. For each test that fails the compaction requirements, the testing firm at the direction of the County shall make two additional tests. Contractor shall pay cost of additional tests made because of failure of compaction test.
- C. Correct deficiencies in compaction.

3.11 SOIL TESTING

- A. Provide services of a soil-testing firm.
- B. Testing laboratory soil specialist, as a minimum, shall be at the project site for the following:
1. Provide a minimum of one (1) in-place density test for every 1,000 lf of trench.

- C. Density tests shall be made in accordance with ASTM D-698, Standard Proctor Method.
- D. Submit test reports and soil specialist daily logs in accordance with Section, Quality Control.
- E. Based on test results, make corrections, adjustments, and modifications of methods, materials, and moisture content for proper trench compaction.

3.12 PAVEMENT PATCHING

- A. Repair damaged pavement structure.
- B. Cut existing pavement for utility installation in straight lines generally parallel to the utility. Properly dispose of removed pavement structure.
- C. Extend pavement patch 1 foot beyond each side of trench on firm subgrade. Slope new surface to drain.
- D. Asphalt Pavements: Replace asphalt pavement with a pavement structure equal to existing but no less than as detailed on the Drawings.
- E. Concrete Pavements: Replace concrete pavement with pavement structure equal to existing but no less than as detailed as Drawings. Concrete shall be minimum 3,000 psi. When existing concrete joint is within 5 feet of trench remove existing concrete to joint. Provide expansion joint at edge of existing concrete. Surface treatment shall match existing.
- F. Curbs, Gutters, and Sidewalks: Replace curbs and gutters, and sidewalks removed or damaged with similar sections to match the existing. Remove to nearest existing joint.
- G. Approval of Other Authorities: Pavements under the jurisdiction of the NC Division of Highways shall be subject to the approval of a representative of that Division.
- H. Raise existing and new manholes and valve boxes to finished pavement grade. Excavate around top of existing manhole and valve box as necessary. Remove existing top ring, and install new grade ring(s) as necessary. Install existing cover. Raise existing valve box. Provide concrete collar around manhole ring and valve box.
- I. Pavement patching shall include the cost to adjust existing and new manhole and valve boxes to finished pavement elevations.

3.13 GRADING AND CLEAN-UP

- A. Provide for testing and clean up as soon as practicable, so these operations do not lag far behind the pipe installation. Perform preliminary clean up and grading as soon as backfill is complete.
- B. Provide positive drainage of finished grade and drain away from structures. Finished grade shall be reasonably smooth, compacted, free from irregular surface changes and comparable to the adjacent existing ground surface.
- C. Seed disturbed areas with a suitable seed mixture that has been approved by the County and in accordance with NCDENR Sedimentation and Erosion Control requirements.
- D. Upon completion of backfilling, remove and properly dispose of excess material and waste.

END OF SECTION

SECTION 02445

BORE AND JACK OF CONDUITS

PART 1 GENERAL

1.01 SCOPE

- A. Provide, complete in place, carrier pipe installed within steel encasement pipe under railroads and highways as indicated on the Drawings.

1.02 RELATED SECTIONS

- A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
 - 1. Section 02315 Trenching for Utilities
 - 2. Section 02510 Water Distribution System
 - 3. Section 02530 Sanitary Sewer System

1.03 INDUSTRY REFERENCES

- A. The latest revision, at the time of bidding, of the publications listed below form a part of this specification.
 - 1. Highway Crossing: Install pipe under highways in accordance with "Policies and Procedures for Accommodating Utilities on Highway Rights-of-Way," NC Department of Transportation, as a minimum.
 - 2. Railroad Crossings: Install pipe under railroads in accordance with Part 5.3, Specifications for Pipelines Conveying Non-Flammable Substances, American Railway Engineering Association (AREA), as a minimum.

1.04 SUBMITTALS

- A. Submit the following to the County for approval:
 - 1. Affidavit of Compliance: Affidavit shall attest that supplied products conform to the referenced standard and this specification and that all tests set forth in each applicable referenced publication have been performed and that all test requirements have been met. Submit for each of the following materials:
 - a. Encasement Pipe.
 - 2. Catalog Data: Submit manufacturer's standard drawings or catalog cuts for the following. Clearly indicate equipment to be furnished for the Project including options to be provided.
 - a. Pipe support.
 - b. Casing seal.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Encasement Pipe: Encasement pipe shall be uncoated spiral welded steel meeting ASTM A-139, Grade B, with minimum yield strength of 35,000 psi. Pipe length, and size shall be as indicated on the Drawings. The minimum wall thickness shall be as follows:

1. N.C. Department of Transportation and County Roads

Pipe Size (O.D.-inches)	Wall Thickness (inches)
4 - 12-3/4	0.188
16 – 24	0.250
30	0.312
36	0.375
42	0.500
48	0.500

- B. Carrier Pipe: Carrier pipe shall be of the type, size, and joints as indicated on the Drawings and specified in Section, Water Distribution System and Section, Sanitary Sewer System.
- C. Pipe Support: Provide pipe supports designed and manufactured for the support of the carrier pipe size and material to be used for the Project within the encasement size indicated on the Drawings. Supports shall be designed to carry the pipe at the support spacing specified and meet the following minimum requirements:
1. Band Width: 8 inches for pipes 14 inches and under and 12 inches for pipes 16 inches and over.
 2. Band and Riser Material: 14 gauge steel for band and riser except if the riser is over 6 inches high the steel shall be 10 gauge for riser. Riser shall be of the channel shape. Band with risers shall a fusion bonded PVC coating of a minimum of 10-mil thickness. Band shall be bolted together with stainless steel bolts, nuts, and washers.
 3. Band Liner: Provide PVC liner a minimum of 0.09 inches.
 4. Runners: Glass Reinforced Polyester or UHMW Polymer plastic. Runner shall be a minimum of 1 inch wide and not more than 1 inch shorter than the bandwidth. Provide 2 top and 2 bottom runners for pipe sizes through 12 inches and 2 top and 4 bottom runners for pipes over 12 inches.
 5. Pipe position within casing: Centered and Restrained.
 6. Support Spacing:
 - a. General:
 - 1) Provide a support within one foot on each side of joints. Provide a support within one foot of each end of casing.
 - 2) Provide additional supports as needed per manufacturer's recommendations.
 - b. PVC: Provide pipe supports at a maximum of 6 foot spacing along pipe in addition to the above requirement.
 7. Supports shall be as manufactured by Advance Products & Systems, Inc., Pipeline Seal and Insulator, Inc or equal.
- D. Casing End Seal: Provide casing seal designed and manufactured for sealing around the casing and carrier pipe. The seal may be a wrap-around or a pull-on. Seal shall be made of 1/8-inch thick synthetic rubber. Seal shall be secured with stainless steel banding straps with worm gear tightening device.

PART 3 EXECUTION

3.01 GENERAL

- A. Verify the subsurface conditions at each boring site. Payment will not be made for encasement pipe installed but not usable.
- B. Stabilize and maintain bore pit bottom to provide proper equipment support and maintain pipe alignment. Dewater as necessary for site. Excavate bore pit in accordance with OSHA regulations. Provide adequate barricades, railings, and warning lights throughout the boring operation. Conduct operation in such a manner so as not to create a hazard to, nor impede the flow of traffic.
- C. Install encasement pipe by dry boring and jacking.
- D. Boring auger diameter shall not be greater than the outside diameter of the encasement pipe and shall not extend more than 6-inches ahead of the cutting edge of the encasement pipe. Fill voids that are formed during the operation with a 1:3 portland cement grout pumped at 50 psi to ensure that there will be no settlement of the roadway.
- E. As the boring operation progresses, butt weld each new section of the encasement pipe to the section previously jacked into place. Maintain proper alignment. Confirm the grade of the encasement pipe as the Work progresses.
- F. If an obstruction is encountered during the boring operation, efforts should be made to remove the obstruction. If obstruction cannot be removed, withdraw the encasement pipe and fill the void with 1:3 portland cement grout at 50 psi. If the encasement pipe cannot be withdrawn, seal ends before moving to another bore site. Engineer shall approve location of new bore site. A maximum of two (2) attempts as described above as necessary, including additional bore pits, shall be made by the Contractor at the bid unit price.
- G. If, after the second attempt, it is found to be impossible to install the encasement pipe by boring due to rock or some other obstruction, a change order will be negotiated for placing the pipeline by open-cut or tunneling in accordance with the Contract Documents.
- H. Provide seals at each end of encasement pipe.

3.02 CARRIER PIPE

- A. Install carrier pipe in the encasement pipe using manufactured pipe supports. Supports shall prevent movement of the carrier pipe within the encasement. Space supports as specified.

END OF SECTION

SECTION 02510

WATER DISTRIBUTION SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work under this section includes, but is not limited to, piping, valves, fire hydrants, water service line, and appurtenances for a complete potable water distribution system.

1.02 RELATED SECTIONS

- A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
 - 1. Section 02315 Trenching for Utilities
 - 2. Section 02445 Bore and Jack of Conduits

1.03 REFERENCES

- A. Publications are referred to in the text by basic designation only.
 - 1. American Society of Sanitary Engineering (ASSE) Standards
 - a. 1013 Reduced Pressure Principle Backflow Preventers
 - b. 1015 Double Check Backflow Prevention Assembly
 - c. 1069 Outdoor Enclosures for Backflow Prevention Assemblies
 - 2. American Society for Testing and Materials (ASTM)
 - a. C443 Flexible Watertight Joints for Precast Manhole Sections
 - b. C478 Precast Reinforced Concrete Manhole Sections
 - c. C828 Low-Pressure Air Test of Vitrified Clay Pipe Lines (4 to 12 inch)
 - d. C890 Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
 - e. C923 Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
 - f. D1784 Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
 - g. D1785 Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
 - h. D2241 Poly(Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series)
 - i. D2466 Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
 - j. D2467 Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
 - k. D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
 - l. D3350 Polyethylene Plastics Pipe and Fittings Materials.
 - m. F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - n. F1483 Specification for Oriented Poly(Vinyl Chloride) PVCO, Pressure Pipe
 - 3. American Water Works Association (AWWA)
 - a. B300 Hypochlorites
 - b. B301 Liquid Chlorine
 - c. C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
 - d. C105 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids

- e. C110 Ductile-Iron and Gray-Iron Fittings, 3 inch through 48 inch, for Water and Other Liquids
- f. C115 Flanged Ductile-Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges
- g. C150 Thickness Design of Ductile Iron Pipe
- h. C151 Ductile-Iron Pipe, Centrifugally Cast, for Water
- i. C153 Ductile-Iron Compact Fittings, 3 inch through 24 inch and 54 inch through 64 inch, for Water Service
- j. C502 Dry-Barrel Fire Hydrants
- k. C504 Rubber-Seated Butterfly Valves
- l. C508 Swing-Check Valves for Waterworks Service, 2 inch Through 24 inch NPS
- m. C509 Resilient Seated Gate Valves for Water and Sewerage Systems
- n. C510 Double Check Valve Backflow-Prevention Assembly
- o. C511 Reduced-Pressure Principle Backflow-Prevention Assembly
- p. C512 Air-Release, Air / Vacuum, and Combination Air Valves for Waterworks Service
- q. C550 Protective Epoxy Interior Coatings for Valves and Hydrants
- r. C600 Standard for Installation of Ductile Iron Water Mains and Their Appurtenances
- s. C605 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
- t. C651 Disinfecting Water Mains
- u. C700 Cold-Water Meters-Displacement Type, Bronze Main Case
- v. C701 Cold-Water Meters-Turbine Type, for Customer Service
- w. C702 Cold-Water Meters-Compound Type
- x. C704 Cold-Water Meters-Propeller Type for Waterworks Applications
- y. C800 Underground Service Line Valves and Fittings
- z. C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch, for Water Distribution
- aa. C901 Polyethylene (PE) Pressure Pipe and Tubing, 1/2 inch through 3 inch for Water Service
- bb. C905 Polyvinyl Chloride (PVC) Water Transmission Pipe, 14 inch through 36 inch, for Water Distribution
- cc. M23 PVC Pipe - Design Installation
- 4. National Sanitation Foundation (NSF) Standards
 - a. 14 Plastic Piping Components and Related Materials
 - b. 60 Drinking Water Treatment Chemicals – Health Effects
 - c. 61 Drinking Water System Components - Health Effects
 - d. 372 Drinking Water System Components – Lead Content

1.04 SUBMITTALS

- A. Submit the following in accordance with Section, Submittal Procedures:
 - 1. Affidavit of Compliance: Affidavit shall attest that supplied products conform to the referenced standard and this specification and that all tests set forth in each applicable referenced publication have been performed and that all test requirements have been met. Submit for each of the following materials:
 - a. Pipe and Fittings
 - 1) Ductile iron
 - 2) Polyvinyl Chloride (PVC)
 - i) AWWA C900
 - ii) AWWA C909 Oriented PVC

- iii) ASTM F1483 Oriented PVC
 - iv) Pressure rated
 - v) Schedule 40 & 80
 - 3) Copper pipe and tubing
 - 4) Polyethylene (PE) pressure pipe and tubing
 - b. Valves
 - 1) Gate
 - i) Resilient-Seated
 - ii) Tapping
 - 2) Butterfly
 - 3) Check
 - 4) Air release
 - c. Fire hydrants
 - d. Pre-cast concrete manholes
 - e. Service valves and fittings
 - 1) Corporation valves
 - 2) Meter setter with meter valve and check valve
 - f. Backflow prevention assembly
 - g. Meters
2. Catalog Data: Submit manufacturer's standard drawings or catalog cuts for the following. Clearly indicate equipment to be furnished for the Project including options to be provided.
- a. Pipe and Fittings
 - 1) Ductile iron
 - 2) Polyvinyl Chloride (PVC)
 - i) AWWA C900
 - ii) AWWA C909 Oriented PVC
 - iii) ASTM F1483 Oriented PVC
 - iv) Pressure rated
 - v) Schedule 40 & 80
 - 3) Copper pipe and tubing
 - 4) Polyethylene (PE) pressure pipe and tubing
 - b. Valves
 - 1) Gate
 - i) Resilient-Seated
 - ii) Tapping
 - 2) Butterfly
 - 3) Check
 - 4) Air release
 - c. Pre-cast Concrete Manholes and appurtenances
 - 1) Manhole steps
 - 2) Pipe connectors
 - 3) Joint material
 - d. Castings
 - e. Tapping sleeves
 - f. Valve boxes
 - g. Fire hydrants
 - h. Service valves and fittings
 - 1) Service saddles
 - 2) Corporation valves
 - 3) Meter setter with meter valve and check valve
 - 4) Meter box

- i. Backflow prevention assembly and enclosure
- j. Meters
- k. Blowoff assembly
- l. Pressure Gauge
- 3. Reports:
 - a. Field test report for each section of pipe for the following:
 - 1) Measured chlorine residual
 - 2) Bacteriological test
 - 3) Pressure test
 - b. Field test report for each backflow prevention device.
- 4. Operation and Maintenance Instructions: Submit complete operation and maintenance manual for the following:
 - a. Valves
 - b. Fire hydrants
 - c. Meters
 - d. Backflow prevention assembly

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Provide a suitable pipe hook or rope sling when handling the pipe with a crane. Lifting of the pipe shall be done in a vertical plane. Under no conditions shall the sling be allowed to pass through the pipe unless adequate measures are taken to prevent damage to both the tongue and groove ends.
- B. Deliver pipe in the field as near as practicable to the place where it is to be installed. Distribute pipe along the side of the trench opposite to the spoil bank. Where necessary to move the pipe longitudinally along the trench, it shall be done in such a manner as not to injure the pipe or coating.
- C. Shield PVC pipe and fittings stored on site from the sun's ultraviolet rays by suitable cover, or indoor storage.

PART 2 PRODUCTS

2.01 GENERAL

- A. Products with surfaces intended to be in contact with the drinking water shall be certified and listed in accordance with NSF 61 for potable drinking water.

2.02 DUCTILE IRON PIPE

- A. Pipe and fittings 3-inch to 64-inch shall conform to AWWA C150 and C151 and the following requirements:
 - 1. Size shall be as indicated on the Drawings.
 - 2. Minimum pipe pressure class shall be 250 unless indicated otherwise on the Drawings.
 - 3. Suitable for a system working pressure of 150 psi at the depth indicated on the Drawings with a laying condition as indicated in Section, Trenching for Utilities.
 - 4. Interior lining to be used in a drinking water system shall be certified and listed in accordance with NSF 61.
 - 5. Interior shall be lined with cement-mortar with seal coat in accordance with AWWA C104.

- B. Ductile-iron pipe for below ground service shall have push-on or mechanical joints, unless noted otherwise on the Drawings, conforming to AWWA C150 and C151, and to the following requirements:
 - 1. Provide mechanical joint fittings, unless noted otherwise on the Drawings.
 - 2. Encase pipe in polyethylene conforming to AWWA C105.
- C. Ductile-iron pipe for above ground service shall have flanged joints, unless noted otherwise on the Drawings, conforming to AWWA C115.
 - 1. Pipes to be painted shall have only a shop primer on the outside by the manufacturer. Verify that proposed manufacturer's primer is compatible with the proposed paint system.
- D. Fittings for ductile-iron pipe shall conform to AWWA C110, or C153 and to the following requirements:
 - 1. Joint type shall be as specified above for the supplied ductile-iron pipe.
 - 2. In lieu of exterior asphaltic coating and interior cement lining, fittings may be provided with a 6-8 mil nominal thickness fusion bonded epoxy coating inside and out in conformance with AWWA C550.
 - 3. Fittings shall be made of ductile-iron.
- E. Gaskets shall be nitrile material for installation in areas as designated on the Drawings.
- F. Ductile iron pipe on piers shall have Mech-Lok™ rigid restrained joint by Griffin Pipe Products Co. or approved substitute.
- G. Special Pipe Joints
 - 1. River Crossing (Ball Joint)
 - a. Boltless
 - b. Bolted
 - 2. Restrained
 - a. Provide restrained joint pipe at fittings and valves on water mains. Length of restrained pipe shall be as indicated on the Drawings. Restrained joints shall be Snap-Lok (Griffin Pipe), Flex Ring and Lok-Ring (American), TR Flex (U.S. Pipe) or approved equal.
 - b. Restrained joint pipe and fittings shall meet all AWWA standards and other requirements as specified above for standard ductile iron pipe and fittings unless addressed herein.
 - c. Field made joints are allowable but should be avoided where possible. Careful planning to locate field cuts in standard pipe sections is preferred. For field made joints in restrained piping, use field weldments or an insert equal to TR Flex Gripper Rings or approved equal. Gasket type field made joints will not be allowed.
 - d. Restrained joint fittings shall be provided by the restrained joint pipe supplier. Fittings shall be of the same model / type as the pipe supplied from the pipe manufacturer.
 - e. Restrained joint fittings may be push-on joint type.
 - f. Megalugs, Series 1100, as manufactured by EBAA Iron Sales shall be allowable for restraint where fittings or valves are not available with restrained joints.
 - g. Where additional fittings/valves are required for pipes not shown on Drawings, consult with Engineer for length of restrained joint pipe necessary each side of fittings/valve prior to installation of pipe/fitting.

- h. Tees for hydrants do not have to be restrained along the main line except where they are within required restrained length of nearby fittings or valves.
- i. Contractor shall develop a field layout schedule and drawing for restrained joint pipe installations.

2.03 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

A. General

- 1. Pipe and fitting size shall be as indicated on the Drawings.
- 2. PVC materials shall comply with ASTM D1784 with a cell classification of 12454-B.
- 3. Pipe shall be certified and listed for potable water distribution products in accordance with NSF 14 or 61 and bear the NSF seal on each section of pipe.

B. AWWA C900: C900 PVC pipe 4-inch to 12-inch shall conform to AWWA C900 and the following requirements:

- 1. Outside diameter shall conform to ductile-iron pipe.
- 2. Pipe shall be a minimum pressure class 150 with a minimum standard dimension ratio of DR 21 .
- 3. Pipe shall have plain end and elastomeric-gasket bell ends.
- 4. Fittings shall conform to AWWA C110 or C153 and have mechanical joints. Fittings shall be made of gray-iron or ductile-iron. Interior of fittings shall be cement-mortar lined with seal coat in accordance with AWWA C104.

C. Pressure Rated: Pressure Rated (PR) PVC pipe 1-1/2-inch to 12-inch shall conform to ASTM D2241 and the following requirements:

- 1. Pipe shall be pressure rated 200 with a standard dimension ratio of SDR 21.
- 2. Pipe shall have an integral elastomeric-gasket bell end. The joints and gaskets shall comply with ASTM D3139 and ASTM F477.
- 3. Fittings for pipe 3-inch and larger shall conform to AWWA C110, or C153 and have mechanical joints with transition gaskets as required for the pipe outside diameter. Fittings shall be made of gray-iron or ductile-iron. Interior of fittings shall be cement-mortar lined with seal coat in accordance with AWWA C104.

D. Schedule 40 & 80: Schedule 40 & 80 PVC pipe 1/2-inch to 12-inch shall conform to ASTM D1785 and the following requirements:

- 1. Outside diameter shall conform to iron pipe.
- 2. Pipe shall be schedule 40 or 80.
- 3. Pipe shall have an integral elastomeric-gasket bell end or solvent weld joints.
- 4. Fittings for the pipe shall conform to ASTM D2466 or D2467 as appropriate for the pipe schedule.

2.04 POLYETHYLENE PRESSURE PIPE AND TUBING

A. Polyethylene pressure pipe and tubing, 1/2-inch through 3-inch, shall conform to AWWA 901 and the following requirements:

- 1. The line shall be the size indicated on the Drawings and shall be polyethylene tubing.
- 2. The line shall be made from material having standard PE code designation PE 3408.
- 3. The line shall have a minimum pressure class of 160 psi with a dimension ratio (DR) of DR-9.

2.05 TAPPING SLEEVE

- A. Tapping Sleeve: Tapping sleeves shall be 304 stainless steel, flanged for the tapping valve and manufactured for a working pressure of 150 psi. Sleeve shall have a full body 360-degree gasket. Sleeve shall have a 3/4-inch test plug. Bolts and nuts shall be stainless steel.

2.06 VALVES

- A. General: Valves shall meet the following requirements:
 - 1. Size shall be as required for the pipe size and material as indicated on the Drawings and specified.
 - 2. Open by counterclockwise rotation.
 - 3. Provide an interior protective epoxy coating in accordance with AWWA C550 on ferrous surfaces in contact with the liquid.
 - 4. Components in contact with the liquid shall be in compliance with NSF 61.
 - 5. Standard system working pressure is 150 psi.
 - 6. Equip valves with a suitable means of operation.
 - 7. Ends shall be mechanical joint for underground location and flanged joint for above ground location/underground utility vaults.
 - 8. For buried valves over 5 feet deep, provide extension stems of cold rolled steel to bring the operating nut to within 2 feet of the ground surface. Extension stems shall also be provided as required for floor stands and to floor valve box.
 - 9. Provide valve accessories as required for proper valve operation for valve locations as indicated on the Drawings and as recommended by valve manufacturer.
 - 10. Similar valve types shall be of one manufacturer.
- B. Gate Valves, Resilient-Seated: Gate valves 3-inch to 20-inch shall conform to AWWA C509 for and to the following requirements:
 - 1. O-ring stem seal on non-rising (NRS) stem valves.
 - 2. Valves shall be non-rising stem (NRS) with wrench nut for underground locations and Outside Screw and Yoke (OS&Y) with handwheel for above ground locations unless noted otherwise on the Drawings.
 - 3. Special material for bolts and nuts.
- C. Tapping Valves: Tapping valves shall conform to the specifications for the gate valves as indicated in this Section and the following:
 - 1. Valve shall be specifically modified for the passage and clearance of the tapping machine cutter.
 - 2. The mating end to the tapping sleeve shall be raised male surface to provide true alignment to the sleeve and tapping machine. The valve shall be compatible with the tapping sleeve.
- D. Butterfly Valves: Butterfly valves 3-inch through 72-inch shall conform to AWWA C504 for potable water and to the following requirements:
 - 1. Valve body shall be ductile iron and mechanical joint for below ground locations and flanged short body in underground vaults and above ground locations. End mechanical joints shall conform to ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11. End flanges shall conform to ANSI B16.1, class 125 and ANSI/AWWA C110/21.10.
 - 2. Valves shall be class 150B.
 - 3. Rubber seats shall mate with stainless steel or nickel-copper alloy seat surfaces.

4. Valve shafts shall consist of one-piece unit extending completely through the valve disc for valves under 12-inches. Above this size, shaft shall be one piece or the stub-shaft type. Shafts shall be type 304 stainless steel.
 5. Valve discs shall be cast iron, ductile iron, or stainless steel.
 6. Valve Actuator
 - a. Manual Actuator: Manual actuator shall be of the traveling nut type. Valves for buried service shall have a standard AWWA nut. Valves for above ground shall have a handwheel, or chain wheel as indicated on the Drawings.
- E. Swing-Check Valves: Swing-check valves 2 to 24-inch shall conform to AWWA C508 and to the following requirements:
1. Provide lever and weight for swing check control.
 2. Metal to Metal seat construction.
 3. Ends shall be flanged.

2.07 AIR VALVES

- A. Provide air valves in conformance with AWWA C512 and the following:
1. Valve type shall be an Air Release valve.
 - a. Inlet size: 2 inch
 - b. Small orifice minimum: 1/8 inch
 2. Valve shall be designed for the following automatic operation:
 - a. Release accumulated air while the main is in operation and under pressure.
 3. Valve shall be designed for a system pressure 150 psi.
 4. Provide threaded inlet.
 5. Provide stainless steel ball float and wetted internal parts.
 6. Provide isolating bronze ball valve for connection to main line.

2.08 MANHOLES

- A. Provide manholes made of precast concrete sections in conformance with ASTM C478, NC Department of Transportation, and the following requirements:
1. General
 - a. Provide manholes to the depth as indicated on the Drawings. Manhole inside diameter shall be 4 feet unless noted otherwise on the Drawings.
 - b. Precast concrete manholes shall be as manufactured by Adams Concrete, Carolina Precast Concrete, Inc., D & M Concrete Specialties, Inc., N. C. Products Corp., Stay Right Tank, Tindall Concrete Products, Inc. or approved substitute.
 2. Precast Concrete Sections
 - a. Minimum wall thickness shall be 5-inches.
 - b. Base: Cast monolithically without construction joints or with an approved PVC waterstop in the cold joint between the base slab and the walls. The width of the base extensions on Extended Base Manholes shall be no less than the base slab thickness.
 - c. Riser: Minimum lay length of 16 inches.
 - d. Eccentric Cone: Top inside diameter shall be 24 inches. Width of the top ledge shall be no less than the wall thickness required for the cone section.
 - e. Transition Cone: Provide an eccentric transition from 60-inch and larger manholes to 48-inch diameter risers, cones, and flat slab top sections. Minimum slope angle for the cone wall shall be 45 degrees.

- f. Transition Top: Provide an eccentric transition from 60-inch and larger manholes to 48-inch diameter risers, cones, and flat slab top sections. Transition Top sections shall be furnished with vents as shown on the manhole details. The maximum amount of fill over the transition top section shall be 20 feet. Transition Tops shall not be used in areas subject to vehicle traffic.
 - g. Flat Slab Top: Designed for HS-20 traffic loadings as defined in ASTM C890. Items to be cast into Special Flat Slab Tops shall be sized to fit within the manhole ID and the top and bottom surfaces. Provide a float finish for exterior slab surface.
 - h. Precast or core holes for pipe connections. Diameter of hole shall not exceed outside diameter of pipe by more than 3-inches.
 - i. Grade Rings: May be used to adjust ring and covers to finished grade. No more than 12 vertical inches of grade rings will be allowed per manhole. Grade Rings shall be no less than 4 inches in height.
 - j. Lifting Devices: Devices for handling precast components shall be provided by the precast manufacturer and comply with OSHA Standard 1926.704.
3. Joints
- a. Manufacturer in accordance with tolerance requirements of ASTM C 990 for butyl type joints.
 - b. Minimize number of joints. Do not use riser section for manholes up to 6 feet tall and no more than one riser for each additional 4 feet in height.
 - c. Flexible Joint Sealants: Provide preformed butyl rubber based sealant material conforming to Federal Specification SS-S-210A, Type B - Butyl Rubber or O-ring rubber gasket conforming to ASTM C443.
4. Inverts
- a. Provide a brick and mortar or precast concrete invert.
 - b. Form and finish invert channel to provide a consistent slope from inlet(s) to outlet up to 4-inches.
 - c. Channel walls shall be formed to 3/4 of the height of the outlet pipe diameter.
 - d. Finish benches with a minimum uniform 1:12 slope. Provide a 1/4-inch radius at the edge of bench and trough.
5. Flexible Pipe Connectors: Provide flexible connectors for pipe to manhole that conform to ASTM C923. Location of connectors shall vary from Project Drawings no more than 1/2-inch vertically and 5 degrees horizontally.
6. Manhole Steps:
- a. Steps shall be made of 1/2-inch grade 60 steel encapsulated by co-polymer polypropylene and have serrated tread and tall end lugs.
 - b. Secure steps to the wall with compression fit in tapered holes or cast-in-place. Align steps along a vertical wall and shall not be located over a pipe opening. First step shall be a maximum of 26 inches from the bottom.
 - c. Steps shall be by American Step Co., Inc., Bowco Industries, Inc., M. A. Industries, Inc. or approved substitute.

2.09 CASTINGS

A. General

- 1. Made of gray iron, ASTM A-48 - class 30, or ductile iron, ASTM A536, grade 65-45-12.
- 2. Castings shall be free from imperfections not true to pattern. Casting tolerances shall be plus or minus 1/16 inch per foot of dimension. Top shall set neatly in

frame, with edges machined for even bearing and proper fit to prevent rattling and flush with the edge of frame.

3. Castings shall be as manufactured by Neenah Foundry Co., U.S. Foundry & Manufacturing Corp., Vulcan Foundry, or approved equal.

B. Manhole Ring and Cover:

1. Minimum clear opening shall be 22 inches.
2. Minimum weight for frame and cover shall be 300 pounds and suitable for Heavy Duty Highway Traffic Loads of H-20.
3. Frame shall have four 3/8-inch anchor bolt holes equally spaced.
4. "Water" shall be cast on the cover as appropriate. Casting shall bear the name of the manufacturer and the part number.
5. Provide solid cover.
6. Provide cover with two 1-inch perforated holes unless noted as watertight on the Drawings.
7. Provide the following where indicated on the Drawings:
 - a. Ring and cover shall be watertight.
 - b. Bolt down cover. Bolt down covers shall be provided with four (4) 3/8-inch stainless steel hex head bolts at 90 degrees.

2.10 VALVE ACCESSORIES

- A. Valve Box, Below Ground: Boxes shall be high strength cast iron of the screw or telescopic type. Box shall consist of a flare base section, center extension as required, and a top section with the word "WATER" cast in the cover. Length of box shall be such that full extension of box is not required at the depth of water main cover.
- B. Extension Stem (if necessary): Stem shall be sized so as to transmit full torque from the operating mechanism to the valve stem without binding, twisting, or bending. Stem shall be made from stainless steel. Stem shall be complete with couplings for connection to valve and floor stand where required. When valve extension kits are used they must be as recommended by the valve manufacturer.

2.11 INDICATOR POST

- A. Indicator post shall be made of carbon steel or ductile iron. Post shall be UL Listed and FM approved. Design shall allow for the addition of a supervisory switch. The operating wrench shall be easily removed by Owner. Wrench shall also be able to be locked to the post with a padlock (owner supplied) to prevent unauthorized operation.
- B. Post Indicator shall be the vertical type, having two large window openings covered with a heavy clear plexiglass at the post top. Aluminum target plates shall be provided with the words OPEN and SHUT cast in large, easy-to-read, raised letters located directly behind each window.
- C. Stem, indicators and working parts shall be fully protected from moisture and weather damage by complete enclosure.
- D. Operating nuts shall be 1-1/4 inches square. Provide wrench with the indicator post.
- E. Provide tamper switch to allow for connection to building security system. Gate valve tamper switches shall be installed on valve in accordance with manufacturer's instructions. The mechanism shall be contained in a weatherproof die cast aluminum housing, which shall provide a 3/4 inch tapped conduit entrance and incorporate the necessary facilities for attachment to the valve. Switch housings

shall be finished in red baked enamel. Switch mechanism shall have a minimum rated capacity of one amp, 125 volt AC - .25 amp. 24 volt DC. Assembly shall be tamper-proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting. Gate valve switches shall be Underwriter's Laboratories listed and Factory Mutual approved. Provide and turn over to Owner a wrench for tamper boxes.

2.12 SERVICE VALVES AND FITTINGS

- A. Water service valves and fittings shall conform NSF 61 and AWWA C800 for normal pressure and the following requirements:
1. Service valves and fittings shall conform to Owner's standards. If Owner's standards conflicts with these specifications, consult with Engineer before proceeding.
 2. Service saddle: Provide service saddle for service pipe connection to main pipe material. Saddles shall meet the following requirements:
 - a. Brass body to conform to the outside dimension of the main.
 - b. O-ring, Buna N rubber gasket to provide watertight connection.
 - c. Hinged, double bottom strap design.
 - d. Threaded outlet to match threads on corporation valve.
 3. Corporation valve
 - a. Stop size shall be the same as service line.
 - b. Inlet thread shall be as per AWWA C800.
 - c. Outlet thread shall be as required for the pipe material specified.
 4. Pressure reducing valve
 - a. Shall meet ASSE 1003.
 - b. Bronze body, renewable stainless steel seat.
 - c. Suitable for reducing from an inlet pressure range of 100 – 150 psi to an outlet pressure of 40 psi.
 5. Meter boxes
 - a. Boxes and cover shall be cast iron
 - b. Minimum 18 inches deep.
 - c. Sized for required water meter.
 6. Meter setter
 - a. Setter shall be made of copper and compatible with the Owner's meter and other fittings to be supplied.
 - b. Setter shall have a meter valve on the public side of the meter. Valve shall be O-ring sealed and capable of being locked in the closed position. Setter shall have an ASSE approved dual check valve on the private side of the meter.

2.13 FIRE HYDRANTS

- A. Fire hydrants shall conform to AWWA C502 and to the following requirements:
1. Nozzles: Two (2) 2-1/2-inch hose and One (1) 4-1/2-inch pumper connections.
 2. Nozzle threads: Owner standard.
 3. Main valve diameter: 5-1/4- or 4-1/2 inch.
 4. Minimum depth of bury: 42-inches.
 5. Inlet connection: 6-inch mechanical joint.
 6. Open counterclockwise.
 7. Close with water pressure.
 8. O-ring seals
 9. Traffic model with frangible sections near the ground line designed to break on impact.

10. Provide extension for hydrant standpipe as required to set centerline of hydrant nozzle a minimum of 15-inches and a maximum of 24-inches.
11. Exterior color above ground line shall match Owners.
12. All hydrants of one manufacturer.
13. All hydrants must be same in each Water and Sewer District.

2.14 BACKFLOW PREVENTION ASSEMBLY

- A. Backflow prevention assemblies shall conform to USC Foundation for Cross Connection Control and Hydraulic Research and to the following requirements:
 1. The size and type shall be as indicated on the Drawings.
 2. Double Check Valve (DCV) in conformance with AWWA C510 and ASSE 1015.
 3. Reduced Pressure Zone (RPZ) in conformance with AWWA C511 and ASSE 1013.
 4. Unit shall include a flow Detector consisting of an auxiliary line with an approved backflow preventer and water meter. Flow detector assembly shall comply with ASSE 1047 or 1048.
 5. Service shall be for cold water.
 6. End connection shall be threaded or flanged as indicated on the Drawings.
 7. Assembly shut-off valves shall be:
 - a. 2-inch and under: 1/4 turn, full port, resilient seated, bronze ball valve.
 - b. Over 2-inch: OS&Y resilient seated gate valves.
 8. Valves shall be internally epoxy coated in accordance with AWWA C550.

2.15 BACKFLOW PREVENTER ENCLOSURES

- A. Enclosures for backflow preventers (BFP) shall meet the following requirements:
 1. Aluminum or fiberglass reinforced construction sized to totally enclose "wet" portion of BFP.
 2. Provide access through lockable doors or hinged lid for testing of BFP.
 3. Shall be totally removable for maintenance of BFP.
 4. Lined with unicellular, non-wicking, insulation.
 5. Provide thermostatically controlled heat source within enclosure to provide freeze protection to minus 30 degrees F.
 6. For enclosure of reduced pressure zone BFP provide drain openings at each end to accommodate full port discharge form device. Openings shall be protected against intrusion of wind, debris, and animals.
 7. Provide means of permanent anchor to concrete pad.

2.16 METERS

- A. Displacement Type Meters: Displacement type meters shall conform to AWWA C700 and to the following requirements:
 1. Meter size shall be as indicated on the Drawings.
 2. Meter ends shall match pipe fittings.
 3. Provide magnetic drive with sealed gear housing.
 4. Totalizer shall have:
 - a. 4-inch dial reading in gallons
 - b. Six-digit totalizer
 5. Must be capable of remote readout to match Owner's existing system.
- B. Turbine Meters: Turbine meters shall conform to AWWA C701 and to the following requirements:
 1. Class meter: II
 2. Meter size shall be as indicated on the Drawings.

3. Meter ends shall match pipe fittings.
 4. Provide magnetic drive with sealed gear housing.
 5. Flow tube shall be cast iron with 2 mil epoxy coating.
 6. Register shall have:
 - a. Direct reading six-digit totalizer reading in gallons.
 - b. Circular test dial
 - c. Must be capable of remote readout to match Owner's existing system.
- C. Compound Meters: Compound meters shall conform to AWWA C702 and to the following requirements:
1. Meter size shall be as indicated on the Drawings.
 2. Meter ends shall match pipe fittings.
 3. Provide magnetic drive with sealed gear housing.
 4. Main casing shall be cast iron.
 5. Totalizer shall have:
 - a. 4-inch dial reading in gallons
 - b. Six-digit totalizer
 - c. Circular test dial
 - d. Must be capable of remote readout to match Owner's existing system.
- D. Propeller Meters: Propeller meters shall conform to AWWA C704 and to the following requirements:
1. Meter size shall be as indicated on the Drawings.
 2. Meter ends shall match pipe fittings.
 3. Provide magnetic drive with sealed gear housing.
 4. Flow tube shall be cast iron.
 5. Indicator/Totalizer shall have:
 - a. 4-inch combination dial reading in gallons per minute (gpm) and gallons
 - b. Rate of flow indicator with a range of 0-15,000 gpm
 - c. Six-digit totalizer
 - d. Circular test dial
 - e. Must be capable of remote readout to match Owner's existing system.

2.17 PRESSURE GAUGE

- A. Pressure gauge shall meet the following requirements:
1. Use: Pressure reading locally for the specific location/use as determined by the Owner.
 2. Liquid fill: Glycerin
 3. Dial: White aluminum with black markings.
 4. Dial size: 4 ½ inch minimum.
 5. Tube material: Bronze or Stainless Steel.
 6. Case & Ring: Aluminum
 7. Accuracy: 1/2 % of full scale.
 8. Stem connection: Lower.
 9. Gauge reading: Combination reading in psi and feet of water (ft) with range of 0 – 85 (200).
 10. Equip with a stopcock.
 11. Mounted vertically on piping in location approved by Owner.
- B. Provide a ¼ inch tap at locations shown on Drawings for each pressure gauge required.

2.18 THRUST BLOCKING

- A. Provide concrete thrust blocking in accordance with the detail on the Drawings.
- B. Thrust blocking is not required where restrained joint fittings and equivalent length of restrained joint pipe are used unless shown otherwise on the Drawings.

2.19 DISINFECTANT

- A. The following products may be used as the disinfectant:
 - 1. Chlorine, liquid: AWWA B301.
 - 2. Hypochlorite, calcium and sodium: AWWA B300.

PART 3 EXECUTION

3.01 GENERAL

- A. Pipe installation shall meet the following general guidelines:
 - 1. Lay pipe in the presence of Engineer, unless specifically approved otherwise.
 - 2. Handle pipe and accessories in accordance with manufacturer's recommendations. Take particular care not to damage pipe coatings.
 - 3. Carefully inspect pipe immediately prior to laying. Do not use defective pipe. Replace pipe damaged during construction.
 - 4. Lay pipe to grade and alignment indicated on the Drawings.
 - 5. Provide proper equipment for lowering pipe into trench.
 - 6. Do not lay pipe in water or when the trench or weather conditions are unsuitable for the work.
 - 7. Provide tight closure pipe ends when work is not in progress.
 - 8. Keep pipe interior free of foreign materials.
 - 9. Clean bell and spigots before joining. Make joints and lubricate gasket in accordance with pipe manufacturer recommendation.
 - 10. Disinfection of pipe during installation:
 - a. Soak gaskets for minimum of one hour in a 50 - 100 ppm hypochlorite solution prior to installation.
 - b. Mop bells and spigots of pipe, fittings and valves with a 50 - 100 ppm hypochlorite solution immediately prior to making joints.
 - 11. Block fittings with concrete, or restrain as indicated on the Drawings or as required to prevent movement.

3.02 RELATION OF WATER MAINS TO SEWERS

- A. Lateral Separation: Lay water mains at least 10 feet laterally from existing and proposed sewers. Where existing conditions prevent a 10-foot lateral separation, the following shall be followed with approval of the Engineer:
 - 1. Lay water main in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
 - 2. Lay water main in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
- B. Crossing Separation: Lay bottom of water main at least 18-inches above the top of the sewer. Where existing conditions prevent an 18-inch vertical separation, construct both the water main and sewer of ferrous materials and with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.

- C. Crossing a Water Main Under a Sewer: When it is necessary for a water main to cross under a sewer, construct both the water main and the sewer of ferrous materials and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

3.03 WATER SERVICE

- A. Water service lines shall extend from the main distribution line [to a meter box located at the right-of-way] or [to a point approximately 5 feet outside the building face].
- B. 3/4-inch water service lines may be direct tapped to ductile iron pipe. Water service taps larger than 3/4-inch shall be made using a service saddle.
- C. Taps shall be located at 10 or 2 o'clock on the circumference of the pipe.
- D. Service taps shall be staggered, alternating from one side of the water main to the other and at least 12 inches apart.
- E. Taps on the same side of the main shall be a minimum of 24 inches apart.
- F. Install meter boxes and water service components so top of meter will be within 6 inches of the surface.
- G. County will install water meter.

3.04 DUCTILE IRON PIPE

- A. Install pipe in conformance with AWWA C600 and the following:
 - 1. For laying pipe in a vertical or horizontal curve, each full length pipe may be deflected by the following offset distance:
 - a. Push-on joint
 - 1) 3 to 12-inch pipe: 14-inch offset
 - 2) 14 to 36-inch pipe: 8-inch offset
 - b. Mechanical joint
 - 1) 3 to 6-inch pipe: 20-inch offset
 - 2) 8 to 12-inch pipe: 15-inch offset
 - 3) 14 to 20-inch pipe: 8-inch offset
 - 4) 24 to 36-inch pipe: 6-inch offset
 - 2. For laying restrained joint pipe in a vertical or horizontal curve, except for horizontal directional drills (HDD), each full length pipe may be deflected by the following offset distance:
 - a. 6 to 12-inch pipe: 11-inch offset
 - b. 16 to 20-inch pipe: 7-inch offset
 - c. 24 to 30-inch pipe: 5-inch offset
 - d. 36-inch pipe: 4-inch offset
 - e. 42 to 48-inch pipe: 1 1/4 -inch offset

3.05 PVC PRESSURE PIPE

- A. Install PVC C900 pipe in conformance with AWWA C605.
- B. Solvent Weld: Field cut ends shall be sanded to roughing the surface. Joints shall be cleaned of foreign material. Solvent shall be applied to the joint and joint made as recommended by the manufacturer. Excess solvent shall be wiped off. Joint should not be moved until sufficiently set up.

- C. Bell and Spigot Joints: Clean bell and spigot ends prior to jointing. Ends of field cut pipe shall be beveled with file. Gasket shall be clean and lightly lubricated. Joint shall be made as recommended by the manufacturer.

3.06 VALVES AND FITTINGS

- A. Install buried valves on top of an 18-inch square, 3-inch thick, solid concrete pad (minimum dimensions). The concrete pad may be provided by a pre-cast manufacturer or cast-in-place in the field above grade. Concrete used for the pads shall be a minimum 3,000 psi mix. The pads may not be cast-in-place in the pipe trench. Connection to pipe shall be such that there shall be no stress at the joint caused by misalignment or inadequate support of pipe or valve.
- B. Valve Box: Set a valve box over each buried valve. Support box so that no stress shall be transmitted to the valve or pipe line. Install box plumb and set top flush with finished grade. Operating nut shall be centered in box. Provide a 24-inch x 24-inch wide by 6-inch thick concrete pad at top of valve boxes outside paved areas.
- C. Valve operation nut shall be within 30 inches of the top of box. Provide stem extension if necessary to bring operating nut to within 30 inches of the top of box.
- D. Install fittings as recommended by the manufacturer. Fittings shall be blocked or otherwise restrained from movement.
- E. Install valves, gates, and accessories indicated on the Drawings and in complete accordance with the manufacturer's recommendations.
- F. Install air / vacuum valve inside a manhole.

3.07 POST INDICATOR VALVE

- A. Post indicator shall be installed plumb and such that the top of the post is 36" above finished grade.
- B. The "OPEN" and "SHUT" targets shall be set for the appropriate valve size.
- C. Coordinate installation of tamper switch with electrical contractor. Mount switches so not to interfere with the normal operation of the valve and shall be adjusted to operate within two revolutions of the valve control or when the stem has moved no more than one-fifth of the distance from its normal position.

3.08 MANHOLES

- A. Provide 12 inches of No. 67 stone base to extend a minimum of 6 inches beyond the manhole base.
- B. Set base plumb and level. Align manhole invert with pipe invert.
- C. Secure pipe connectors to pipe in accordance with manufacturer's recommendation.
- D. Clean bells and spigots of foreign material that may prevent sealing. Unroll the butyl sealant rope directly against base of spigot. Do not stretch. Follow manufacturer's instructions when using O-ring seals.
- E. Set precast components so that steps align.
- F. Plug lift holes using a non-shrink grout. Cover with a butyl sealant sheet on the outside and seal on the inside with an application of an epoxy gel 1/8-inch thick extending 2 inches beyond the opening.
- G. Set manhole frames to grade with grade rings. Seal joints between cone, adjusting rings, and manhole frame with butyl sealant rope and sheet.

- H. Encase manhole rings in a concrete collar 18-inches wide by 6-inches thick of 3,000 psi concrete beneath paved surfaces.
- I. Finish the interior by filling fractures greater than 1/2 inch in length, width or depth with a sand cement mortar. Do not fill the joints between the precast components.
- J. Clean the interior of the manhole of foreign matter.

3.09 METERS

- A. Install meter boxes and water service components so top of meter will be within 6 inches of the surface.
- B. The Owner will install water meter.

3.10 HYDRANT

- A. Set hydrant in accordance with County requirements.

3.11 PAINTING

- A. Equipment shall receive the manufacturer's standard coating for the intended application. Coatings shall be suitable for the intended application.
- B. Repaint damaged paint services.
- C. Above ground piping and piping within vaults shall be painted in accordance with Section, Painting.

3.12 BACKFLOW PREVENTION TESTING

- A. Install and test Backflow prevention devices in accordance with the requirements of the local authority having jurisdiction.

3.13 PRESSURE TESTING

- A. Pressure test in accordance with AWWA C600 for ductile iron pipe and AWWA C605 and M23 for PVC pipe and as specified herein
- B. General:
 - 1. The Engineer shall approve the source, quality, and method of disposal of water to be used in test procedures.
 - 2. Obtain Owner's permission 48 hours prior to filling or flushing of pipe system with water from Owner's water system. Owner shall operate valves connected to the existing water system. Where large quantities of water may be required for flushing, Owner reserves the right to require that flushing be done at periods of low demand.
 - 3. Clean and flush pipe system of foreign matter prior to testing.
 - 4. Provide air vents at the high points in the line section to be tested for releasing of air during filling. Service corporation stops may be used for air vent when located at a high point. Include cost of air vents in price of testing. Leave corporation stops in place after testing and note locations on As-Built Drawings.
 - 5. Allow concrete blocking to reach design strength prior to pressure testing.
 - 6. Test main prior to installation of service taps.
 - 7. Repair defects in the pipe system. Make repairs to the same standard as specified for the pipe system.
 - 8. Retest repaired sections until acceptance.
 - 9. Repair visible leaks regardless of the test results.
 - 10. Pipe sections shall not be accepted and placed into service until specified test limits have been met.

C. Testing

1. Notify Owner and Engineer a minimum of 48 hours prior to testing.
2. Perform tests in the presence of Engineer.
3. Make pressure tests between valves. Furnish suitable test plugs where line ends in "free flow."
4. Upon completing a section of pipe between valves, test pipe by maintaining for a two hour period a hydrostatic pressure of 150 psig.
5. Test pressure shall not vary by more than +/- 5 psi for the duration of the test.
6. No length of line shall be accepted if the leakage is greater than that determined by the following formula based on the appropriate test pressure:
L = Allowable leakage per 1,000 feet of pipe in gallons per hour.
D = Nominal diameter of the pipe in inches.
100 psi: $L = D \times 0.07$
150 psi: $L = D \times 0.08$
200 psi: $L = D \times 0.09$
250 psi: $L = D \times 0.10$

3.14 DISINFECTION

- A. After satisfactory completion of the pressure test, disinfect new potable water mains and existing mains that have required repair in accordance with AWWA C651 and as specified herein. Disinfect water mains in a maximum length per day of 2,000 feet.
- B. General:
 1. Provide a superintendent experienced in the required procedures for disinfecting with chlorine.
 2. Obtain Owner's permission 48 hours prior to filling, flushing, and chlorinating of the water mains. Owner shall operate valves connected to the existing water system.
 3. Do not allow highly chlorinated water into the existing distribution system.
 4. If there is any question that the chlorinated discharge will cause damage to the environment, a reducing agent shall be applied to the water to neutralize the residual chlorine. Federal, state, or local environmental regulations may require special provisions or permits prior to disposal of highly chlorinated water.
 5. Perform disinfection and testing in presence of Engineer.
- C. Connection to Existing System: Notify Owner 48 hours prior to making connections to the existing system. Thoroughly clean the existing water main exterior prior to the installation of tapping sleeves and corporation stops. Lightly dust with calcium hypochlorite powder the water main exterior and the interior surface of the tapping sleeve, and corporation stops.
- D. After satisfactory flushing of the main, disinfect by the injection of a chlorine solution. Induce chlorine in sufficient quantity to maintain a chlorine residual of at least 50 ppm throughout the system to be tested. Maintain the chlorine solution in the system for at least 24 hours.
- E. Valves and Fire Hydrants: Open and close valves on the mains being disinfected a minimum of three times during the chlorine contact period and a minimum of three times during flushing. Fire hydrants and other appurtenances should receive special attention to insure proper disinfection.

- F. For Cut-In Construction: Use the following procedures for disinfecting of the new installation and the existing main at the cut-in point in accordance with AWWA C651, Section 9:
 - 1. Apply liberal quantities of hypochlorite, in the form of tablets, to the open trench.
 - 2. Interior of new pipe and fittings and the ends of the existing mains shall be swabbed or sprayed with a one percent hypochlorite solution before installation.
 - 3. Install a 2-inch tap downstream of the work area. Tap shall be used for blowing off the main, or use the next fire hydrant downstream of the work area for blowing off the main.
 - 4. Install a 2-inch tap just upstream of the new installation. Control Water from the existing system so as to flow slowly into the work area during the application of chlorine. After the line is thoroughly flushed, add chlorine solution at a concentration of 100 ppm by the continuous feed method and hold in the main for one (1) hour.
- G. Prior to flushing, the free chlorine residual shall be a minimum of 10 ppm. Flushing of the lines shall proceed until the lines contain the normal chlorine residual of the system.
- H. Test in the field for free chlorine residual:
 - 1. Sample location shall be the same as required for the bacteriological test samples.
 - 2. Immediately after injection of the chlorine solution. Sample shall have a chlorine residual as specified.
 - 3. Prior to flushing of the highly chlorinated water from the potable water system and a minimum of 24-hours after the initial injection of the chlorine. Sample shall have a minimum chlorine residual as specified.

3.15 BACTERIOLOGICAL TESTING

- A. Required location for obtaining water samples:
 - 1. Every 2,000 lf
 - 2. End of each main.
 - 3. A minimum of one from each branch.
 - 4. Mains at cut-in locations: Each side of work area. Time between samples to be determined by County.
- B. A laboratory, certified for the required testing by the State of North Carolina, shall collect the sample and perform the testing. The laboratory shall be the same for both sampling and testing.
- C. Obtain two water samples at each specified location for the bacteriological testing. Take the first sample immediately after flushing of the chlorinated water and again in 24-hours.
- D. Recommended additional samples. During the required sampling of water from the new system, it is recommended that samples be taken from the existing potable water source to determine if coliforms are present.
- E. Care in sampling. No hose or fire hydrant shall be used for the collection of samples. Take samples from an approved sample tap consisting of a corporation stop installed in the main with a copper tube gooseneck assembly. Operation shall be such as to ensure that the sample collected is actually from water that has been in the new system. Copper tube gooseneck assembly shall be removed and sample tap corporation stop shut off upon completion of testing bacteriological testing is requirements.

- F. Test samples for the presence of coliform organisms in accordance with the latest edition of Standard Methods for the Examination of Water and Wastewater. Testing method used shall be the multiple-tube fermentation technique, the membrane-filter technique, or presence/absence.
- G. Test for odor. The water in the new system should also be tested to assure that no offensive odor exists due to chlorine reactions or excess chlorine residual.
- H. If samples show the presence of coliform, procedure 1 or 2 described below shall be followed, with the approval of the Owner, before placing the unit or facility in service.
 - 1. Take repeat samples at least 24 hours apart until consecutive samples do not show the presence of coliform.
 - 2. Again subject the system to chlorination and sampling as described in this section.
- I. If samples are free of coliform, and with the approval of the County, the potable water system may be placed in service.
- J. Contamination: If, in the opinion of the Engineer, possible contaminants have entered the existing water system, or water samples show the water in the existing system to be unsafe on completion of the work, the existing water system shall be disinfected as specified herein and shall include all contaminated components. Disinfection of the existing system shall be coordinated with the County.

3.16 VALVE OPERATION

- A. Prior to final acceptance provide competent personnel to operate each valve in presence of Engineer. Verify that valves are left in the open position.

END OF SECTION

SECTION 02530

SANITARY SEWER SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Work under this section includes, but is not limited to, piping, valves, and appurtenances for a complete sanitary sewer collection system.

1.02 RELATED SECTIONS

- A. The following Sections have work that is directly related to this Section. This does not relieve the Contractor of his responsibility of proper coordination of all the work:
1. Section 02315 Trenching for Utilities
 2. Section 02445 Bore & Jack of Conduits.

1.03 REFERENCES

- A. Publications are referred to in the text by basic designation only.
1. American Society for Testing and Materials (ASTM)
 - a. A126 Gray iron Castings and Valves, Flanges and Pipe Fittings.
 - b. C361 Reinforced Concrete Low-Head Pressure Pipe.
 - c. C443 Flexible Watertight Joints for Precast Manhole Sections
 - d. C478 Precast Reinforced Concrete Manhole Sections
 - e. C828 Low-Pressure Air Test of Vitrified Clay Pipe Lines (4 to 12 inch)
 - f. C890 Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
 - g. C923 Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
 - h. C1244 Test Method for Concrete Sewer Manholes by the Negative Air Pressure
 - i. D1248 Polyethylene Plastics Molding and Extrusion Materials
 - j. D1784 Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
 - k. D2241 Poly(Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series)
 - l. D 2321 Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
 - m. D2680 Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Pipe
 - n. D3034 Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - o. D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
 - p. D3350 Polyethylene Plastics Pipe and Fittings Materials
 - q. F477 Elastomeric Seals (Gaskets) for Joining Plastic Pipe
 - r. F794 Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
 - s. F949 Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings
 - t. F894 Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
 - u. F1483 Specification for Oriented Poly(Vinyl Chloride) PVCO, Pressure Pipe

2. American Water Works Association (AWWA)
 - a. C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
 - b. C105 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
 - c. C110 Ductile-Iron and Gray-Iron Fittings, 3 inch through 48 inch, for Water and Other Liquids
 - d. C115 Flanged Ductile-Iron Pipe with Threaded Flanges
 - e. C151 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
 - f. C153 Ductile-Iron Compact Fittings, 3 inch through 16 inch, for Water and Other Liquids
 - g. C504 Rubber-Seated Butterfly Valves
 - h. C507 Ball Valves, 6 inch through 48 inch
 - i. C508 Swing-Check Valves for Waterworks Service, 2 inch Through 24 inch NPS
 - j. C509 Resilient-Seated Gate Valves for Water Supply Service
 - k. C512 Air-Release, Air / Vacuum, and Combination Air Valves for Waterworks Service
 - l. C550 Protective Epoxy Interior Coatings for Valves and Hydrants
 - m. C600 Standard for Installation of Ductile Iron Water Mains and Their Appurtenances
 - n. C605 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
 - o. C900 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch through 12 inch, for Water Distribution
 - p. C906 Polyethylene (PE) Pressure Pipe and Fittings 4 inch through 63 inch for Water Distribution
 - q. M23 PVC Pipe - Design Installation
3. National Sanitation Foundation (NSF) Standards
 - a. 14 Plastic Piping Components and Related Materials
4. UNI-BELL Plastic Pipe Association (UNI)
 - a. B-5 Recommended Practice for the Installation of Polyvinyl Chloride (PVC) Sewer Pipe
 - b. B-6 Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe

1.04 SUBMITTALS

- A. Submit the following in accordance with Section, Submittal Procedures:
 1. Affidavit of Compliance: Affidavit shall attest that supplied products conform to the referenced standard and this specification and that tests set forth in each applicable referenced publication have been performed and that test requirements have been met. Submit for each of the following materials:
 - a. Pipe
 - 1) Ductile iron
 - 2) Polyvinyl Chloride (PVC) pressure pipe
 - i) AWWA C900
 - ii) Pressure rated
 - iii) Schedule 40 & 80
 - 3) Polyvinyl Chloride (PVC) gravity sewer pipe
 - i) SDR 35
 - ii) Schedule 40, drain, waste, and vent (DWV) pipe

- b. Pre-cast concrete manholes
 - c. Valves
 - 1) Resilient-seated gate
 - 2) Plug
 - 3) Check
 - 4) Air Release
2. Catalog Data: Submit manufacturer's standard drawings or catalog cuts for the following. Clearly indicate equipment to be furnished for the Project including options to be provided.
- a. Pipe
 - 1) Ductile iron
 - 2) Ductile Iron with restrained joints
 - 3) Polyvinyl Chloride (PVC) pressure pipe
 - i) AWWA C900
 - ii) Pressure rated
 - iii) Schedule 40 & 80
 - 4) Polyvinyl Chloride (PVC) gravity sewer pipe
 - i) SDR 35
 - ii) Schedule 40, drain, waste, and vent (DWV) pipe
 - b. Pre-cast Concrete Manholes and the following appurtenances:
 - 1) Manhole steps
 - 2) Pipe connectors
 - 3) Joint material
 - 4) Castings
 - c. Service saddles
 - d. Valves
 - 1) Resilient-seated gate
 - 2) Plug
 - 3) Check
 - 4) Air Release
3. Reports:
- a. Field test report for each section of pipe for the following:
 - 1) Pressure test for force mains.
 - 2) Low-pressure air test for gravity mains.
 - 3) Vacuum test for manholes.
4. Operation and Maintenance Instructions: Submit complete operation and maintenance manual for the following:
- a. Valves.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Provide a suitable pipe hook or rope sling when handling the pipe with a crane. Lifting of the pipe shall be done in a vertical plane. Under no conditions shall the sling be allowed to pass through the pipe unless adequate measures are taken to prevent damage to both tongue and groove ends.
- B. Deliver pipe in the field as near as practicable to the place where it is to be installed. Distribute pipe along the side of the trench opposite to the spoil bank. Where necessary to move the pipe longitudinally along the trench, it shall be done in such a manner as not to injure the pipe or coating.
- C. Shield PVC pipe and fittings stored on site from the sun's ultraviolet rays by suitable cover, or indoor storage.

PART 2 PRODUCTS

2.01 DUCTILE-IRON PIPE

- A. Pipe and fittings shall conform to the following requirements:
 - 1. Size shall be as indicated on the Drawings.
 - 2. Suitable for a system working pressure of 150 psi.
 - 3. Interior of pipes and fittings shall be lined with virgin polyethylene complying with ASTM D1248, compounded with an inert filler and with sufficient carbon black to resist ultraviolet rays during above ground storage of the pipe and fittings. The polyethylene shall be bonded to the interior of the pipe or fitting by heat. The lining shall be 40 mils nominal thickness and a minimum of 30 mils. The lining shall be American Polybond, U.S. Polylined or approved equal.
- B. Ductile-iron pipe for below ground service shall have push-on or mechanical joints, unless noted otherwise on the Drawings, conform to AWWA C151, and to the following requirements:
 - 1. Pipe thickness class shall be suitable for a laying condition as specified in Section, Trenching for Utilities, at the depth indicated on the Drawings, and at the system working pressure specified above.
 - 2. Provide mechanical joint fittings, unless noted otherwise on the Drawings.
 - 3. Encase pipe in polyethylene conforming to AWWA C105.
- C. Ductile-iron pipe for above ground service shall have flanged joints, unless noted otherwise on the Drawings, and conform to AWWA C115.
 - 1. Pipes to be painted shall have only a shop primer on the outside by the manufacturer. Verify that proposed manufacturer's primer is compatible with the proposed paint system.
- D. Fittings for ductile-iron pipe shall conform to AWWA C110, or C153 and to the following requirements:
 - 1. Joint type shall be as specified above for the supplied ductile-iron pipe.
 - 2. Fittings shall be made of gray-iron or ductile-iron.
- E. Ductile iron pipe on piers shall have Mech-Lok™ rigid restrained joint by Griffin Pipe Products Co. or approved equal.
- F. Special Pipe Joints
 - 1. River Crossing (Ball Joint)
 - a. Boltless
 - b. Bolted
 - 2. Restrained
 - a. Provide restrained joint pipe at fittings and valves where indicated on the Drawings. Length of restrained pipe shall be as shown. Restrained joints shall be Snap-Lok (Griffin Pipe), Flex Ring and Lok-Ring (American), TR Flex (U.S. Pipe) or approved equal.
 - b. Restrained joint pipe and fittings shall meet all AWWA standards and other requirements as specified above for standard ductile iron pipe and fittings unless addressed herein.
 - c. Field made joints are allowable but should be avoided where possible. Careful planning to locate field cuts in standard pipe sections is preferred. For field made joints in restrained piping, use field weldments or an insert equal to TR Flex Gripper Rings or approved equal. Gasket type field made joints will not be allowed.

- d. Restrained joint fittings shall be provided by the restrained joint pipe supplier for where located within restrained joint pipe sections. Fittings shall be of the same model as the pipe supplied from the pipe manufacturer.
- e. Restrained joint fittings may be push-on joint type.
- f. Megalugs, Series 1100, as manufactured by EBAA Iron Sales shall be allowable for restraint where fittings or valves are not available with restrained joints.
- g. Where additional fittings/valves are required and not shown on Drawings, consult with Engineer for length of restrained joint pipe necessary each side of fittings/valve prior to installation of pipe/fitting.
- h. Contractor shall develop a field layout schedule and drawing for restrained joint pipe installations.

2.02 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

A. General

- 1. Pipe and fitting size shall be as indicated on the Drawings.
- 2. PVC materials shall comply with ASTM D1784 with a cell classification of 12454-B.
- 3. Pipe used for potable water systems shall comply with NSF 61.
- 4. Pipe used for reclaimed water system shall be colored purple (Pantone 522) and embossed on opposite sides every three feet with the words "Caution – Reclaimed Water – Do Not Drink."

B. AWWA C900: C900 PVC pipe 4-inch to 12-inch shall conform to AWWA C900 and the following requirements:

- 1. Outside diameter shall conform to ductile-iron pipe.
- 2. Pipe shall be a minimum pressure class 200 with a minimum standard dimension ratio of DR 21.
- 3. Pipe shall have plain end and elastomeric-gasket bell ends.
- 4. Fittings shall conform to AWWA C110, or C153 and have mechanical joints. Fittings shall be made of gray-iron or ductile-iron. Interior of fittings shall be cement-mortar lined with seal coat in accordance with AWWA C104.

C. Pressure Rated: Pressure Rated (PR) PVC pipe 1-1/2-inch to 12-inch shall conform to ASTM D2241 and the following requirements:

- 1. Pipe shall be pressure rated 200 with a standard dimension ratio of SDR 21.
- 2. Pipe shall have an integral elastomeric-gasket bell end. The joints and gaskets shall comply with ASTM D3139 and ASTM F477.
- 3. Fittings for pipe 3-inch and larger shall conform to AWWA C110, or C153 and have mechanical joints with transition gaskets as required for the pipe outside diameter. Fittings shall be made of gray-iron or ductile-iron. Interior of fittings shall be cement-mortar lined with seal coat in accordance with AWWA C104.

D. Schedule 40 & 80: Schedule 40 & 80 PVC pipe 1/2-inch to 12-inch shall conform to ASTM D1785 and the following requirements:

- 1. Outside diameter shall conform to iron pipe.
- 2. Pipe shall be schedule 40 or 80.
- 3. Pipe shall have an integral elastomeric-gasket bell end or solvent weld joints.
- 4. Fittings for the pipe shall conform to ASTM D2466 or D2467 as appropriate for the pipe schedule.

2.03 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

A. General

1. Pipe and fitting size shall be as indicated on the Drawings.
2. PVC materials shall comply with ASTM D1784 with a cell classification of 12454-B.
3. Pipe shall have an integral elastomeric-gasket bell end. Gaskets shall be in conformance with ASTM F477.
4. See Section, Trenching for Utilities, for trench bedding and haunching requirements.

B. SDR 35: PVC SDR 35 gravity sewer pipe 4-inch to 15-inch and related fittings shall conform to ASTM D-3034 and the following requirements:

1. Pipe shall have standard dimension ratio of SDR 35.
2. Nominal pipe length shall be a minimum of 13 feet.

2.04 MANHOLES

A. Provide manholes made of precast concrete sections in conformance with ASTM C478, NC Department of Transportation, and the following requirements:

1. General

- a. Provide manholes to the depth as indicated on the Drawings. Manhole inside diameter shall be 4 feet unless noted otherwise on the Drawings.
- b. Precast concrete manholes shall be as manufactured by Adams Concrete, Carolina Precast Concrete, Inc., D & M Concrete Specialties, Inc., N. C. Products Corp., Stay Right Tank, Tindall Concrete Products, Inc. or approved equal.

2. Precast Concrete Sections

- a. Minimum wall thickness shall be 5-inches.
- b. Base: Cast monolithically without construction joints or with an approved PVC waterstop in the cold joint between the base slab and the walls. The width of the base extensions on Extended Base Manholes shall be no less than the base slab thickness.
- c. Riser: Minimum lay length of 16 inches.
- d. Eccentric Cone: Top inside diameter shall be 24 inches. Width of the top ledge shall be no less than the wall thickness required for the cone section.
- e. Transition Cone: Provide an eccentric transition from 60-inch and larger manholes to 48-inch diameter risers, cones, and flat slab top sections. Minimum slope angle for the cone wall shall be 45 degrees.
- f. Transition Top: Provide an eccentric transition from 60-inch and larger manholes to 48-inch diameter risers, cones, and flat slab top sections. Transition Top sections shall be furnished with vents as shown on the manhole details. Tops shall not be used in areas subject to vehicle traffic.
- g. Flat Slab Top: Designed for HS-20 traffic loadings as defined in ASTM C890. Items to be cast into Special Flat Slab Tops shall be sized to fit within the manhole ID and the top and bottom surfaces. Provide a float finish for exterior slab surface.
- h. Precast or core holes for pipe connections. Diameter of hole shall not exceed outside diameter of pipe by more than 3-inches.
- i. Grade Rings: May be used to adjust frame and cover to finished grade. Grade Rings shall be no less than 4 inches in height.
- j. Lifting Devices: Devices for handling precast components shall be provided by the precast manufacturer and comply with OSHA Standard 1926.704.

3. Joints
 - a. Manufacturer in accordance with tolerance requirements of ASTM C 990 for butyl type joints.
 - b. Minimize number of joints. Do not use riser section for manholes up to 6 feet tall and no more than one riser for each additional 4 feet in height.
 - c. Flexible Joint Sealants: Preformed butyl rubber based sealant material conforming to Federal Specification SS-S-210A, Type B and ASTM C990.
 - d. External Seal: Polyethylene backed flat butyl rubber sheet no less than 1/16-inch thick and 6-inches wide.
4. Inverts
 - a. Brick and mortar or precast concrete invert.
 - b. Form and finish invert channel to provide a consistent slope from inlet(s) to outlet up to 4-inches.
 - c. Channel walls shall be formed to 3/4 of the height of the outlet pipe diameter.
 - d. Finish benches with a minimum uniform 1.5:12 slope. Provide a 1/4-inch radius at the edge of bench and trough.
5. Flexible Pipe Connectors: Provide flexible connectors for pipe to manhole that conform to ASTM C923. Location of connectors shall vary from Project Drawings no more than 1/2-inch vertically and 5 degrees horizontally. Provide stainless steel pipe clamp type band around flexible connection to sewer pipe.
6. Manhole Steps:
 - a. Steps shall be in accordance with ASTM C478 and made of 1/2-inch grade 60 steel encapsulated by co-polymer polypropylene and have serrated tread and tall end lugs.
 - b. Secure steps to the wall with compression fit in tapered holes or cast-in-place. Align steps along a vertical wall and shall not be located over a pipe opening. First step shall be a maximum of 26 inches from the bottom.
 - c. Steps shall be by American Step Co., Inc., Bowco Industries, Inc., M. A. Industries, Inc. or approved equal.

2.05 CASTINGS

A. General

1. Made of gray iron, ASTM A-48 - class 30, or ductile iron, ASTM A536, grade 65-45-12.
2. Castings shall be free from imperfections not true to pattern. Casting tolerances shall be plus or minus 1/16-inch per foot of dimension. Top shall set neatly in frame, with edges machined for even bearing and proper fit to prevent rattling and flush with the edge of frame.
3. Castings shall be as manufactured by Neenah Foundry Co., U.S. Foundry & Manufacturing Corp., or Vulcan Foundry

B. Manhole Frame and Cover:

1. Minimum clear opening shall be 22 inches.
2. Minimum weight for frame and cover shall be 300 pounds and suitable for Heavy Duty Highway Traffic Loads of H-20.
3. Frame shall have four 3/8-inch anchor bolt holes equally spaced.
4. Cast "Sanitary Sewer" on the cover. Casting shall bear the name of the manufacturer and the part number.
5. Provide solid cover.

6. Provide cover with two 1-inch perforated holes unless noted as watertight on the Drawings.
7. Provide the following where indicated on the Drawings:
 - a. Ring and cover shall be watertight.
 - b. Bolt down cover. Bolt down covers shall be provided with four (4) 3/8-inch stainless steel hex head bolts at 90 degrees.

2.06 SEWER SERVICE

- A. Provide PVC service wye the same material as the main. Saddles shall be solvent welded and fastened with double stainless steel bands.

2.07 VALVES

- A. General: Valves shall meet the following requirements:
 1. Size shall be as required for the pipe size and material as indicated on the Drawings and specified.
 2. Open by counterclockwise rotation.
 3. Standard system working pressure is pressure psi.
 4. Equip valves with a suitable means of operation.
 5. For buried valves over 5 feet deep, provide extension stems of cold rolled steel to bring the operating nut to within 2 feet of the ground surface.
 6. Provide valve accessories as required for proper valve operation for valve locations as indicated on the Drawings and as recommended by valve manufacturer.
 7. Valve accessories shall be compatible to proper valve operation.
 8. Similar valve types shall be of one manufacturer.
- B. Gate Valves, Resilient-Seated: Gate valves 3-inch to 20-inch shall conform to AWWA C509 for and to the following requirements:
 1. O-ring stem seal on non-rising (NRS) stem valves.
 2. Ends shall be mechanical joint for underground locations and flanged joint for above ground locations.
 3. Valves shall be non-rising stem (NRS) with wrench nut for underground locations and Outside Screw and Yoke (OS&Y) with handwheel for above ground locations unless noted otherwise on the Drawings.
 4. Be of one manufacturer.
 5. Special material for bolts and nuts.
- C. Plug Valves: Plug valves shall conform to the following requirements:
 1. Plug valves shall be of the non-lubricated, eccentric type designed for a working pressure of 175 psi for valves 12 inch and smaller, 150 psi for valves 14 inch and larger.
 2. Valves shall provide tight shut-off at rated pressure.
 3. The plug valve body shall be cast iron ASTM A126 Class B with a welded-in overlay of not less than 90% nickel alloy content on all the surfaces contacting the face of the plug.
 4. The valve plug shall be constructed of cast iron conforming to ASTM A126 Class B, with Buna N resilient seating surface to mate with the body seat.
 5. Valve flanges shall be in accordance with ANSI B16.1 Class 125.
 6. Shaft bearings shall be sleeve-type, sintered, oil impregnated, and permanently lubricated stainless steel.
 7. Plug valve shaft seals shall be of the multiple V-ring type and shall be adjustable. Sealing system shall conform to AWWA C504 and C507 standards.

All packing shall be replaceable without removing the bonnet or actuator and while valve is in service.

8. Valves 6" and larger shall be provided with gear actuators.
 9. Provide levers or hand wheels to operate the valve as recommended by the manufacturer.
 10. Full ported (i.e.100% flow area) and piggable.
- D. Swing Check Valves: Swing check valves from 2 to 24 inch shall conform to AWWA C508 and to the following requirements:
1. Provide lever and weight for swing check control.
 2. Resilient material to Metal seat construction.
 3. Ends shall be flanged.

2.08 AIR VALVES

- A. Provide air valves in conformance with AWWA C512 and the following:
1. Valve type shall be a combination valve.
 - a. Inlet size: 2 inch
 - b. Large orifice minimum: 1 inch
 - c. Small orifice minimum: 1/8 inch
 2. Valve shall be designed for the following automatic operation:
 - a. Release of large quantities of air during the filling of the main.
 - b. Permit air to enter the main when it is being emptied.
 - c. Release accumulated air while the main is in operation and under pressure.
 3. Valve shall be designed for a system pressure 150 psi. Valve shall also operate at a minimum system pressure of 20 psi.
 4. Provide threaded inlet.
 5. Provide stainless steel ball float and wetted internal parts.
 6. Provide isolating bronze ball valve for connection to main line.
 7. For sewage force mains provide tall body to minimize possibility of sewage plugging orifice or linkage.
 8. Sewage force main valve shall include backwash accessories. They shall include bronze flushing ball valves and 5 feet of rubber hose with quick-connect coupling on each end.
 9. Shall be installed in 5 FT diameter flat top manhole.

2.09 VALVE BOX

- A. Valve Box, Below Ground: Boxes shall be high strength cast iron of the screw or telescopic type. Box shall consist of a base section, center extension as required, and a top section with cover marked "SEWER."

2.10 THRUST BLOCKING

- A. Provide concrete thrust blocking for pressure lines in accordance with the detail on the Drawings.
- B. Thrust blocking is not required where restrained joint fittings and equivalent length of restrained joint pipe are used unless shown otherwise on the Drawings.

PART 3 EXECUTION

3.01 GENERAL

- A. Pipe installation shall meet the following general guidelines:
 - 1. Lay pipe in the presence of Owner's Representative, unless specifically approved otherwise.
 - 2. Handle pipe and accessories in accordance with manufacturer's recommendations. Take particular care not to damage pipe coatings.
 - 3. Carefully inspect pipe immediately prior to laying. Do not use defective pipe. Replace pipe damaged during construction.
 - 4. Lay pipe to grade and alignment indicated on the Drawings.
 - 5. Provide proper equipment for lowering pipe into trench.
 - 6. Provide tight closure pipe ends when work is not in progress.
 - 7. Keep pipe interior free of foreign materials.
 - 8. Do not lay pipe in water or when the trench or weather conditions are unsuitable for the work.
 - 9. Clean bell and spigots before joining. Make joints and lubricate gasket in accordance with pipe manufacturer recommendation.
 - 10. Block fittings with concrete, or restrained as indicated on the Drawings or as required to prevent movement.
- B. Gravity Pipe: Gravity pipe installation shall meet the following general guidelines:
 - 1. Lay pipe upgrade from the lower end and at the grades and alignment indicated on the Drawings.
- C. A complete set of As-Builts shall be provided to the County.

3.02 RELATION OF WATER MAINS TO SEWERS

- A. Lateral Separation: Lay water mains at least 10 feet laterally from existing and proposed sewers. Where existing conditions prevent a 10-foot lateral separation, the following shall be followed with approval of the County:
 - 1. Lay water main in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
 - 2. Lay water main in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer.
- B. Crossing Separation: Lay bottom of water main at least 18 inches above the top of the sewer. Where existing conditions prevent an 18-inch vertical separation, construct both the water main and sewer of ferrous materials and with joints that are equivalent to water main standards for a distance of 10 feet on each side of the point of crossing.
- C. Crossing a Water Main Under a Sewer: When it is necessary for a water main to cross under a sewer, construct both the water main and the sewer of ferrous materials and with joints equivalent to water main standards for a distance of 10 feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

3.03 SEWER PIPE

- A. Lay sewer pipe to true lines and grades by use of laser beam equipment or other acceptable means.

- B. Minimum Separation Distances:
 - 1. 100-foot horizontal separation from wells or other water supplies.
 - 2. 24-inch vertical separation from storm sewers or ferrous pipe shall be used.
 - 3. For separation from water mains see paragraph 3.02 above.

3.04 DUCTILE IRON PIPE

- A. Install pipe in conformance with AWWA C600 and the following:
 - 1. For laying pipe in a vertical or horizontal curve, each full length pipe may be deflected by the following offset distance:
 - a. Push-on joint
 - 1) 3 to 12-inch pipe: 14-inch offset
 - 2) 14 to 36-inch pipe: 8-inch offset
 - b. Mechanical joint
 - 1) 3 to 6-inch pipe: 20-inch offset
 - 2) 8 to 12-inch pipe: 15-inch offset
 - 3) 14 to 20-inch pipe: 8-inch offset
 - 4) 24 to 36-inch pipe: 6-inch offset
 - 2. For laying restrained joint pipe in a vertical or horizontal curve, except for horizontal directional drills (HDD), each full length pipe may be deflected by the following offset distance:
 - a. 6 to 12-inch pipe: 11-inch offset
 - b. 16 to 20-inch pipe: 7-inch offset
 - c. 24 to 30-inch pipe: 5-inch offset
 - d. 36-inch pipe: 4-inch offset
 - e. 42 to 48-inch pipe: 1 ¼ -inch offset

3.05 PVC PRESSURE PIPE

- A. Install PVC C900 pipe in conformance with AWWA C605.
- B. Solvent Weld: Where indicated in these specifications or on the plans, solvent weld type joints shall be used. Field cut ends shall be sanded to roughing the surface. Joints shall be cleaned of foreign material. Solvent shall be applied to the joint and joint made as recommended by the manufacturer. Excess solvent shall be wiped off. The joint should not be moved until sufficiently set up.
- C. Bell and Spigot Joints: Clean bell and spigot ends prior to jointing. Ends of field cut pipe shall be beveled with file. Gasket shall be clean and lightly lubricated. Joint shall be made as recommended by the manufacturer.

3.06 VALVES AND FITTINGS

- A. Install buried valves on top of an 18-inch square, 3-inch thick, solid concrete pad (minimum dimensions). The concrete pad may be provided by a pre-cast manufacturer or cast-in-place in the field above grade. Concrete used for the pads shall be a minimum 3,000 psi mix. The pads may not be cast-in-place in the pipe trench. Connection to pipe shall be such that there shall be no stress at the joint caused by misalignment or inadequate support of pipe or valve.
- B. Install fittings as recommended by the manufacturer. Fittings shall be blocked or otherwise restrained from movement.
- C. Valve Boxes: Set valve boxes flush with finished grade. Box shall be supported so that no stress shall be transmitted to the valve. Operating nut shall be centered in box.

- D. Install valves, gates, and accessories indicated on the Drawings and in complete accordance with the manufacturer's recommendations.
- E. Valve boxes shall be set straight with the operating nut centered and supported on (2) 4" concrete blocks, to prevent load transfer onto valve body or pipe line. Set top of box at finished grade. Provide a 24-inch x 24-inch wide by 6-inch thick concrete pad at top of valve boxes outside paved areas.

3.07 AIR VALVES

- A. Main shall be drilled for a two inch connection.
- B. Valve shall be installed on the main line with a service saddle.
- C. Install air valve in a five (5) foot diameter flat top manhole.

3.08 MANHOLES

- A. Set base plumb and level. Align manhole invert with pipe invert.
- B. Secure pipe connectors to pipe in accordance with manufacturer's recommendation.
- C. Clean bells and spigots of foreign material that may prevent sealing. Unroll the butyl sealant rope directly against base of spigot. Do not stretch. Follow manufacturer's instructions when using O-ring seals.
- D. Set precast components so that steps align.
- E. Plug lift holes using a non-shrink grout. Cover with a butyl sealant sheet on the outside and seal on the inside with an application of an epoxy gel 1/8-inch thick extending 2 inches beyond the opening.
- F. Set manhole frames to grade with grade rings. Seal joints between cone, adjusting rings, and manhole frame with butyl sealant rope and sheet.
- G. Apply external seal to the outside of joint.
- H. Finish the interior by filling fractures greater than 1/2-inch in length, width or depth with a sand cement mortar.
- I. Clean the interior of the manhole of foreign matter.

3.09 SEWER CLEANOUTS

- A. Sewer cleanouts connected to ductile iron pipe shall also be ductile iron sewer pipe conforming to these specifications.
- B. Sewer cleanouts connected to PVC pipe shall also be PVC sewer pipe schedule 40 conforming to ASTM-D-3034 latest revision. Use elastomeric gaskets for pipe joints.
- C. Service wyes shall be used on new PVC pipe. Service saddles shall be used on existing PVC, solvent welded to the main and fastened with double stainless steel bands.
- D. Cleanouts shall be a minimum of 4-inch diameter unless noted otherwise on the Drawings. Provide sewer cleanouts with screw-in watertight cap. Installation shall be in accordance with the details as shown on the Drawings.

3.10 SERVICE CONNECTIONS

- A. Make service connections in accordance with the standard detail on the Drawings.

- B. Service connections to the main lines shall be perpendicular to the main line to the edge of the right-of-way or easement line.
- C. Four-inch lines shall have a minimum slope of 1.0 % and have cleanouts every 75 feet at a minimum in addition to a cleanout at the right-of-way line or at the edge of the easement.
- D. Six-inch lines shall have a minimum slope of 0.60 % and have cleanouts every 100 feet at a minimum in addition to a cleanout at the right-of-way line or at the edge of the easement.
- E. 6-inch service lines shall tie directly into a manhole.
- F. Service lines, which are connected into manholes, shall be installed less than 2.5 feet above the invert or shall be installed as a standard drop.
- G. Service connections made using a "ROMAC C" sewer saddle shall be made only when the service line is cast iron soil pipe and when the sewer main is 8-, 10-, or 12-inch diameter concrete, ductile iron, or PVC sewer pipe. This type connection cannot be used on truss sewer pipe. The opening in the sewer main for the "ROMAC C" sewer saddle shall be cut with a hydraulically driven or pneumatically driven circular tapping saw of the same nominal diameter as the sewer service line.

3.11 PAINTING

- A. Equipment shall receive the manufacturer's standard coating for the intended application. Coatings shall be suitable for the intended application.
- B. Repaint damaged paint services.
- C. Above ground piping and piping within vaults shall be painted in accordance with the County's requirements.

3.12 TESTING

- A. General
 1. Clean and flush pipe system of foreign matter prior to testing.
 2. Notify Owner and Engineer a minimum of 48 hours prior to testing.
 3. Perform tests in the presence of Engineer.
 4. Length of line to be tested at one time shall be subject to approval of Engineer.
 5. Pipe sections shall not be accepted and placed into service until specified test limits have been met.
 6. Repair defects in the pipe system. Make repairs to the same standard as specified for the pipe system.
 7. Retest repaired sections until acceptance.
 8. Repair visible leaks regardless of the test results.
- B. Pressure Mains
 1. The Engineer shall approve the source, quality, and method of disposal of water to be used in test procedures.
 2. Obtain Owner's permission 48 hours prior to filling or flushing of pipe system with water from Owner's water system. Owner shall operate valves connected to the existing water system. Keep pipe interior clean during construction to minimize the amount of water required for flushing. Where large quantities of water may be required for flushing, Engineer reserves the right to require that flushing be done at periods of low demand.

3. Pressure test in accordance with AWWA C600 for ductile iron pipe and AWWA C605 and M23 for PVC pipe and the following.
4. Make pressure tests between valves. Furnish suitable test plugs where line ends in "free flow."
5. Provide air vents at the high points in the line section to be tested for releasing of air during filling. Service corporation stops may be used for air vent when located at a high point. Include cost of air vents in price of testing. Leave corporation stops in place after testing and note locations on As-Built Drawings.
6. Allow concrete blocking to reach design strength prior to pressure testing.
7. Force main shall be completely filled with water, all air expelled from the pipe, and the discharge end of the pipeline shall be plugged and adequately blocked before hydrostatic test begins.
8. Upon completing a section of pipe between valves, test pipe by maintaining for a two hour period the following hydrostatic pressure for each main:
 - a. Force main: 150 psig
9. Test pressure shall not vary by more than +/- 5 psi for the duration of the test.
10. No length of line shall be accepted if the leakage is greater than that determined by the following formula based on the appropriate test pressure:
 - L = Allowable leakage per 1,000 feet of pipe in gallons per hour.
 - D = Nominal diameter of the pipe in inches.
 - 100 psi: $L = D \times 0.07$
 - 150 psi: $L = D \times 0.08$
 - 200 psi: $L = D \times 0.09$
 - 250 psi: $L = D \times 0.10$

C. Gravity Sewer Mains

1. Test gravity lines between manholes.
2. Light Testing: Engineer will check for displacement of pipe as follows:
 - a. A light will be flashed between the ends of the pipe section being tested.
 - b. If the illuminated interior shows misalignment, or other defects as designated by County, defects shall be repaired.
3. General
 - a. Infiltration shall not exceed 100 gallons per inch of diameter, per mile of pipe, per 24 hours. County may require flow measurement for verification of infiltration.
 - b. Verify that maximum infiltration rate shall not be surpassed by air testing as follows.
4. Low Pressure Air Test:
 - a. Air testing of sewer mains shall conform to UNI-B-6 and the following requirements:
 - b. Perform initial air test when each section of main is complete including services to right of way. Test as construction proceeds.
 - c. Wet interior surfaces of porous pipe material prior to testing.
 - d. Safety
 - 1) Provide a superintendent who has experience in low pressure air testing of gravity sewer mains.
 - 2) Follow safety recommendations of air testing equipment manufacturer.
 - 3) Properly brace sewer plugs during testing. Test plugs prior to use in air testing.
 - 4) No one shall be allowed in manhole or trench when pipe is under pressure.

- 5) Pressurizing equipment shall include a regulator and a pressure relief valve, which are set no higher than 9 psig. Monitor gauges continuously to assure that the pressure does not exceed 9 psig.
- e. Equipment
 - 1) Sewer plugs shall be specifically designed for low pressure air testing.
 - 2) Use two separate air hoses.
 - i) One to connect the control panel to the sealed line for introducing the air.
 - ii) One from the sealed line to the control panel to provide constant monitoring of the air pressure in the line.
 - iii) If Pneumatic plugs are used a separate line shall be used to inflate the plugs.
 - 3) As a minimum the above ground air testing equipment shall include a shutoff valve, pressure regulating valve, pressure relief valve, input pressure gauge, and a continuous monitoring pressure gauge having a pressure range from 0 to at least 10 psig.
 - 4) Continuous monitoring pressure gauge shall be at least 4 inches in diameter with minimum divisions of 0.10 psi and an accuracy of +/- 0.04 psi.
 - 5) Monitoring gauges shall be subject to calibration as deemed necessary.
 - 6) Air used for testing shall pass through a single above ground control panel.
- f. Testing
 - 1) Groundwater Determination: Immediately prior to each air test, determine groundwater level by a method acceptable to the County. Adjust pressure used in air test in accordance with groundwater level.
 - 2) Apply air slowly to the test section until the pressure reached is 4.0 psi plus an adjustment of 0.433 psi for each foot of ground water above the crown of the pipe. Internal air pressure, including adjustment for ground water, should never exceed 9.0 psi.
 - 3) When the above required pressure is reached, throttle air supply to maintain internal pressure for at least two minutes to permit stabilization.
 - 4) When pressure has stabilized at required pressure, shut off air supply.
 - 5) While observing the continuous monitoring pressure gauge, decrease pressure approximately 0.5 psi from required pressure.
 - 6) At this reading timing shall commence with a stop watch and allowed to run until pressure has dropped 1.0 psi or allowable time has lapsed. Line shall be "Acceptable" if the pressure drop does not exceed 1 psig in the time prescribed for the test in Table 1, Low Pressure Air Testing for Gravity Sewer Mains, at the end of this section.
5. Deflection Test for SDR 35 and Ribbed (ASTM F 949) PVC pipe.
 - a. Measure for deflection of pipe no sooner than thirty days after installation and backfill.
 - b. Deflection shall not exceed 5 percent of pipe diameter. Maximum allowable long term deflection shall be 5 percent.
 - c. Measure deflection with an approved "GO-NO-GO GAUGE" method or by an approved recording deflectometer. Verify gauge on site prior to testing.

6. Hydrostatic Test for Gravity Sewers
 - a. The source, quality, and method of disposal of water to be used in test procedures shall be approved by the County.
 - b. Obtain Owner's permission 48 hours prior to filling or flushing of pipe system with water from Owner's water system. Owner of water system shall operate valves connected to the existing water system.
 - c. Air test line, as described above, prior to hydrostatic testing.
 - d. Provide taps for filling and pressurizing the line. Service corporation stops may be used. Include cost of taps in price of testing. Leave corporation stops in place after testing and note locations on As-Built Drawings.
 - e. Suitable means for thrust restraint shall be installed for testing.
 - f. Test for each manhole reach.
 - g. Test pipe by maintaining for a two-hour period a hydrostatic pressure of 150 psig.
 - h. Test pressure shall not vary by more than +/- 5 psi for the duration of the test.
 - i. Pressure test in accordance with AWWA C600 for ductile iron pipe and as described above.
 - j. Hydrostatic testing for gravity sewers within 100 feet of a water supply well shall be paid for as described in Section, Basis for Payment.

- D. Vacuum test each manhole in accordance with ASTM C1244 and the following:
 1. No personnel shall be allowed in manhole during testing.
 2. Test manhole after assembly and prior to backfilling.
 3. Plug pipes with suitably sized and rated pneumatic or mechanical pipeline plugs. Brace plugs to prevent displacement.
 4. Position vacuum test head assembly to seal against interior surface of the top of cone section in accordance with manufacturer's recommendation.
 5. Draw vacuum of 10 inches of mercury on manhole. Shut off the vacuum pump and close valve on vacuum line.
 6. Measure time for vacuum to drop to 9 inches of mercury. Manhole shall pass if time meets or exceeds the following:

Manhole I.D. (inches)	48	60	72	84	96	120
Seconds	60	75	90	105	120	150
 7. If manhole fails test, remove head assembly, coat interior with a soap and water solution, and repeat vacuum test for approximately 30 seconds. Leaking areas will have soapy bubbles. Make necessary repairs to the satisfaction of the County and repeat test until manhole passes.

END OF SECTION