DINWIDDIE COUNTY WATER AUTHORITY

VOLUME II
STANDARD SPECIFICATIONS
AND DETAILS FOR
CONSTRUCTION OF WATER AND SEWER
LINES AND RELATED WORK

March 2024

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FOREWORD

These Standards have been developed for water and sewer utility projects within Dinwiddie County and for the Dinwiddie County Water Authority personnel who review those projects. The standards are not intended as a regulation but should be used as a guide to establish a degree of uniformity for drawings and specifications for all water and sewer utility projects.

The Standards consist of two volumes as follows:

- Volume I - design standards for water mains, pump stations and sewer lines, force mains and pump stations.

- Volume II - specifications for construction and materials for water and sewer lines.

State and Federal regulations must be satisfied on all projects. In the event the Dinwiddie County Water Authority Standards differ from State or Federal Requirements, the more restrictive standard shall be utilized.

It is very difficult to generalize when addressing matters of engineering design without endangering the final product; therefore, persons should strive for designs which show consideration of details presented herein. However, these details are secondary to good engineering judgment. The design of water mains, pump stations, force mains and gravity sewers requires special consideration for each specific project and can not be generalized. Therefore, the design engineer is responsible for checking the specific requirements of each project against these standards and making any additions, deletions or changes necessary for the project being designed.

Work described herein is under the jurisdiction of the Dinwiddie County Water Authority, hereinafter referred to as the DCWA.

DCWA will review all plans and specifications, however, all documents for new construction must be submitted to the appropriate state agencies for review and a certificate of construction must be issued before construction can begin.

PROCEDURAL SECTION

1. Specifications will be provided by the Dinwiddie County Water Authority upon request for the cost of reproduction and handling.

2. Design notes, calculations, and plans for the project must be submitted by the design professional to the appropriate review agencies.

3. Any deviations to these specifications and standards must have prior approval from the Virginia Department of Health, Division of Water Supply Engineering before installation.

4. These specifications may be used for projects to be built within Dinwiddie County. Use of these specifications is limited to projects with 12-inches and smaller water lines and gravity sewers 12-inches, 10-inches, and 8-inches in diameter on NON EPA funded projects. Project plans will be required for each project and will be prepared and submitted in accordance with the appropriate state agencies.

5. All requests for deviation from these standard specifications will be set forth in writing and directed to the Dinwiddie County Water Authority. The Dinwiddie County Water Authority in the form of a letter will issue permission for the change. A copy of the letter of permission will also be sent to the Commonwealth of Virginia, State Department of Health.

6. The purpose of these specifications is to standardize the construction of water lines and sewer lines in the Dinwiddie County Water Authority.

7. The design professional that is responsible for the project must prepare project plans and determine that all standard details and specifications are appropriate for the intended use. He also has the responsibility of stating upon completion of project construction that all specified tests were performed with results within specified limits and that the project was built in accordance with the plans and specifications.

8. The specifications have been developed using Construction Specification Institute (CSI) format. Additional sections or modifications to the enclosed should be incorporated as needed for specific projects.

SECTION 00870 - STANDARD DETAILS

Standard Details have been adopted in order to produce uniformity of facilities to be operated by the DCWA. These details are a guide to the normal procedure. However, where it is necessary due to specific job requirements to deviate from the standards, the designer shall prepare the appropriate detail and show it on the plans.

SECTION 00870 - STANDARD DETAILS

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DINWIDDIE COUNTY WATER AUTHORITY

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	DIAMETER	MINIMUM WALL THICKNESS			
		CRITERIA WITHIN RAILROAD RIGHT OF WAY		CRITERIA WITHIN VDOT RIGHT OF WAY	
		R.C.P. WITH PROTECTIVE COATING	STEEL WITH PROTECTIVE COATING	R.C.P.	STEEL
4"	16"	3.0"	0.250"	3.0"	0.250"
6"	16"	3.0"	0.250"	3.0"	0.250"
8"	20"	3.0"	0.375"	3.0"	0.250"
10"	20"	3.0"	0.375"	3.0"	0.250"
12"	24"	3.5"	0.375"	3.5"	0.250"
15"	24"	3.5"	0.375"	3.5"	0.250"
16"	24"	3.5"	0.375"	3.5"	0.250"
18"	30"	4.0"	0.500"	4.0"	0.375"
20"	30"	4.0"	0.500"	4.0"	0.375"
21"	30"	4.0"	0.500"	4.0"	0.375"
24"	36"	4.5"	0.563"	4.5"	0.375"
30"	42"	5.0"	0.625"	5.0"	0.500"
33"	42"	5.0"	0.625"	5.0"	0.500"
36"	48"	5.5"	0.688"	5.5"	0.500"
42"	54"	6.0"	0.750"	6.0"	0.500"

REINFORCED CONCRETE CASING PIPE SHALL BE ASTM C–76, CLASS III.

STEEL CASING PIPE SHALL BE ASTM 1–139, GRADE B.

NOTES:

A. Slopes through bores shall not be based on minimum grade unless it is the only slope available.

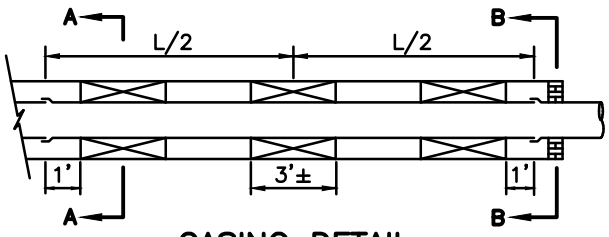
B. Increasing thickness of casing must be considered where bore lengths exceed 125'.

C. Use minimum of .3125" thickness where ground cover over pipe exceeds 15'.

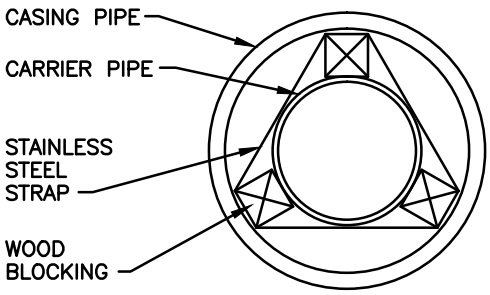
D. Contractor shall make an effort to bore in the appropriate direction based on existing soil conditions. Engineer must take into consideration where bore pit is to be placed in order that proper space is available, where possible.

REVISIONS		DRAWING NO.
2024	CASING PIPE REQUIREMENTS	DCWA 100

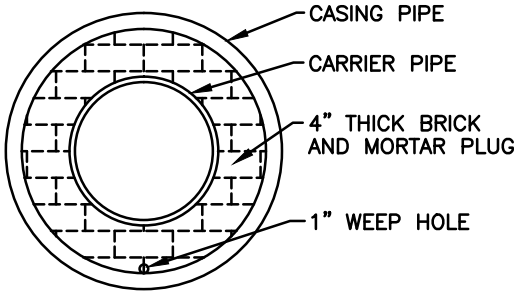
DINWIDDIE COUNTY WATER AUTHORITY



CASING DETAIL



SECTION A–A



SECTION B–B

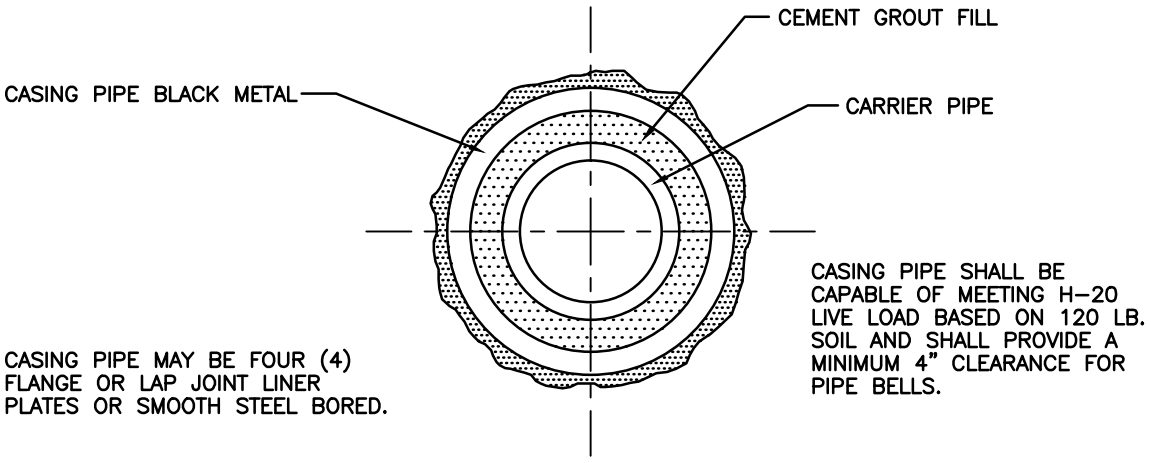
1. DUCTILE IRON PIPE REQUIRES THREE (3) POINT BLOCKING. PLASTIC CARRIER PIPE REQUIRES FOUR (4) POINT BLOCKING.
2. CENTER BLOCKING SHALL BE AT MID–SPAN OF PIPE LENGTH AND OUTSIDE BLOCKING NOT LESS THAN 1' FROM ANY JOINT. ALL SUPPORT BLOCKS SHALL BE AT LEAST 3' IN LENGTH, CONTRACTING A MINIMUM 30% CARRIER PIPE CIRCUMFERENCE.
3. BLOCKING SHALL BE CONSTRUCTED OF LOCUST, CYPRESS, CRESOTE TREATED HARDWOOD, OR OTHER MATERIAL APPROVED BY DCWA.
4. STAINLESS STEEL STRAPS AND CLIPS HOLDING BLOCKING TO CARRIER PIPE SHALL HAVE A MINIMUM CROSSECTION OF 0.014 IN. SQ. STRAP SPACING SHALL BE AT 2' INTERVALS, WITH A MINIMUM TWO (2) BANDS PER BLOCK LENGTH.
5. STEEL CASING SHALL HAVE A MINIMUM YIELD STRENGTH OF 35.000 PSI AND SUFFICIENT CORROSION PROTECTION.
6. CASING SHALL HAVE A MINIMUM SLOPE OF 1/2%.
7. ENDS OF CASING SHALL HAVE A 4" THICK BRICK AND MORTAR PLUG IN THE ANNULAR SPACE WITH A 1" WEEP HOLE.
8. VALVES OR OTHER CONTROL/MAINTENANCE EQUIPMENT ATTACHED TO WATERLINE SHALL BE LOCATED A MINIMUM FOUR PIPE LENGTHS FROM THE END OF THE CASING, OR AS APPROVED BY THE COUNTY.
9. WATERLINES TO BE ENCASED UNDER RAILROADS WILL COMPLY WITH COUNTY AND AMERICAN RAILROAD ENGINEERING SPECIFICATIONS FOR PIPELINES, WHICHEVER IS THE HIGHER.
10. WATERLINES TO BE ENCASED UNDER STATE ROADS WILL COMPLY WITH COUNTY AND ANY APPLICABLE VDOT SPECIFICATIONS, WHICHEVER IS THE HIGHER.
11. WHEN INSTALLING CARRIER PIPE, CONTRACTOR SHALL PUSH SO THAT PIPE JOINTS ARE ALWAYS BEING COMPRESSED.
12. CARRIER PIPE SHALL BE WRAPPED WITH TAR PAPER AT MASONRY PLUG.

NO SCALE

REVISIONS	CASING DETAIL – WATER	DRAWING NO.
2024		DCWA 105

DINWIDDIE COUNTY WATER AUTHORITY

LENGTH OF CASING
AS SHOWN IN PLANS



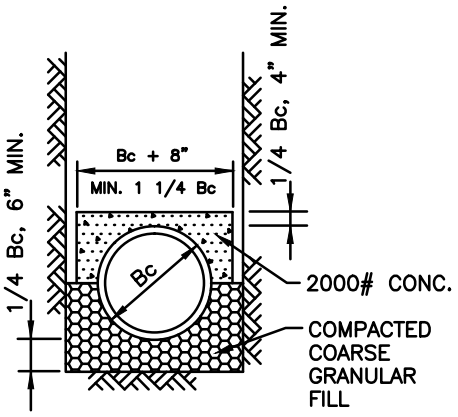
TYPICAL SECTION

1. CARRIER PIPE REQUIRES THREE (3) POINT BLOCKING.
2. CENTER BLOCKING SHALL BE AT MID-SPAN OF PIPE LENGTH AND OUTSIDE BLOCKING NOT LESS THAN 1' FROM ANY JOINT. ALL SUPPORT BLOCKS SHALL BE AT LEAST 3' IN LENGTH, CONTACTING A MINIMUM 30% CARRIER PIPE CIRCUMFERENCE.
3. BLOCKING SHALL BE CONSTRUCTED OF LOCUST, CYPRESS, CREOSOTE TREATED HARDWOOD, OR OTHER MATERIAL APPROVED BY COUNTY.
4. STEEL STRAPS AND CLIPS HOLDING BLOCKING TO CARRIER PIPE SHALL HAVE A MINIMUM CROSS SECTION OF 0.014 IN. STRAP SPACING SHALL BE AT 2' INTERVALS, WITH A MINIMUM TWO (2) BANDS PER BLOCK LENGTH.

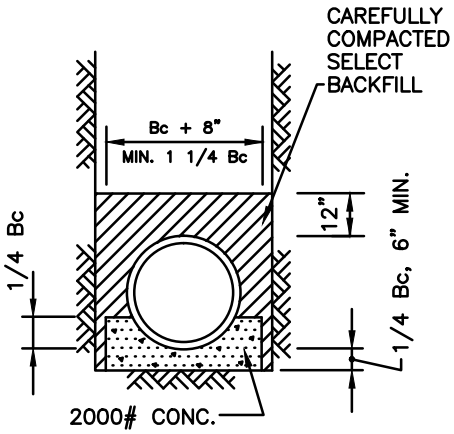
REVISIONS	CASING PIPE DETAIL SEWER	DRAWING NO.
2024		DCWA 107

Bc = O.D. OF PIPE

DINWIDDIE COUNTY WATER AUTHORITY



CLASS "A" BEDDING
LOAD FACTOR = 2.8



CLASS "A–1" BEDDING
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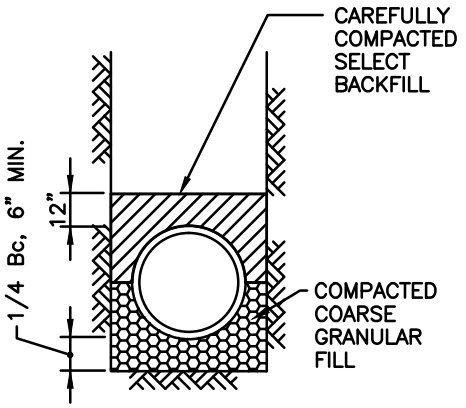
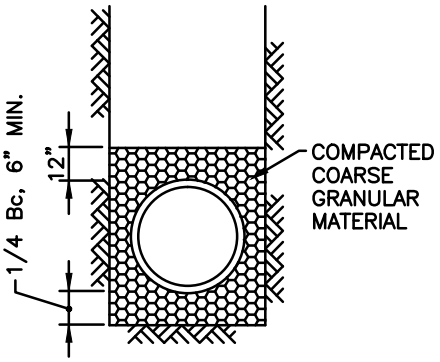


CLASS "B" BEDDING
LOAD FACTOR = 1.9



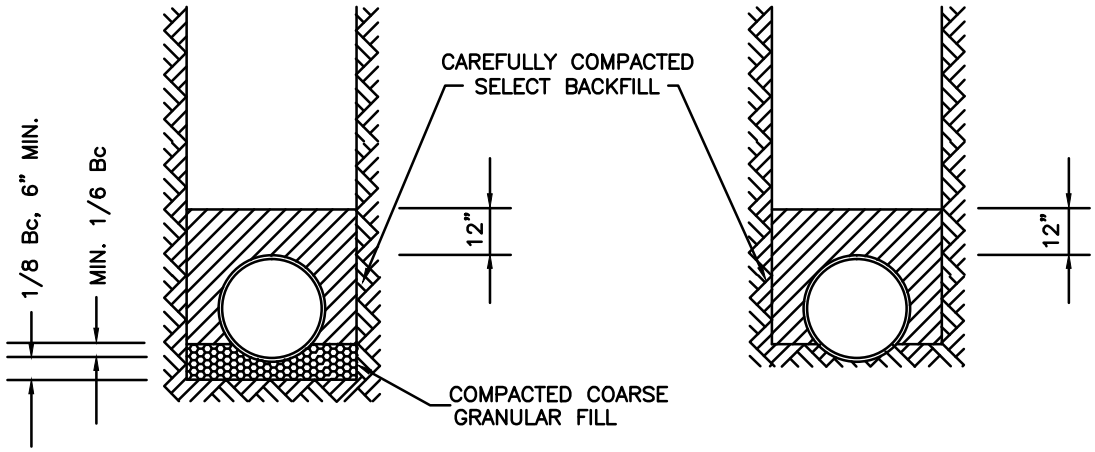
CLASS "B–1" BEDDING
LOAD FACTOR = 1.9

NOTE: IN ROCK TRENCH, EXCAVATE AT LEAST 6" BELOW THE BOTTOM OF THE PIPE.

REVISIONS		DRAWING NO.
2024	TRENCH BEDDING – I DCWA	111 A

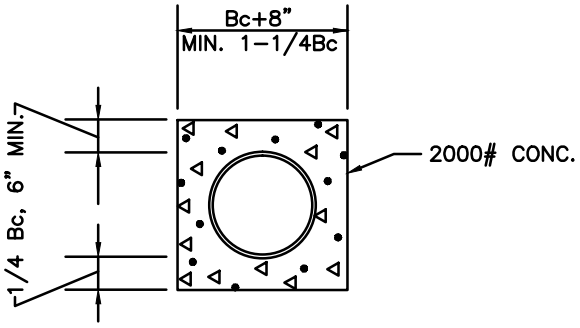
Bc = O.D. OF PIPE

DINWIDDIE COUNTY WATER AUTHORITY



CLASS "C" BEDDING
LOAD FACTOR = 1.5

CLASS "C-1" BEDDING
LOAD FACTOR = 1.5

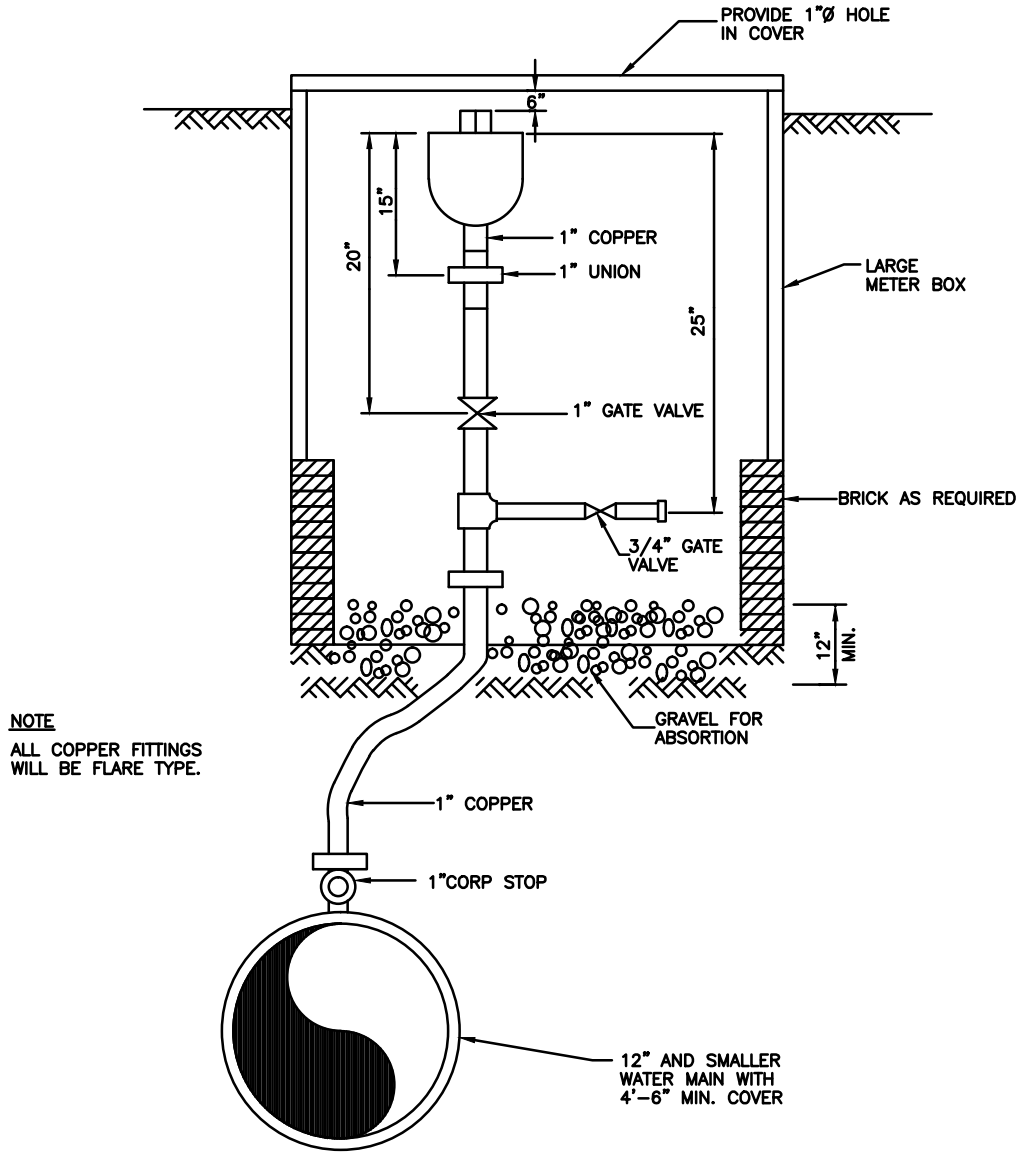


CONCRETE ENCASEMENT
LOAD FACTOR = 4.5

NOTE: IN ROCK TRENCH, EXCAVATE AT LEAST 6" BELOW THE BOTTOM OF THE PIPE.

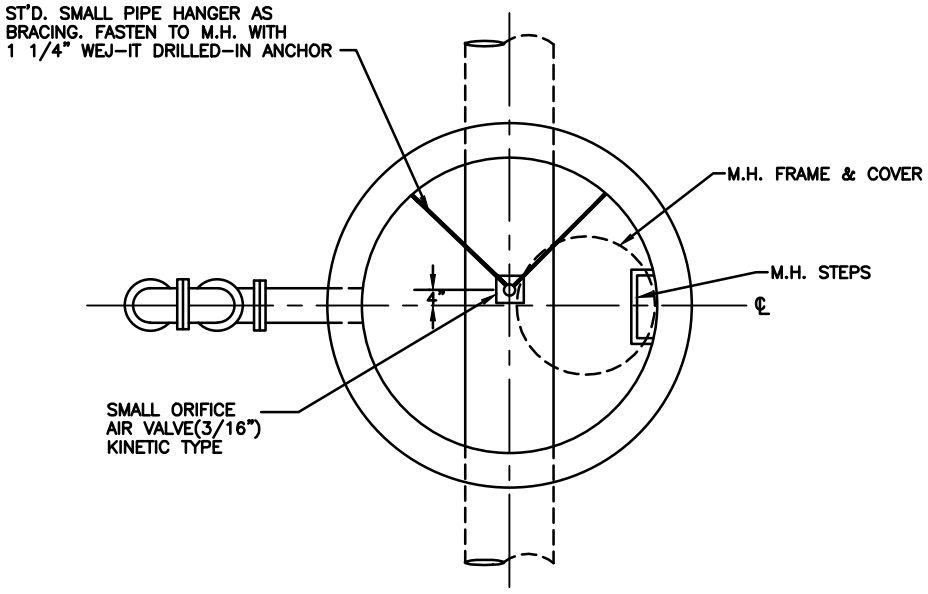
REVISIONS	TRENCH BEDDING – II	DRAWING NO.
2024		DCWA 111

DINWIDDIE COUNTY WATER AUTHORITY

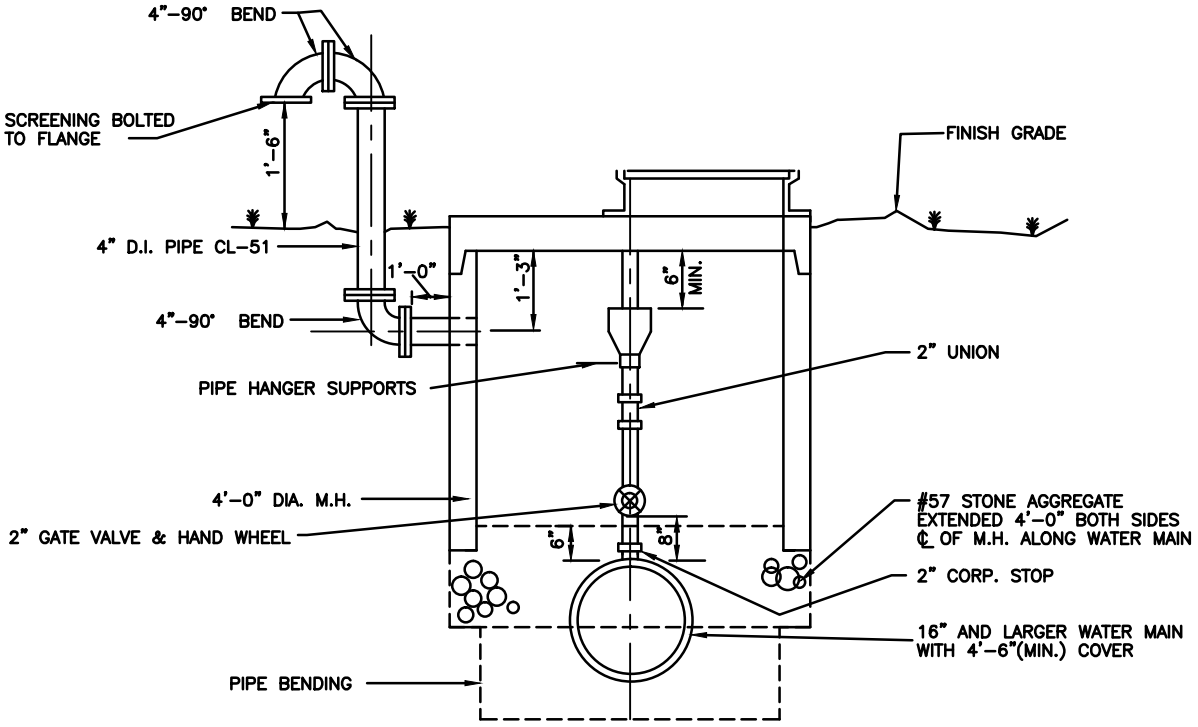


REVISIONS		DRAWING NO.
2024	1–INCH AIR RELEASE VALVE	DCWA 115

DINWIDDIE COUNTY WATER AUTHORITY



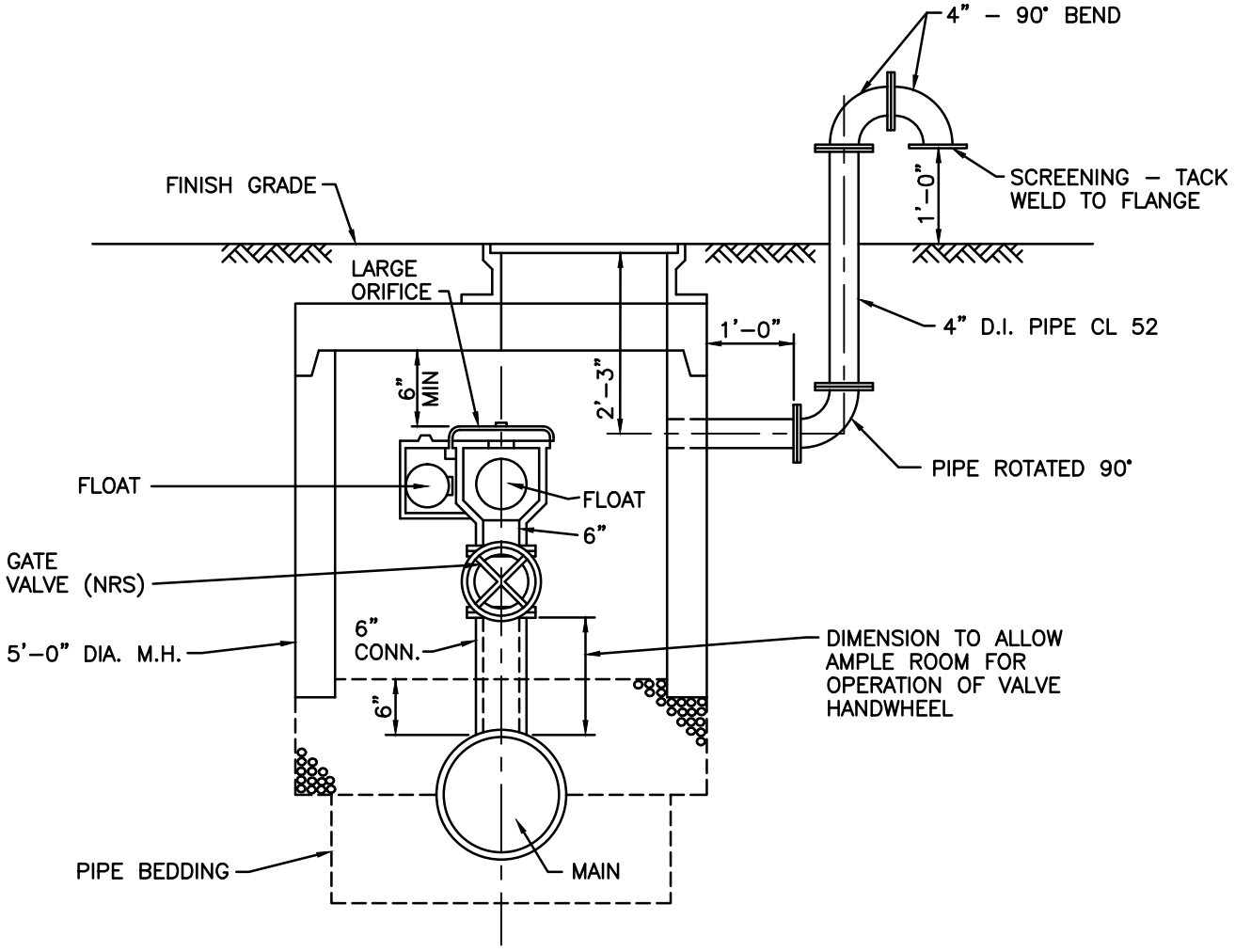
PLAN



ELEVATION

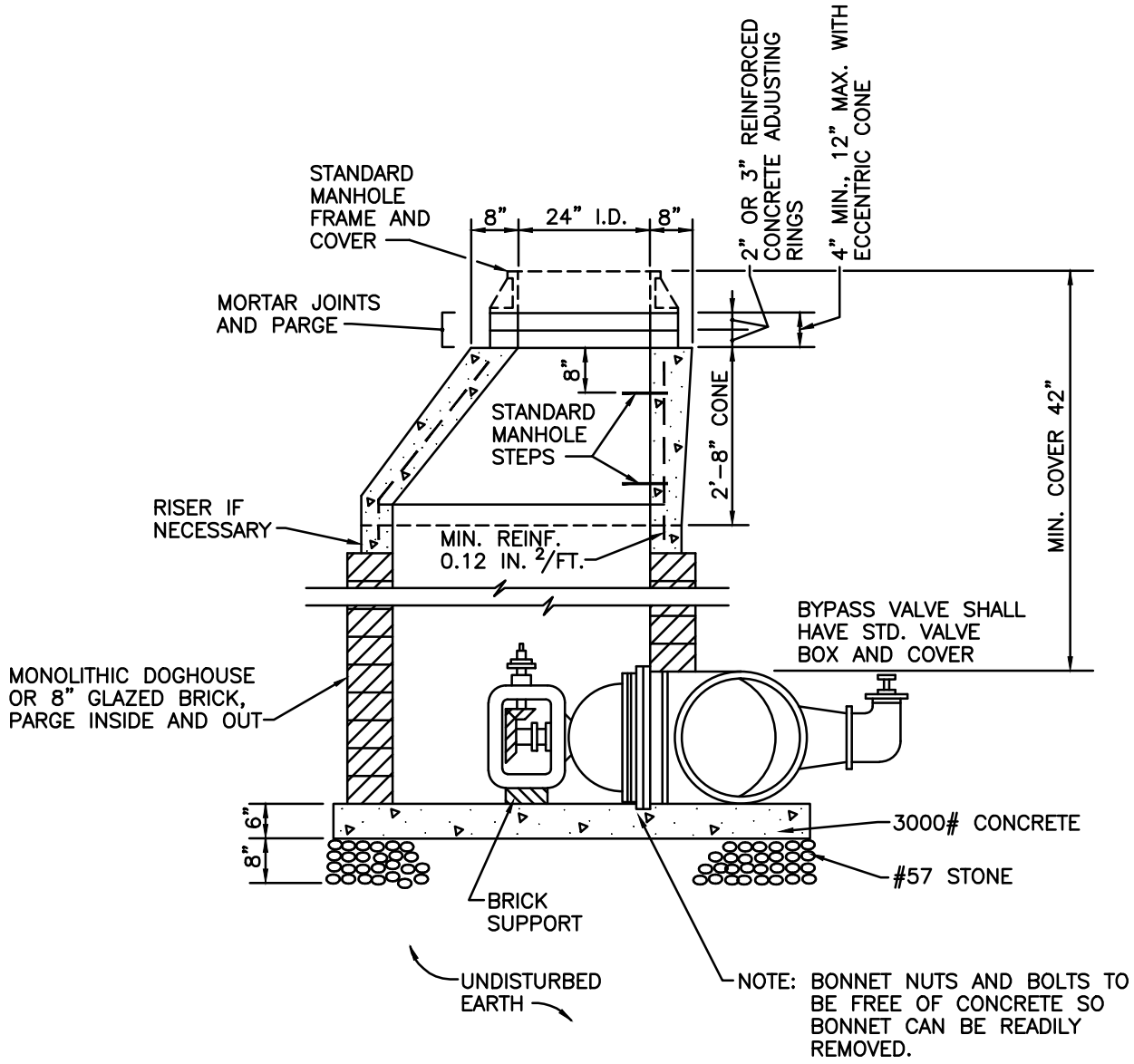
REVISIONS	2-INCH AIR RELEASE VALVE ASSEMBLY	DRAWING NO.
2024		DCWA 116

DINWIDDIE COUNTY WATER AUTHORITY



REVISIONS		DRAWING NO.
2024	COMBINATION AIR VALVE 110	DCWA 120

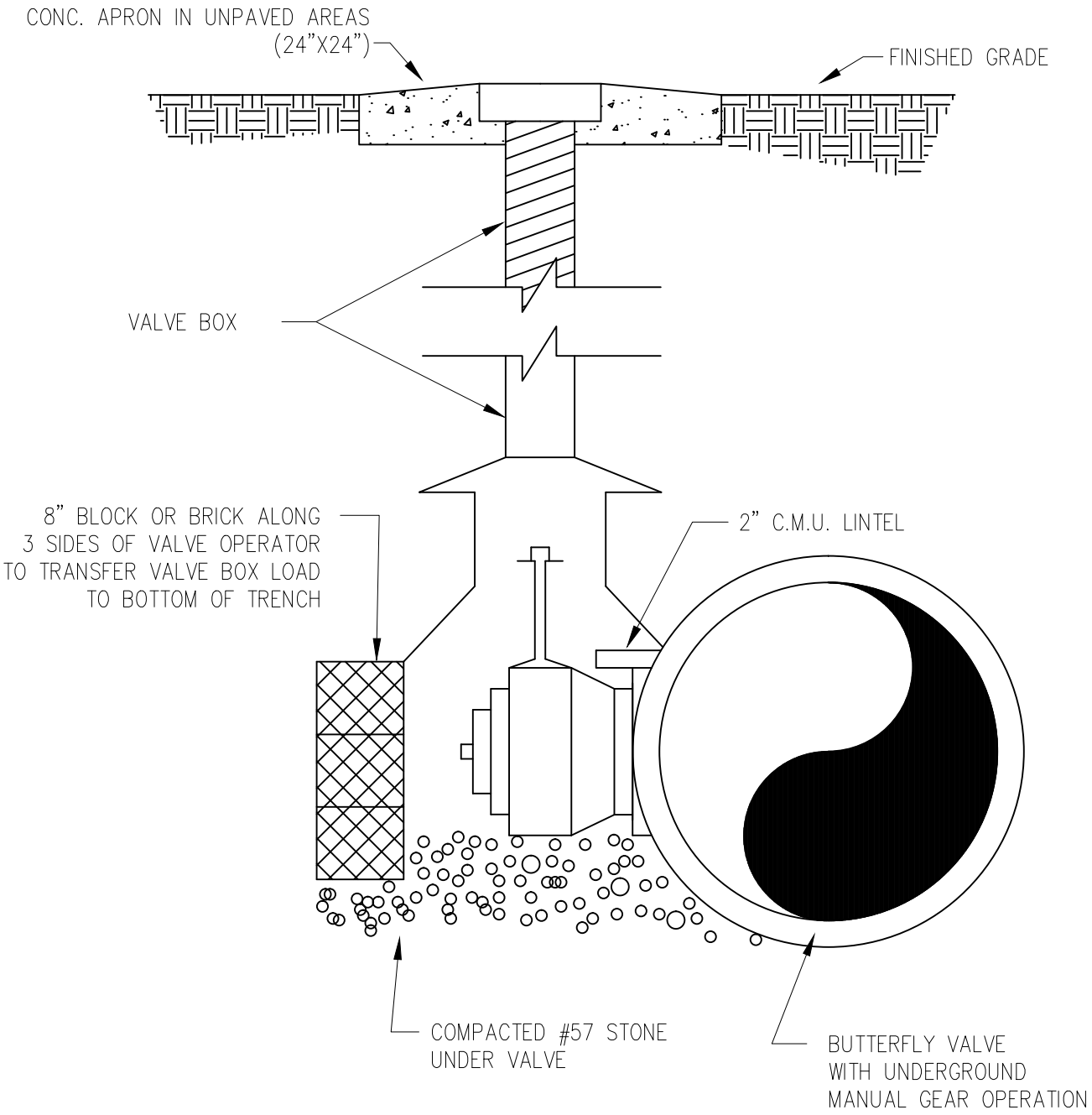
DINWIDDIE COUNTY WATER AUTHORITY



NO SCALE

REVISIONS	STANDARD VALVE MANHOLE (16-INCH AND LARGER)	DRAWING NO.
2024		DCWA 121

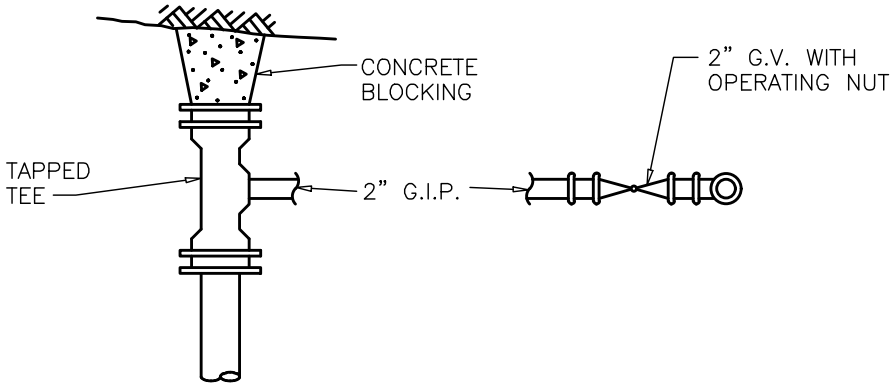
DINWIDDIE COUNTY WATER AUTHORITY

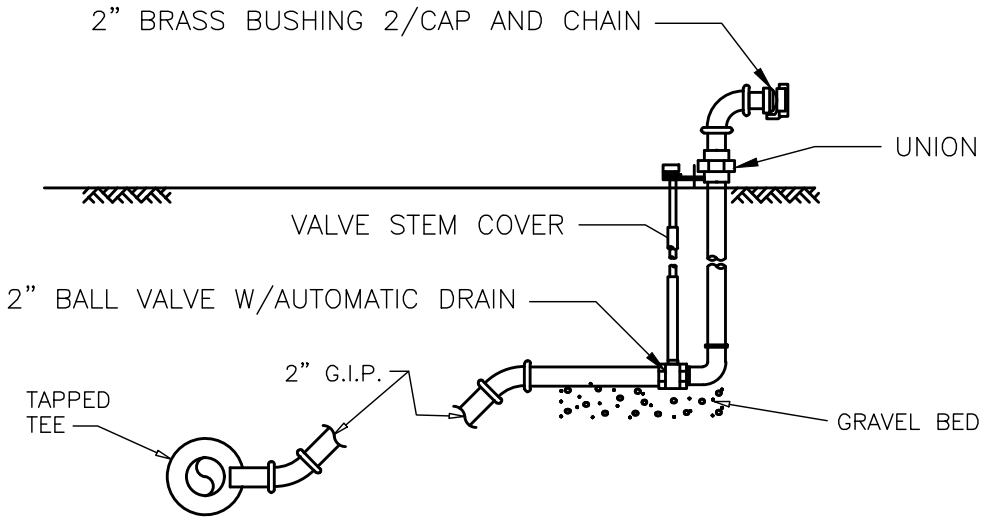


NOT TO SCALE

REVISIONS	16–INCH & LARGER BUTTERFLY VALVE INSTALLATION	DRAWING NO.
2024		DCWA 122

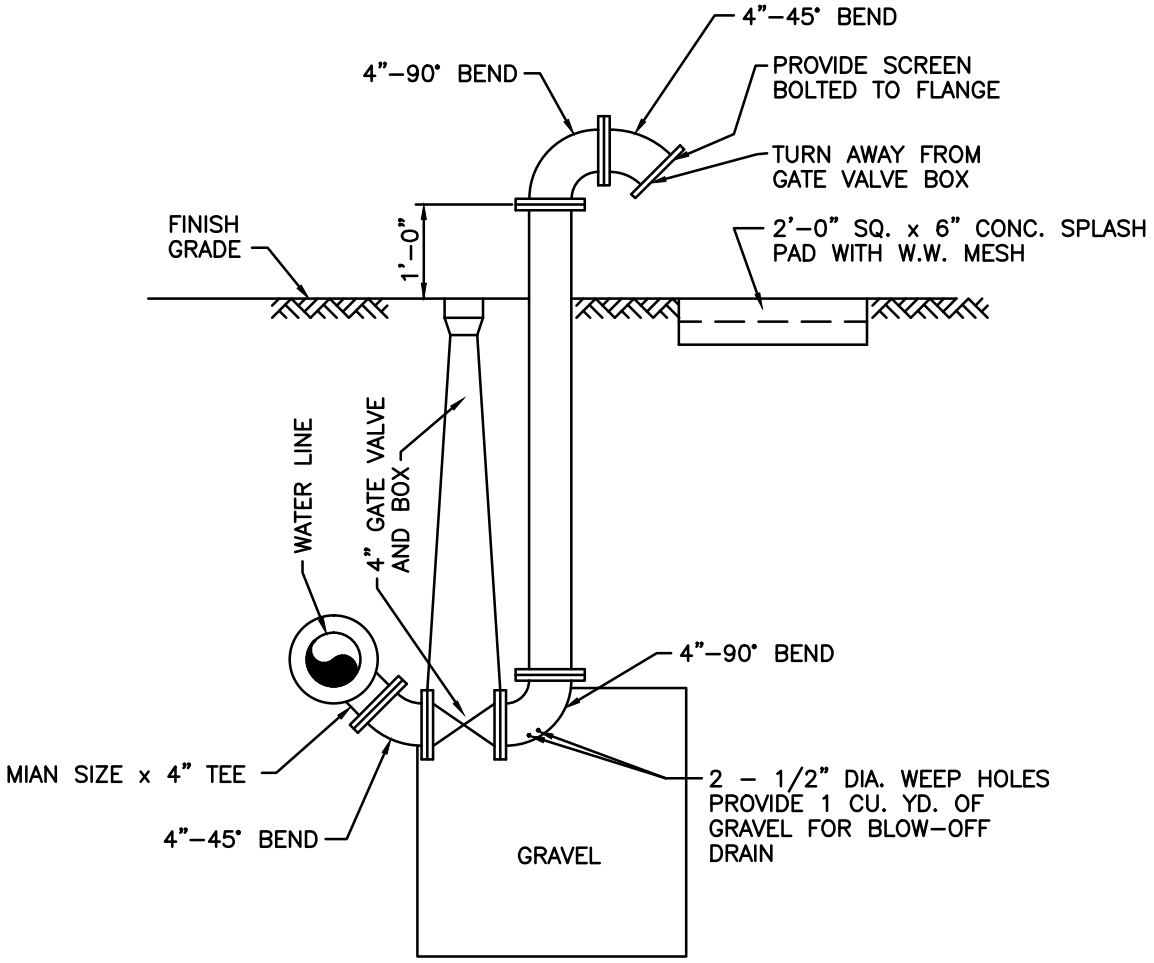
DINWIDDIE COUNTY WATER AUTHORITY





REVISIONS		DRAWING NO.
2024	DETAILS – 2–INCH BLOW–OFF	DCWA 130

DINWIDDIE COUNTY WATER AUTHORITY

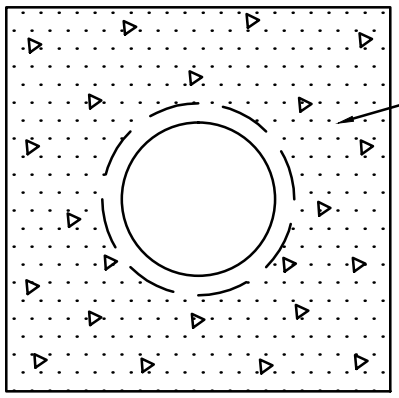


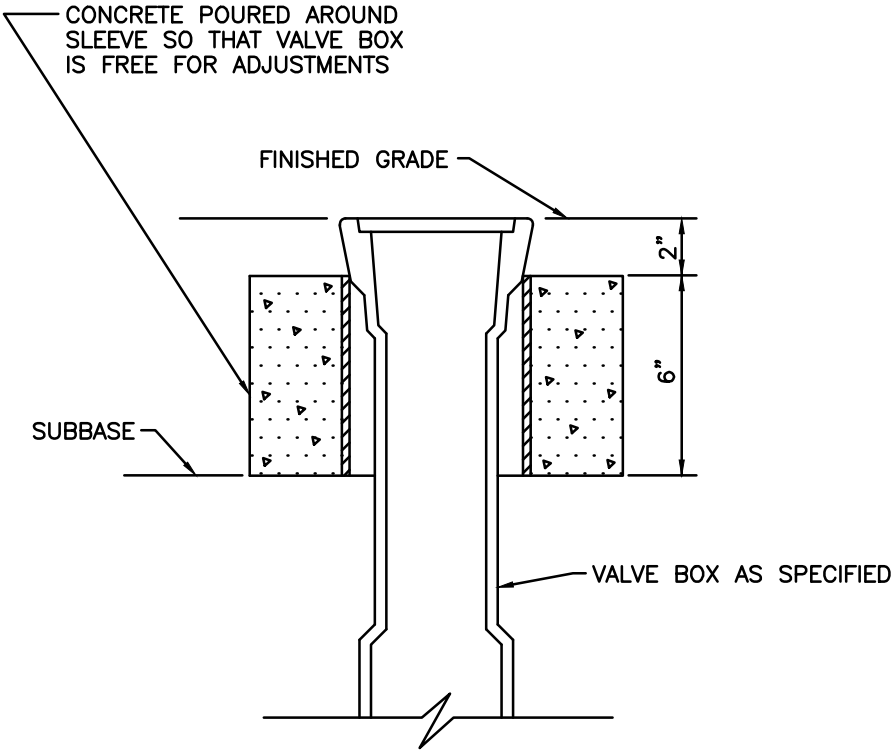
ELEVATION

NOTE: ALL FITTINGS FOR BLOW–OFF SHALL BE FLANGED.

REVISIONS	4–INCH BLOW–OFF	DRAWING NO.
2024		DCWA 132

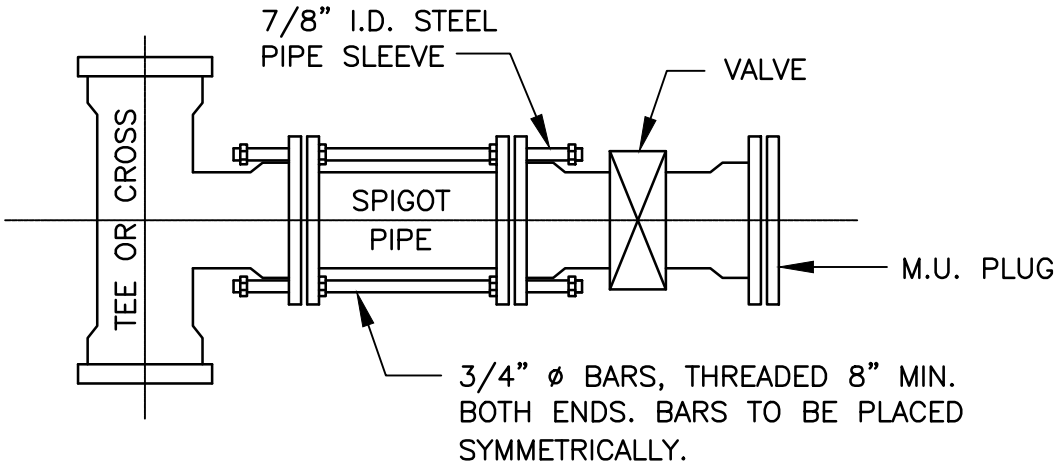
DINWIDDIE COUNTY WATER AUTHORITY





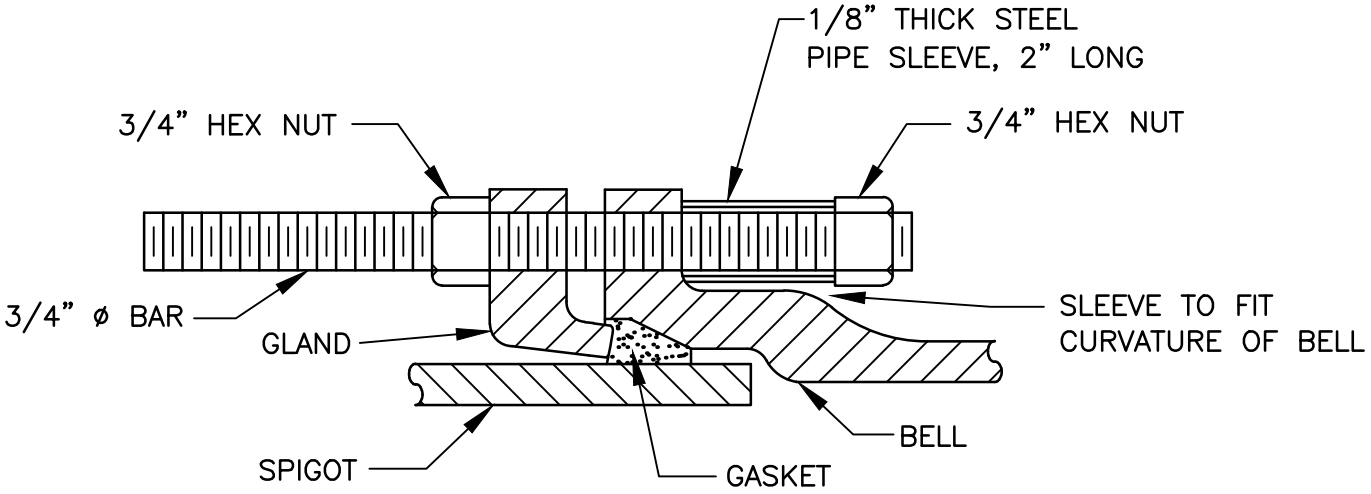
REVISIONS	VALVE BOX INSTALLATION DETAIL	DRAWING NO.
2024		DCWA 145

DINWIDDIE COUNTY WATER AUTHORITY



PLAN

NOT TO SCALE



CROSS SECTION

SLEEVE & BAR ASSEMBLY

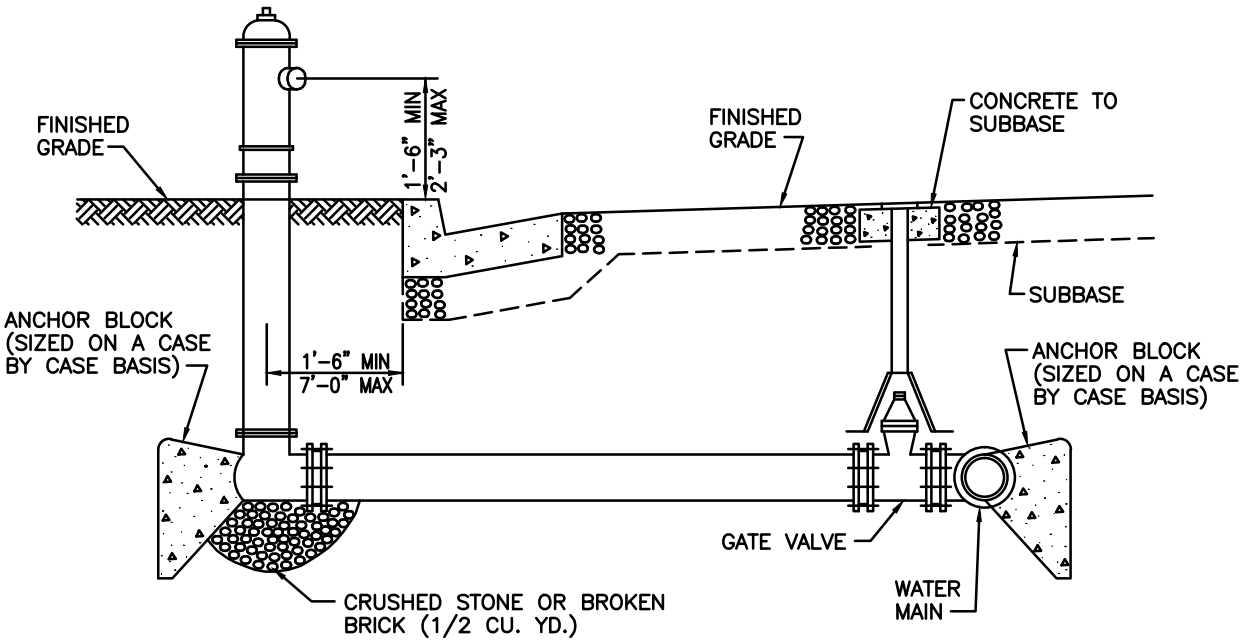
NOT TO SCALE

PAINT ALL STEEL WITH TWO COATS OF VALDURO ASPHALT PAINT OR APPROVED EQUAL.

VALVE SIZE	NUMBER OF ø BARS REQUIRED	MAXIMUM LENGTH OF SPIGOT PIPE
6"	2	27"
8"	2	27"
10"	4	27"
12"	6	27"
14"	8	36"
16"	8	36"
18"	10	36"
20"	12	36"
24"	16	36"

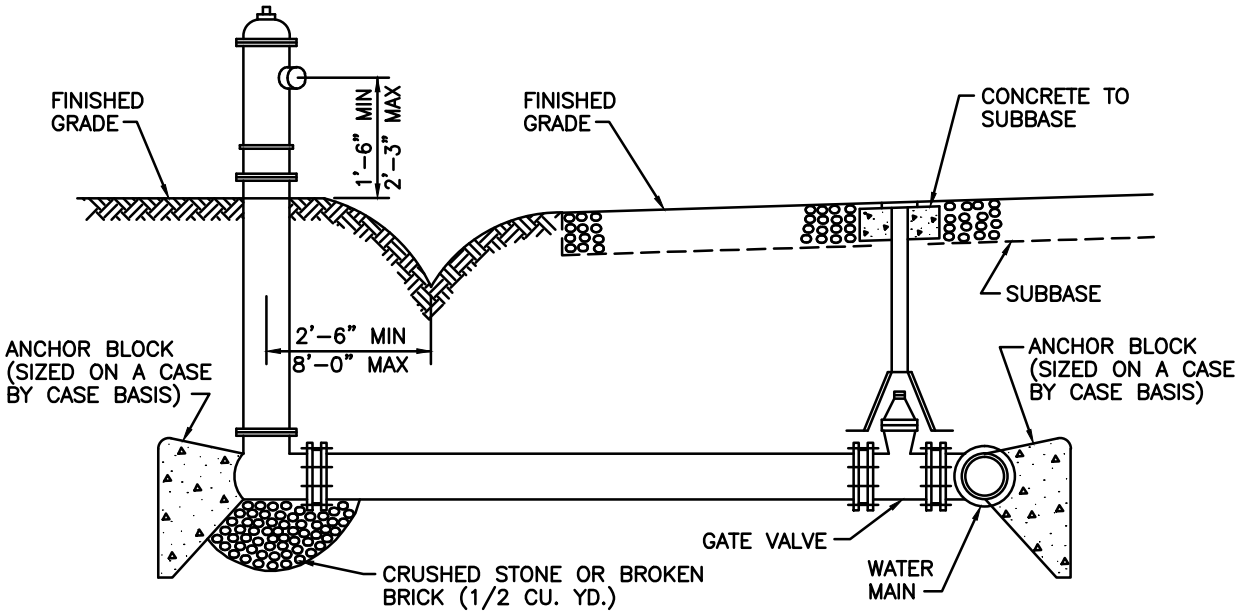
REVISIONS		DRAWING NO.
2024	STRAPPING VALVE TO MAIN	DCWA
		146

DINWIDDIE COUNTY WATER AUTHORITY



CURB & GUTTER

HYDRANT COLOR SHALL BE OSHA SAFETY YELLOW



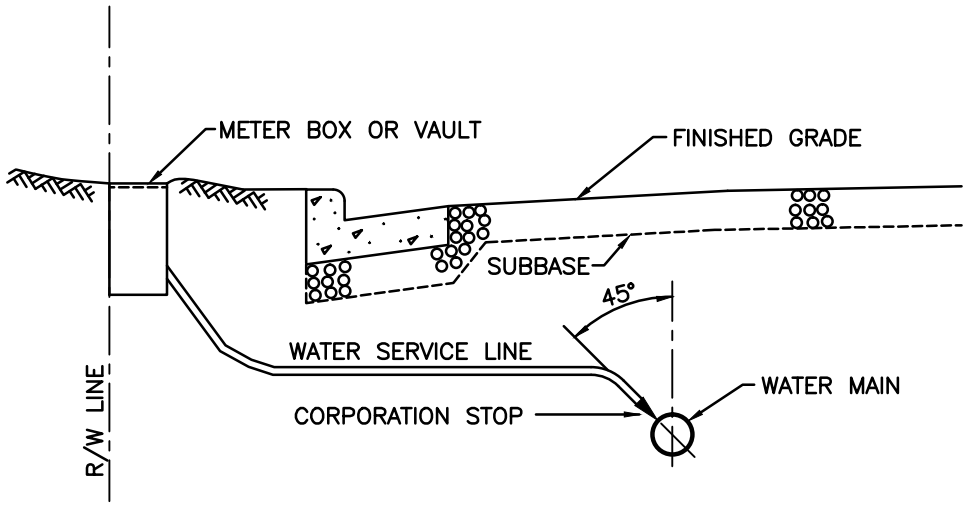
DITCH

5 1/4 BURY

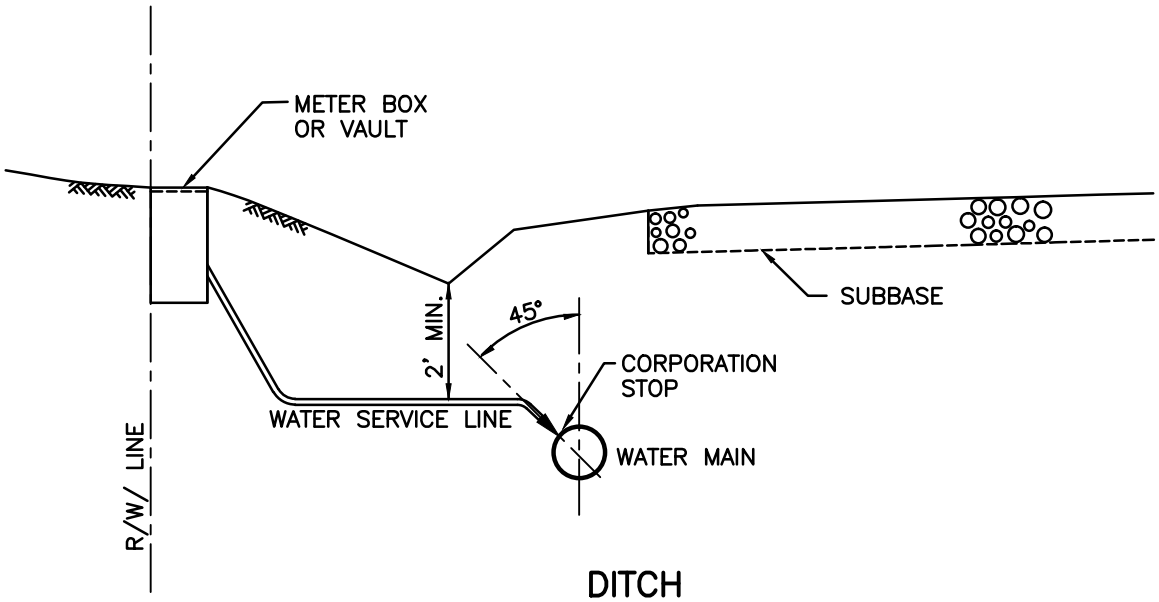
REVISIONS	TYPICAL FIRE HYDRANT DETAIL	DRAWING NO.
2024		DCWA 160

DINWIDDIE COUNTY WATER AUTHORITY

WATER SERVICE SHALL BE 200psi BLACK POLY PLASTIC TUBING OR K COPPER



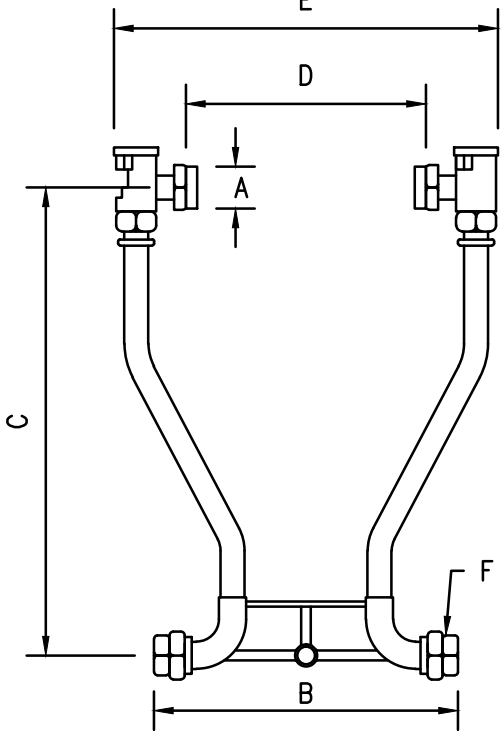
CURB & GUTTER



DITCH

REVISIONS	METER INSTALLATION DETAIL	DRAWING NO.
2024		DCWA
		170

DINWIDDIE COUNTY WATER AUTHORITY



McDONALD or FORD METER SETTERS

DIMENSIONS	DCWA METER SIZES	
	5/8" x 3/4"	1"
A	1 5/16"	1 5/8"
B	9 1/2"	12 3/4"
C	HEIGHTS AS	ORDERED
D	7 1/2"+3/8"	10 3/4"+3/8"
E	12"	17 1/4"
F	3/4"	1"

THESE FEATURES OR EQUAL:

ANGLE KEY VALVE

ANGLE CARTRIDGE DUAL CHECK VALVE

COMPRESSION FITTING INLET

BRACING EYE

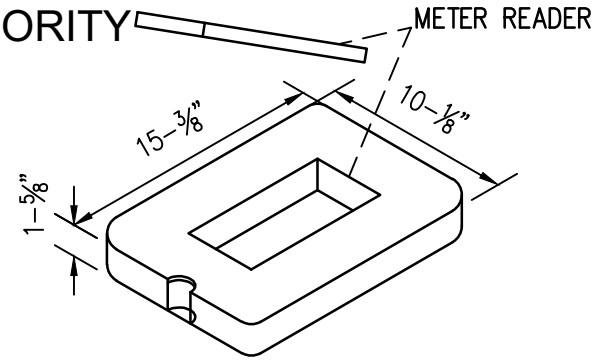
COMPRESSION FITTING OUTLET

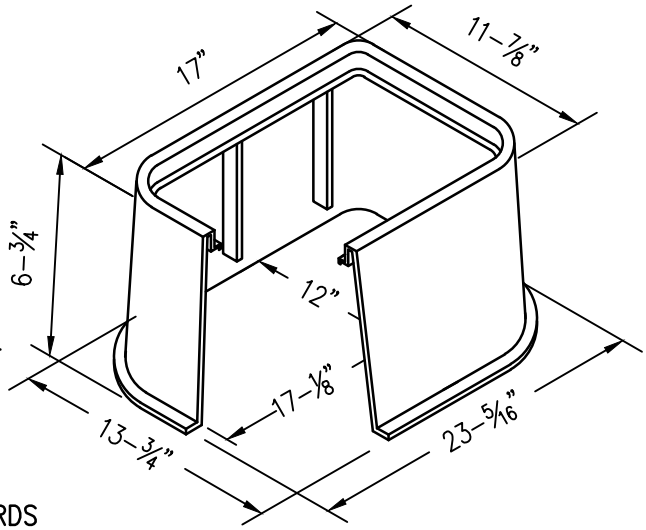
ALL BRASS CONFORMS TO AWWA STANDARDS

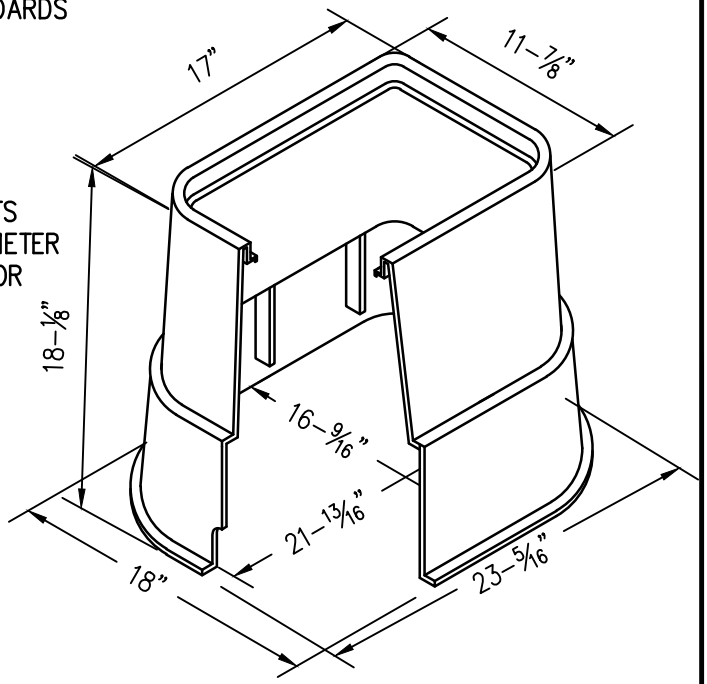
ALL COPPER CONFORMS TO ASTM STANDARDS

LEAD-FREE SOLDER

SADDLE NUTS HOLD THE METER IN PLACE FOR TIGHTENING



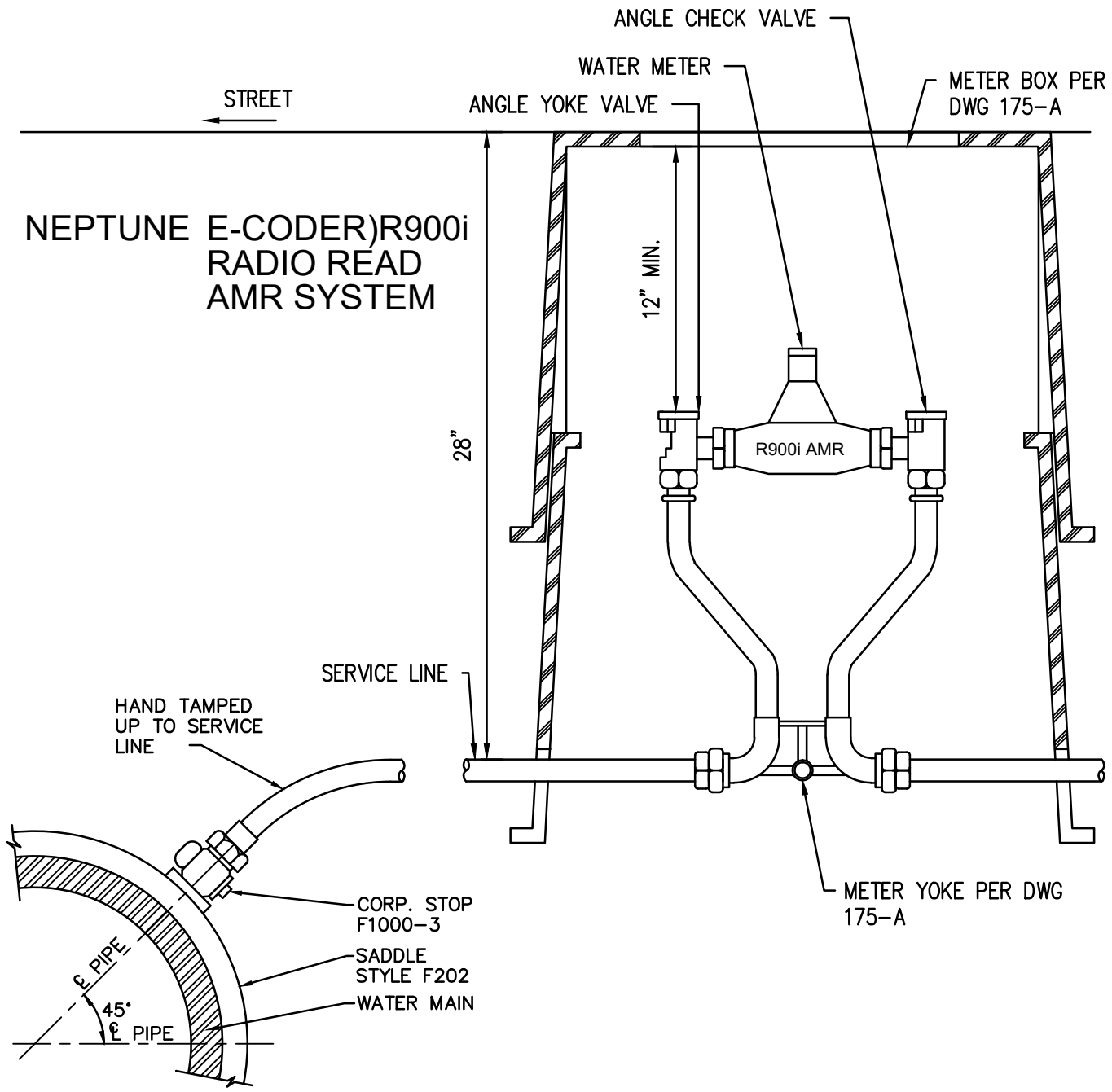




ANGLE CARTRIDGE DUAL CHECK VALVE

REVISIONS	TYPICAL WATER METER YOKE, BOX, RISER & TOP FOR DCWA 5/8"x3/4" OR A 1" METER	DRAWING NO.
3/9/2007 2024		DCWA 175-A

DINWIDDIE COUNTY WATER AUTHORITY

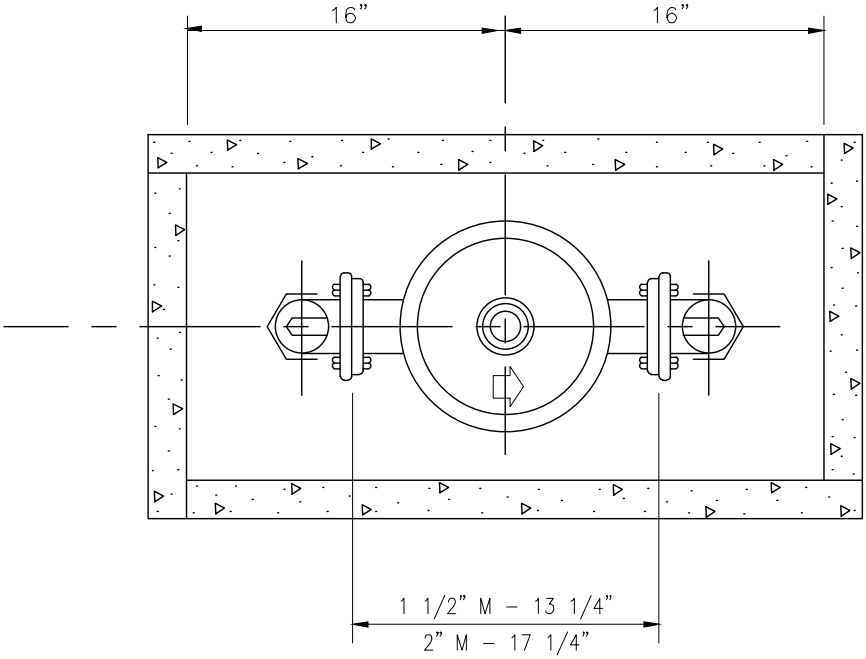


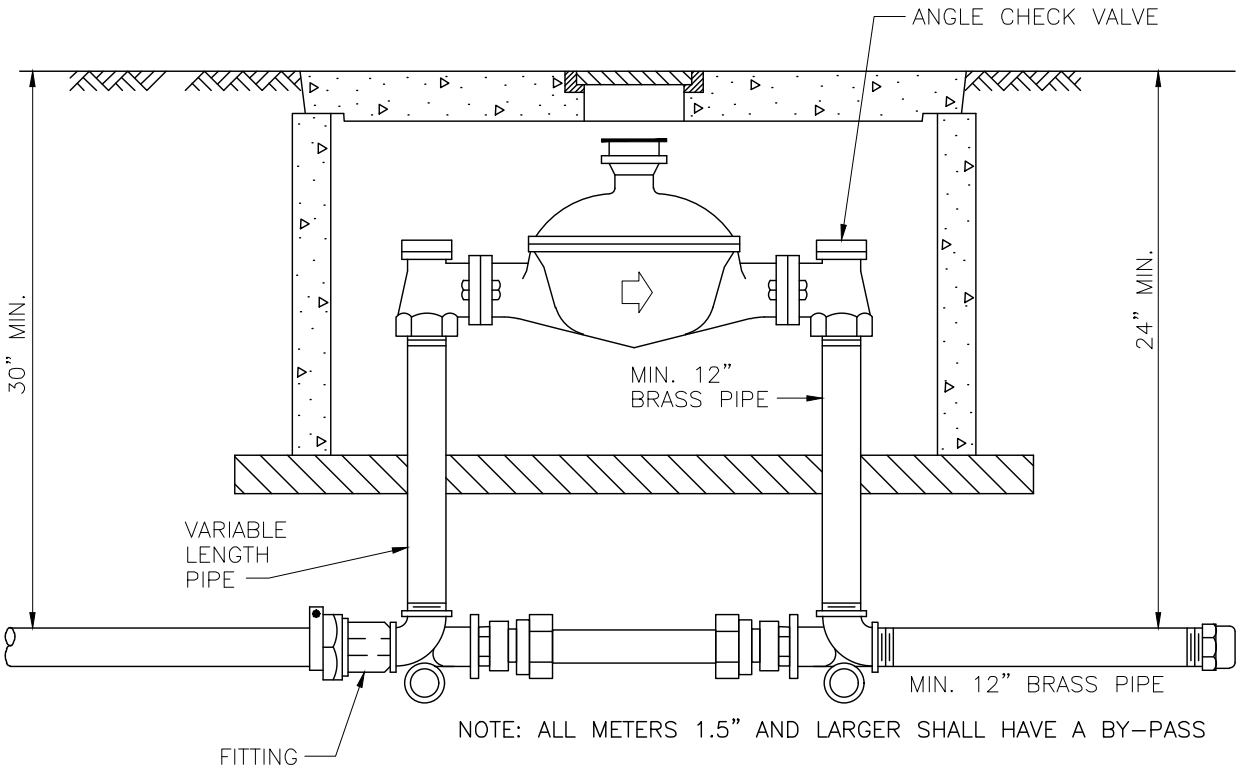
ENLARGED VIEW

NOTE:
SERVICE LINE MATERIAL SHALL BE ¾" COPPER TYPE "K" CTS OR ¾" IPS HDPE CLASS 200. IF HDPE SERVICE LINE IS USED, FITTINGS ON YOKE SHALL BE FOR HDPE PIPE

REVISIONS	TYPICAL WATER METER CONNECTION FOR 3/4-INCH AND 1-INCH SERVICE	DRAWING NO.
3/9/2007 2024		DCWA 175

DINWIDDIE COUNTY WATER AUTHORITY





NOTE: ALL METERS 1.5" AND LARGER SHALL HAVE A BY–PASS

REVISIONS		DRAWING NO.
2024	1 1/2–INCHES OR 2–INCHES DISC METER SETTINGS	DCWA 180–1

DINWIDDIE COUNTY WATER AUTHORITY

MATERIAL FOR 1 1/2" DISC METER WITH 1 1/2" INLET AND 1 1/2" OUTLET

QTY.	DESCRIPTION
1	1 1/2" Disc Meter w/gaskets, bolts and nuts
2	1 1/2" Flanged angle valves
5	1 1/2" Brass Pipe (2 pcs. 12" long; 1 pc. variable length; Pipe to be cut and threaded by Contractor)
2	1 1/2" Brass elbows
1	1 1/2" Brass blind cap

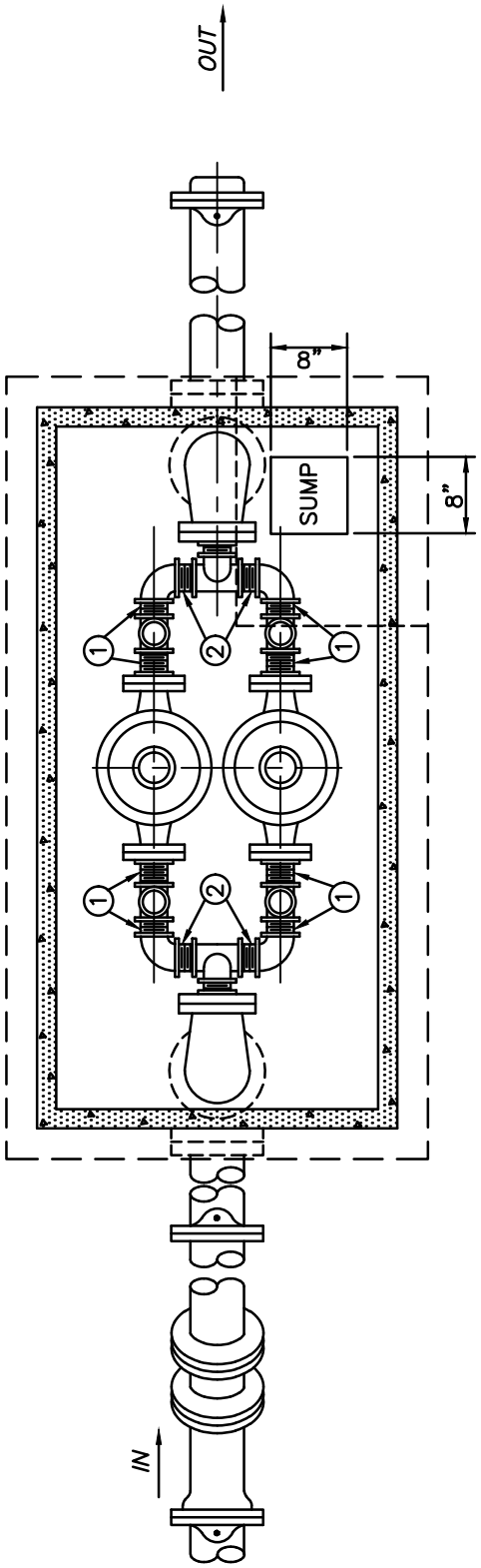
MATERIAL FOR 2" DISC METER WITH 2" INLET AND 2" OUTLET

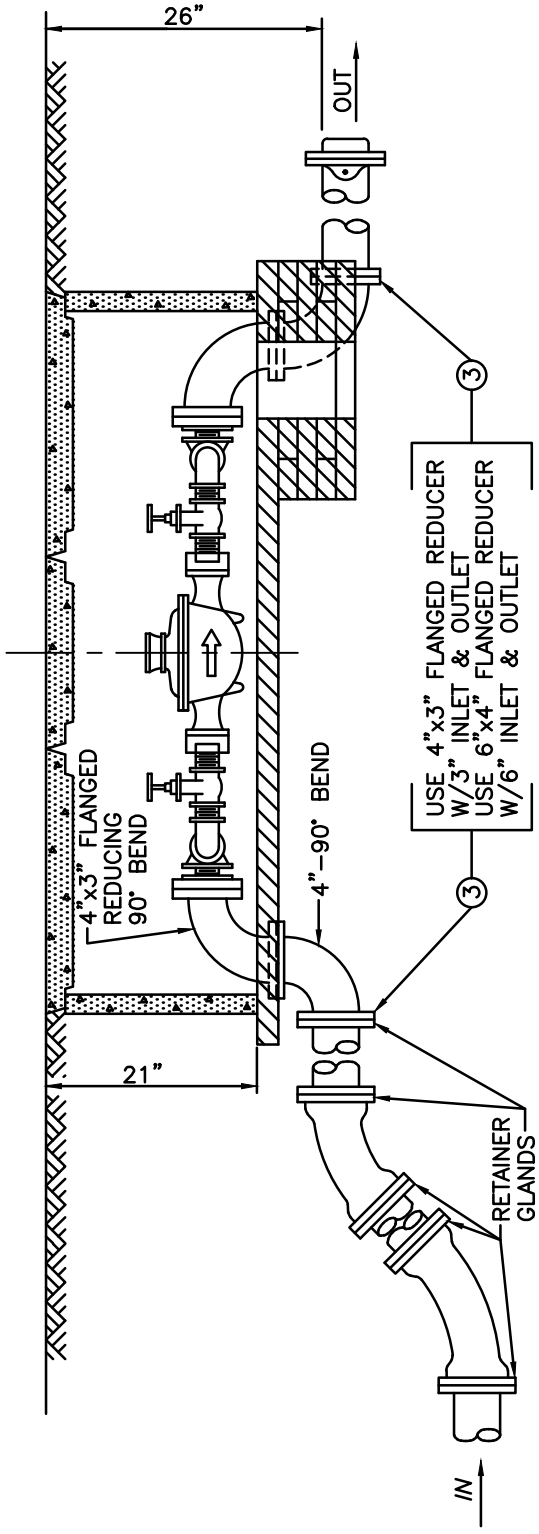
QTY.	DESCRIPTION
1	2" Disc Meter w/gaskets, bolts and nuts
2	2" Flanged angle valves
5	2" Brass Pipe (2 pcs. 12" long; 1 pc. variable length; Pipe to be cut and threaded by Contractor)
2	2" Brass elbows
1	2" Brass blind cap

NEPTUNE
E-CODER)R900i
RADIO READ

REVISIONS	MATERIALS LIST FOR 1 1/2-INCH OR 2-INCH DISC METER SETTING	DRAWING NO.
2024		DCWA 180-2

DINWIDDIE COUNTY WATER AUTHORITY





① 2"x2 1/2" NIPPLES
② 2"x 3" NIPPLES

BRASS

1 OF 3

REVISIONS	DUAL 2-INCH METER SETTING	DRAWING NO.
2024		DCWA 185-1

DINWIDDIE COUNTY WATER AUTHORITY

TYPE I (4" INLET & 4" OUTLET)

QTY.	
2	2" Disc meters with companion flanges, gaskets, bolts & nuts
8	2"X 2 1/2" Brass nipples
4	2"X3" Brass nipples
4	2" Brass gate valves
4	2" 90° Brass elbows
2	2"x2"X3" Brass tees
2	3" Close brass nipples
2	3" Companion flanges
2	4"x3" Flanged 90° bends
2	4" Flanged 90° bends
2	4" Flanged x plain end nipples 30" long
2	4" 45° MJxMJ bends
5	4" Retainer glands
1	4" MJ cap
2	3" Flange gaskets
4	4" Flange gaskets
*5	4" MJ gaskets
*20	5/8"x1 1/2" Set screws for retainer glands
*20	3/4"x3 1/2" Nuts & bolts for MJ connections
8	5/8"x2 1/2" Nuts & bolts for flange connections
32	5/8"x3" Nuts & bolts for flange connections
1	4" Plain end x plain end nipple approximately 24" long

TYPE II (3" INLET & 3" OUTLET)

QTY. FROM TYPE I ELIMINATE	
2	4" Flanged x plain end nipples 30" long
1	4" Plain end X plain end nipple
2	4" MJ x MJ 45° bends
5	4" Retainer glands
*5	4" MJ Gaskets
*20	3/4"x3 1/2" Nuts & bolts for MJ connections
1	4" MJ Cap

ADD

8	5/8"x2 1/2" Nuts & bolts for flange connections
*20	5/8"x3" Nuts & bolts for MJ connections
2	3" Flange x plain end nipples 30" long
2	4" x 3" Flanged reducers
2	3" 45° MJ x MJ bends
1	3" Plain end x plain end nipple approximately 24" long
5	3" Retainer glands
*5	3" MJ gaskets
2	3" Flange gaskets
1	3" MJ Cap

* Above MJ gaskets, set screws, & MJ nuts and bolts are supplied with respective MJ fittings.

REVISIONS		DRAWING NO.
2024	MATERIALS LIST FOR DUAL 2-INCH METER SETTING	DCWA 185-2

DINWIDDIE COUNTY WATER AUTHORITY

TYPE III (6" INLET AND 6" OUTLET)

QTY.	FROM TYPE I ELIMINATE
2	4" Flanged x plain end nipples 30" long
1	4" Plain end nipple
*20	5/8"x1 1/2" Set screws for retainer glands
2	4" MJ x MJ 45° bend
5	4" Retainer glands
*5	4" MJ gaskets
1	4" MJ cap

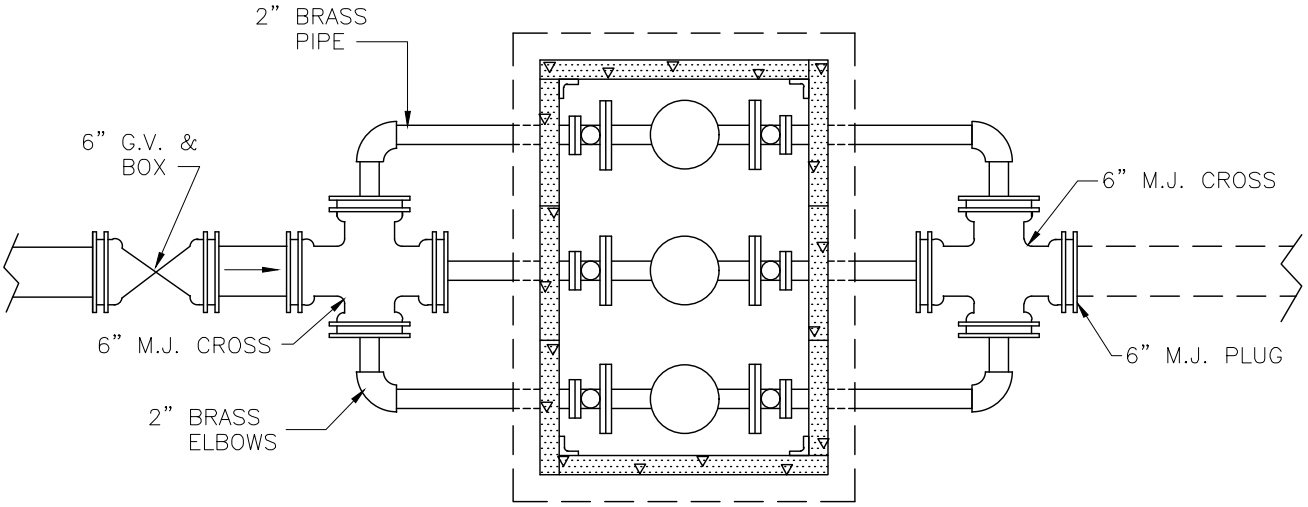
ADD

5	6" Retainer glands
*5	6" MJ gaskets
1	6" MJ cap
2	6" Flange gaskets
*30	5/8"x2" Set screws for retainer glands
16	3/4"x3 1/4" Nuts & bolts for flange connections
*10	3/4"x3 1/2" Nuts & bolts for MJ connections
2	6" Flange x plain end nipples 30" long
2	6"x4" Flanged reducers
2	6" MJ x MJ 45° bends
1	6" Plain end x plain end nipple approximately 24" long

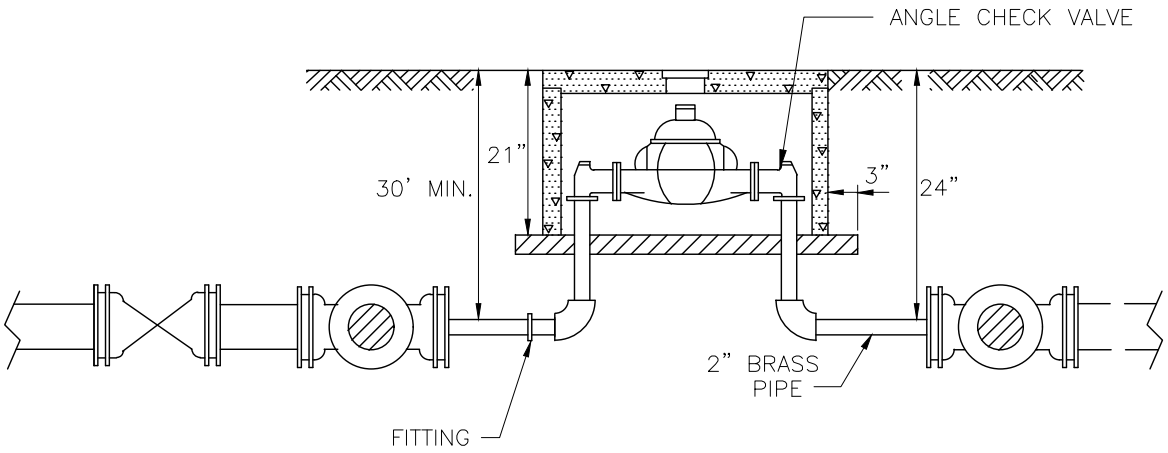
* Above MJ gaskets, set screws, & MJ nuts and bolts are supplied with respective MJ fittings.

REVISIONS	MATERIALS LIST FOR DUAL 2-INCH METER SETTING	DRAWING NO.
2024		DCWA 185-3

DINWIDDIE COUNTY WATER AUTHORITY



PLAN



SECTION

REVISIONS	TRIPLE 2–INCHES METER SETTING	DRAWING NO.
2024		DCWA 190–1

DINWIDDIE COUNTY WATER AUTHORITY
MATERIAL FOR TRIPLE 2" DISC METER
WITH 6" INLET AND 6" OUTLET

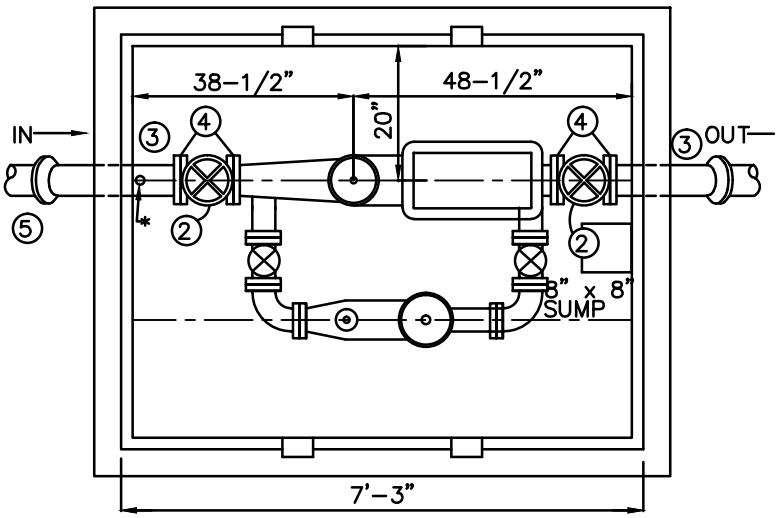
QTY.	DESCRIPTION
3	2" Disc meters w/gaskets, bolts & nuts
6	2" Flanged angle valve
20	2" Brass pipe – 16 pieces of variable length; pipe to be cut & threaded by contractor
10	2" Brass elbows
3	2" Ford C–86–66 or C–86–67 or approved equal
2	6" M.J. crosses w/bolt & nuts
6	6" M.J. plugs drilled & tapped for 2"
1	6" G.V. & box
6	6" D.I. pipe
1	6" M.J. plug

NEPTUNE
E-CODER)R900i
RADIO READ METERS

REVISIONS	MATERIALS LIST FOR TRIPLE 2–INCH METER SETTING	DRAWING NO.
2024		DCWA 190–2

DINWIDDIE COUNTY WATER AUTHORITY

* 1/2" TAP WITH COCK

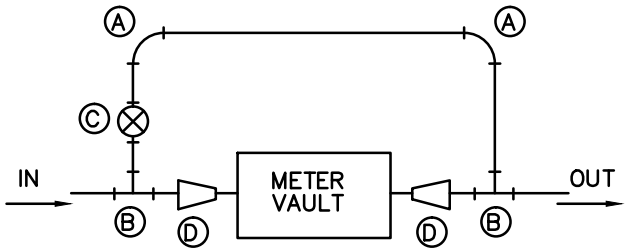


PLAN

SCALE 3/8" = 1'–0"

MATERIALS LIST

①	1 – 4",6" OR 8" F.M. METER NEPTUNE
②	2 – 4",6" OR 8" FLANGED GATE VALVES
③	2 – 4",6" OR 8" FLANGED BY PLAIN NIPPLES
④	4 – 4",6" OR 8" GASKETS
⑤	2 – 4",6" OR 8" – 45° M.J. BENDS W/RETAINER GLANDS



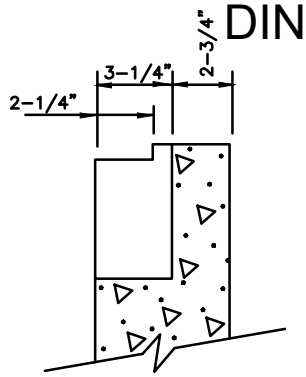
METER BY–PASS DETAIL

NOTE: INSTALL BY–PASS ON ALL F.M. METERS 6" W/4" METER
6" W/6" METER
8" W/8" METER

Ⓐ – 2– 90° BENDS
Ⓑ –2– TEES
Ⓒ –1 VALVE & VALVE BOX
Ⓓ –2–6" x 4" REDUCERS

REVISIONS		DRAWING NO.
2024	4–INCH, 6–INCH, & 8–INCH F.M. METER SETTING	DCWA 195–1

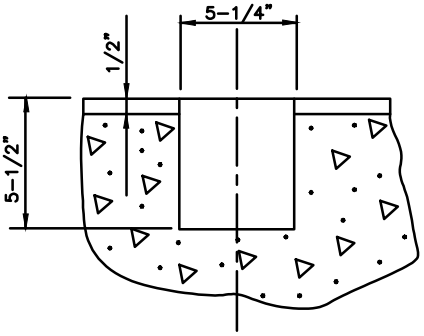
DINWIDDIE COUNTY WATER AUTHORITY



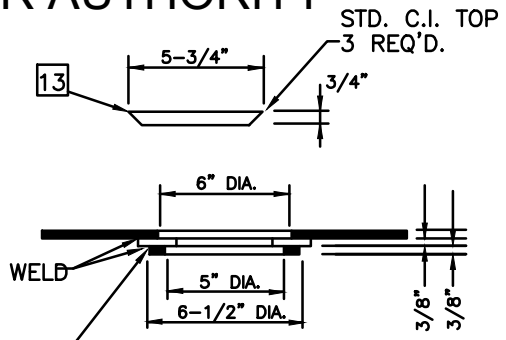
SECTION

BEAM RECESS

SCALE: 1-1/2" = 1'-0"

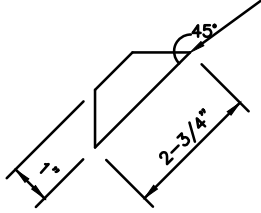


ELEVATION



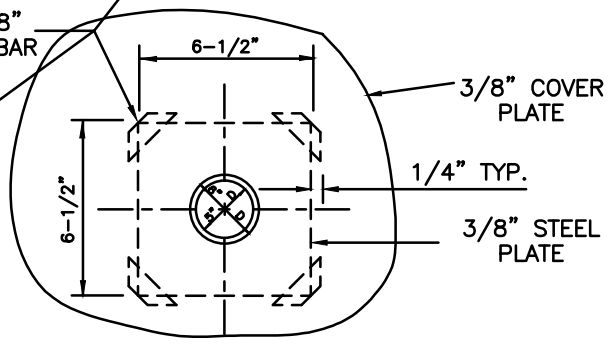
SECTION

SCALE: 1-1/2" =1'-0"



SPACER

SCALE: 3" = 1'-0"
12 REQ'D.



OPENING IN COVER PL
& C.I. TOP SUPPORT

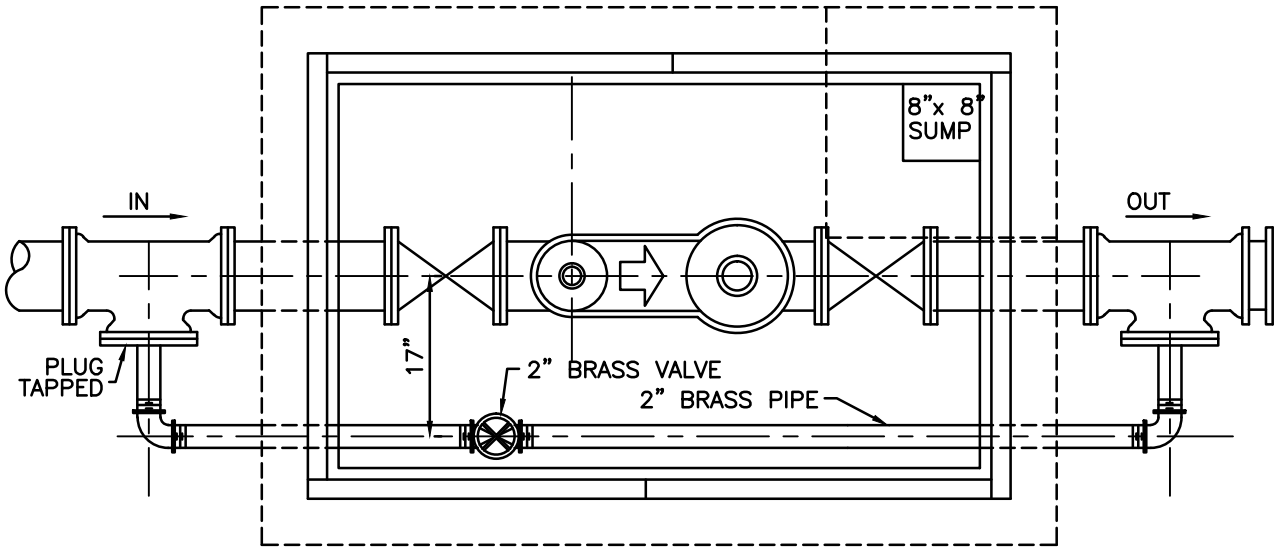
SCALE: 1-1/2" = 1'-0"
3 REQ'D.

MATERIALS LIST

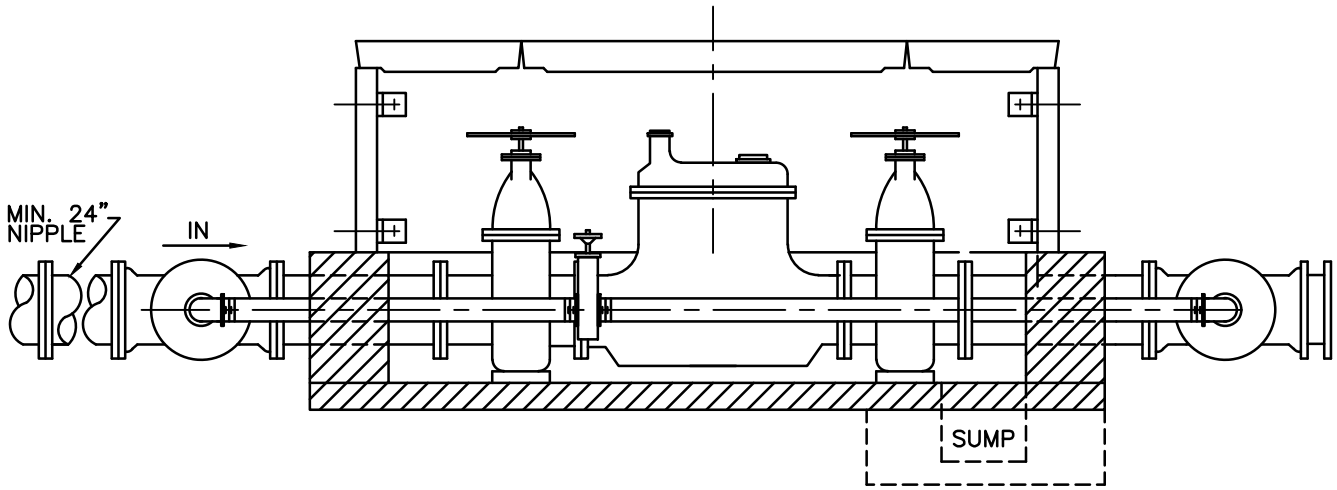
①	1 – 4",6" OR 8" F.M. METER
②	2 – 4",6" OR 8" FLANGED GATE VALVES
③	2 – 4",6" OR 8" FLANGED BY PLAIN NIPPLES
④	4 – 4",6" OR 8" GASKETS
⑤	2 – 4",6" OR 8" – 45° M.J. BENDS W/RETAINER GLANDS
6	1000 BRICKS & MORTAR
7	1/4 CUBIC YARD CLASS 2000 PSI CONCRETE
8	150 NO. 3 REINFORCING BARS
9	2 – 5" WF BEAMS @ 18.5 lbs. x 6'-0 1/4"
10	3 – 2'-6" x 5'-10 1/2"x 3/8" SAFTEY TREAD COVER PLATES
11	42'-6" – 2"x2"x1/4" STEEL ∠
12	2'-6" – 1"x 3/8" STEEL STRIP
13	3 – 5 3/4" x 3/4" CAST IRON TOPS

REVISIONS		DRAWING NO.
2024	4–INCH, 6–INCH, & 8–INCH F.M. METER SETTING	DCWA 195–2

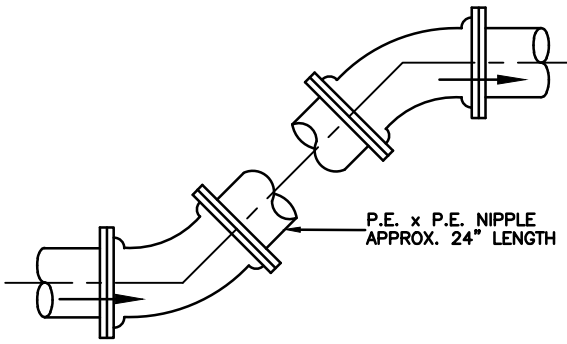
DINWIDDIE COUNTY WATER AUTHORITY



PLAN
NO SCALE



ELEVATION
NO SCALE



ELEVATION
NO SCALE

REVISIONS		DRAWING NO.
2024	4–INCH COMPOUND METER SETTING	DCWA 200–1

DINWIDDIE COUNTY WATER AUTHORITY

TYPE I (4" INLET & 4" OUTLET)

QTY.	DESCRIPTION
1	4" CT meter
2	4" flanged wheel valves
2	4" flanged x PE nipples 30" long
1	4" PE x PE nipple approx. 24" long
2	4" x 3" MJ tees
2	3" MJ plug tapped 2"
2	4" 45° MJ bends
7	4" retainer glands
1	4" MJ plug
10	2" brass pipe cut & threaded by contractor
1	2" brass gate valve
2	2" 90° brass elbows
4	4" flanged gaskets
*8	4" MJ gaskets
1	4" PE x PE nipple 24" min. length
*32	3/4" x 3–1/2" MJ nuts & bolts
32	5/8" x 3" flanged nuts & bolts
*8	5/8" x 3" MJ nuts & bolts
*2	3" MJ gaskets
*28	5/8" x 1–1/2" set screws for retainer glands

TYPE II (6" INLET AND 6" OUTLET)

ELIMINATE FROM TYPE I

QTY.	
2	4" flanged x PE nipples 30" long
1	4" PE x PE nipple to reach elev. of water main
2	4" x 3" MJ tees
2	4" 45° MJ bends
7	4" retainer glands
1	4" MJ plug
*8	4" MJ gaskets
1	4" PE x PE nipple 24" min. length
*28	5/8" x 1–1/2" set screws for retainer glands

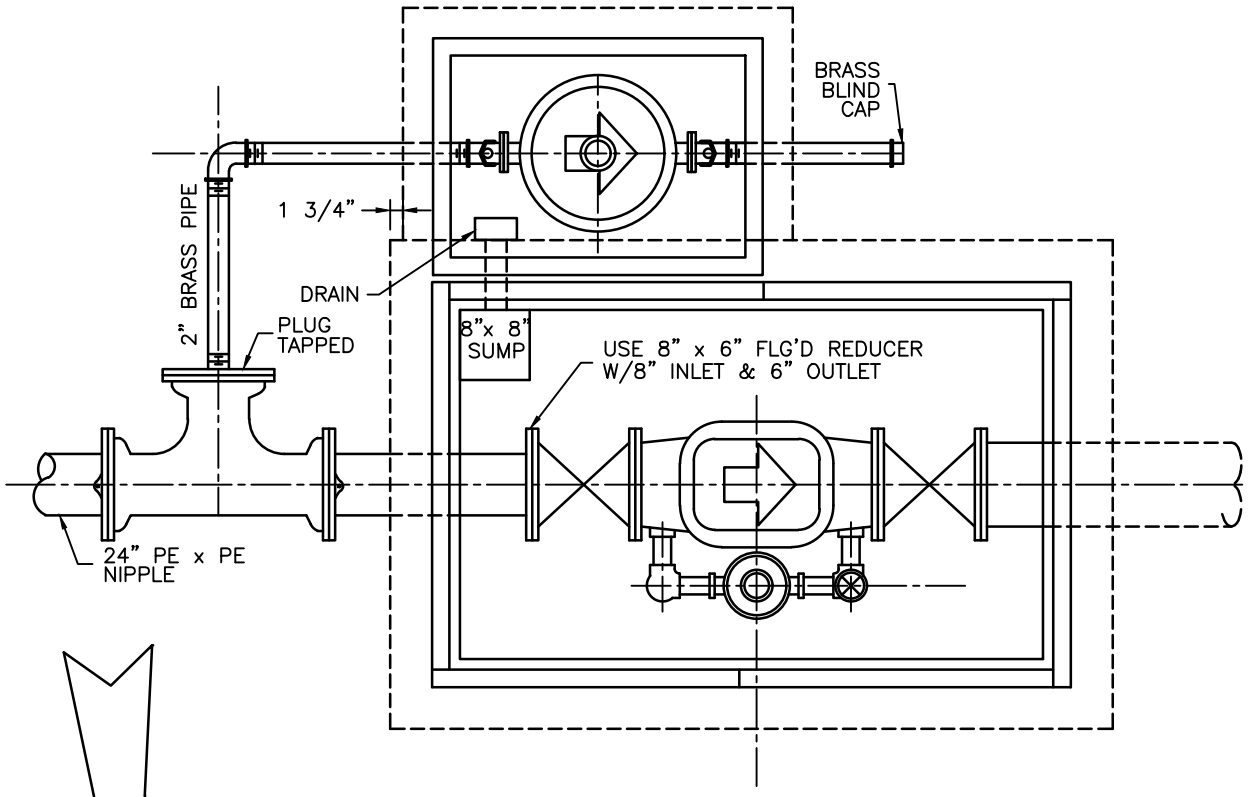
ADD

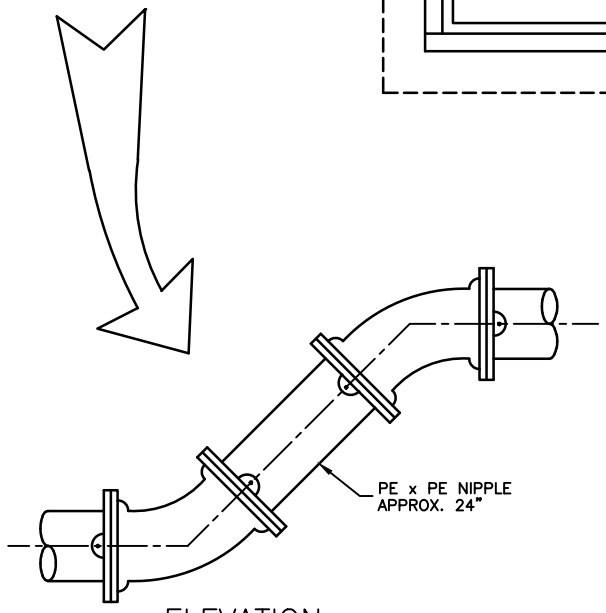
2	6" x 4" flanged reducers
2	6" flanged x PE nipples 30" long
2	6" x 3" MJ tees
2	6" 45° MJ tees
2	6" flanged gaskets
7	6" retainer glands
1	6" MJ plug
*8	6" MJ gaskets
*16	3/4" x 3–1/2" MJ nuts & bolts
16	3/4" x 3–1/2" flanged nuts & bolts
1	6" PE x PE nipple 24"min. length
1	6" PE x PE nipple approx. 24" long
*42	5/8" x 2" set screws for retainer glands

* Above MJ gaskets, set screws, & MJ nuts & bolts are supplied with respective fittings.

REVISIONS		DRAWING NO.
2024	MATERIALS LIST FOR 4–INCH COMPOUND METER SETTING	DCWA 200–2

DINWIDDIE COUNTY WATER AUTHORITY





ELEVATION

NO SCALE

REVISIONS		DRAWING NO.
2024	1 1/2–INCH OR 2–INCH METER 6–INCH DETECTOR CHECK SETTING	DCWA 205–1

TYPE I 1 1/2" DISC METER, 6" DC (8" INLET) (6"OUTLET) 2" BRASS INLET & OUTLET)

QTY.	DESCRIPTION
1	1–1/2" Disc Meter with gaskets, bolts, and nuts
2	1–1/2" flanged angle valves
3	2" brass elbows
10	2" brass pipe to be cut & threaded by contractor
1	8 x 3 MJ tee
1	3" MJ plug tapped 2"
2	6" flanged x plain end nipples 30" long
2	6" 45° MJ bends
1	6" plain end x plain end nipple approx. 24" long.
1	6" plain end x plain end nipple 24" min. length
7	6" MJ retainer glands
1	6" MJ cap
*7	6" MJ gaskets
4	6" flanged gaskets
2	6" flanged gate valves
1	6" DC meter
*42	3/4" x 3–1/2" nuts & bolts for MJ connections
*4	5/8" x 3" nuts & bolts for MJ connections
*42	5/8" x 2" set screws for retainer glands
32	3/4" x 3–1/4" nuts & bolts for flange connections

NEPTUNE
E-CODER)R900i
RADIO READ METERS

TYPE II 1–1/2"" DISC METER, 6" DC (8" INLET) (6"OUTLET) 2" BRASS INLET & OUTLET)

QTY.	ELIMINATE FROM TYPE I
1	6" x 3" MJ tee
1	6" flanged x plain end nipple 30" long
2	6" 45° bends
1	6" plain end x plain end nipple approx. 24" long
6	6" MJ retainer glands
1	6" plain end x plain end nipple 24" min. length
*6	6" MJ gaskets
*36	3/4" x 3–1/2" nuts & bolts for MJ connections

ADD

1	8" x 3" MJ tee
1	8" flanged x plain end nipple 30" long
2	8" 45° MJ bends
1	8" plain end x plain end nipple approx. 24" long
6	8" MJ retainer glands
1	8" plain end x plain end nipple 24" min. length
*6	8" MJ gaskets
*36	3/4" x 4" nuts & bolts for MJ connections
1	8" x 6" flanged reducer
8	3/4" x 3–1/2" nuts & bolts for flanged connections
1	8" flanged gasket

DINWIDDIE COUNTY WATER AUTHORITY

* Above MJ gaskets, set screws, & MJ nuts & bolts are supplied with respective fittings.

REVISIONS		DRAWING NO.
2024	MATERIALS LIST FOR 1 1/2–INCH OR 2–INCH METER 6–INCH DETECTOR CHECK SETTING	DCWA 205–2

DINWIDDIE COUNTY WATER AUTHORITY

NEPTUNE E-CODER)R900i RADIO READ METERS

TYPE III 2" DISC METER, 6" DC (6" INLET) (6"OUTLET) 2" BRASS INLET & OUTLET)

QTY.	FROM TYPE I ELIMINATE
1	1–1/2" Disc Meter with gaskets, bolts, and nuts
	ADD
1	2" Disc Meter with gaskets bolts, and nuts

QTY.	FROM TYPE I ELIMINATE
2	1–1/2" flanged angle valves
	ADD
2	2" FLANGED ANGLE VALVES

TYPE IV 2" DISC METER, 6" DC (6" INLET) (6"OUTLET) 2" BRASS INLET & OUTLET)

QTY.	FROM TYPE II ELIMINATE
1	1–1/2" Disc Meter with gaskets, bolts, and nuts
	ADD
1	2" Disc Meter with gaskets bolts, and nuts

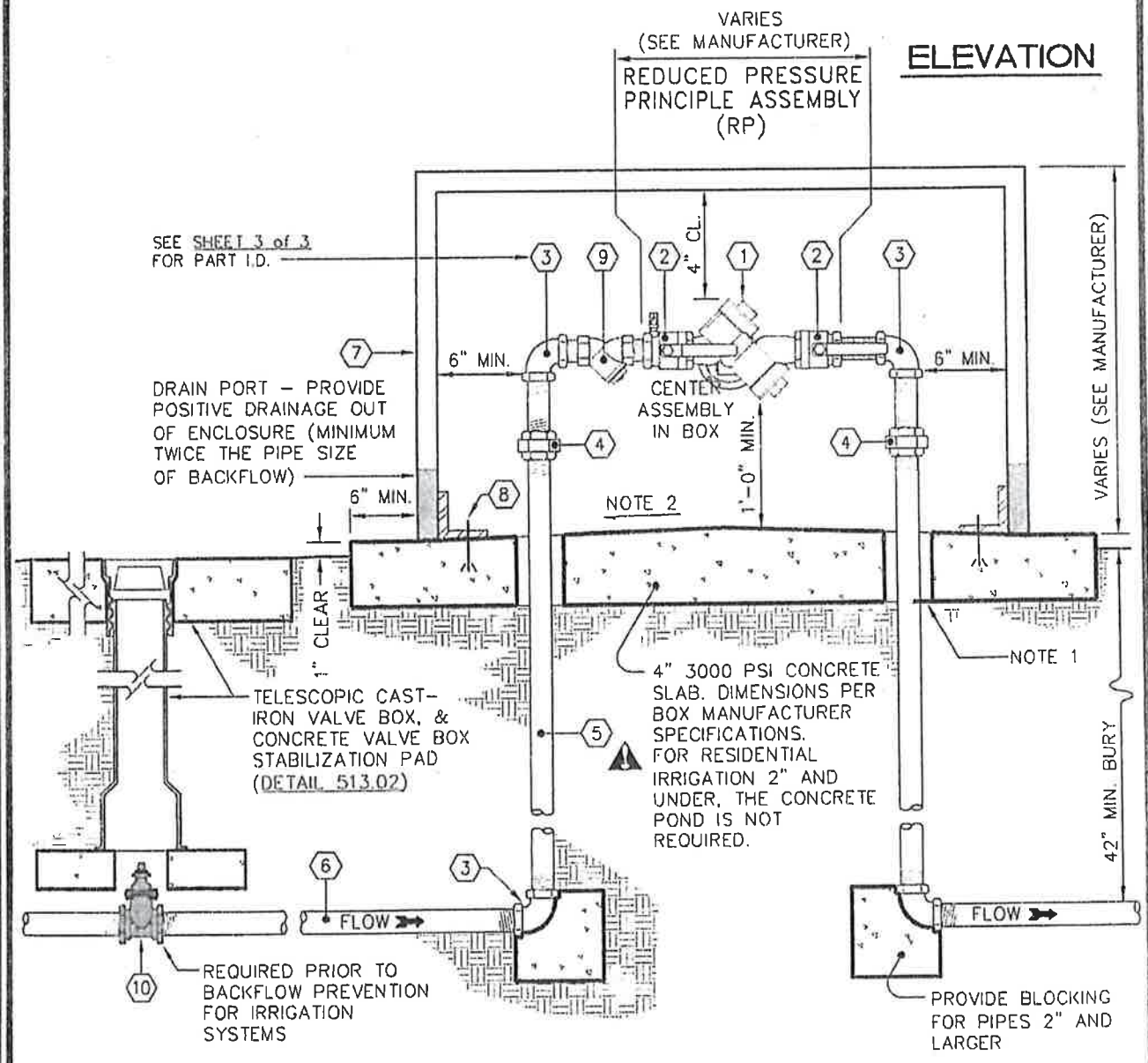
QTY.	FROM TYPE II ELIMINATE
2	1–1/2" flanged angle valves
	ADD
2	2" FLANGED ANGLE VALVES

* Above MJ gaskets, set screws, & MJ nuts & bolts are supplied with respective fittings.

REVISIONS	MATERIALS LIST FOR 1 1/2–INCH OR 2–INCH METER 6–INCH DETECTOR CHECK SETTING	DRAWING NO.
2024		DCWA 205–3

-IRRIGATION ONLY-
RP TYPE BACKFLOW TO BE INSTALLED WITHIN 50' OF DOMESTIC TEE W/ SEPARATE IRRIGATION METER

DINWIDDIE COUNTY WATER AUTHORITY



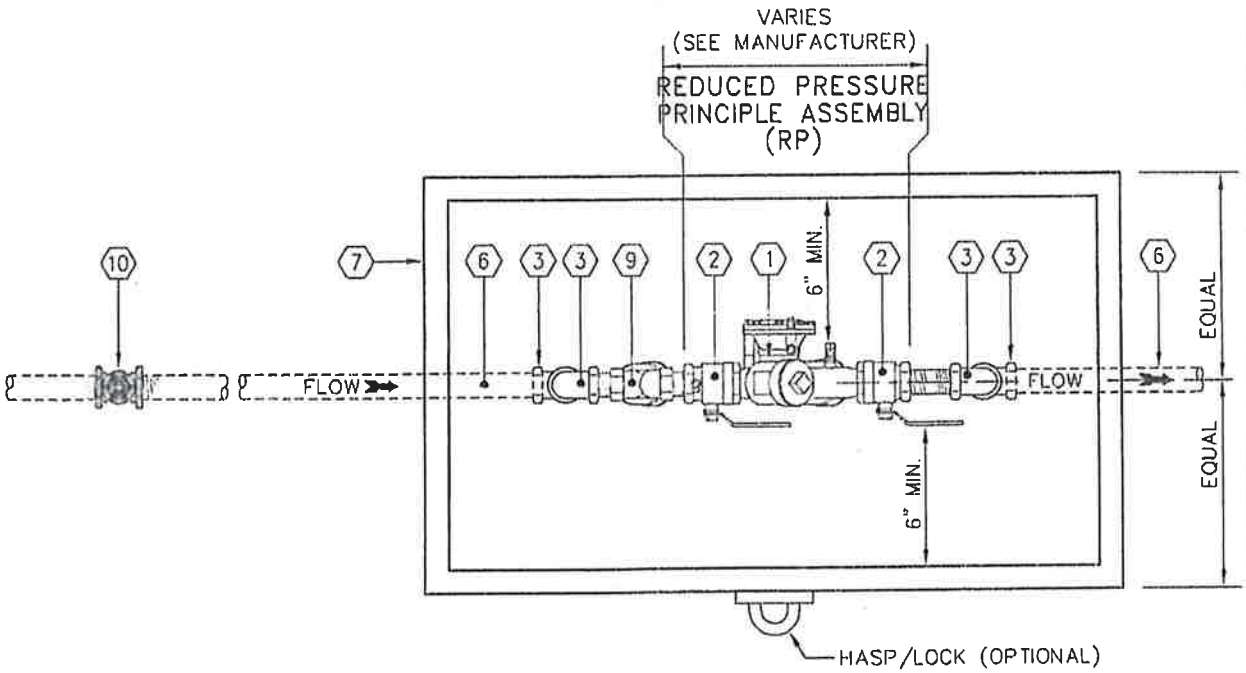
DCWA

2024	3/4" to 2" IRRIGATION ONLY, RP ASSEMBLY (ABOVE GROUND)	206-1

-IRRIGATION ONLY-
RP TYPE BACKFLOW TO BE INSTALLED WITHIN 50' OF DOMESTIC TEE W/ SEPARATE IRRIGATION METER

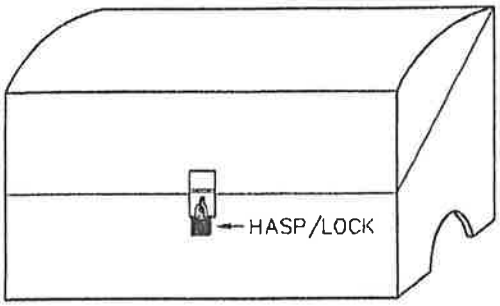
DINWIDDIE COUNTY WATER AUTHORITY

PLAN VIEW



2024	DCWA **3/4" to 2" IRRIGATION ONLY, RP ASSEMBLY (ABOVE GROUND)**	206-2

DINWIDDIE COUNTY WATER AUTHORITY



TYPICAL ENCLOSURE

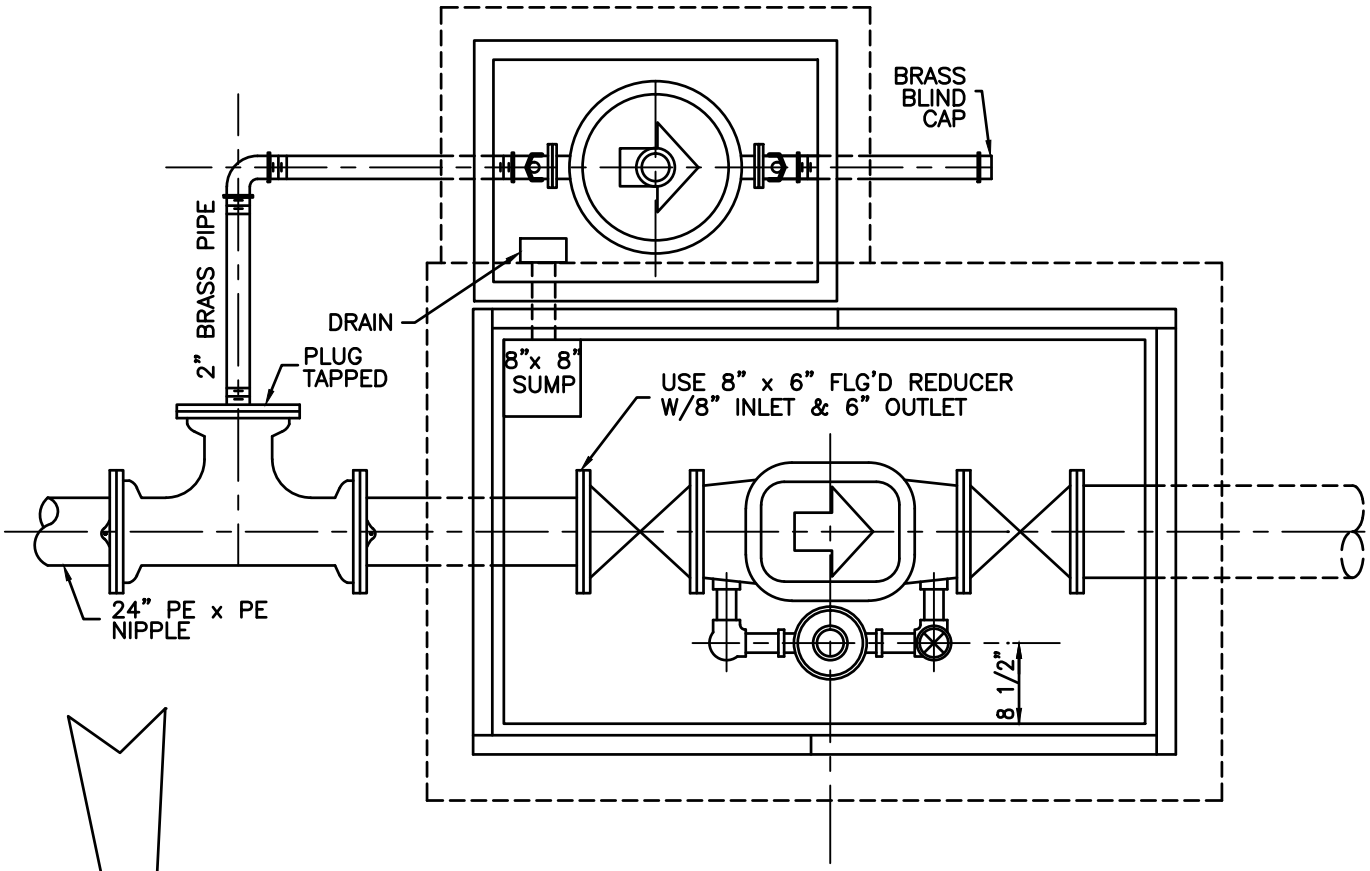
(#)	PART	MANUFACTURER MODEL / Cat. No.
1	BACKFLOW PREVENTION ASSEMBLY, AS APPLICABLE	ASSE APPROVED LIST PROVIDED AT www.ASSE-Plumbing.org
2	1/4 TURN FULL PORT BRONZE BALL SHUT-OFF VALVE	---
3	ALL MATERIALS TO CONFORM TO SECTION 6 ON NC PLUMBING CODE.	---
4	OPTIONAL THREADED UNION AT GROUND LEVEL WITHIN 3" OF GROUND (REQUIRED FOR IRRIGATION ONLY)	---
5	ALL MATERIALS TO CONFORM TO SECTION 6 ON NC PLUMBING CODE.	---
6	ALL MATERIALS TO CONFORM TO SECTION 6 ON NC PLUMBING CODE.	---
7	INSULATED ENCLOSURE WITH LOCKING ACCESS AND OPTIONAL HEATER (120 V, 1 PHASE 60 HZ) VERIFY FITTINGS WILL FIT INSIDE BOX BEFORE ORDERING	HOTBOX / HB.75 - HB3E (OR APPROVED EQUIVALENT) MEETING ASSE 1060
8	STAINLESS STEEL ANCHOR BOLTS PER BOX MANUFACTURER RECOMMENDED SIZE AND SPACING	---
9	STRAINER REQUIRED WITHIN 3' OF BFP (EXCLUDING FIRE BACKFLOW APPLICATIONS)	---
10	U.G. VALVE REQUIRED PRIOR TO BACKFLOW PREVENTER FOR IRRIGATION APPLICATIONS.	---

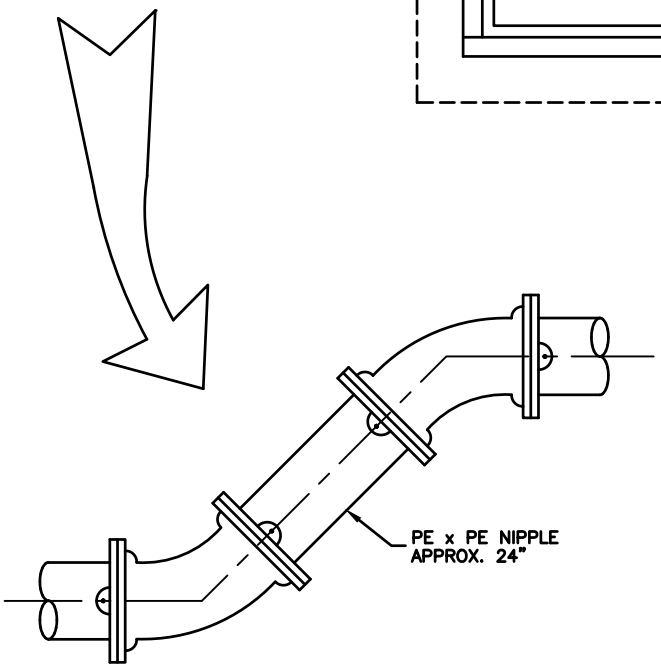
NOTES:

1. Provide minimum 1" annular clearance around all risers.
2. Slope floor to drain to ports at both ends. Ensure positive surface grade away from enclosure.
3. Construction and materials shall meet the requirements of the NC Plumbing Code and, for fire services, NFPA.
4. Minimum clearance 12" from ground, Maximum 60" to highest part of backflow & 6" clearance on all sides from walls.
5. Lawn irrigation requires a seperate irrigation meter | G.S. 143-355.4
6. NOTE TO ENGINEER: Heat is optional for domestic back flow. Only required on fire protection

		DCWA
2024	**3/4" to 2" IRRIGATION ONLY, RP ASSEMBLY (ABOVE GROUND)**	206-3

DINWIDDIE COUNTY WATER AUTHORITY





ELEVATION

NO SCALE

REVISIONS	1 1/2–INCH OR 2–INCH METER 8–INCH DETECTOR CHECK SETTING	DRAWING NO.
2024		DCWA 210–1

TYPE I 1 1/2" DISC METER, 8" DC (8" INLET) (8"OUTLET) 2" BRASS INLET & OUTLET)

QTY.	DESCRIPTION
1	1–1/2" Disc Meter with gaskets, bolts, and nuts
2	1–1/2" flanged angle valves
3	2" brass elbows
10	2" brass pipe to be cut & threaded by contractor
1	8 x 3 MJ tee
1	3" MJ plug tapped 2"
1	8" DC meter
2	8" flanged gate valves
2	8" flanged x plain end nipples 30" long
2	8" 45° MJ bends
1	8" plain end x plain end nipple approx. 24" long.
1	8" plain end x plain end nipple 24" min. length
1	8" MJ cap
7	8" retainer glands
*7	8" MJ gaskets
4	8" flange gaskets
32	3/4" x 3–1/2" nuts & bolts for flange connections
*42	5/8" x 2" set screws for retainer glands
*4	5/8" x 3" nuts & bolts for MJ connections
*42	3/4" x 4" nuts & bolts for MJ connections

TYPE II 2" DISC METER, 8" DC (8" INLET) (8"OUTLET) 2" BRASS INLET & OUTLET)

QTY.	ELIMINATE FROM TYPE I
1	1–1/2" Disc Meter with gaskets, bolts, and nuts
2	1–1/2" flanged angle valves

ADD

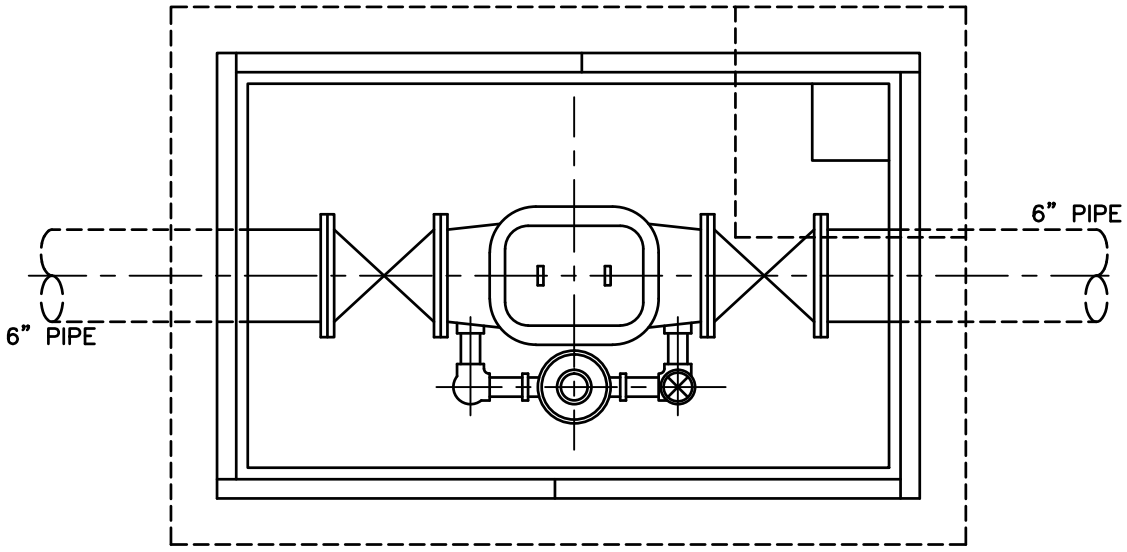
1	2" Disc Meter with gaskets bolts, and nuts
2	2" flanged angle valves

DINWIDDIE COUNTY WATER AUTHORITY

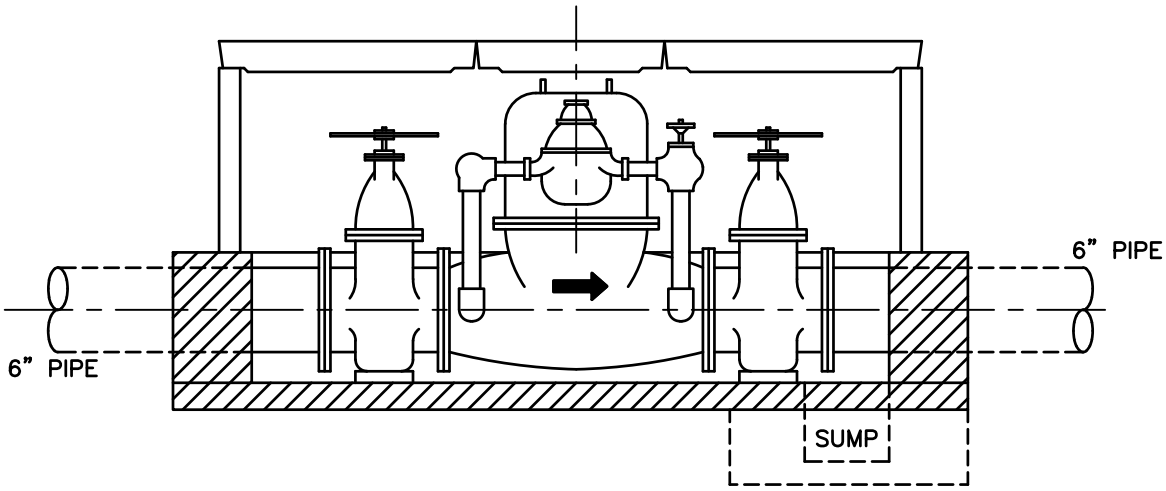
* Above MJ gaskets, set screws, & MJ nuts & bolts are supplied with respective fittings.

REVISIONS	MATERIALS LIST FOR 1 1/2–INCH OR 2–INCH METER 8–INCH DETECTOR CHECK SETTING	DRAWING NO.
2024		DCWA 210–2

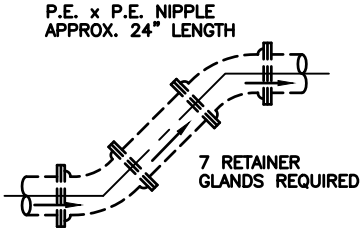
DINWIDDIE COUNTY WATER AUTHORITY



PLAN
NO SCALE



ELEVATION
NO SCALE



ELEVATION
NO SCALE

REVISIONS		DRAWING NO.
2024	6-INCH DETECTOR CHECK	DCWA 215-1

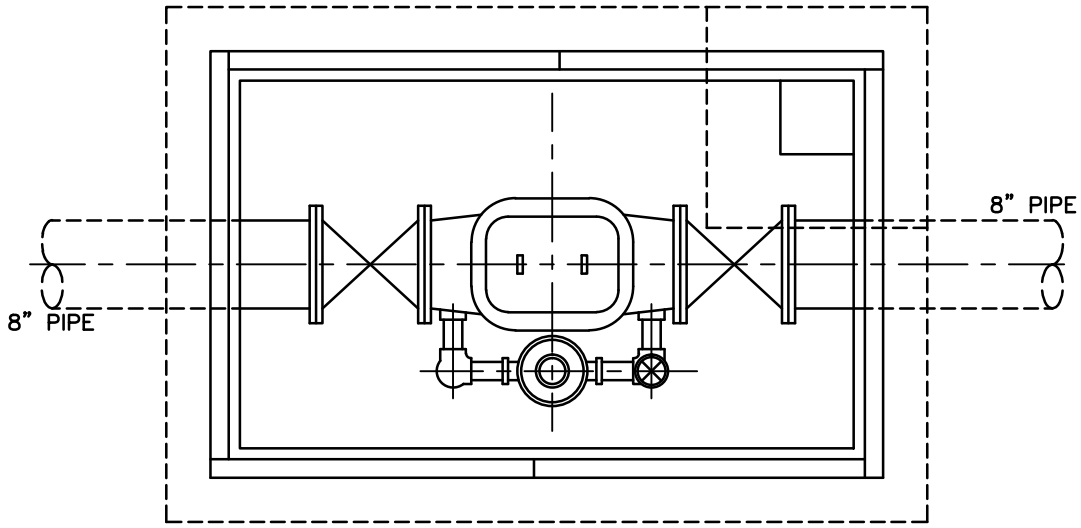
DINWIDDIE COUNTY WATER AUTHORITY

QTY.	DESCRIPTION
2	6" flanged x plain end nipples 30" long
2	6" 45° MJ bends
1	6" plain end x plain end nipple approx. 24" long
1	6" plain end x plain end nipple 24" min. length
7	6" MJ retainer glands
1	6" M.J. cap
*7	6" M.J. gaskets
4	6" flanged gaskets
2	6" flanged gate valves
1	6" DC meter
*42	3/4" x 3–1/2" nuts & bolts for MJ connections
*4	5/8" x 3" nuts and bolts for MJ connections
*42	5/8" x 2" set screws for retainer glands
32	3/4" x 3–1/4" nuts & bolts for flange connections

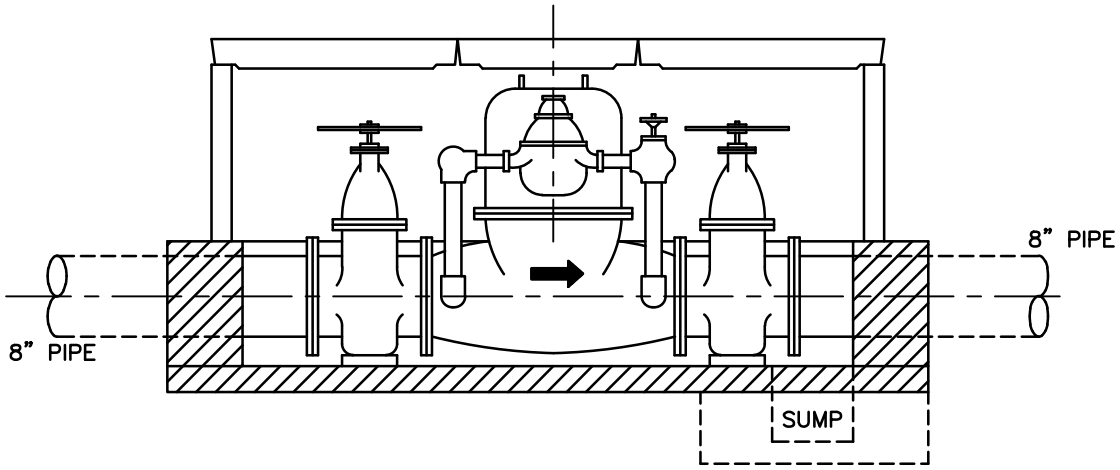
* Above MJ gaskets, set screws, & MJ nuts & bolts are supplied with respective fittings.

REVISIONS		DRAWING NO.
2024	MATERIALS LIST FOR 6–INCH DETECTOR CHECK	DCWA 215–2

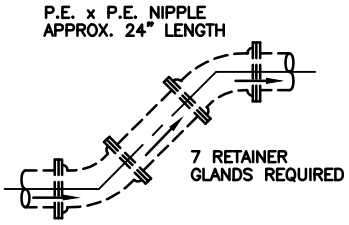
DINWIDDIE COUNTY WATER AUTHORITY



PLAN
NO SCALE



ELEVATION
NO SCALE



ELEVATION
NO SCALE

REVISIONS		DRAWING NO.
2024	8-INCH DETECTOR CHECK	DCWA 220-1

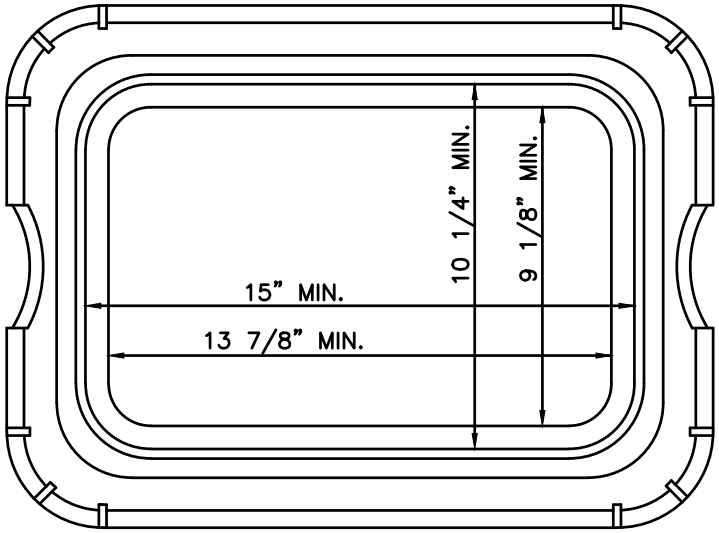
DINWIDDIE COUNTY WATER AUTHORITY

QTY.	
1	8" DC METER
2	8" FLANGED GATE VALVES
2	8" FLANGED x PLAIN END NIPPLES 30" LONG
2	8" 45° BENDS
1	8" PLAIN END x PLAIN END NIPPLE APPROXIMATELY 24" LONG
1	8" PLAIN END x PLAIN END NIPPLE 24" MIN. LENGTH
1	8" MJ CAP
7	8" RETAINER GLANDS
*7	8" MJ GASKETS
4	8" FLANGE GASKETS
32	3/4" x 3 1/2" NUTS AND BOLTS FOR FLANGE CONNECTIONS
*42	5/8" x 2" SET SCREWS FOR RETAINER GLANDS
*4	5/8" x 3" NUTS AND BOLTS FOR MJ CONNECTIONS
*42	3/4" x 4" NUTS AND BOLTS FOR MJ CONNECTIONS

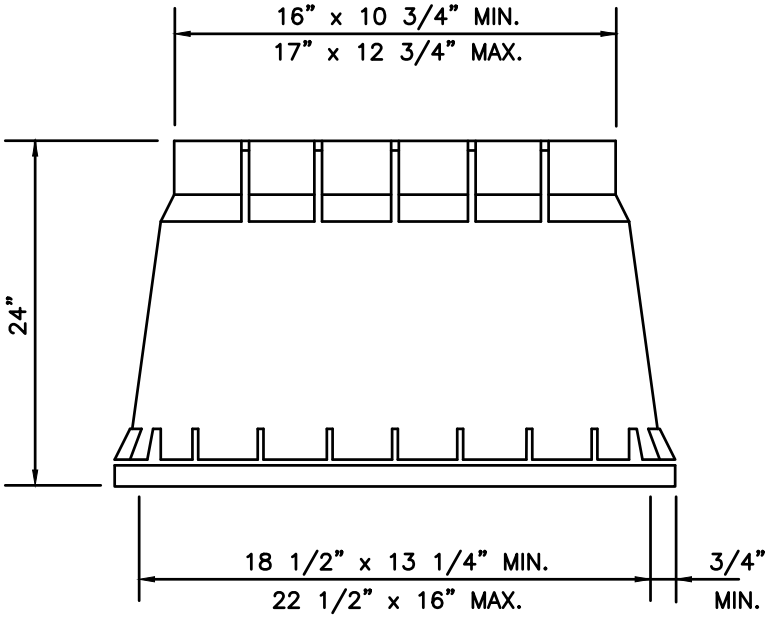
*ABOVE MJ GASKETS, SET SCREWS AND MJ NUTS AND BOLTS ARE SUPPLIED WITH RESPECTIVE MJ FITTINGS.

REVISIONS		DRAWING NO.
20 2024	MATERIALS LIST FOR 8-INCH DETECTOR CHECK	DCWA 220-2

DINWIDDIE COUNTY WATER AUTHORITY



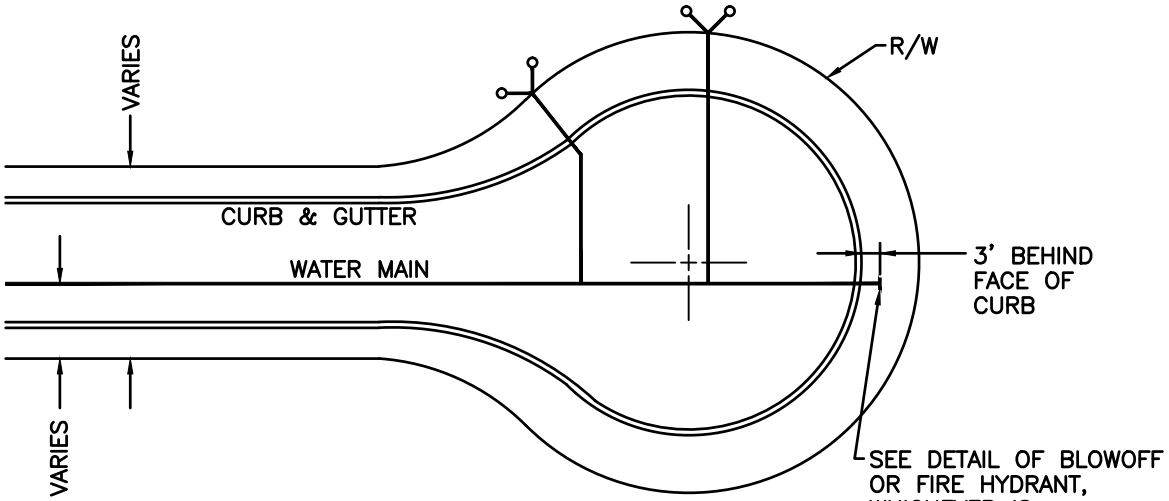
PLAN



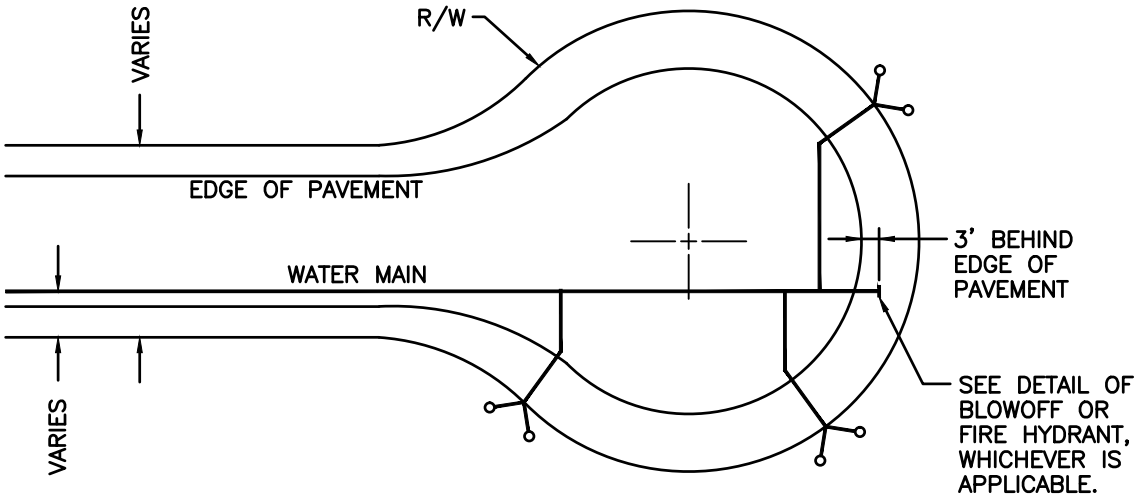
ELEVATION

REVISIONS	PLASTIC METER BOX (5/8–INCH METER)	DRAWING NO.
2024		DCWA 231

DINWIDDIE COUNTY WATER AUTHORITY



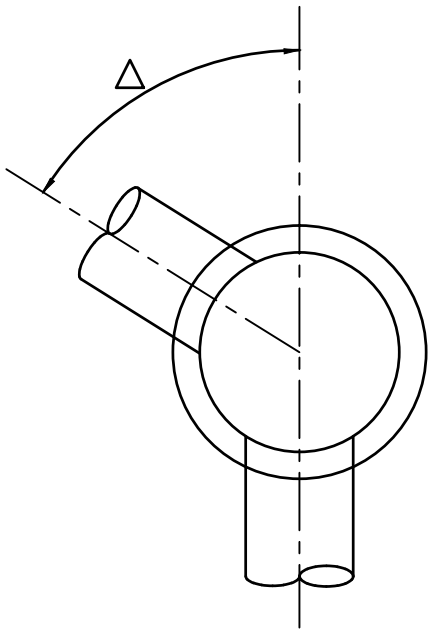
END OF MAIN LOCATION ON CUL-DE-SAC WITH EXISTING CURB AND GUTTER.



END OF MAIN LOCATION ON UNIMPROVED CUL-DE-SAC WITH OR WITHOUT FUTURE CURB AND GUTTER.

REVISIONS	TYPICAL WATER MAIN LOCATION ON CUL-DE-SAC	DRAWING NO.
2024		DCWA 235

DINWIDDIE COUNTY WATER AUTHORITY



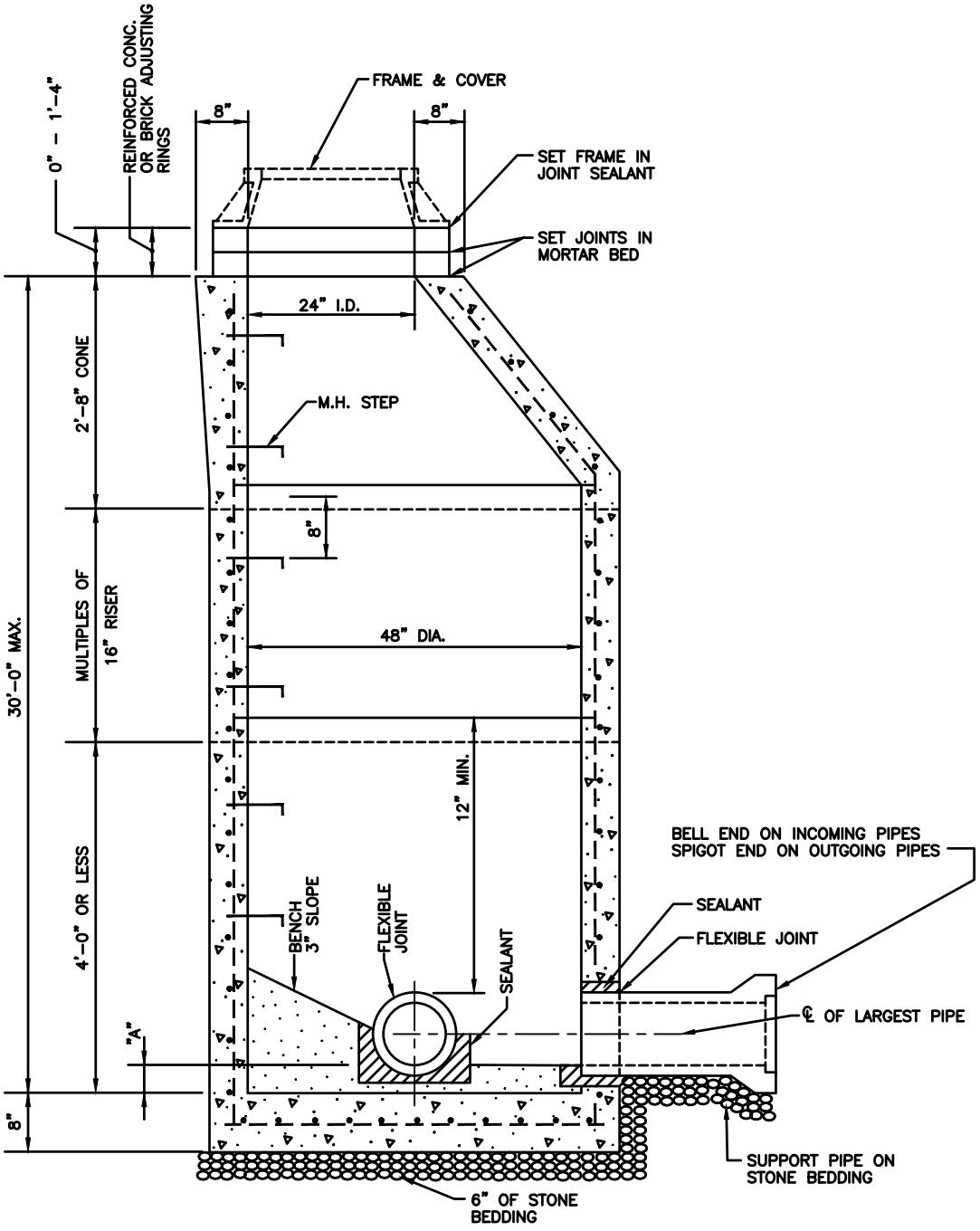
MANHOLE SIZING TABLE

MAXIMUM △'S AT MANHOLE (DEGREES)

SEWER PIPE SIZE	SIZE OF MANHOLE				
	48"	60"	72"	84"	96"
21"	68°	92°	107°		
24"	58°	85°	101°		
27"	47°	77°	95°		
30"	35°	68°	89°	103°	
36"	USE NEXT SIZE	50°	75°	92°	103°
42"		USE NEXT SIZE	60°	80°	94°
48"			USE NEXT SIZE	67°	84°
54"				USE NEXT SIZE	72°

REVISIONS		DRAWING NO.
2024	MANHOLE SIZING TABLE	DCWA 415

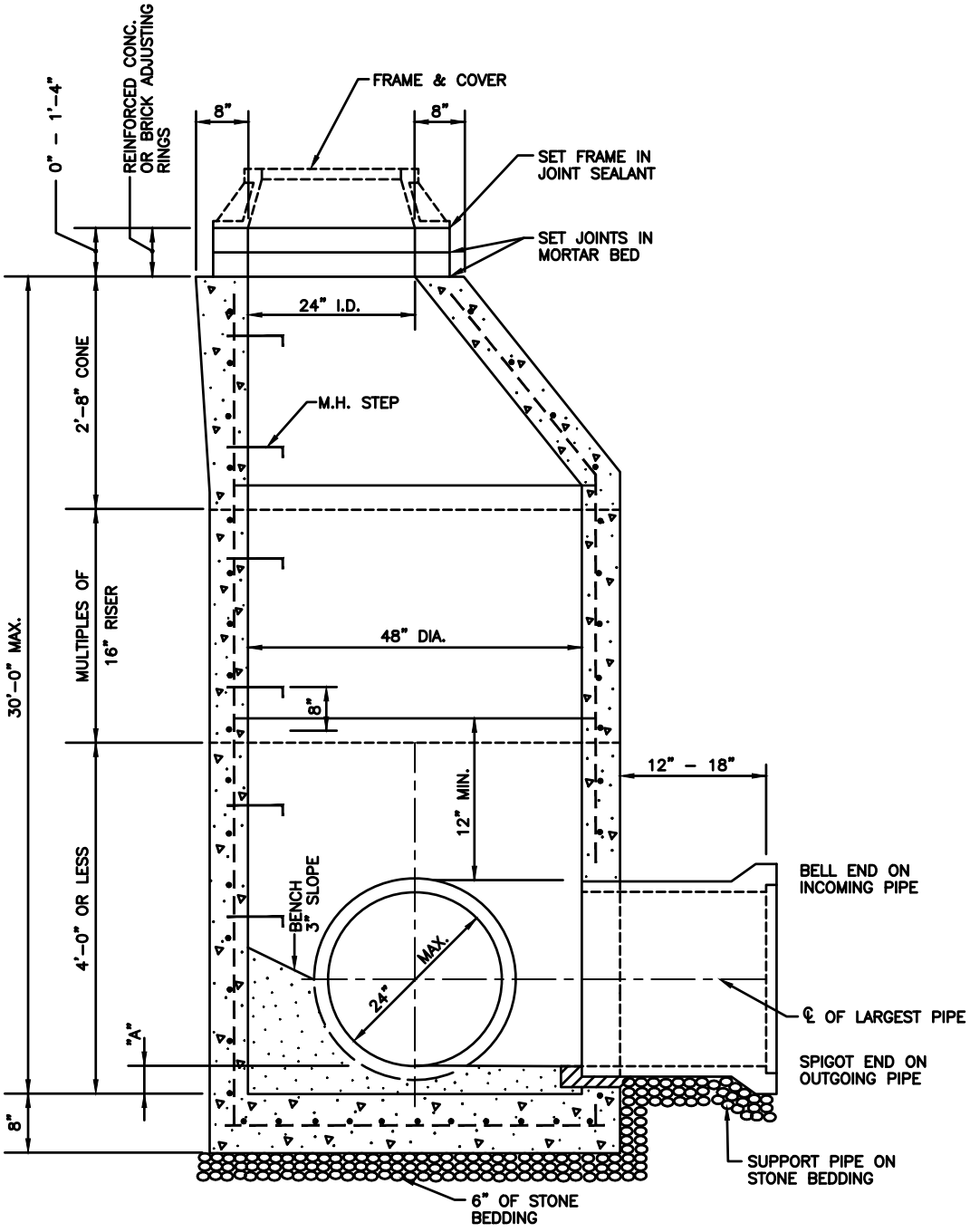
DINWIDDIE COUNTY WATER AUTHORITY



"A" DIMENSION EQUALS PIPE WALL THICKNESS PLUS 2" MINIMUM

REVISIONS	STANDARD PRECAST CONCRETE MANHOLE SEWERS 8–INCH TO 15–INCH	DRAWING NO.
2024		DCWA 420

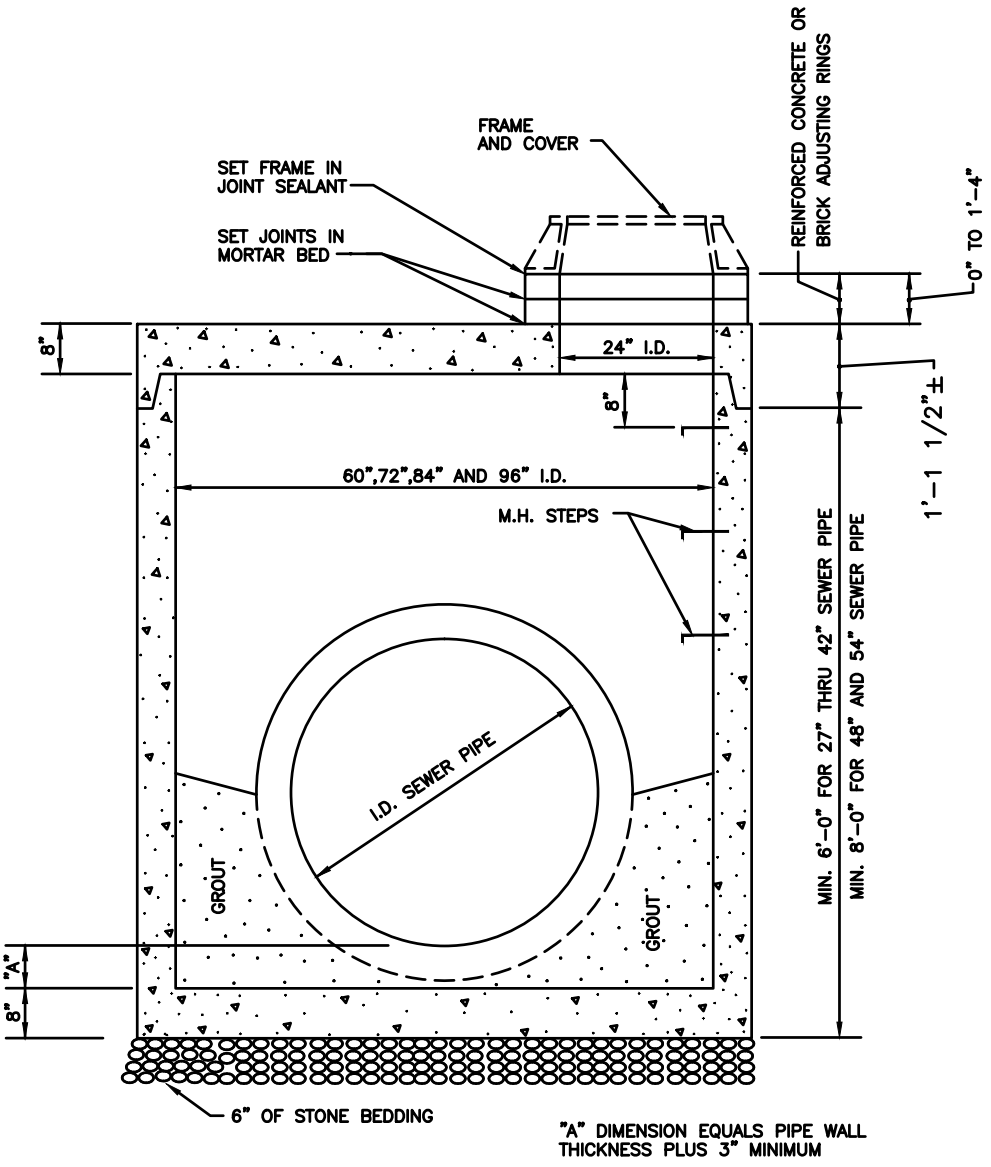
DINWIDDIE COUNTY WATER AUTHORITY



"A" DIMENSION EQUALS PIPE WALL THICKNESS PLUS 2" MINIMUM

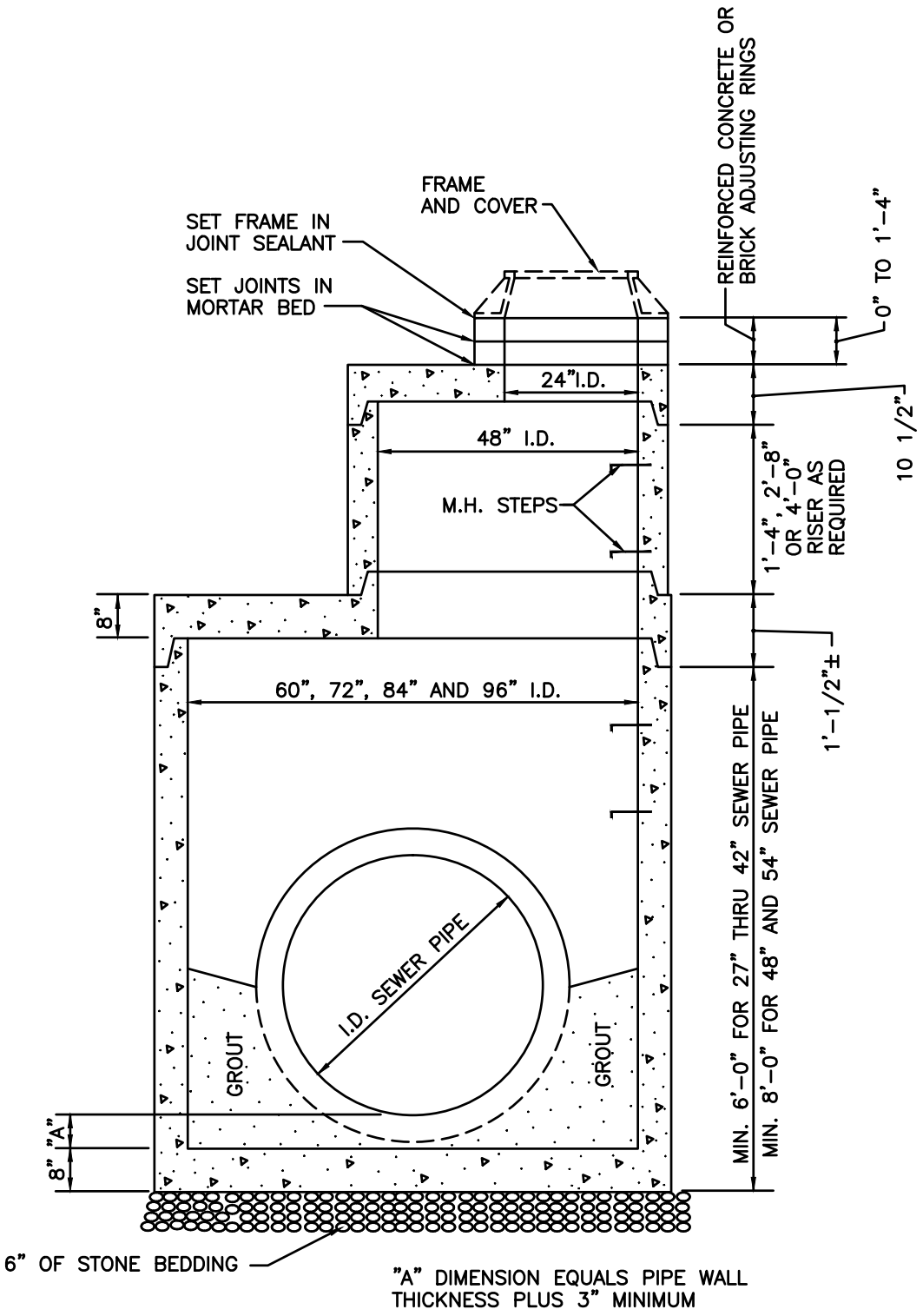
REVISIONS	STANDARD PRECAST CONCRETE MANHOLE SEWERS 18–INCH, 21–INCH AND 24–INCH	DRAWING NO.
2024		DCWA 425

DINWIDDIE COUNTY WATER AUTHORITY



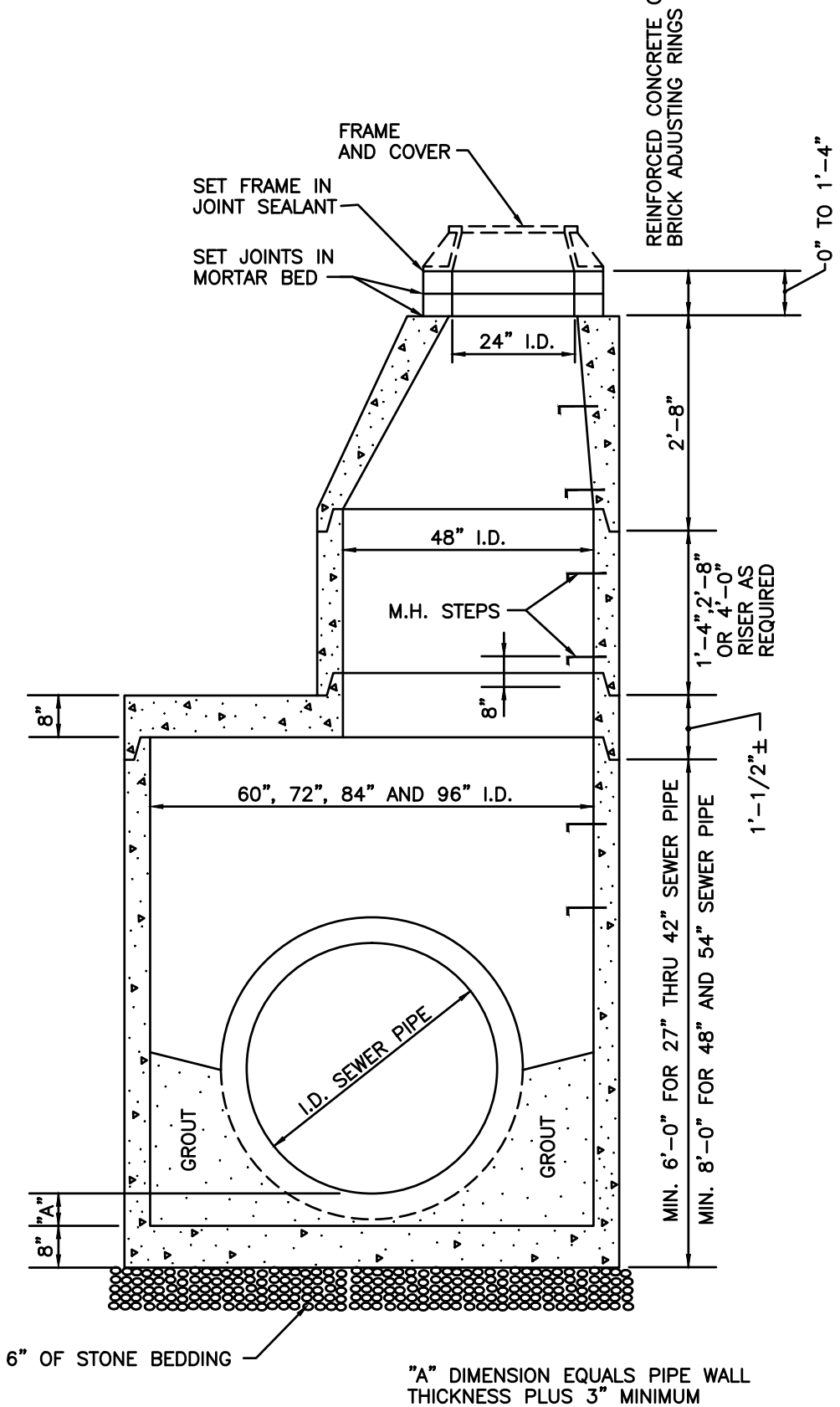
REVISIONS	60–INCH, 72–INCH, 84–INCH AND AND 96–INCH I.D. MANHOLE–I	DRAWING NO.
2024		DCWA 426

DINWIDDIE COUNTY WATER AUTHORITY



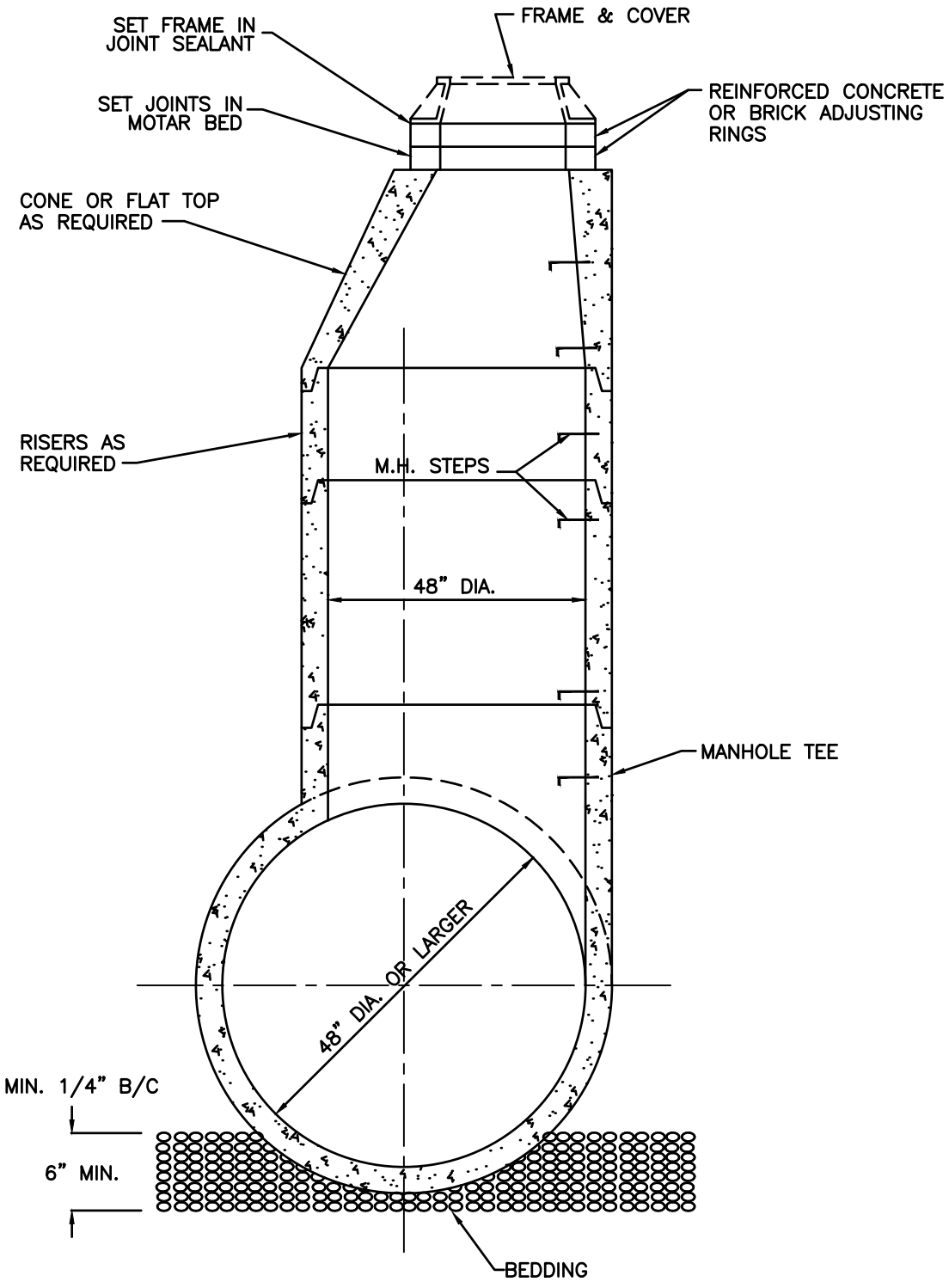
REVISIONS		DRAWING NO.
2024	60-INCH, 72-INCH, 84-INCH AND AND 96-INCH I.D. MANHOLE-II	DCWA 427

DINWIDDIE COUNTY WATER AUTHORITY



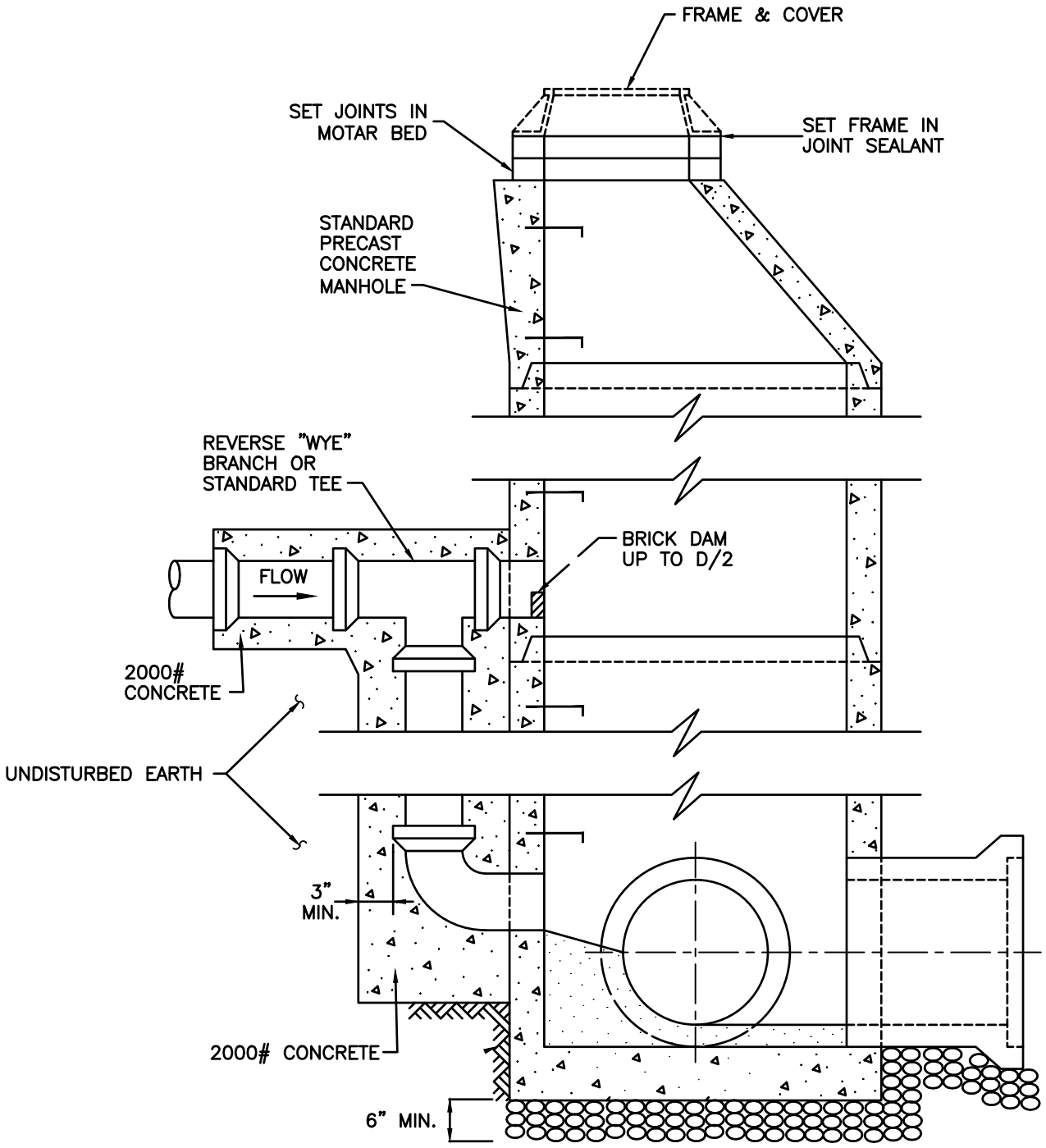
REVISIONS	60–INCH, 72–INCH, 84–INCH AND AND 96–INCH I.D. MANHOLE–III	DRAWING NO.
2024		DCWA 428

DINWIDDIE COUNTY WATER AUTHORITY



REVISIONS		DRAWING NO.
2024	TEE MANHOLE	DCWA 430

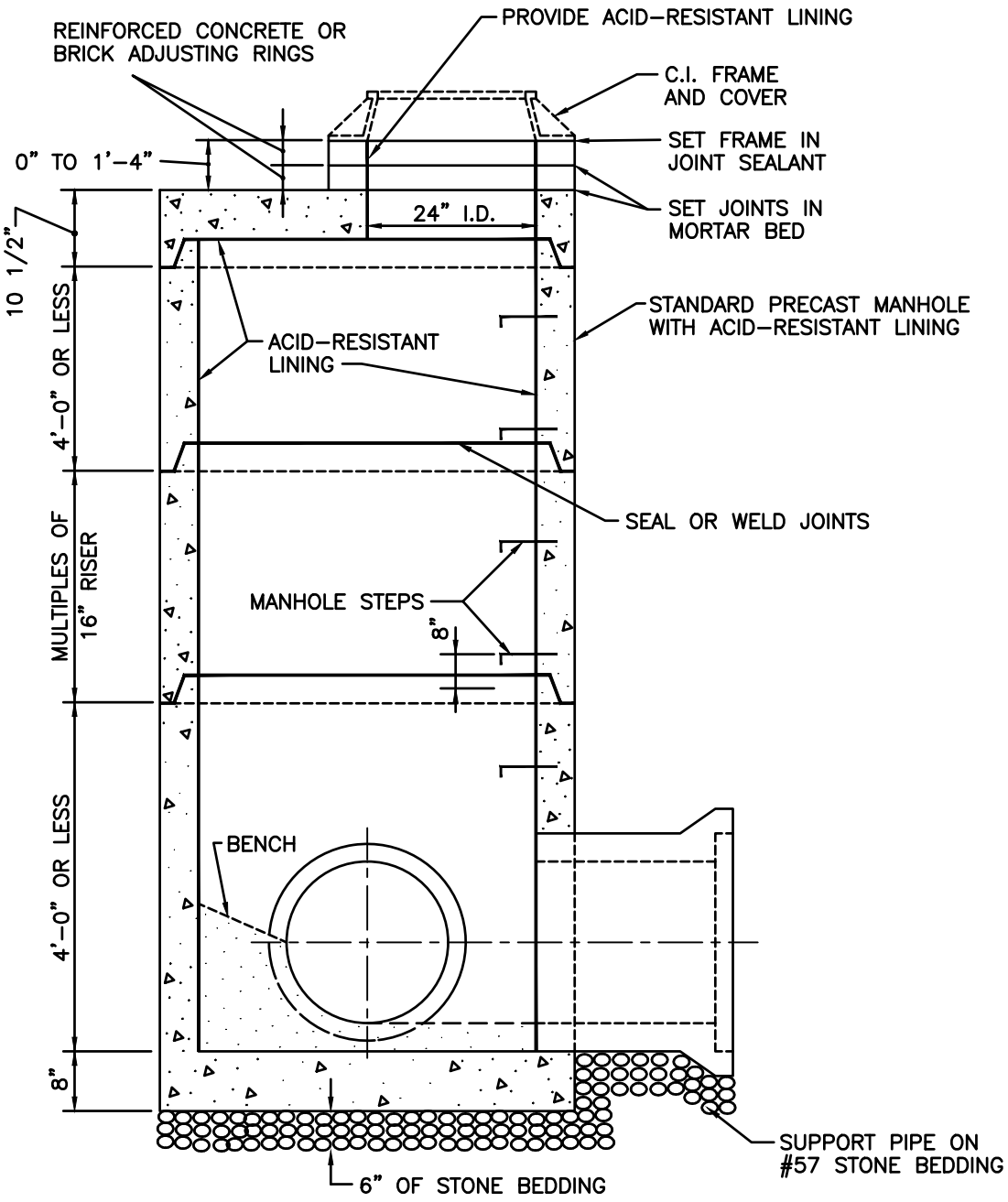
DINWIDDIE COUNTY WATER AUTHORITY



NOTE: CONCRETE ENCASEMENT MAY BE ELIMINATED IF D.I. PIPE AND FITTINGS ARE USED FOR DROP CONNECTION.

REVISIONS	STANDARD DROP MANHOLE	DRAWING NO.
2024		DCWA 435

DINWIDDIE COUNTY WATER AUTHORITY

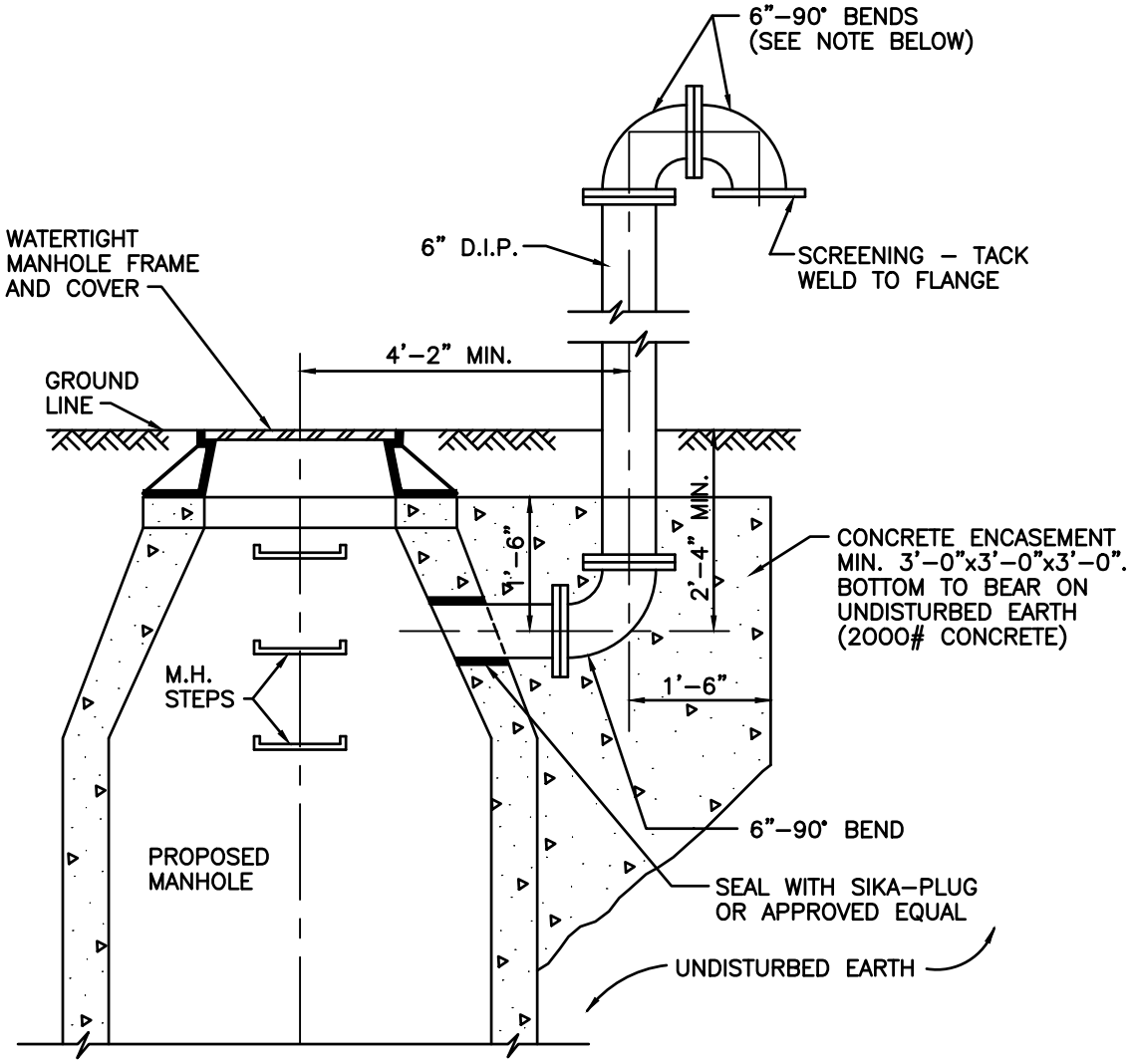


NOTE: USE SULFATE RESISTANT CEMENT TO PREPARE MORTAR IN BUILDING INVERT AND BENCH.

SEE DRAWING OF "STANDARD PRECAST CONCRETE MANHOLE" FOR ADDITIONAL MANHOLE DETAILS.

REVISIONS	ACID–RESISTANT LINING MANHOLE	DRAWING NO.
2024		DCWA 440

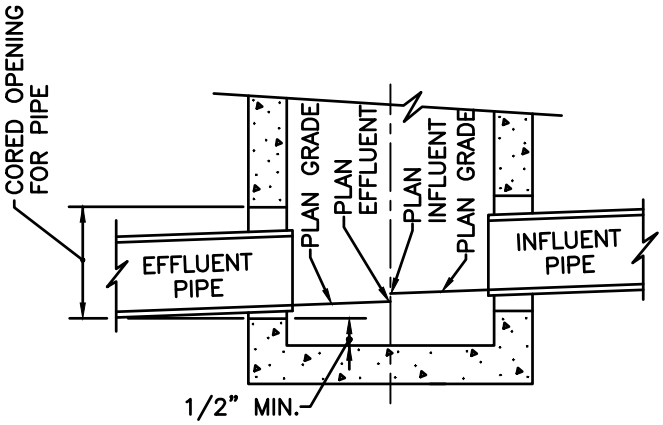
DINWIDDIE COUNTY WATER AUTHORITY



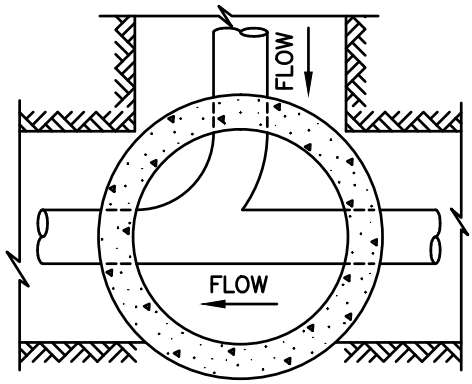
NOTE: IF TOP ELEVATION OF VENT IS LESS THAN 8'–0" ABOVE GROUND LINE, THE 2–6" 90° BENDS WILL BE REQUIRED. 8'–0" AND HIGHER ABOVE GROUND LINE WILL NOT REQUIRE ANY FITTINGS. (OPEN TO ATMOSPHERE)

REVISIONS	MANHOLE VENT DETAIL	DRAWING NO.
2024		DCWA 445

DINWIDDIE COUNTY WATER AUTHORITY



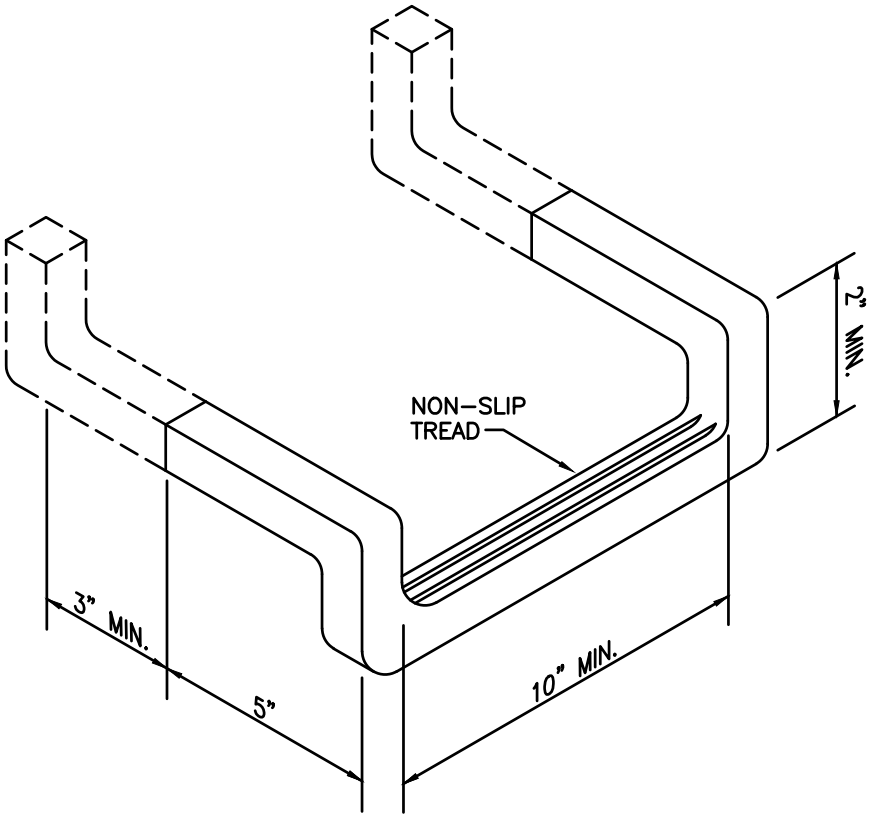
NOTE: ELEVATIONS SHOWN APPLY AT THE CENTERLINE OF MANHOLES. PERCENT OF GRADE ON SEWER BETWEEN MANHOLES IS BASED ON THE HORIZONTAL DISTANCE, MANHOLE CENTERLINE TO MANHOLE CENTERLINE.



PLAN INVERT

REVISIONS	STANDARD INVERT DETAILS	DRAWING NO.
2024		DCWA 455

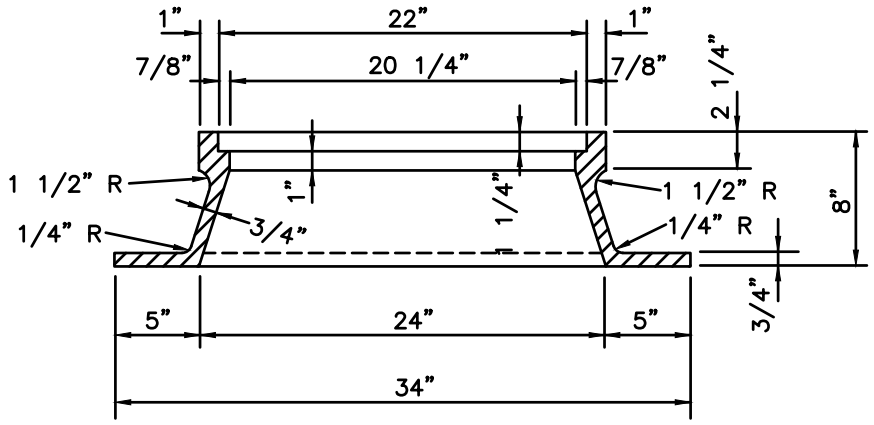
DINWIDDIE COUNTY WATER AUTHORITY



NOTE: MANHOLE STEPS SHALL CONFORM TO O.S.H.A. STANDARDS AND SHALL BE SET 16" O.C. VERTICALLY.

REVISIONS	STANDARD MANHOLE STEP	DRAWING NO.
2024		DCWA 460

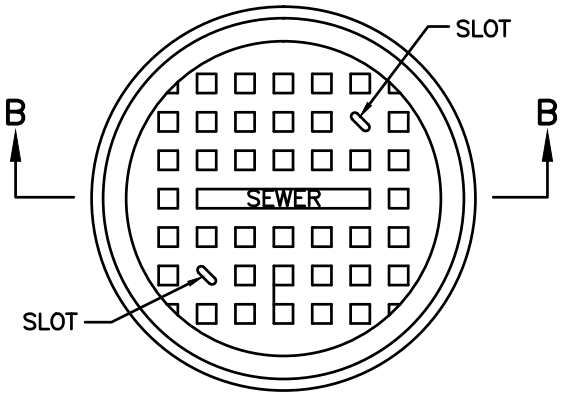
DINWIDDIE COUNTY WATER AUTHORITY

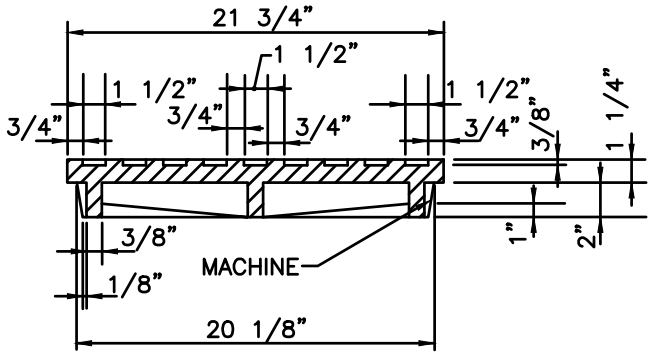


MIN. WEIGHTS

FRAME	210 LBS
COVER	130 LBS
TOTAL	340 LBS

FRAME SECTION

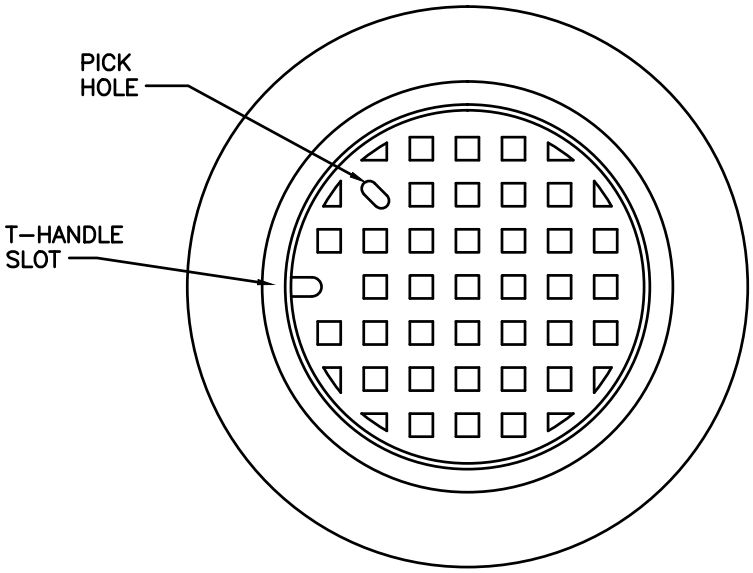




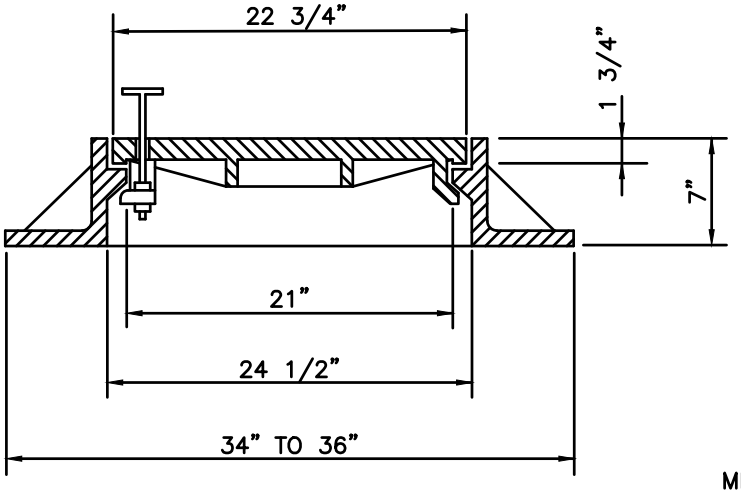
SECTION B–B

REVISIONS		DRAWING NO.
2024	STANDARD MANHOLE FRAME & COVER	DCWA 465

DINWIDDIE COUNTY WATER AUTHORITY



"T" HANDLE REMOVABLE ONLY WHEN COVER IS LOCKED

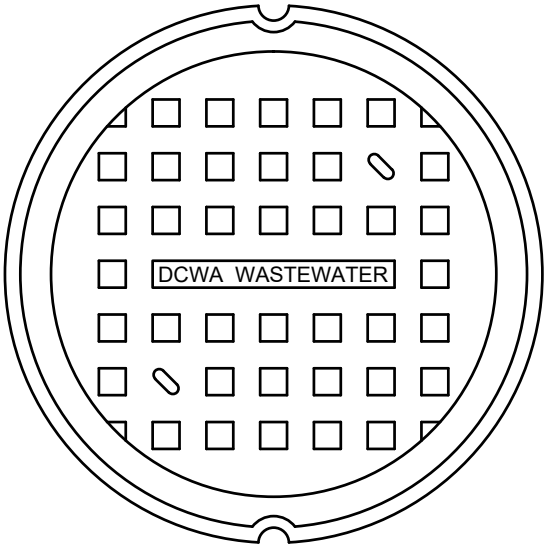


MIN. WEIGHTS

FRAME	— LBS
COVER	— LBS
TOTAL	405 LBS

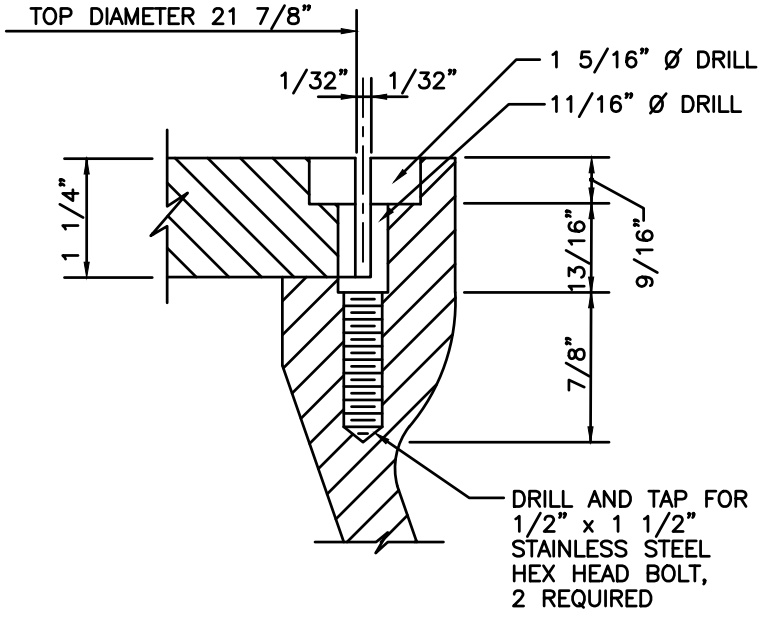
REVISIONS		DRAWING NO.
2024	VANDALPROOF MANHOLE FRAME & COVER	DCWA 466

DINWIDDIE COUNTY WATER AUTHORITY



NOTES:

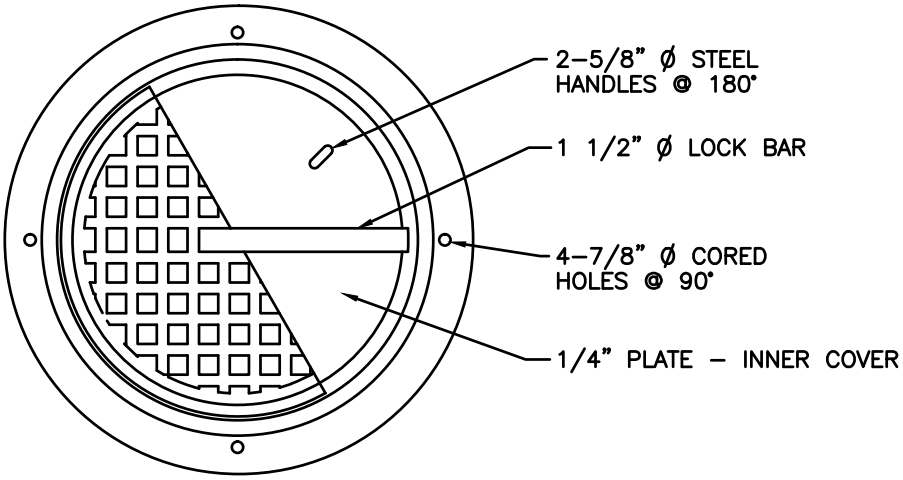
1. VANDALPROOF MANHOLE FRAME & COVER SHALL BE SAME DIMENSION AS "STANDARD MANHOLE FRAME & COVER".

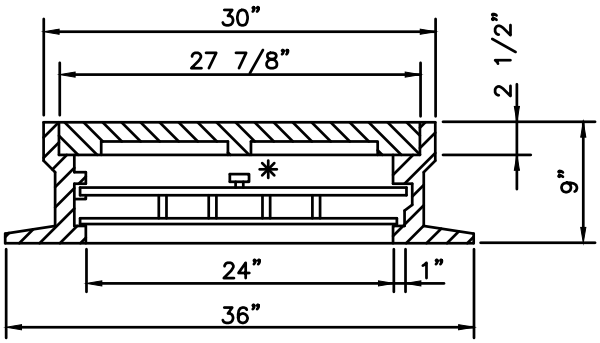


SECTION THROUGH BOLT

REVISIONS	ALTERNATE VANDALPROOF MANHOLE FRAME & COVER	DRAWING NO.
2024		DCWA 467

DINWIDDIE COUNTY WATER AUTHORITY





RECESSED PICK HOLE
SHALL NOT EXTEND
CLEAR THRU COVER.

* BRONZE OR BRASS HEX. HEAD BOLT WITH 5/8" SHANK.

STEEL INNER COVER, HANDLES AND LOCK BAR.

1/4" x 1" CONTINUOUS NEOPRENE GASKET BETWEEN INNER COVER AND FRAME.

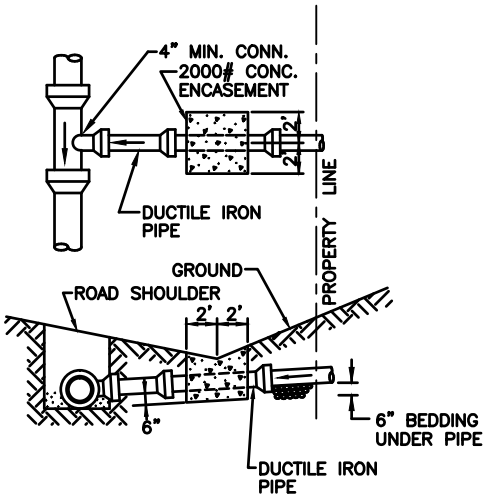
FRAME SHALL BE SET IN SEALANT AND BOLTED THRU TO THE MANHOLE CONE SECTION WITH 4 3/4" ANCHOR BOLTS.

MIN. WEIGHTS

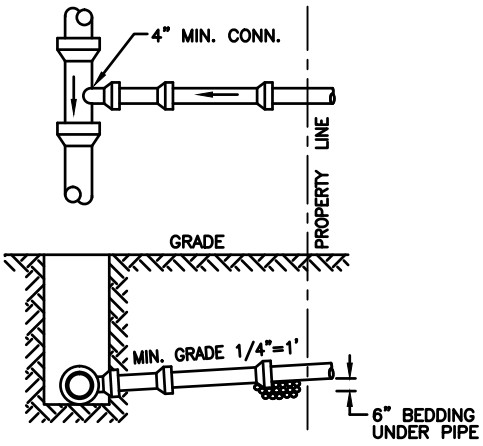
FRAME	295 LBS.
COVER	230 LBS.
INNER COVER	46 LBS.
TOTAL	571 LBS.

REVISIONS		DRAWING NO.
2024	WATERTIGHT MANHOLE FRAME & COVER	DCWA 468

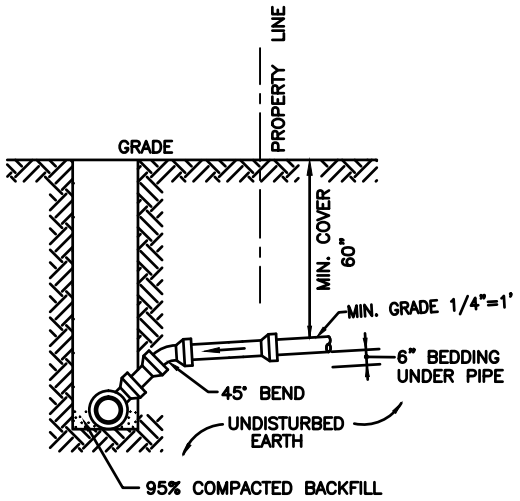
DINWIDDIE COUNTY WATER AUTHORITY



CONCRETE DITCH APRON
A



BRANCH HOUSE CONNECTION
B

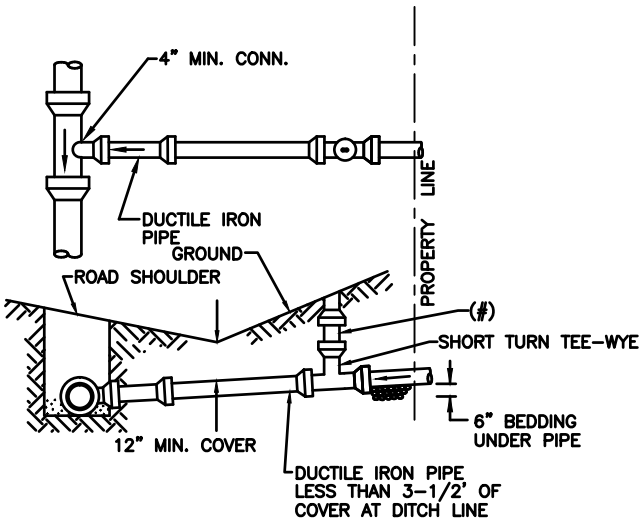


"TEE" BRANCH CONNECTION W/45° BEND
C

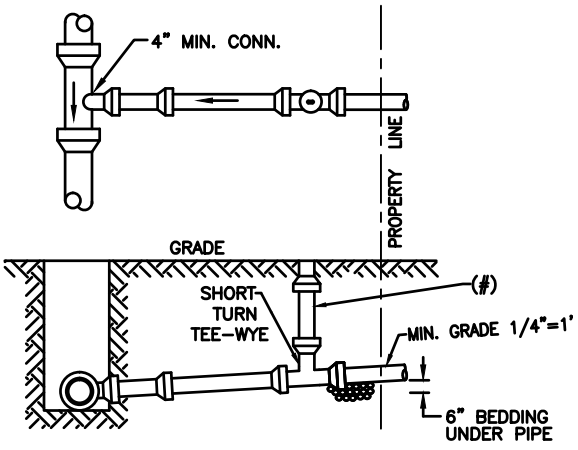
NOTE: 1/8" : 1' GRADE MAY BE USED WITH CLEAN OUT AT THE PROPERTY LINE. USING D.I. SERVICE PIPE.

REVISIONS	TYPICAL HOUSE CONNECTION DETAILS	DRAWING NO.
2024		DCWA 470

DINWIDDIE COUNTY WATER AUTHORITY

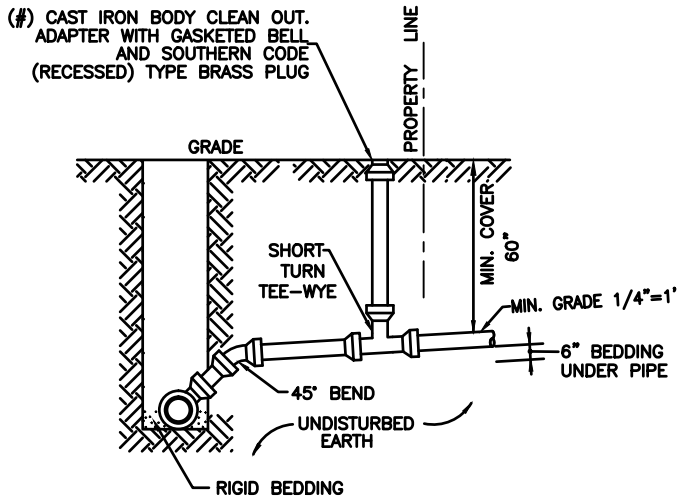


DITCH CROSSING
A



STANDARD HOUSE CONNECTION
B

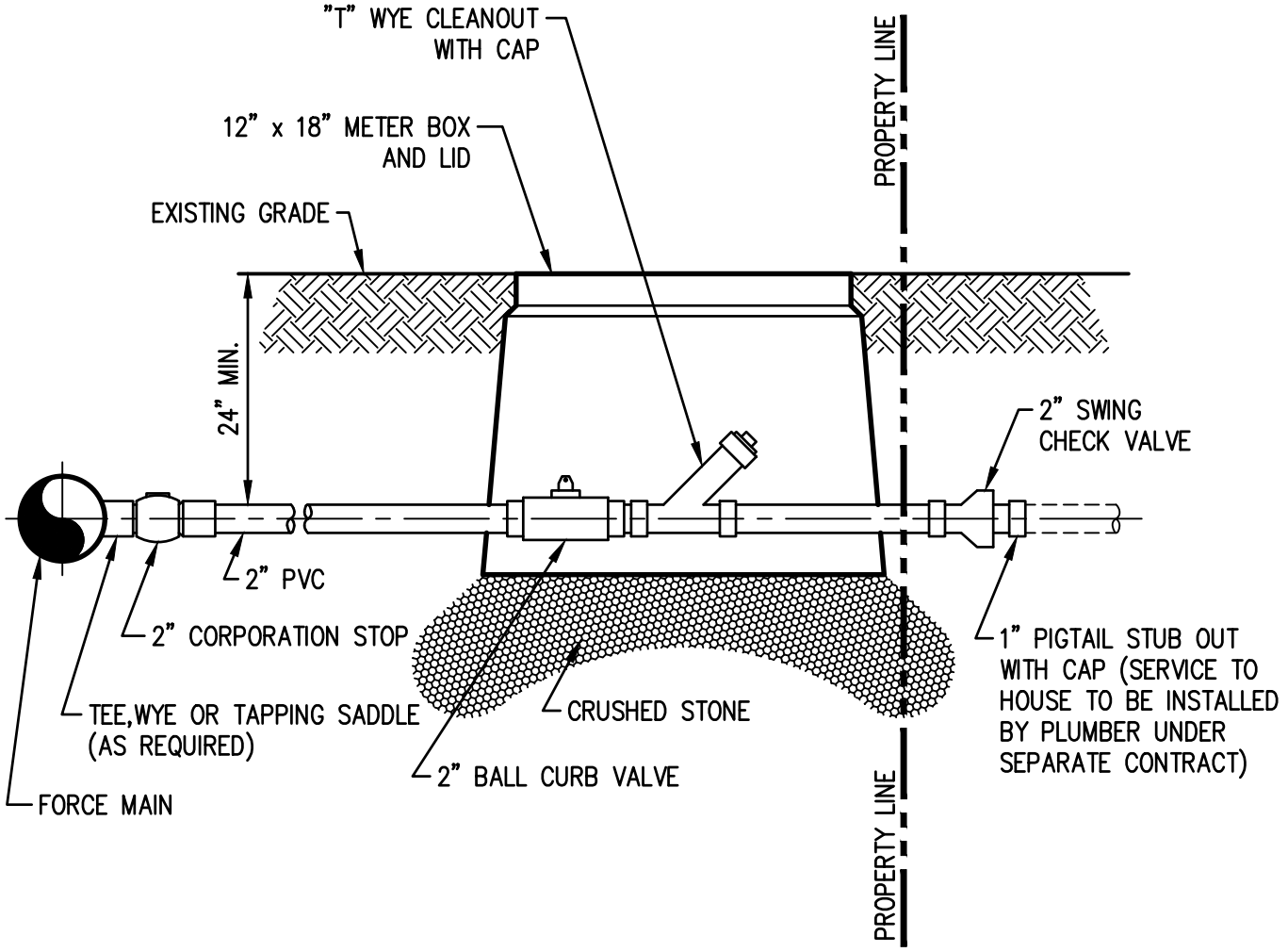
NOTE: 1/8"=1' GRADE MAY BE USED WITH A C.O. AT THE PROPERTY LINE WITH D.I. OR PVC PIPE.



"TEE" BRANCH CONNECTION W/45° BEND
C

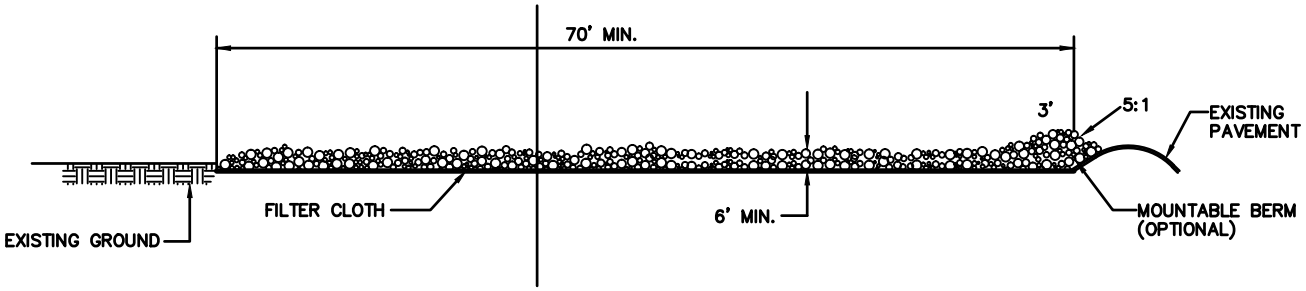
REVISIONS	HOUSE CONNECTION DETAILS WITH CLEAN-OUT	DRAWING NO.
2024		DCWA 471

DINWIDDIE COUNTY WATER AUTHORITY

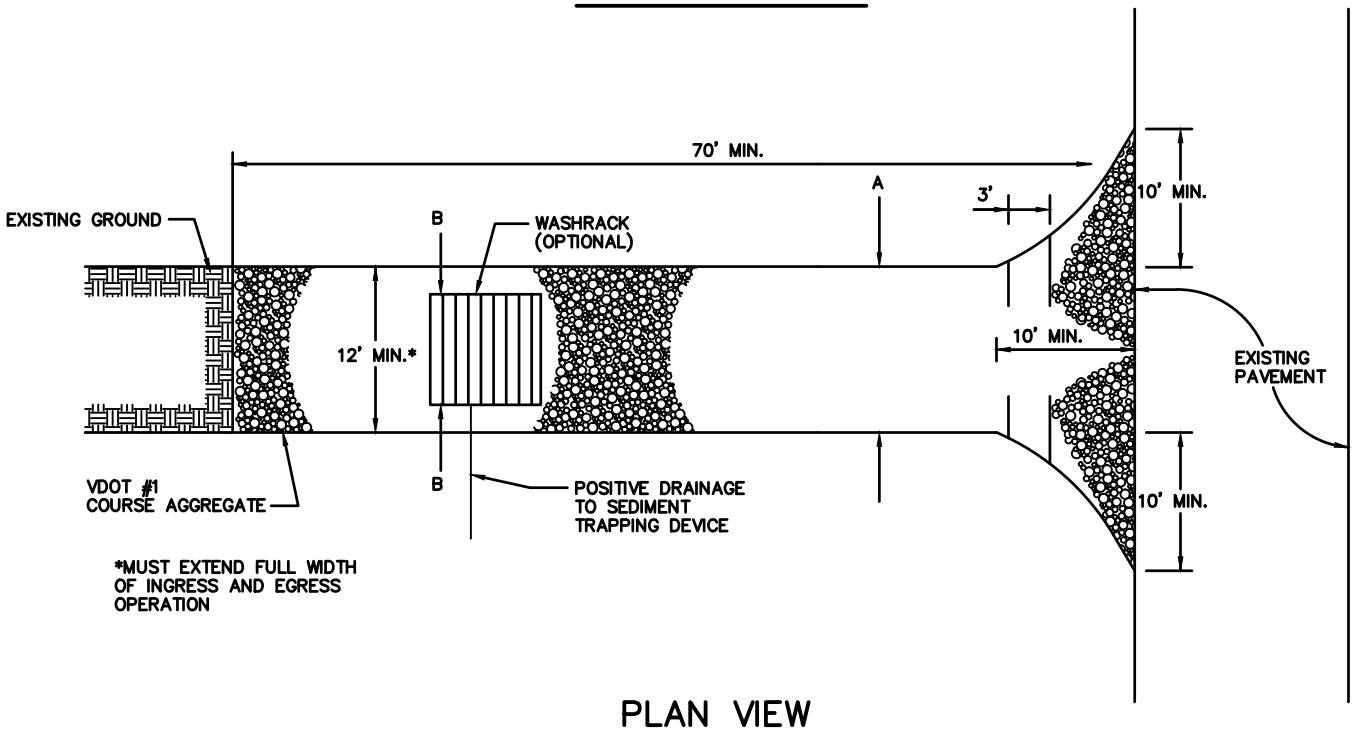


NOTE: COMPRESSION FITTINGS TO BE USED

REVISIONS	FORCE MAIN SERVICE CONNECTION	DRAWING NO.
2024	NOT TO SCALE	DCWA 476

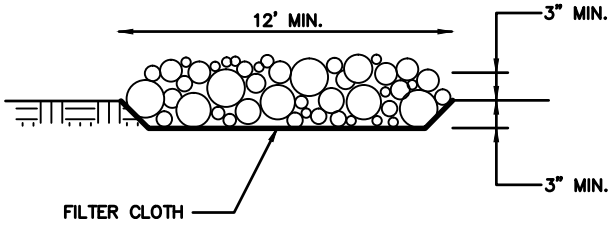


SIDE ELEVATION

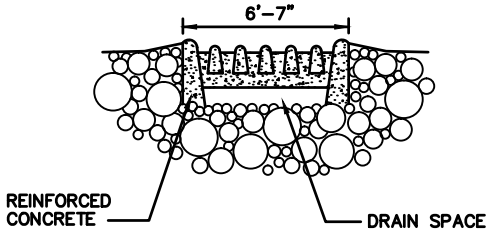


PLAN VIEW

DINWIDDIE COUNTY WATER AUTHORITY

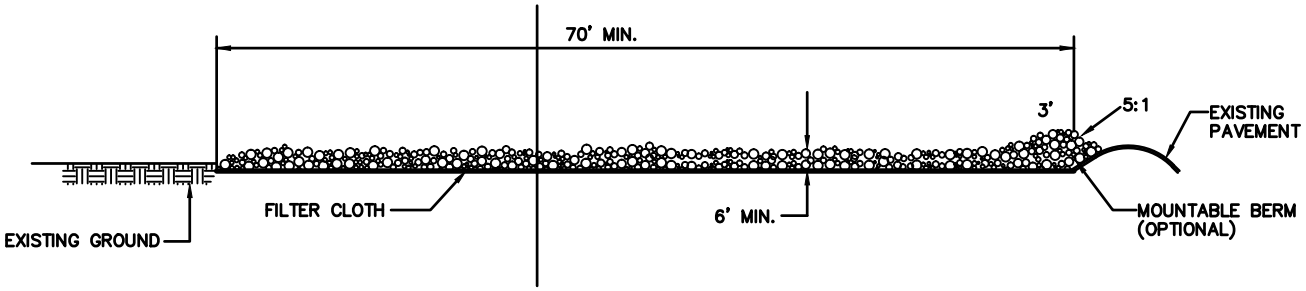


SECTION A–A

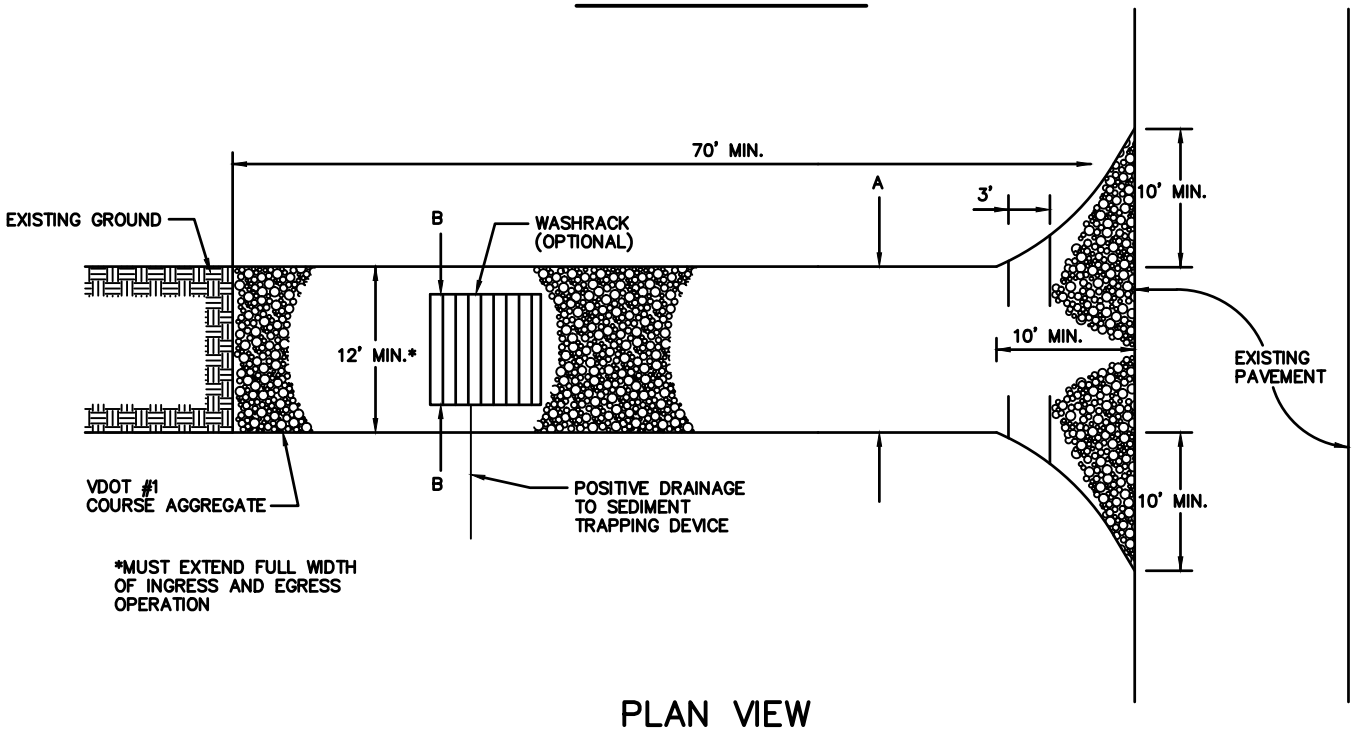


SECTION B–B

REVISIONS		DRAWING NO.
2024	STONE CONSTRUCTION ENTRANCE	DCWA 500

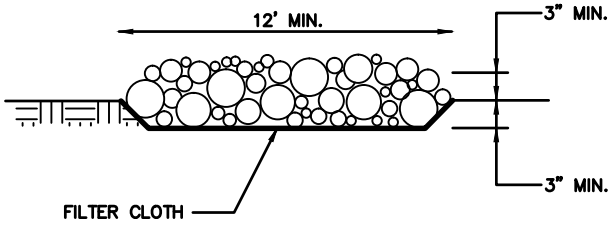


SIDE ELEVATION

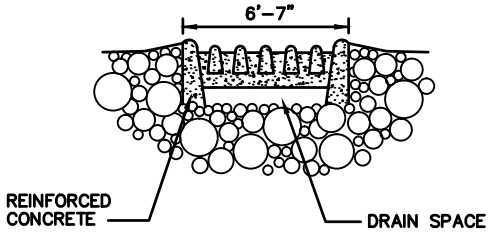


PLAN VIEW

DINWIDDIE COUNTY WATER AUTHORITY

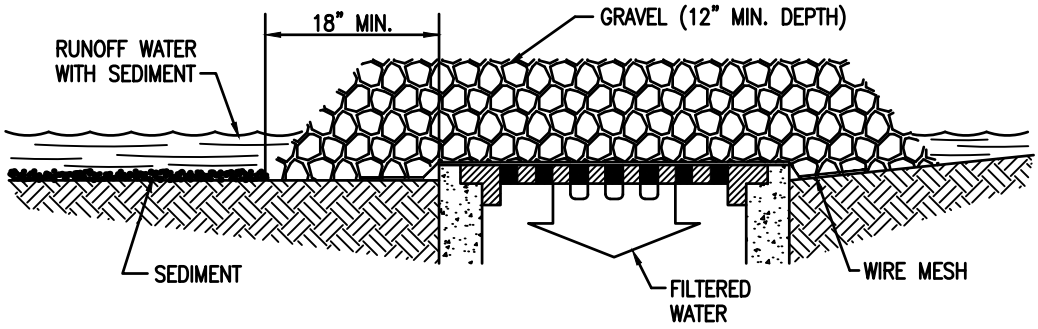


SECTION A–A

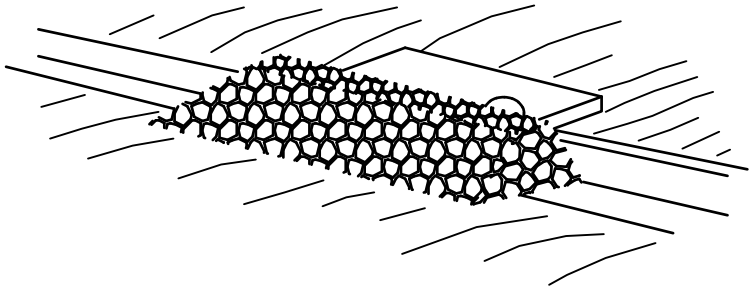


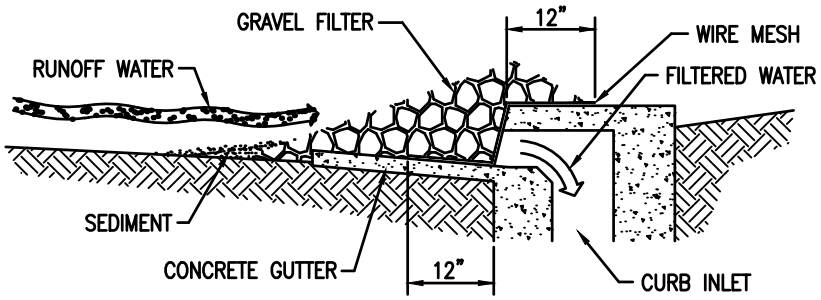
SECTION B–B

REVISIONS		DRAWING NO.
2024	STONE CONSTRUCTION ENTRANCE	DCWA 501



GRAVEL AND WIRE MESH DROP INLET SEDIMENT FILTER

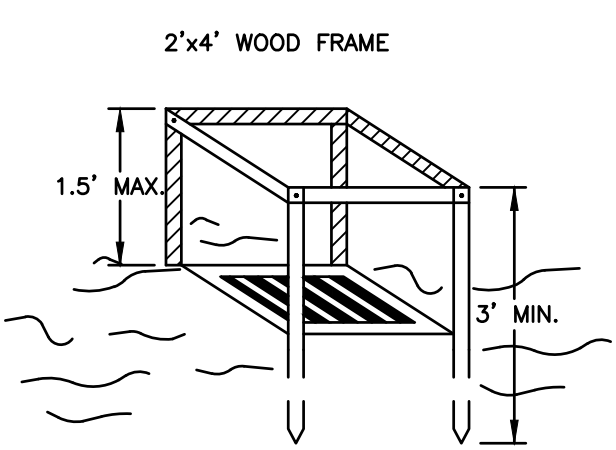


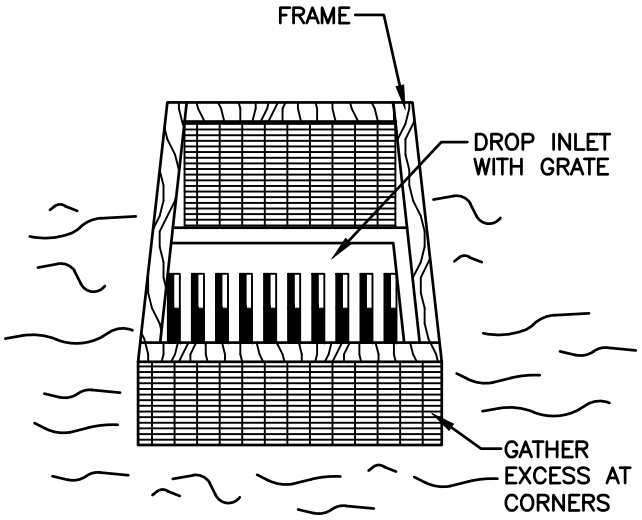


GRAVEL CURB INLET SEDIMENT FILTER

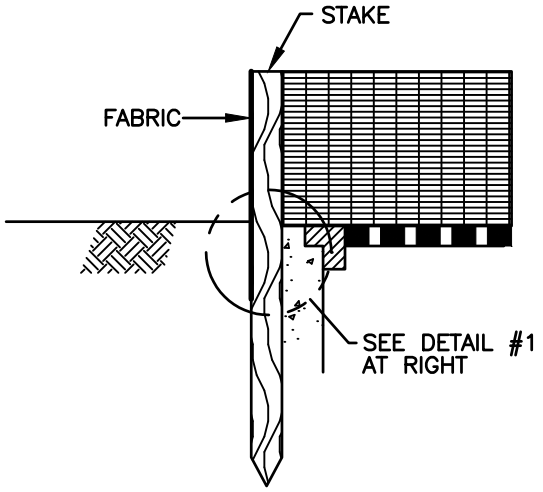
REVISIONS	STORM DRAIN INLET PROTECTION	DRAWING NO.
2024		DCWA
		506

DINWIDDIE COUNTY WATER AUTHORITY

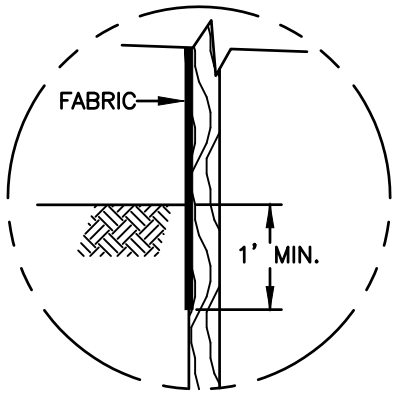




PERSPECTIVE VIEWS



ELEVATION OF STAKE AND FABRIC ORIENTATION



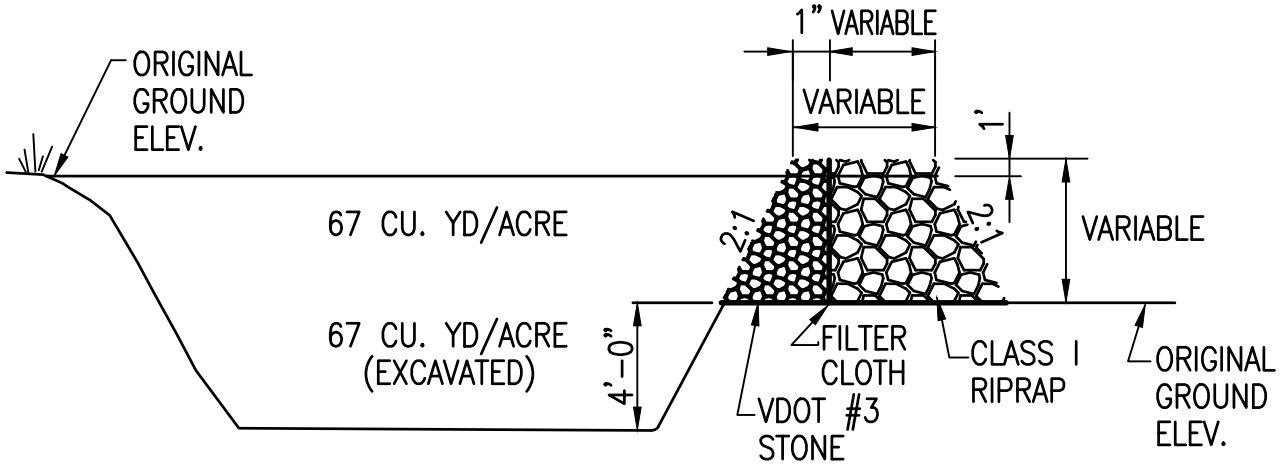
DETAIL A

SPECIFIC APPLICATION

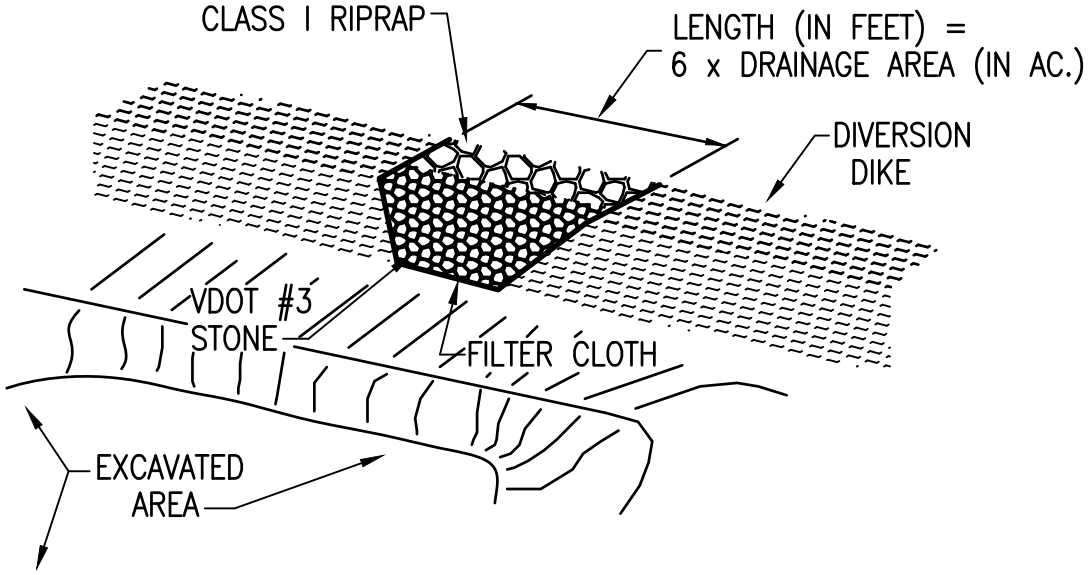
THIS METHOD OF INLET PROTECTION IS APPLICABLE WHERE THE INLET DRAINS A RELATIVELY FLAT AREA (SLOPE NO GREATER THAN 5%) WHERE THE INLET SHEET OR OVERLAND FLOWS (NOT EXCEEDING 1 C.F.S.) ARE TYPICAL. THE METHOD SHALL NOT APPLY TO INLETS RECEIVING CONCENTRATED FLOWS, SUCH AS IN STREET OR HIGHWAY MEDIANS.

REVISIONS	SILT FENCE DROP INLET PROTECTION	DRAWING NO.
2024		DCWA 507

DINWIDDIE COUNTY WATER AUTHORITY



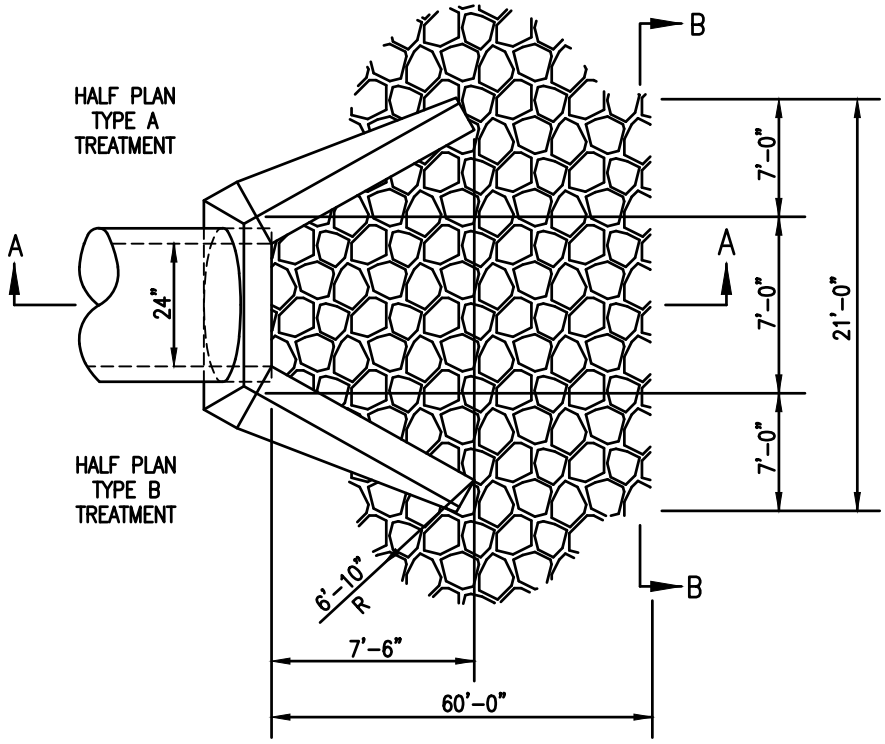
CROSS SECTION OF OUTLET



OUTLET (PERSPECTIVE VIEW)

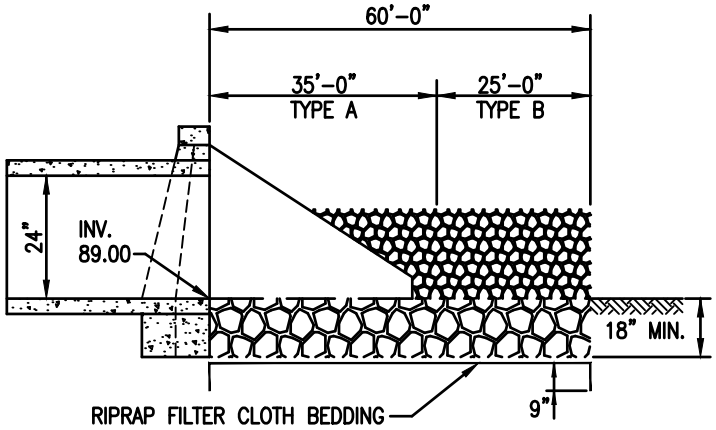
*** COARSE AGGREGATE SHALL BE VDOT #3, #357 OR #5*

REVISIONS	TEMPORARY SEDIMENT TRAP	DRAWING NO.
2024		DCWA 508

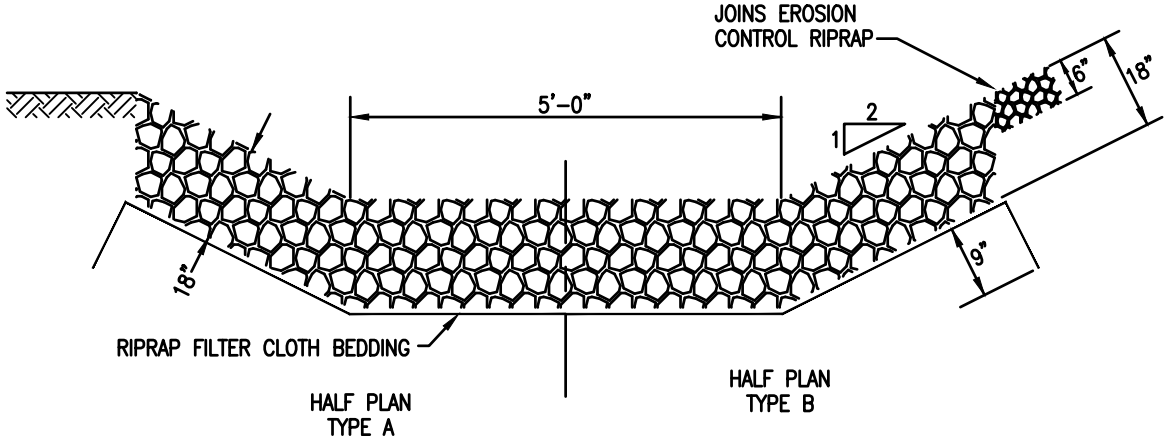


PLAN

DINWIDDIE COUNTY WATER AUTHORITY



SECTION A–A



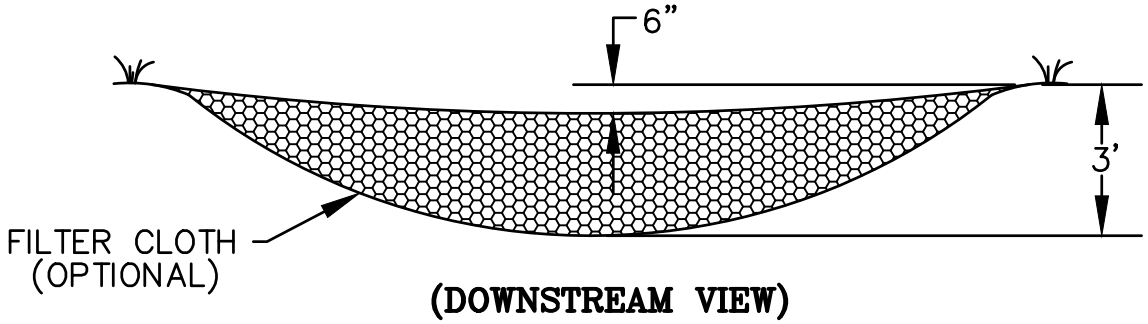
SECTION B–B

REVISIONS		DRAWING NO.
2024	OUTLET PROTECTION	DCWA 509

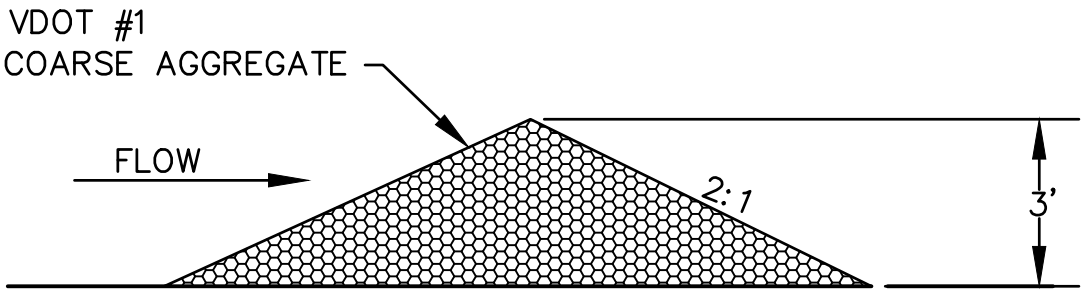
DINWIDDIE COUNTY WATER AUTHORITY

ROCK CHECK DAM

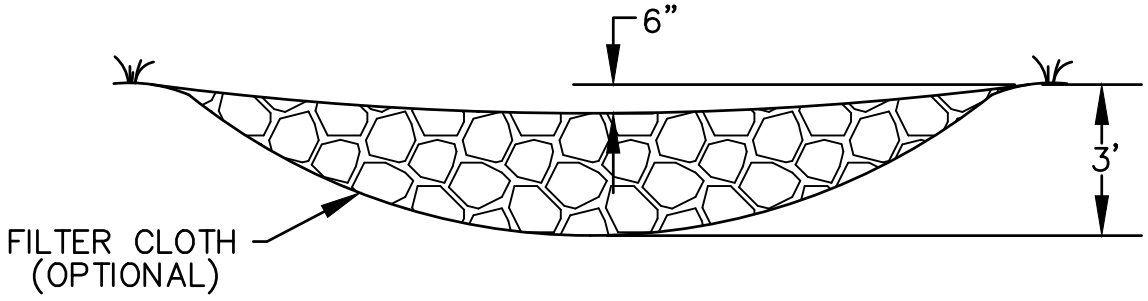
2 ACRES OR LESS OF DRAINAGE AREA



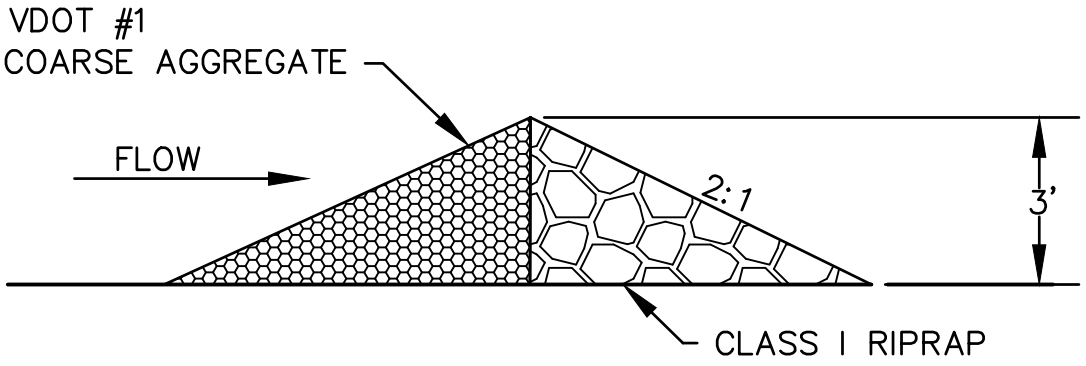
(DOWNSTREAM VIEW)



2 – 10 ACRES OF DRAINAGE AREA



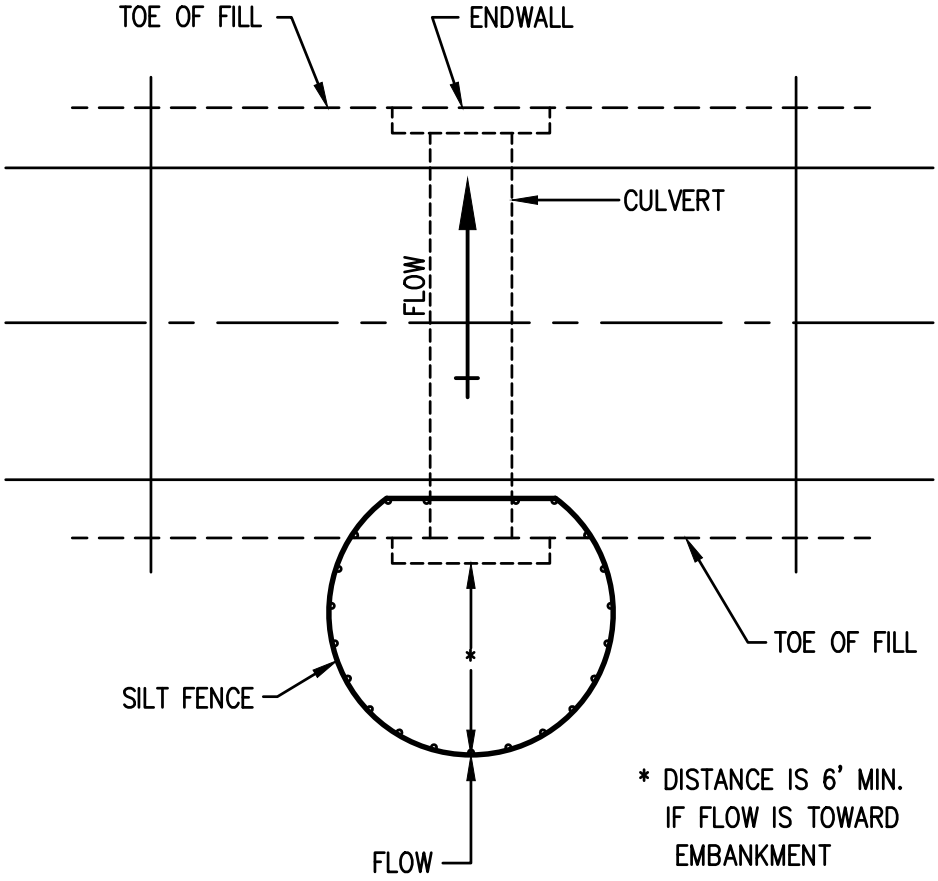
(DOWNSTREAM VIEW)



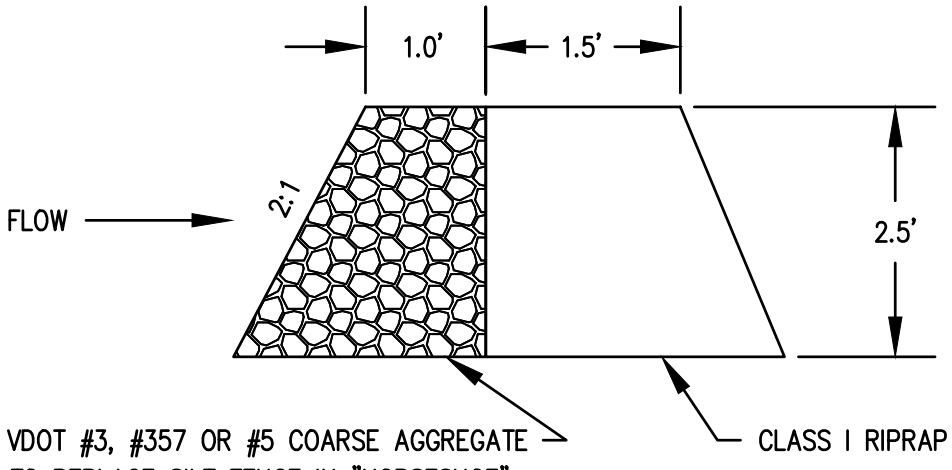
REVISIONS		DRAWING NO.
2024	ROCK CHECK DAM	DCWA 512

DINWIDDIE COUNTY WATER AUTHORITY

SILT FENCE CULVERT INLET PROTECTION

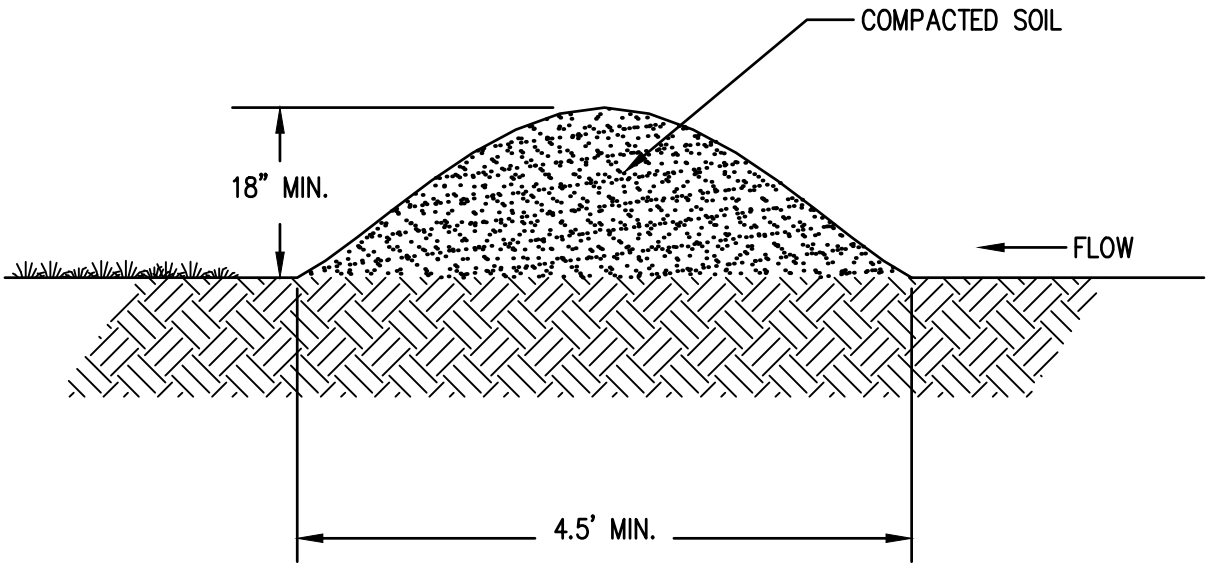


OPTIONAL STONE COMBINATION



REVISIONS		DRAWING NO.
2024	SILT FENCE CULVERT INLET PROTECTION	DCWA 513

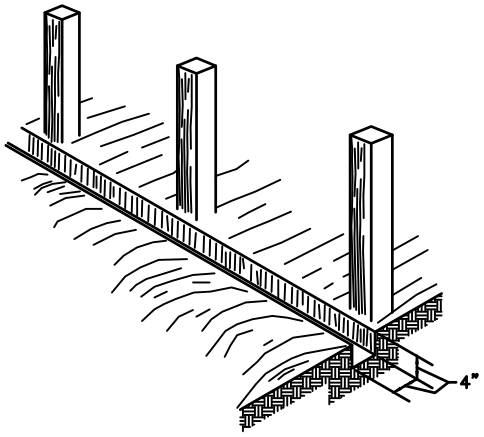
DINWIDDIE COUNTY WATER AUTHORITY



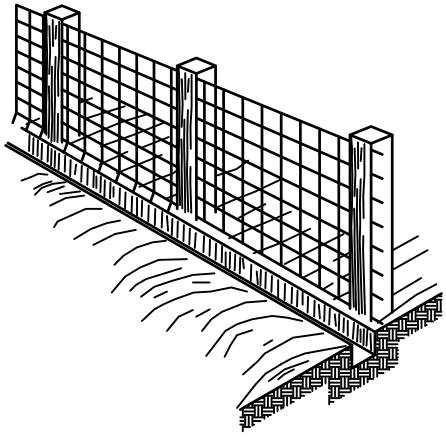
REVISIONS	TEMPORARY DIVERSION DIKE	DRAWING NO.
2024		DCWA 514

DINWIDDIE COUNTY WATER AUTHORITY

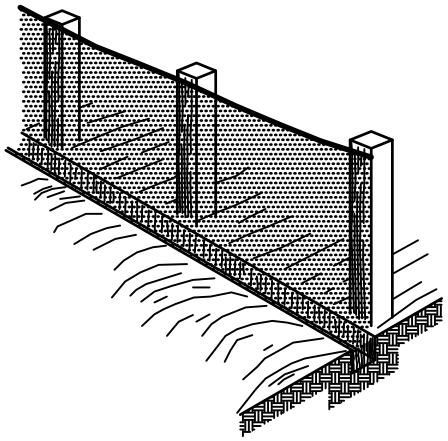
1. SET POSTS AND EXCAVATE A 4"x4" TRENCH UPSLOPE ALONG THE LINE OF POSTS.



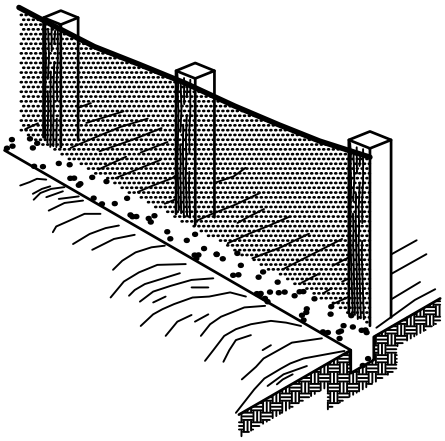
2. STAPLE WIRE FENCING TO THE POSTS.



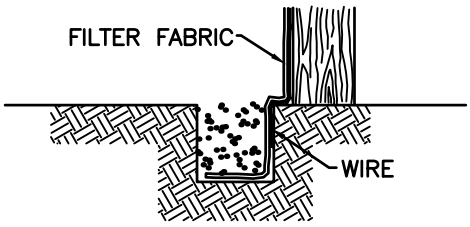
3. ATTACH THE FILTER FABRIC TO THE WIRE FENCE AND EXTEND IT INTO THE TRENCH.



4. BACKFILL AND COMPACT THE EXCAVATED SOIL.



EXTENSION OF FABRIC AND WIRE INTO THE TRENCH.

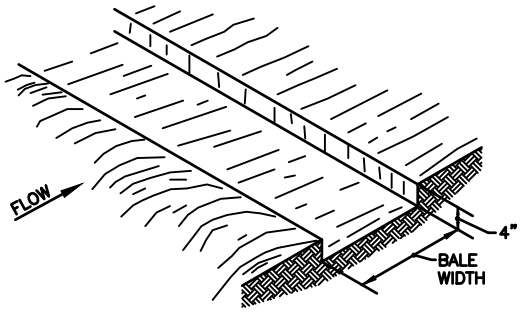


CONSTRUCTION OF A SILT FENCE

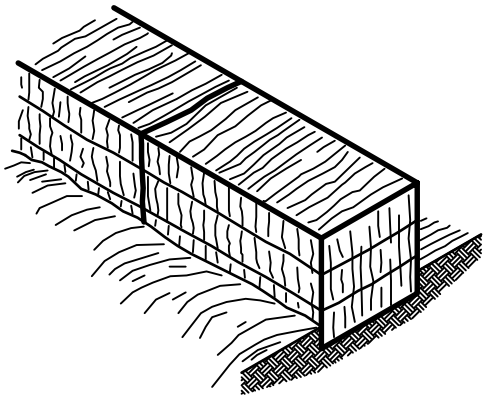
REVISIONS		DRAWING NO.
2024	SILT FENCE	DCWA 600

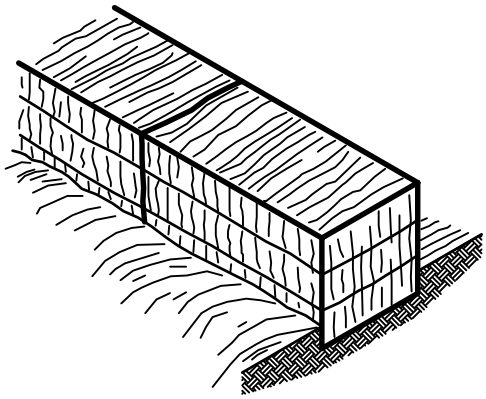
CONSTRUCTION OF A STRAW BALE BARRIER

1. EXCAVATE THE TRENCH.

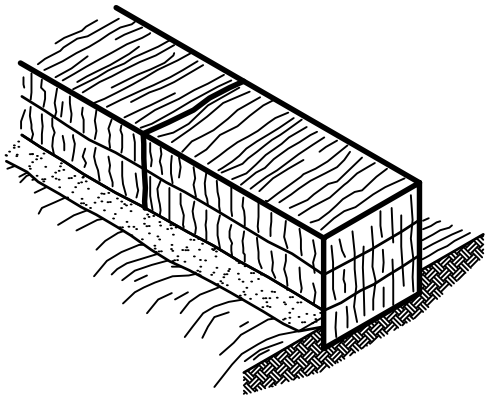


2. PLACE AND STAKE STRAW BALES.



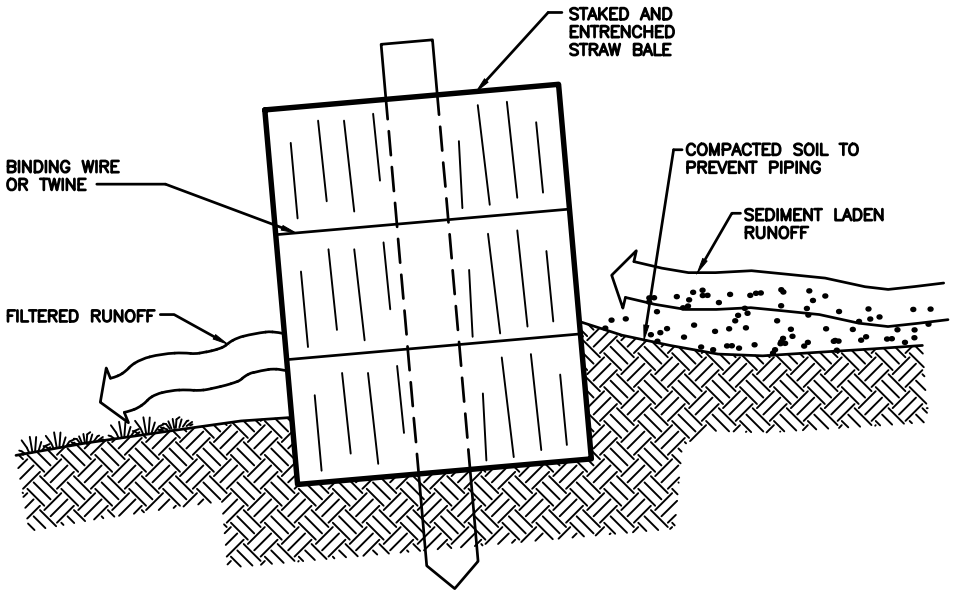


3. WEDGE LOOSE STRAW BETWEEN BALES.



4. BACKFILL AND COMPACT THE EXCAVATED SOIL.

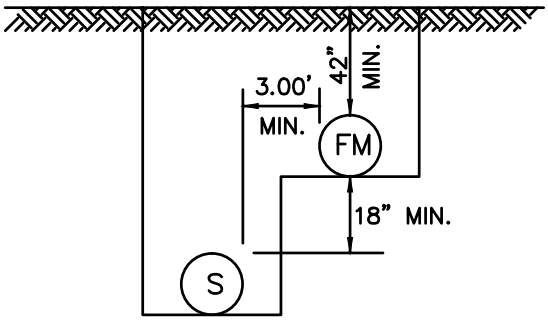
CROSS–SECTION OF A PROPERLY INSTALLED STRAW BALE



DINWIDDIE COUNTY WATER AUTHORITY

REVISIONS	STRAW BALE	DRAWING NO.
2024		DCWA 610

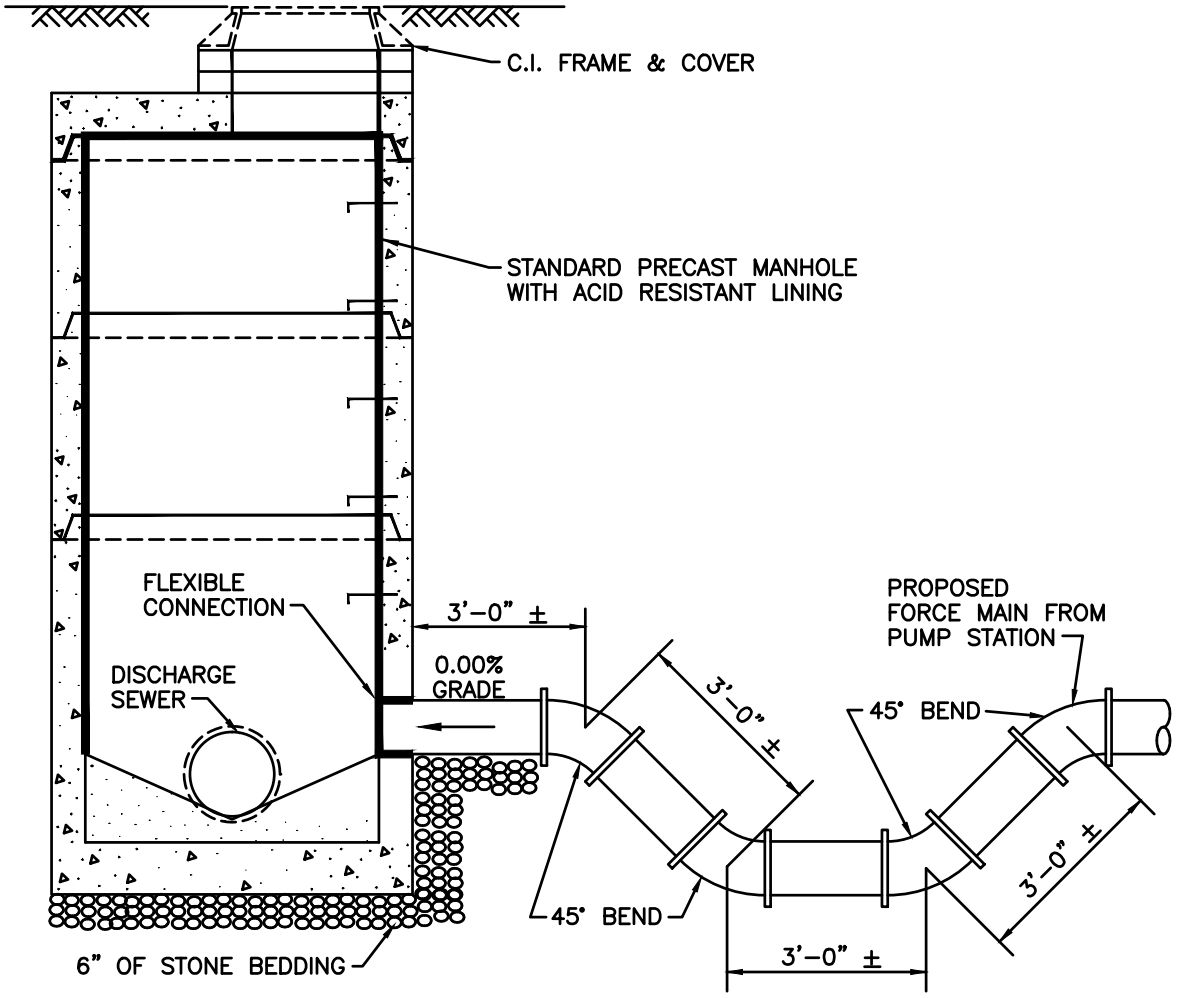
DINWIDDIE COUNTY WATER AUTHORITY



TYPICAL SECTION

REVISIONS	SEWER AND FORCE MAIN IN SAME TRENCH	DRAWING NO.
2024		DCWA 700

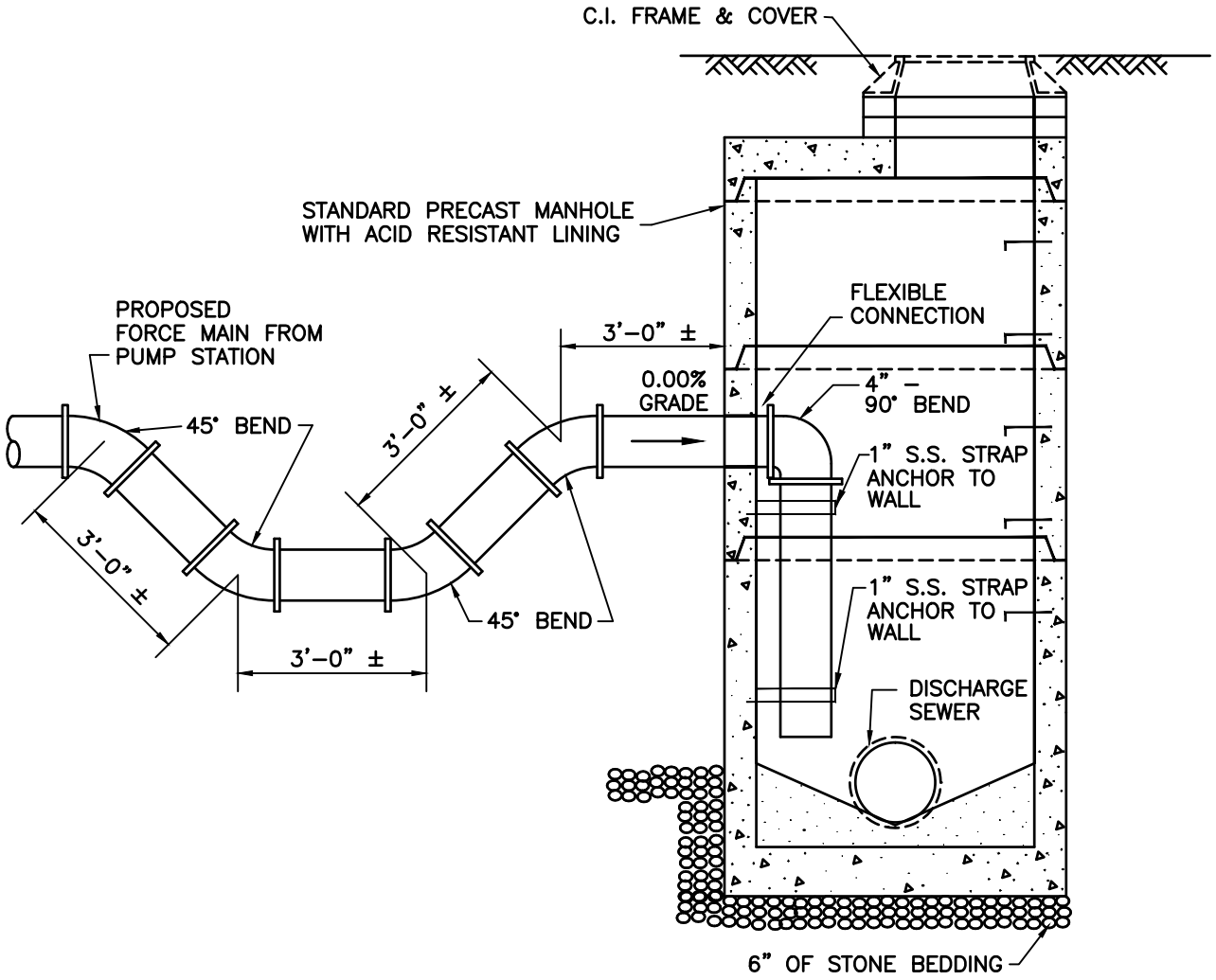
DINWIDDIE COUNTY WATER AUTHORITY



NOTE : USE SULFATE RESISTANT CEMENT TO PREPARE MOTAR IN BUILDING INVERT & BENCH.

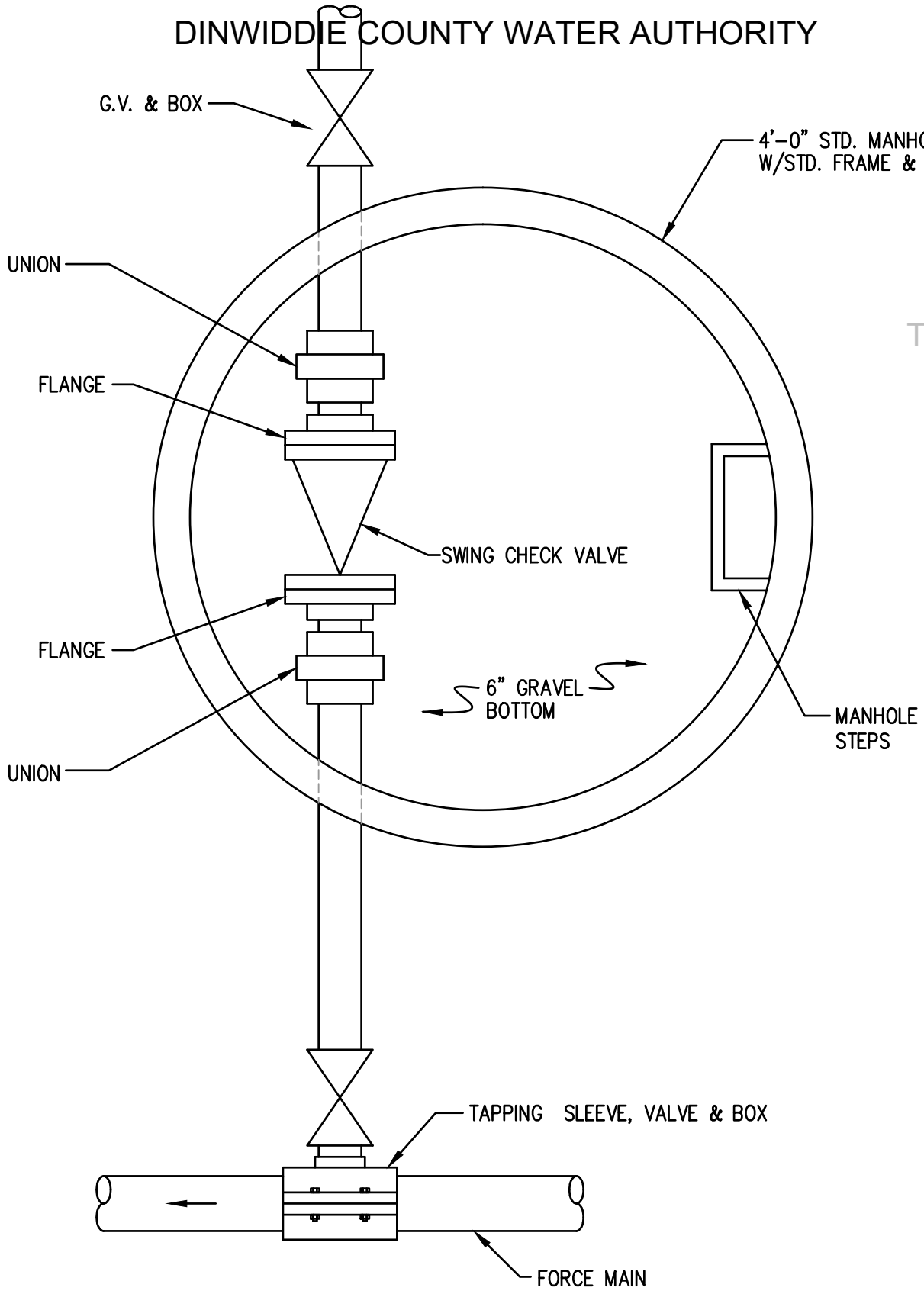
REVISIONS	FORCE MAIN TERMINATION AT MANHOLE	DRAWING NO.
2024		DCWA 705

DINWIDDIE COUNTY WATER AUTHORITY



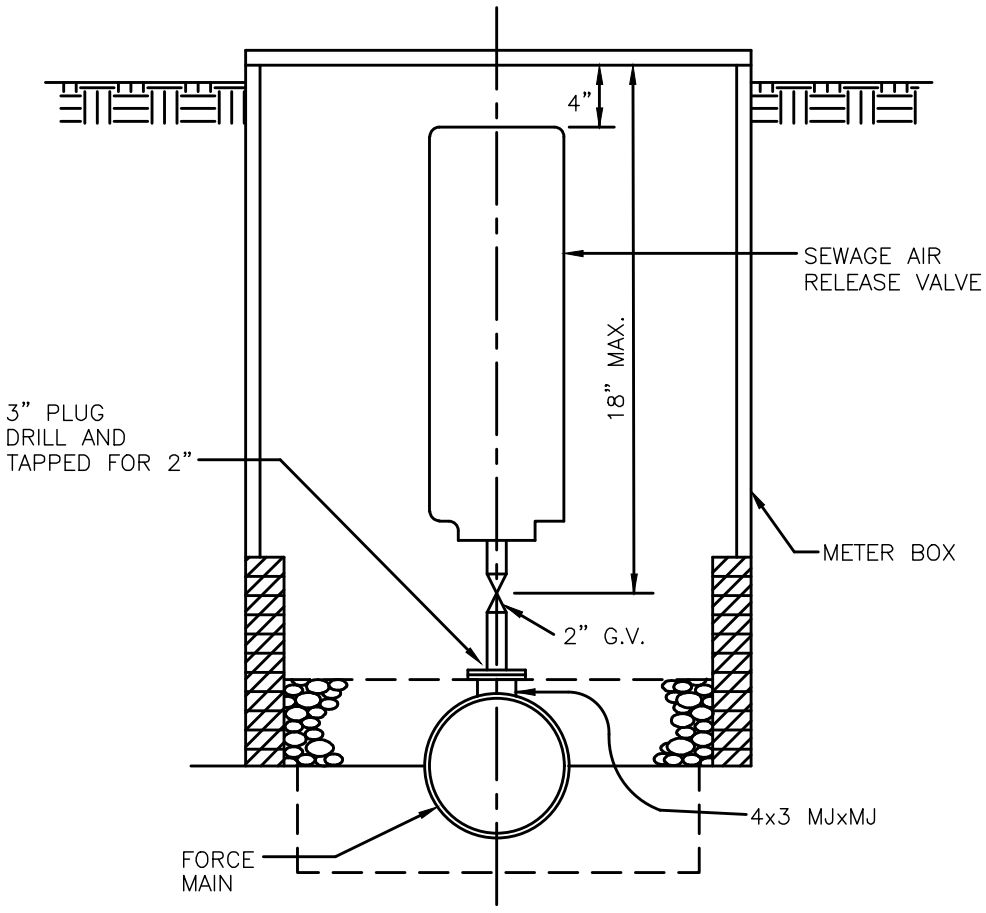
REVISIONS	FORCE MAIN TERMINATION AT MANHOLE	DRAWING NO.
2024		DCWA 706

DINWIDDIE COUNTY WATER AUTHORITY



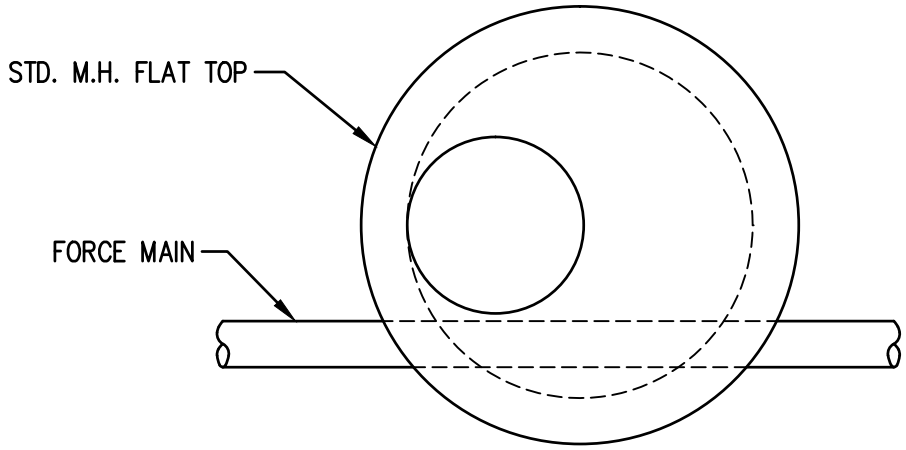
REVISIONS	TYPICAL CONNECTION TO EXISTING FORCE MAIN LARGER THAN 2-INCH	DRAWING NO.
2024		DCWA 709

DINWIDDIE COUNTY WATER AUTHORITY



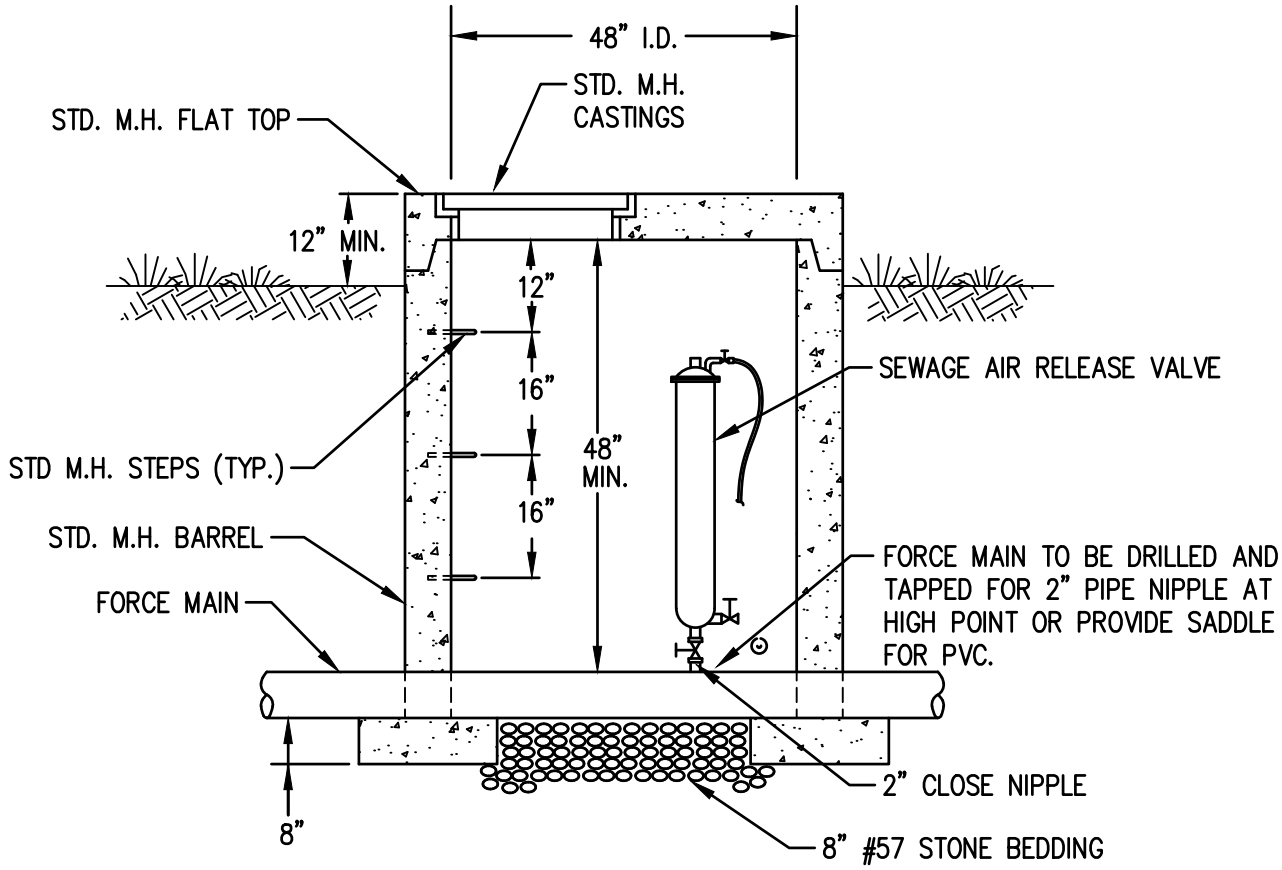
REVISIONS	SEWAGE AIR RELIEF VALVE INSTALLATION	DRAWING NO.
2024		DCWA 710

DINWIDDIE COUNTY WATER AUTHORITY



PLAN

NOTE: FORCE MAIN TO BE OFFSET IN MANHOLE TO PROVIDE CLEARANCE TO EXISTING SEWER AND/OR FORCE MAIN.

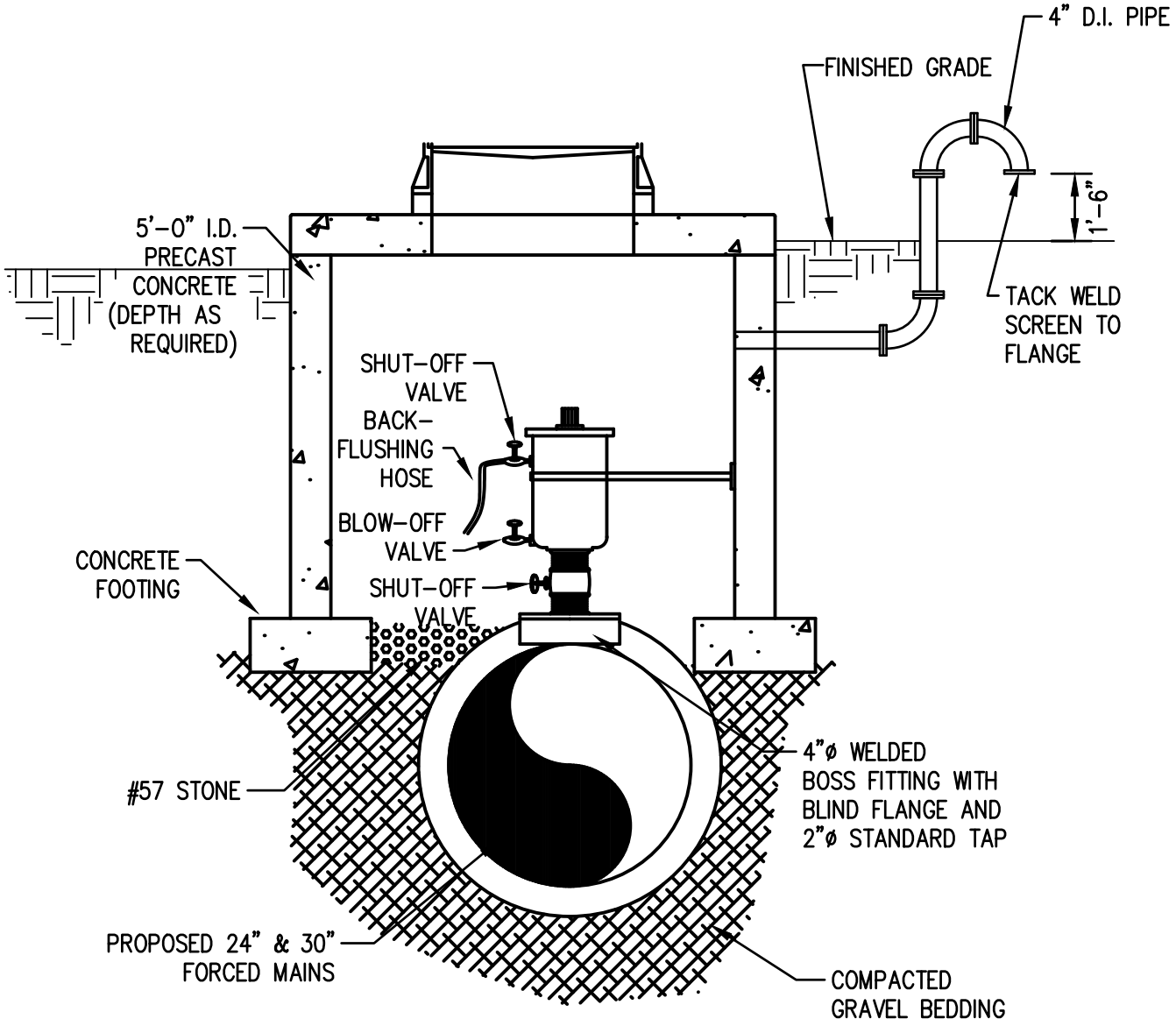


SECTION

NOT TO SCALE

REVISIONS	SEWAGE AIR RELEASE VALVE	DRAWING NO.
2024		DCWA 712

DINWIDDIE COUNTY WATER AUTHORITY



NOTE: AIR & VACUME RELEASE VALVES SHALL BE AS MANUFACTURED BY APCO MODEL #447 SERIES 440 SAVV WITH BACKFLUSHING ATTACHMENTS.

NOT TO SCALE

REVISIONS	SEWAGE COMBINATION AIR VALVE	DRAWING NO.
2024		DCWA 713

SECTION 02050 - DEMOLITION

1.0 **GENERAL**

1.1 General Requirements

A. The work includes demolition or removal of all construction indicated or specified.

B. All materials resulting from demolition work, except those designated hereinafter to be reused or retained by the Owner, shall become the property of the Contractor and shall be removed from the limits of Owner's property.

1.2 Submittals

A. The procedures proposed for the accomplishment of salvage and demolition work shall be submitted to the Engineer for approval. The procedures shall provide for the careful removal and disposal of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services. The procedures shall include a detailed description of the sequence of operations.

1.3 Dust Control

A. The amount of dust resulting from demolition shall be controlled so as to prevent the spread of dust to occupied portions of the buildings and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create hazardous or objectionable conditions such as ice, flooding, and pollution.

1.4 Protection

A. Protection of Existing Work: The Contractor shall carefully survey the existing work and examine the Drawings and Specifications to determine the extent of the work before beginning any cutting or demolition work.

(1) The location of all utilities may not be shown on the Contract Drawings, and if shown may not be accurately located. The Contractor shall contact Miss. Utility for assistance in accurately locating all public utilities.

(2) The Contractor shall take all necessary precautions to insure against damage to existing work to remain in place, to be reused,

or to remain the property of the Owner, and any damage to such work shall be repaired or replaced as approved by the Engineer at no additional cost to the Owner. The Contractor shall carefully coordinate the work of this Section with all other work and construct and maintain shoring, bracing and supports as required. The Contractor shall insure that structural element are not overloaded and be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal or demolition work performed under any part of this Contract.

B. Protection of Buildings from the Weather: The interior of all buildings, materials and equipment shall be protected from the weather at all times.

C. Protection of Trees: Trees within the project site which might be damaged during demolition, and which are indicated to be left in place shall be protected. Any tree designated to remain that is damaged during the work under this Contract shall be replaced.

D. Environmental Protection: All work and Contractor operations shall comply with all Federal, State and local ordinances and regulations.

1.5 Burning

A. Burning, where allowed by local ordinance, will be permitted.

1.6 Use of Explosives

A. The use of explosives will be permitted, but the Contractor will be held responsible for all damage resulting from its use.

2.0 **PRODUCTS**

2.1 Remove and store on the site, at a location designated by Owner or Engineer, equipment or material designated to be reused.

2.2 Owner will designate equipment or material to be retained by Owner. Remove and store on the site at the location designated by Owner, equipment or material so designated.

2.3 Take possession and remove from the site any equipment or material not designated to be reused or to remain the property of the Owner.

3.0 **EXECUTION**

3.1 Hazardous Materials and Conditions

A. If hazardous materials or conditions are encountered during demolition operations, notify Virginia Department of Emergency Management (800-468-8892) promptly. Notify Owner and Engineer of the existence and nature of such conditions. Based on Contractor's evaluation of the degree of hazard present, make a timely evacuation of the immediate area of the hazard.

B. Contractor will not be reimbursed for first eight hours of lost time encountered due to the existence of unanticipated hazardous conditions. Any delays after the first eight hours together with any costs for materials, equipment or labor to assist in the determination of the nature and extent of the hazard and any costs involved in the removal or neutralization of such hazardous materials will be subject to negotiation between the Owner and the Contractor. Any agreement on the extent of the work required and the costs involved will be by means of an executed Change Order.

C. Any hazardous materials encountered shall be removed from the site and deposited in an approved hazardous waste landfill. Where necessary, Contractor shall employ such specialists as may be necessary to remove the hazard found to exist.

3.2 Demolition Operations.

A. Unless otherwise specified, do not remove structures from the premises as a whole, or in a substantially whole condition. Completely demolish buildings and structures at the site, including removal of foundations, floors, and other parts.

B. Keep the work wet down thoroughly to prevent dust and dirt from rising.

C. All structures designated for demolition shall be removed to a minimum depth of 18 in. below finished grade.

D. Grade area over and around structures in a uniform manner that will preclude ponding of water.

3.3 Maintaining Traffic.

A. Coordinate with Owner all closures or obstructions of streets and sidewalks.

3.4 Utilities.

A. Terminate utility services and remove such utilities within five (5) feet of structures scheduled for demolition.

B. Notify Owner of discontinuance of water services for structures to be demolished. After services have been disconnected by Owner, remove all water piping within five (5) feet of the structure and cap or plug exposed end of pipe.

C. Locate the point at which each storm and/or sanitary sewer from the structure to be demolished leaves the structure, excavate at that point and remove all exposed sewer pipe. Provide air-and-watertight cap over exposed end of sewer. Cap may be of the same type and size as existing pipe if pipe joint is exposed. If pipe joint is not exposed, install 20 gage galvanized steel cap over exposed end of sewer pipe and pour concrete over pipe and cap. Concrete shall be a minimum of four inches thick around pipe and cap.

D. Notify the gas company of discontinuance of gas services for structures to be demolished. Request the gas company to cut off gas service at valve and remove meter. Locate the point at which the gas pipe leaves the building to be demolished and remove all underground gas piping within five (5) feet of the structure. Cap and plug exposed end of pipe.

E. Locate the point at which any other liquid or gas conveying pipe or pipes leaves the structure, excavate at the point and remove all pipe within five (5) feet of the structure. Observe all safety precautions where the pipe may have been used to convey explosive or toxic substances. Provide air-and-watertight cap over exposed end of pipes by installing a 20 gage galvanized steel cap over the exposed ends of the pipe and pouring concrete over pipe and cap. Concrete shall be a minimum of four inches thick around pipe and cap.

F. Locate all electrical services and disconnect all loads. Notify the power company that load has been disconnected. Request that power company remove meters and service connections. Remove any conduits or wires left by the power company after they have been de-energized by the power company. Any electrical utilities uncovered in demolition that might be energized shall be checked with the power company, de-energized, and removed.

G. Locate all telephone services and telephone cables to structures to be demolished to which cables are attached. Request telephone company to remove, relocate or raise service cables that must be kept in operation. Report to the telephone company for their action, all telephone cables uncovered in demolition. Remove any telephone cables left by the telephone company.

H. Locate the point where all other electrical, control and instrumentation

conduits and cables leave a structure to be demolished. Verify that all electrical power has been removed from all current carrying conductors. Pull conductors from conduits, remove all exposed conduits within five (5) feet of the structure and seal exposed end with a 20 gage galvanized steel cap and pour a minimum of four inches of concrete all around conduit and cap. Cut exposed cable and tape exposed end.

3.5 Clean up.

A. Remove promptly salvageable material that is not to be reused in construction or is not to be retained by Owner. On site sale of such material is prohibited.

B. Clean up debris resulting from demolition continuously with the progress of the work.

C. Remove debris from site without spillage. Rubbish and debris shall be removed from Owner's property daily unless otherwise directed so as to not allow accumulation on the site. Materials that cannot be removed daily shall be stored in areas specified by the Engineer. Deposit debris in an approved landfill in accordance with Federal, State and local ordinances and regulations. Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.

D. Do not store or permit debris to accumulate on the site. If the Contractor fails to remove excess debris promptly, the Owner reserves the right to cause its removal at the Contractor's expense.

E. Remove all tools, equipment, and materials from demolition of the site, and all rubbish upon completion of the work.

F. Leave the site clean, neat, and orderly and in a condition to begin new construction.

END OF SECTION

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SECTION 02085 - REMOVAL AND DISPOSAL OF ASBESTOS MATERIALS

1.0 GENERAL

1.1 Description

A. The work covered by this Section includes the handling of friable materials containing asbestos which are encountered during removal and demolition operations and the incidental procedures and equipment required to protect workers and occupants of the building or area, or both, from contact with airborne asbestos fibers. The work also includes the disposal of the removed asbestos containing materials. The asbestos work includes the demolition and removal of asbestos insulation located on existing piping. The Contractor shall establish control areas (see definitions) for the removal of asbestos insulation based on areas found to contain asbestos materials.

1.2 Reference Specifications are referred to by abbreviation as follows:

A. American National Standards Institute ---------- ANSI

B. Code of Federal Regulations ----------CFR

C. Occupational Safety and Health Administration ---------- OSHA

D. United States Environmental Protection Agency ----------EPA

E. National Institute for Occupational Safety and Health ---------- NIOSH

1.3 Definitions

A. Amended Water: Water containing a wetting agent or surfactant.

B. Asbestos: The term asbestos includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and antinolite.

C. Asbestos Control Areas: An area where asbestos removal operations are performed which is isolated by physical boundaries to prevent the spread of asbestos dust, fibers, or debris.

D. Asbestos Fibers: This expression refers to asbestos fibers having an aspect ration of 3:1 and longer than 5 micrometers.

E. Ceiling Concentration: An exposure of airborne concentrations of asbestos fibers at any time in excess of 10 fibers, longer than 5

micrometers, per cubic centimeter of air.

F. Area Monitoring: Sampling of asbestos fiber concentrations within the asbestos control area and outside the asbestos control area which is representative of the airborne concentrations of asbestos fibers which may reach the breathing zone.

G. Friable Asbestos Material: Material that contains more than one percent asbestos by weight and that can be crumbled, pulverized, or reduced to powder by hand pressure when dry.

H. HEPA Filter Equipment: High efficiency particulate absolute filtered vacuuming equipment with a filter system capable of collecting and retaining asbestos fibers. Filters shall be of 99.97 percent efficiency for retaining fibers of 0.3 microns or larger.

I. Non-Friable Asbestos Material: Material that contains asbestos in which the fibers have been locked in by a bonding agent, coating, binder, or other material so that the asbestos is well bound and will not release fibers in excess of the asbestos control limit during any appropriate use, handing, demolition, storage, transportation, processing, or disposal.

J. Personal Monitoring: Sampling of asbestos fiber concentrations within the breathing zone of an employee.

K. Time Weighted Average (TWA): Three samples are required to establish the 8 hour time weighted average. The TWA is an 8 hour time weighted average airborne concentration of fibers, longer than 5 micrometers, per cubic centimeter of air.

1.4 Title to Materials

A. All materials resulting from demolition work, except as specified otherwise, shall become the property of the Contractor and shall be disposed of as specified herein.

1.5 Quality Controls

A. All work shall be performed in accordance with applicable OSHA and EPA guidelines.

B. Protection of Existing Work to Remain: Perform demolition work without damage or contamination of adjacent work. Where such work is damaged or contaminated, it shall be restored to its original condition.

C. Medical Requirements: 29 CFR 1910.1001.

D. Medical Examinations: Before exposure of airborne asbestos fibers, provide workers with a comprehensive medical examination as required by 29 CFR 1910.1001. This examination is not required if adequate records show the employee has been examined as required by 29 CFR 1910.1001 requirements within the past year. The same medical examination shall be given on an annual basis to employees engaged in an occupation involving asbestos fibers and within 30 calendar days before or after the termination of employment in such occupation. Specifically identify x-ray films of asbestos workers to the consulting radiologist and mark medical record jackets with the word "ASBESTOS".

E. Medical Records: Maintain complete and accurate records of employees' medical examinations for a period of 20 years after termination of employment and make records of the required medical examinations available for inspection and copying to: The Assistant Secretary of Labor for Occupational Safety and Health, The Director of The National Institute for Occupational Safety and Health (NIOSH), authorized representative of either of them, and an employee's physician upon the request of the employee or former employee.

F. Training: Within 3 months prior to assignment to asbestos work, instruct each employee with regard to the hazards of asbestos, safety and health precautions, and the use and requirements for protective clothing and equipment including respirators. Fully cover engineering and other hazard control techniques and procedures.

G. Permits and Notifications: Secure necessary permits in conjunction with asbestos removal, hauling, and disposition and provide timely notification of such actions as may be required by federal, state, regional, and local authorities. Notify the Regional Office of EPA in accordance with 40 CFR 61.22 (d)(1) and provide copies of the notification to the Engineer and the State Environmental Regulatory Agency 20 days prior to commencement of the Work.

H. Safety Compliance: In addition to detailed requirements of this Specification, comply with laws, ordinances, rules, and regulations of federal, state, regional, and local authorities regarding handling, storing, transporting, and disposing of asbestos waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1910.1001 and 40 CFR 61, Subparts A and B. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting the Work. Where the requirements of this Specification and referenced documents vary, the most stringent requirement shall apply.

I. Respirator Program: Establish a respirator program as required by ANSI Z88.2 and 29 CFT 1910.134.

J. Industrial Hygienist: Conduct monitoring and training under the direction of an industrial hygienist certified by the American Board of Industrial Hygiene.

1.6 Submittals: The following items shall be submitted to and approved by the Engineer prior to commencing work involving asbestos materials.

A. Certificates of Compliance: Submit manufacturer's certification that vacuums, ventilation equipment, and other equipment required to contain airborne asbestos fibers conform to ANSI Z9.2.

B. Asbestos Plan: Submit a detailed plan of the work procedures to be used in the removal and demolition of materials containing asbestos. Such plan shall include location of asbestos control areas, change rooms, layout of change rooms, interface of trades involved in the construction, sequencing of asbestos related work, disposal plan, type of wetting agent and asbestos sealer to be used, air monitoring, and a detailed description of the method to be employed in order to control pollution. This plan must be approved prior to the start of any asbestos work.

C. Testing Laboratory: Submit the name, address, and telephone number of the testing laboratory selected for the monitoring of airborne concentrations of asbestos fibers along with certification that persons counting the samples have been judged proficient by successful participation in the NIOSH Proficiency Analytical Testing (PAT) Program.

D. Industrial Hygienist: Submit the name, address, and telephone number of the hygienist selected to direct monitoring and training and certification that the industrial hygienist is certified by the American Board of Industrial Hygiene.

E. Monitoring Results: Fiber counting shall be completed and results reviewed by the industrial hygienist within 16 hours. The industrial hygienist shall notify the Contractor and the Engineer immediately of any exposures to asbestos fibers in excess of the acceptable limits. Submit all monitoring results to the Engineer within 3 working days.

F. Notification: Notify the Engineer 3 working days prior to the start of asbestos work.

G. Landfill: Submit written evidence that the landfill for disposal is approved for asbestos disposal by the EPA and state or local regulatory agency(s).

H. Local Exhaust System: Pressure differential recordings for each work day shall be reviewed by the industrial hygienist and submitted to the Engineer within 24 hours from the end of each work day. The industrial hygienist shall notify the Contractor and the Engineer immediately of any variance in the pressure differential which could cause exposure of adjacent unsealed areas to asbestos fiber concentrations in excess of the TWA.

I. Training: Submit certificates signed by each employee that the employee has received training in the proper handling of materials that contain asbestos; understands the health implications and risks involved, including the illnesses possible from exposure to airborne asbestos fibers; understands the use and limits of the respiratory equipment to be used; and understands the results of monitoring of airborne quantities of asbestos as related to health and respiratory equipment.

1.7 Equipment

A. General: Make available to the Engineer two complete sets of personal protective equipment as required herein for entry to the asbestos control area at all times for inspection of the asbestos control area.

B. Respirators: Select respirators from those approved by the Mine Safety and Health Administration (MSHA), Department of Labor, or NIOSH, Department of Health and Human Services.

(1) Respirators for Handling Asbestos: Provide personnel engaged in the removal and demolition of asbestos materials with Type C supplied air respirators, continuous flow or pressure demand class.

(2) Optional Respirators for Handling Asbestos: Use Type C continuous flow or pressure-demand, supplied air respirators until the Contractor establishes that the average airborne concentrations of asbestos the employees will confront will not exceed 100 times the permissible exposure limits, i.e., 8 hour time weighted average (TWA) and ceiling limit. When the exposure limits are established, the respirators presented in 29 CFR 1910.1001 that afford adequate protection at such upper concentrations of airborne asbestos may be used. If the Contractor decides to provide respirators other than a Type C continuous flow or pressure demands, supplied air respirator, the Contractor shall determine the exposure of each employee to airborne asbestos during each type of removal operation. Determine both the ceiling limit and the 8 hour, time weighted average concentration of asbestos to which each of the employees is exposed during each type of removal operation.

C. Special Clothing

(1) Protective Clothing: Provide personnel exposed to airborne concentrations of asbestos fibers with fire retardant disposable protective whole body clothing, head coverings, gloves, and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber gloves for comfort but shall not be used alone. Make sleeves secure at the wrists and make foot coverings secure at the ankles by the use of tape.

(2) Work Clothing: Provide work clothes for wear under the disposable protective coveralls and foot coverings.

D. Change Rooms: Provide a temporary unit with a separate decontamination locker room and a clean locker room for personnel required to wear whole body protective clothing. Provide two separate lockers for each asbestos worker, one in each locker room. Keep street clothing and street shoes in the clean locker. Vacuum and remove asbestos contaminated disposable protective clothing while still wearing respirators at the boundary of the asbestos work area and seal in impermeable bags or containers for disposal. Do not remove disposable protective clothing in the decontamination locker room. Remove cloth work clothing in the decontamination locker room. Tag and bag cloth work clothes for laundering and keep work shoes in the decontamination locker. Do not wear work clothing between home and work. Locate showers between the decontamination locker room and the clean locker room and require that all employees shower before changing into street clothes. Clean asbestos contaminated work clothing in accordance with 29 CFR 1910.1001.

E. Eye Protection: Provide goggles to personnel engaged in asbestos operations when the use of a full face respirator is not required.

F. Caution Signs and Labels: Provide caution signs at all approaches to asbestos control areas containing concentrations of airborne asbestos fibers. Locate signs at such a distance that personnel may read the sign and take the necessary protective steps required before entering the area. Provide labels and affix to all asbestos materials, scrap, waste, debris, and other products contaminated with asbestos.

(1) Caution Sign: Vertical format conforming to 29 CFR 1910.145 (d) (4), minimum 20 by 14 inches displaying the following legend in the lower panel:

Legend	Notation
Asbestos	1" Sans Serif Gothic or Block
Dust Hazard	¾" Sans Serif Gothic or Block
Avoid Breathing Dust	¼" Gothic
Wear Assigned Protective Equipment	¼" Gothic
Do Not Remain in Area Unless Your Work Requires It	¼" Gothic
Breathing Asbestos Dust May Be Hazardous to Your Health	14 Point Gothic

Spacing between lines shall be at least equal to the height of the upper of any two lines.

(2) Caution Labels: Provide labels of sufficient size to be clearly legible, displaying the following legend:

CAUTION

CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
BREATHING ASBESTOS DUST MAY
CAUSE SERIOUS BODILY HARM

G. Tools and Local Exhaust System: Provide a local exhaust system in the asbestos control area. The local exhaust system shall be in accordance with ANSI Z9.2. Equip exhaust with absolute (HEPA) filters. Local exhaust equipment must be sufficient to maintain a minimum pressure differential of minus 0.02 inch of water column relative to adjacent, unsealed areas. Provide continuous 24 hour per day monitoring of the pressure differential with an automatic recording instrument. In no case shall the building ventilation system be used as the local exhaust system for the asbestos control area. Filters on vacuums and exhaust equipment shall conform to ANSI Z9.2.

2.0 **PRODUCTS**

2.1 Not Applicable

3.0 **EXECUTION**

3.1 Work Procedure

A. Perform asbestos related work in accordance with 29 CFR 1910.1001 and as specified herein. Use wet removal procedures. Personnel shall wear and utilize protective clothing and equipment as specified herein. Eating, smoking, or drinking shall not be permitted in the asbestos control area. Personnel of other trades, not engaged in the removal and demolition of asbestos, shall not be exposed at any time to airborne concentrations of asbestos, unless all the personnel protection provisions of this specification are complied with by the trade personnel. Shut down the building heating, ventilating, and air conditioning system and provide temporary heating, ventilating, and air conditioning. Disconnect electrical service when wet removal is performed and provide temporary electrical service.

B. Masking and Sealing

(1) Asbestos Control Area Requirements: Seal openings in areas where the release of airborne asbestos fibers is expected. Establish an asbestos control area with the use of curtains, portable partitions, or other enclosures in order to prevent the escape of asbestos fibers from the contaminated asbestos control area. In all possible instances, control area development shall include protective covering of walls, and ceilings with a continuous membrane of two layers of minus 4-mil plastic sheet sealed with tape to prevent water or other damage. Provide two layers of 6-mil plastic sheet over floors and extend a minimum of 12 inches up walls. Seal all joints with tape. Provide a local exhaust system in the asbestos control area. Openings will be allowed in enclosures of asbestos control areas for the supply and exhaust of air for the local exhaust system. Replace filters as required to maintain the efficiency of the system.

(2) Cover all equipment as described above, that cannot be removed prior to asbestos removal operations.

C. Asbestos Handling Procedures

(1) General Procedures: Sufficiently wet asbestos material with a fine spray of amended water during removal, cutting, or other handling

so as to reduce the emission of airborne fibers. Remove material and immediately place in plastic disposal bags. Where unusual circumstances prohibit the use of plastic bags, submit an alternate proposal for contaminant of asbestos fibers to the Engineer for approval. For example, in the case where both piping and insulation are to be removed, the Contractor may elect to wet the insulation and wrap the pipes and insulation in plastic and remove the pipe by sections.

D. Identification of Asbestos Free Insulation: Stencil "ASBESTOS-FREE" markings to the exterior jacket of all non-asbestos insulated piping installed under this contract. Apply such marking at maximum of 24 foot intervals. Indicate the limits of new "ASBESTOS-FREE" insulation with a one inch wide band with attached arrow pointing in the direction of the label "ASBESTOS-FREE". Paint markings in orange, as specified in Section 09900 - Painting.

E. Monitoring: Monitoring of airborne concentrations of asbestos fibers shall be in accordance with 29 CFR 1910.1001 and as specified herein.

(1) Monitoring Prior to Asbestos Work: Provide area monitoring and establish the reference TWA one day prior to the masking and sealing operations for each demolition site.

(2) Monitoring During Asbestos Work: Provide personal and area monitoring and establish the TWA during the first exposure to airborne concentrations of asbestos. Thereafter, provided the same type of work is being performed, provide area monitoring once every 4 hours during the work shift inside the asbestos control area, and at the exhaust opening of the local exhaust system. If monitoring outside the asbestos control area shows airborne concentrations have reached the specified TWA, stop all work, correct the condition(s) causing the increase, and notify the Engineer immediately.

(3) Monitoring After Final Clean-Up: Provide area monitoring of asbestos fibers and establish the TWA of less than 0.5 fibers/cc after final cleanup but before removal of the enclosure of the asbestos control area. Provide area monitoring and establish the TWA 2 days, 5 days, 15 days, and 30 days after the enclosure of the asbestos control area is removed. The fiber counts from these samples shall be less than 0.5 fibers/cc or be not greater than the reference TWA, whichever is less. Should any of the final samplings indicate a higher value, the Contractor shall take appropriate actions to reclean the area and shall repeat the monitoring.

F. Site Inspection: While performing asbestos removal work, the Contractor shall be subject to on-site inspection by the Engineer who may be assisted by safety or health personnel. If the work is found to be in violation of this Specification, the Engineer will issue a stop work order to be in effect immediately and until the violation is resolved. Standby time required to resolve the violation shall be at the Contractor's expense.

3.2 Clean-up and Disposal

A. Housekeeping: Essential parts of asbestos dust control are housekeeping and clean-up procedures. Maintain surfaces of the asbestos control area free of accumulations of asbestos fibers. Give meticulous attention to restricting the spread of dust and debris; keep waste from being distributed over the general area. Do not blow down the space with compressed air. When asbestos removal is complete, all asbestos debris is removed from the work site, and final clean-up is completed, certify the area as safe before the signs are removed. After final clean-up, remove all filters on the building HVAC system and provide new filters. Dispose of filters as asbestos-contaminated materials. Reestablish HVAC, mechanical, and electrical systems in proper working order. The Engineer will visually inspect the affected surfaces for residual asbestos material and accumulated dust and the Contractor shall reclean all areas showing dust or residual asbestos materials. If recleaning is required, monitor the asbestos airborne concentration after recleaning. Notify the Engineer before unrestricted entry is permitted. The Owner shall have the option to perform monitoring to certify the areas are safe before entry is permitted.

B. Disposal of Asbestos

(1) Procedure for Disposal: Collect asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing which may produce airborne concentrations of asbestos fibers and place in sealed impermeable bags. Affix a caution label to each bag. Dispose of waste asbestos material at an EPA or state-approved sanitary landfill. Procedure for hauling and disposal shall comply with 40 CFR 61 (Subpart B), state, regional and local standards. Sealed plastic bags may be dumped from drums into burial site unless the bags have been broken or damaged. Damaged bags shall remain in the drum and the entire contaminated drum shall be buried. Uncontaminated drums may be recycled. Workers unloading the sealed drums shall wear appropriate respirators and personal protective equipment when handling asbestos materials at the disposal site.

END OF SECTION

SECTION 02110 - SITE CLEARING

1.0 GENERAL

1.1 Description

A. Work under this Section of the Specifications includes general site clearing operations, including trees and vegetation removal, protection of existing trees to be left standing, and clearing and grubbing.

1.2 Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements not indicated to be removed, and improvements on adjoining properties.

A. Restore all improvements damaged by this Work to their original condition, and acceptable to the Owner or other parties or authorities having jurisdiction.

1.3 Protect existing trees and other vegetation indicated to remain in place against cutting, breaking, or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line. Provide temporary fences, barricades or guards as required to protect trees and vegetation to be left standing.

1.4 Mulch cleared trees and vegetation. Mulch is the preferred method by DCWA.

2.0 PRODUCTS

2.1 Not Applicable.

3.0 EXECUTION

3.1 Clearing

A. Remove from the site trees, brush, shrubs, down timber, rotten wood, rubbish, other vegetation as well as fences, and incidental structures necessary to allow for new construction.

(1) Remove all trees, stumps, and roots within 10-feet of any structure or pipeline.

(2) Stumps of trees, other than the above, to be left in place shall be cut off shall be left not more than 6-inches above original grade.

Remove all stumps when such stumps will be less than 5-feet below finished grade.

B. Clearing work shall be restricted to area within rights-of-way or easements or within "Construction Limits" indicated on Contract Drawings.

3.2 Existing Trees and Shrubs

A. Trees and shrubs that are to remain within "Construction Limits" will be indicated on Contract Drawings or conspicuously marked on site.

B. Ownership to Trees: Unless otherwise noted, trees within the "Construction Limits" shall become the property of the Contractor and shall be removed from the site.

3.3 Grubbing

A. Grub areas within and to a point 10-feet outside of all structures and pipe lines, areas to receive fill where finished grade will be less than 3-feet above existing grade, cut areas where finished grade will be less than 2-feet below existing grade, transitional areas between cut and fill, and any area to receive control fill.

B. Remove from the ground to a depth of 18-inches, all stumps, roots 1/2-inch and larger, organic material and debris.

C. Use only hand methods for grubbings inside the drip lines of trees which are to remain.

3.4 Clean up debris resulting from site clearing operations continuously with the progress of the work.

3.5 Remove all waste material from site.

3.6 Remove debris from site in such a manner as to prevent spillage. Keep pavement and area adjacent to site clean and free from mud, dirt and debris at all times.

END OF SECTION

SECTION 02225 - TRENCHING & BACKFILLING

1.0 GENERAL

1.1 Work included in this Section includes trenching and backfilling for underground pipelines and related structures only.

1.2 Reference Specifications are referred to by abbreviation as follows:

A. American Society for Testing and Materials ..... ASTM

B. American Association of State Highway and Transportation Officials ..... AASHTO

C. Virginia Department of Transportation ..... VDOT

1.3 The Contractor shall perform all construction operations in accordance with the U.S. "Occupational Safety and Health Act of 1970", the Standards of the U.S. Department of Labor, Occupational Safety and Health Administration and the latest amendments thereto.

1.4 The Contractor shall perform all construction operations in accordance with the "Rules and Regulations Governing the Safety and Health of Employees Engaged in Construction" as adopted by the Safety and Health Codes Commission of the Commonwealth of Virginia and all latest revisions thereto and issued by the Department of Labor and Industry.

1.5 Store and use explosives in accordance with Federal, State and Local regulations. The Contractor shall be responsible for and shall satisfactorily correct all damage resulting from the use of explosives.

1.6 The Contractor/Developer shall provide a Third Party engineer to perform all compaction testing over utilities and report the findings to VDOT and the Dinwiddie County Water Authority.

1.7 Locate existing utilities, culverts and structures, above and/or below ground, before any excavation starts. Coordinate work with utility companies through an approved utility location service. Protect, maintain in service, and prevent damage to utilities not designated to be removed. When utilities are encountered and are not shown on Drawings or when locations differ from those shown on Drawings, notify the DCWA for instructions before proceeding.

1.8 All excavation is unclassified and no additional payment will be allowed regardless of materials encountered.

2.0 PRODUCTS

2.1 Pipe Bedding Fill

A. Granular fill shall meet requirements for coarse aggregates, VDOT Specifications, Size No. 57.

2.2 Select Backfill

A. Aggregate fill shall meet requirements for coarse aggregates, VDOT Specification, size No. 57.

B. Clean earth fill shall be an approved material free of debris, roots, frozen materials, organic matter, rock or gravel larger than 1-inch in any dimension or other harmful matter.

2.3 Rip-rap, where shown on the Drawings shall conform to VDOT Specification "Dry Rip-Rap - Class I."

3.0 EXECUTION

3.1 Strip existing topsoil, leaf mold and organic materials, meeting topsoil requirements of Section 02935 - Seeding. Deposit in storage piles separate from other excavated material.

3.2 Where the trench width exceeds the allowable width, the Contractor at his own expense shall provide for increased loads on pipe as directed by the DCWA.

3.3 Unauthorized excavation consists of the removal of material beyond indicated subgrade elevations or side dimensions without specific approval of the DCWA. Where unauthorized excavations occur, restore these areas to the elevations and dimensions shown on the Drawings with granular fill.

3.4 Where removal of unsatisfactory material is due to fault or negligence of the Contractor, by inadequate shoring or bracing, dewatering, material storage or other failure to meet specified requirements, any work deemed necessary by the DCWA to correct the faulty condition shall be performed at no additional cost to the Owner.

3.5 Excavation

A. Open trenches only so far in advance of pipe laying as permitted by DCWA. In no case will more than 500-feet of trench may be open at one time. Trenches shall be backfilled at the end of each working day except where otherwise permitted.

B. The width of the trench at and below the top of the pipe shall not exceed the outside diameter of the pipe plus 18-inches except that for pipe 12-inches or less in diameter, the trench width shall not exceed 33-inches. Where this width is exceeded, Contractor shall provide for increased pipe loading as directed by the DCWA.

C. The trench walls above the top of the pipe may be sloped or the trench, above the top of the pipe, may be widened as necessary for bracing, sheeting and shoring. Construction methods shall be subject to review and approval by the DCWA.

D. Excavate trenches for gravity lines, pressure lines to elevations shown on Contract Drawings or to depths specified.

E. The bottom of the trench for gravity lines shall be as specified herein under "Pipe Bedding".

F. The bottom of the trench for pressure lines shall be shaped to fit the bottom of the pipe as specified herein under "Pipe Bedding".

(1) Excavate for bell holes at each joint.

(2) Where rock is encountered, excavate a minimum of 6-inches below the bottom of the pipe for bedding.

G. Dewater excavation as necessary to provide proper protection. If deemed necessary, the DCWA may require continuous dewatering 24 hours per day by adequate pumpage or well-points until backfilling is completed. The method, and equipment used for dewatering shall be subject to the approval of the DCWA.

H. Where unsuitable soil is encountered, excavate to depth determined by the DCWA and replace with select backfill thoroughly and uniformly compacted.

I. Where underground streams or springs are found, provide temporary drainage and notify the DCWA.

J. Remove from project site and dispose of all material unsatisfactory for backfill, continuously with the progress of the work.

K. Remove shoring and all form materials, unless ordered to remain.

L. Where rock is encountered and a manhole, vault, or other structure will bear entirely on rock, it shall be used to support the foundation. Where only a part of the foundation would bear on rock, excavate to an even depth of 8-inches

below the entire structure and backfill with aggregate fill and thoroughly compact.

M. Provide a minimum of 8-inches between rock excavation and sides of structures.

3.6 Sheeting

A. Maintain trench walls in a safe condition at all times. Provide sheeting, shoring, and bracing as necessary to prevent cave-in of excavation or damage to existing structures on or adjoining the site.

B. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.

C. Maintain sheeting, shoring and bracing in excavations regardless of time period excavations will be open. Carry down sheeting, shoring and bracing as excavation progresses in accordance with the proper authority.

D. Sheeting, shoring and bracing left in place shall be cut off to a depth of not less than 18-inches below grade.

3.7 Pipe Bedding

A. Bed all sewer pipe in accordance with bedding details as shown in Section 00870 - Standard Details.

B. Except where otherwise shown on the Drawings, all gravity lines using rigid pipe such as concrete, etc. shall be Class C bedding as a minimum.

C. Except where otherwise shown on the Drawings, all gravity lines using flexible pipe such as PVC, etc. shall be Class B-1 bedding as a minimum.

D. Except where otherwise shown on the Drawings, all pressure lines using rigid pipe such as ductile iron, etc. shall be Class C-1 bedding as a minimum.

E. Except where otherwise shown on the Drawings, all pressure lines using flexible pipe such as PVC, etc. shall be Class C-1 bedding as a minimum.

F. Compact pipe bedding by tamping or rodding to prevent settlement.

3.8 Backfill

A. Backfill trench to a compacted depth of 1-foot over the pipe with select backfill in accordance with the details shown in Section 00870 - Standard Details. Backfill shall be placed by hand, uniformly on each side of the pipe

and compacted in layers not exceeding 5-inches. Do not backfill on muddy or frozen soil, or with muddy or frozen soil.

B. Backfill trench from 1-foot above the pipe to grade with clean earth fill free of stones not larger than 5-inches or one half the layer thickness, whichever is smaller. Layers shall not exceed 12-inches, except that under road shoulders and under existing or future paved areas, layers shall not exceed 8-inches. Backfill shall be compacted to the density specified for the areas in which it is located except that minimum compaction in any area shall be to the density of the adjacent soil.

C. Excavation depressions caused by removal of stumps or other clearing operations to firm subgrade, fill with clean earth fill and compact as specified.

D. Place backfill materials evenly adjacent to structures. Take care to prevent wedging action of the backfill against structures by carrying the material uniformly around the structure to approximately the same elevation in each lift.

E. Compact soil materials using equipment suitable for materials to be compacted and work area locations. Use power-driven hand tampers for compacting materials adjacent to structures.

F. Compact aggregate fill placed around manholes or other structures to required density.

3.9 Compaction (Third Party Testing by CONTRACTOR)

A. Percentage of maximum density requirements.

(1) Compact each layer of fill or backfill to not less than the following percentages of the maximum density at optimum moisture content as determined by ASTM D 1557 (AASHTO T-180).

95% beneath and within 25-feet of buildings and structures, including those shown for future construction.

90% beneath pavements, walks, and road shoulders, including those shown for future construction.

85% in other unpaved areas.

3.10 Grading

A. Uniformly grade all areas within the limits designated on the Contract Drawings, including adjacent transition areas. Finish surfaces within specified tolerances with uniform levels or slopes between points where elevations are shown and existing grades.

B. Finish all surfaces free from irregular changes.

C. Finish subgrade areas to receive topsoil to within 0.10-foot of required subgrade elevations.

D. Shape subgrade under walks to line, grade, and cross-section to within 0.10-foot of required subgrade elevations.

E. Shape subgrade under pavement to line, grade, and cross-section to within 1/2-inch of required subgrade elevations.

F. Protect newly graded areas from traffic and erosion. Repair and reestablish grade in settled, eroded, or rutted areas to the specified tolerances.

G. Where compacted areas are disturbed by subsequent construction or adverse weather scarify the surface, reshape and compact to the required density. Use hand tamper for recompaction over underground utilities.

3.11 Utilities to be Abandoned or Removed

A. When underground utilities are to be abandoned in place, plug, cap, or seal with concrete at the "construction limits" or at points shown.

B. Remove underground utilities indicated on the Drawings to be removed and backfill resulting excavation with suitable material, compacted as specified. Plug, cap or seal utilities with concrete, at the construction limits or at points shown.

3.12 Erosion Control

A. Comply with local erosion control ordinance and with the "Virginia Erosion and Sediment Control Handbook" by the Virginia Soil and Water Conservation Commission to control erosion and sedimentation.

B. Submit erosion control plan to the DCWA for review and approval prior to commencing any grading operations.

C. Install all applicable erosion and siltation control measures in accordance with approved plan prior to grading.

D. No more than 500-feet of trench shall be open at any one time.

E. All utility lines, not in streets, shall be mulched with hay or straw and seeded within 15 days after backfilling.

F. Any disturbed area, not paved, sodded or built upon by November 15 is to be seeded on that date with oats, abruzzi rye, or equivalent and mulched with hay or straw.

G. Protect graded areas from the action of the elements. Settlement or other damage that occurs prior to acceptance of the work shall be repaired and grades satisfactorily reestablished.

H. Repair after cleanup: Upon completion of construction work and after spoils and debris have been removed, regrade any areas disturbed by operations.

3.13 Clean Up

A. Keep work area clean at all times and promptly remove all materials and debris not intended for incorporation in the Work. Broom clean the surfaces of all paved areas immediately after backfilling operations.

B. Maintain backfilled trenches from the nuisance of dust, mud or settling during the entire length of the Contract and for a period of one year following Final Acceptance of the Work.

C. In the event the Contractor fails to satisfy these requirements to the satisfaction of the DCWA, or otherwise prosecute the Work in a reasonable or proper manner, and after a reasonable period of time has elapsed after notification by the DCWA of unsatisfactory conditions, the Owner reserves the right to employ outside services to take such corrective action as deemed necessary by the DCWA. The cost incurred in taking corrective actions will be deducted from any monies due the Contractor by the Owner or such other means of collection as may be available to the Owner.

3.14 Preparation for Final Inspection

A. Locate and adjust all manholes, valve boxes, etc. to final grade and flush out all gravity pipe lines as necessary prior to final inspection by the DCWA. The costs of this work shall be included in the applicable bid prices.

3.15 Existing Driveways, Fences, Culverts, etc.

The Contractor shall return all driveways, fences, culverts, lawn areas, paved areas, etc. to the same condition existing prior to construction. Any culverts damaged during construction shall be replaced with new culverts at no cost to the Owner.

END OF SECTION

SECTION 02320 - CASING PIPES

1.0 GENERAL

1.1 Work included in this Section consists of furnishing and installing casing pipe under highways and railroads. Carrier pipe is specified in other Sections.

1.2 Reference Specifications are referred to by abbreviation as follows:

A. American Association of State Highway & Transportation Officials ..... AASHTO

B. American Railway Engineering Association .....AREA

C. American Society for Testing and Materials ..... ASTM

D. American Waterworks Association ..... AWWA

E. Virginia Department of Transportation ..... VDOT

1.3 Submittals

A. Submit complete Product Data including pipe diameter, wall thickness strengths, joining details and reference to appropriate Standards Agency and Standard Number with certification of which product conforms to which Standard.

B. Submit complete construction details for each installation with reference to appropriate Product Data.

C. Submittals shall be in a form suitable for review and approval by railroad company or VDOT.

D. Submit data and details to DCWA for review not less than 30 days in advance of proposed installation work. DCWA reserves the right to delay beginning of installation until review is completed and appropriate approvals have been obtained. Additional costs caused by such delays shall be borne by Contractor.

E. Review by DCWA shall in no way relieve Contractor of his responsibility under this Contract.

1.4 After review and approval of submittals, provide not less than 72 hours notice to DCWA prior to beginning of installation work.

1.5 Contractor shall secure all permits, bonds and insurance required and pay all fees for installation work.

1.6 Contractor shall provide, at his own expense, a Railroad Protective Liability Policy in the amount of not less than $250,000/$500,000 bodily injury and a minimum of $250,000 property damage coverage. Policy shall name the railroad company as the insured and be issued to the Contractor. These insurance requirements are in addition to other insurance requirements as set forth elsewhere in the Contract Documents.

2.0 PRODUCTS

2.1 Strength Requirements - Casing Pipe

A. Casing pipe for use under highways shall have a strength to equal or exceed AASHTO H-20 loading.

B. Casing pipe for use under railroads shall have a strength to equal or exceed AREA Manual for Railway Engineering, Section 5.2, E-80 loading.

C. Unit weight of soil shall be taken as 120 lbs. per cu. ft. The height of cover over the pipe shall be as indicated on the Contract Drawings.

D. Casing spacers shall have 14 gauge, T-304 stainless steel bands and risers. Liner shall be EPDM or PVC with a hardness durometer "A" 85-90 and a maximum water absorption of 1%. Runners shall be of Ultra High Molecular Weight Polymer (UHMWP) with a minimum compressive strength of 18,000 psi per ASTM D-695. Nuts, bolts and washers shall be stainless steel. All risers shall be MIG welded to the band. Casing spacers shall be as manufactured by BMW Company or approved equal.

2.2 Tunnel Liner Plates

A. Plates for use under highways shall conform to AASHTO Design Specifications, Section 13, with an installation stiffness safety factor of 4.

B. Plates for use under railroads shall conform to AREA Manual for Railroad Engineering, Section 4.12, with an installation stiffness safety factor of 4.

C. Plates shall be fabricated from structural quality, hot rolled, carbon steel sheets or plates conforming to ASTM Specification A569. Minimum tensile strength shall be 42,000 psi.

D. Plates shall be cold formed to permit in-place assembly of a steel support system as the tunnel is excavated.

E. Plates shall be accurately curved to suit tunnel cross section and shall be of a uniform fabrication to allow plates of similar curvature to be interchanged.

F. Plates for highway crossings may have either two-flange or four-flange plates.

G. Plates for railroad crossings shall have two-flange or four-flange plates.

H. Provide a minimum of one grout hole two inches in diameter in each circumferential ring to permit grouting as liner work proceeds. All grout holes shall be plain, tapped or welded with coupling. Provide tapped holes with a pipe plug screwed in place.

I. Provide bituminous coating on all steel plates. Bituminous material shall conform to AASHTO Designation M 190.

J. Bolts and nuts shall be of the diameter and length as recommended by the manufacturer. Bolts and nuts shall be quick acting, coarse thread and shall conform to ASTM Specification A307, Grade A or A449.

2.3 Smooth steel pipe for installation by boring or jacking in place shall be new prime pipe having a minimum yield strength of 35,000 psi.

A. Casing pipe shall be welded pipe conforming to ASTM Specification A252, Grade II.

(1) Where the entire area between casing pipe and carrier pipe is to be grouted, provide uncoated casing pipe.

(2) Where the entire area between casing pipe and carrier pipe is not to be grouted, provide interior bituminous coating conforming to AWWA C203.

2.4 Grout mix for filling voids shall consist of the following:

A. 1 part cement, conforming to VDOT Specifications, Section 216.

B. 2½ parts sand, conforming to VDOT Specifications, Section 202, Grade C.

C. Provide minimum amount of mixing water necessary to obtain required consistency of grout.

3.0 EXECUTION

3.1 All work by the Contractor within the Rights-of-Way must be subordinate to the free and unobstructed use of Rights-of-Way for the passage of traffic without delay or danger to life, equipment, or property. All operations shall be conducted in such a manner that all work will be performed below roadway level. The Contractor shall provide watchmen, barricades and flagmen as required. If required, work shall be carried out on a 24 hour basis. Additional payment will not be made for complying with these requirements.

3.2 Installation of the casing pipe shall be carried on in such a manner that there will be no settlement of the ground surface over the casing. The installation of the casing pipe shall follow as close as possible behind excavation operations. The Contractor will be held responsible for any and all settlement that may occur above the casing pipe during and after installation.

3.3 Contractor's work within Rights-of-Way of VDOT shall conform to their permit requirements.

3.4 Contractor's work within Rights-of-Way of the railroad shall conform to current AREA specifications and to the requirements of the railroad company.

3.5 Horizontal and vertical alignment for the casing pipes on this Project are critical. The maximum deviation from alignment and grade for the carrier pipe as shown on the Contract Drawings are as follows:

A. Horizontal alignment - 1.0%

B. Vertical alignment - 1.0%

3.6 Casing pipe shall have a minimum diameter sufficient to provide a four inch clearance between maximum diameter of carrier pipe and the minimum diameter of the casing pipe.

3.7 Casing pipe gage thickness shall be as required by approving authority for the particular casing pipe diameter.

3.8 Install casing pipe by either boring, jacking or tunneling.

3.9 Commence installation operations from a pit of suitable dimensions. Sheet and shore pit walls if necessary.

3.10 Install tunnel liner plates for the full length of the specified casing pipe using one type of plate only. Stagger grout holes on successive rings. Assemble plates in accordance with manufacturer's instructions.

A. Handle coated plates in such manner as to prevent bruising, scaling or breaking of the coating. Any plates damaged during handling or placement shall be replaced by the Contractor at his own expense. Small areas with minor damage may be repaired by Contractor as directed by the Director.

B. Trim periphery of any tunnel smoothly to fit the outside of the tunnel liner.

C. Pressure-grout voids between installed liner plates and the tunnel wall. Apply grout through grouting holes in liner plates with such pressure that all voids will be completely filled. Limit grouting pressure to 15 psi. Conduct grouting operations concurrent with tunneling operations.

3.11 Smoothly pave bottom of casing pipe with concrete in such a way that carrier pipe installation will be true to line and grade. Pull carrier pipe in place one joint at a time. Grout or otherwise block carrier pipe in place to maintain line and grade and resist movement due to thrust pressure.

3.12 On carrier pipes for gravity service, where difference in diameter between carrier pipe and casing pipe is 24 in. or less, pressure grout the entire area between the carrier pipe and the casing pipe for the entire length of the casing pipe to eliminate all void spaces.

3.13 On carrier pipes for gravity service, where difference in diameter between carrier pipe and casing pipe exceeds 24 in., or carrier pipes are for pressure service, install bulkheads at each end of casing pipe. Materials and methods for installing bulkheads shall meet the requirements of the Authority.

3.14 Where any casing pipe installed is found to prohibit installation of carrier pipe to alignment and grade shown on Contract Drawings, Contractor shall submit a plan to DCWA for review and approval showing proposed method of correcting deviation without changing alignment and grade shown on Contract Drawings.

END OF SECTION

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SECTION 02500 - CONSTRUCTION ON STATE MAINTAINED STREETS & ROADS

1.1 Definitions

A. Department - The Virginia Department of Transportation (VDOT).

B. Department Specifications - The Department's "Road and Bridge Specifications" dated, Latest Revision.

C. Landscape Engineer - The Landscape Engineer of the Department or his authorized representative.

D. Permit - The Permit granted by the Department for Underground Installations on public Rights-of-Way under the jurisdiction of the Commonwealth of Virginia.

E. Permits Manual - The Department's "Land Use Manual of Permits" Latest Revision.

F. Resident Engineer - The Resident Engineer of the Department for the geographical area of the Work, or his authorized representative.

1.2 General

A. Contractor's operations within the Rights-of-Way of State maintained streets and roads shall conform in full to the requirements of the Department.

(1) Comply with "Special Provisions for Underground Installation Permit Number _____ included in the Project Manual as Attachment "A".

(2) Comply with requirements set forth herein to the extent that they are not in conflict with the Special Provisions for Underground Installation.

1.3 Procedure

A. DCWA has not obtained a Permit from the Department for construction on State maintained streets and roads.

(1) The Contractor shall act as the Authorized Agent of DCWA in securing the necessary permit.

(2) The Contractor shall pay all fees and post any required Bonds imposed as a condition of the issuance of the Permit.

B. The Contractor shall pay all inspection costs imposed by the Department as a part of the Permit requirements. The cost to the Contractor of paying such costs shall be estimated and included in the Unit Prices in the Bid.

C. Any additional materials and work required of the Contractor by the Department that is not specified in the Project Manual and could not reasonably be foreseen shall be added to the Contract by Change Order.

D. The Contractor shall indemnify DCWA from any costs assessed by the Department due to the failure to completely restore streets and roads under the Department's jurisdiction in a timely fashion.

E. Where the Department requires the Permittee to repair sinks in trench backfill for three years, the Contractor shall be responsible for the repair of such sinks for a period of one year. The DCWA will then be responsible for such sinks for the second and third years.

F. Where the Permit refers to the Permittee being required to move, remove alter or change any installation that interferes with future construction of the highway, such reference shall not be construed as being of any concern to the Contractor.

G. Notify police, fire and rescue departments in advance of starting construction on any street or road which might interfere with their operations. Provide such notice for each street or road affected.

END OF SECTION

ATTACHMENT "A"

Special Provisions for Underground Installation Permit Number _____

1. The underground installation granted by this Permit must be constructed exactly as shown on the accompanying Drawings. Distances from edge of pavement or R/W and depths below pavement, ditch line or ground surface must be as indicated on the sketch. Method of construction, i.e., trenching, boring, pushing, jacking, etc., must be indicated on the Drawings.

2. A permit may be denied any applicant, and all permits issued by the State Highway Commission may be revoked, whenever, in the opinion of the State Highway Commissioner, the safety, use, and/or maintenance of the highway so requires.

3. Applicants to whom permits are issued shall at all times indemnify and save harmless the State Highway Commission and the Commonwealth of Virginia from responsibility, damage, and/or liability arising from the exercise of the privileges granted in such permit.

4. The Permittee shall cooperate with the Department to maintain all roads and streets in a safe and travelable condition at all times during the construction and warranty periods except when such road or street is permitted by the Department to be closed to the public.

5. The Permittee shall immediately have corrected any situation which may arise as a result of these installations that the Resident Project Representative or Director deems hazardous to the traveling public, even though it may not be specifically covered in the Permit or Manual.

6. The Department reserves the right to stop the work at any time the terms of this Permit are not satisfactorily complied with, and the Department may, at its discretion complete any of the work covered in the Permit, at the expense of the Permittee.

7. If the Work started under this Permit is not completed in a reasonable length of time, and after due notice, the Applicant fails to complete the Work, the Department will do whatever is necessary to restore the roadway and right-of-way to its original condition, and complete any other work required under this Permit. The Applicant hereby agrees to pay the Department the actual cost of completing the work required and performed by the Department.

8. All work done under this Permit on the road right-of-way, shall in all respects, including location, alignment, elevation and grade, manner of performing the

work, restoration of conditions, etc., be subject to Department's directions and shall be done to the satisfaction of the Department.

9. If during construction it is deemed necessary by the Department to assign inspectors to the Project, the Permittee is to pay the Department an additional inspection fee in an amount that will cover the salary, expenses and mileage of the inspector or inspectors assigned by the department for handling work covered by this Permit. Said inspection fee to be paid promptly when bills are rendered by the Department.

10. Road drainage is not to be blocked. The shoulders, ditches, roadside, and drainage facilities as well as the pavement, shall be left in as good a condition as found, consistent with adjoining sections of the highway, and kept in a condition satisfactory to the Department. Signs, if removed, shall be replaced at their exact position and height, and thoroughly tamped in a perpendicular position.

11. Road and street connections and private entrances are to be kept in a satisfactory condition. Entrances are not to be blocked and ample provision must be made for safe ingress and egress to adjacent property at all times. When entrances are disturbed, they must be restored to the original condition or to a condition satisfactory to the Resident Engineer and the property owner. Mail and newspaper boxes shall be replaced at their original location and height.

12. Traffic is not to be blocked or re-routed without special written permission of the Resident Engineer. Where one-way traffic is permitted to be maintained, it shall be flagged 24 hrs. per day.

13. Erosion and siltation control shall be provided in accordance with the Department's Specifications.

14. Signs shall be in accordance with the Department's "Virginia Work Area Protection Manual." The signs are to be located as directed by the Resident Engineer. Traffic is to be protected by adequate lights, barricades and construction signs at all times.

15. The Permittee shall be responsible for identifying, locating, adjusting, and/or relocating existing utilities, property markers, and right-of-way monuments, including making all arrangements therefor.

16. Where landscape is disturbed on State right-of-way, it shall be replaced with a minimum of 2" of topsoil and reseeded according to State's Specifications.

17. This Permit does not cover the cutting or trimming of any trees which may be involved under this Permit. When it is necessary to cut or trim trees, a separate Tree Trimming Permit must be issued.

18. No tree roots over 3" in diameter are to be cut without special permission of the Landscape Engineer. All roots over 3" in diameter are to be clean cut with an axe or saw. Particular attention shall be given not to splinter the roots next to the tree. Whenever possible, tunneling through or under roots shall prevail instead of cutting anchor roots.

19. The Permittee shall see that dusty conditions are kept to a minimum, either by the addition of water or calcium chloride at all times.

20. Coordinate construction schedule with Resident Engineer. Advise Resident Engineer of any changes in schedule. Notify Resident Engineer in advance of starting construction on each street or road.

21. Construction operations will normally be permitted during the period from November 1 to April 1 subject to weather conditions existing at the time. The Department will suspend operations during periods of adverse weather conditions.

22. The Department reserves the right to suspend the Work and discontinue the issuance of permits for the installation of all underground utilities during the period of November 1 to April 1.

23. Long, open trenches will not be permitted. The maximum length trench at any time, including backfill portion of same not then suitable for traffic, shall not exceed 500'. Trenches are not to be left open overnight.

24. No excavated material is to be placed on the pavement, without written permission of the Resident Engineer. When so permitted the pavement shall be satisfactorily cleaned by an approved method. No cleated equipment is to be used on the pavement.

25. The backfilling of trenches and replacement of pavement shall be in accordance with the Department's Specifications and the conditions as set forth herein.

26. All backfilling of trenches shall be in layers of no greater thickness than 6", and shall be made to a minimum of 95% density compaction. Compaction by water will not be permitted.

27. Where pavement and shoulder areas are disturbed and cannot be compacted to 95% density, the areas shall be rebuilt using stabilized material.

28. Trenches in existing road shoulders shall be replaced with a topping of crusher run stone applied over the entire disturbed width of the shoulder to the same depth found to be existing or a minimum of 2" deep, whichever is greater.

29. All road crossings must be jacked, driven or pushed under the roadway in a manner as directed by the Department and to the satisfaction of the Department.

Pavement shall not be disturbed and precautions must be taken to eliminate the possibility of the equipment breaking or marring the hard surface.

30. The Permittee will be required to restore the base and surface on all roads covered by this Permit disturbed or deemed by the Department to have been weakened as a result of construction operations.

31. No bituminous material shall be applied between November 1 and April 1, except by written authorization from the Department and treatment shall be applied in accordance with the latest Department Specifications.

32. The bituminous prime treatment shall consist of RC-250 or CAE-2 type asphalt applied at a rate of 0.4 gallon per sq. yd. with 35 lbs. per sq. yd. of #78 crushed stone. The prime treatment shall be allowed to stand for a period of at least 24 hours before a seal treatment is applied.

33. The bituminous seal treatment shall consist of RC-250 or CAE-2 type asphalt applied at a rate of 0.3 gallon per sq. yd. with 25 lbs. per sq. yd. of #78 crushed stone.

34. During the process of placing the prime and the seal treatments, they shall be rolled by a self-powered, self-propelled unit with a manufacturer's rating of 7 to 10 tons.

35. Upon completion of the work under this Permit, the Permittee shall notify the Resident Engineer by letter giving the Permit Number and Route Numbers so that a final inspection can be made.

36. The Contractor shall maintain the completed Work in a manner satisfactory to the Department during the remainder of the Contract period and for a period of one year after final acceptance of the Work by the Department.

END OF ATTACHMENT

SECTION 02502 - PAVING & SURFACING - ACCESS ROADS AND PARKING AREAS

1.0 GENERAL

1.1 Description

A. Furnish and install surfacing and surface treatment materials on roads and parking areas not subject to VDOT jurisdiction.

1.2 Reference Specifications are referred to by abbreviation as follows:

A. Virginia Department of Transportation
Road and Bridge Specifications, latest edition ..... VDOT

2.0 PRODUCTS

2.1 Base course aggregate shall be Type I, Aggregate Base Material as defined in VDOT Specifications. Aggregate size shall be 21 or 21A.

2.2 Seal and tack coat shall be grade RC-250 asphalt material as defined in VDOT Specifications.

2.3 Asphalt base shall be Type IM-1A Asphalt Concrete as defined in VDOT Specifications.

2.4 Asphalt surface shall be Type SM-1A, Asphalt Concrete, as defined in VDOT Specifications.

2.5 Pavement marking materials shall consist of spray paint or preformed plastic pavement marking material conforming to VDOT Specifications.

2.6 Concrete shall be in accordance with Division 3 - Concrete.

3.0 EXECUTION

3.1 Pavement Repairs.

A. When pavement, curb and gutter or sidewalks must be cut, make the cut in a straight line, parallel to the pipe and 6 inches wider than the disturbed base, to provide an undisturbed shoulder under the new work.

3.2 Pavement Placement

A. Prepare subgrade by grading and compacting immediately prior to placing

the aggregate base course. The surface shall be true to line and grade and shall be checked with suitable templates or other approved method. Construction methods and equipment shall meet requirements of applicable portions of VDOT Specifications.

B. Place the aggregate base course in layers not to exceed 6 inches in thickness. Construction methods and equipment shall meet requirements of VDOT Specifications.

C. Apply a seal coat at the rate of 0.05-0.15 gal./sq. yd.

D. Place asphalt base to a depth of 2 inches minimum, unless otherwise shown.

E. Apply a tack coat over the entire area of old and new pavement at the rate of 0.10 gal./sq. yd.

F. Place asphalt surface over the area designated on contract plan to a depth of 1½ inches minimum, unless otherwise shown.

3.3 Pavement Marking

A. Apply pavement marking in a neat and workmanlike manner on a clean and dry pavement. Markings shall be 4" wide and shall conform to markings shown on the Drawings.

3.4 Upon completion of construction work and after spoils and debris have been removed, regrade any areas disturbed by the operations.

END OF SECTION

SECTION 02665 - WATER DISTRIBUTION SYSTEM

1.0 GENERAL

1.1 Work in this Section includes all exterior potable water distribution system piping and appurtenances.

1.2 Reference Specifications are referred to by abbreviation as follows:

A. American National Standards Institute ..... ANSI

B. American Society for Testing and Materials ..... ASTM

C. American Water Works Association ..... AWWA

D. Commercial Standard (National Bureau of Standards) .....CS

E. Federal Standards ..... FS

F. Virginia Department of Transportation ..... VDOT

1.3 Separation of water lines and sanitary sewers.

A. Follow State Health Department "Waterworks Regulations" for separation of water mains and sewer lines.

B. Parallel Installation

(1) Normal Conditions - Water lines shall be constructed at least 10-feet horizontally from a sewer or sewer manhole whenever possible. The distance shall be measured edge-to-edge.

(2) Unusual Conditions - When local conditions prevent a horizontal separation of at least 10-feet, the water line may be laid closer to a sewer or sewer manhole provided that:

(a) The bottom of the water line is at least 18-inches above the top of the sewer.

(b) Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe pressure-tested in place to 50 psi without leakage before backfilling. The sewer manhole shall be of watertight construction and tested in place.

C. Crossing

(1) Normal Conditions - Water lines crossing over sewers shall be laid to provide a separation of at least 18-inches between the bottom of the water line and the top of the sewer whenever possible.

(2) Unusual Conditions - When local conditions prevent a vertical separation described in Crossing, Normal Conditions, Paragraph C above, the following construction shall be used.

(a) Sewers passing over or under water lines shall be constructed of the materials described in Parallel Installation, Unusual Conditions - Paragraph B above.

(b) Water lines passing under sewers shall also be protected by providing the following:

1. A vertical separation of at least 18-inches between the bottom of the sewer and the top of the water lines.

2. Adequate structural support for the sewers to prevent excessive deflection and settling.

3. That the length of the water line shall be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.

D. Sanitary sewers or sewer manholes -No water pipes shall pass through or come in contact with any part of sewer or sewer manhole.

2.0 PRODUCTS

A. Submit shop drawings on all products as required by DCWA.

B. Provide certified test results of pipe testing.

2.1 Ductile iron pipe shall meet requirements of AWWA/ANSI C151/A21.51 for Pressure Class 150, unless otherwise indicated on the Drawings. Pressure classes shall meet requirement of AWWA C150. All pipe shall have a cement mortar lining on the interior and a bituminous coating on the exterior.

2.2 Flanged cast iron and ductile iron pipe shall meet the requirements of AWWA/ANSI C115/A.21.15 for Class 150, C1.50 thickness Class 53, unless otherwise shown on Contract Drawings. Thickness class shall meet requirements

of AWWA/ANSI C150/A21.50. All pipe shall have a cement mortar lining on the interior and a bituminous seal coat on the exterior.

2.3 Polyvinylchloride (PVC) pipe and fittings in sizes 4-inches through 12-inches for water works service shall meet the requirements of AWWA C900, C.I.P. O.D. Class 150 except that all connections shall be made using elastomeric gasket joints.

2.4 Polyethylene pipe shall meet the requirements of AWWA C901, Standard Code Designation PE3408, Pressure Class 200 psi.

2.5 Copper tubing shall meet requirements of ASTM B88 for Type "L" copper, hard drawn, for above ground and Type "K" hard drawn for below ground.

2.6 Gray iron and ductile iron fittings shall meet requirements of AWWA/ANSI C110/A21.10. Pressure ratings shall be a minimum of 250 psi for fittings 12-inches and smaller and at least 150 psi for fittings 14-inches and larger, or pressure specified for adjacent piping, whichever is greater. All fittings shall be all bell, mechanical joint, or mechanical joint plain end unless otherwise approved by the DCWA. All fittings shall have a cement mortar lining on the interior and a bituminous coating on the exterior.

2.7 Compact ductile iron fittings shall meet requirements of AWWA/ANSI C153/A21.53 in sizes 4-inches through 12-inches. 14-inches and 16-inches sizes shall conform to manufacturer's standard. All fittings shall be all bell, mechanical joint, or mechanical joint plain end unless otherwise approved by DCWA. All fittings shall have a cement mortar lining on the interior and a bituminous coating on the exterior.

2.8 Mechanical joints and jointing materials shall meet requirements of AWWA C111.

A. Mechanical joint retainer glands shall meet requirements of AWWA C111 except that retainer gland shall be modified to accommodate set screws.

B. Locked type mechanical joints may be used where restrained joints are required.

2.9 Push-on joint and rubber gasket shall meet requirements of AWWA C111.

A. Restrained push-on joints may be used where restrained joints are required.

2.10 Flanged joints for ductile iron pipe shall meet requirements of ANSI B16.1.

2.11 Flanged joint gaskets shall be full-face, made of rubber, and shall meet requirements of ANSI B16.21.

2.12 Cement mortar lining with bituminous seal coat for ductile iron pipe and fittings or for cast iron fittings shall meet requirements of AWWA C104.

A. Cement mortar lining shall be standard thickness.

2.13 Exterior, bituminous coating for ductile iron pipe and fittings and cast iron fittings shall meet requirements of AWWA C106 or AWWA C151 as applicable.

2.14 Metal harness shall be galvanized rods and clamps as detailed on Drawings.

2.15 Fittings for copper piping shall meet requirements of ANSI B16.22 for wrought copper, sweat joint. Soldering joints shall be made using ASTM B32 Alloy Grade Sn96 or Sb5 solder having a maximum lead content of 0.2%.

2.16 Screwed fittings for galvanized steel pipe shall be 150 lb. standard, malleable iron meeting the following requirements: dimensions, ANSI B16.3; threads, ANSI B2.1; material, ASTM A47; galvanizing, ASTM Al53.

A. Exterior, coal tar enamel coatings for steel pipe shall be materials and applications as specified in AWWA C203. Finish coat shall be single wrap kraft paper. Affidavit of compliance will not be required. Conditions of service shall be as indicated on Contract Drawings.

2.17 Gate Valves

A. Non-rising stem valves, 3-inches thru 16-inches, shall be resilient seated and shall meet requirements of AWWA C509. Valves shall have 250 psi working pressure. Valve ends shall be compatible with piping systems in which they are installed. Valve shall have ductile iron (ASTM A536) body, bronze mounted, bronze stem, ductile iron wedge coated with nitrile rubber. The interior and exterior of the body and bonnet shall have fusion bonded epoxy coating in accordance with ASNI/AWWA C550. Valve shall have o-ring seals and open counter-clockwise.

B. Non-rising stem gate valves, larger than 16-inches, shall meet requirements of AWWA C500. Valves shall be for at least 150 psi working pressure or pressure rating specified for adjacent piping whichever is greater. Valve ends shall be compatible with piping systems in which valves are installed. Valve shall be cast iron body, bronze mounted with double parallel disc and bronze stem. Valve shall have o-ring seals and open counter-clockwise.

C. Horizontally installed gate valves 16-inches and larger in a horizontal line shall be fitted with tracks, scrapes and rollers to carry the weight of the disc and ease operations.

D. Valves 16-inches and larger shall have geared operation.

E. Bypass valves shall be provided on all gate valves 16-inches and larger where indicated on the Contract Drawings.

F. Operators

(1) Buried valves shall be equipped with 2-inches square operating nuts unless otherwise shown on the Drawings. Where nuts will be more than 48-inches below finished grade, extension stems shall be pin connected to valve stem. Extension stem shall raise operating nut to within 24-inches of finished grade.

(2) Interior valves shall be handwheel operated except where otherwise shown on the Drawings.

(3) Interior valves in inaccessible locations shall be provided with chain operators as shown on the Drawings.

G. Valves shall be American-Darling, Clow, Dresser (M&H), Kennedy, Mueller, A.P. Smith (MET.), or approved equal meeting this Specification.

H. Gate valves smaller than 3-inches shall be bronze, solid wedge, rising stem, at least 200 psi gauge working pressure, Jenkins 49-U threaded ends or Jenkins 1242 solder ends.

I. Tapping valves shall meet requirements of gate valves specified above except that seat opening shall be larger than nominal size and valve outlet end shall have mechanical joint.

2.18 Butterfly Valves

A. Butterfly valves 3-inches and larger shall be of the rubber seated, tight closing type meeting requirements of AWWA C504 and shall be Class 150B unless otherwise indicated. Wafer-type valves shall not be used.

B. Valve ends shall be mechanical joint or bell joint in accordance with AWWA C111. The valve manufacturer shall supply accessories (bolts, glands, and gaskets).

C. Valve operator shall be of the traveling-nut type, sealed, gasketed and lubricated for underground service. Valve operator shall be capable of withstanding an input torque of 450-foot pounds at full open or closed position, without damage to the valve and valve operator. Valve operator shall be AWWA standard 2-inches square operating nut.

D. Rubber seal may be applied to the body or to the disc.

E. Valves shall open counter-clockwise.

F. Valves shall be factory tested in accordance with Section 5.2 of AWWA Specification C504. Upon request, the manufacturer shall furnish certified copies of test reports.

G. Valves shall be American-Darling, Dresser "450", Mueller, Pratt Groundhog or approved equal.

2.19 Check Valves

A. Check valves 3-inches and larger shall be iron body, bronze mounted, swing check valves, meeting requirements of AWWA C508. Check valves 3-inches through 12-inches shall be for 175 psi non-shock cold water working pressure. Valves 14-inches through 24-inches shall be for 150 psi non-shock cold water. Valves shall have outside weight and lever.

B. Manufacturer shall be American Darling Valve and Manufacturing Company, Eddy-Iowa Division of Clow Corporation, Kennedy Valve Manufacturing Company, M&H Division of Dresser Industries, or G-A Industries, Inc.

2.20 Pressure Reducing Valve

A. Valves shall be hydraulically operated and of the self-contained, differential piston type. The valves shall function to reduce high upstream pressure to a predetermined lower downstream pressure without shock or hammer.

B. The valve shall be air and water cushioned and when required, provide tight valve closure. When required, the valve shall open wide to permit full pipe line opening. An indicator shall be furnished as an integral part of the valve to show piston position within the body.

C. The valves shall be cast iron body. The piston shall be of cast bronze provided with renewable leather or composition cup and seat. The valve liner shall be of cast bronze provided with a leather or composition cup. The valve shall be provided with "V" shaped ports for flow passage

downstream of the seat opening. The valve assembly shall be so constructed as to permit removal of the piston or liner from the valve body without removing the valve body from the line.

D. The pilot valve shall be of the single seated, globe body pattern, diaphragm operated and spring loaded with convenient discharge pressure setting over a range no less than 30 psi.

E. Valves in sizes 3-inches to 12-inches shall have a working pressure of 175 psi. Valves in sizes 14-inches and up shall have a working pressure of 150 psi. Valves shall be provided with 125 lb. ANSI flanges and shall be similar to G-A Industries, Inc., Fig. No. 4500-D.

2.21 Altitude Valve

A. Function

(1) The altitude control valve shall be of the double acting type, functioning to close off at maximum pre-set level in tank or reservoir; and opening when the system pressure drops below the static head, for the purpose of returning the storage water back through the valve for distribution.

(2) A hand operated valve in the power water line to the top of the piston shall permit adjustment of the speed of valve closing. The tank water level control shall be by means of a diaphragm operated, spring loaded, three way pilot which directs power water to or from the top of the main valve piston. The three-way pilot shall be of bronze or stainless steel construction. The diaphragm surface exposed to the tank head shall be not less than 57 square inches. It shall be possible to adjust the spring above the diaphragm for water level control approximately 20% above or below the factory setting.

(3) The valve shall be completely piped ready for installation.

B. Description

(1) The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area, and the area on the upper surface of the piston is of a greater area than the underside of the piston.

(2) The valve piston shall be guided on its outside diameter by long stroke stationary Vee ports that shall be downstream of the seating surface to minimize the consequences of throttling. Throttling

shall be done by the valve Vee ports and not the valve seating surfaces.

(3) The valve shall be capable of operating in any position and shall incorporate only one flanged cover at the valve top from which all internal parts shall be accessible. There shall be no stems, stem guides, or spokes within the waterway. There shall be no springs to assist the valve operation.

C. Construction

(1) The valve body shall be of cast iron ASTM A-126 with flanges conforming to the latest ANSI Standards. The valve shall be extra heavy construction throughout. The valve interior trim shall be bronze B-62 as well as the main valve operation.

(2) The valve seals shall be easily renewable while no diaphragm shall be permitted within the main valve body.

(3) All controls and piping shall be of non-corrosive construction.

(4) A visual valve position indicator shall be provided for observing the valve piston position at any time.

D. Manufacturer

The valve shall be as manufactured by GA Industries of Mars, Pennsylvania, Fig. 3300-DR or approved equal.

2.22 Valve boxes shall be adjustable cast iron valve boxes of the three-piece type, consisting of lid, two-piece sliding extension and base. Base shall be proper type and size for the valve with which it is used. The word "water" shall be cast or embossed on the valve box lid in letters not less than 1-inches high. Valve box shall be manufactured by Mueller Company, Richard Foundry, or Tyler.

2.23 Tapping sleeves shall meet requirements of AWWA C110 for pressure ratings shown on the Drawings. Sleeves shall be built in two sections and shall be mechanical joint type with flanged outlet. The tapping sleeve shall be for the size and type of pipe shown on the Drawings and shall be U.S. Pipe model H-304SS, or approved equal.

2.24 Flexible coupling shall be of gasketed, sleeve type. Each coupling shall consist of a steel middle ring, two steel followers, two rubber compounded wedge section gaskets and sufficient galvanized track, head steel bolts to properly compress the gaskets. Couplings shall be of the type to match piping in which they are installed. Couplings shall be manufactured by Dresser Manufacturing Division of Dresser Industries or Smith-Blair.

2.25 Flanged adapters or joining plain-end pipe to flanged items shall be Style 128 or 127 as manufactured by Dresser Manufacturing Division of Dresser Industries or Smith-Blair Type 912 or 913.

2.26 Fire hydrants shall conform to the requirements of AWWA Standard C502, latest revision for "Dry Barrel Fire Hydrants" and shall comply in full with the following requirements.

A. Hydrants shall be of the three post type of dry top design rated 150 psi with compression main valve opening counterclockwise against pressure. Each hydrant shall have a 6-inches standardized, mechanical joint inlet connection with accessories. The internal valve shall provide a minimum of 4 1/2-inches unobstructed flow area. Each hydrant shall be designed to allow the removal of all operating parts through the standpipe without excavation. Each hydrant shall be constructed with an oil lubricated dry type bonnet with "O" ring seals above and below operating threads.

B. The standpipe sections shall be connected at the ground line by a two-part safety flange that prevents damage to the barrel sections when the hydrant is struck by a vehicle. The standpipe and safety flange design shall permit rotation of the hydrant nozzles to any desired position without excavation or disassembly of the operating components. Threaded joints, above or below ground, or breakable bolts will not be allowed for the barrel assembly.

C. The main valve operating rod shall be designed with a travel stop so that the rod cannot be placed in compression. Travel stops located at the bottom of the hydrant will not be acceptable. The operating rod threads top and bottom shall be isolated from contact with water in the bonnet or in the inlet shoe. A safety stem coupling on the operating rod shall be placed at the ground line.

D. The drain mechanism shall be co-related with the operation of the main valve to provide a momentary flushing of the drain ports each time the hydrant is opened. The drain ports shall be fully closed when the hydrant valve is more than 2½ turns open. The drain ports shall be fully open when the hydrant is in the closed position.

E. The nozzle outlets shall consist of two (2) 2 1/2-inches inches hose nozzles 180° apart and one (1) 5 1/4-inches pumper connection. The nozzle threads shall conform to ANSI Standard B26. The nozzle caps shall be individually attached to the standpipe with heavy duty non-kinking chains that permit free turning of the cap. The operating nut and cap nuts shall be National Standard pentagon with 1 1/2-inches from point to flat.

F. The exterior of the hydrants above the ground line shall be shop painted OSHA Safety Yellow or as approved by the DCWA.

G. Fire hydrants shall be Kennedy K-81-A "Guardian", Mueller Model A-421 “Centurion”, or an approved equal.

2.27 Pressure gauges shall be open front case type with bronze bourdon tube soldered to socket and tip, stainless steel movement, and a 4 1/2-inches white coated dial graduated from 0 to 100 psi. gauges shall be similar to Ashcroft No. 1279.

2.28 Compound gauges shall be open front case type with bronze bourdon tube soldered to socket and tip, stainless steel movement, and a 4 1/2-inches white coated dial graduated from 0 to 100 psi and 0 to 30-inches vacuum.

2.29 Air and vacuum valves shall be constructed with cast iron bodies, type 302 stainless steel floats, bronze trim and buna-N seats. Valves shall be of the size and at the locations indicated on the Drawings. Valves shall be of the combination type to relieve large volumes of air as the lines are filled or emptied and release small quantities of entrained air under pressure. Valves shall be for working pressures indicated on Drawings. Manufacturers shall be Valve & Primer Corp., American Darling Valve and Manufacturing, Val-Matic Valve & Manufacturing Company, or Clow Corporation.

2.30 Water service connection accessories shall consist of a corporation stop, meter box and meter yoke as shown on Standard Drawing 175.

2.31 Meter Box shall be square and as manufactured by Mid-States Plastics, Inc.

2.32 Manholes

A. Manholes shall be constructed of pre-cast reinforced concrete manhole sections in accordance with the requirements of ASTM C478 and detailed in Section 00870 - Standard Details.

B. A maximum of two lift holes per manhole section may be provided.

C. Provide tongue and groove joints in manhole sections with a preformed groove in the tongue for placement of an O-ring type round, rubber gasket.

(1) Gasket shall comply with requirements of ASTM C361.

(2) Gasket shall provide the sole element in sealing the joint from either internal or external hydrostatic pressure.

D. Joint sealant shall be a one-component polyurethane sealant similar to Sika "Sikaflex" Series 430.

E. Manhole steps shall be corrosion-resistant and shall be 1-inch square cast iron, rubber-covered steel or aluminum. The steps shall conform to the dimensions shown in Section 00870 - Standard Drawings.

F. Manhole frames and covers shall be molded of gray cast iron conforming to ASTM A48, Class 30. Castings shall be coated with a coal tar pitch varnish, to which sufficient oil has been added to make a smooth coating, tough and tenacious when cold, but not tacky or brittle. Seating surfaces between frame and cover shall be machined. The dimensions and weights shall conform to the requirements shown in Section 00870 -Standard Details.

(1) Standard Manhole Frame and Cover shall be similar to Richards Foundry Corporation No. D-1125.

(2) Vandal-proof Manhole Frame and Cover shall be similar to Neenah Foundry Co., Cat. No. R-1926-C with 4 - 1-inch diameter vent holes.

2.33 Globe valves smaller than 3-inches shall be of bronze construction with bronze plug type discs and solder joint ends.

2.34 Thrust blocking and/or joint restraint units shall be as shown in Contract Documents or as directed by Project Representative based upon field conditions. Concrete shall have 3000 psi strength at 28 days in accordance with Cast-in-Place Concrete Standard and shall meet requirements of ASTM C94.

2.35 Detectable Marking Tape

A. Plastic marking tape consisting of one layer of aluminum foil laminated between two layers of inert plastic film. Tape shall be resistant to alkalis, acids and other destructive agents commonly found in the soil. The laminate shall be strong enough that the layers cannot be separated by hand.

B. Tape shall be a minimum of 4 1/2-millimeters thick with a minimum tensile strength of 60 lbs. in the machine direction and 58 lbs. in the transverse direction per 3-inches wide strip. Tape color shall be APWA Color Coded for marking the particular utility line and shall be imprinted with a continuous warning message to indicate the type of utility being marked, the message normally being repeated every 16-inches to 36-inches. Tape shall be inductively locateable and conductively traceable using a standard pipe and cable locating device. Tape shall be 3-inches wide Terra Tape "Sentry Line Detectable 620".

2.36 Detector Check Valves

Detector Check Valves shall be epoxy coated UL and FM approved, hot dipped galvanized cast iron with brass by-pass meter trim. Valves shall be ITT Grinnel/Kennedy Model 1371G, or 1369G Hersey Model EDC, Mueller #A-2133-6 or Viking Model E-1.

3.0 EXECUTION

3.1 Pipe Laying, General

A. Take all precautions necessary to insure that pipe, valves, fittings, and other accessories are not damaged in unloading, handling, and placing in trench. Examine each piece of material just before installation to determine that no damage has occurred. Remove any damaged material from the site and replace with undamaged material.

B. Exercise care to keep foreign material and dirt from entering pipe during storage, handling, and placing in trench. Close ends of in-place pipe at the end of any work period to preclude the entry of animals and foreign material.

C. Bedding of pipe shall be as specified in Section 02225 - Trenching & Backfilling.

D. Do not lay pipe when trench bottom is muddy or frozen, or has standing water.

E. Use only those tools specifically intended for cutting the size and material and type pipe involved. Make cut to prevent damage to pipe or lining and to leave a smooth end at right angles to the axis of the pipe.

F. Lay pipe with bell ends facing the direction of laying. Where grade is 10% or greater, lay pipe uphill with bell ends upgrade.

3.2 Install pressure line with a minimum depth of cover of 42-inches over the top of the pipe, where no grades are shown on the Contract Drawings.

A. Where grades on the pressure line conflict with existing pipes or structures, lay pressure line to additional depth with a uniform vertical curve to provide proper clearance without the use of fittings. No additional payment will be allowed for additional excavation.

B. Lay pressure line pipe with bell ends facing the direction of laying. Where grade is 10% or greater, pipe shall be laid uphill with bell ends upgrade.

3.3 Joining Mechanical Joint Pipe

A. Thoroughly clean inside of the bell and 8-inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter. Paint the bell and the spigot with soap solution (half cup granulated soap dissolved in 1 gallon water). Slip cast-iron gland on spigot end with lip extension of gland toward the end of pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland.

B. Push the spigot end forward to seat in the bell. Then, press the gasket into the bell so that it is located evenly around the joint. Move the gland into position, insert bolts and screw nuts up finger tight. Then tighten all nuts to torque listed below:

Bolt Size - Inches	Torque Ft. - Lbs.
5/8	40 - 60
3/4	60 - 90
1	70 - 100
1¼	90 - 120

Tighten nuts on alternate side of the gland until pressure on the gland is equally distributed.

C. Join lock-type mechanical joint pipe according to manufacturer's recommendations.

D. Permissible deflection in mechanical joint pipe shall not be greater than 2/3 of that listed in AWWA C600.

E. Permissible deflection in lock-type mechanical joint pipe shall be as recommended by manufacturer.

3.4 Joining Push-On Joint Pipe

A. Thoroughly clean inside of the bell and 8-inches of the outside of spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex rubber gasket and insert in the gasket recess of the bell socket. Apply a thin film of gasket lubricant supplied by pipe manufacturer, to either the gasket or the spigot end of the joining pipe. Start the spigot end of the pipe into the socket with care. Then complete the joint by forcing the plain end of the bottom of the socket with a forked tool or jack-type device. File the end of field cut pipe to match the manufactured spigot end.

B. Join restrained push-on joints according to manufacturer's recommendations.

C. Permissible deflection in push-on joint pipe shall not be greater than 2/3 of that listed in AWWA C600.

D. Permissible deflection in restrained push-on joint pipe shall be as recommended by manufacturer.

3.5 Join PVC pipe and fittings in accordance with manufacturers' instructions and install in accordance with ASTM D2321.

3.6 Join copper pipe using 95-5 solder and suitable flux. Do not use acid core solder.

3.7 Setting Valves and Valve Boxes

A. Install valves with operator stems in the vertical plane through the pipe axis and perpendicular to the pipe axis. Locate valves where shown on Drawings. Thoroughly clean before installation. Check valves for satisfactory operation.

B. Equip all underground valves with valve boxes where shown on the Drawings. Set valve boxes in accordance with Standard Details. Set box in alignment with valve stem centered on valve nut. Set the valve box to prevent transmitting shock or stress to the valve. Set the box cover flush with the finished ground surface or pavement. PVC extensions shall not be permitted.

C. Construct manholes for all underground valves where shown on the Contract Drawings. Construct manholes to prevent transmitting any load or shock to the valve or pipe. Locate manholes and valve relative to each other in order that packing, operator and other parts of the valve are readily accessible for minor repairs.

3.8 Manhole shall be constructed to the elevations shown on the Contract Drawings in accordance with the provisions of Standard Details.

A. Set manhole base section on bed of VDOT #57 stone to a minimum depth of 6-inches. Stone shall be thoroughly compacted and carefully leveled.

B. Join all manhole riser and cone or flat slab top sections by the use of rubber gaskets.

C. Plug lift holes and repair any defects in manhole.

D. Set adjusting rings in portland cement mortar bed.

(1) Rings will not be required outside of paved roadways or walkways unless called for on the Drawings.

(2) Rings in paved roadways or walkways shall permit upward or downward adjustment of manhole frame by 6-inches.

E. Set manhole frame in bed of sealant. Bed shall consist of one, 3/8-inches bead laid flush with the inside edge of the frame base and another 3/8-inches bead laid flush with the outside edge of the frame base.

F. Bolt watertight manhole frames to manhole cone or flat slab top section as shown on the Standard Details.

3.9 Locate fire hydrants as shown on Drawings and in accordance with Standard Details.

3.10 Provide air and vacuum valve at locations shown on Drawings. Install gate valve between water main and relief valves. Construct manholes for air and vacuum relief valve as shown on Drawings.

3.11 Provide reaction anchors of concrete blocking, metal harness, retainer gland type or restrained joint type pipe at all changes in direction of pressure pipelines and as shown on Drawings.

A. Concrete reaction anchors shall bear against undisturbed earth and shall be of the size and shape shown on the Drawings.

B. Use metal harness restraints as shown on Drawings.

C. Where retainer glands are used, extreme care shall be taken so that each set screw is tightened as recommended by the manufacturer before the pipe is backfilled and tested.

3.12 Installation of Tapping Sleeves and Tapping Valves

A. All tapping sleeves shall be set to avoid interference with existing pipe joints.

B. After all tapping sleeves and valves have been set in place, a pressure test of 150 psi shall be made to insure that there are no leaks around the sleeve or through the valve. All leakage shall be corrected.

C. The actual tap shall be made in presence of a representative of the DCWA. The DCWA shall be notified 48 hours in advance of making the tap.

3.13 Detectable Tape

A. Install marking tape in all trenches containing buried, non-metallic, pressure pipe lines. Tape shall be installed in all trenches with a cover of 18-inches to 54-inches and a minimum clearance over the pipe lines of 18-inches. Place tape on edge of trench toward the center of the pavement in roadways. In other locations, place tape to the north or east of the utility line. Wrap tape around all valves, corporation stops and meter setters. Wrap tape three turns around base of fire hydrants and extend tape up above ground against fire hydrants. Tape shall be made electrically conductive throughout the entire system using splices of a type recommended by the manufacturer.

3.14 Disinfection of Water Lines

A. Disinfect and test water mains and accessories in accordance with AWWA Standard C 601 and the following:

B. All water lines shall be disinfected before being placed in operation.

C. Prior to disinfection all water lines shall be flushed unless the tablet method disinfection is used. All valves and hydrants shall be operated during this operation. Flushing velocities should not be less than 2.5 feet per second. Adequate provisions shall be made for drainage of flushing water.

D. Methods of Chlorine Application

(1) Continuous feed method - Potable water shall be introduced into the pipe line at a constant flow rate. Chlorine shall be added to a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 mg/l. The chlorinated water shall remain in the pipe line at least 24 hours, after which, the chlorine concentration in the water shall be at least 10 mg/l. All valves and appurtenances shall be operated while the chlorinated water remains in the pipe line.

(2) Slug Method - Potable water shall be introduced into the pipe line at a constant flow rate. This water shall receive a chlorine dosage that will result in a chlorine concentration of 100 mg/l in a "slug" of the water. The chlorine shall be added long enough to insure that all portions of the pipe are exposed to the 100 milligrams per liter chlorine solution for at least 3 hours. The chlorine residual shall be checked at regular intervals not to exceed 2000-feet to insure that adequate disinfection is occurring. As the chlorinated

water passes valves and appurtenances, they shall be operated to insure disinfection of these appurtenances.

(3) Tablet Method - This method shall not be used if non-potable water or foreign materials have entered the lines or if the water temperature is below 50°C (41°F).

The tablets shall be placed in each pipe section and in all appurtenances. Enough tablets shall be used to insure that a chlorine concentration of 25 mg/l is provided in the water. They shall be attached by an adhesive to the top of the pipe sections and crushed or rubbed in all appurtenances. The adhesive shall be acceptable to the State Health Department. The filling velocity of the potable water in the pipe line shall be less than 1-foot per second. The water chlorine solution shall remain in contact with the pipe for 24 hours. All valves and appurtenances shall be operated while the chlorinated water is in the pipe line.

E. Final Flushing - After the required retention period, the heavily chlorinated water shall be flushed from the pipe line using potable water.

F. Testing - After the lines have been flushed, the water lines shall be tested. Samples shall be collected at regular intervals, not exceeding 2000-feet throughout the length of pipe line.

(1) All chlorine residual determinations shall be made using only those methods approved by the Bureau.

(2) Two water samples for bacteriological analysis must be collected at least 24 hours apart and analyzed by a certified laboratory. The results of these samples must indicate no coliform contamination before the pipe, tanks, or equipment can be utilized as part of the waterworks. If contamination is indicated, then the disinfection procedures must be repeated.

G. Maintain a copy of AWWA Standard C601 on Project site during all disinfecting operations.

3.15 Acceptance Tests

A. Supply the pumps, calibrated gauges and meters, and all the necessary apparatus. Notify DCWA at least 48 hours in advance of the test date and perform tests in presence of DCWA's representative.

B. Owner will supply water at no cost for one test of potable water lines only; the Contractor at his own cost will supply all other water.

C. After the line has been backfilled and at least seven days after the last concrete reaction anchor has been poured, subject the line or any valved section of the line to a hydrostatic pressure test in accordance with AWWA C600, except as modified herein. Fill the system with water at a velocity of approximately 1-foot per second while necessary measures are taken to eliminate all air. After the system has been filled, raise the pressure by pump to l.5 x the working pressure. Test pressures shall: (l) not be less than l.25 x the working pressure at the highest point along the test section, (2) not exceed thrust restraint pressure, (3) not vary by more than + or -5 psi, (4) not exceed twice the rated pressure of the valves or hydrants when test includes closed gate valves, (5) not exceed rated pressure of valves if resilient-seated butterfly valves are used, (6) shall be at least 100 pounds per square inch gauge. Measure pressure at the low point on the system compensating for gauge elevation. Maintain this pressure for two hours. If pressure cannot be maintained, determine cause, repair and repeat the test until successful.

D. A leakage test shall be conducted concurrently with the pressure test in accordance with AWWA C600, except as modified herein. Leakage shall be determined with a calibrated test meter, furnished by the Contractor. Leakage is defined as the quantity of water required to maintain a pressure within 5 psi of the specified test pressure, after air has been expelled and the pipe filled with water. Leakage shall not exceed 10 gallons per day per mile per inch of diameter. If leakage exceeds that specified, find and repair the leaks and repeat the test until successful.

E. All visible leaks shall be repaired regardless of the amount of leakage.

F. No leakage will be allowed for welded steel pipe. If leaks are revealed by test, repair by rewelding. Peening of leaks will not be allowed.

END OF SECTION

SECTION 02730 - SANITARY SEWER SYSTEM

1.0 GENERAL

Work in this Section includes all exterior sanitary sewer system and force main work on the construction plans.

1.1 Related requirements in other sections of the Specifications.

1.2 Reference Specifications are referred to by abbreviation as follows:

A. American National Standards Institute ..... ANSI

B. American Society for Testing and Materials ..... ASTM

C. American Water Works Association ..... AWWA

D. Virginia Department of Transportation ..... VDOT

1.3 Definitions

A. Outside or exterior shall mean 5-feet beyond the perimeter of buildings, except that footing drains are included.

B. Inside or interior shall mean inside buildings and within 5-feet of the perimeter of buildings, except that footing drains are excluded.

1.4 Separation of water lines and sanitary sewers.

A. Follow State Health Department "Waterworks Regulations" for separation of water mains and sewer lines.

B. Parallel Installation

(1) Normal Conditions - Water lines shall be constructed at least 10-feet horizontally from a sewer or sewer manhole whenever possible. The distance shall be measured edge-to-edge.

(2) Unusual Conditions - When local conditions prevent a horizontal separation of at least 10-feet, the water line may be laid closer to a sewer or sewer manhole provided that:

(a) The bottom of the water line is at least 18-inches above the top of the sewer.

(b) Where this vertical separation cannot be obtained, the sewer shall be constructed of AWWA approved water pipe pressure-tested in place to 50 psi without leakage prior to backfilling. The sewer manhole shall be of watertight construction and tested in place.

C. Crossing

(1) Normal Conditions - Water lines crossing over sewers shall be laid to provide a separation of at least 18-inches between the bottom of the water line and the top of the sewer whenever possible.

(2) Unusual Conditions - When local conditions prevent a vertical separation described in Crossing, Normal Conditions, Paragraph C above, the following construction shall be used.

(a) Sewers passing over or under water lines shall be constructed of the materials described in Parallel Installation, Unusual Conditions - Paragraph (B) above.

(b) Water lines passing under sewers shall, in addition, be protected by providing:

(1) A vertical separation of at least 18-inches between the bottom of the sewer and the top of the water lines.

(2) Water lines passing under sewers shall, in addition, be protected by providing:

(3) That the length of the water line shall be centered at the point of the crossing so that joints shall be equidistant and as far as possible from the sewer.

D. Sanitary sewers or sewer manholes -No water pipes shall pass through or come in contact with any part of sewer or sewer manhole.

2.0 PRODUCTS

2.1 Polyvinyl-Chloride (PVC) pipe and fittings in sizes 4-inches through 12-inches shall meet the requirements of AWWA C900, C.I.P. O.D., Class 200 except that all connections shall be made using elastomeric gasket joints.

2.2 Polyvinylchloride (PVC) sewer pipe and fittings in sizes 4-inches through 15-inches shall meet the requirement of ASTM Standard D3034 SDR 35, Type PSM with flexible elastomeric seals conforming to ASTM Standard F477.

2.3 Polyvinylchloride (PVC) sewer pipe and fittings in sizes 18-inches through 27-inches shall meet the requirements of ASTM F679 wall thickness T-1, PS 46 with flexible elastomeric seals conforming to ASTM Standard F477.

2.4 Ductile iron pipe shall meet requirement of AWWA/ANSI C151/A21.51 for pressure Class 150, thickness Class 51, unless otherwise indicated on the Drawings. Thickness class shall meet requirements of AWWA C150. Pipe shall have cement-mortar lining and a bituminous seal coat on the exterior.

2.5 Flanged cast iron and ductile iron pipe shall meet the requirements of AWWA/ANSI C115/A21.15 for Class 150, thickness Class 53, unless otherwise shown on Contract Drawings. Thickness class shall meet requirements of AWWA/ANSI C150/A21.50. All pipe shall have a cement mortar lining on the interior and a bituminous seal coat on the exterior.

2.6 Gray cast iron and ductile iron fittings shall meet requirements of AWWA/ANSI C110/A21.10. Thickness class shall be Class 53 unless otherwise shown on Contract Drawings. Thickness class shall meet requirements of AWWA/ANSI C150/A21.50. Fittings shall have cement-mortar lining and a bituminous seal coat on the exterior.

2.7 Compact ductile iron fittings shall meet requirements of AWWA/ANSI C153/A21.53 in sizes 4-inches through 12-inches. 14-inches and 16-inches sizes shall conform to manufacturer's standard. Fittings shall have cement-mortar lining and a bituminous seal coat on the exterior.

2.8 Mechanical joints and jointing materials shall meet requirements of AWWA C111.

A. Mechanical joint retainer glands shall meet requirements of AWWA/ANSI C111/A21.11. Glands for ductile iron pipe shall be Mega lug Series 1100 as manufactured by EBAA Iron Sales Inc. or approved equal. Glands per PVC pipe shall be Mega lug Series 1600, 6500 or 2000 as manufactured by EBAA Iron Sales Inc. or approved equal.

B. Locked type mechanical joints may be used where restrained joints are required.

C. Metal harness shall be galvanized rods and clamps as detailed on Drawings.

2.9 Push-on joint and rubber gasket shall meet requirements of AWWA/ANSI C111/A21.11.

A. Locked type restrained push-on joints may be used where restrained joints are required.

2.10 Flanged joints for ductile iron pipe shall meet requirements of ANSI B16.1.

2.11 Flanged joint gaskets shall be full face, made of 1/16-inch thick rubber, and shall meet requirements of ANSI B16.21.

2.12 Cement mortar lining with bituminous seal coat for cast iron pipe and fittings or ductile iron pipe shall meet requirements of AWWA/ANSI C104/A21.4.

A. Cement mortar lining shall be standard thickness.

2.13 Exterior, bituminous coating for cast iron fittings and ductile iron pipe shall meet requirements of AWWA/ANSI C106/A21.6 or C151/A21.51 as applicable.

2.14 Reinforced concrete pipe, steel cylinder type, non-prestressed and prestressed, rubber gaskets for joints, fittings and specials shall meet requirements of AWWA C300, and AWWA C301. Design pressure as defined in these standards shall be as indicated on Drawings. Design limits of pipe shall be such that they shall not be exceeded by the combined requirements of design pressure plus 40% of design pressure for water hammer, plus earth dead load.

2.15 Gate valves shall be as follows:

A. Non-rising stem valves, 3-inches thru 16-inches, shall be resilient seated and shall meet requirements of AWWA C509. Valves shall have 250 psi working pressure. Valve ends shall be compatible with piping systems in which they are installed. Valve shall have ductile iron (ASTM A536) body, bronze mounted, bronze stem, ductile iron wedge coated with nitrile rubber. The interior and exterior of the body and bonnet shall have fusion bonded epoxy coating in accordance with ASNI/AWWA C550. Valve shall have o-ring seals and open counter-clockwise.

B. Non-rising stem gate valves, larger than 16-inches, shall meet requirements of AWWA C500. Valves shall be for at least 150 psi working pressure or pressure rating specified for adjacent piping whichever is greater. Valve ends shall be compatible with piping systems in which valves are installed. Valve shall be cast iron body, bronze mounted with double parallel disc and bronze stem. Valve shall have o-ring seals and open counter-clockwise.

2.16 Valve boxes shall be adjustable cast iron valve boxes of the three piece type, consisting of lid, two piece sliding extension and base. Base shall be proper type and size for the valve with which it is used. The word "Sewer" shall be cast or embossed on the valve box lid in letters not less than 1-inch high. Valve box shall be manufactured by Mueller Company, Richard Foundry, or Tyler.

2.17 Check valves 3-inches and larger shall be iron body, bronze mounted, swing check valves, meeting requirements of AWWA C508. Check valves 3-inches through 12-inches shall be for 175 psi non-shock cold water working pressure. Valves 14 through 24-inches shall be for 150 psi non-shock cold water. Valves shall have outside weight and lever. Manufacturer shall be American Darling Valve and Manufacturing Company, Eddy-Iowa Division of Clow Corporation, Kennedy Valve Manufacturing Company, M & H Division of Dresser Industries, or G-A Industries, Inc.

2.18 Plug Valves

A. General

(1) Valves shall be of the non-lubricated type. Valves in sizes 36-inches and smaller shall be designed for a working pressure of 150 psi. Valves in sizes 42-inches and larger shall be designed for a working pressure of 125 psi. Valves shall provide tight shutoff with rated pressure from either direction.

(2) Ports in valves shall be round or rectangular style. Where rectangular port valves are furnished, valves shall have a minimum flow area of 100% of corresponding port area.

(3) Valve bodies shall be of ASTM A-126, Class B cast iron. Valves shall have a molded elastomer covering all seating surfaces. The elastomer shall be suitable for the service intended. Valves 3-inches and larger shall have welded-in overlay seat of nickel-copper alloy conforming to ASTM B127. Nickel content shall be not less than 90% nickel. Overlay shall be applied to all surfaces in contact with plug face.

(4) Plugs shall be of cast iron complying with ASTM A-126, Class B or ductile iron complying with ASTM A-126, Grade 65-45-12. Plugs shall be of one piece construction.

(5) Valves shall be equipped with PTFE thrust bearings on the upper and lower bearing journals. Bearings shall be permanently lubricated and replaceable, sleeve type bearings conforming to AWWA C-504-87, Sec. 3.6 and AWWA C-507-85, Sec. 3.2. Bearings shall be of sintered oil impregnated type 316 stainless steel, ASTM A743, Grade CF-8M.

(6) Valve shaft seals shall be of the "U" cup type in accordance with AWWA C504-87, Sec. 3.7. Seals shall be self-adjusting and repackable without removing the bonnet from the valve.

(7) Each valve shall be given a hydrostatic and seat test in accordance with AWWA C504-87, Sec. 5.2. Certified copies of test results and Proof-of-Design shall be furnished in accordance with the cited standard, when requested.

B. Two-Way Valves

(1) Two-way valves shall be of the eccentric type. Threaded ends shall meet NPT standard. Mechanical joint ends shall comply with AWWA C111-64.

C. Three-Way Valves

(1) Three-way valves shall be of the tapered plug type. Flanged valves shall meet ANSI B16.1 including facing, drilling and flange thickness. Valves shall be furnished with a plug to shut off one port at a time unless other arrangement is shown on the Drawings. Provide a sprayed, epoxy overlay with a minimum 5 mil thickness on all internal surfaces.

D. Operators

(1) Buried valves shall be equipped with 2-inches sq. operating nuts unless otherwise shown on the Drawings. Where nuts will be more than 48-inches below finished grade, extension stems shall be pin connected to valve stem. Extension stem shall raise operating nut to within 24-inches of finished grade.

(2) Interior valves 6-inches and smaller in size shall be wrench operated, except where otherwise shown on the Drawings. Valves shall be capable of being converted to worm gear or automated operation without removing the bonnet or plug from the valve. Valves shall be equipped with a 2-inches sq. nut for use with removable levers or extended "T" handles. A wrench shall be furnished with each valve.

(3) Interior valves 8-inches and larger shall be right-angle, worm-gear operated and equipped with hand-wheels except where otherwise shown on the Drawings. Gear operators shall be totally enclosed, permanently lubricated. Operators shall comply with AWWA C 504-87, Sec. 3.8 and AWWA C507-85, Sec. 3.2. Gear components shall be of ductile iron, ASTM A536, Grade 65-45-12, supported on bronze bushings.

(4) Interior valves in inaccessible locations shall be provided with valve floor-stands or chain operators as shown on the Drawings.

(5) Hydraulic, pneumatic or electric operators shall be provided, where shown on Drawings.

E. Manufacturer

(1) The valves shall be as manufactured by Keystone Valve Manufacturing Con., Milliken Valve Co., or approved equal.

2.19 Flexible couplings shall be of a gasketed, sleeve type. Each coupling shall consist of a steel middle ring, two steel followers, two rubber compounded wedge section gaskets and sufficient galvanized track head steel bolts to properly compress the gaskets. Couplings shall be of the type to match piping in which installed. Couplings shall be manufactured by Dresser Manufacturing Company or Smith-Blair.

2.20 Flanged adapters for joining plain-end pipe to flanged items shall be 128 or 127 as manufactured by Dresser Manufacturing Division of Dresser Industries or Smith-Blair type 912 or 913.

2.21 Pressure gauges shall be open front case type with bronze bourdon tube soldered to socket and tip, stainless steel movement, and a 4½ psi white coated dial graduated from 0 to 100 psi. Gages shall be Ashcroft No. 1279.

2.22 Compound gauges shall be open front case type with bronze bourdon tube soldered to socket and tip, stainless steel movement, and a 4½ psi white coated dial graduated from 0 to 100 psi and from 0 to 30-inches vacuum.

2.23 Air release valves and air and vacuum valves, located where indicated on Contract Drawings, shall have cast iron body and cover, bronze mechanism and seat, buna-N needle and stainless steel float and lever pins. Valves shall have valved quick coupling back flushing connection. Valves shall be APCO Model 400 and 401 sewage valves as manufactured by Valve and Primer Co. or Model 48 and 301 by Val-Matic Corporation.

2.24 Manholes

A. Manholes shall be constructed of pre-cast reinforced concrete manhole sections in accordance with the requirements of ASTM C478 and detailed in Standard Details.

B. A maximum of two lift holes per manhole section may be provided.

C. Provide tongue and groove joints in manhole sections with a preformed groove in the tongue for placement of an O-ring type round, rubber gasket.

(1) Gasket shall comply with requirements of ASTM C361.

(2) Gasket shall provide the sole element in sealing the joint from either internal or external hydrostatic pressure.

D. Provide flexible pipe connections to manholes, other than acid-resistant manholes, for pipes 15-inches and smaller.

(1) Materials shall be resistant to water, sewage, acids, ozone, weathering and aging. Use neoprene conforming to ASTM C443 and stainless steel, Series 300.

(2) Cast or core drill openings in manholes to receive connectors. Connectors shall be suitable for field repair or replacement. Connectors not suitable for field replacement are unacceptable.

(3) The assembled connectors shall allow at least an 11-degree angular deflection of the pipe and at least 1-inches of lateral misalignment in any direction and be suitable for a normal variation in diameter or roundness for the pipe material used.

(4) Connectors shall be similar to Kor-n-Seal as manufactured by National Pollution Control Systems, Inc.

E. Liners for acid-resistant manholes shall be of fiberglass reinforced polyester or polyvinylchloride construction and shall be installed to protect the pre-cast manhole sections from the inside base of the manhole to the base of the manhole frame.

(1) FRP liners shall consist of a 3/16-inch thick fiberglass reinforced polyester with a 15-millimeters gel coat interior surface. The polyester resin shall be similar to Dion No. 6694. Joints between sections of the liner shall be sealed in accordance with the manufacturer's instructions.

(2) PVC liners shall consist of polyvinylchloride plates, not less than 0.060-inch thick, with integral bonding ribs and shall be similar to Amercoat "T-Lock Amer-Plate". Joints between sections of liner shall be welded in accordance with the manufacturer's instructions.

F. Sealant for manhole frames shall be a one-component polyurethane sealant similar to Sika "Sikaflex" Type 1a.

G. Sealant for flexible pipe connections shall be a two-component polyurethane sealant similar to Sika "Sikaflex" Type 2c with primer Type 429.

H. Manhole steps shall be corrosion-resistant and shall be 1-inches square cast iron, rubber-covered steel or aluminum. The steps shall conform to the dimensions shown in Standard Details.

I. Manhole frames and covers shall be molded of gray cast iron conforming to ASTM A48, Class 30. Castings shall be coated with a coal tar pitch varnish, to which sufficient oil has been added to make a smooth coating, tough and tenacious when cold, but not tacky or brittle. Seating surfaces between frame and cover shall be machined. The dimensions and weights shall conform to the requirements shown in Section 00870 -Standard Details.

(1) Standard Manhole Frame and Cover shall be similar to East Jordan Iron Works Cat. No. 1544.

(2) Vandal-proof Manhole Frame and Cover shall be similar to Neenah Foundry Co., Cat. No. R-1926-C with 4 - 1-inch diameter vent holes.

(3) Watertight Manhole Frame and Cover shall be similar to East Jordan Iron Works No. V-2150-7.

2.25 Detectable Marking Tape

A. Plastic marking tape shall consist of one layer of aluminum foil laminated between two layers of inert plastic film. Tape shall be resistant to alkalis, acids and other destructive agents commonly found in the soil. The laminate shall be strong enough that the layers cannot be separated by hand.

B. Tape shall be a minimum of 4½ -millimeters thick with a minimum tensile strength of 60 lbs. in the machine direction and 58 lbs. in the transverse direction per 3-inches wide strip. Tape color shall be APWA Color Coded for marking the particular utility line and shall be imprinted with a continuous warning message to indicate the type of utility being marked, the message normally being repeated every 16-inches to 36-inches. Tape shall be inductively locateable and conductivity traceable using a standard pipe and cable locating device. Tape shall be 3-inches wide Terra Tape "Sentry Line Detectable 620".

3.0 EXECUTION

3.1 Take all precautions necessary to insure that pipe, valves, fittings, and related items are not damaged in unloading, handling and placing in trench. Examine each piece of material just prior to installation to determine that no damage has

occurred. Remove any damaged material from the site and replace with undamaged material.

A. Keep pipe clean. Exercise care to keep foreign material and dirt from entering pipe during storage, handling and placing in trench. Close ends of in-place pipe at the end of any work period to prevent entry of animals and foreign material.

B. Bed pipe as specified in Trenching & Backfilling.

C. Do not lay pipe when weather or trench conditions are unsuitable.

3.2 Lay gravity sewers so as to maintain a true alignment and grade as indicated on Contract Drawings. After completion, the pipe shall exhibit a full circle of light when lighted at one manhole and viewed from the next.

A. Commence laying gravity sewers at the lowest point on a section of line and lay pipe with the bell ends uphill.

B. Pipe Joint. Preparatory to making pipe joints on gravity sewer lines, clean and dry all surfaces of joint pipe and jointing material. Use lubricants, primers, adhesives and similar materials as recommended by the manufacturer. Place, fit, join and adjust the jointing materials or factory fabricated joints as recommended by the manufacturer to obtain the degree of watertightness required. As soon as possible after the joint is made, place sufficient backfill material, as specified under Trenching & Backfilling, along each side of the pipe to resist forces that might tend to move the pipe off line and grade.

C. Complete backfilling as specified under Trenching & Backfilling. Place backfill over the pipe immediately after the pipe has been laid. Provide ductile iron pipe where cover over main line sewer pipe is less than 5.5-feet in public roads and 3.5-inch easements.

3.3 Install force main with a minimum depth of cover of 42-inches over the top of the pipe, where no grades are shown on the Drawings.

A. Where grades on the force main conflict with existing pipes or structures, lay force main to additional depth with a uniform vertical curve to provide proper clearance without the use of fittings and without creating a high point in the line. No additional payment will be allowed for additional excavation. Provide allowance for expansion as directed by the DCWA.

B. Lay force main pipe with bell ends facing the direction of laying. Where grade is 10% or greater, pipe shall be laid uphill with bell ends upgrade.

3.4 Joining Pipe

A. Join mechanical joint pipe as follows:

(1) Thoroughly clean inside of the bell and 8-inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating and other foreign matter from the joint. Paint the bell and spigot with soap solution (half cup granulated soap dissolved in 1 gallon water). Slip cast-iron gland on spigot end with lip extension of gland toward end of pipe. Paint rubber gasket with or dip into the soap solution and place on the spigot end with thick edge toward the gland.

(2) Push the spigot end forward to seat in the bell. Then carefully press the gasket into the bell so that is located evenly around the joint. The gland is moved into position, bolts inserted and nuts screwed up finger tight, then tighten all nuts to torque listed below. Contractor shall provide a calibrated torque wrench for verification of torque.

Bolts Size - Inches	Torque Ft. -Lbs.
5/8	40 -60
3/4	60 -90
1	70 -100
1¼	90 -120

(3) Tighten nuts on alternate sides of the gland until pressure on the gland is equally distributed.

(4) Permissible deflection in mechanical joint pipe shall not be greater than listed in AWWA C600.

B. Join push-on joint Ductile Iron pipe as follows.

(1) Thoroughly clean inside of the bell and 8-inches of the outside of the spigot end of the joining pipe to remove oil, grit, excess coating, and other foreign matter. Flex rubber gasket and insert in the gasket recess of the bell socket. Apply a thin film of gasket lubricant supplied by pipe manufacturer, to either the gasket or the spigot end of the joining pipe.

(2) Start spigot end of pipe into socket with care. The joint shall then be completed by forcing the plain end to the bottom of the socket with a forked tool or jack type device. Field cut pipe shall have the end filed to match the manufactured spigot end.

(3) Permissible deflection in push-on joint pipe shall not be greater than 2/3 of that listed in AWWA C600.

C. Join reinforced concrete pipe with rubber gaskets installed as recommended by the manufacturer.

D. Install PVC pipe in accordance with ASTM D-2321.

E. Set valves and valve boxes as follows.

(1) Set vertically installed valves with stems in the vertical plane through the pipe axis and perpendicular to the pipe in the plane 90° to the pipe axis. Locate valves where indicated on Drawings. Thoroughly clean valves before installation. Check valves for satisfactory operation.

(2) Equip all underground valves without gearing or operators with valve boxes. The box shall be in alignment with valve stem centered on valve nut. The valve box shall be so as not to transmit shock or stress to the valve. Set box cover flush with the finished ground surface or pavement.

(3) House all operators or gearing of underground valves, equipped with gearing or operators, in manholes. Construct manhole to prevent transmitting any load or shock to the valve or pipe. Locate manholes and valves relative to each other in order that packing, operator, and other parts of the valve are readily accessible for minor repairs.

3.5 Provide force main air vent valves at locations indicated on Drawings and at all high points of the mains. Install gate valve between main and air valves. Construct manholes for air and vacuum relief valves.

3.6 Use sleeves where pipes, valves stem extensions or equipment parts pass through concrete or masonry walls or slabs. Sleeves shall be either cast iron or schedule 40 steel of sufficient size to allow sealing around pipes and clearance for valve stems or equipment. Extend vertical sleeves through slabs 1-inch above top surface.

A. Use cast iron sleeves with intermediate collars to anchor and provide a water stop on outside of sleeves that pass through exterior walls below grade. Seal pipes using oakum.

3.7 Provide reaction anchors of concrete blocking, metal harness or retainer gland type at all changes in direction of pressure pipelines and as shown on Drawings.

A. Concrete reaction anchors shall bear against undisturbed earth and shall be of the size and shape indicated on Drawings.

B. Use metal harness restraints as indicated on Drawings.

3.8 Construct service connections for sewer main to property line as follows:

A. Place a tee fitting with 4-inch or 6-inches outlet in the sewer where service connection is to be constructed. Lay pipe from the tee to the property line on a grade of not less than 1/4-inch per foot or lay ductile iron pipe or PVC pipe on a grade of not less than 1/8-inch per foot. Close service connection at the property line with a water-tight plug. See Standard Details.

B. Install service connections on existing sewer mains with a compression type cast iron saddle as manufactured by Pioneer, Geneco or approved equal. Secure saddle to the pipe with a 24 gauge stainless steel strap and two nickel-bronze T bolts. Make connections of this type by machine tapping or cutting the pipe. Use mastic sealer type gasket to insure a water-tight connection.

C. Determine the depth of service connections by the deepest of the following:

(1) Provide 5-feet cover at the edge of the road paving or 15-feet from the center line of the street.

(2) Provide 18-inches cover at the bottom of highway ditches unless protected by concrete ditch apron.

(3) Provide 30-inches cover at the property line when property is above street.

(4) Provide depth necessary for a 1% grade if required to provide service to a property.

D. Place a 2-inches x 4-inches solid piece of lumber at the end of each service connection. The 2-inches x 4-inches marker shall be set vertically and extend from invert to minimum 6-inches above grade.

E. Construct concrete pedestals where shown on the Drawings and/or as directed by the DCWA, in accordance with Standard Detail.

F. Provide ductile iron pipe or concrete encasement where cover over sewer connections is less than 3.5-feet in public roads or right-of-way and 3.5-feet in easements.

3.9 Manholes shall be constructed to the elevations shown on the Contract Drawings in accordance with the provisions of Standard Details.

A. Set manhole base section on bed of VDOT #57 stone to a minimum depth of 6-inches. Stone shall be thoroughly compacted and carefully leveled.

B. Join all manhole riser and cone or flat slab top sections by the use of rubber gaskets.

C. Pack and brush joints in FRP lining in acid-resistant manholes with sealant to provide a watertight and acid-resistant seal. Field weld joints in PVC lining of acid-resistant manholes in accordance with manufacturer's instructions.

D. Install pipe stubs in manholes where called for on the Contract Drawings. All stubs shall extend 12-inches -18-inches beyond the manhole and shall be sealed watertight with a plug or cap.

E. Install flexible manhole connections for all pipes sizes 8-inches to 15-inches, inclusive and apply sealant to completely fill joint between manhole barrel and flexible connection for the full thickness of the manhole barrel.

F. Plug lift holes and repair any defects in manhole.

G. Set adjusting rings in Portland cement mortar bed.

(1) Rings will not be required outside of paved roadways or walkways unless called for on the Contract Drawings.

(2) Rings in paved roadways or walkways shall permit upward or downward adjustment of manhole frame by 6-inches.

H. Set manhole frame in bed of sealant. Bed shall consist of one, $\frac{3}{8}$-inch bead laid flush with the inside edge of the frame base and another $\frac{3}{8}$-inch bead laid flush with the outside edge of the frame base.

I. Bolt watertight manhole frames to manhole cone or flat slab top section as shown on the Standard Details.

J. Construct drop connections where called for on the Contract Drawings.

(1) Drop connection may be constructed of the same pipe material as used on the sewer line or may be constructed of ductile iron pipe and fittings.

(2) Drop connections shall be encased in concrete except where ductile iron pipe and fittings are used.

K. Construct bench of concrete or brick and mortar.

(1) Lowest elevation of bench shall be at the spring line of the outgoing pipe.

(2) Slope bench 3-inches toward channel for drainage.

(3) Where stubs or knockouts are provided for future pipe connections, bench shall be so formed.

(4) Use sulfate resistant cement for concrete or mortar on all acid-resistant manholes.

(5) Where sealant is used, bench shall not be in contact with pipe or flexible pipe connection.

3.10 Install detectable marking tape in all trenches containing buried, non-metallic, pressure pipelines. Tape shall be installed in all trenches with a cover of 18-inches to 54-inches and a minimum clearance over the pipelines of 18-inches. Place tape on edge of trench toward the center of the pavement in roadways. In other locations, place tape to the north or east of the utility line. Wrap tape around all valves, corporation stops and meter setters. Wrap tape three turns around base of fire hydrants and extend tape up above ground against fire hydrants. Tape shall be made electrically conductive throughout the entire system using splices of a type recommended by the manufacturer.

3.11 Testing Gravity Sewer Lines and Manholes

A. Testing of gravity sewer lines shall be conducted on short sections of sewer line, i.e., between manholes, or at the end of each day's work. Provide all labor, materials, tools, and equipment necessary to make the tests.

B. Sanitary sewer lines 24-inches diameter and smaller shall be tested after backfill using a low-pressure air test in accordance with the appropriate ASTM Standard Test Method. (F1417 PVC Pipe)

C. Low-pressure air test

(1) Summary of Method: Plug the section of the sewer line to be tested. Introduce low-pressure air into the plugged line. Use the quantity and rate of air loss to determine the acceptability of the section being tested.

(2) Preparation of the sewer line: Flush and clean the sewer line prior to testing, thus serving to wet the pipe surface as well as clean out any debris. A wetted interior pipe surface will produce results that are more consistent. Plug all pipe outlets using approved pneumatic plugs with a sealing length equal to or greater than the diameter of the line being tested to resist the test pressure. Give special attention to laterals.

(3) Ground Water Determination: Install a 1/2-inch capped galvanized pipe nipple, approximately 12-inches long, through the manhole on top of the lowest sewer line in the manhole. Immediately prior to the line acceptance test, the ground water elevation shall be determined by removing the pipe cap and blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic hose to the pipe nipple. The hose shall be held vertically and a measurement of the height in feet of water over the invert of the pipe shall be taken after the water has stopped rising in the plastic hose.

(4) Procedures: Determine the test duration for the section under test by computation from the applicable formulas shown in the appropriate (test method) ASTM. The pressure-holding time is based on an average holding pressure of 3 psi gauge or a drop from 3.5 psi to 2.5 psi gauge.

Add air until the internal air pressure of the sewer line is raised to approximately 4.0 psi gauge. After an internal pressure of approximately 4.0 psi gauge is obtained, allow time for the air pressure to stabilize. The pressure will normally show some drop until the temperature of the air in the test section stabilizes.

When the pressure has stabilized and is at or above the starting test pressure of 3.5 psi gauge, commence the test. Before starting the test, the pressure may be allowed to drop to 3.5 psi gauge. Record the drop in pressure for the test period. If the pressure has dropped

more than 1.0 psi gauge during the test period, the line shall be presumed to have failed. The test may be discontinued when the prescribed test time has been completed although the 1.0 psi gauge drop has not occurred.

The test procedure may be used as a presumptive test that enables the installer to determine the acceptability of the line before backfilling and subsequent construction activities.

If the pipe to be tested is submerged in ground water, the test pressure shall be increased to 1.0 psi for every 2.31-feet the ground water level is above the invert of the sewer.

(5) Safety: The air test may be dangerous if, because of lack of understanding or carelessness, a line is improperly prepared.

It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. In as much as a force of 250-pound is exerted on an 8-inches plug by a internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or of a plug that is partially deflated before the pipe pressure is released can be dangerous.

As a safety precaution, pressurized equipment shall include a regulator or relief valve set at perhaps 10 psi to avoid over-pressurizing and damaging an otherwise acceptable line. No one shall be allowed in the manholes during testing.

D. All gravity sewer lines and manholes shall undergo a **third party video inspection** to be provided to the Dinwiddie County Water Authority.

E. Sanitary sewer lines larger than 24-inches in diameter shall be tested by infiltration or exfiltration as hereinafter detailed. Manholes may likewise be tested by infiltration or exfiltration as an alternative to vacuum testing.

(1) Use infiltration test when ground water is at least 4-feet above pipe crown along entire length of line to be tested. Plug the pipe at the upper manhole. Install suitable measuring device at the next lowest manhole. Measure the amount of water flowing through the outlet after flow has been stabilized.

(2) Ground water determination: Use same procedure as "low pressure air test" above.

(3) Use exfiltration test when ground water is less than 4-feet above the pipe crown. Conduct exfiltration test of lower manhole as

detailed below. After acceptable test of lower manhole, plug the pipeline to be tested at the lower manhole. Fill the line and manhole to 4-feet above pipe crown or top of manhole whichever is less. Let the water stand until pipe has reached maximum absorption and until all trapped air has escaped, 4 hour minimum. After maximum absorption is reached, refill manhole to original level. After 30 minutes, record difference in level and convert to gallons.

(4) Allowable leakage of the sewer shall be 100 gallons per inch of pipe diameter per mile per 24 hours up to a maximum of 2,400 gallons per mile per 24 hours.

(5) Gravity sewers crossing or entering streams must exhibit zero exfiltration or infiltration.

F. Manhole Exfiltration Test: If air testing of sewer lines is employed, the manholes shall normally be tested by exfiltration. All pipes leading to and from manhole shall be plugged. Plugs shall be inserted into the pipes a distance greater than the length of the plugs used to air test each respective section of sewer line, so as to insure the manhole and sewer line tests overlap. Plugs shall be secured to the manhole structure. The manholes shall be filled with water to the top of frame and allowed to soak for a minimum of four hours to permit the manhole to absorb water. The cover shall be on the manhole during the soaking period. At the end of the soaking period, water shall be added until the manhole overflows. No loss of water will be permitted over a four-hour period. Upon completion of the test, the water shall be removed from the manhole.

G. Vacuum testing of manholes: Vacuum tests shall be conducted on newly constructed manholes following construction & after all connections have been made but before any backfilling around the manhole. Successful testing shall be accomplished before any backfilling operations.

(1) Provide necessary vacuum pump, pneumatic plugs and accessories required for proper performance of the test. Plugs shall have a sealing strength equal to or greater than the diameter of the connecting pipe to be sealed.

(2) Follow all local, state and federal safety precautions. Brace inverts if lines entering the manhole have not been backfilled or otherwise restrained to prevent pipe from being dislodged and pulled into the manhole.

(3) Install vacuum tester head assembly at the top access of the manhole. Adjust the cross brace to insure that the inflatable

sealing element inflates and seals against the straight top section of the manhole if possible.

(4) Attach the vacuum pump assembly to the proper connection on the test head assembly. Make sure the vacuum inlet/outlet valve is in the closed position.

(5) Following safety precautions and testing equipment manufacturer's instructions, inflate sealing element to the recommended maximum inflation pressure. Do not overinflate.

(6) Start the vacuum pump assembly engine and allow preset pump to stabilize. Open the inlet/outlet ball valve and evacuate the manhole to 10-inches Hg (approximately -5psi gauge). Pressurizing the manhole may result in damage to manhole or to test equipment.

(7) Close vacuum inlet/outlet ball valve and monitor vacuum for specified test period (see table). If vacuum does not drop in excess of 1-inch Hg., manhole is considered acceptable and the manhole passes the test. If manhole fails the test, complete necessary repairs and repeat test procedures until satisfactory results are obtained.

Manhole Diameter (inches)	48	60	72
Depth of Manhole (Feet)		Time (seconds)	
8	14	18	23
10	17	23	28
12	21	28	34
14	25	32	40
16	28	37	45
18	32	41	51
20	35	46	57
22	39	51	62
24	42	55	68
26	46	60	74
28	49	64	80
30	53	69	85

(8) Repeat the above test procedure after backfilling manhole for final acceptance test.

3.12 Testing of flexible pipe gravity sewer

A. Provide third party video inspection of entire line after the pipeline has been installed and backfill materials have been compacted to their required

standard densities, as set out in ASTM D 2321 or other applicable standard.

B. A permanent video record of all testing by the third party Contractor shall be forwarded to the DCWA after completion of testing and acceptance of each line.

C. The Contractor shall immediately replace all sections of pipe with problem areas not accepted by DCWA.

D. All materials and labor required for testing, replacement of pipelines shall be furnished by the Contractor, and the cost thereof included in the price bid for furnishing and installing pipelines.

3.13 Force Main tests shall be as follows:

A. Supply the pumps, water, calibrated gauges and meters, and all the necessary apparatus. Notify the Owner and the DCWA at least 48 hours in advance of the test date and perform tests in presence of the DCWA.

B. Hydrostatic pressure test. After the line has been backfilled and at least seven days after the last concrete anchor block was poured, a hydrostatic pressure test shall be performed. Carefully fill the system with water at a velocity of approximately 1-foot per second while necessary measures are taken to eliminate all air. After the system has been filled, raise the pressure by pump to 50 psi above the working pressure indicated on Drawings, as measured at end of force main closest to sewage pump discharge. Measure pressure at lowest point in system with gauge compensated for elevation. Maintain this pressure for at least two hours. No leakage will be allowed and if pressure cannot be maintained determine the cause, repair and repeat the test until successful.

C. All visible leaks shall be repaired regardless of the amount of leakage.

D. A leakage test shall be conducted concurrently with the pressure test. Leakage shall be determined with a calibration test meter, furnished by the Contractor. Leakage is defined as the quantity of water required to maintain a pressure within 5 psi of the specified test pressure, after air has been expelled and the pipe filled with water. Leakage shall not exceed 10 gallons per day per mile per inch of diameter. If leakage exceeds that specified, find and repair the leaks and repeat the test until successful.

END OF SECTION

SECTION 02800 - DIRECTIONALLY CONTROLLED HORIZONTAL DRILLING

1.0 GENERAL

1.1 The work to be performed under this contract shall consist of the installation of **(description of directional drill i.e., size & type of line, creek/stream/river/wetland/road crossing, etc.)** by directionally controlled horizontal drilling method as shown on Contract Drawings. Services furnished by the contractor include all labor, equipment and consumable necessary to accomplish the following tasks:

A. Supply of all pipes required for the installation in accordance with the specification Section _____. **(Coordinate Specification Section in which pipe for directional drill is specified.)**

B. Clearing, grading and general site/access preparation necessary for construction operations.

C. Transportation of all equipment, materials, labor, and consumable to and from the jobsite.

D. Erection of horizontal drilling equipment at the rig site defined on construction drawings.

E. Drilling of a pilot hole along the alignment defined in construction drawings.

F. Reaming the pilot hole to a diameter suitable for installation of the pull section.

G. Installation of the pull section along the reamed hole.

1.2 All excavated material is to be protected in conformance with Virginia Erosion and Sediment Control handbook, latest edition.

2.0 PRODUCTS

2.1 Contractor is responsible for transporting storing and securing needed quantities of any water required. Acquiring permission to use water from any source is the responsibility of the Contractor. Potable water supply rates may be limited.

2.2 Directional drilling with wireline guidance: The directional drilling equipment shall be controlled by means of an electronic tool directional system with wireline guidance.

2.3 Directional drilling with electronic tool directional system: The directional drilling equipment shall be controlled by means of an electronic tool directional system (i.e., Digitrac-Mark III).

2.4 A Bentonite clay slurry shall be provided to completely seal around the installed carrier pipe. This drilling mud shall be totally inert and pose no environmental risk.

2.5 The directional drilling equipment shall employ a fluid cutting technique. The equipment shall be sized by the Contractor based on the drill distances and shall be minimally capable of a Pull Back Force of 40,000 lbs. (without pre-reaming).

2.6 Contractor shall provide and use a ground survey grid system such as "Tru-Tracker" during the pilot hole operation.

2.7 Contractor shall provide a tracer wire during the pullback operation for future locating purposes. The tracer wire shall be no less than 1 #8 solid or wound coated wire.

2.8 The transition from HDPE pipe installed by directionally controlled horizontal drilling to ductile iron pipe shall be made using a Ductile-Iron Mechanical Joint Anchoring Kit (DIMJA-Kit) for the appropriate size pipe as manufactured by Independent Pipe Products or approved equal.

3.0 EXECUTION

3.1 The Contractor will at all times provide and maintain instrumentation which will accurately locate the pilot hole. The Engineer will have access to these instruments and their readings at all times.

3.2 Underground Utilities

A. Contractor's operation will be conducted in a location which contains other underground utilities. The Contractor shall contact Miss Utility, 48 hours before beginning any work in this area.

B. Verify the location of all adjacent underground utilities.

C. Modify drilling practices or downhole assemblies to prevent damage to adjacent underground utilities.

3.3 The directional drilling operation shall be a closed system to minimize the discharge of water drilling and mud and cuttings to the water body or land areas involved in the construction process.

3.4 The general work areas on the entry and exit sides shall be enclosed by a 12" berm to contain unplanned spills or discharges. (Mud pits must be lined with waterproof filters if existing soil conditions will not contain drilling water, mud and cuttings.)

3.5 Equipment (pumps, tanks, vacuum trucks, etc.) and materials (such as ground sheets, silt fence, hay bales, booms, absorbent pads and sediment curtains) for clean-up of seeps, mud fractures and other contingencies shall be provided and maintained at all sites.

3.6 Construction related activities involving fuels and lubricants such as vehicle refueling and equipment maintenance, including the draining and pumping of lubricants, shall be conducted a minimum of 100 feet from the surface water bodies to eliminate contamination in case of a spill.

3.7 Any fuels or lubricants spilled shall be cleaned up immediately.

3.8 All directional drilling activities shall be conducted in a manner to minimize disturbances to traffic and business activity.

3.9 The Contractor shall be responsible for maintaining appropriate traffic control measures.

3.10 Pilot Hole:

A. A pilot hole will be drilled by an appropriately sized drill pipe.

B. A smoothly curved pilot hole shall follow the designated center line of the pipe profile described on the Drawings.

C. The position of the drill string shall be monitored by the Contractor.

D. Contractor shall compute the position in the x, y and z axis relative to ground surface from down-hole survey data a minimum of one per pipe length (approximately 20 foot intervals).

E. Deviations between the recorded position of the drill string and the required position shall be documented and immediately brought to the attention of the Design Engineer.

F. The vertical profile defined on the Drawings shall be the minimum depth and radius of curvature.

G. Contractor shall provide to the Design Engineer, on demand, the data generated by the down-hole survey tools in a form suitable for independent calculation of the pilot hole profile.

H. The actual exit point shall fall within the planned exit pit which shall be a rectangle approximately 10' wide by 20' long.

3.11 Reaming:

A. Upon approval of the pilot hole location by the Design Engineer, the hole opening or enlarging phase of the installation shall begin.

B. The borehole diameter shall be increased to accommodate the pullback operation of the PVC pipe.

C. The type of hole opener or back reamer to be utilized in this phase shall be determined by the types of subsurface soil conditions that have been encountered during the pilot hole drilling operation.

D. The reamer type shall be at the Contractor's discretion.

3.12 Pipe Pullback Operation

A. The pipes shall be laid out as shown on the Drawings and assembled in a manner that does not obstruct adjacent roads or Public activities as well as vehicle and pedestrian traffic adjacent to the layout areas.

B. During the pullback operation, the Contractor shall monitor roller operation and use side-booms or cranes if required, to assist movement of the pipe.

C. Situations which cause pipe damage shall be corrected immediately. Pipe damage shall be repaired by Contractor before pulling operations resume.

D. The Contractor shall provide adequate support/rollers along the stringing areas to support the required length of the PVC pipe for each bore, if required.

E. Support/rollers shall be comprised of a non-abrasive material arranged in a manner to provide support to the bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback.

F. Spacing for the supports/rollers shall be at 20' centers.

G. Pulling Loads: The maximum pull (axial tension force) exerted on the PVC pipelines shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not overstressed.

H. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50% of the yield stress for flexural bending of the PVC pipe.

I. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense.

J. The Contractor shall take appropriate steps during pullback to ensure that the PVC pipe will be installed without damage.

K. During the pullback operation, the Contractor shall monitor roller operation and cranes or pipe layers if required to assist movement of the PVC pipe. Surface damage shall be repaired by the Contractor before pulling operations resume.

L. The lead end of the pipe shall be closed during the pullback operation.

M. After the carrier pipe is completely pulled through the tunnel, a sufficient relaxation period, as recommended by the specified pipe manufacturer, shall be provided prior to the final pipe tie-in.

N. The Contractor shall install, maintain, and leave in place any sheeting, underpinning, cribbing, and other related items (other than that required for the boring and receiving pits) to support any structure or facility affected by the boring operation. The Design Engineer, depending upon existing conditions, may require that additional sheeting for excavation be left in place.

3.13 Pipe Handling

A. The Contractor shall off load, stack, handle and string the pipe.

B. Pipe may be assembled and aligned using the line string or stovepipe method.

C. Torsion and Stresses: A swivel with a minimum load rating of 50,000 lb. shall be used to connect the PVC pipe.

D. The Contractor shall at all times handle the PVC pipe in a manner that does not over-stress the pipe.

3.14 Handling Drilling Fluids and Cuttings:

A. During the drilling, reaming or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits.

B. These fluids must not be discharged into any waterways.

C. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site.

D. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.

3.15 Any noticeable surface defects resulting from improper operation of this boring equipment shall be repaired by the Contractor at his expense.

END OF SECTION

SECTION 02900 - LANDSCAPING

1.0 GENERAL

1.1 Description

A. Furnish and install all items of landscaping including trees, shrubs and seeding as specified herein and shown on the Contract Drawings.

1.2 Reference Specifications are referred to by abbreviation as follows.

A. American Association of Nurserymen, Inc. ----------AAN

B. American National Standard Institute ---------- ANSI

C. American Society for Testing and Materials ----------ASTM

D. Federal Specifications----------FS

1.3 Submit three copies of following:

A. Seed Test Report

B. Fertilizer Analysis

C. Aggregate Bed Sample

1.4 Materials shall be delivered in unbroken containers, clearly marked by the manufacturer as to contents. Seed, limestone, and fertilizer shall be labeled as to proportions, analysis and quality. Store all materials in a manner affording protection from damage by weather or vandalism.

1.5 Deliver trees and shrubs with earth ball wrapped in burlap and secured with netting or wire.

1.6 Plants, shrubs and trees shall be guaranteed to be viable and shall be replaced if dead or dying. Replacement shall be within 30 days of inspections made at six months and one year from date of acceptance.

2.0 PRODUCTS

2.1 Topsoil shall be fertile, friable loam, containing not less than 2%, by weight, of finely divided, decomposed vegetable matter. Topsoil shall be free of subsoil, clay lumps, brush, weeds, roots larger than ½" diameter and other material toxic or harmful to growth.

2.2 Fertilizer shall meet requirements of Federal specification O-F-241. Provide fertilizer that is complete, inorganic, uniform in composition and suitable for application with approved equipment.

A. Proportions of fertilizer nutrients for broadleaf evergreens shall be the following-

8 lbs. of actual nitrogen
8 lbs. of actual phosphate
8 lbs. of actual potash

B. Proportions of fertilizer nutrients for all other vegetation shall be the following-

5 lbs. of actual nitrogen
10 lbs. of actual phosphate
5 lbs. of actual potash

2.3 Grass seed, tested within 6 months of sowing, shall have the following characteristics.

A. Permanent Seeding

Species	Percentages (Minimum) Weight	Purity	Germination
Kentucky 31 Tall Fescue	90	98	90
Merion Kentucky Bluegrass	5	90	75
Kenblue Kentucky Bluegrass	5	85	75

B. Temporary Seeding

Seeding Date	Species	Percentages(Min.) Seeding Rate Wgt. Lbs./Acre	Purity	Germ.
Seeding Date	Species			
2/15-4/30	Oats	100	98	85	96
5/1-8/31	Millet	100	98	80	40
9/1-11/15	Rye	100	96	85	140

2.4 Lime shall be ground agricultural grade limestone containing not less than 85% calcium and magnesium carbonates. Fineness shall be such that 100 percent will pass a No. 20 sieve, and not less than 50% will pass a No. 100 sieve. Burnt lime or hydrated lime may be substituted in equivalent carbonates, if requested.

2.5 Type I mulch shall be "Hold/Gro" erosion control fabric manufactured by Gulf States Paper Corporation, P. O. Box 3199, Tuscaloosa, Alabama 35401. The fabric shall be manufactured of materials which degrade in 6 to 8 months under outdoor exposure.

2.6 Type II mulch composed of threshed straw of cereal grain, pine needles or wood fiber shall be free of objectionable weed seeds or other harmful material.

2.7 Asphalt adhesive for use with Type II mulch shall be emulsified asphalt meeting requirements of ASTM D977, Grade SS-1.

2.8 Mulch composed of threshed straw of cereal grain, pine needles or wood fiber shall be free of objectionable weed seeds or other harmful material.

2.9 Asphalt adhesive for use with mulch shall be emulsified asphalt meeting requirements of ASTM D977, grade SS-1.

2.10 Synthetic mulch binder for use with mulch: Curasol, DCA-70, Petroset, or Terra Tack.

2.11 Sod shall be composed of at least 70% of Kentucky 31 tall fescue and be cut to provide a minimum thickness of 2". Vegetation more than 5" in height shall be cut to 3" or less before sod is lifted.

2.12 Plants and trees shall meet requirement of ANSI 260.1, "USA Standard for Nursery Stock". Furnish well-formed, true to type plants with well-developed root systems, free from defects. Trees shall meet requirements of branching, caliper and height as specified by AAN.

2.13 Aggregate beds shall consist of hard, durable, rounded particles, 3/4" to 1½" diameter. Stone shall be reasonably free of flat or elongated particles and free of shells, clay, loam, dust or other foreign matter.

3.0 **EXECUTION**

3.1 Seed all areas within "Limits of Construction" and all areas disturbed during construction.

3.2 Apply seeding products only when wind velocity is less than 15 miles per hours.

3.3 Temporary Seeding

A. Use in areas when final grading has not been completed or when permanent seeding cannot be done due to the specified permanent seeding dates, March 1 to April 15 and September 1 to October 15.

B. Apply fertilizer at a rate of 15 lbs. of 10-20-10 per 1000 sq. ft. (600 lbs. per acre) or equivalent.

C. For loose soil, work lime and fertilizer into soil and then seed. For packed or hard soil, loosen top layer while working lime and fertilizer into soil and then seed at the rate required for the temporary seeding species.

D. Seed only between February 15 and November 15. Use mulching or sodding between November 15 and February 15.

3.4 Prepare soil for permanent seeding by tillage of topsoil in place to loosen thoroughly and break up all clods to a depth of 6". Remove all stumps and roots, coarse vegetation, stones larger than 1½" and all construction debris. Soil shall be worked by suitable agricultural equipment to a depth of not less than 4 inches. Rake to a uniform, smooth and drainable surface.

A. Apply lime and fertilizer uniformly and mix well into top 4 inches of seed bed. Apply lime at the rate of 100 lbs. pr 1000 sq. ft. Apply fertilizer at the rate of 50 lbs. of 5-10-5 per 1000 sq. ft. or 25 lbs. of 10-20-10 per 1000 sq. ft. Rates should be adjusted for other grades of fertilizer.

B. Seeding in Lawn Areas: After final grading, a finely pulverized seed bed shall be prepared using a minimum of three inches (3") of topsoil over the entire area to be seeded. Topsoil, previously placed, may be used to the extent available. Cost of any additional topsoil shall be included in the cost of seeding. Mulch shall be Type II. Type I may be required depending on the slope of area to be seeded.

C. Seeding in Easements: After final grading and site preparation, grass seed shall be applied at the rate of 60 pounds per acre and followed immediately by mulching and protection as provided. Mulch shall be Type II.

3.5 Sow permanent grass seed between dates of March 1 and April 15 or September 1 and October 15.

3.6 Sow seed by mechanical seeder as follows.

A. Mix seed thoroughly with clean dry sawdust and broadcast at rate of 6 lbs. per 1000 sq. ft. in cross directions to ensure uniform distribution. Rake surface lightly and roll with appropriate type of lawn roller weighing maximum of 150 lbs. per foot of width.

B. Apply mulch uniformly leaving not more than 10% of the soil surface exposed.

C. Anchor mulch by the following methods.

(1) Apply light tack coat of asphalt emulsion.

(2) In residential areas, apply synthetic mulch binder at rate recommended by manufacturer.

(3) On slopes steeper than 4 horizontal to 1 vertical, fasten heavy jute mesh to wooden stakes.

3.7 Plant trees in pits with vertical sides cut 2 feet greater than ball diameter and deep enough to allow 6 inches of compacted topsoil below ball or root of tree. Backfill with topsoil mixed with 1½ pounds of 5-10-5 fertilizer per inch of caliper. Support trees with wire stays encased in section of garden hose, or similar material placed around trunk in a single loop. Tighten wires by twisting strands together or by use of turnbuckles.

3.8 Plant shrubs in pits 15 to 18 inches deep backfilled with topsoil mixed with fertilizer, ¼ lb. per 2 foot shrub height. Use 8-8-2 fertilizer, ¼ lb. per 2 foot shrub height. Use 8-8-8 fertilizer with broadleaf evergreens and 5-10-5 with all others.

3.9 Set vines and ground cover plants in 8 inch beds of topsoil mixed with 50 lbs. of 5-10-5 fertilizer per 1000 sq. ft.

3.10 Remove all soiling or staining of walks, drives and parking areas resulting from landscape work. Maintain paved areas in clean condition.

3.11 Turfgrass Maintenance

A. Water as required to keep soil moist during germination period.

B. Mowing

(1) When grass reaches height of 3½" or more, mow to height of 2½".

(2) Maintain grass height between 2½" and 4 inches.

(3) Do not remove more than 33% of total height of grass in one mowing.

C. Reseed and mulch spots larger than 1 sq. ft. without uniform stand of grass.

D. Mow and maintain all seeded areas until uniform stand of grass is acceptable to Engineer.

E. In the event that growth is not established by final project inspection, continue the specified attention until stand is accepted by Engineer.

F. Correct or repair all undue settling as evidenced by complaints received within one year after final project inspection.

END OF SECTION

SECTION 02935 - SEEDING

1.0 GENERAL

1.1 Description

A. Furnish and install all items of seeding as specified herein and shown on the Contract Drawings.

1.2 Reference Specifications are referred to by abbreviation as follows:

A. American Society for Testing and Materials ..... ASTM

B. Federal Specifications ..... FS

1.3 Submit three copies of following:

A. Seed Test Report

B. Fertilizer Analysis

1.4 Materials shall be delivered in unbroken containers, clearly marked by the manufacturer as to contents. Seed, limestone, and fertilizer shall be labeled as to proportions, analysis and quality. Store all materials in a manner affording protection from damage by weather or vandalism.

2.0 PRODUCTS

2.1 Topsoil shall be the top 6-inches of original soil from the site, unless otherwise noted on the Drawings. Topsoil obtained off-site shall be fertile, friable loam, containing not less than 2 percent, by weight, of finely divided, decomposed vegetable matter. Topsoil shall be free of subsoil, clay lumps, brush, weeds, roots larger than 1/2-inch diameter, stones larger than 1/2-inch diameter and other material toxic or harmful to growth.

2.2 Fertilizer shall meet requirements of Federal Specification 0-F-241. Provide fertilizer that is complete, inorganic, uniform in composition and suitable for application with approved equipment.

A. Proportions of fertilizer nutrients shall be as follows:

Mixed grasses and legumes: 1000 lbs./acre 10-20-10 or equivalent nutrients (23-lbs./1000 ft^2).

Legume stands only:	1000 lbs./acre 5-20-10 (23 lbs./1000 ft^2. is preferred; however, 1000 lbs./acre of 10-20-10 or equivalent may be used.
Grass stands only:	1000 lbs./acre 10-20-10 or equivalent nutrients, (23-lbs./1000 ft^2).

Other fertilizer formulations, including slow-release sources of nitrogen (preferred from a water quality standpoint), may be used provided they can supply the same amounts and proportions of plant nutrients.

2.3 Certified seed will be used for all permanent seeding. The seed must meet published state standards and bear an official "Certified Seed" label. Grass seed, tested within 6 months of sowing, shall have the following characteristics.

A. Permanent Seeding

1. General Slope (3:1 or less)

	Total Lbs. Per Acres
Kentucky 31 fescue	128-lbs.
Red Top Grass	2 lbs.
Seasonal Nurse Crop*	20 lbs.
	150 lbs.

2. Low-Maintenance Slope (Steeper than 3:1)

Kentucky 31 Fescue	108 lbs.
Red Top Grass	2 lbs.
Seasonal Nurse Crop*	20 lbs.
Crownvetch**	20 lbs.
	150 lbs.

* Use seasonal nurse crop in accordance with seeding dates as stated below:

Feb.16-April ..... Annual Rye
May 1-Aug.15 ..... Foxtail Millet
Aug.16-Oct. ..... Annual Rye
Nov.-Feb.15 ..... Winter Rye

** Substitute Sericea lespedeza for Crownvetch east of Farmville, VA (May through September use hulled Sericea, all other periods, use unhulled Sericea). If Flat pea is used in lieu of Crownvetch, increase rate to 30 lbs./acre. All legume seed must be properly inoculated. Weeping Lovegrass may be added to any slop or low-maintenance mix during warmer seeding periods; add 10-20 lbs./acre in mixes.

B. Temporary Seeding

Planting Dates	Species	Rate (lbs./acre)
Sept.1-Feb.15	50/50 Mix of Annual Ryegrass (Lolium multi-florum) Cereal (Winter) Rye (Secale cereale)	50 - 100
Feb.16-Apr.30	Annual Ryegrass (Lolium multi-florum)	60 - 100
May 1-Aug.31	German Millet (Setaria Italica)	50

2.4 Lime shall be ground agricultural grade limestone containing not less than 85% calcium and magnesium carbonates. Fineness shall be such that 100% will pass a No. 20 sieve, not less than 50% will pass a No. 100 sieve. Burnt lime or hydrated lime may be substituted in equivalent carbonates, if requested.

2.5 Type I mulch shall be "Hold/Gro" erosion control fabric manufactured by Gulf States Paper Corporation, P. O. Box 3199, Tuscaloosa, Alabama 35401 or equivalent. The fabric shall be manufactured of materials that degrade in 6-inches to 8 months under outdoor exposure. Type I mulch shall be used on slopes greater than or equal to 3:1.

2.6 Type II mulch composed of straw or hay, fiber mulch or corn stalks shall be free of objectionable weed seeds or other harmful materials. Type II much may be used on slopes less than 3 to 1.

2.7 Type II mulch shall be anchored by means of a mulch anchoring tool, fiber mulch application or a synthetic mulch binder, which is organically formulated.

2.8 Fiber mulch shall not be used during the dry summer months or used for a late fall mulch cover. Straw, hay or corn stalk mulch shall be used.

2.9 Asphalt, petroleum based, or chemical binders shall not be used.

2.10 Sod shall be composed of at least 70% of Kentucky 31 tall fescue and be cut to provide a minimum thickness of 2-inches. Vegetation more than 5-inches in height shall be cut to 3-inches or less before sod is lifted.

3.0 EXECUTION

3.1 Seed all areas within "Limits of Construction" and all areas disturbed during construction.

3.2 Apply seeding products only when wind velocity is less than 15 miles per hours.

3.3 Temporary Seeding

A. Use to reduce erosion and sedimentation in disturbed areas that will not be brought to final grade for a period of more than 30 days. Use to reduce damage from sediment and runoff to downstream or off-site areas, and to provide protection to bare soils exposed during construction until permanent vegetation or other erosion control measures are established.

B. Apply fertilizer at a rate of 600 lbs./acre of 10-20-10 (14 lbs./1,000 sq.ft.) or equivalent nutrients.

C. For loose soil, work lime and fertilizer into soil and then seed. For packed or hard soil, loosen top layer while working lime and fertilizer into soil and then seed at the rate required for the temporary seeding species.

D. Seed shall be evenly applied with a broadcast seeder, drill, culti-packer seeder or hydroseeder. Small grains shall be planted no more than 1-inch deep. Grasses and legumes shall be planted with no less than 1/4-inch soil cover.

E. Seeding made in the fall for winter cover and during hot and dry summer months shall be mulched with straw. Fiber mulch will not be considered adequate during these periods.

F. Areas that fail to establish vegetation cover, adequate to prevent rill erosion, shall be reseeded as soon as such areas are identified.

3.4 Permanent Seeding

A. Prepare soil for permanent seeding by tillage of topsoil in place to loosen thoroughly and break up all clods to a depth of 6-inches. Remove all stumps and roots, coarse vegetation, stones larger than 1 1/2-inches and all construction debris. Soil shall be worked by suitable agricultural equipment to a depth of not less than 4-inches. Rake to a uniform, smooth and drainable surface.

B. Apply lime and fertilizer uniformly and mix well into top 4-inches of seedbed. Apply lime at the rate of 90 lbs. per 1,000-square feet Apply fertilizer at the rate of 100 lbs. of 10-20-10 per acre or 23 lbs. of 10-20-10

per 1,000-square feet Rates should be adjusted for other grades of fertilizer.

C. Seeding in Lawn Areas: After final grading, a finely pulverized seedbed shall be prepared using a minimum of 3-inches of topsoil over the entire area to be seeded. Topsoil, previously placed, may be used to the extent available. Cost of any additional topsoil shall be included in the cost of seeding. Mulch shall be Type II. Type I may be required depending on the slope of area to be seeded.

D. Seeding in Easements: After final grading and site preparation, grass seed shall be applied at the rate of 6- lbs. per acre and followed immediately by mulching and protection as provided. Mulch shall be Type II.

3.5 Use seasonal nurse crop in accordance with dates as specified in this Section part 2.3.

3.6 Sow permanent seed by mechanical seeder as follows:

A. Apply seed uniformly with a broadcast seeder, drill, culti-packer seeder, or hydroseeder on a firm, friable seedbed. Seeding depth should be 1/4 -inch to 1/2-inch Apply in cross directions to ensure uniform distribution.

B. Mulch shall be applied as follows:

(1) Straw or hay mulch shall be applied at the rate of 1.5-2-tons per acre or 70-90-lbs. per 1,000-square feet with a mulch blower or by hand. It shall be anchored after application.

(2) Fiber mulch shall be applied at the rate of a minimum of 1,500-lbs. per acre or 35 lbs. per 1,000-square feet. It shall be applied as a slurry.

(3) When fiber mulch is the only available mulch during periods when straw should be used, apply at a minimum rate of 2,000-lbs. per acre or 45-lbs. per 1,000-square feet

(4) Corn stalk mulch shall be applied at the rate of 4-6 tone per acre or 185-275 lbs. per 1,000-square feet. It shall be applied with a mulch blower or by hand. Stalks shall be cut or shredded in 4-inches to 6-inches lengths and air-dried. It shall not be used in fine turf areas.

C. Anchor mulch to the following standards:

(1) Straw mulch shall be anchored immediately after spreading to prevent displacement.

(2) Use of a mulch-anchoring tool (i.e., Krimper Tool) shall be limited to grades less than 3 to 1. Machinery shall be operated on the contour.

(3) Use a fiber mulch, shall be applied by means of a hydroseeder at a rate of 500-750 lbs. per acre over top of straw mulch or hay.

(4) If a synthetic mulch binder is used, apply at the rate recommended by manufacturer.

(5) On slopes steeper than 3 to 1 fasten Type I mulch as recommended by the manufacture.

3.7 Remove all soiling or staining of finished walks, drives and parking areas resulting from seeding work. Maintain paved areas in clean condition.

3.8 Turfgrass Maintenance

A. Water as required to keep soil moist during germination period.

B. Mowing

(1) When grass reaches height of 3 1/2-inches to 4-inches, mow to height of 2 1/2-inches.

(2) Maintain grass height between 2 1/2-inches and 4-inches.

(3) Do not remove more than 33% of total height of grass in one mowing.

C. Reseed and mulch spots larger than 1-square feet without uniform stand of grass.

D. Mow and maintain all seeded areas until uniform stand of grass is acceptable to the DCWA.

E. In the event that growth is not established by final project inspection, continue the specified attention until stand is accepted by the DCWA.

F. Correct or repair all undue settling as evidenced by complaints received within one year after final inspection.

END OF SECTION

SECTION 03301 - CAST-IN-PLACE CONCRETE (25 Yds. or less)

1.0 GENERAL

1.1 Description

A. Work includes:

(1) Wood and steel formwork for cast-in-place concrete, complete with shoring, bracing and anchorage.

(2) Reinforcing steel bars and welded steel wire fabric for cast-in-place concrete, complete with tie wire, support chairs, bolsters, bar supports, spacers and all accessories for reinforcing.

(3) Mixing, transporting, placing and finishing of cast-in-place concrete.

2.0 PRODUCTS

2.1 Concrete work shall meet requirements of ACI 301-95 with the following modifications and supplements.

A. Cement for concrete shall be ASTM C150 of the following types:

(1) Except where otherwise designated, cement shall be Type I or Type II.

(2) Cement for water retention structures shall be Type II.

B. The 28 day compressive strength of concrete for this project shall be as follows:

(1) Class "A", 4,000 psi for all structures, not otherwise designated herein or on the Drawings.

(2) Class "B", 3,000 psi for slabs on grade reinforced with welded wire fabric only and those uses designated on the Drawings.

(3) Class "C" 2,000 psi for concrete under structural base slabs, cradles, encasements and those uses designated on the Drawings.

(4) Concrete maximum slump shall be three inches (3") for slabs and four inches (4") for other members unless otherwise noted on Drawings (before HRWR).

(5) The concrete design mix may be taken from a four point design curve that is current with the concrete producer.

C. All exterior concrete permanently exposed to the weather or designated to be waterproof concrete, shall be air-entrained concrete conforming to ASTM C260. Air content shall be six percent (6%) plus or minus one percent (±1%). Air entraining admixture shall be Master Builders MBAE, W.R. Grace Deravair or equal.

D. Water reducing admixtures shall conform to ASTM C494, Type A. The water reducing admixture used must be approved in writing by Engineer. The water reducer shall be Master Builders Polyheed, W.R. Grace WRDA w/Hycol or equal by Euclid Chemical Co.

E. High range water reducing admixture, conforming to ASTM C494, Type F or G, shall be added to concrete on job-site for concrete to be used in walls and columns, all pumped concrete, all concrete with water cement ratio of 0.45 or lower or, at Contractor's option, any other concrete. The high range water reducer used must be approved in writing by Engineer. The high range water reducers shall be Master Builders Rheobuild 1000, W.R. Grace WRDA19 or Daracem 100 or equal by Euclid Chemical Co. All concrete containing the high range water reducer shall have a maximum slump of 8" unless otherwise approved by the Engineer. The concrete shall arrive at the job-site at a slump of 2" to 3", be verified, then the high range water reducer added to increase slump to the approved level. After addition, a minimum of 70 revolutions or 5 minutes mix time shall be provided to assume proper mix.

F. Earth cuts may be used as forms for footings only.

G. Removal of forms and reshoring shall be done only in a manner that will support all loads including dead load and construction live loads.

H. Reinforcing steel shall be ASTM A615 Grade 60. Welded wire fabric shall be ASTM A185.

3.0 **EXECUTION**

3.1 Concrete work shall meet requirements of ACI 301-95 with the following modifications and supplements.

A. Forms used for formed concrete shall produce a smooth formed finish. All exposed, formed concrete shall receive smooth rubbed finish.

B. All formed concrete surfaces to receive waterproofing shall have a smooth form finish.

C. Special attention shall be given to repair of surface defects to provide a finished surface that is equal to or better than the adjacent concrete. Appearance of finished surfaces shall be as follows:

(1) Exposed to view and/or permanently exposed to process liquids: Remove all fins and projections; clean all honeycombs and tie holes; patch with concrete; fill all bug holes and surface blemishes as required to provide a smooth uninterrupted surface similar to a grout cleaned finish.

(2) Below grade, to be waterproofed, or not otherwise specified: Remove all fins and projections; clean all honeycombs and tie holes and patch with concrete.

D. All interior flat cement finished surfaces of floors, steps, platforms, etc. shall be finished by screeding and finished with wood float or steel trowel as the Engineer may prescribe. Exterior slabs, steps and sidewalks shall have a broom finish. Sidewalks shall be edged.

E. Curing and Protection: All concrete shall be cured by an approved method for the period of time given below:

Type II cement	7 days
Type I or Type II cement blended with Pozzolan	12 days

(1) Immediately after placement, concrete shall be protected from premature drying; apply Master Builders "Confilm" to flat slabs; extremes in temperatures, rapid temperature change, mechanical injury and injury from rain and flowing water. All materials and equipment needed for adequate curing and protection shall be available and at the placement prior to placing concrete. No fire or excessive heat shall be permitted near or in direct contact with the concrete at any time. Curing shall be accomplished by any of the following methods, or combination thereof, as approved.

(a) Moist Curing: Concrete to be moist-cured shall be maintained continuously wet for the entire curing period. If water or curing materials used, stains or discolors concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned. When wooden forms are left in place during curing, they shall be kept wet at all times. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Horizontal surfaces shall be cured by ponding, by covering with a 2 inch minimum thickness of continuously saturated sand, or by covering with

waterproof paper, polyethylene sheet, polyethylene-coated burlap or saturated burlap.

(b) Membrane Curing: Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete. The curing compound shall be white pigmented and shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. The formed surfaces shall be thoroughly moistened with water and the curing compound shall be applied. Curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. The compound shall be applied in a one-coat continuous operation by mechanical spraying equipment, at a uniform coverage in accordance with the manufacturer's printed instructions. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method at the coverage herein specified. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

F. Environmental Conditions:

(1) Hot weather concreting shall follow recommendations of ACI 305.

(2) Cold weather concreting shall follow recommendations of ACI 306, particularly Table 1.4.1 - Recommended Concrete Temperatures and Table 1.4.2 - Protection Recommended for Concrete Placed in Cold Weather. When ambient placement temperatures are less than 50°F, all concrete shall contain a non-chloride accelerating admixture conforming to ASTM C494, Type C or E, and shall be used in accordance with manufacturer's recommendations.

3.2 Reinforcing Steel

A. All reinforcing steel splices shall be Class B under applicable categories per ACI 318-99 and ACI Detailing Manual - 1994.

B. Placement of reinforcement and accessories shall be in accordance with CRSI Pub. "Placing Reinforcing Bars," Sixth Edition, 1992.

C. All reinforcement within the limits of a day's pour shall be in place and the Resident Project Representative shall be notified in sufficient time to permit inspection before concreting begins.

END OF SECTION

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SECTION 15151 - DISPLACEMENT TYPE
COLD WATER METERS 5/8-INCH THRU 2-INCHES

1.0 GENERAL

1.1 Furnish and install cold water meters as specified herein where shown on drawings.

1.2 Reference Specifications are referred to by abbreviation as follows:

A. American Water Works Association ..... AWWA

1.3 Submit three (3) copies of shop drawings for meters.

2.0 PRODUCTS

A. All meters shall be constructed in accordance with AWWA C700 latest revision "Standard Specification for Cold Water Meters - Displacement Type." Meters may be oscillating-piston or nutating-disc.

B. All meters shall be the Neptune AMR System as shown below, or an approved equivalent:

Meter Size Inches	Model
5/8	r900i E-Coder Radio Read
3/4	r900i E-Coder Radio Read
1	r900i E-Coder Radio Read
1 1/2-2	r900i E-Coder Radio Read

C. Registers:

(1) Registers shall read in gallons and have Data Log capability.

D. Guarantee and Maintenance Program:

(1) Manufacturer must provide a meter maintenance plan in writing which includes the price of repairing meters to meet AWWA new meter accuracy standards after the expiration of the performance guarantee.

3.0 EXECUTION

3.1 Install meters in accordance with manufacturer’s instructions.

END OF SECTION

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