

WATERLINE REPLACEMENT CONTRACT
(Sinclair Road - State Route K Roundabout)

THIS CONTRACT, made and entered into this ____ day of _____, 2020, by and between the CITY OF COLUMBIA, MISSOURI, a municipal corporation, hereinafter called "CITY," and CONSOLIDATED PUBLIC WATER SUPPLY DISTRICT NO. 1 OF BOONE COUNTY, MISSOURI, a Missouri public corporation, hereinafter called "DISTRICT:"

WITNESSETH:

WHEREAS, the CITY has prepared plans for a roundabout and other road improvements to be made in the State Route K and Sinclair road right-of-way (herein "Road Improvements"); and

WHEREAS, in connection with the aforesaid Road Improvements the parties desire to reach agreement in regard to replacing and relocating portions of the existing waterlines of the DISTRICT to accommodate the Road Improvements.

NOW, THEREFORE, in consideration of the respective covenants of the parties and other valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the undersigned do hereby mutually agree as follows:

1. CITY'S DUTIES IN CONNECTION WITH WATERLINE REPLACEMENT AND RELOCATION: As part of the Road Improvements, CITY shall cause a contractor approved by the District in advance and in writing ("Contractor") to perform all work required to replace, install and relocate the DISTRICT's existing three-inch (3"), four-inch (4"), six-inch (6"), and eight-inch (8") waterlines and related water service facilities that are shown and described on the distribution sheets, profiles, and construction details prepared by Bartlett & West, attached hereto as Exhibit "A" and incorporated herein by reference (the "Water Lines"), with such work to be performed in conformity with and as described in both Exhibit "A" and in the Standard Specifications and Details for the District prepared by Bartlett & West, attached hereto as Exhibit "B" and incorporated herein by reference (the "Work");

2. DISTRICT UPGRADE COST: DISTRICT desires as part of the CITY's Work that the four-inch (4") Water Line on the north side of State Route K as shown on Exhibit "A" be upgraded to eight-inch (8") Water Line. DISTRICT shall pay CITY the lump

sum of twenty-four thousand dollars (\$24,000.00) for said upgrade, due and payable upon completion of the Work related to said upgraded Water Line and placed in service.

3. CITY COST: CITY agrees that, with the exception of the twenty-four thousand dollar (\$24,000.00) lump sum to be paid by District for the upgrade as provided in paragraph 2, above, CITY shall be responsible for all costs of the Work. In addition, upon CITY's receipt of DISTRICT's itemized invoice, CITY agrees to reimburse the DISTRICT the lesser of: (i) twelve thousand dollars (\$12,000.00); or (ii) an amount equal to the sum of Bartlett & West's engineering fees charged to the DISTRICT in connection with the preparation of Exhibit "A," the DISTRICT's attorneys' fees for the preparation of this Contract, and the DISTRICT's other reasonable costs and expenses incurred in connection with this Contract as itemized by the District.

4. EASEMENTS: Concurrently with the execution of this Contract, CITY shall deliver to DISTRICT that certain original, executed Waterline Easement a copy of which is attached hereto as Exhibit "C" and made a part hereof. In connection with the Work, the CITY shall utilize the easements and easement rights granted to the DISTRICT pursuant to Exhibit "C," pursuant to those certain Waterline Easements copies of which are attached hereto as Exhibit "D", Exhibit "E", Exhibit "F", Exhibit "G", and pursuant to the Platted Utility Easement attached here to as Exhibit "H."

5. INSPECTION: CITY agrees to give to DISTRICT written notice not less than seventy-two (72) hours prior to Contractor's commencement of any of the Work, and DISTRICT shall have the right to have a representative present to inspect the Work as the same is being done.

6. WATER SERVICE DISRUPTION: CITY agrees to cause its Contractor to perform the Work in such a manner as to minimize the disruption of water service to the patrons of the DISTRICT.

7. WATERLINE TESTING: DISTRICT will furnish water to the Water Lines in connection with Contractor flushing and testing the Water Lines in accordance with the rules and regulations of the Missouri Department of Natural Resources.

8. OWNERSHIP: That upon completion of the Work in accordance with the provisions contained herein the Water Lines shall be deemed transferred to and become the waterlines of the DISTRICT.

9. CORRECTIVE WORK: CITY shall promptly give DISTRICT written notice when the Road Improvements have been completed. CITY shall repair or replace or cause Contractor to repair or replace, at CITY's expense, any defective work or materials installed under this Contract which arise or become apparent within one (1) year after the completion of the Road Improvements, and in addition CITY shall perform or cause Contractor to perform such backfilling work, erosion control work and cleanup work which the DISTRICT determines is needed within one (1) year after the Road Improvements have been completed. To the extent allowed by law, CITY agrees to indemnify and hold DISTRICT harmless from any loss or damage arising out of or resulting from the failure of the CITY to perform when due its obligations under this paragraph provided that DISTRICT notifies CITY in writing of such loss or damage within one (1) year of completion of the Road Improvements, and provides all necessary documentation.

10. ENFORCEMENT IN EQUITY: It is agreed that in the event of any controversy concerning the rights or obligations of the parties hereto under this Contract, such rights or obligations may be enforceable in law or in equity, or both; provided however, such remedies shall be cumulative and not exclusive, and shall be in addition to any other remedies which the parties may have.

11. LITIGATION EXPENSES: In the event of any litigation between the parties in regard to the provisions of this Contract, the prevailing party in said litigation shall have the right to recover from the other party all reasonable litigation expenses including reasonable attorneys' fees.

12. JURISDICTION AND VENUE: The jurisdiction and venue of any dispute under the terms of this Contract shall be in the Circuit Court of Boone County, Missouri.

13. SUCCESSORS AND ASSIGNS: This Contract shall be binding upon the parties hereto and their successors and assigns.

14. NON WAIVER OF IMMUNITIES: Except to the extent of CITY's limited agreement to indemnify DISTRICT as specifically set forth in paragraph 9, above, the language of this Contract shall not constitute or be construed as a waiver or limitation for either party's rights or defenses with regard to each party's applicable sovereign, governmental, or official immunities and protections as provided by federal and state constitutions or laws.

day and year first above written.

CITY:
CITY OF COLUMBIA, MISSOURI



BY: _____
JOHN GLASCOCK, City Manager

ATTEST:

SHEELA AMIN, City Clerk

APPROVED AS TO FORM:

NANCY THOMPSON, City Counselor 

DISTRICT:
CONSOLIDATED PUBLIC WATER SUPPLY
DISTRICT NO. 1 OF BOONE CITY, MISSOURI

BY: _____
JAMES KYD, District President

ATTEST:

JANET SEARS, District Clerk

STATE OF MISSOURI)
) SS.
CITY OF BOONE)

On this _____ day of _____, 2020, before me appeared JOHN GLASCOCK, to be personally known, who, being by me duly sworn, did say that he is the City Manager of the City of Columbia, Missouri, and that the seal affixed to the foregoing instrument is the corporate seal of the City and that this instrument was signed and sealed on behalf of the City by authority of its City Council and the City Manager acknowledged this instrument to be the free act and deed of the City.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal, at my office in Columbia, Missouri, the day and year first above written.

My commission expires: _____

Notary Public

STATE OF MISSOURI)
) SS.
COUNTY OF BOONE)

On this _____ day of _____, 2020, before me appeared JAMES KYD, to me personally known, who, being by me duly sworn, did say that he is the President of CONSOLIDATED PUBLIC WATER SUPPLY DISTRICT NO. 1 OF BOONE CITY, MISSOURI, a Missouri public corporation, and that the seal affixed to the foregoing instrument is the corporate seal of said corporation and that said instrument was signed and sealed in behalf of said corporation by authority of its Board of Directors and the said President acknowledged said instrument to be the free act and deed of said corporation.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal, at my office in Columbia, Missouri, the day and year first above written.

My commission expires: _____

Notary Public

CPWSD NO. 1 OF BOONE COUNTY, MISSOURI

SINCLAIR-ROUTE K ROUNDABOUT WATER LINE RELOCATION

DISTRICT PROJECT NO. 2018-004

CONSTRUCTION PLANS

JULY 2020



KEY MAP



PROJECT LOCATION MAP
NOT TO SCALE

SHEET INDEX		
SHEET NO.	DRAWING NO.	SHEET TITLE
1	G-001	COVER SHEET
2	G-101	DISTRIBUTION SHEET
2	G-102	DISTRIBUTION SHEET
4	G-401	PROFILES
5	G-501	CONSTRUCTION DETAILS
6	G-502	CONSTRUCTION DETAILS

- GENERAL**
1. NO WORK SHALL BE STARTED WITHOUT NOTIFYING THE WATER DISTRICT AT LEAST 72 HOURS IN ADVANCE AT (573) 440-6723.
 2. CONTRACTOR SHALL OBTAIN A BOONE COUNTY PERMIT FROM PUBLIC WORKS, WHERE REQUIRED.
 3. DISTRICT WILL OBTAIN A HYDRO PERMIT, WHERE REQUIRED. ANY OTHER PERMITS ARE CONTRACTOR'S RESPONSIBILITY.
 4. CONTRACTOR IS RESPONSIBLE TO HAVE ALL UTILITIES WITHIN PROJECT AREA LOCATED IN THE FIELD PRIOR TO CONSTRUCTION. CONTACT MISSOURI ONE CALL SYSTEM AT 1-800-955-8876 OR #11.
 5. WATER LINE ALIGNMENT TO BE STAKED BY THE WATER DISTRICT. VARIANCE FROM APPROVED ALIGNMENT MUST BE APPROVED BY THE WATER DISTRICT PRIOR TO INSTALLATION.
- INSTALLATION**
6. MINIMUM COVER ON WATER LINE SHALL BE 48", UNLESS OTHERWISE NOTED.
 7. LOCATOR WIRE SHALL BE INSTALLED ON ALL PIPE INCLUDING SERVICE CROSSINGS. TWO STRANDS OF LOCATOR WIRE SHALL BE INSTALLED ON HIGHWAY BORIES AND CREEK CROSSINGS.
 8. MAINTAIN 18" OF HORIZONTAL AND 18" OF VERTICAL SEPARATION BETWEEN WATER LINES AND HIGH-POTENTIAL LINES.
 9. CONTRACTOR TO CONFORM ALL SERVICE CROSSINGS, AS REQUIRED.
 10. CONCRETE THURST BLOCKING FORMS TO BE APPROVED BY THE WATER DISTRICT INSPECTOR. READY POURING BLOCKING, CONCRETE BLOCKS OR QUICKCRETE SHALL NOT BE ALLOWED.
 11. ALL LINES TO BE PIGGED, DISINFECTED AND PRESSURE TESTED PRIOR TO CONNECTING TO EXISTING MAIN. TEMPORARY BLOWOFFS, FLUSH VALVES, ETC. WILL BE THE CONTRACTOR'S RESPONSIBILITY FOR INSTALLATION AND REMOVAL, AS NECESSARY.
 12. TRENCH BACKFILL UNDER PRIVATE ROAD CROSSINGS SHALL BE 2" CLEAN ROCK. TRENCH BACKFILL FOR PRIVATE ENTRANCES AND COUNTY ROADS SHALL BE 2" COMPACTED SURFACE ROCK.
 13. TIE-INS OR WET TAP TIE-INS SHALL BE MADE ONLY AFTER CONTRACTOR OR INDIVIDUAL HAS COORDINATED AND ACQUIRED PRIOR APPROVAL FROM THE WATER DISTRICT AS TO:
 - A) ACTUAL TIME OF DAY SERVICE WILL BE DISRUPTED.
 - B) METHOD OF TIE-IN AND WATER TAP HAVE BEEN APPROVED BY THE WATER DISTRICT INSPECTOR.
 - C) ALL MATERIALS NEEDED FOR TIE-IN ON SITE AND ASSEMBLED AS FAR AS POSSIBLE.
 - D) NO TIE-INS TO BE SCHEDULED ON HOLIDAYS, WATER DISTRICT PAID HOLIDAYS OR WEEKENDS.
 14. CONTRACTOR TO CLEANUP, SEED AND MULCH AS PER PROJECT SPECIFICATIONS.
 15. ALL PIPES WITH OPEN ENDS INDICATED FOR ABANDONMENT SHALL BE GAPPED.
 16. VALVES TO BE REASSEMBLED WILL BEHIND THE ALDER TO AT LEAST 12" BELOW THE GROUND. THE LID WILL BE COVER TO THE WATER DISTRICT.
 17. FITTINGS TO BE MECHANICAL JOINT DUCTILE IRON. PVC FITTINGS GREATER THAN 2" WILL NOT BE ALLOWED. ALL MECHANICAL JOINT FITTINGS SHALL HAVE SIGNA OR EAGLE JOINT RESTRAINTS.
 18. TEES WITH ANCHOR COUPLINGS MAY BE USED IN LIEU OF ANCHOR TEES SHOWN ON THE PLANS.
 19. USE OF 30" ALL-TERRAZO STAINLESS STEEL TIE-SACK BODIES MAY BE APPROVED BY THE WATER DISTRICT INSPECTOR IN PLACE OF 24" ANCHOR COUPLINGS.

CALL OR CLICK 3 DAYS BEFORE YOU DIG:

 1-800-DIG-BITE or 811
 www.motcall.com

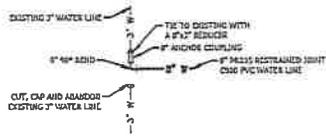
Bartlett & West
 1118 E. 11th St., Suite 100, Boone County, Missouri
 64601-1118

COVER SHEET
 SINCLAIR-ROUTE K ROUNDABOUT WATER LINE RELOCATION
 CPWSD NO. 1 OF BOONE COUNTY, MISSOURI
 DISTRICT PROJECT NO. 2018-004

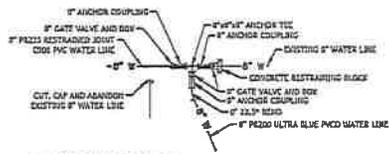


DESIGNED BY:	07/30/2020
DRAWN BY:	EM
CHECKED BY:	EM
DATE:	JULY 2020
DRAWING NO.:	G-001
SHEET NO.:	1 OF 6

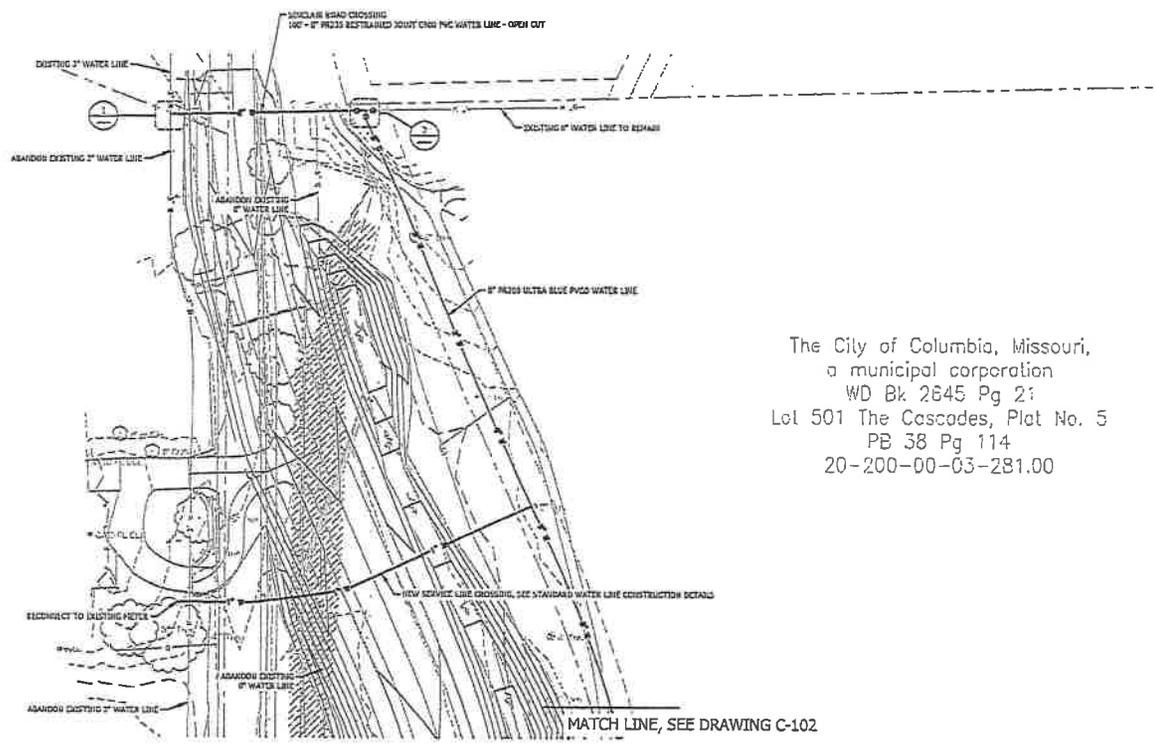
EXHIBIT "A"



1 DETAIL C-101-1
NOT TO SCALE



2 DETAIL C-101-2
NOT TO SCALE



The City of Columbia, Missouri,
 a municipal corporation
 WD Bk 2645 Pg 21
 Lot 501 The Cascades, Plat No. 5
 PB 38 Pg 114
 20-200-00-03-281.00

DATE	
DESCRIPTION	
BY	
CHECKED	
DATE	

Bartlett & West
 CIVIL ENGINEERS & ARCHITECTS
 1114 CHANDLER ST., SUITE 100 • COLUMBIA, MISSOURI 65201
 PHONE: (314) 425-1111 FAX: (314) 425-1112
 www.bartlettwest.com

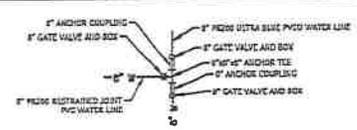
DISTRIBUTION SHEET
 SINCLAIR-ROUTE K ROUNDABOUT WATER LINE RELOCATION
 CPWSD NO. 1 OF BOONE COUNTY, MISSOURI
 DISTRICT PROJECT NO. 2019-004



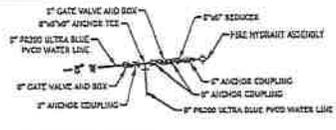
DESIGNED BY	CAE
CHECKED BY	CAE
APPROVED BY	TCB
ISSUED FOR	7811.021
DATE	JULY 2020
DRAWING NO.	C-101
SHEET NO.	2 OF 6

Project: Sinclair Roundabout Water Line Relocation - District Project No. 2019-004
 Drawing: Distribution Sheet C-101
 Date: July 2020
 Scale: 1" = 30'
 Sheet: 2 of 6

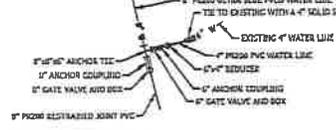
EAK IS ONE THIRD OF OFFICIAL DRAWINGS. IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.



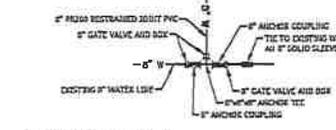
1 DETAIL C-102-1
NOT TO SCALE



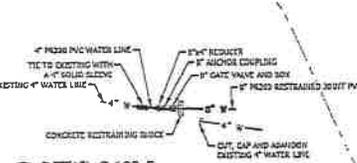
2 DETAIL C-102-2
NOT TO SCALE



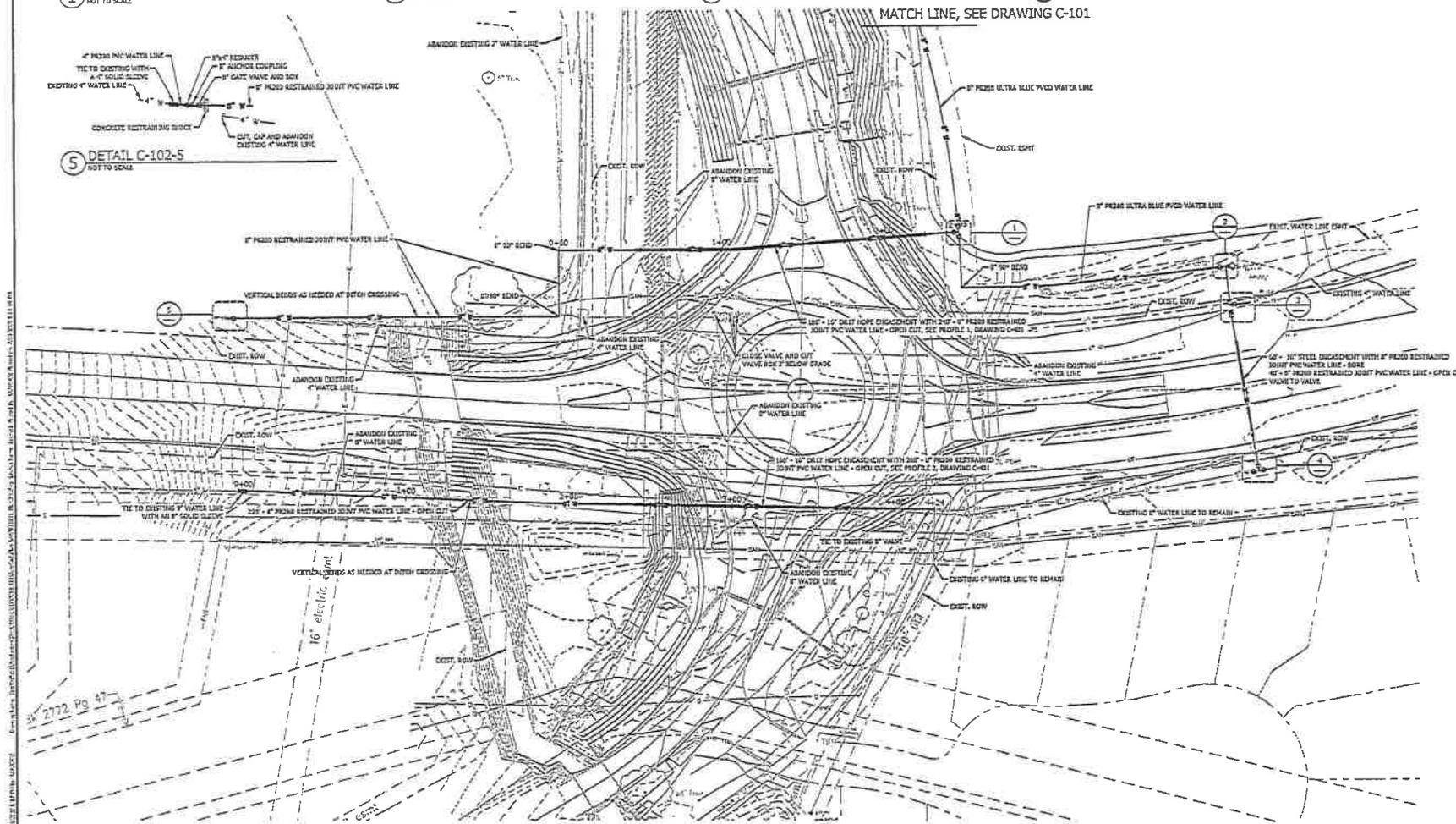
3 DETAIL C-102-3
NOT TO SCALE



4 DETAIL C-102-4
NOT TO SCALE



5 DETAIL C-102-5
NOT TO SCALE



DISTRIBUTION SHEET
SCALE 1"=30'

Bartlett & West

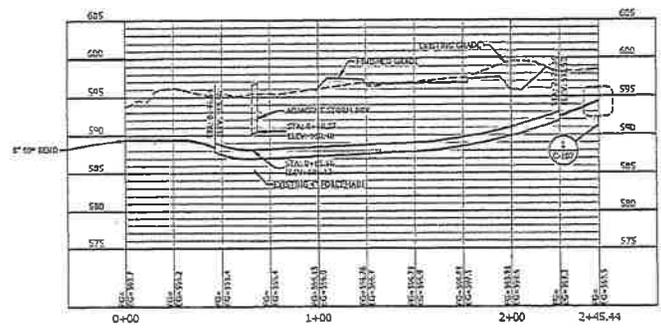
1111 SOUTH PARKWAY, SUITE 100, JEFFERSON CITY, MISSOURI 64104
PH: 816.251.1111 FAX: 816.251.1112
WWW.BARTLETTWEST.COM

DISTRIBUTION SHEET
SINCLAIR-ROUTE K ROUNDABOUT WATER LINE RELOCATION
CPWSD NO. 1 OF BOONE COUNTY, MISSOURI
DISTRICT PROJECT NO. 2018-004

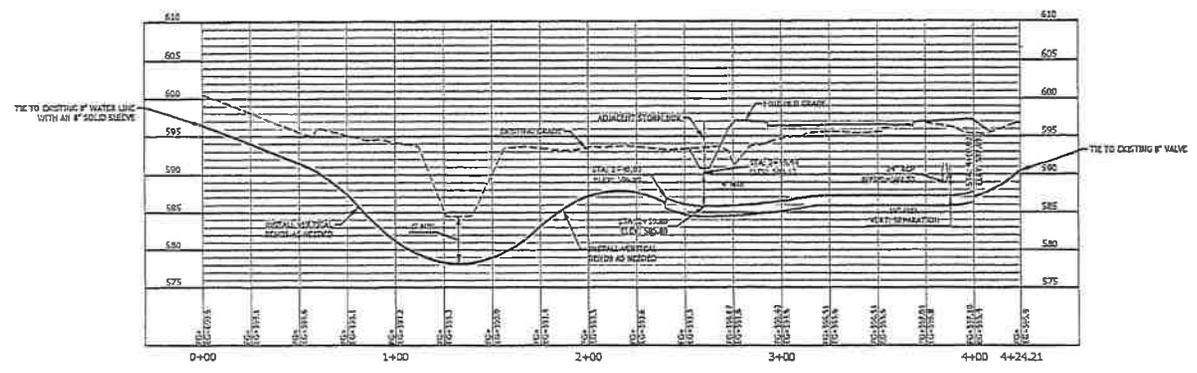


DATE	07-30-2020
DESIGNED BY	EAK
DRAWN BY	EAK
APPROVED BY	TCS
ISSUED FOR	2018.004
DATE	MAY 2018
DESIGNED NO	C-102
SHEET NO	3 OF 6

DATE IS ONE INCH ON OFFICIAL DRAWINGS. 1" = 10' NOT ONE INCH ABOUT SCALE ACCORDINGLY.



1 PROFILE 1
SCALE 1"=20'



2 PROFILE 2
SCALE 1"=20'

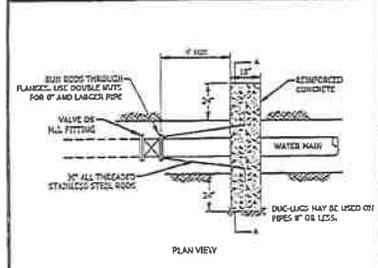
DRAWING NO. 2018-004
 PROJECT NO. 1 OF BOONE COUNTY, MISSOURI
 DISTRICT PROJECT NO. 2018-004
 DATE: JULY 2018
 DRAWN BY: C-401
 CHECKED BY: EAK
 DESIGNED BY: EAK
 PROJECT NO: 2018-004
 DISTRICT PROJECT NO: 2018-004
 DATE: JULY 2018
 DRAWING NO: C-401
 SHEET NO: 4 OF 2

Bartlett & West

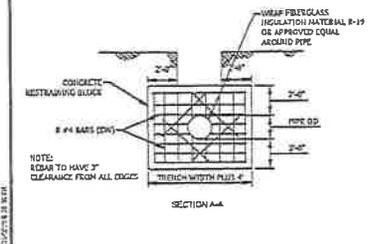
PROFILES
 SINCLAIR-ROUTE K ROUNDABOUT WATER LINE RELOCATION
 CPWSD NO. 1 OF BOONE COUNTY, MISSOURI
 DISTRICT PROJECT NO. 2018-004



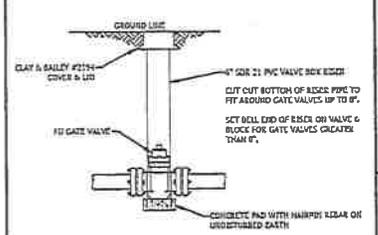
DESIGNED BY:	EAK
CHECKED BY:	EAK
PROJECT NO:	2018-004
DISTRICT PROJECT NO:	2018-004
DATE:	JULY 2018
DRAWING NO:	C-401
SHEET NO:	4 OF 2



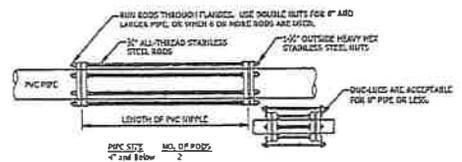
PIPE SIZE	NO. OF RODS
4" - 6"	4
6" - 8"	7
10" - 14"	7
16" - 18"	8
20" - 24"	12



2 HAIRPIN REBAR DETAIL
NOT TO SCALE



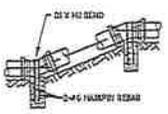
3 GATE VALVE AND VALVE BOX DETAIL
NOT TO SCALE



PIPE SIZE	NO. OF RODS
4" - 6"	2
6" - 8"	4
10" - 14"	4
16" - 18"	8
20" - 24"	12

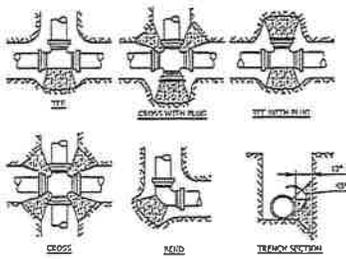
NOTES:
TIEBACK RODS MAY BE ATTACHED TO ALL FITTINGS, VALVES, HYDRANTS, AND CONCRETE RESTRAINING BLOCKS.

4 TIEBACK ROD DETAILS
NOT TO SCALE



VERTICAL REBAR THRUST BLOCK DETAIL

VERTICAL THRUST BLOCKS									
PIPE SIZE	MIN. VOLUME OF CONCRETE	MIN. SPACING							
4"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
6"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
8"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
10"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
12"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
14"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
16"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
18"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
20"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
24"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23

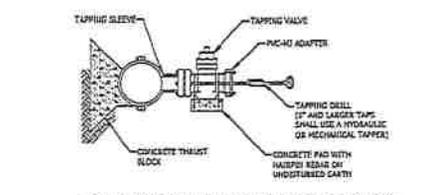


HORIZONTAL THRUST BLOCKS									
PIPE SIZE	MIN. VOLUME OF CONCRETE	MIN. SPACING							
4"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
6"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
8"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
10"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
12"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
14"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
16"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
18"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
20"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23
24"	11.23	22.4	4.8	9.6	11.23	22.4	4.8	9.6	11.23

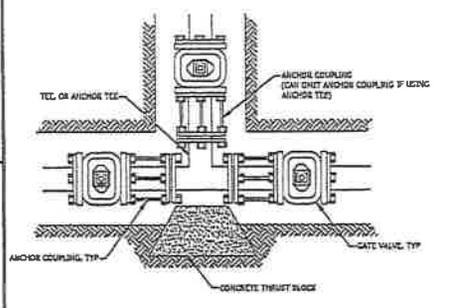
HORIZONTAL REBAR THRUST BLOCK DETAIL

NOTES:
1. THRUST BLOCKS SHALL BE FORMED AND POURED ACCORDING TO THE DETAIL. KEEP 1\"/>

8 THRUST BLOCKING DETAIL
NOT TO SCALE



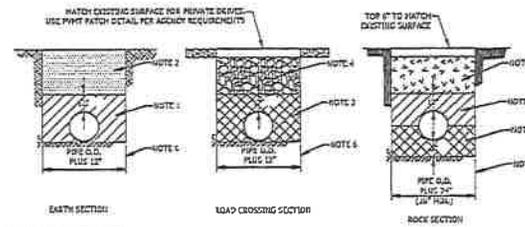
5 TAPPING SLEEVE AND VALVE ASSEMBLY
NOT TO SCALE



6 VALVES AT INTERSECTIONS & BRANCH LINES
NOT TO SCALE

- GENERAL NOTES:
- NO WORK SHALL BE STARTED WITHOUT NOTIFYING THE WATER DISTRICT AT LEAST 72 HOURS IN ADVANCE AT (501) 409-8000.
 - CONTRACTOR SHALL OBTAIN A BOONE COUNTY PERMIT FOR PUBLIC WORKS, WHEN REQUIRED.
 - THE WATER DISTRICT WILL OBTAIN A HOUST PERMIT, WHEN REQUIRED. ANY OTHER PERMITS ARE CONTRACTOR'S RESPONSIBILITY.
 - CONTRACTOR IS RESPONSIBLE TO HAVE ALL UTILITIES WITHIN PROJECT AREA LOCATED IN THE FIELD PRIOR TO CONSTRUCTION. CONTACT MISSOURI GAS LOCATOR AT 1-800-541-1111 OR 811.
 - WATER LINE ALIGNMENT TO BE STAKED BY THE WATER DISTRICT. VARIANCE FROM APPROVED ALIGNMENT MUST BE APPROVED BY THE WATER DISTRICT PRIOR TO INSTALLATION.
- INSTALLATION NOTES:
- MINIMUM COVER ON WATER LINE SHALL BE 48", UNLESS OTHERWISE NOTED.
 - LOCATOR WIRE SHALL BE INSTALLED ON ALL PIPE INCLUDING SERVICE CROSSINGS. TWO STRAKES OF LOCATOR WIRE SHALL BE INSTALLED ON HIGHWAY ROADS AND CROSS CROSSINGS.
 - HORIZONTAL 10' OF HORIZONTAL AND 10' OF VERTICAL SEPARATION BETWEEN WATER LINES AND UNDESIRABLE LINES.
 - CONTRACTOR TO CONFIRM ALL SERVICE CROSSINGS, AS REQUIRED.
 - CONCRETE THRUST BLOCKING MUST BE APPROVED BY THE WATER DISTRICT INSPECTOR BEFORE POURING BLOCKS. CONCRETE BLOCKS OR CURBSETS SHALL NOT BE ALLOWED.
 - TEMPORARY BLOWOFFS, FURN VALVES, ETC. WILL BE THE CONTRACTOR'S RESPONSIBILITY FOR INSTALLATION AND REMOVAL, AS NECESSARY.
 - TRENCH BACKFILL UNDER PRIVATE ROAD CROSSINGS SHALL BE 3" CLEAN SAND. TRENCH BACKFILL FOR PRIVATE CROSSINGS AND COUNTY ROADS SHALL BE 3" COMPACTED SIEVE SAND.
 - TIE-BARS OR WET TAP TIE-BARS SHALL BE MADE ONLY AFTER CONTRACTOR OR INDIVIDUAL HAS COORDINATED AND ACQUIRED PERMITS FROM THE WATER DISTRICT AS TO:
 - ACTUAL TIME OF DAY SERVICE WILL BE DISCUSSIBLE.
 - METHOD OF TIE-IN AND MATERIALS HAVE BEEN APPROVED BY THE WATER DISTRICT INSPECTOR.
 - ALL MATERIALS NEEDED FOR TIE-IN ON SITE AND ASSEMBLED AS FAR AS POSSIBLE.
 - NO TIE-BARS TO BE SCHEDULED ON HOLIDAYS, WATER DISTRICT PAID HOLIDAYS OR WEEKENDS.
 - CONTRACTOR TO CLEANUP, STAKE AND MAINTAIN AS PER PROJECT SPECIFICATIONS.
 - ALL PIPES WITH OPEN ENDS (EXCEPT FOR ANTI-SIPHON) SHALL BE CAPPED.
 - VALVES TO BE ANCHORED WILL REQUIRE THE EXTERIOR TO BE AT LEAST 12" BELOW THE GROUND. THE LID WILL BE COVERED TO THE WATER OUTLET.
 - FITTINGS TO BE MECHANICAL JOINT DUCTILE IRON. PVC FITTINGS GREATER THAN 3" WILL NOT BE ALLOWED. ALL MECHANICAL JOINT FITTINGS SHALL HAVE ON-LOAD JOINT RESTRAINTS.
 - TIES WITH ANCHOR GROUPINGS MAY BE USED IN LINES OF ANCHOR TIES SHOWN ON THE PLANS.
 - USE OF 3/4" ALL-THREAD STAINLESS STEEL TIE-BACK RODS MAY BE APPROVED BY THE WATER DISTRICT INSPECTOR IN PLACE OF ANCHOR COUPLINGS.

1 RESTRAINING BLOCK DETAIL
NOT TO SCALE



- NOTES:
- SUITABLE EARTH EXCAVATED MATERIAL FREE FROM DEBRIS, MUCK, MUD BALLS, ROCK, AND HARD OBJECTS LARGER THAN 1" DIA. PIPE SHALL REST ON UNDISTURBED EARTH WITH CONTACT FOR PIPE DIAL.
 - SUITABLE EARTH EXCAVATED MATERIAL FREE FROM DEBRIS, MUCK, MUD BALLS, ROCK, AND HARD OBJECTS LARGER THAN 2" DIA.
 - WASTES BEHIND 1/4" OR SMALLER.
 - FOR COUNTY ROAD USE 3/4" THICK LIMESTONE ROCK. FOR OTHER ROADWAYS AND PRIVATE DRIVES USE 1" CLEAN LIMESTONE ROCK, OR AS REQUIRED BY LOCAL JURISDICTION. SUITABLE MIN. OF EARTH EXCAVATED MATERIAL WITH NO HOLE THRU SOLE EXCEPT TO ROCK NO LARGER THAN 1/4" DIA.
 - ADDITIONAL TRENCH WIDTH AS REQUIRED TO INSTALL FITTINGS AND THRUST BLOCKS.
 - ADDITIONAL TRENCH WIDTH TO INSTALL FITTINGS AND THRUST BLOCKS TO BE PIPE O.D. PLUS 12" WITH A MINIMUM OF 4".
- NOTES:
- EXCAVATED MATERIAL SHALL BE TAMPED BY LAYERS UNDER THE PIPE MANHOLES AND AROUND THE PIPE TO TOP OF PIPE, TO PROVIDE A UNIFORM BEARING SURFACE.
 - ANY OVER EXCAVATION DUE TO REMOVAL OF UNSUITABLE MATERIAL IN THE BOTTOM OF THE TRENCH SHALL BE BACKFILLED WITH ACCEPTABLE MATERIAL AND COMPACTED.
 - COVER OVER THE PIPE SHALL BE 48" UNLESS OTHERWISE SHOWN ON THE PLANS.
 - LOCATOR WIRE, NOT SHOWN, SHALL BE INSTALLED ON ALL PIPE.
 - FOR ROCK SECTION, PROVIDE A 2" LONG CARTON (SEE SECTION) OF SUITABLE EARTH EXCAVATED MATERIAL FROM BOTTOM OF TRENCH TO TOP OF TRENCH A MINIMUM SPACING OF 100 FT, OR AS DIRECTED BY THE DISTRICT INSPECTOR.

7 PIPE TRENCHING DETAIL
NOT TO SCALE

Bartlett & West
ENGINEERS, ARCHITECTS, PLANNERS AND SURVEYORS
1000 WEST 10TH AVENUE, SUITE 100
DENVER, COLORADO 80202
PHONE: (303) 733-1111
FAX: (303) 733-1112
WWW.BARTLETTWEST.COM

CONSTRUCTION DETAILS
SINGLE-LANE ROUTE K ROUNDABOUT WATER LINE RELOCATION
CIVIL NO. 1 OF BOONE COUNTY, MISSOURI
DISTRICT PROJECT NO. 2018-004



DATE PLOTTED	8/10/2018
DESIGNED BY	EAJ
CHECKED BY	EAJ
DATE PLOTTED	7/17/2018
SCALE	1"=10'
PROJECT NO.	2018-004
DATE	JULY 2018
DRAWING NO.	C-501
SHEET NO.	5 of 6

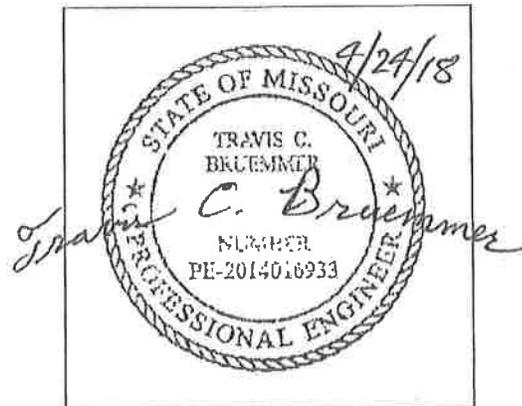
STANDARD SPECIFICATIONS AND DETAILS

FOR

**CONSOLIDATED PUBLIC WATER SUPPLY DISTRICT NO. 1
OF BOONE COUNTY, MISSOURI**

PREPARED BY

**BARTLETT & WEST, INC.
CERTIFICATE OF AUTHORITY NO. 000167-ENGINEERING
1719 SOUTHRIDGE DRIVE, SUITE 100
JEFFERSON CITY, MO 65109**



**TRAVIS C. BRUEMMER, P.E.
LICENSE NO. PE-2014016933**

EXHIBIT "B"

APRIL 2018

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Bartlett & West

SECTION 02512

WATER DISTRIBUTION SYSTEM
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1. GENERAL

1.1 SCOPE

The work included in these specifications consists of the construction of a new water system. The work consists of the complete and satisfactory construction, testing and sterilization of the system, ready for use as shown and specified. Construction plans indicate all work that is to be performed.

The work includes the furnishing of all materials, tools, and equipment to install new water pipe, fittings, valves, valve covers, hydrants, meters and all incidental and miscellaneous work necessary to complete the project.

1.2 SUBMITTALS

Contractor shall submit to the District for review all materials proposed for the project, including pipe, valves, fire hydrants, fittings, and other items. Gravel, concrete, asphalt and seeding does not have to be submitted, but will be approved by the District Inspector prior to installation.

2. TRENCH EXCAVATION & BACKFILL

2.1 CONSTRUCTION STAKING

The District will stake water lines, hydrants, structures, etc. shown on the drawings. Service meter pits and service connections to mains will be field determined by the District Inspector.

2.2 SITE PREPARATION

- A. Contractor shall remove trees, bushes, tree stumps, roots, debris, and other vegetation, as required for installations.
- B. Contractor shall remove pavement, road surfacing, junk and structures.
- C. Contractor shall mark adjacent property, fences, trees, and structures that are to be protected.
- D. All salvageable materials, as determined by the District Inspector, shall be set aside for District pickup. All non-salvageable materials shall be removed from the site and properly disposed by Contractor.

2.3 UNDERGROUND UTILITY LOCATIONS

The Contractor shall comply with Sec. 319.015 - 319.050 RS MO and shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and he shall be held responsible for the repair of such structures when broken or otherwise damaged because of carelessness on his part.

The actual location of existing utilities is the sole responsibility of the Contractor. Those shown on the plans are given to call particular attention to areas of special concern. Contractor shall contact one call (1-800-DIG-RITE), as well as individual utilities as necessary to insure all utilities are located in the field prior to construction.

2.4 SEPARATION OF WATER MAINS, SANITARY SEWERS AND STORM SEWERS

A. General

The following factors should be considered in providing adequate separation prior to trench excavation as required by the Missouri Department of Natural Resources (DNR):

1. Materials and type of joints for water and sewer pipes.
2. Soil conditions.
3. Service and branch connections to the water main and sewer line.
4. Compensating variations in the horizontal and vertical separations.
5. Space for repair and alterations of water and sewer pipes.
6. Off-setting of pipes around manholes.

B. Parallel Installation

Water mains shall be laid at least ten feet horizontally from any existing or proposed line carrying non-potable fluids such as, but not limited to drains, storm sewers, sanitary sewers, combined sewers, sewer service connections, and process waste or product lines. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten-foot separation, the DNR-Public Drinking Water Branch may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a non-potable line, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the non-potable line and on either case, at such an elevation that the bottom of the water main is at least 18 inches above the top of the non-potable line.

In areas where the recommended separations cannot be obtained, either the waterline or the non-potable line shall be constructed of mechanical or manufactured restrained joint pipe, fusion welded pipe, or cased in a continuous casing. Casing pipe must be a material that is approved for use as water main. Conventional poured concrete is not an acceptable encasement.

C. Crossings

Water mains crossing sewers, or any other lines carrying non-potable fluids shall be laid to provide a minimum vertical clear distance of 18 inches between the outside of the water main and the outside of the non-potable pipeline. The water main shall always be installed above the non-potable pipeline. 18-inch separation is a structural protection measure to prevent the sewer or water main from settling and breaking the other pipe. At crossings, the full length of water pipe shall be located so both joints will be as far from the non-potable pipeline as possible but in no case less than ten feet or centered on a 20-foot pipe. In areas where the recommended separations cannot be obtained either the waterline or the non-potable pipeline shall be constructed of mechanical or manufactured restrained joint pipe, fusion welded pipe, or cased in a continuous casing that extends no less than ten feet on both sides of the crossing. Special structural support for the water and sewer pipes may be required. Casing pipe must be a material that is approved for use as water main. Conventional poured concrete is not an acceptable encasement.

D. Exception

Any exception from the specified separation distances above (parallel and crossing) must be submitted to the Missouri Department of Natural Resources for approval.

E. Force Mains

There shall be at least a ten-foot horizontal separation between water mains and sanitary sewer force mains or other force mains carrying non-potable fluids and they shall be in separate trenches. In areas where the recommended separations cannot be obtained, either the waterline or the non-potable line shall be constructed of mechanical joint pipe or cased in a continuous casing, be constructed of mechanical joint pipe, or be jointless or fusion welded pipe. Where possible, the waterline shall also be at such an elevation that the bottom of the water main is at least 18 inches above the top of the non-potable line. Casing pipe must be a material that is approved for use as water main. Conventional poured concrete is not an acceptable encasement.

F. Sewer Manholes

No waterline shall be located closer than ten feet to any part of a sanitary or combined sewer manhole. Where the separation cannot be obtained, the waterline shall be constructed of mechanical

or manufactured restrained joint pipe, fusion welded pipe, or cased in a continuous casing. Casing pipe must be a material that is approved for use as water main. The full length of water pipe shall be located so both joints will be as far from the manhole as possible, but in no case less than ten feet or centered on a 20-foot pipe. No water pipe shall pass through or come into contact with any part of a sanitary or combined sewer manhole.

G. Disposal Facilities

No water main shall be located closer than 25 feet to any wastewater disposal facility, agricultural waste disposal facility, or landfill. Water mains shall be separated by a minimum of 25 feet from septic tanks and wastewater disposal areas such as cesspools, subsurface disposal fields, pit privies, land application fields, and seepage beds.

2.5 PIPE TRENCH EXCAVATION

A. Excavation Method

The Contractor shall use a backhoe or excavator to dig the trench. A trencher type excavation machine may be used as approved by the District. In yards with sod or turf type surfaces, the operator shall take special care and remove excavated materials without removing additional turf beyond the trench.

B. Depth of Pipe

Minimum depth of cover over pipe shall be forty-eight inches (48") as measured from the final ground level to the nearest surface of the pipe. Greater depths will be required to make smooth transitions at points of abrupt changes in the ground surface. Extra depths may be required under highways, railroads, and streams. These extra depth conditions will conform to the requirements as shown on the drawings, and as required by other agencies involved.

C. Trench Width

The width of the trench shall be ample to permit the pipe to be laid and jointed properly, and the backfill to be placed and compacted as specified. Trenches shall be of such extra width, when required, as will permit the convenient placing of timber supports, sheeting and bracing and handling of fittings. Minimum trench widths are shown on the plans.

D. Shoring

Open cut trenches shall be sheeted and braced as required by any governing federal or state law, municipal ordinances, and as may be necessary to protect life, property, or the work. Where sheeting and bracing are used, the trench width shall be increased accordingly. Trenches shall be kept free from water and pipe shall not be laid in water or on soggy material.

Temporary support, adequate protection, and maintenance of all underground and surface structures, drains, sewers, and other obstructions encountered in the progress of the work shall be furnished by the Contractor at his expense and under the direction of his Engineer. Any structures that have been disturbed shall be restored upon completion of the work

E. Removal of Pavement

The Contractor shall remove pavement and road surfaces as a part of the trench excavation, and the amount removed shall depend upon the width of trench specified for the installation of the pipe and the width and length of the pavement area required to be removed for the installation of valves, specials, manholes, or other structures. The width of pavement removed along the normal trench for the installation of the pipe shall not exceed the width of the trench specified by more than 6" on each side of the trench. The width and lengths of the area of pavement removed for the installation of appurtenances shall be equivalent to those for the associated pipeline or 6" wider than the appurtenance (whichever is greater). Wherever, in the opinion of the District Inspector, existing conditions make it necessary or advisable to remove additional pavement, the Contractor shall remove it as directed by the District Inspector and shall receive extra compensation therefore, provided such additional work is not shown in the drawings or specified. The Contractor shall use such methods, such as drilling, chipping, or sawing as will assure the breaking of the pavement along straight lines. The face of the remaining pavement shall be approximately vertical.

F. Protection of Property

All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Roadway gutters shall be kept clear or other satisfactory provisions made for street drainage. Natural watercourses shall not be obstructed.

Trees, shrubbery, fences, poles, and all other property and surface structures shall be protected unless their removal is shown on the drawings or authorized by the District Inspector. When it is necessary to cut roots and tree branches, such cutting shall be done under the supervision and direction of the District Inspector.

G. Stream Crossing

When crossing watercourses greater than 15 feet in width, the following shall be provided per the Missouri Department of Natural Resources:

1. Flowing Streams

a) Restrained joint pipe shall be used for open cut crossings and encased in a welded steel casing. Restrained joint pipe shall be used for bored crossings.

b) Valves shall be provided at both ends of water crossings so that the section can be isolated for testing or repair; the valves shall be easily accessible and should not be subject to flooding; a Water Sampling Station shall be installed at the valve closest to the supply source in an accessible location.

c) Water Sampling Stations shall have permanent taps on each side of the valve to allow insertion of a small meter to determine leakage and for sampling purposes.

d) The stream crossing pipe or casing shall extend at least 15 feet beyond the upper edge of the stream channel on each side of the stream.

2. Intermittent Flowing Streams

a) Restrained joint pipe shall be used for all stream crossings;

b) The pipe shall extend at least 15 feet beyond the upper edge of the stream channel on each side of the stream.

3. Culverts and Ditches

Waters lines under ditches, outflows of culverts, and other places which have or could exhibit severe cutting or erosion shall be encased as indicated in the drawings. Encasement shall be placed at such points as located on the drawings. The Engineer or District Inspector may require additional locations to be encased. Extra compensation will be allowed for such additional work.

H. Barricades, Guards, & Safety Provisions

To protect persons from injury and to avoid property damage, adequate barricades, construction signs, torches, red lanterns, and guards, as required shall be placed and maintained during the progress of the construction work and until it is safe for traffic to use the highway. All material piles, equipment, and pipe that may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor. Safety rules and regulations of local authorities shall be observed.

I. Maintenance of Traffic & Closing of Streets

The Contractor shall carry on the work in a manner that will cause the least interruption in traffic and may close to through travel not more than two consecutive blocks, including the cross street intersected. The Contractor shall provide suitable bridging over the trench where traffic must cross open trenches.

The Contractor shall post suitable signs indicating that a street is closed and necessary detour signs for the proper maintenance of traffic. All signage will meet the Manual of Uniform Traffic Control Devices (MUTCD). Adequate signage will be required in the Work Zone.

2.6 BEDDING

A. General

The bedding material shall be placed in the bottom of the trench prior to placement of the pipe. The bedding below the pipe shall provide continuous and uniform bearing for the pipe except at the bell or joints at which a hole shall be dug to prevent the end from bearing. From the bottom of the trench to a depth of one foot above the top of the pipe, the trench bedding shall be placed around the pipe by shovel slicing or other means so that voids are eliminated. Bedding material around the pipe shall be thoroughly tamped to provide uniform and continuous bearing. The material shall be consolidated to 90% Standard Proctor. The Contractor shall use special care in placing bedding material to avoid damage or movement of the pipe. Frozen material will not be allowed for bedding.

B. Poor Soil

Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, refuse, vegetable or other organic material, or large pieces or fragments of inorganic material that will not provide adequate long term support, the Contractor shall excavate any such unsuitable material. Replaced material in the overdig area shall be thoroughly compacted with acceptable earth excavation or granular material, as approved by the District Inspector.

C. Rock

Rock ½ inch or larger shall be not be used in the bedding.

2.7 BACKFILLING

A. General

Backfill material shall be placed above the pipe bedding to the top of the trench with excavated material. The backfill shall be neatly rounded over the trench to a sufficient height to allow for settlement to grade after consolidation to make the earth surface conform as nearly as possible to the original condition. Backfilling material shall be deposited in the trench for its full width on each side of the pipe, fittings, and appurtenances simultaneously. Backfilling by machine methods will be allowed, if overseen by laborers to watch for rock, improper backfill material, and damage to pipe.

The replacement of backfill material into the trench shall be accomplished by running equipment parallel to the trench. The process of running equipment perpendicular to the trench to push backfill into the trench is prohibited.

Laborers following behind the backfill operation shall be using a shovel to remove remaining small amounts of earth from turf so that the work areas (not the trench area) will be restored to their original condition the day the excavation occurs.

The Contractor may backfill with excavated material where backfill material is not indicated on the drawings or specified. If excavated material is unsuitable for backfill as determined by the District Inspector, the Contractor shall provide approved material to backfill the trench.

If the excavated material consists of sand or loam or clay which has been excavated in a manner to eliminate lumps or clods (e.g. excavation by a trenching machine), the trench may be backfilled by means of a road grader or similar device, which will gently roll the material into the trench by multiple passes parallel to the trench.

Where additional trench settlement occurs, refilling shall be required to bring the surface to conform to the adjacent ground.

B. Backfill under Permanent Pavement

Where the excavation is made through permanent pavements, curbs, driveways, or sidewalks, or where such pavements are undercut, the entire trench shall be backfilled to the subgrade of the pavement with sand or granular backfill material. Backfill shall be compacted to 90% of the maximum Standard Proctor for the material. Backfill in trench shall not exceed 8" lifts.

C. Backfill under Private Gravel Drives

Walks and driveways consisting of broken stone, gravel, slag, or cinders shall be backfilled and compacted with suitable excavated material. If excavated material is not suitable or as directed by the District Inspector, the trench shall be backfilled and compacted with 1" surface rock. The top 12" of backfill shall match the existing aggregate.

D. Backfilling around Structures

Compacted backfill will be required around valve boxes, fire hydrants and other items, which project to ground, surface to insure continuity of proper alignment.

E. Backfilling in Freezing Weather

Backfilling will not be allowed in freezing weather except as approved by the District Inspector. No fill shall be made where the material already in the trench is frozen, and in no instances shall frozen material be used in the backfill.

F. Excess Excavated Material

Excess excavated materials from trenches located in open fields shall be uniformly distributed within the construction limits. Excess excavated materials within streets, driveways, parkways, highways and roads not required for backfilling or grading shall be removed from the site.

3. PIPE, JOINTS AND FITTINGS

3.1 GENERAL

- A. Each pipe shall be clearly marked indicating thickness class, net weight of pipe without lining, and name of manufacturer. The Certificate of Conformance shall in effect state the material is PVC 1120 and meets the requirements of ASTM D2241-65 or latest revision thereof.
- B. The same type of joint shall be used throughout the project for a particular type of pipe, unless otherwise specified.
- C. Pipe shall be installed according to the manufacturer's recommendations and these specifications.

3.2 REFERENCES

Gray Iron Castings for Valves, Flanges and Pipe Fittings	ANSI/ASTM A126
Rigid Poly Vinyl Chloride (PVC) Compounds	ANSI/ASTM D1784
Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings	ANSI/ASTM D2564
Ductile Iron and Gray-Iron fittings	ANSI/AWWA C110
Elastomeric Seals (gaskets) for Joining Plastic Pipe	ASTM F477, D3139
Polyvinyl Chloride (PVC) Pressure Pipe	ANSI/AWWA C900, C905
Standard for Molecular Oriented Polyvinyl Chloride	AWWA C909, ASTM F1483
Practice for Making Solvent-Cemented Joints with Poly-Vinyl Chloride (PVC) Pipe and Fittings	ASTM D2855

3.3 PIPE

A. Ductile Iron Pipe	ANSI/AWWA C150/A21.50; C151/A21.51; C115/A21.15 Class 50, except as otherwise specified; cement lined and sealed meeting ANSI/AWWA C104/A21.4.
B. PVC Pipe	ASTM 2241 IPS pressure rated pipe, AWWA C900, AWWA 905, AWWA 909, ASTM F1483, Schedule 40 & 80 meeting ASTM D 1785 NSF Standard 14 and CSA Standard B137.3
C. PVC Restrained Joint Pipe Integral Bell	ASTM D2241, C900RJ, or C905RJ Machining matching grooves in the pipe and coupling or bell with a nylon spline inserted into the groove. Couplings may be used, only as approved by the District Inspector.
D. Polyethylene Service Pipe Service Line Size	ASTM D2239 and PE 3408, SDR-7 pressure rated for 200 psi 3/4" size short side connection to meter 1" size under roadways to meter 2" size under roadways to double meters
E. Copper Pipe Coupling Copper to Copper PE to Copper PVC to Copper	ASTM B88 "Type K" with no splice under pavement. Ford pack joint Ford pack joint with stainless steel insert Schedule 80 PVC Nipple 12 inches long inserted into the pack joint and the other end is coupled with a standard PVC rubber ring coupling.
F. Brass Pipe	ASTM B43 for red brass pipe

3.4 CASING PIPE

PVC Pipe

8 inch through 15 inch	SDR 26 per ASTM D3034, or ASTM 2241
18 inch through 27 inch	ASTM F789 PS 115, or equivalent pipe stiffness.
Joint	Bell and spigot meeting ASTM D3212 if open cut construction, or restrained joint pipe if bored.
Rubber Gasket	ASTM F477. Solvent weld or non-gasket friction joints are not acceptable.

Steel Pipe

Yield Strength	35,000 psi conforming to ASTM A53-B
Thickness	As defined in the project requirements or authorizing permit agency
Length	Random lengths of pipe may be used, but all ends must be V grooved-butt welded around the complete perimeter to adjacent pipe.
Welds	Water tight and equal to or stronger than pipe

HDPE Pipe	PE 3608/4710 DR 11 High Density Polyethylene meeting ASTM F 714, AWWA C906
Size	DIPS or IPS are acceptable based on the required clearance of the casing spacer, carrier pipe size and required minimum clearance as defined in this specification section.
Joint	ASTM D 3261 Heat Fusion in conformance to PPI-TR-2. Remove excess material (burrs) on outside of pipe. Remove inside burrs.
Fusible PVC Pipe	Fusible pipe to meet AWWA C900 and AWWA C905 based on pipe size
Pipe	ASTM 2241 or ASTM D1785, as applicable.
Size	As shown on the plans, or acceptable size based on the required clearance of the casing spacer, carrier pipe size and required minimum clearance as defined in this section.
Joint	Butt-fused heated joint, as required by manufacturer and in conformance to PPI-TR-2. Burst test of fused sections per ASTM D1599. Remove excess material (burrs) on inside of pipe.

3.5 PIPE JOINTS

A. General

The coupling-joint system shall have been tested and approved by the National Sanitation Foundation and certification of said approval shall be submitted.

Pipe ends shall be clean and smooth. Pipe lengths shall be such that a space is left between pipe ends of not less than ¼ inch or more than 1 inch. Pipe shall have a ring painted around the spigot end in such a manner as to allow field checking of setting depth of pipe in socket.

If manufacturer's design is such that excessive homing of pipe is detrimental, then two rings shall be required to meet tolerances. Contractor shall back pipe up to maintain position required.

The manufacturer shall furnish drawings of the joint and gasket. The dimensions of the bell, socket, and plain end shall be in accordance with the manufacturer's standard design dimensions and tolerances. Such dimensions shall be gauged at sufficiently frequent intervals to assure dimensional control and satisfactory joint assembly.

No contaminated material or any material capable of supporting prolific growth of microorganisms shall be used for sealing joints. Packing material shall be handled in such a manner as to avoid contamination. Packing materials must conform to AWWA Standards.

B. PVC Pipe Joints

Push-on Joint	ASTM Spec D3139. Bell end shall have tapered socket to create an interference type fit, as defined in ASTM D2672
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Gasket	Elastomeric Seals meeting ASTM F-477
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C. Ductile Iron Pipe Joints

Mechanical Joint	ANSI/AWWA C111/A21.11. Mechanical joint ductile iron fittings shall be used for all pipe sizes greater than 2-inch. Oversize (transition) gasket for use in ductile iron fittings will be acceptable
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Push-on Joint	ANSI/AWWA C111/A21.11, except gaskets shall be neoprene or other synthetic rubber. Natural rubber will not be acceptable.
Restrained Push-On Joint	Pipe with restrained push-on joint shall be capable of being deflected to 4° after assembly for pipes 12" in diameter and smaller. US Pipe TR Flex, Griffin Snap-Lok or approved equal.
Flange	ANSI/AWWA C110/A21.10, C115/A21.15, ANSI B16.1, B16.5
Steel Flange	U.S. Pipe "Flange-Type" ASTM C207
Bolt	ASTM A307 chamfered or rounded ends projecting ¼ to ½ inch beyond outer face of nut.
Nut	ASTM A307 hexagonal, ANSI B18.2, heavy semi-finished pattern
Gasket	ANSI/AWWA C111/A 21.11 and ASTM D1330, Grade I, red rubber, ring type, 1/8 inch thick; or U.S. Pipe "Flange-Tyte" 1/8 inch thick.
Packing Material	Yarning or packing material shall consist of molded or tubular rubber rings.
D. Uni-Flange Pipe Restraint	
PVC Pipe Barrel	Ford Meter Box Co., Series UFRCS 1300
PVC Pipe Bell Joints	Ford Meter Box Co., Series UFRCS 1390
E. Ductile Iron Lugs	ASTM A 536 for ¾" rods.
3.6 FITTINGS	
A. Ductile Iron Fittings	
General	ANSI/AWWA C110/A21.10, and to be compact type meeting ANSI/AWWA C153/A 21.53; 350 psi rated Cement lined and sealed meeting ANSI/AWWA C104/A21.4, and bituminous coating for outside pipe per manufacturer's standard.
Sleeves/Adapters	
DI to DI	Mechanical joint solid sleeve
DI to Steel or galvanized	Mechanical joint solid sleeve with sleeve size changed to accommodate pipe OD.
DI to IPS	Mechanical joint solid sleeve with PVC transition gasket.
IPS to Steel	Mechanical joint solid sleeve
AC to IPS	Hymax 2000 as manufactured by Total Pipe Solutions, Inc.
Anchor Coupling (Swivel Gland)	Fast Fabricators, Inc., or equal. Used with tees and solid adapters.
Tapped Fitting	Threaded, tapered. Used on tees and plugs.

B.	Brass Fittings	Ford Brass Fittings meeting ASTM B-62																								
	Polyethylene To Brass	Ford Fitting - stab type compression fitting with Reverse Taper																								
C.	Plastic Fittings																									
	PR 200 (< 4" size)	ASTM D 3139 NSF approved and marked, and used only with Water District approval.																								
	Schedule 40 & 80 Solvent Weld Threaded End Gasket Bell	ASTM D1784 ASTM D2467 ASTM D2464 ASTM D3139																								
D.	Tapping Saddle																									
	To Ductile Iron Pipe	Ductile iron with stainless steel wrap-around and rubber sealing gasket; 250 psi pressure rating																								
	To Ductile Iron Pipe with Corp Stop	Ford Ductile Iron Saddle F202																								
	To PVC Pipe	Ford Brass Saddle S71 for all sizes																								
	To PE Pipe	Ford Brass Saddle S41																								
E.	Tapping Sleeve																									
	Material	Type 304 Stainless Steel																								
	MJ outlet	One-piece casting having a plain end and a mechanical joint gland TIG and MIG welded a full 360 degrees; Type 304 Stainless Steel Flange.																								
	Gasket	Mechanical Joint Outlet Gasket, Branch Sealing Gasket, and Complete Circle Gasket attached to the sleeve at the factory.																								
	Drop-In Bolt	Square Neck Track-Head bolts with a minimum of two (2) longer starter bolts. Minimum quantity of drop-in bolts and mechanical joint outlet bolts per outlet diameter shown below.																								
		<table border="0" style="margin-left: 40px;"> <thead> <tr> <th style="text-align: center;">Outlet Diameter (inch)</th> <th style="text-align: center;">Drop-In Bolts (Quantity)</th> <th style="text-align: center;">MJ Outlet Bolts (Quantity)</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">2</td><td style="text-align: center;">8</td><td style="text-align: center;">2</td></tr> <tr><td style="text-align: center;">3</td><td style="text-align: center;">8</td><td style="text-align: center;">4</td></tr> <tr><td style="text-align: center;">4</td><td style="text-align: center;">10</td><td style="text-align: center;">4</td></tr> <tr><td style="text-align: center;">6</td><td style="text-align: center;">10</td><td style="text-align: center;">6</td></tr> <tr><td style="text-align: center;">8</td><td style="text-align: center;">16</td><td style="text-align: center;">6</td></tr> <tr><td style="text-align: center;">10 - 12</td><td style="text-align: center;">20</td><td style="text-align: center;">8</td></tr> <tr><td style="text-align: center;">14 - 16</td><td style="text-align: center;">36</td><td style="text-align: center;">12</td></tr> </tbody> </table>	Outlet Diameter (inch)	Drop-In Bolts (Quantity)	MJ Outlet Bolts (Quantity)	2	8	2	3	8	4	4	10	4	6	10	6	8	16	6	10 - 12	20	8	14 - 16	36	12
Outlet Diameter (inch)	Drop-In Bolts (Quantity)	MJ Outlet Bolts (Quantity)																								
2	8	2																								
3	8	4																								
4	10	4																								
6	10	6																								
8	16	6																								
10 - 12	20	8																								
14 - 16	36	12																								
F.	Polyethylene Wrap																									
	Material	8-mil thick Class C (Black) conform to ANSI/AWWA C105																								
	Adhesive Tape	2 inches wide and plastic backed, capable of bonding securely to metal surfaces and/or polyethylene material.																								

4. VALVES, STRUCTURES and APPURTENANCES

4.1 VALVES

Gate Valve	Encapsulated Wedge non-rising stem; triple "O" Ring Seal and conforming to AWWA Specification C509.
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Joint	Mechanical joint with 200 psi design working pressure and have resilient seats.
Operator	2" square operating nut opening counter clockwise.
Coatings	Protective epoxy interior coating according to AWWA C550.
Setting	Set vertical and in true alignment where shown on plans and construction details
Butterfly Valve	Mechanical joint Rubber-Seated Butterfly Valves M & H style 450 & 4500 conforming to AWWA C504, or equal.
Operator	Horizontal hex shaft, underground operator with 2" nut; closure turns similar to like size gate valve
Coatings	Protective epoxy interior coating according to AWWA C550.
Ball Valve	Ford B-87, Ford B11 and Ford B-81 with C87 pack joint, or equal.
Body	There shall be top and port O ring seals, and top anti-friction washer and bottom low friction plastic bearing insert with screwed ends
Operator	Tee head with removable plug for in-line repair.
Optional Body	Bronze body with Tee head, double O ring stem seals, molded Bura N rubber port seals and ball seats, full round opening ball with screwed ends.
Corporation Stop	Ford F1100 meeting AWWA Specification C800-55. Corporation stops for service lines shall be size 3/4" x 3/4", unless otherwise specified.

4.2 VALVE BOX

Riser Pipe	6" PR 200 PVC
Cover	Clay and Bailey No. 2194 cover and ring

4.3 DETECTOR CHECK VALVE

A Watts Series SS07F detector check valve with by-pass meter shall be installed on private fire protection and automatic sprinkler systems, and installed in a structure as shown in the details. Valve and line size will be determined by the District.

4.4 FIRE HYDRANT

Fire hydrants shall be American Darling B-84-B-5, Clow Medallion, or Mueller Centurion No. 250. Hydrant shall be self-draining, non-rising stem, nozzle threads meeting National American Standard Fire Hose Specs with caps and no chains.

Fire hydrants shall be factory applied red paint, have operating threads that are sealed and lubricated, the 1½" pentagonal operating nut shall open counterclockwise.

Hydrants shall be set for standard pipe burial depth unless shown otherwise on the plans. The hydrant gate valve and barrel shall be vertical and plumb.

4.5 AUTOMATIC FLUSHING UNIT

Automatic flushing unit shall be Kupferle 9400-A or approved equal, and shall be constructed and meet the requirements as shown in the construction details.

4.6 CLEANOUT

Cleanouts shall be constructed as shown in the details. All cleanouts shall be connected to a gate or ball valve; have proper thrust blocking, be self-draining with weep hole and rock; the riser shall be set plumb and left approximately 2' above ground, where practical.

Temporary cleanouts for testing shall be constructed of the material and size of the new water line for purposes of pigging the line. Once completed the cleanout piping will be removed.

4.7 AIR RELEASE VALVE

Air release valves shall be installed in pits as shown on the plans. The air release valve shall be a combination air valve Model D-040 as manufactured by A.R.I., Model 202 as manufactured by Val-Matic or approved equal.

4.8 WATER SAMPLING STATION

Water sampling station shall be as manufactured by Kupferle or approved equal, which meets the following requirements.

Housing	HDPE meeting ASTM D1248 set 4" above grade;
Ultra-Violet Resistance	7-9 yrs meeting ASTM G-26-92
Cover	Lockable
Color	Neutral earth tone or green
Flammability	1.59 cm/min meeting ASTM D635
Sampling/Flow Meter	3/4" brass threaded hose nozzle outlet with iron spigot handle.
Port	All working parts to be brass; removable from above ground.
Above Ground Piping	Brass
Below Ground Piping	48" burial depth of sampling pipe. Sampling pipe to be inside brass frost jacket. Above ground draining system for sampling pipe to prevent freezing.
Connection to Main	3/4" Ford F1100 Corp Stop connection to Main 3/4" PE service line from main to sampling pipe

4.9 SERVICE METER & PIT

Pit Setter	Ford Plastic PFBHC-248-18-28 for 3/4" service (short-set) Ford Plastic PFBHC-288-18-28 for 1" service (road crossings)
Dimensions	18" inside diameter, 30" pit depth
Lid	Ford 2380-01-1012
Ring	Ford 2210-01-6050
Meter	Neptune Model T10 AMR

5. INSTALLATION

5.1 PIPES, FITTINGS, AND STRUCTURES

Pipe shall be of sizes indicated on the drawings and laid to the lines indicated thereon, in accordance with these specifications

Pipe interiors shall be thoroughly cleaned of all foreign matter before lowering into trench.

All pipe, fittings, valves, hydrants, and accessories shall be carefully lowered into the trench with suitable equipment in a manner that will prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

All ductile iron materials shall be wrapped in a polyethylene encasement.

A. Pipe Placement

Each section of pipe shall rest upon the pipe bedding for its full length with recesses excavated at joints. Bell holes for pipe 8 inches and larger shall be excavated by hand. Any length that has had its line, grade or joint disturbed after laying shall be taken up and relaid. Under no circumstances shall pipe be laid in water nor when trenches or weather conditions are unsuitable for such work, unless otherwise directed by the District Inspector. Any section of pipe already laid but found damaged or defective shall be replaced with new pipe at no additional expense to the Owner. Any pipe that has floated shall be re-laid, or as directed by the District Inspector.

Pipe shall be cut square by the aid of miter box, when field cutting pipe. The cut end which will be inserted into a socket shall be beveled with a milled curved-tooth flat file or other approved device. A factory pipe end shall be used as a guide to determine the bevel. Mark a stop guide on the pipe by use of a pencil or crayon to provide visual observation for proper insertion depth.

A rubber gasket shall be placed in the annular recess of the pipe or fitting socket with a lubricant that is water-soluble, non-toxic, non-objectionable in taste and odor, non-supportive of bacteria growth, and have no deterioration effect on the PVC or rubber gaskets. Lubricant containers shall be labeled with the trade name or trademark of lubricant manufacturer or pipe manufacturer. The lubricant shall be suitable for use in potable water. It shall be delivered to the job in enclosed containers and shall be kept clean.

The plain end adjoining pipe shall be thrust into the pipe socket, compressing the gasket uniformly around the pipe to form a positive seal. The gasket and the annular recess shall be so designed and shaped that the gasket is locked in place against displacement as the joint is assembled. Details of the joint design and assembly shall be in accordance with the joint manufacturer's standard practice.

Pipe may be furnished with a socket as an integral part of each piece of pipe or a coupling type socket with rubber gasket on each side may be provided. Ends of pipe intended to be inserted into a socket shall be factory beveled.

Pipe shall be kept clean after placement in the trench. Precautions shall be taken to protect pipe interiors, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize entrance of foreign material. When pipe laying is not in progress, as, for example, at the close of the day's work, all openings in the pipeline shall be closed by water tight-plugs. Joints of all pipe in the trench shall be completed before work is stopped. Enough backfill shall be placed over the pipe to prevent flotation. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

Dirt entering the pipe that will not be removed by the flushing operation, as deemed by the District Inspector, shall be cleaned and swabbed with a 5 per cent hypochlorite disinfection solution, as necessary.

B. Pipe Joint Deflections

Maximum angular joint deflection is shown in the table. Fittings are required if the pipe deflection is exceeded.

Maximum Allowable Bending Radius and Joint Deflection for PVC Pipe

Pipe Type	Pipe Size (in)	Minimum Laying Radius (foot)	Offset per 20 ft Section of Pipe (Inch)
ASTM 2241	2	50	47
	3	75	32
	4	95	25
	6	140	17
	8	180	13
	10	225	11
	12	270	9
AWWA C900/C905	16	355	7
	4	125	19
	6	180	13
	8	235	10
	10	290	8
	12	345	7
	16	452	5

The following table shall be used in determining the minimum radii for restrained joint pipe used in open cut and directional boring installations.

Maximum Allowable Bending Radius and Joint Deflection for PVC Restrained Pipe

Pipe Type	Pipe Size	Minimum Laying Radius (foot)	% Change in Pitch per 10'
All PVC and Fusible PVC	2	75	7.6
	3	100	5.7
	4	125	4.6
	6	200	2.9
	8	250	2.3
	10	300	1.9
	12	375	1.5
	16	500	1.1
	18	550	1.0
	20	625	0.9
24	650	0.88	

The minimum bending radii for HDPE pipe is based on the dimension ratio (DR) as follows:

Minimum Bend Ratio for HDPE Pipe

Dimension Ratio (DR)	Bend Ratio (α)
9	20
11	25
13.5	25
17	27
21	27
26	34

Minimum Radius = α times Pipe OD in feet

5.2 POLYETHYLENE WRAP (POLYWRAP)

Ductile iron pipe, fittings, valves, valve boxes and appurtenances shall be encased in 8-mil thick polyethylene according to ANSI/AWWA C105/A21.5. Although the polyethylene encasement should prevent contact between the pipe and surrounding backfill and bedding material, it is not intended to be completely airtight or watertight.

All lumps of clay, mud, cinders, or other materials that might be on the pipe surface should be removed prior to installation of the polyethylene encasement. Care should be taken to prevent soil or bedding material from becoming trapped between the pipe and the polyethylene.

The polyethylene film should be fitted to the contour of the pipe to affect a snug, but not tight, encasement with minimum space between the polyethylene and the pipe. Sufficient slack should be provided in contouring to prevent stretching the polyethylene when bridging irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to the polyethylene during backfilling operations. Overlaps and ends should be secured with polyethylene-compatible adhesive tape, tape at least every 4 feet.

For installation below the water table, both ends of the polyethylene tube shall be sealed as thoroughly as possible by wrapping circumferentially with adhesive tape or strapping at each joint overlap.

5.3 LOCATOR WIRE

Wire	Kris-Tech Wire PE-45 #12, or approved equal solid blue wire.
Splices/Connections	Kris-Tech Splice Kit 3M-DBR-Part Number – 054007-09964.

Locator wire shall be in at least 1,500-foot rolls and installed in such a manner to keep splices to a minimum. Rolls of 500 feet are only acceptable on jobs of less than 500 feet in length. Splices shall ONLY be made in valve boxes or locator wire splicing boxes.

Locator wire shall be taped to the top of all pipe installed including service lines. Locator wire at valve boxes shall be taped to the outside of the riser pipe; a hole or slot cut into the riser pipe to bring the wire into the pipe; and, enough wire spooled in the valve box to extend 24" outside the valve box.

Locator wire installation and signal loss shall be included under the 1-year pipe and workmanship warranty.

5.4 TAPPING SLEEVES

The branch opening shall be larger in diameter than nominal to allow the use of a full-size cutter. All welding shall be passivated to return the welded stainless steel to its original corrosion resistant state. There shall be no paper or plastic adhesive labels attached to the tapping sleeve, any information appearing on the sleeve shall be stenciled. The tapping sleeve shall be factory hydrostatically tested on pipe to verify proper fit and weld integrity with zero leakage allowed. The tapping sleeve shall be air tested to 50 psi prior to making the tap.

5.5 TAPPING SADDLES

If tapping saddles are installed on pipe containing polywrap, first place 3 wraps of polyethylene adhesive tape around pipe and then tap through tape and poly film. Repair any damage to wrap with tape and extra film as per ANSI/AWWA C105/A21.5. Remove material where saddle gasket touches pipe adjacent to hole.

After tap has been made, wrap & tape service line to 3 feet from main line and encase saddle with wrap & tape to 1 foot each sidesaddle on main line. Protect saddle & service line in this fashion regardless of whether main line has been encased with polywrap. Use sintered teflon pipe dope or TFE tape on all screw threads. Any saddle placed on ductile iron pipe shall be poly wrapped and taped to 1 foot each side of saddle.

When using a 2" Ford Ball Corp with pack joint on outlet, use sintered teflon pipe dope or TFE tape on all screw threads from main line.

5.6 TIEBACK RODS

A. General

Tieback rods are required wherever the continuity of restraint has been made discontinuous by use of a coupling. Tieback rods shall be used to hold assemblies together, such as at a tee which has a valve located on one or various sides, and at other locations where pipe restraint is required to prohibit movement.

Tieback rods shall be stainless steel all-thread 3/4" diameter rods with stainless steel 1-1/4" outside heavy hex nuts on both sides of fittings, bolt holes, etc. Use of more or larger tiebacks will be indicated on plans, if required. The number of rods is dependent upon the pipe size and the normal operating water pressure in the line.

The Water District will determine the normal operating water pressure. Operating pressure is normally less than 160 psi.

Pipe Size	Number of Tie-back Rods vs. Pipe Size	
	Operating Pressure ≤160 psi	>160 psi
4" & Smaller	2	2
6" - 8"	4	6
10" - 14"	6	8
16" - 18"	8	10
20" - 24"	12	16

B. Installation

The rods shall be run through the bolt holes in fittings, valves, etc. Both sides of all flanges shall be bolted. Double nuts are required for pipe sizes that are 8" and larger, or require more than 4 rods. Where possible, use an Anchor Style Fitting on one end when a group of fittings occurs at one location.

Ductile iron lugs may be used for assemblies up to and including 8" pipe size.

Rods may be slightly bowed to traverse around the body of some devices. Rods may be added which hook into said holes so that rods may remain straight. Anchor straps, socket clamp assemblies, etc. may be used by the contractor in his normal procedures.

When installing tieback rods with concrete reaction blocks adjust nuts after concrete has set.

C. Exceptions

1. In cases where tieback rods require lengths greater than 4', uni-flange pipe restraints may be used, as directed by the District Inspector.
2. When piping is mounted on prefabricated skids, connection of piping to skids may be used in lieu of tieback rods.

5.7 CONCRETE THRUST BLOCKING

Concrete thrust blocking shall be used at all bends, tees, end caps, and at other locations requiring pipe restraints. Thrust blocks must be placed against undisturbed earth.

Thrust blocks shall be constructed of 3,000 psi commercial redi-mix concrete with a slump no greater than 6-inch.

Prior to pouring concrete, polyethylene wrap shall be placed around valves, fittings, bolts and all-thread rods to keep concrete separated from pipe and fittings. Duct tape to hold plastic in place may be used. Water District to approve thrust blocking forms prior to placement of concrete.

A. Horizontal Thrust Blocks

The bearing area is the face dimension that is located against unexcavated earth on the back side of the trench. The height and width face dimensions shall be established in the field meeting the bearing area shown in the table in the plans. The centerline of the face dimensions shall be located at the centerline of the pipe in both the horizontal and vertical directions.

When fittings and valves have been connected by tieback rods to form one continuous unit, the entire aggregated system may be treated as one for the purpose of concrete thrust blocking. The contractor may reduce concrete reaction blocking requirements, as approved by the District Inspector.

B. Vertical Thrust Blocks

The concrete required to restrain vertical bends is shown in the table on the plans.

C. Concrete Restraining Blocks

Concrete restraining blocks, sometimes called a deadman or cross blocking, shall be anchored to a valve or fitting with the same size and number of tieback rods as defined for tieback rods.

D. Reinforcing Steel

Reinforcing steel bars	ASTM A 615 or A 706 Grade 60 deformed billet steel
Welded Wire Reinforcement	ASTM A 185 and be furnished in sheets
Tie Wire	16 gauge minimum, soft annealed

6. PIPE BORING

6.1 GENERAL REQUIREMENTS

Borings shall meet all requirements set forth by the permit issued by the appropriate jurisdiction. Contractor shall obtain necessary permits and do all work in accordance with their requirements.

6.2 CASING AND SPACER DATA

The Contractor shall submit shop drawings for the casing pipe and spacers. The spacer shall be sized to ensure that the bell of the carrier pipe does not touch the casing. The casing shall have at least a 1-1/2" clearance between the outside diameter of pipe with the casing spacer attached and the casing pipe. Contractor's supplier shall show compatibility of casing size with spacer design.

SPACER DATA		
Pipe Size (inch)	Max. Skid Spacing (feet)	Spacer Width (inch)
4	4½	6
6	6	6
8	7	8
10	8½	8
12	9½	8
16	10	8

A. Spacer Materials

Totally non-metallic constructed of preformed sections of high-density polyethylene. Spacers shall be ISO 9002 certified for strength and quality. RACI casing spacers are the only approved brand.

B. End Seal

1/8" synthetic rubber wrap around with ½" stainless steel banding straps. Advanced Products Model AW has been approved.

C. Lubrication

Flux soap or drilling mud.

D. Installation

Casing spacers shall have a minimum number of projections around the circumference totaling the number of diameter inches.

Casing spacers shall be fastened tightly to the carrier pipe so that the spacers do not move during installation with double backed tape. Tool recommended for installation by the manufacturer shall be used during installation. Lubricate the spacers at time of installation.

6.3 CASING INSTALLATION

Casings may be installed by boring or open cut methods as is required. Casing shall be installed as boring equipment removes material from hole. Contractor may use larger casing size, but shall be responsible for any related modifications as a result.

Joining procedures must be such that concentricity of the entire completed casing will be maintained, and that the line and grade of the carrier pipe will be continuously straight. A full circle must be seen to prove that the casing is concentric from end to end by the lamping method of inspection.

The burial depth of the carrier pipe inside the casing shall be 48" below the lowest level of surface being crossed, except as specifically shown on the plans or defined by the governing jurisdiction. The casing may be lowered to avoid vertical bends.

The entire casing shall be installed and inspected before any pipe is inserted into the casing.

Contractor shall complete bore before other work is started so that slight misalignments in connecting pipes can be adjusted.

6.4 PVC CARRIER PIPE INSTALLATION IN CASING

1. All carrier pipes shall have restrained joints.
2. Pipe may be installed by using drawn cable or jacking. The force used to install the pipe must spread over the pipe end on which it bears, by use of a flat piece of wood or other similar force sustaining material.
3. No less than twenty foot long sections of pipe shall be used to minimize the number of joints within the casing.
4. It will be unnecessary to use restrained joint pipe if the casing is shorter than the carrier pipe. Also, the pipe may be laid directly on the casing without the use of spacers.
5. On 4" and larger pipes, a MJ sleeve, a fitting or valve shall be installed on either side of the casing.
6. On pipes smaller than 4", a PVC repair style coupling may be installed on either side of the casing, in lieu of a ductile iron sleeve.
7. Bores under roadways and creeks where encased or not shall have two separate strands of locator wire attached to the waterline that runs from isolation valves on either side of the bore as terminal points for the extra wire.

6.5 DIRECTIONAL BORING

A. General Requirements

Directional bores shall be completed using a directional boring machine supplied with an output signal to allow the Contractor to track the location of the drill head at all times. Size of drilling equipment shall be adequate for the job, but not grossly oversized such that an undue amount of thrust or torque is placed on the carrier pipe. Drilling fluids shall be selected for the site specific soil and ground water conditions. Confine free flowing (escaping) slurry or drilling fluids at the ground surface during pullback or drilling to prevent damage or hazardous conditions in surrounding areas. Remove all residual slurry from the surface and restore the site to pre-construction conditions. Fully repair any and all bore/relief pits constructed, including vacuuming drilling fluids and compacting disturbed earth.

All pipelines provided in the restrained joint area shall be installed to a minimum depth of 6 feet under creeks and 10 feet under river crossings, unless shown otherwise on the plans. All work associated with installing restrained joint pipe in the designated areas and, if crossing wetlands, creeks, rivers, streams or other waterways, shall conform to all permit requirements and to State and federal regulations.

Restrained joint areas depicted on the drawings are not to be considered exact and represent the general length of the restrained joint pipe. The actual length of the restrained joint area will be determined in the field by the District Inspector, and may differ from that shown on the drawings.

B. Execution

A pilot hole shall be bored first, with an angle of entry not to exceed 20% grade from the horizontal, and proceed under the obstacle being crossed while maintaining the required soil. The pilot hole shall extend to the point of exit no shallower than 8 feet from the surface on a grade not to exceed 20%, unless shown otherwise on the Plans. The carrier pipe shall be restrained joint PVC pipe, unless otherwise shown on the Plans.

The carrier pipe shall be assembled on the exit side of the bore, and installed by back reaming in the reverse direction. Deviations from this method shall be approved by the District Inspector. The pull section shall be adequately supported during pullback. Pipe should not drag on the ground. Above-ground pipe assembly shall be checked for suitability of installation before pullback. The borehole shall be reamed to approximately 1.2 times the outside diameter of the carrier pipe. Use sufficient drilling fluids and monitor pullback pressure to detect any problems before heaving of the bore path surface occurs. Maintain the minimum cover required as shown on the plans.

A swivel shall be used when back reaming to prevent rotational torque (torsion) on the carrier pipe. Carrier pipe to be capped as necessary to prevent drilling fluids from entering.

Provide long-body transition couplings and reducers as necessary to complete the connection to the adjoining pipe. The Contractor shall provide the required depth of cover over the pipe upon tying in the restrained joint pipe with the adjoining pipeline.

All bore/relief pits constructed including vacuuming drilling fluids shall be backfilled.

C. Installation Alignment Record Data

Trace bore path by interpretation of electronic signals sent by a monitoring device. If a District Inspector is present, identify the cutting head location after each push to confirm that the bore will meet the proper horizontal and vertical alignments.

In addition to the electronic locator of the drill head, the Contractor shall keep a record of the location after each rod push. Data shall include the following, as appropriate:

Rod	number
Length	foot
Depth	foot
Offset (L/R)	foot
Pitch	percent grade

Submit to the Engineer a print out of the bore path for accurately determining the boring profile and to exhibit that sufficient cover was achieved during the bore. The bore path printout must be submitted prior to final pay request

7. TESTING OF PIPELINE

7.1 FIELD INSPECTION

The Engineer may perform various tests at times that he deems necessary, including pressure tests with his own equipment. Joints may be cut out of the pipeline for inspection and testing. This does not imply that indiscriminate cutting of joints will be allowed. Pipe may be cut at such times to facilitate such tests and the Contractor shall perform such cuts and repairs as requested.

Pipes, fittings, valves, hydrants, and accessories shall be inspected for defects prior to placement into the trench. Any defective, damaged, or unsound material shall be repaired or shall be removed from the site.

7.2 WATER FOR TESTING

It is the Contractor's responsibility to provide the water for testing. With District approval, Contractor may tap an existing waterline with the proper tapping materials to obtain water at the site. Upon completion of the need for water, Contractor will remove all connecting pipe to the corporation stop and close the corporation stop fully.

7.3 LINE CLEANING

To insure that lines are clean prior to disinfection, a polyethylene pig swabbing device shall be run through the line. The pig shall be sized for the specific size of the pipe, and shall be provided by the Contractor. The Contractor may do the line cleaning in segments as suits his construction methodology. The pipe segments shall be subdivided to facilitate practical lengths of line cleaning, or as directed by the Water District.

Contractor shall install and remove all temporary connections and devices required to insert the pig, provide adequate water for flushing, and removal of the pig upon completion.

The cleaning of some lines may be waived if the District Inspector feels that the pipe installed is clean and free of foreign matter.

7.4 DISINFECTING NEW WATER MAINS

Disinfection of Water Mains shall be in accordance with the latest edition of AWWA C651.

A. Flushing Requirements

The main shall be flushed with potable water prior to disinfection until discolored water, mud, and debris are eliminated. The flushing velocity should be at least 3.0 ft/sec. The rate of flow required to produce this velocity in various diameters is shown in the table below. No site for flushing should be selected unless it has adequate drainage.

Pipe Size (inches)	Flow Required to Produce 3.0 fps Velocity (gpm)
4	118
6	265
8	470
10	735
12	1,060

B. Forms of Chlorine for Disinfection

1. Liquid Chlorine

Inject with a solution feed chlorinator and a water booster pump. Use an experienced operator and follow the instructions of the chlorinator manufacturer.

2. Calcium Hypochlorite (Dry)

Dissolve in water to a known concentration in a drum and pump into the pipeline at a metered rate.

3. Sodium Hypochlorite (Solution)

Dilute in water to desired concentration and pump into the pipeline at a metered rate.

C. Disinfection by Continuous Feed Method of Chlorine Application

This method is suitable for general application. Water from the existing distribution system or other approved sources of supply shall be made to flow at a constant, measured rate into the pipeline. The water shall receive a dose of chlorine, fed at a constant, measured rate. The two rates shall be proportioned so that the chlorine concentration in the water in the pipe is maintained at a minimum of 50 mg/L available chlorine.

To assure that a proper concentration is maintained, the chlorine residual should be measured at regular intervals in accordance with the procedures described in the current edition of "Standard Methods and AWWA M12-Simplified Procedures for Water Examination".

The amount of chlorine residual required for each 100 ft of pipe of various diameters is shown on the table below. Solutions of 1 per cent chlorine may be prepared with sodium hypochlorite or calcium hypochlorite. The latter solution requires approximately 1 lb of calcium hypochlorite in 8.5 gal of water.

Chlorine Required to Produce 50 mg/L
Concentration in 100 ft of Pipe

Pipe Size (Inch)	100 percent Chlorine (Lbs)	1 percent Chlorine Solutions (Gal)
4	0.027	0.33
6	0.061	0.73
8	0.108	1.30
10	0.170	2.04
12	0.240	2.88

During the application of the chlorine, valves shall be manipulated to prevent the treatment dosage from flowing back into the line supplying the water. Chlorine application shall not cease until the entire main is filled with the chlorine solution. The chlorinated water shall be retained in the main for at least 24 hr, during which time all valves and hydrants in the section treated shall be operated in order to disinfect the appurtenances. At the end of this 24 hr period, the treated water shall contain no less than 25 mg/L chlorine throughout the length of the main.

D. Final Flushing

After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than 1 mg/L. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline. De-chlorination of heavily chlorinated water shall be completed in accordance with AWWA C651 with de-chlorinating chemicals.

E. Bacteriologic Testing

At least twenty-four (24) hours after final flushing, bacteriologic sample(s) shall be collected from the end of the line, or other points as required by the District Inspector, and tested for bacteriologic quality and shall show the absence of coliform organisms. The samples collected shall be delivered by Contractor to a certified laboratory within 24 hours of obtaining the samples.

If the number and frequency of samples is not prescribed by the public health authority having jurisdiction, at least one sample shall be collected from chlorinated supplies where chlorine residual is maintained throughout the new main. In the case of mains exceeding 3000 ft, it is desirable that samples be collected midway along the length of the line as well as at its end. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. When the samples are satisfactory, the main may be placed in service.

Two consecutive passing tests are required to demonstrate successful disinfection. The Contractor shall re-chlorinate the pipeline segment that is being tested after three bacteriological tests have failed.

Contractor shall incur all costs of sampling and supplying the District with a copy of test results.

7.5 DISINFECTION AFTER CONNECTION/REPAIR TO EXISTING WATERLINES

The procedures outlined in this section apply primarily when mains are wholly or partially dewatered. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.

A. Trench Chlorination

When an old line is opened, either by accident or by design, the excavation will likely be wet and badly contaminated from nearby sewers. Liberal quantities of hypochlorite applied to open trench areas will lessen the danger from contamination.

B. Swabbing with Hypochlorite Solution

The interior of all pipe and fittings used in making the repair (particularly couplings and tapping sleeves) shall be swabbed with a 5 per cent hypochlorite solution before they are installed.

C. Slug Method for Chlorination

In addition to the procedures above, a section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed. The pipeline will be chlorinated with a highly concentrated dosage as high as 500 mg/L with the contact time reduced to at least 30 minutes.

D. Flushing

Flushing shall be started as soon as the repairs are completed and continued until discolored water is eliminated. The line shall be flushed from both directions, as directed by the District Inspector.

E. Bacteriological Testing

Bacteriologic samples shall be taken at the end of the line in the direction of flow. If the direction of flow is unknown, samples shall be taken on each side of the main break.

7.6 LEAKAGE TESTING

A. Preparation of Waterline

Contractor shall perform a hydrostatic test of the new waterline. Prior to the test, Contractor shall verify that test section is fully isolated, and that all air has been expelled from the pipeline to the satisfaction of the District Inspector. This may be accomplished by means of air relief valves, blow-off valves, hydrants or other means. If required, taps shall be made at high points where air relief valves are not called for on the plans. Such taps shall be plugged after testing is complete. Corporation stops should be installed before this test, if possible.

B. Equipment

Contractor shall provide all necessary water, piping, pumps, gauges (face divisions of 2 psi or less) and fittings for testing.

C. Testing Pressure

Generally, the test pressures for PR 200 PVC and PR 250 PVC are 160 psi and 200 psi, respectively. District Inspector will verify lowest elevation within the section of piping to be tested, and determine the test pressure and the testing location. Apply a test pressure equal to the design pressure of the

pipeline at the lowest point of the alignment. After the specified pressure has been reached, the pump shall be stopped and all pipe, fittings, valves, hydrants, joints, and appurtenances examined for leaks.

Any visible leaks shall be repaired. After visible leaks are repaired, the pipeline shall be refilled with water and re-pressurized to the design pressure of the pipeline. This pressure shall be maintained for a period of four hours.

D. Allowable Leakage

A container of water shall be attached to the distribution line in a manner to allow the water in the container to flow into the pressurized lines. Water loss in the container shall be measured after the test and acceptability of the line shall be based on the following formula for a leakage allowance of 10.5 gallons per inch diameter per mile per day:

$$L = \frac{NxDx\sqrt{P}}{74,000}$$

Where: *L* = Allowable Leakage in gallons per hour
N = Number of joints in line being tested
D = Nominal pipe diameter in inches
P = Average test pressure in psi

Allowable Leakage per 1000 ft in gal per hr				
Test Pressure (psi)	Pipe Size (inch)			
	4	6	8	12
150	0.34	0.50	0.65	0.95
160	0.35	0.51	0.67	0.99
170	0.36	0.53	0.69	1.02
180	0.37	0.54	0.71	1.05
200	0.39	0.57	0.75	1.10
220	0.41	0.60	0.78	1.16

8. SITE RESTORATION

8.1 CLEAN UP

Final cleaning up shall be completed as soon as practical. All surplus water main materials furnished by the Contractor and all tools and temporary structures shall be removed from the site by the Contractor. All dirt, rubbish, and excess earth from the excavation shall be hauled to a dump provided by the Contractor and the construction site left clean to the satisfaction of the Engineer or District Inspector. All surplus water main materials furnished by the Owner and delivered to the site by the Contractor shall be removed and delivered by the Contractor to a location designated by the Owner. All surplus water main material furnished and delivered by the Owner shall be removed by the Owner.

Brush and trees removed from right-of-way easement for water line installation shall be removed from property or burnt, unless in accordance with District Policy the landowner has given Water District a written request for brush to be piled and left for landowners use.

The District Inspector may require the Contractor to rework the cleanup immediately in areas where neglect is causing a nuisance. The Engineer or District Inspector shall be the sole judge of nuisance. Nuisance may result from a lack of improper workmanship at the time of pipe installation, or due to forces of nature after pipe has been installed. The notice shall be in writing and the re-cleanup shall be accomplished in 2 weeks from said notice. Cleanup, so notified to be done and remaining undone after 2 weeks may be hired done by others and the cost deducted from monies due the Contractor.

If any pavement, trees, shrubbery, fences, poles, or other property and surface structures have been damaged, removed, or disturbed by the Contractor, whether deliberately or through failure to carry out the requirements of the Contract Documents, state laws, municipal ordinances, or the specific direction of the Engineer or District Inspector, or through failure to employ usual and reasonable

safeguards, such property and surface structures shall be replaced or repaired at the expense of the Contractor. These damaged items shall be replaced, repaired or restored to a condition equal to that before the work began.

All completed lines shall be returned as nearly as possible to the original condition, including seeding or sodding, as necessary.

The Contractor shall restore all pavement, sidewalks, curbing, gutters, shrubbery, fences, poles, or other property and surface structures removed or disturbed as a part of the work to a condition equal to that before the work began, and shall furnish all incidental labor and materials. No permanent pavement shall be restored unless the condition of the backfill is such as to properly support the pavement, and until approved by the Engineer or District Inspector. There will be no extra compensation for this work unless identified in the pay items.

8.2 REVEGETATION

A. Grading and Base Preparation

Earthwork shall conform to the lines and grades as shown on the plans. Grading shall provide positive drainage and a neat appearance conforming to the surrounding area. The area shall be tilled by disking or harrowing and all clods, lumps, etc. broken to a size to allow future mowing. Broken concrete, rubble, stones, roots, debris or other unsuitable material shall be removed. All disturbed areas shall be finished with at least 2-inches of topsoil.

B. Fertilizer and Lime

Fertilizer shall be a standard commercial 12-12-12 product which, when applied at the proper rate, will supply the quantity of total nitrogen (N), available phosphoric acid (P₂O₅), and soluble potash (K₂O), as specified. Submittals shall be provided for approval on all fertilizer used on the project. Material may be accepted on the basis of bag label analysis or supplier's certification.

Fertilizer Application Rates:

Temporary Seeding	400 pounds per acre.
Permanent Seeding:	
Lawn Area	200 pounds per acre
Non-Lawn Area	300 pounds per acre

Lime shall be applied in Non-Lawn areas at a rate of 50 pounds per 1,000 sq feet or as determined by a soil test.

C. Sodding

Lawns established in zoysia grass that are stripped of vegetation will be replaced with zoysia sod. Seeding will not be permitted.

D. Temporary Seeding

Temporary seeding is required within 30 days of the installation of the water line and backfilling. The following procedures shall be taken.

1. Remove foreign materials, plants, roots, stones, and debris from the disturbed area. Do not bury foreign material. Remove contaminated subsoil. Using suitable excavated material, mound backfill over the trench to allow for settlement.
2. Apply the following temporary grass seed mix at the specified rate

Spring Planting Season		Fall Planting Season	
<u>Lawn Area</u>	<u>Rate</u>		<u>Rate</u>
Oats or Rye *	60 lb/ac	Winter Wheator Rye	60 lb/ac

Non-Lawn Area

Oats, Barley, Rye, Red Clover, or Creeping Fescue	60 lb/ac	Winter Wheat or Winter Rye	60 lb/ac
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* Other quick growing grain seed may be approved for use.

3. Apply fertilizer three weeks after seeding.
4. Reseed areas within 30 days of initial seeding where no stand of grass has occurred.

E. Final Seeding

Contractor shall seed only when soil and climatic conditions are such as to insure plant growth. Submittals shall be provided for approval on all grass seeds used on the project. Seed shall meet all requirements of the Missouri Seed Law for 99% Pure 85% germination.

4. Till the seeding area at least 3 inches deep. Remove foreign materials, plants, roots, stones, and debris from the disturbed area. Add suitable material to areas that settled excessively.
5. Spread 2 inches of topsoil over the area. Rake until the surface is smooth and level with the surrounding ground
6. Apply fertilizer at least one week before seeding. Work the fertilizer into the topsoil.
7. Apply the following permanent grass seed mix at the specified rate.

<u>Lawn Area</u>	<u>Rate</u>	<u>Non-Lawn Area</u>	<u>Rate</u>
Falcon IV or Major	200 lb/ac	Bromegrass	30 lb/ac
Oats *	100 lb/ac	K-31 Fescue	200 lb/ac
		Winter Wheat	100 lb/ac

* Other quick growing seed may be approved for use.

The Contractor shall be responsible for the growth of the seeded area. Any portion of the seeded area that is not in good growing condition at the end of thirty (30) days shall be reseeded as specified above.

F. Mulch

Apply mulch over the seeded areas at a rate of 1 ton per acre. The vegetative mulch shall be cereal straw from stalks of oats, rye, wheat, or barley. The straw shall be free of prohibited weed seeds as stated in the Missouri Seed Law, and shall be relatively free of all other noxious and undesirable seeds. The straw shall be clean and bright, relatively free of foreign material, and be dry enough to spread properly.

All mulch shall be distributed evenly over the area to be mulched within 24 hours following the seeding operation. Following the mulching operation, precautions shall be taken to prohibit foot or vehicular traffic over the mulched area. Any mulch which is displaced shall be replaced at once, but only after the work preceding the mulching which may have been damaged as a result of the displacement has been acceptably repaired.

Mulch placed on embankments steeper than 2-1/2:1 will need to be tacked or punched in.

Mulch is intended to reduce erosion during rain events. In the event there is too little mulch or heavy rains occur, whereby the seeded area erodes resulting in rivulets and other irregularities of the ground surface, the area will be re-graded with added topsoil, re-fertilized, re-seeded, and re-mulched.

END OF SECTION



TYPICAL CONSTRUCTION DETAILS

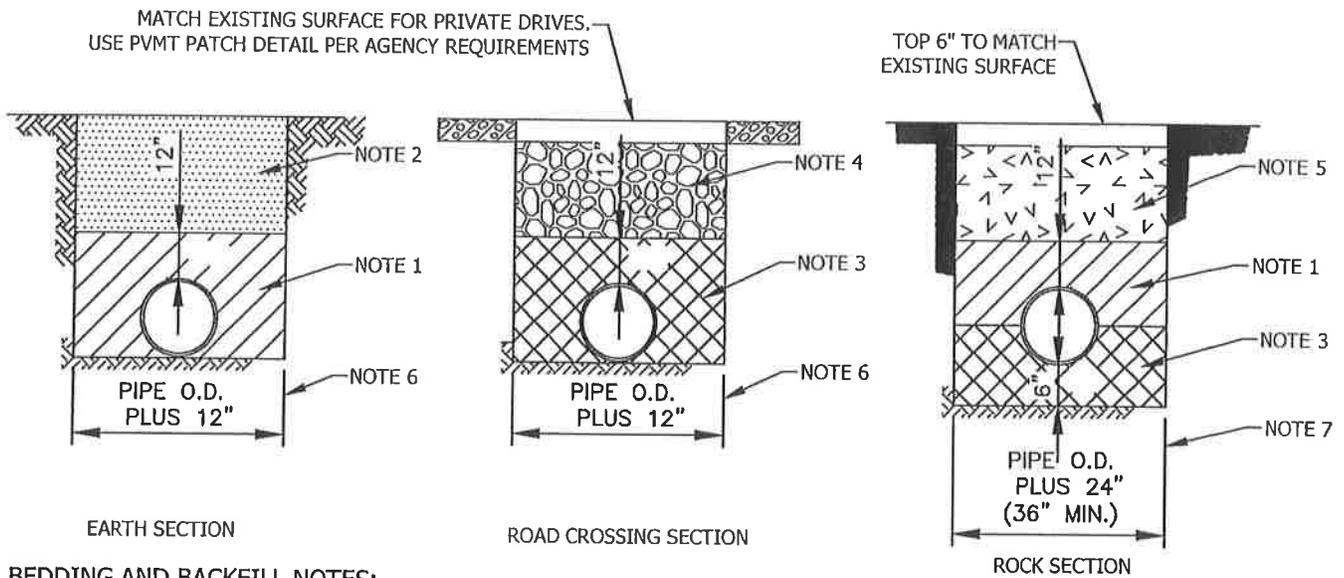
TABLE OF CONTENTS

<u>No.</u>	<u>Detail</u>
1	Pipe Trenching
2	Thrust Blocking
3	Concrete Restraining Block
4	Tieback Rod & Hairpin Rebar
5	Locator Wire
6	Gate Valve
7	Fire Hydrant
8	2" Connection to Main
9	End Cleanouts
10	End Cleanout at Tee or Cross
11	Side Cleanouts
12	Auto Flush Unit
13	1" Service Line Roadway Crossing
14	2" Service Line Roadway Crossing
15	Waterline Installation at Cul-de-sac
16	Typical Roadway Crossings
17	Encasement Pipe Spacer
18	Air Release Pit
19	Detector Check Valve Manhole
20	Water Sampling Station
21	Typical Stream Crossing

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Drawing Name: \\nt00cif001\production\proj\7000\7011\7011.000\7011\7011 SPECIFICATIONS\DNR Standard Specifications Submittal\2018 OSP Renewal Specs and Details\STANDARD DETAILS April 2018.dwg Layout Name: TRENCHING Plotted By: KAK00402 Plotted on: 4/24/2018 9:58:41 AM



BEDDING AND BACKFILL NOTES:

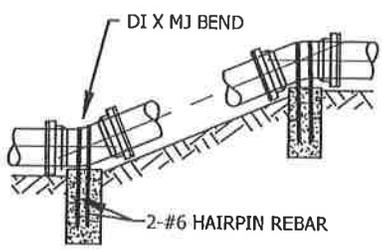
1. SUITABLE EARTH EXCAVATED MATERIAL FREE FROM DEBRIS, MUCK, MUD BALLS, ROCK, AND HARD OBJECTS LARGER THAN 1" DIA. PIPE SHALL REST ON UNDISTURBED EARTH WITH CUTOUT FOR PIPE BELL.
2. SUITABLE EARTH EXCAVATED MATERIAL FREE FROM DEBRIS, MUCK, MUD BALLS, ROCK, AND HARD OBJECTS LARGER THAN 2" DIA.
3. WASTE ROCK 1/4" OR SMALLER.
4. FOR COUNTY ROAD USE 2.5" MINUS LIMESTONE ROCK. FOR OTHER ROADWAYS AND PRIVATE DRIVES USE 1" CLEAN LIMESTONE ROCK, OR AS REQUIRED BY LOCAL JURISDICTION.
5. SUITABLE MIX OF EARTH EXCAVATED MATERIAL WITH NO MORE THAN 50% EXCAVATED ROCK NO LARGER THAN 4" SIZE.
6. ADDITIONAL TRENCH WIDTH AS REQUIRED TO INSTALL FITTINGS AND THRUST BLOCKS.
7. ADDITIONAL TRENCH WIDTH TO INSTALL FITTINGS AND THRUST BLOCKS TO BE PIPE O.D. PLUS 32" WITH A MINIMUM OF 42".

GENERAL NOTES:

1. BEDDING MATERIAL SHALL BE TAMPED IN LAYERS UNDER THE PIPE HAUNCHES AND AROUND THE PIPE TO TOP OF PIPE. TO PROVIDE A UNIFORM BEARING SURFACE.
2. ANY OVER EXCAVATION DUE TO REMOVAL OF UNSUITABLE MATERIAL IN THE BOTTOM OF THE TRENCH SHALL BE BACKFILLED WITH ACCEPTABLE MATERIAL AND COMPACTED.
3. COVER OVER THE PIPE SHALL BE 48" UNLESS OTHERWISE SHOWN ON THE PLANS.
4. LOCATOR WIRE, NOT SHOWN, SHALL BE INSTALLED ON ALL PIPE.
5. FOR ROCK SECTION, PROVIDE A 5' LONG EARTHEN DAM SECTION OF SUITABLE EARTH EXCAVATED MATERIAL FROM BOTTOM OF TRENCH TO TOP OF TRENCH A MINIMUM SPACING OF 100 FT, OR AS DIRECTED BY THE DISTRICT INSPECTOR.

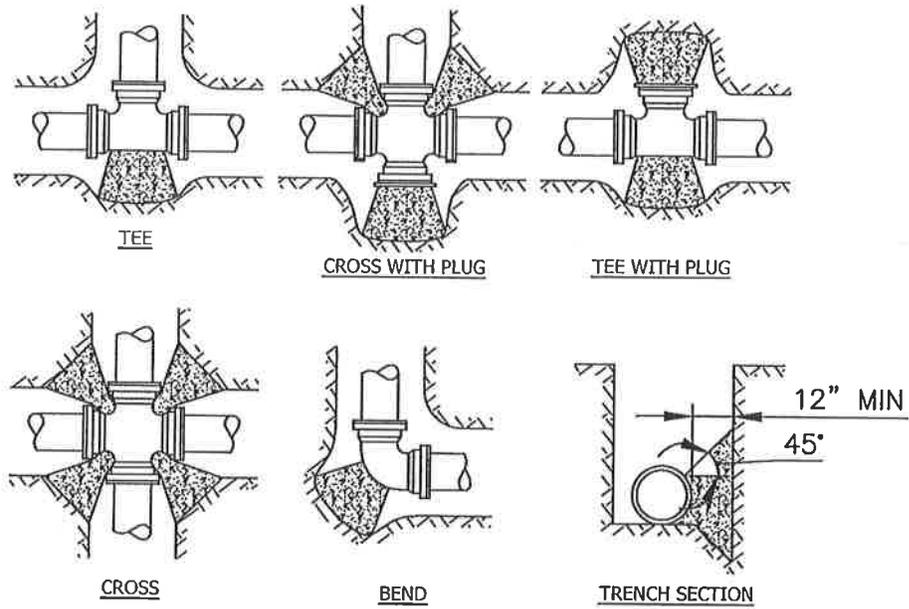
<p>Bartlett & West</p> <p>www.bartlettwest.com</p>	<p>PIPE TRENCHING DETAIL</p>	<p>STANDARD DETAILS</p>	<p>DETAIL NUMBER</p>
	<p>CPWSD NO. 1 OF BOONE COUNTY</p>	<p>DATE:</p> <p>APRIL 2018</p>	<p>1</p>

Drawing Name: \\nt00cdfs01\production\proj\7000\7011\7011.000\7011 STANDARD SPECIFICATIONS SUBMITTAL\2018 OSP Renewal Specs and Details\STANDARD DETAILS April 2018.dwg Layout Name: THRUST BLOCKING Plotted By: KAKO402 Plotted on: 4/24/2018 9:58



VERTICAL THRUST BLOCKS								
Pipe Size (in)	Min. Volume of Concrete (cy)				Min. Bearing Area (sf)			
	11.25	22.5	45	90	11.25	22.5	45	90
4	0.2	0.4	0.7	1.0	0.0	0.1	0.6	2.0
6	0.4	0.8	1.5	2.1	0.1	0.3	1.2	4.2
8	0.7	1.4	2.5	3.5	0.1	0.5	2.1	7.2
10	1.1	2.1	3.9	5.5	0.2	0.8	3.3	11.1
12	1.5	3.0	5.5	7.7	0.3	1.2	4.6	15.7

VERTICAL BEND THRUST BLOCK DETAIL



HORIZONTAL THRUST BLOCKS						
Pipe Size (in)	Minimum Bearing Area (sf)					
	11.25	22.5	45	90	Tee/Plug	Cross *
4	0.4	0.8	1.5	2.8	2.0	1.0
6	0.8	1.7	3.2	6.0	4.2	2.1
8	1.4	2.8	5.5	10.1	7.2	3.6
10	2.2	4.4	8.5	15.8	11.1	5.6
12	3.1	6.1	12.0	22.2	15.7	7.8
14	3.7	7.4	14.5	26.7	18.9	9.5
16	4.8	9.6	18.9	34.9	24.7	12.3

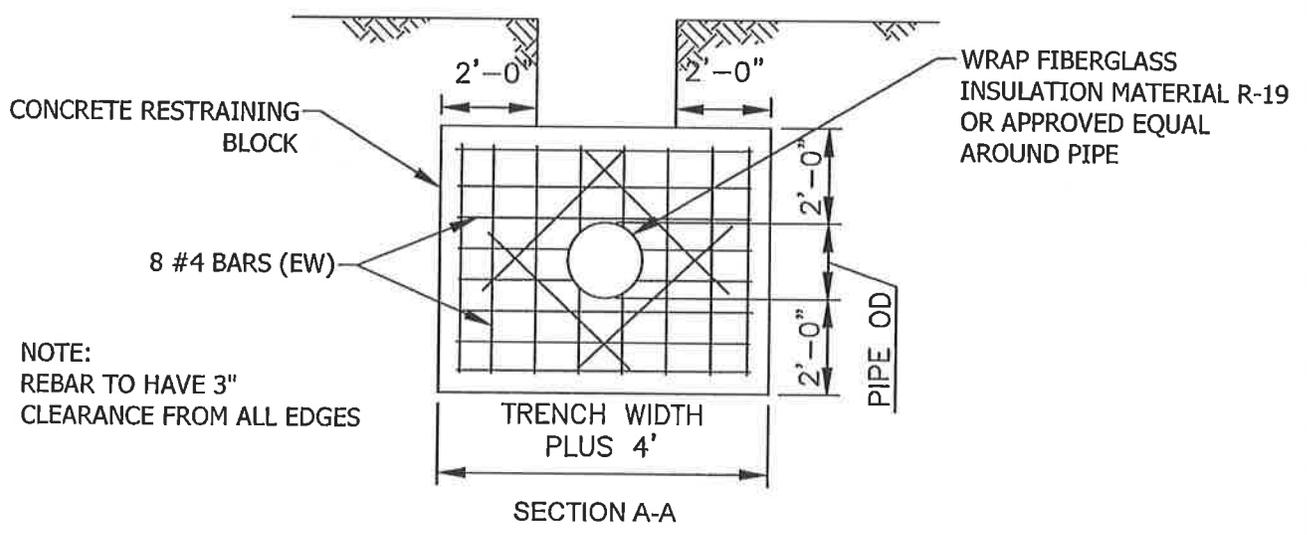
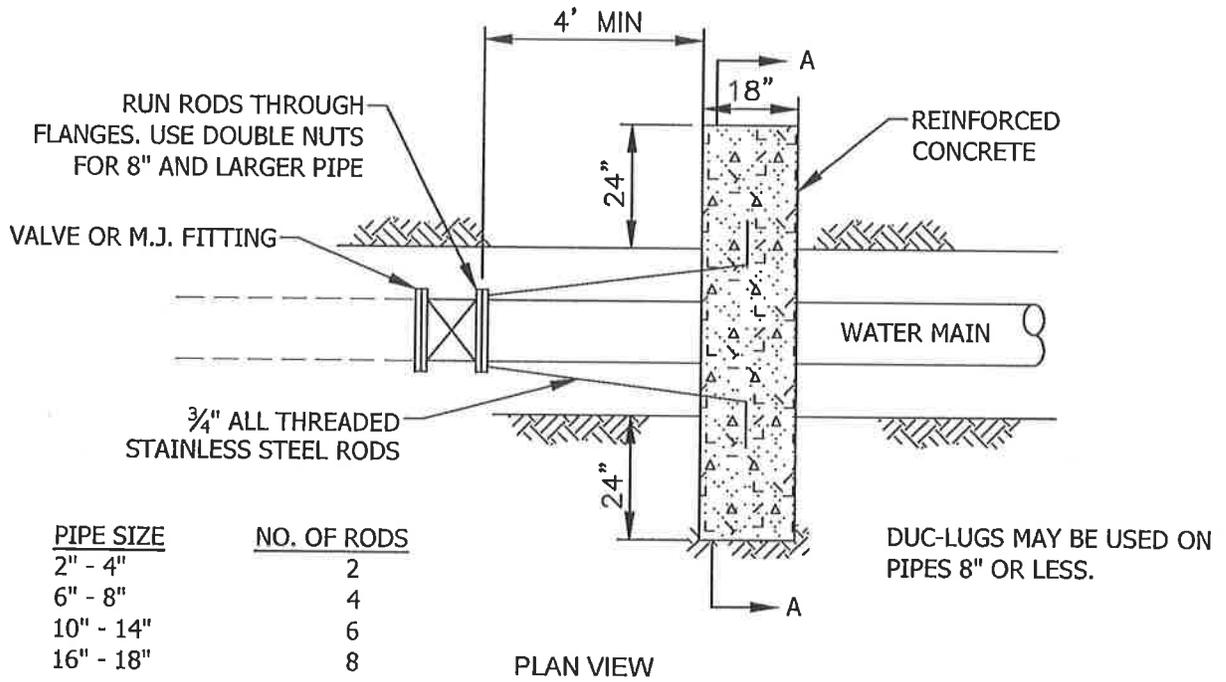
* Use at each corner

HORIZONTAL BEND THRUST BLOCK DETAIL

- THRUST BLOCKS SHALL BE FORMED AND Poured AGAINST UNDISTURBED SOIL. KEEP "T" BOLTS CLEAR OF CONCRETE, WRAPPED IN 8 MIL VINYL PLASTIC PROTECTOR.
- THICKNESS BETWEEN FITTING AND SOIL SHALL BE A MINIMUM OF 12".
- CONCRETE SHALL HAVE 3000 PSI MINIMUM COMPRESSIVE STRENGTH.
- PLUGS SHALL BE WRAPPED WITH 8 MIL VISQUEEN.

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	CPWSD NO. 1 OF BOONE COUNTY	DATE: APRIL 2018	2

Drawing Name: \\nt00cdfs01\production\Proj\7000\7011\17011.000\7011 SPECIFICATIONS\DIR Standard Specifications Submittal\2018 OSP Renewal Specs and Details\STANDARD DETAILS April 2018.dwg Layout Name: RESTRAIN BLOCK Plotted By: KAK00402 Plotted on: 4/24/2018 9:58:4



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RESTRAINING BLOCK DETAIL

CPWSD NO. 1 OF BOONE COUNTY

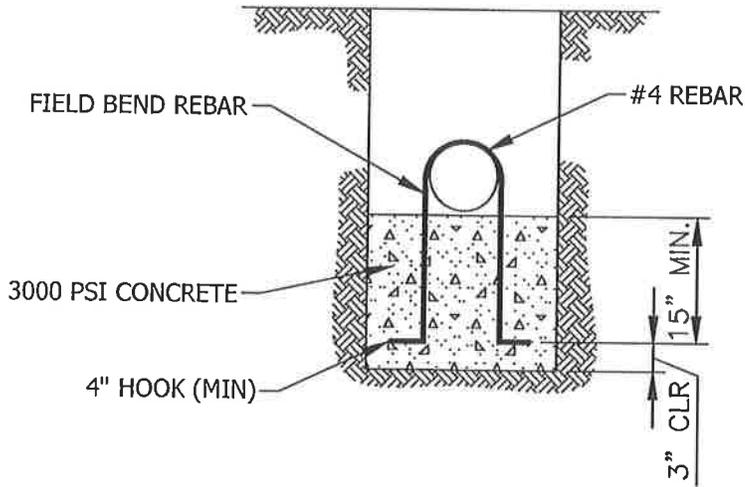
STANDARD DETAILS

DATE: APRIL 2018

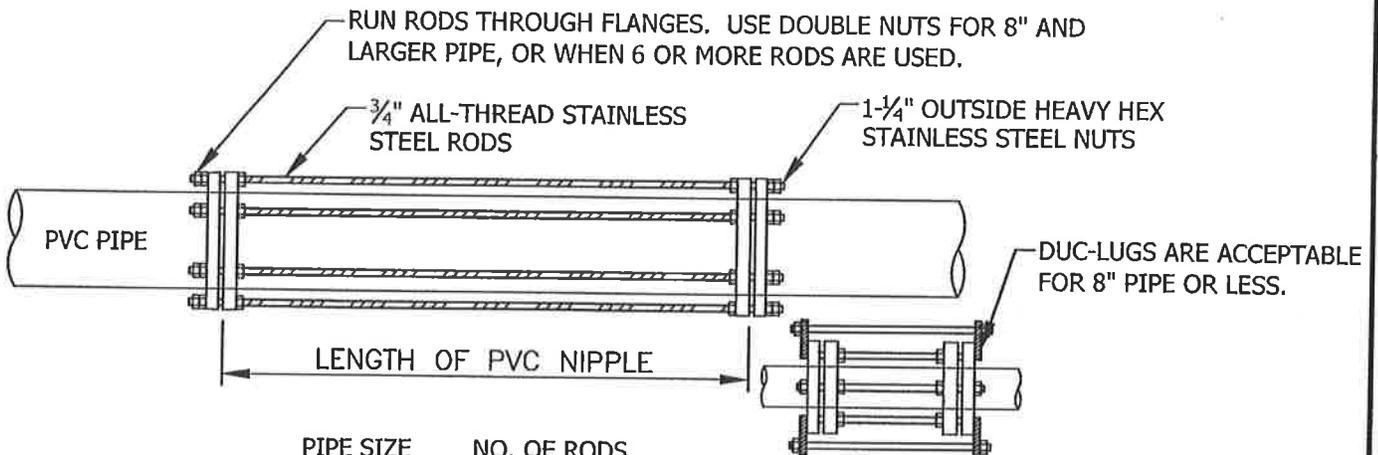
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3

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HAIRPIN REBAR DETAIL



PIPE SIZE	NO. OF RODS
4" and Below	2
6" - 8"	4
10" - 14"	6
16" - 18"	8
20" - 24"	12

TIEBACK RODS MAY BE ATTACHED TO D.I. FITTINGS, VALVES, HYDRANTS, AND CONCRETE RESTRAINING BLOCKS.

TIEBACK ROD DETAIL

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**TIEBACK ROD & HAIRPIN
REBAR DETAILS
CPWSD NO. 1 OF BOONE COUNTY**

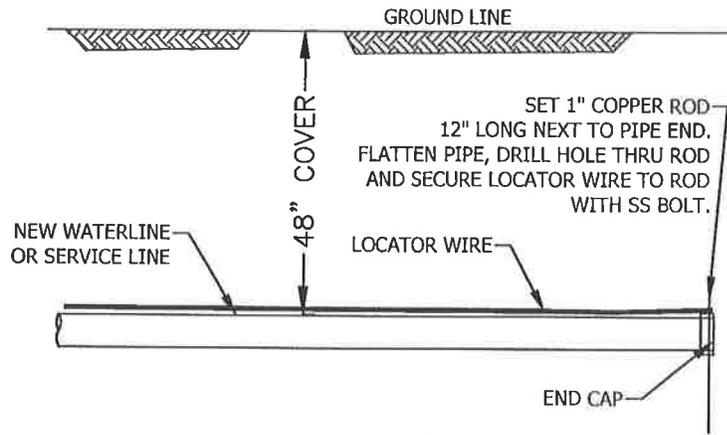
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DATE:
APRIL 2018

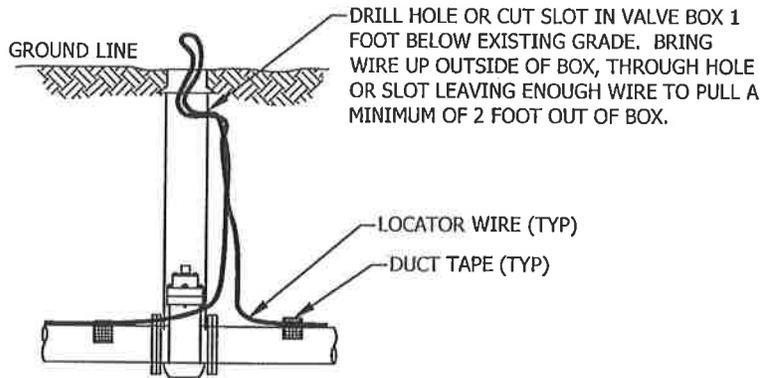
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SECTION VIEW
TERMINATION DETAIL



SECTION VIEW

LOCATOR WIRE NOTES:

1. LOCATOR WIRE TO BE PE-45 SOLID COPPER WIRE WITH BLUE INSULATION AS MANUFACTURED BY KRIS-TECH WIRE COMPANY.
2. DUCT TAPE LOCATOR WIRE TO TOP OF PIPE ON EACH SIDE OF BELL AND ONE IN THE MIDDLE OF THE PIPE.
3. AT ALL ENDS OF WATER LINES, THE LOCATOR WIRE SHALL BE EXTENDED 2' ABOVE THE TOP OF THE GROUND AND BE ACCESSIBLE. THERE SHALL BE NO MORE THAN ONE SPLICE BETWEEN ACCESS POINTS AT VALVES.
4. TWO SETS OF LOCATOR WIRE SHALL BE INSTALLED ON PIPE AT ALL BORINGS UNDER HIGHWAYS, AND CREEKS, OR AT ADDITIONAL LOCATIONS AS SHOWN ON THE PLANS.
5. DO NOT WRAP WIRE AROUND BOLTS, NUTS, ETC.
6. SPLICE LOCATOR WIRE USING SPLICING KIT 3M DBR. DUCT TAPE LOCATOR WIRE TO PIPE ON EACH END OF THE SPLICE.
7. WHERE CALLED FOR ON THE PLANS FOR A SPLICE BOX, THE SPLICE BOX SHALL BE IDENTICAL TO A VALVE BOX RISER AND LID WITH THE INSTALLATION OF THE WIRE IDENTICAL TO THAT IN A VALVE BOX.
8. LOCATOR WIRE INSTALLATION CONTINUITY SHALL BE WARRANTED UNDER THE SAME 1 YEAR PIPE AND WORKMANSHIP WARRANTY.

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LOCATOR WIRE DETAILS

CPWSD NO. 1 OF BOONE COUNTY

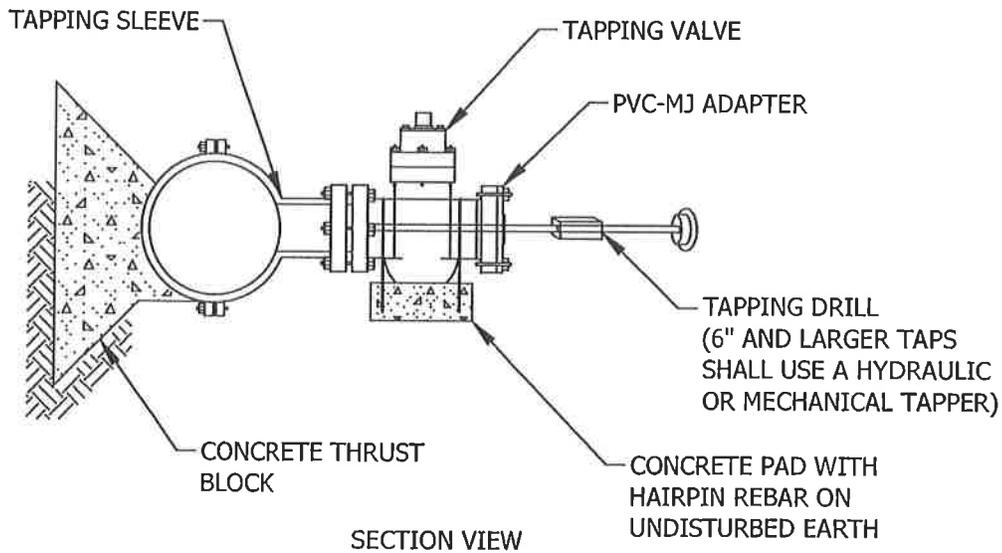
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DATE:

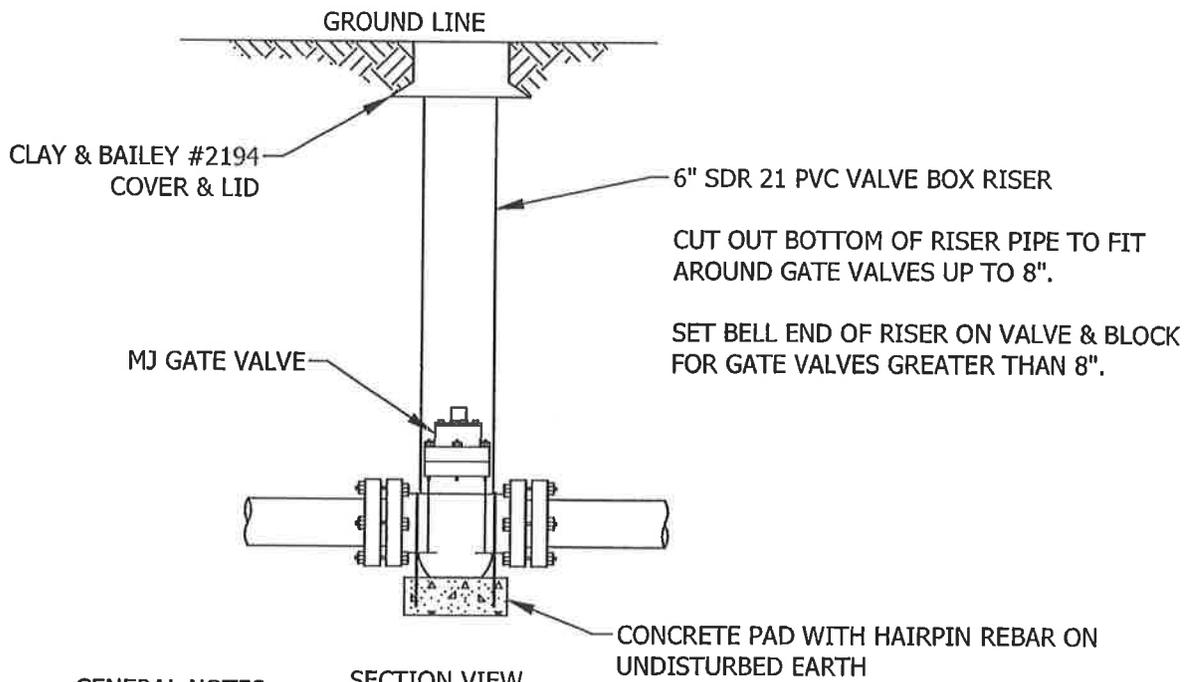
APRIL 2018

DETAIL NUMBER

5



TAPPING SLEEVE AND VALVE ASSEMBLY



GENERAL NOTES:

1. ANCHOR COUPLING OR PVC PIPE WITH TIEBACK RODS WILL BE REQUIRED BETWEEN VALVE AND FITTINGS
2. WRAP VALVE AND JOINTS WITH VISQUEEN.
3. VALVE AND RISER SHALL BE PLUMB AND CHECKED BY A LEVEL.

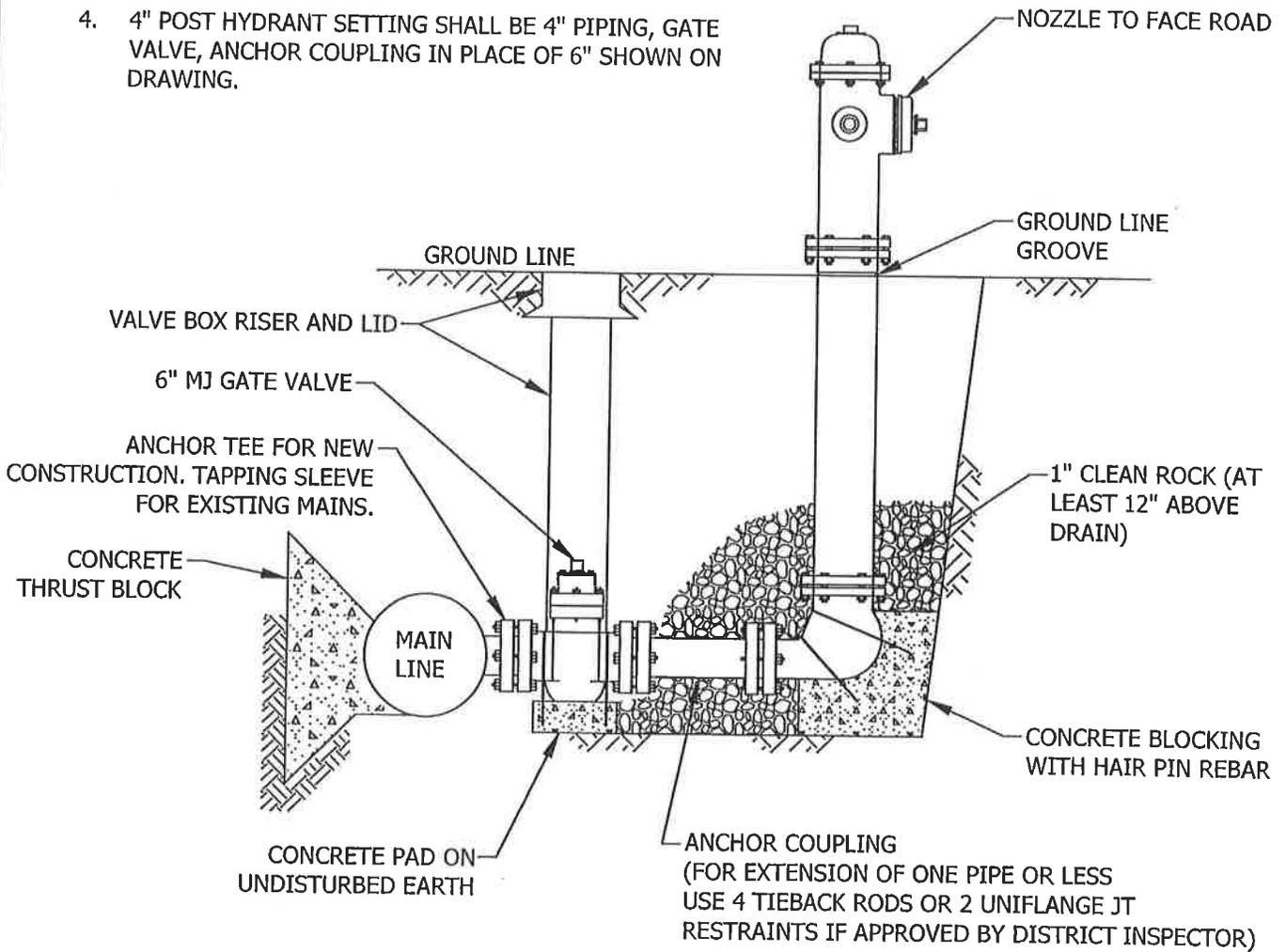
GATE VALVE AND VALVE BOX DETAIL

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	CPWSD NO. 1 OF BOONE COUNTY	DATE: APRIL 2018	

Drawing Name: \\int000cf601\production\Proj\7000\7011\7011.000\7011.000\7011 SPECIFICATIONS\DIR Standard Specifications Submittal\2018 OSP Renewal Specs and Details\STANDARD DETAILS April 2018.dwg Layout Name: FIRE HYDRANT Plotted By: KAK00402 Plotted on: 4/24/2018 9:59:07

NOTES:

1. VALVE, VALVE RISER AND DISCHARGE RISER PIPE TO BE PLUMB AND CHECKED BY A LEVEL.
2. APPROVED FIRE HYDRANTS ARE: AMERICAN DARLING B-84-B-5, CLOW MEDALLION, AND MUELLER CENTURION NO. 250.
3. COMMERCIAL HYDRANT SETTING SHALL BE 8" PIPING, VALVE, ANCHOR COUPLING AND HYDRANT SHOE IN PLACE OF 6" SHOWN ON DRAWING.
4. 4" POST HYDRANT SETTING SHALL BE 4" PIPING, GATE VALVE, ANCHOR COUPLING IN PLACE OF 6" SHOWN ON DRAWING.



FIRE HYDRANT DETAIL

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STANDARD DETAILS

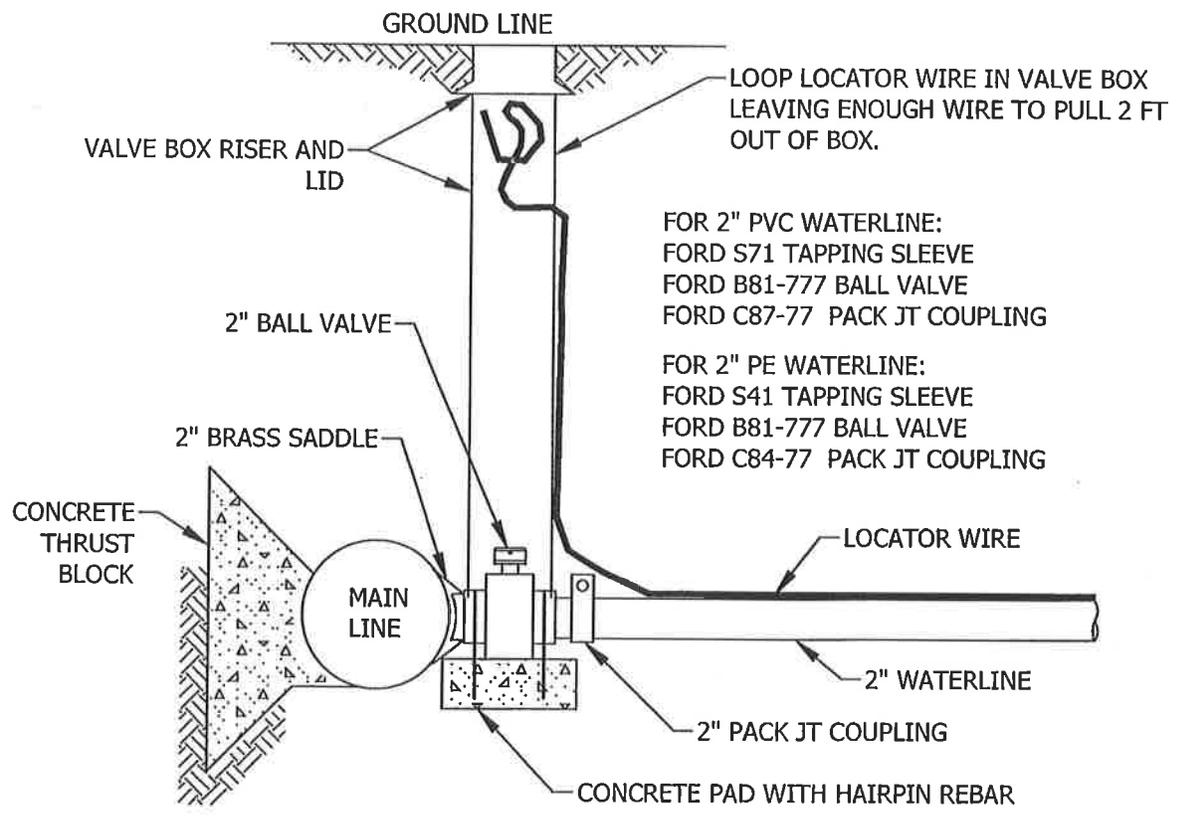
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APRIL 2018

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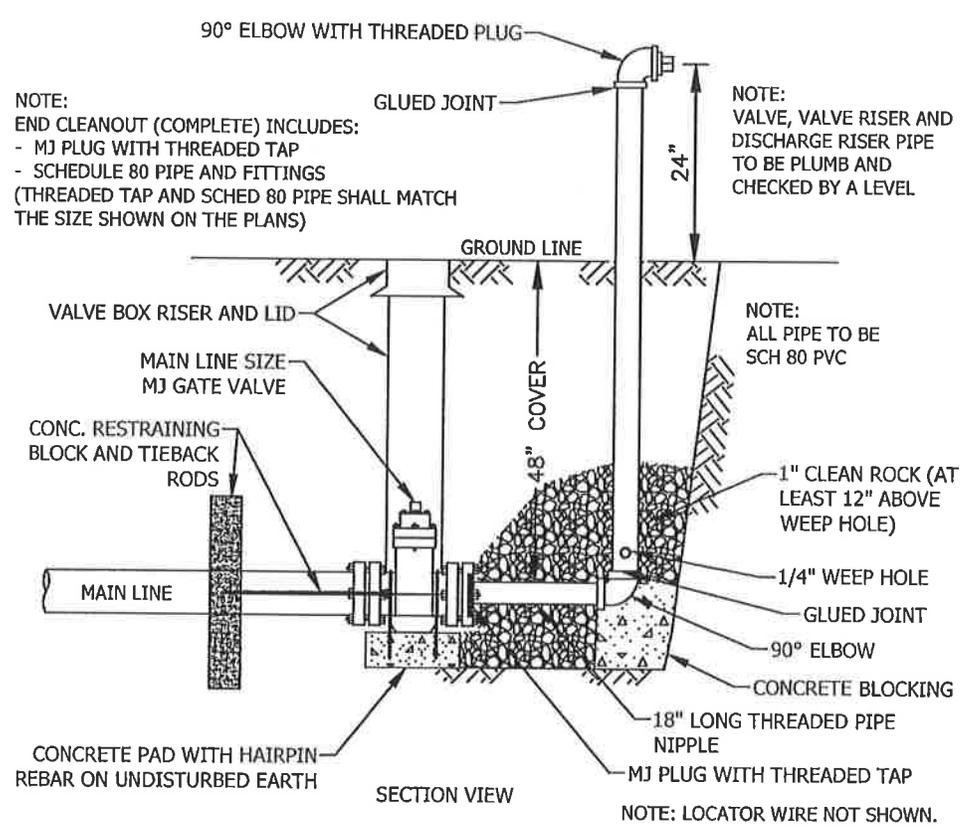
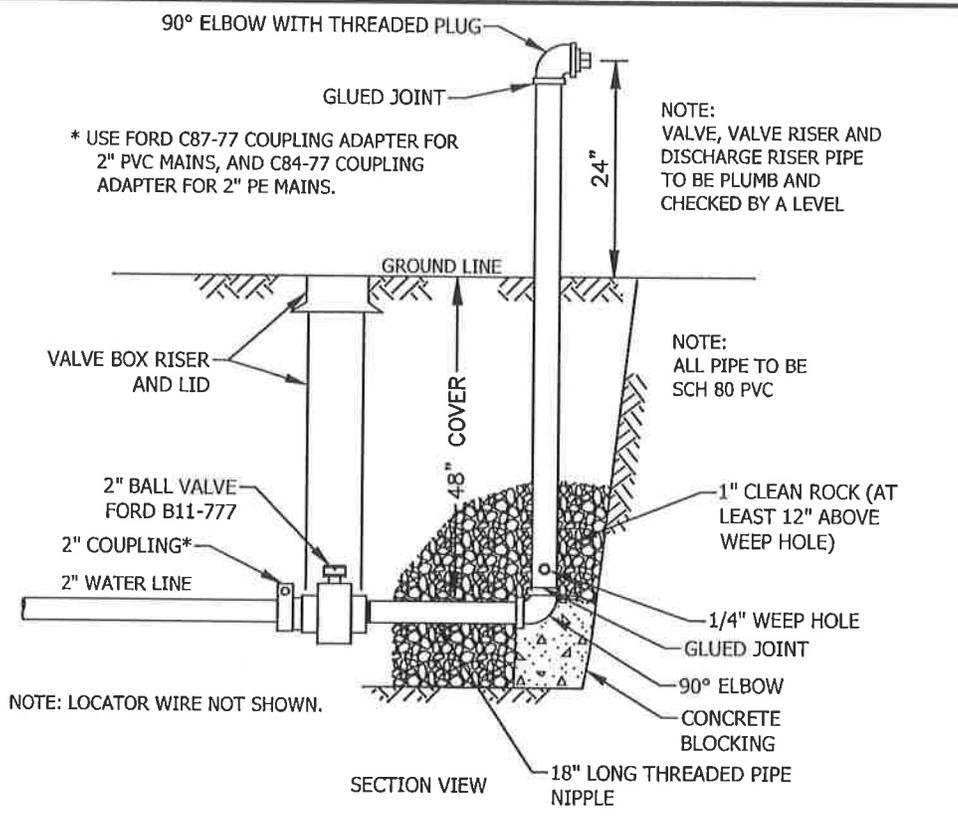
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2" CONNECTION TO MAIN

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	CPWSD NO. 1 OF BOONE COUNTY	DATE: APRIL 2018	8

Drawing Name: \\nt00cdfs01\production\proj\7000\7011\701.1.000\7011 SPECIFICATIONS\DNR Standard Specifications Submittal\2018 OSP Renewal Specs and Details\STANDARD DETAILS April 2018.dwg Layout Name: END CLEANOUT Plotted on: 4/24/2018 9:59:17



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END CLEANOUT DETAILS

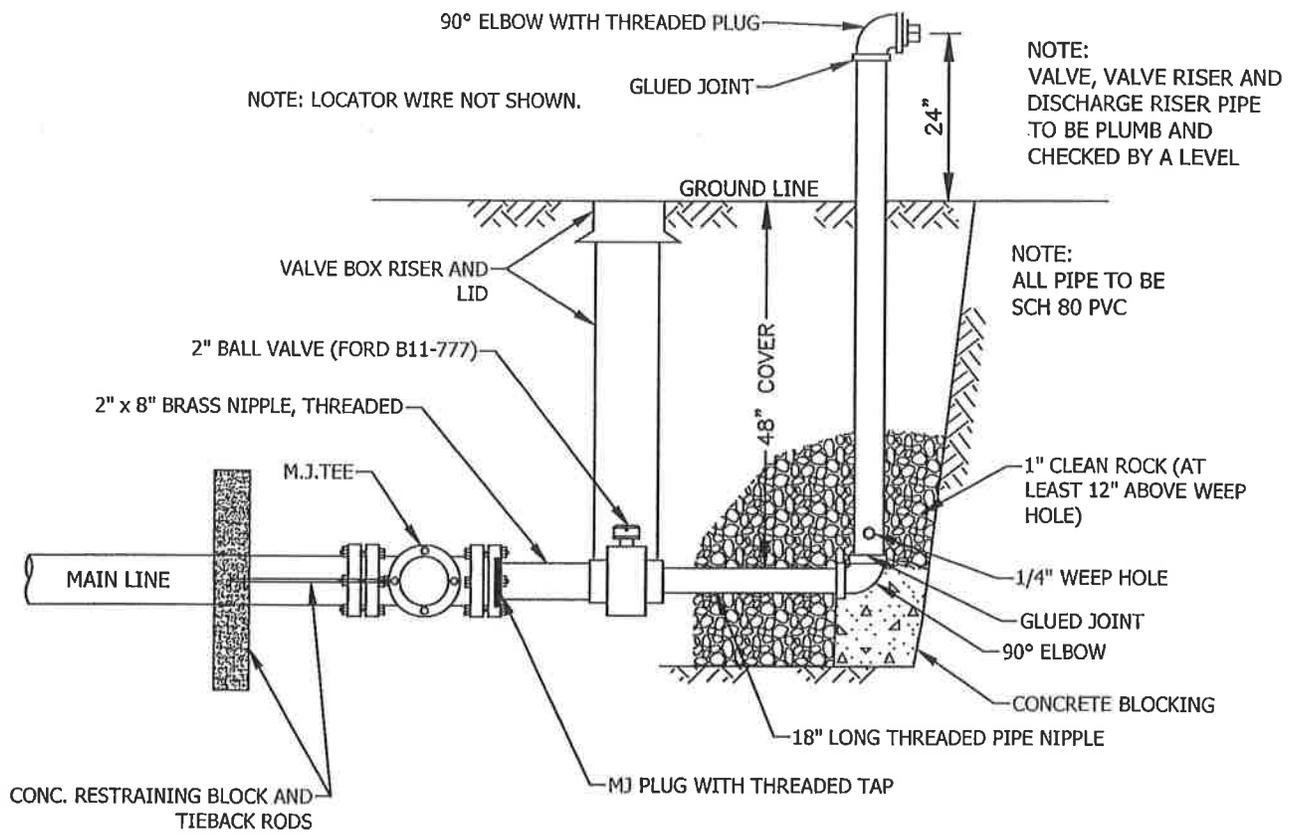
CPWSD NO. 1 OF BOONE COUNTY

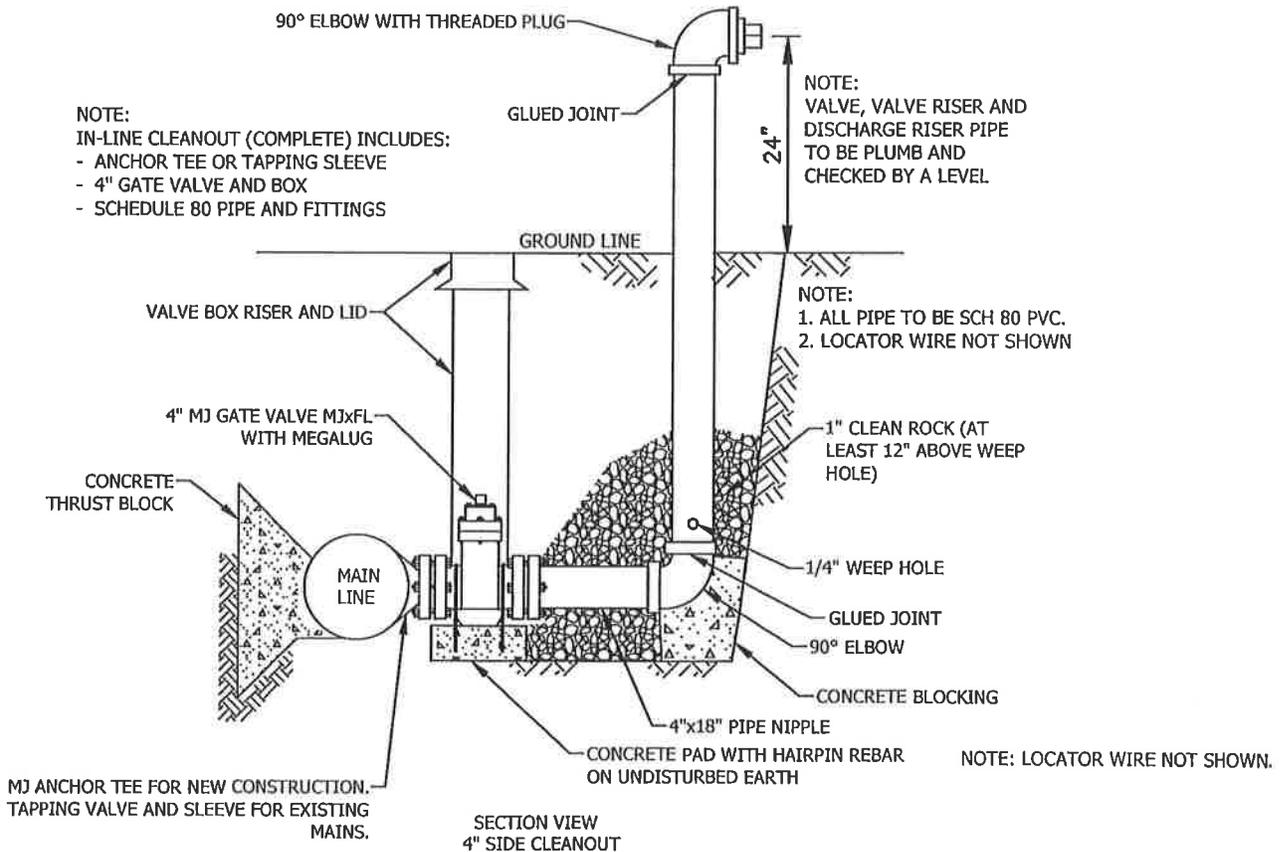
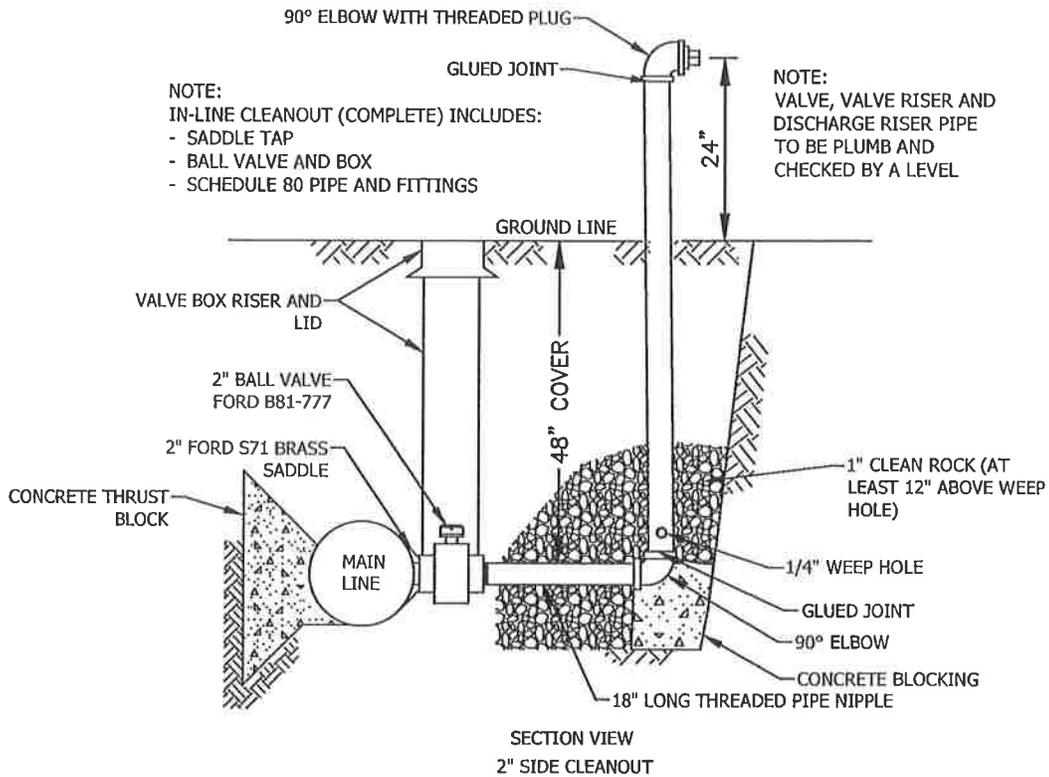
STANDARD DETAILS

DATE: APRIL 2018

DETAIL NUMBER

9





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SIDE CLEANOUT DETAILS

CPWSD NO. 1 OF BOONE COUNTY

STANDARD DETAILS

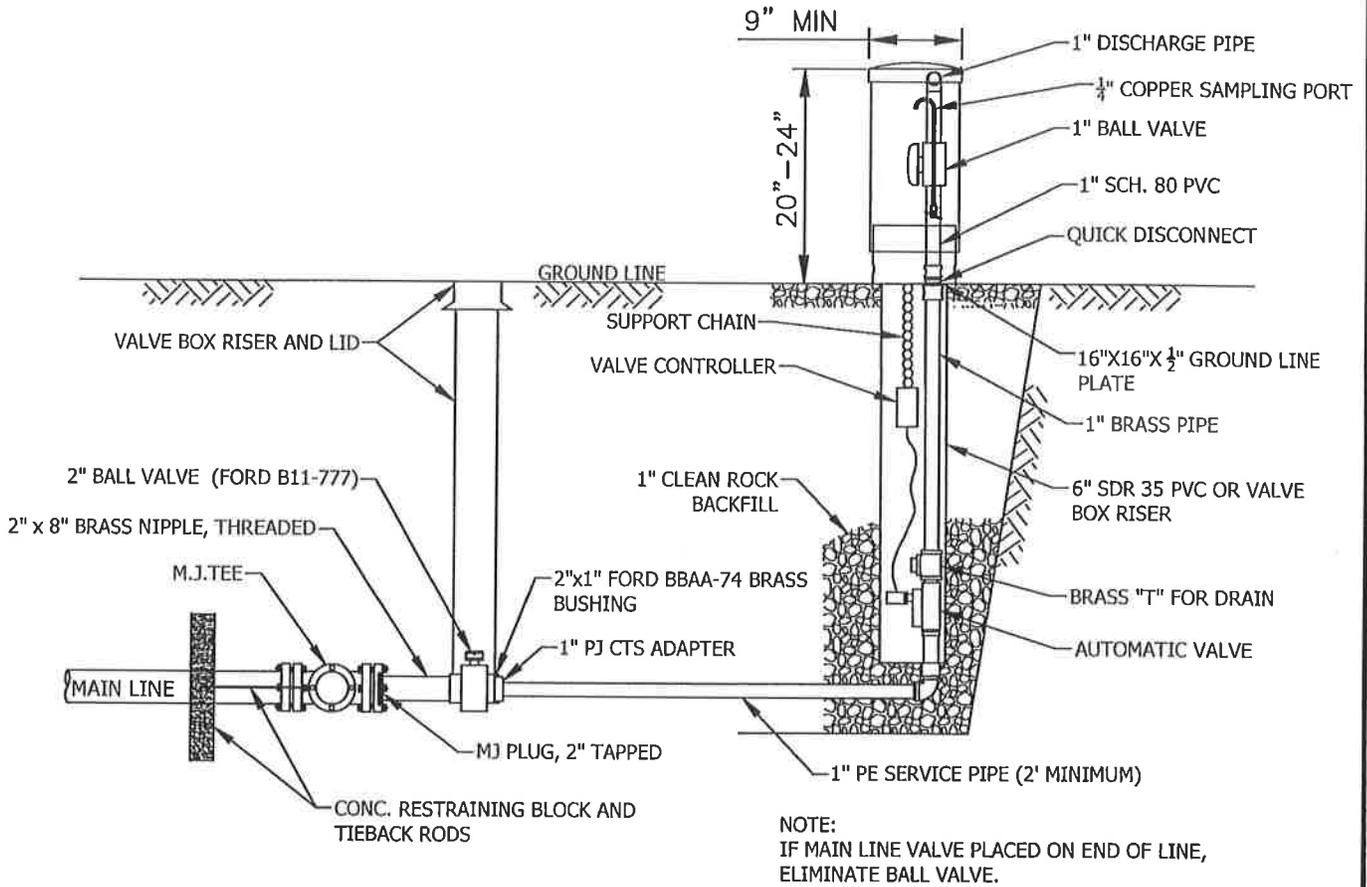
DATE:

APRIL 2018

DETAIL NUMBER

11

Drawing Name: \\nt00dcf601\production\Proj\2000\7011\7011.000\7011 SPECIFICATIONS\DIR Standard Specifications Submittal\2018 OSP Renewal Specs and Details\STANDARD DETAILS April 2018.dwg Layout Name: AUTO FLUSH Plotted on: 4/24/2018 9:59:32 AM



SECTION VIEW

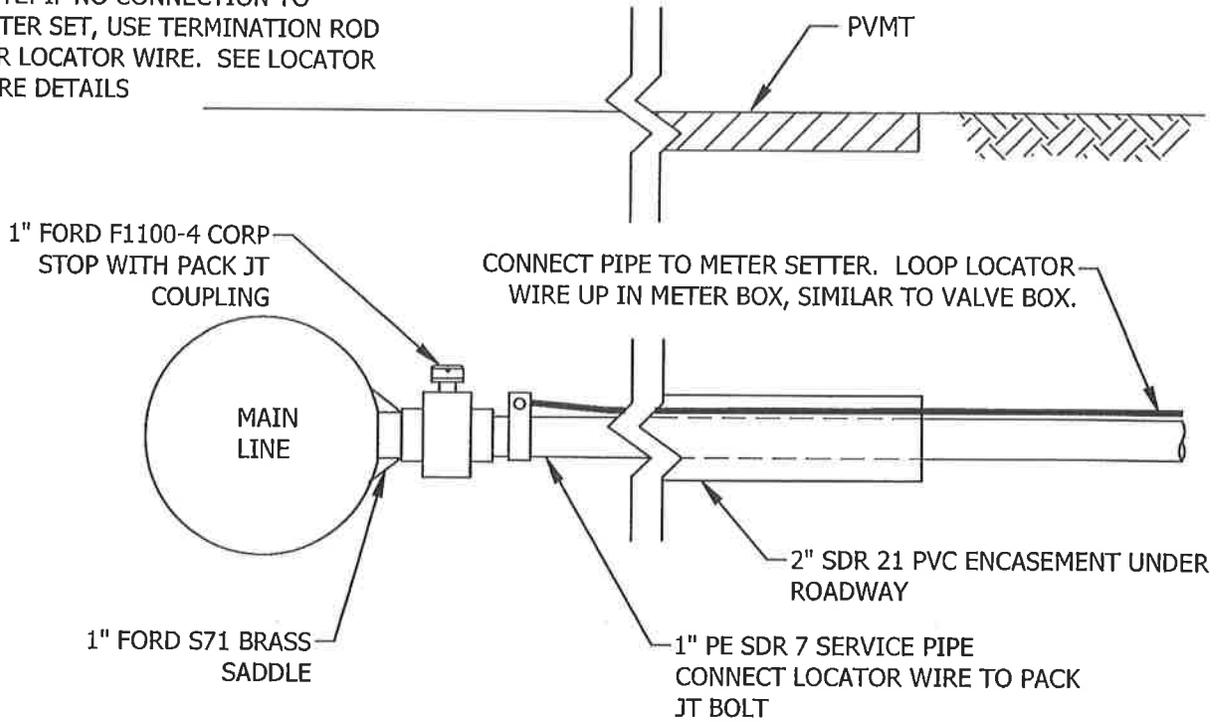
REQUIREMENTS

1. AUTOMATIC FLUSHING DEVICE SHALL HAVE A 1" BRASS FIP INLET, LEADING VERTICALLY INTO A 1" AUTOMATIC SOLENOID VALVE. AUTOMATIC SOLENOID VALVE SHALL HAVE INTERNAL, SELF-CLEANING DEBRIS SCREEN, AND HAVE A 220 PSI RATING. SOLENOID SHALL HAVE NO LOOSE PARTS WHEN REMOVED FROM VALVE.
2. SOLENOID VALVE SHALL HAVE AN O-RING CONNECTOR LOCATED UNDER THE VALVE.
3. EACH UNIT SHALL BE FURNISHED WITH A STAND-ALONE VALVE CONTROLLER. VALVE CONTROLLER WILL NOT REQUIRE A SECOND HAND-HELD DEVICE FOR PROGRAMMING, WITH A MINIMUM OF 9 FLUSHING CYCLES PER DAY.
4. VALVE CONTROLLER SHALL BE SUBMERSIBLE TO 12', OPERATE WITH A 9 VOLT BATTERY AND HAVE RESIN-SEALED ELECTRICAL COMPONENTS.
5. ALL ABOVE GROUND COMPONENTS SHALL BE CONTAINED WITHIN A UV-RESISTANT LOCKING DOMED COVER.
6. UNIT SHALL BE AS MANUFACTURED BY KUPFERLE FOUNDRY COMPANY MODEL 9400-A ST. LOUIS, MO. OR APPROVED EQUAL.
7. VALVE, VALVE RISER TO BE PLUMB AND CHECKED WITH A LEVEL.

Bartlett & West <small>www.bartlettwest.com</small>	AUTO FLUSH UNIT DETAIL	STANDARD DETAILS	DETAIL NUMBER
	CPWSD NO. 1 OF BOONE COUNTY	DATE: APRIL 2018	12

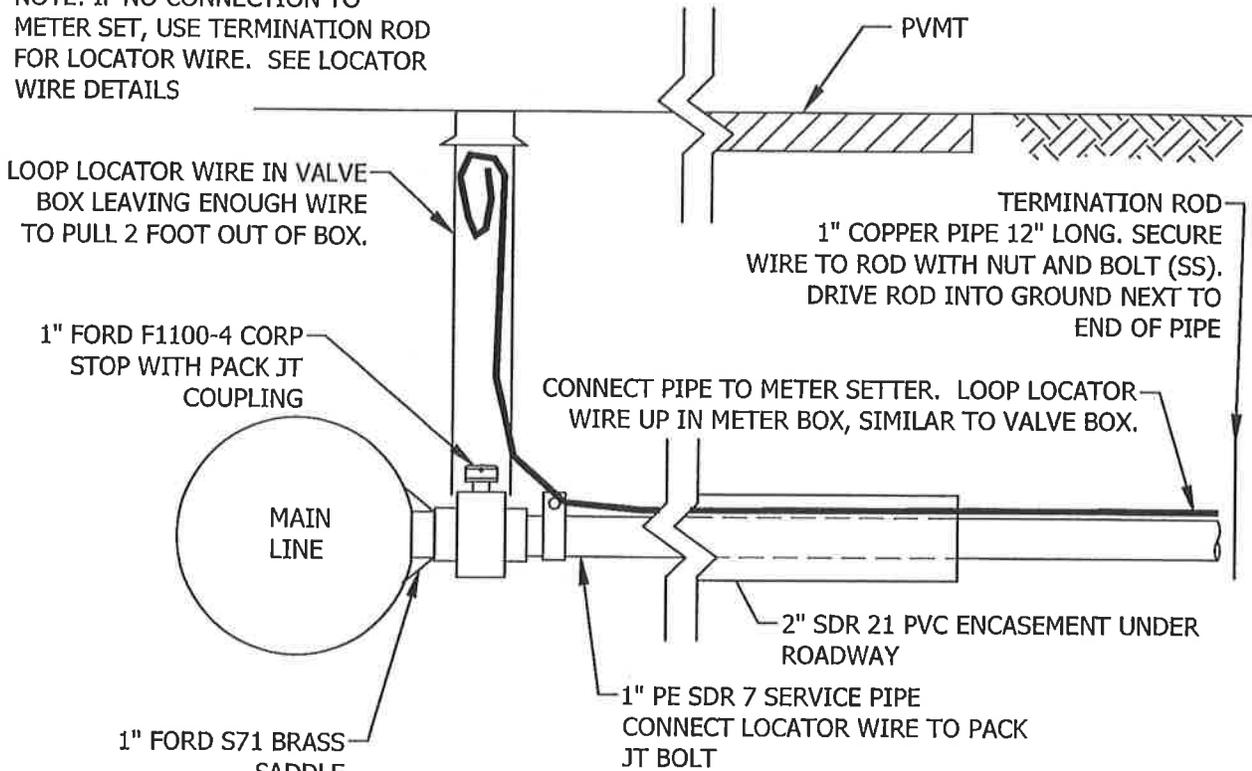
Drawing Name: \\ntb00cf501\production\proj\7000\7011\7011.000\7011 SPECIFICATIONS\DNIR Standard Specifications Submittal\2018 OSP Renewal Specs and Details\STANDARD DETAILS April 2018.dwg Layout Name: 1-CROSSINGS Plotted By: KAK00402 Plotted on: 4/24/2018 9:59:37 A

NOTE: IF NO CONNECTION TO METER SET, USE TERMINATION ROD FOR LOCATOR WIRE. SEE LOCATOR WIRE DETAILS



SECTION VIEW
1" SERVICE LINE ROADWAY CROSSING

NOTE: IF NO CONNECTION TO METER SET, USE TERMINATION ROD FOR LOCATOR WIRE. SEE LOCATOR WIRE DETAILS



SECTION VIEW
1" SERVICE LINE ROADWAY CROSSING WITHOUT METER CONNECTION

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**1" SERVICE LINE ROADWAY
CROSSING DETAILS**
CPWSD NO. 1 OF BOONE COUNTY

STANDARD DETAILS

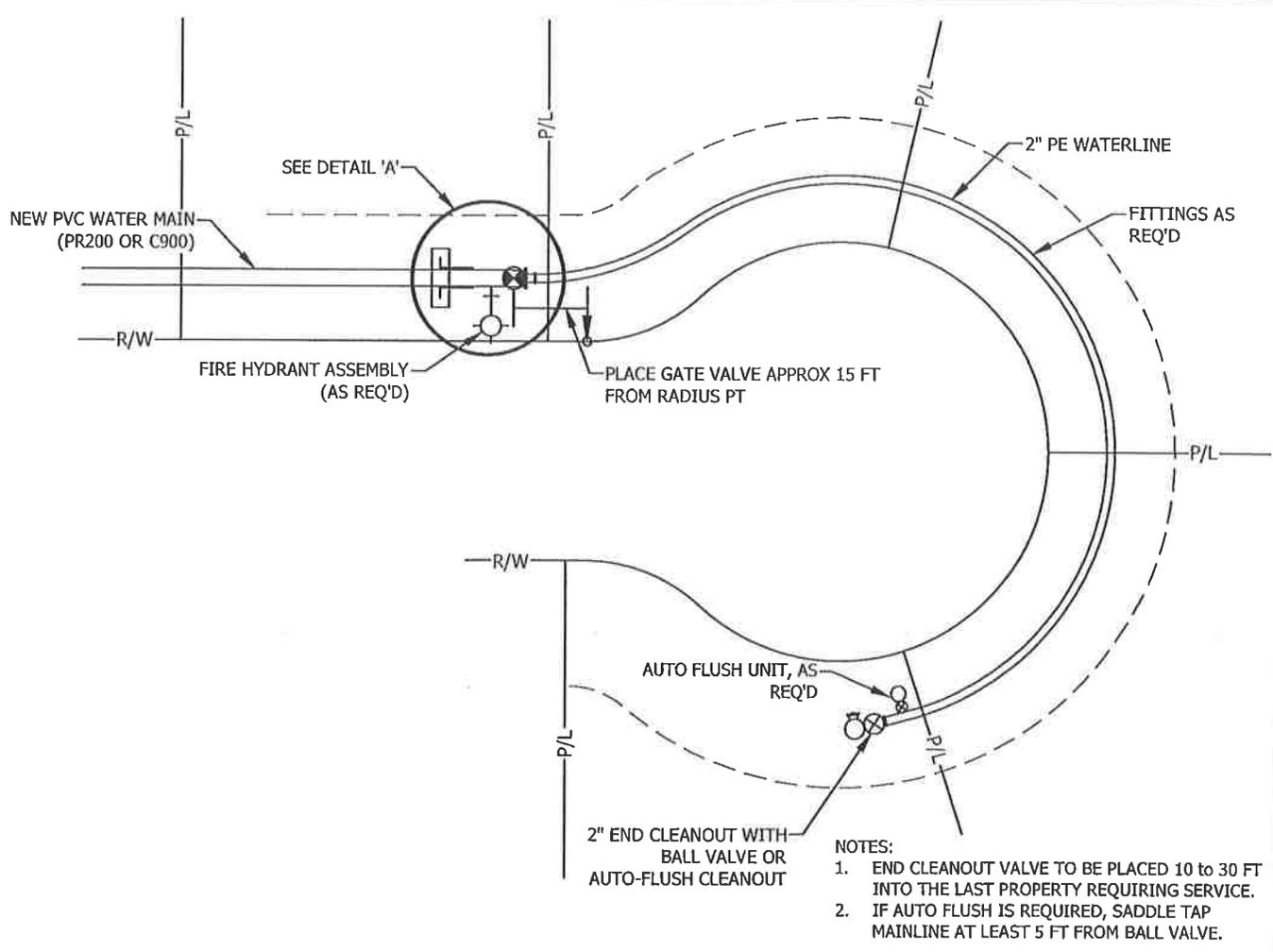
DATE:

APRIL 2018

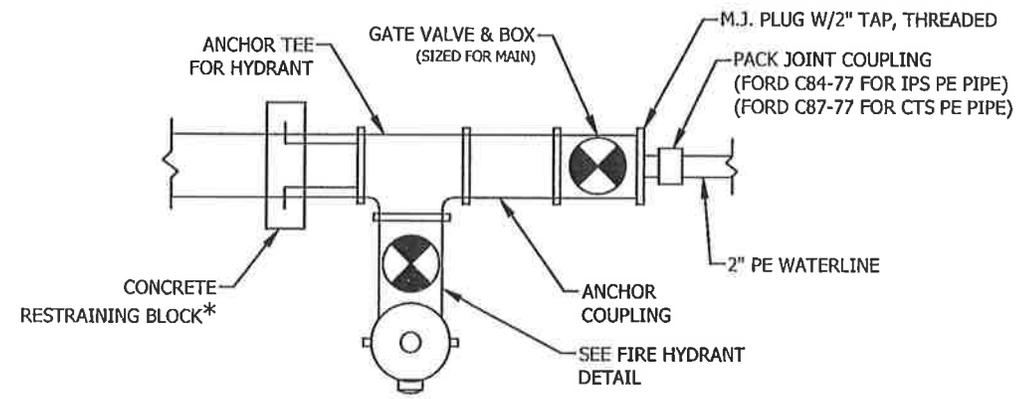
DETAIL NUMBER

13

Drawing Name: \\int0001601\production\Proj\7000\7011\7011.000\7011 SPECIFICATIONS\DWG Standard Specifications Submittal\2018 OSP Renewal Specs and Details\STANDARD DETAILS April 2018.dwg Layout Name: CUL-DE-SAC Plotted by: KAK00402 Plotted on: 4/24/2018 9:59:47 AM



- NOTES:**
1. END CLEANOUT VALVE TO BE PLACED 10 to 30 FT INTO THE LAST PROPERTY REQUIRING SERVICE.
 2. IF AUTO FLUSH IS REQUIRED, SADDLE TAP MAINLINE AT LEAST 5 FT FROM BALL VALVE.

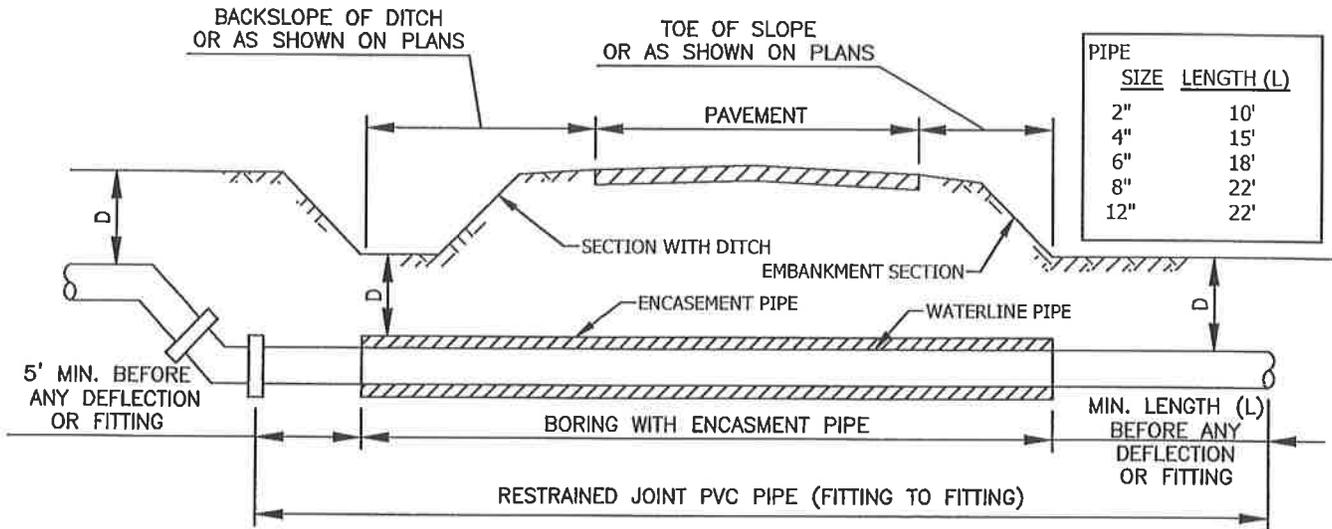


* IF FIRE HYDRANT IS NOT REQUIRED, THEN ANCHOR CONCRETE RESTRAINING BLOCK TO GATE VALVE AND OMIT ANCHOR COUPLING

DETAIL 'A'

 www.bartlettwest.com	WATER LINE INSTALLATION AT CUL-DE-SAC	STANDARD DETAILS	DETAIL NUMBER
	CPWSD NO. 1 OF BOONE COUNTY	DATE: APRIL 2018	15

Drawing Name: \\rtd001\production\proj\7000\7011\7011.0001\7011.SPECIFICATIONS\DNR Standard Specifications Submittal\2018 OSP Renewal Specs and Details\STANDARD DETAILS April 2018.dwg Layout Name: RD CROSSINGS Plotted on: 4/24/2018 9:59:52

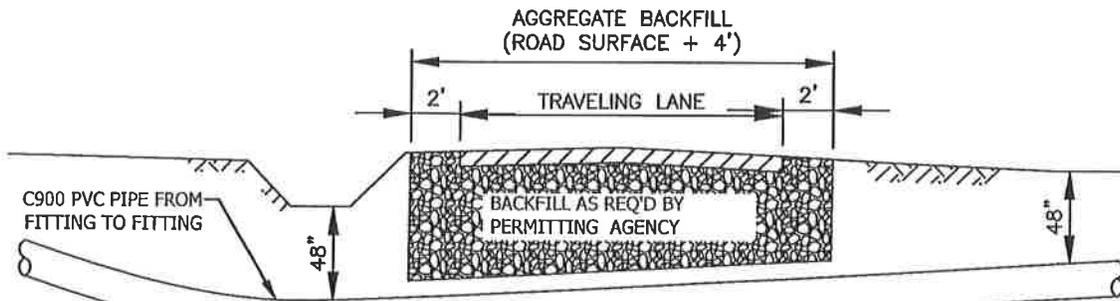


"D"- 48" FOR STEEL ENCASMENT AND 72" FOR HDPE ENCASMENT UNLESS OTHERWISE SPECIFIED

NOTES:

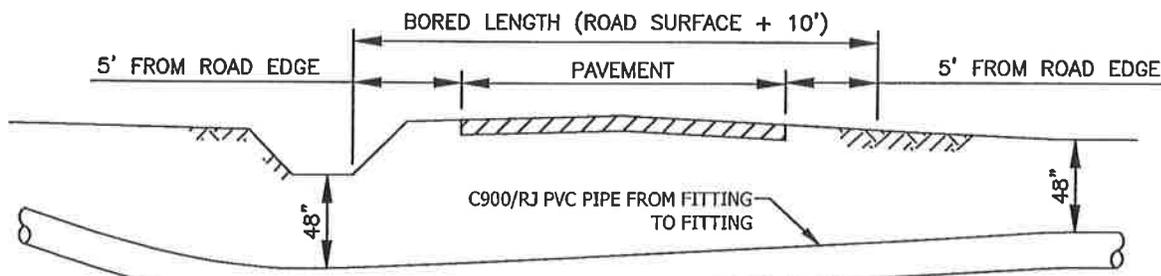
1. CASING TYPE, SIZE AND THICKNESS TO BE DETERMINED BY PERMITTING AGENCY OR SHOWN ON PLANS.
2. REFER TO ENCASMENT DETAIL FOR SPACER AND END SEAL INSTALLATION.
3. LOCATOR WIRE IS NOT SHOWN.

ROADWAY CROSS-SECTION
TYPICAL BORING UNDER STATE HIGHWAY



ROADWAY CROSS-SECTION
TYPICAL OPEN CUT ROAD CROSSING

NOTE: LOCATOR WIRE NOT SHOWN.



ROADWAY CROSS-SECTION
TYPICAL BORED ROAD CROSSING

NOTE: LOCATOR WIRE NOT SHOWN.

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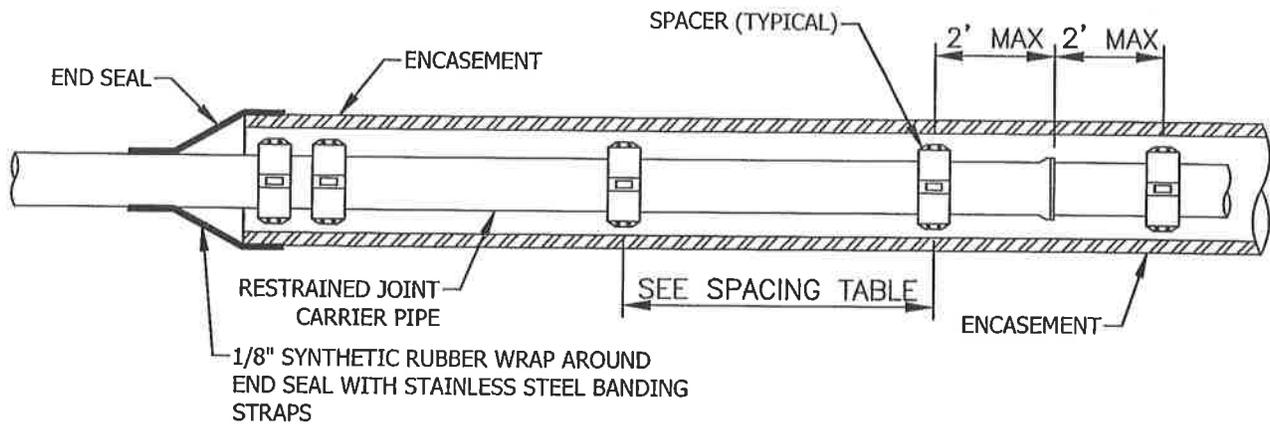
www.bartlettwest.com

TYPICAL ROADWAY CROSSING
CPWSD NO. 1 OF BOONE COUNTY

STANDARD DETAILS
DATE: APRIL 2018

DETAIL NUMBER
16

Drawing Name: \\m00c0c0f001\production\proj\7000\7011\7011.000\7011\STANDARD DETAILS\April 2018.dwg Layout Name: CASING SPACER Plotted on: 4/24/2018 9:59:57



Carrier Pipe Diameter (in)	Skid Spacing Maximum (ft)	Spacer Width (inch)
3	3	5
4	4.5	6
6	6	6
8	7	8
10	8.5	8
12	9.5	8
12+	10	8

NOTES:

1. SPACER O.D. SHALL BE AT LEAST 1/2" LARGER THAN PIPE BELL O.D.
2. CLEARANCE BETWEEN SPACER O.D. AND ENCASEMENT PIPE I.D. SHALL BE AT LEAST 1-1/2".
3. A MINIMUM OF 3 SPACERS PER INDIVIDUAL PIPE REGARDLESS OF PIPE LENGTH.
4. USE DOUBLE SPACERS AT END & ONE EACH SIDE OF A JOINT CASING.
5. END SEALS TO BE SYNTHETIC RUBBER BOOT WITH STAINLESS STEEL ADJUSTING BINDING STRAPS.
6. LOCATOR WIRE NOT SHOWN.

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**ENCASEMENT PIPE
SPACER DETAIL
CPWSD NO. 1 OF BOONE COUNTY**

STANDARD DETAILS

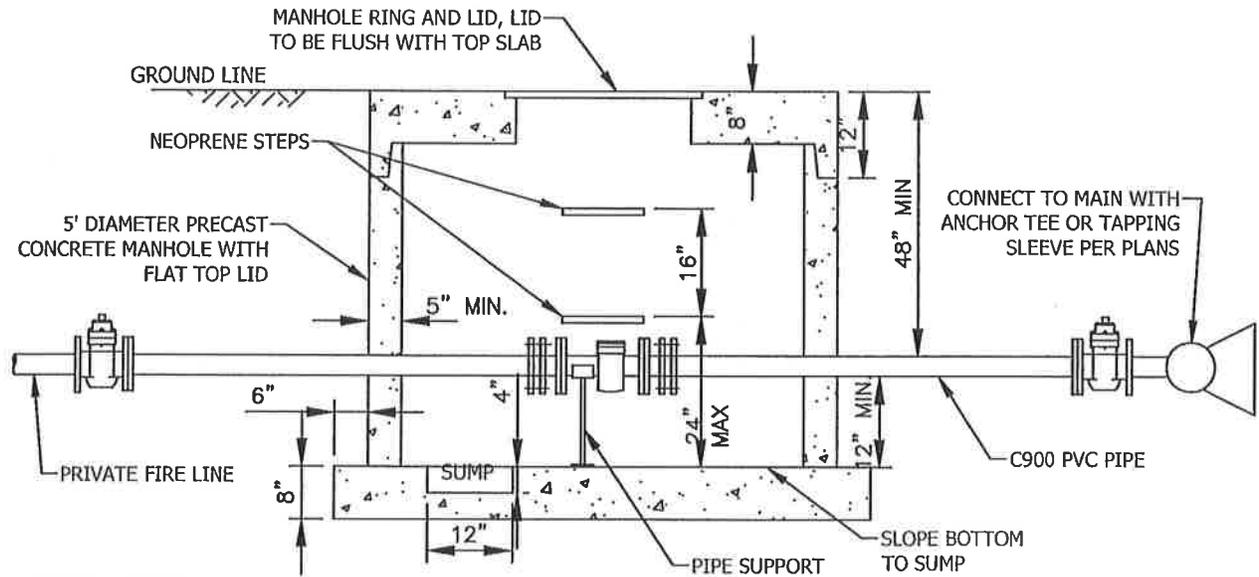
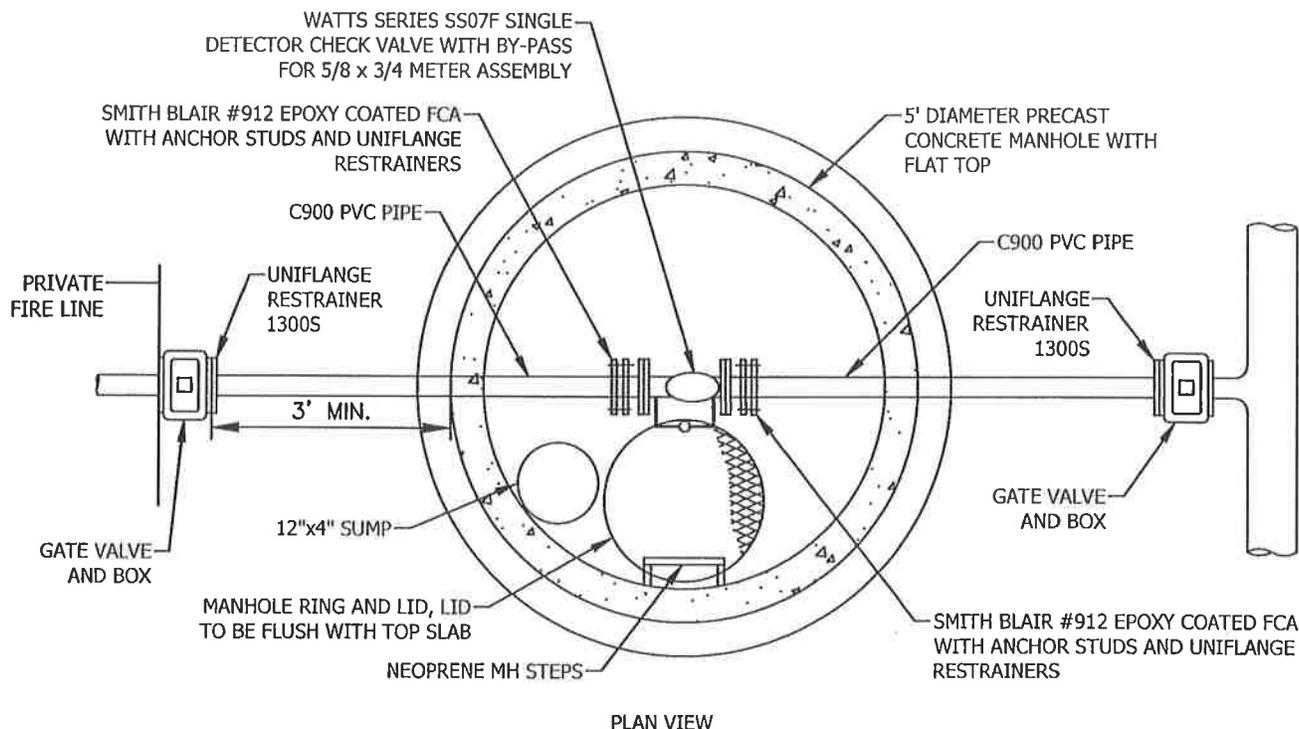
DATE:

APRIL 2018

DETAIL NUMBER

17

Drawing Name: \\nt00cifs01\production\Proj\7000\7011\7011.000\7011 SPECIFICATIONS\DMR Standard Specifications Submittal\2018 OSP Renewal Specs and Details\STANDARD DETAILS April 2018.dwg Layout Name: DETECTOR CHECK VALVE Plotted on: 4/24/2018 10:00

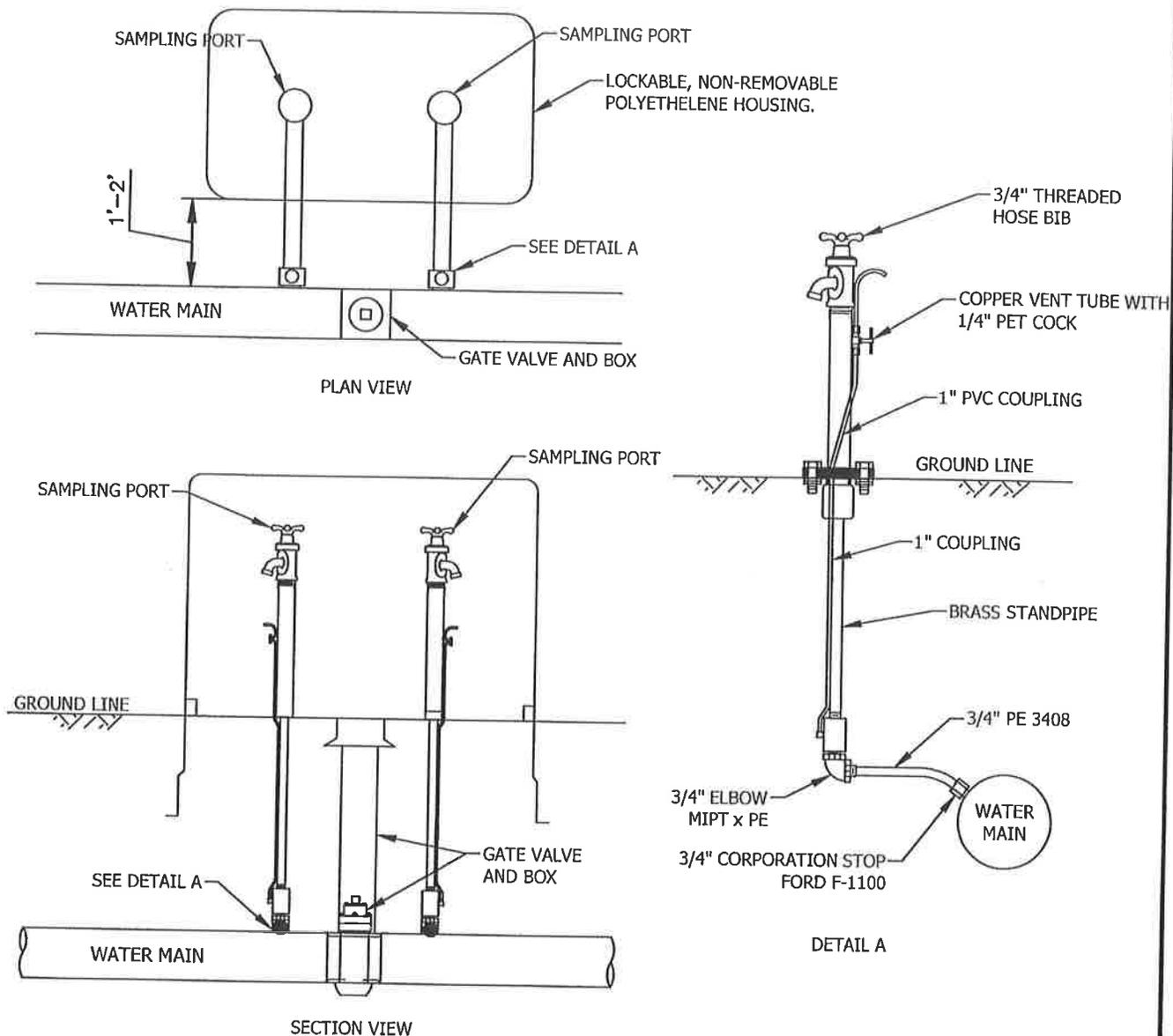


GENERAL NOTES:

1. PRECAST STRUCTURE TO MEET ASTM C478 USING 4000 PSI CONCRETE.
2. RISER JOINTS TO BE A 2.1"x1" MASTIC ROPE.
3. ALL BASES & BOTTOM RISER TO BE POURED MONOLITHIC.
4. FRAME & COVER TO BE DEETER 1180 OR NEENAH R-1960-A.
5. STEP TO BE AMERICAN STEP ML-13 OR EQUAL.
6. ALL PIPE PENETRATIONS TO BE Z-LOCK SEALED.
7. MANHOLE TO BE ORDERED CUSTOM BUILT TO HEIGHT AND EXACT PIPE DEPTH. FOR CORRECT PLACEMENT OF THE PIPE Z LOCK SEALS, MAY REQUIRE EXPOSING EXISTING MAIN TO DETERMINE CORRECT PIPE CENTERLINE DEPTH PRIOR TO ORDERING MANHOLE. PROVIDE PRE-CASTER SIZE OF PIPE, DISTANCE FROM CENTERLINE OF PIPE TO GROUND LINE. THE MANHOLE HEIGHT AND DISTANCE BETWEEN THE CENTERLINE OF PIPE AND TOP OF FLOOR WILL NEED TO BE DETERMINED WITH PRE-CASTER.

<p style="font-size: small; margin-top: 5px;">www.bartlettwest.com</p>	DETECTOR CHECK VALVE MANHOLE	STANDARD DETAILS	DETAIL NUMBER
	CPWSD NO. 1 OF BOONE COUNTY	DATE:	19
		APRIL 2018	

Drawing Name: \\nt000cfs01\production\Proj\700017011\7011.000\7011 SPECIFICATIONS\DWG Standard Specifications Submittal\2018 OSP Renewal Specs and Details\STANDARD DETAILS April 2018.dwg Layout Name: SAMPLING STA Plotted By: KAK00402 Plotted on: 4/24/2018 10:00:11



NOTE:

SAMPLING STATION SHALL BE DUAL STANDPIPE DESIGN, PROVIDING TWO INDEPENDENT ALL-BRASS WATER STREAMS FOR UPSTREAM AND DOWNSTREAM SAMPLING.

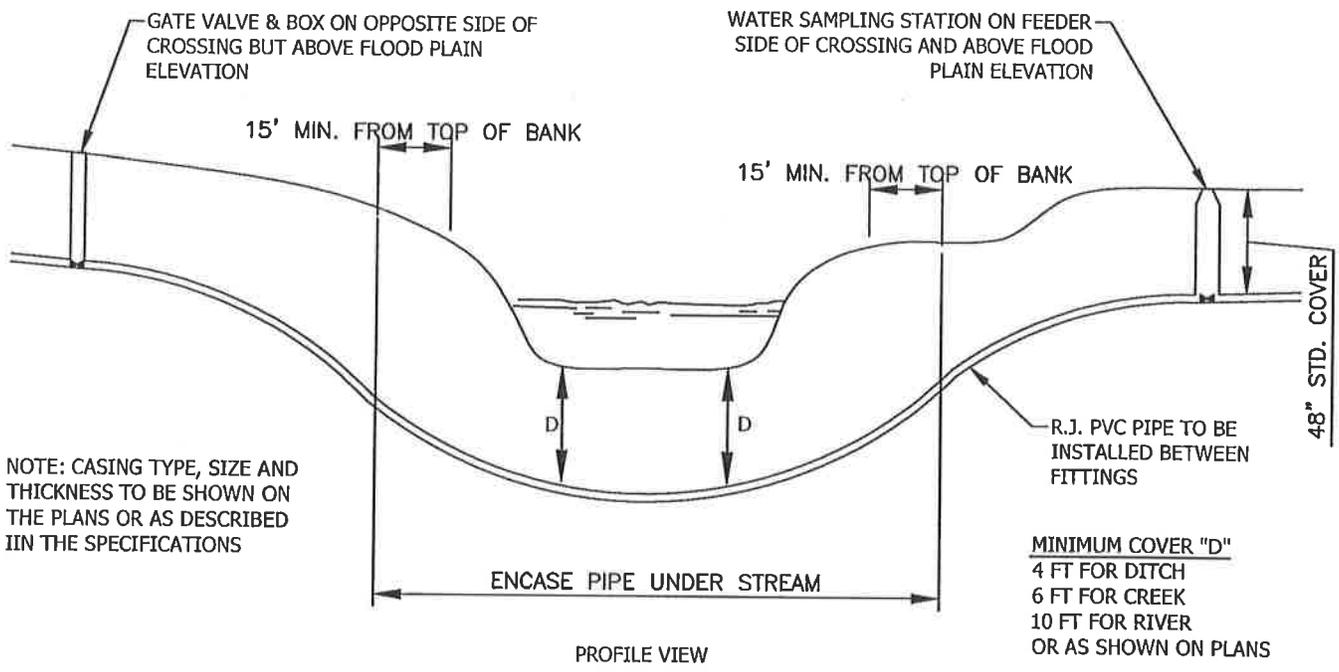
EACH SAMPLING STATION SHALL BE PROVIDED WITH TWO INLETS, 3/4" IN SIZE, AND TWO THREADED BRASS SAMPLING BIBBS LOCATED ABOVE GROUND NEAR TOP OF EACH STANDPIPE. A COPPER VENT TUBE ON EACH 3 1/2' BURY STANDPIPE WILL ENABLE THE WATERWAYS TO BE PUMPED FREE OF STANDING WATER TO PREVENT FREEZING AND MINIMIZE BACTERIA GROWTH.

EACH STANDPIPE SHALL OPERATE INDEPENDENTLY USING A ROTATING HANDLE AND BE ENCLOSED IN ONE UV-RATED LOCKABLE PLASTIC ENCLOSURE.

ALL WORKING PARTS SHALL BE BRASS AND REMOVABLE FROM ABOVE GROUND WITH NO DIGGING, AS MANUFACTURED BY KUPFERLE FOUNDRY COMPANY, ST. LOUIS, MO. MODEL #8100, OR APPROVED EQUAL.

Bartlett & West <small>www.bartlettwest.com</small>	WATER SAMPLING STATION	STANDARD DETAILS	DETAIL NUMBER
	CPWSD NO. 1 OF BOONE COUNTY	DATE: APRIL 2018	20

Drawing Name: \\int00-dfs01\production\Proj\7000\7011\7011.000\7011 SPECIFICATIONS\DNR Standard Specifications Submittal\2018 OSP Renewal Specs and Details\STANDARD DETAILS April 2018.dwg Layout Name: STREAM CROSSING Plotted By: KAK00402 Plotted on: 4/24/2018 10:0



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TYPICAL STREAM CROSSING
CPWSD NO. 1 OF BOONE COUNTY

STANDARD DETAILS

DATE:

APRIL 2018

DETAIL NUMBER

21

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Bartlett & West

Instrument Type: ESMT
Recording Fee: \$30.00 S
No. of Pages: 3



WATER LINE EASEMENT

KNOW ALL PERSONS BY THESE PRESENTS:

That on this 5th day of August, 2020, THE CITY OF COLUMBIA, a Municipal Corporation of the State of Missouri, hereinafter referred to as GRANTOR, for and in consideration of the sum of TEN Dollars \$10.00 and other valuable consideration, paid and delivered by CONSOLIDATED PUBLIC WATER SUPPLY DISTRICT NO. 1 OF Boone County, Missouri, hereinafter referred to as the Grantee, organized under the laws of the State of Missouri; the receipt of which is hereby acknowledged, hereby Grants, Bargains, Sells and Conveys to said Grantee the perpetual easement and right to enter upon the lands of Grantor situated in the County of Boone, State of Missouri, described as follows:

A 10 FOOT WIDE EASEMENT BEING LOCATED ON AND ACROSS A TRACT IN THE NORTHWEST QUARTER OF SECTION 10, TOWNSHIP 47 NORTH, RANGE 12 WEST, CITY OF COLUMBIA, BOONE COUNTY, MISSOURI AND BEING PART OF THE TRACT DESCRIBED BY THE DEED IN BOOK 2645 PAGE 21, ALSO BEING PART OF LOT 501, THE CASCADES, PLAT NO. 5 AS SHOW IN PLAT BOOK 38, PAGE 5, ALL OF THE BOONE COUNTY RECORDS, SAID BASEMENT BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

STARTING AT THE SOUTH EAST CORNER OF SAID LOT 501, THENCE WITH THE EAST LINE OF SAID LOT 501 N.00°04'30"E, 20.67 FEET TO THE NORTH LINE OF A 20 FOOT UTILITY EASEMENT AS SHOWN BY SAID THE CASCADES PLAT NO. 5, TO THE POINT OF BEGINNING (BEARINGS WRITTEN HEREIN ARE BASED UPON THE MISSOURI STATE PLANE COORDINATE SYSTEM CENTRAL ZONE); THENCE FROM THE POINT OF BEGINNING LEAVING SAID EAST LINE AND WITH SAID NORTH LINE S.75°25'45"W, 138.17 FEET; THENCE WITH A CURVE TO THE RIGHT 259.65 FEET, CURVE RADIUS 1362.50 FEET, CHORD S.80°53'15"W, 259.26 FEET TO A POINT ON THE EAST LINE OF 20 FOOT UTILITY EASEMENT AS SHOWN BY SAID THE CASCADES, PLAT NO.5; THENCE WITH SAID EAST LINE, WITH A NON-

EXHIBIT "C"
Nora Dietzel, Recorder of Deeds

Boone County, Missouri

BOONE COUNTY MO AUG 05 2020

Unofficial Document

TANGENT CURVE TO THE LEFT 141.00 FEET, CURVE RADIUS 1352.50 FEET, CHORD N.00°55'20"W, 10.01 FEET; THENCE LEAVING SAID EAST LINE WITH A NON-TANGENT CURVE TO THE LEFT 257.28 FEET, CURVE RADIUS 1352.50 FEET, CHORD N.80°52'40"E, 256.89 FEET; THENCE N.75°25'40"E, 140.79 FEET TO A POINT ON THE EAST LINE OF SAID LOT 501; THENCE WITH SAID EAST LINE S.00°04'30"W, 10.34 FEET TO THE POINT OF BEGINNING AND CONTAINS 3979 SQUARE FEET INCLUSIVE OF 748 SQUARE FEET OF EXISTING SANITARY SEWER EASEMENT.

and to initially and at all times thereafter erect, construct, install, lay, operate, survey, inspect, maintain, repair, rebuild, upgrade, replace, enlarge, remove and patrol on over or under said lands, and in and upon all streets, roads, or highways abutting said lands one or more pipes of any size for the transmission of water, and all appliances necessary in connection therewith, including but not limited to water meter pits, water meters, water meter yokes, water valves, air release valves, water pressure regulators, detection wires and fire hydrants, together with the perpetual right to go in and upon said land for said purposes.

To have and to hold said easement and rights unto said Grantee forever.

Title to said water pipe line shall be and remain in said Grantee.

Grantor covenants to and with said Grantee that subject to existing easements, if any, for public highways or roads, railroads, laterals, ditches, pipelines and electrical transmission or distribution lines and telephone and telegraph lines covering the land herein described, Grantor is lawfully seized and possessed of said lands, has a good and lawful right and power to sell and convey them and that they are free and clear of all liens and encumbrances, except as herein stated.

IN WITNESS WHEREOF, the undersigned has executed this document this 5th day of August, 2020.

CITY OF COLUMBIA, MISSOURI, a Municipal Corporation

BY: John Glascock
John Glascock,
City Manager

ATTEST: Sheela Amin
Sheela Amin,
City Clerk

Approved as to form:

Jack McManus sv
City Counselor -
Jack McManus

Nora Dietzel, Recorder of Deeds

Boone County, Missouri

Unofficial Document

BOONE COUNTY MO AUG 05 2020

STATE OF MISSOURI)
)SS.
COUNTY OF BOONE)

On this 5th day of August, 2020 before me, a Notary Public in and for said state, personally appeared John Glascock, who being by me duly sworn, acknowledged that he is the City Manager of the City of Columbia, Missouri and person described in and who executed the foregoing instrument, and acknowledged to me that he executed the same for the purposes therein stated on behalf of the City.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal, at my office in the county aforesaid, the day and year first above written.

My commission expires: 6/23/24

Kristina Ann Wolf
Notary Public



Nora Dietzel, Recorder of Deeds

CONSOLIDATED PUBLIC WATER SUPPLY DISTRICT NO. 1
OF BOONE COUNTY, MISSOURI

1600 North Seventh Street
Columbia, Missouri 65201

22

WATER LINE EASEMENT

KNOW ALL MEN BY THESE PRESENTS:

That John Sam and Quannah K. Williamson

of the County of Boone, State of Missouri, hereinafter designated as Grantor (herein so styled, whether one or more) for and in consideration of the sum of \$1.00 and other valuable consideration, paid and delivered by Consolidated Public Water Supply District No. 1 of Boone County, Missouri, hereinafter referred to as the Grantee, organized under the laws of the State of Missouri; the receipt of which is hereby acknowledged, hereby Grants, Bargains, Sells and Conveys to said Grantee the perpetual easement and right to enter upon the lands of Grantor situated in the County of Boone, in the State of Missouri, described as follows: N-S (NW-SW)

A tract of land containing .320 Acres, more or less, in the West 1/2 of Section 10, Township 47N, Range 13W.

and to erect, construct, install, lay, operate, survey, inspect, maintain, repair, rebuild, replace, remove and patrol on or over or under said lands, and in and upon all streets, roads, or highways abutting said lands, pipes or tiles for the transmission of water, and all appliances necessary in connection therewith, together with the perpetual right to go in and upon said land for said purposes. The water line easement hereby granted shall be 20 feet in width, the center line thereof to be located across said land as installed.

TO HAVE AND TO HOLD said easement and rights unto said Grantee forever.

It is understood and agreed that the consideration herein stated shall be the full consideration due to Grantor from said Grantee for going upon said lands and laying of said water pipe line, and that said Grantee shall be liable for such damages to crops as may inure in the original construction of said water line, or that may accrue in the future by virtue of the same being located upon said above described lands.

Title to said water pipeline shall be and remain in said Grantee.

Grantor covenants to and with said Grantee that subject to existing easements, if any, for public highways or roads, railroads, laterals, ditches, pipelines and electrical transmission or distribution lines and telephone and telegraph lines covering the land herein described, Grantor is lawfully seized and possessed of said lands, has a good and lawful right and power to sell and convey them and that they are free and clear of all liens and encumbrances, except as herein stated and that Grantor will forever warrant and defend the title to said easement and the quiet possession thereof against the lawful claims and demands of all persons whomsoever.

In the event of a prior lien upon said lands, the Grantor agrees to secure a subordination or release from the holder of such lien, in the event it is requested by Grantee, so that this easement shall be first or prior to such lien.

Grantor further agrees that all checks or warrants that may be paid under the provisions of this easement may be made payable to the Grantor and the holder of such lien.

IN WITNESS WHEREOF, we have set our hands this 16 day of October, 19 92.

John Sam Williamson
Quannah K. Williamson

STATE OF MISSOURI

COUNTY OF Boone } as

On this 16 day of October, 19 92, before me, a Notary Public in and for the County of Boone, in the State of Missouri, personally appeared John Sam and Quannah K. Williamson to me known to be the persons described in and who executed the foregoing instrument and acknowledged that they executed the same as their free act and deed.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal, at my office in Columbia

the day and year first above written.
OFFICIAL NOTARY SEAL
MARY I DALY
Notary Public, State of Missouri
BOONE COUNTY
My Commission Expires MAY 18, 1993

Mary I. Daly
Notary Public

STATE OF MISSOURI

COUNTY OF Boone } Sol.

STATE OF MISSOURI }
COUNTY OF Boone } SS.



I, the undersigned Recorder of Deeds for said county and state do hereby certify that the foregoing instrument of writing was filed for record in my office on the 16th day of October, 1992 at 1 o'clock and 04:00 minutes PM and is truly recorded in Book 934 Page 22.

Witness my hand and official seal on the day and year aforesaid.

BETTIE JOHNSON, RECORDER OF DEEDS
Karen Johnson deputy

EXHIBIT "D"

CONSOLIDATED PUBLIC WATER SUPPLY DISTRICT NO. 1 OF BOONE COUNTY, MISSOURI

498

1500 North Seventh Street
Columbia, Missouri 65201

WATER LINE EASEMENT

KNOW ALL PERSONS BY THESE PRESENTS:

That JOHN SAM WILLIAMSON, JR. AND SUSAN BETH WILLIAMSON, HUSBAND & WIFE, AND JOHN SAM WILLIAMSON, JR., ATTORNEY-IN-FACT, FOR QUANAH WILLIAMSON, A SINGLE PERSON, BY AND THROUGH POWERS GRANTED BY DURABLE POWER OF ATTORNEY RECORDED IN BOOK 1539, PAGE 328, RECORDS OF BOONE COUNTY, MISSOURI, of the County of BOONE, State of MISSOURI, hereinafter designated as Grantor (herein so styled, whether one or more) for and in consideration of the sum of \$10.00 and other valuable consideration, paid and delivered by CONSOLIDATED PUBLIC WATER SUPPLY DISTRICT NO. 1 of Boone County, Missouri, hereinafter referred to as the Grantee, organized under the laws of the State of Missouri; the receipt of which is hereby acknowledged, hereby Grants, Bargains, Sells and Conveys to said Grantee the perpetual easement and right to enter upon the lands of Grantor situated in the County of BOONE, State of MISSOURI, described as follows:

A TRACT OF LAND LOCATED IN THE NORTH HALF OF THE SOUTHWEST QUARTER OF SECTION 9, TOWNSHIP 47 NORTH, RANGE 13 WEST, BOONE COUNTY, MISSOURI, LYING SOUTH OF STATE ROUTE K, AND, A TRACT OF LAND LOCATED IN THE SOUTHEAST QUARTER OF SECTION 9, TOWNSHIP 47 NORTH, RANGE 13 WEST, BOONE COUNTY, MISSOURI, LYING BETWEEN STATE ROUTE K AND OLD PLANK ROAD, CONTAINING IN ALL 95.63 ACRES, MORE OR LESS.

A TRACT OF LAND LOCATED IN THE WEST HALF OF SECTION 10, TOWNSHIP 47 NORTH, RANGE 13 WEST, BOONE COUNTY, MISSOURI, LYING NORTH AND SOUTH OF STATE ROUTE K, CONTAINING IN ALL 310 ACRES, MORE OR LESS.

and to erect, construct, install, lay, operate, inspect, maintain, repair, rebuild, replace, remove and patrol on or over or under said lands, and in and upon all streets, roads, or highways abutting said lands, pipes or tiles for the transmission of water, and all appliances necessary in connection therewith, together with the perpetual right to go in and upon said land for said purposes. The water line easement hereby granted shall be 20 feet in width, the center line thereof to be located across said land as installed.

EASEMENT IS GRANTED FOR WATERLINES TO BE INSTALLED ALONG STATE ROUTE K.

TO HAVE AND TO HOLD said easement and rights unto said Grantee forever.

It is understood and agreed that the consideration herein stated shall be the full consideration due to Grantor from said Grantee for going upon said lands and laying of said water pipe lines and appliances.

Title to said water pipe lines and appliances shall be and remain in Grantee.

Grantor covenants to and with said Grantee that subject to existing easements, if any, for public highways or roads, railroads, laterals, ditches, pipelines and electrical transmission or distribution lines and telephone and telegraph lines covering the land herein described, Grantor is lawfully seized and possessed of said lands, has a good and lawful right and power to sell and convey them and that they are free and clear of all liens and encumbrances, except as herein stated and that Grantor will forever warrant and defend the title to said easement and the quiet possession thereof against the lawful claims and demands of all persons whomsoever.

IN WITNESS WHEREOF, we have set our hands this 23 day of September, 1999.



John Sam Williamson, Jr.

John Sam Williamson Jr.

Susan Beth Williamson

Susan Beth Williamson

John Sam Williamson, Jr.

Attorney-in-fact for Quannah Williamson (Book 1539, Page 398)

John Sam Williamson Jr.

STATE OF MISSOURI)
COUNTY OF BOONE) SS.

On this 23rd day of September, 1999, before me, a Notary Public in and for the County of BOONE, in the State of Missouri, personally appeared John Sam Williamson Jr., Susan Beth Williamson to me known to be the persons described in and who executed the foregoing instrument and acknowledged that they executed the same as their free act and deed.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal, at my office in Columbia, Missouri, the day and year first above written.

My commission expires: August 21, 2003

BILLY W. ROBINSON
NOTARY PUBLIC STATE OF MISSOURI
BOONE COUNTY
MY COMMISSION EXP. AUG. 21, 2003

Billy W. Robinson
Notary Public

EXHIBIT "E"

STATE OF MISSOURI)
) SS.
COUNTY OF Boone)

On this 23rd day of September, 1999, before me personally appeared John Sam Williamson, Jr., attorney in fact for Quannah Williamson, a single person, who is personally known to me to be the person who executed the foregoing instrument in behalf of said Quannah Williamson, and by me being duly sworn did say, that said Quannah Williamson is now living and sane and has not revoked said power of attorney, and the said John Sam Williamson, Jr. acknowledged said instrument to be the free act and deed of said Quannah Williamson.

In Testimony Whereof, I have hereunto set my hand and affixed my official seal at my office in Columbia, MO, this day and year first above written.

My commission expires August 21, 19 2003.

Billy W. Robinson
Notary Public



BILLY W. ROBINSON
NOTARY PUBLIC STATE OF MISSOURI
BOONE COUNTY
MY COMMISSION EXP. AUG. 21, 2003

Document No. 28003

STATE OF MISSOURI)
COUNTY OF BOONE) SS.



I, the undersigned Recorder of Deeds for said county and state do hereby certify that the foregoing instrument of writing was filed for record in my office on the 8th day of November, 1999 at 8 o'clock and 40:29 minutes AM and is truly recorded in Book 1577 Page 498.

Witness my hand and official seal on the day and year aforesaid.

BETTIE JOHNSON, RECORDER OF DEEDS
by Liba Wyatt deputy

Liba Wyatt

2004

WATER LINE EASEMENT

KNOW ALL MEN BY THESE PRESENTS:

That Carl & Opal Bassett
of the County of Boone, and State of Missouri, hereinafter design-
ated as Grantor (herein so styled, whether one or more) for and
in consideration of the sum of \$1.00 and other valuable consider-
ations, paid and delivered by Public Water Supply District No. 6
of Boone County, Missouri (hereinafter referred to as the Grantee)
organized under the laws of the State of Missouri; the receipt of
which is hereby acknowledged, hereby Grants; Bargains; Sells and
conveys to said Grantee the perpetual easement and right to enter
upon the lands of Grantor; situated in the County of Boone, in the
State of Missouri, described as follows:

A tract of land 159A. NE 9-47-13

and to erect, construct, install, lay, operate, survey, inspect,
maintain, repair, rebuild, replace, remove and patrol on or over
or under said lands, and in and upon all streets, roads, or high-
ways abutting said lands, pipes or tiles for the transmission of
water, and all appliances necessary in connection therewith, to-
gether with the perpetual right to go in and upon said land for
said purposes. The water line easement hereby granted shall be
30 feet in width, the center line thereof to be located across
said land as installed.

To have and to hold said easement and rights unto said
Grantee forever.

It is understood and agreed that the consideration herein
stated shall be the full consideration due to Grantor from said
Grantee for going upon said lands and laying of said water pipe
line, and that said Grantee shall be liable for such damages to
crops as may incur in the original construction of said water
line, or that may accrue in the future by virtue of the same
being located upon said above described lands.

Title to said water pipe line shall be and remain in said
Grantee.

Grantor covenants to and with said Grantee that subject to
existing easements, if any, for public highways or roads, rail-
roads, laterals, ditches, pipe lines and electrical transmission
or distribution lines and telephone and telegraph lines covering
the land herein described, Grantor is lawfully seized and posses-
sed of said lands, has a good and lawful right and power to sell
and convey them and that they are free and clear of all liens and
encumbrances, except as herein stated and that Grantor will for-
ever warrant and defend the title to said easement and the quiet
possession thereof against the lawful claims and demands of all
persons whomsoever.

And in the event of a prior lien upon said lands, the Grantor
agrees to secure a subordination or release from the holder of
such lien, so that this easement shall be first or prior to such
lien. That the lien recorded in Book ____, at Page ____ of the
Records of the Recorder of Deeds for Boone County, Missouri, is the
only lien thereon.

EXHIBIT "F"

Grantor further agrees that all checks or warrants that may be paid under the provisions of this easement, may be made payable to the Grantor and the holder of such lien. That the lien holder shall execute waiver on the _____ sheet hereof, which is made a part hereof.

IN WITNESS WHEREOF, We have set our hands this 11th day of

Dec, A.D., 1965.

Carl Barnett
Carl Barnett

STATE OF MISSOURI)
COUNTY OF BOONE) ss

On this 11th day of Dec, 1965, before me, a Notary Public in and for the County of Boone in the State of Missouri, personally appeared Carl Barnett & Opal Barnett to me known to be the persons described in and who executed the foregoing instrument and acknowledged that they executed the same as their free act and deed.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal, at my office in Columbia, Missouri, the day and year first above written.

My commission expires 8-26, 1966.

Maria R. Churchill
Notary Public - Boone County, Mo.

WAIVER

KNOW ALL BY THESE PRESENTS, that whereas the undersigned, _____ is the owner and holder of a certain deed of trust from _____ (hereinafter called Grantor) dated the _____ day of _____, 19____ and recorded in Book _____ at page _____ of the records of the Recorder of Deeds for the County of Boone and the State of Missouri, securing an indebtedness originally in the amount of \$ _____, and

Whereas, said Grantor has entered into a waterline easement dated _____, 19____, appearing on the first sheet of this instrument, giving the Public Water Supply District No. _____ of Boone County, Missouri (hereinafter referred to as the Grantee) a perpetual easement for a water line upon and across the lands described in said water line easement.

Now therefore, in consideration of the premises and the sum of One Dollar and other valuable considerations paid by the said Grantor and Grantee, to the undersigned, the undersigned does hereby waive the priority of the above mentioned deed of trust over the above mentioned easement, intending thereby that the rights of the undersigned and its successors and assigns under the aforesaid deed of trust shall be as though the aforesaid easement were executed and recorded prior to the execution and recording of said deed of trust without otherwise affecting the lien of said deed of trust.

IN WITNESS WHEREOF, The undersigned has caused these presents to be signed and sealed, this _____ day of _____, 19____.

by _____
Title _____

Attest: _____ (Secretary)

Doc. No. 6788
Bk 972 Pg 240

205

WATER LINE EASEMENT

KNOW ALL MEN BY THESE PRESENTS:

That Carl & Opal Bassett of the County of Boone, and State of Missouri, hereinafter designated as Grantor (herein so styled, whether one or more) for and in consideration of the sum of \$1.00 and other valuable considerations, paid and delivered by Public Water Supply District No. 2 of Boone County, Missouri (hereinafter referred to as the Grantee) organized under the laws of the State of Missouri; the receipt of which is hereby acknowledged, hereby Grants; Bargains; Sells and conveys to said Grantee the perpetual easement and right to enter upon the lands of Grantor; situated in the County of Boone, in the State of Missouri, described as follows:

A tract of land *Beginning at a point on the North Right of way line of State Route "K" being 2.2 feet North of the Southeast corner of the Northeast Quarter of Section 9, T 47 N, R 13 W.*

and to erect, construct, install, lay, operate, survey, inspect, maintain, repair, rebuild, replace, remove and patrol on or over or under said lands, and in and upon all streets, roads, or highways abutting said lands, pipes or tiles for the transmission of water, and all appliances necessary in connection therewith, together with the perpetual right to go in and upon said land for said purposes. The water line easement hereby granted shall be 30 feet in width, the center line thereof to be located across said land as installed.

To have and to hold said easement and rights unto said Grantee forever.

It is understood and agreed that the consideration herein stated shall be the full consideration due to Grantor from said Grantee for going upon said lands and laying of said water pipe line, and that said Grantee shall be liable for such damages to crops as may incur in the original construction of said water line, or that may accrue in the future by virtue of the same being located upon said above described lands.

Title to said water pipe line shall be and remain in said Grantee.

Grantor covenants to and with said Grantee that subject to existing easements, if any, for public highways or roads, railroads, laterals, ditches, pipe lines and electrical transmission or distribution lines and telephone and telegraph lines covering the land herein described, Grantor is lawfully seized and possessed of said lands, has a good and lawful right and power to sell and convey them and that they are free and clear of all liens and encumbrances, except as herein stated and that Grantor will forever warrant and defend the title to said easement and the quiet possession thereof against the lawful claims and demands of all persons whomsoever.

And in the event of a prior lien upon said lands, the Grantor agrees to secure a subordination or release from the holder of such lien, so that this easement shall be first or prior to such lien. That the lien recorded in Book , at Page of the Records of the Recorder of Deeds for Boone County, Missouri, is the only lien thereon.

EXHIBIT "G"

Grantor further agrees that all checks or warrants that may be paid under the provisions of this easement, may be made payable to the Grantor and the holder of such lien. That the lien holder shall execute waiver on the _____ sheet hereof, which is made a part hereof.

IN WITNESS WHEREOF, We have set our hands this 13 day of

Dec, A.D., 1965.

Carl Bassett
Opal Bassett

STATE OF MISSOURI)
COUNTY OF BOONE) ss

On this 13th day of Dec, 1965, before me, a Notary Public in and for the County of Boone in the State of Missouri, personally appeared Carl Bassett & Opal Bassett to me known to be the persons described in and who executed the foregoing instrument and acknowledged that they executed the same as their free act and deed.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal, at my office in Columbia, Missouri, the day and year first above written.

My commission expires 8-26, 1966.

Marie D. Overmiller
Notary Public - Boone County, Mo.

WAIVER

KNOW ALL BY THESE PRESENTS, that whereas the undersigned, _____ is the owner and holder of a certain deed of trust from _____ (hereinafter called Grantor) dated the _____ day of _____, 19____ and recorded in Book _____ at page _____ of the records of the Recorder of Deeds for the County of Boone and the State of Missouri, securing an indebtedness originally in the amount of \$ _____, and

Whereas, said Grantor has entered into a waterline easement dated _____, 19____, appearing on the first sheet of this instrument, giving the Public Water Supply District No. _____ of Boone County, Missouri (hereinafter referred to as the Grantee) a perpetual easement for a water line upon and across the lands described in said water line easement.

Now therefore, in consideration of the premises and the sum of One Dollar and other valuable considerations paid by the said Grantor and Grantee, to the undersigned, the undersigned does hereby waive the priority of the above mentioned deed of trust over the above mentioned easement, intending thereby that the rights of the undersigned and its successors and assigns under the aforesaid deed of trust shall be as though the aforesaid easement were executed and recorded prior to the execution and recording of said deed of trust without otherwise affecting the lien of said deed of trust.

IN WITNESS WHEREOF, The undersigned has caused these presents to be signed and sealed, this _____ day of _____, 19____.

by _____
Title _____

Attest: _____ (Secretary)

Doc. No. - 67889

Bk 972 Pg 2402

