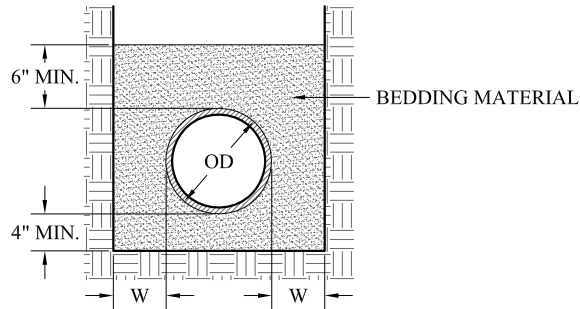
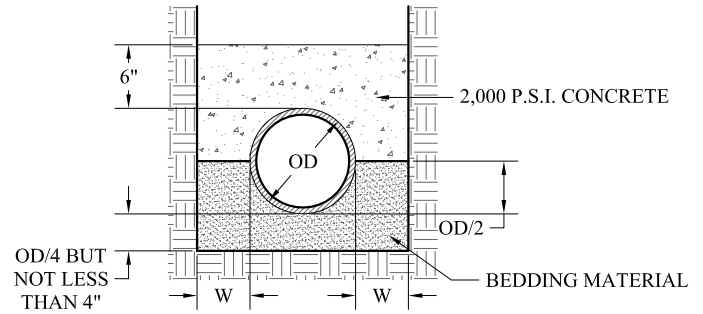


# EMBEDMENT ZONE

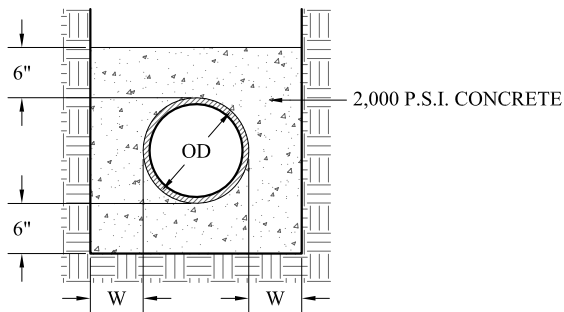
## WATER AND SEWER MAINS



GRAVEL EMBEDMENT



CONCRETE CAP



CONCRETE ENCASEMENT

PIPE SIZE	W
16" OR LESS	6"
GREATER THAN 16"	AS SPECIFIED BY PIPE MFG. & APPROVED BY OWNER

### BEDDING MATERIAL:

GRANULAR MATERIAL THAT WILL REMAIN FIRM AND NOT PERMIT DISPLACEMENT OF THE PIPE EITHER DURING PIPE LAYING AND BACKFILLING OR FOLLOWING COMPLETION OF CONSTRUCTION. THE MATERIAL SHALL MEET THE REQUIREMENTS OF ASTM C33, GRADATION 67 (3/4" TO NO.4) CRUSHED STONE OR PEA GRAVEL MEETING TXDOT GRADE 5 GRADATION PER TEST METHOD TEX-200-F, PART I AND TURNER PIT 'D-BEDDING' ARE ACCEPTABLE. TORPEDO BEDDING IS ALSO AN ACCEPTABLE BEDDING MATERIAL.

\* TRENCH SPOILS ARE NOT ACCEPTABLE FOR "EMBEDMENT ZONE MATERIAL"

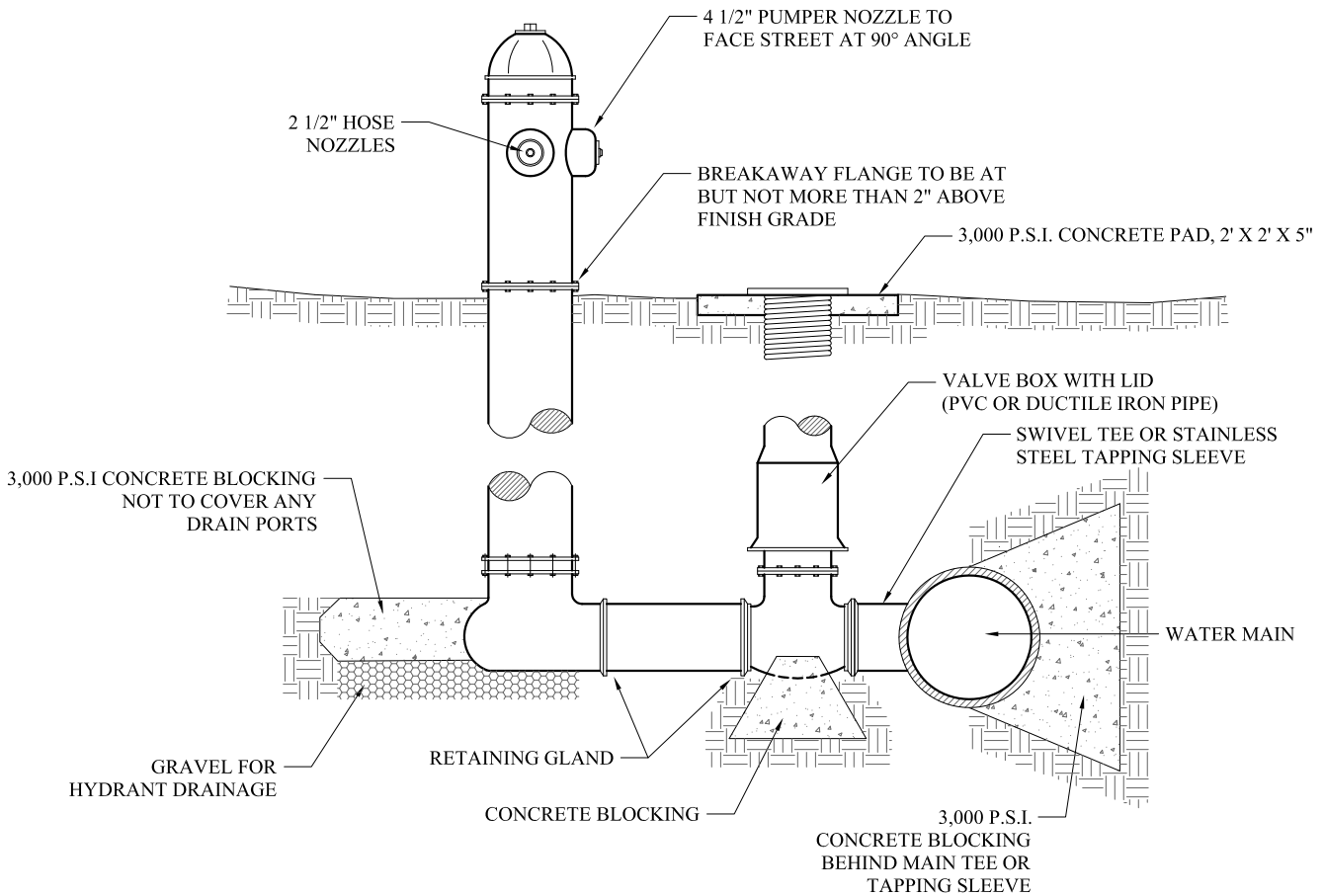
**CITY OF SAN ANGELO**

EMBEDMENT ZONE  
WATER AND SEWER MAINS

W-BED-1



# FIRE HYDRANT INSTALLATION



**NOTES**

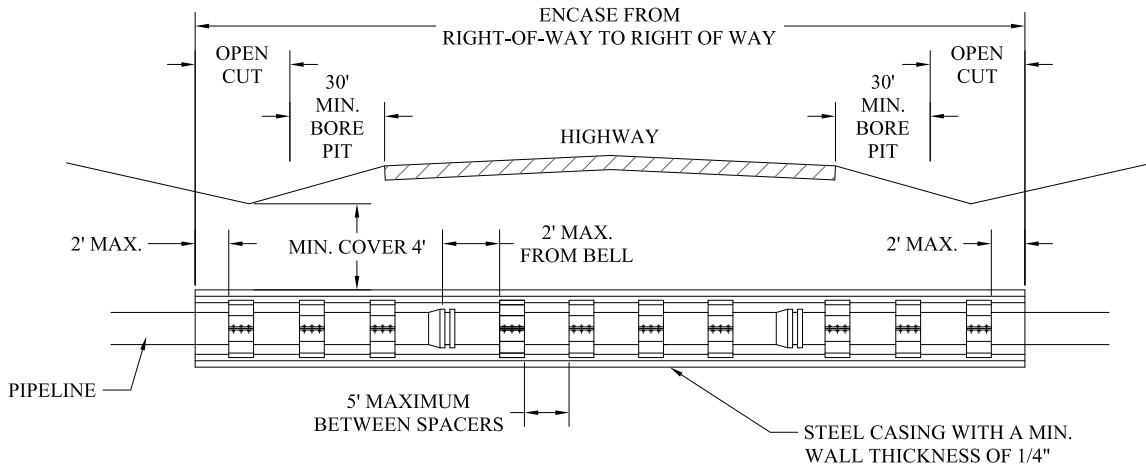
1. CONCRETE BLOCKING TO BE POURED TO UNDISTURBED SOIL.
2. PUMPER NOZZLE CAP TO BE NOT LESS THAN 12" NOR MORE THAN 48" BEHIND CURB.
3. WRAP ALL VALVES & FITTINGS WITH 3 MIL. POLYETHYLENE SHEET PLASTIC.
4. FIRE HYDRANT SHALL BE PAINTED YELLOW, SHERWIN WILLIAMS B-54Y17 OR 617087 OR EQUAL.
5. ANY ASPHALT OR CONCRETE REMOVAL REQUIRED FOR INSTALLATION SHALL BE PAID AT THE UNIT PRICES IN THE UTILITY TRENCH REPAIR CONTRACT.

**CITY OF SAN ANGELO**

FIRE HYDRANT  
INSTALLATION

W-FHI

# HIGHWAY CROSSING



## NOTES

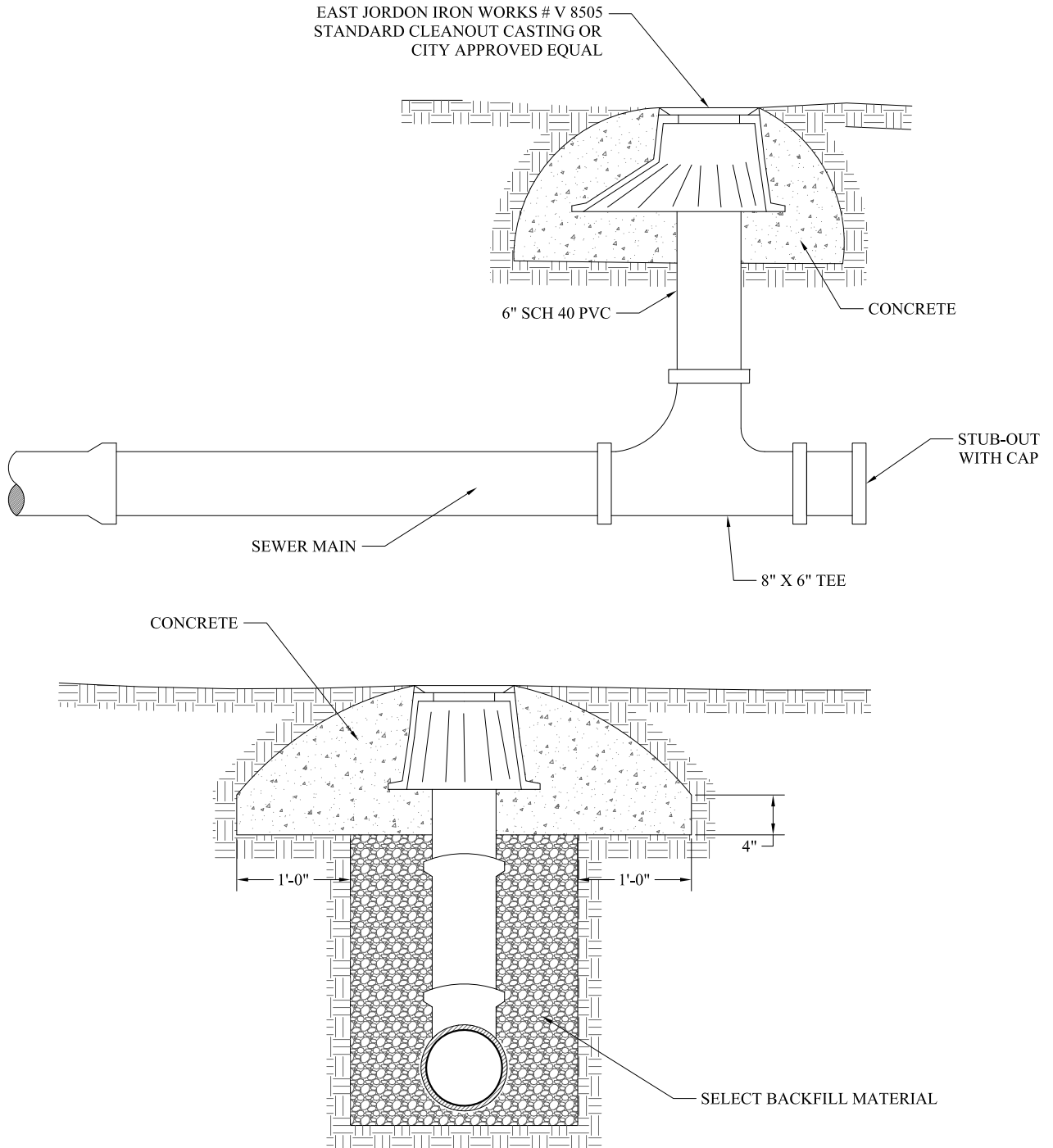
1. ALL HIGHWAY CROSSINGS SHALL BE MADE BY BORING OR TUNNELING. ENCASEMENT PIPE SHALL EXTEND FROM ROW TO ROW. BORE PITS SHALL BE A MINIMUM OF 30' FROM THE EDGE OF PAVEMENT.
2. GROUT AROUND CASING ALL OVER CUTTING IN EXCESS OF 1".
3. CASING SPACERS SHALL BE SPACED A MAXIMUM OF 2' FROM EACH END OF JOINT AND NOT MORE THAN 5' BETWEEN SPACERS. CASING SPACERS SHALL BE APS POLYETHYLENE OR OWNER APPROVED EQUAL.
4. GROUT EACH END OF ENCASEMENT A MINIMUM OF 2'.
5. GROUT SHALL HAVE A MINIMUM STRENGTH OF 1,800 P.S.I. IN 28 DAYS WITH A SLUMP OF 10" OR GREATER.
6. BORING PIT SHALL BE CONFINED TO THE WORK EASEMENT.
7. BORE PITS SHALL BE LOCATED AT THE SPECIFIED END OF ENCASEMENT PIPE AND SHALL BE CONSTRUCTED IN SUCH A MANNER AS TO NOT INTERFERE WITH HIGHWAY STRUCTURAL INTEGRITY & ADEQUATE CLEARANCE FOR SAFE TRAFFIC OPERATIONS. IF NECESSARY, SHORING SHALL BE USED.
8. LINES AND GRADES ARE CRITICAL AND SHALL BE MAINTAINED.
9. RESTORE HIGHWAY RIGHT-OF-WAY TO ORIGINAL OR BETTER CONDITION IN ACCORDANCE WITH TXDOT PERMIT REQUIREMENTS.

**CITY OF SAN ANGELO**

HIGHWAY CROSSING

W-HWY-BORE

# STANDARD CLEANOUT

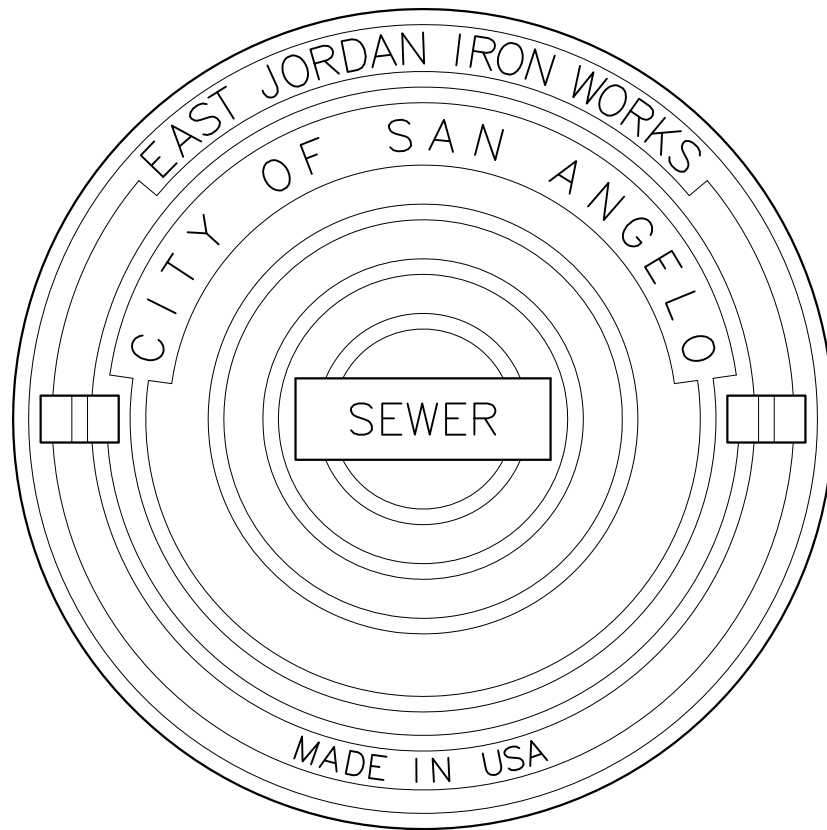


**CITY OF SAN ANGELO**

STANDARD CLEANOUT

W-SA-CO

# SANITARY SEWER STANDARD MANHOLE LID

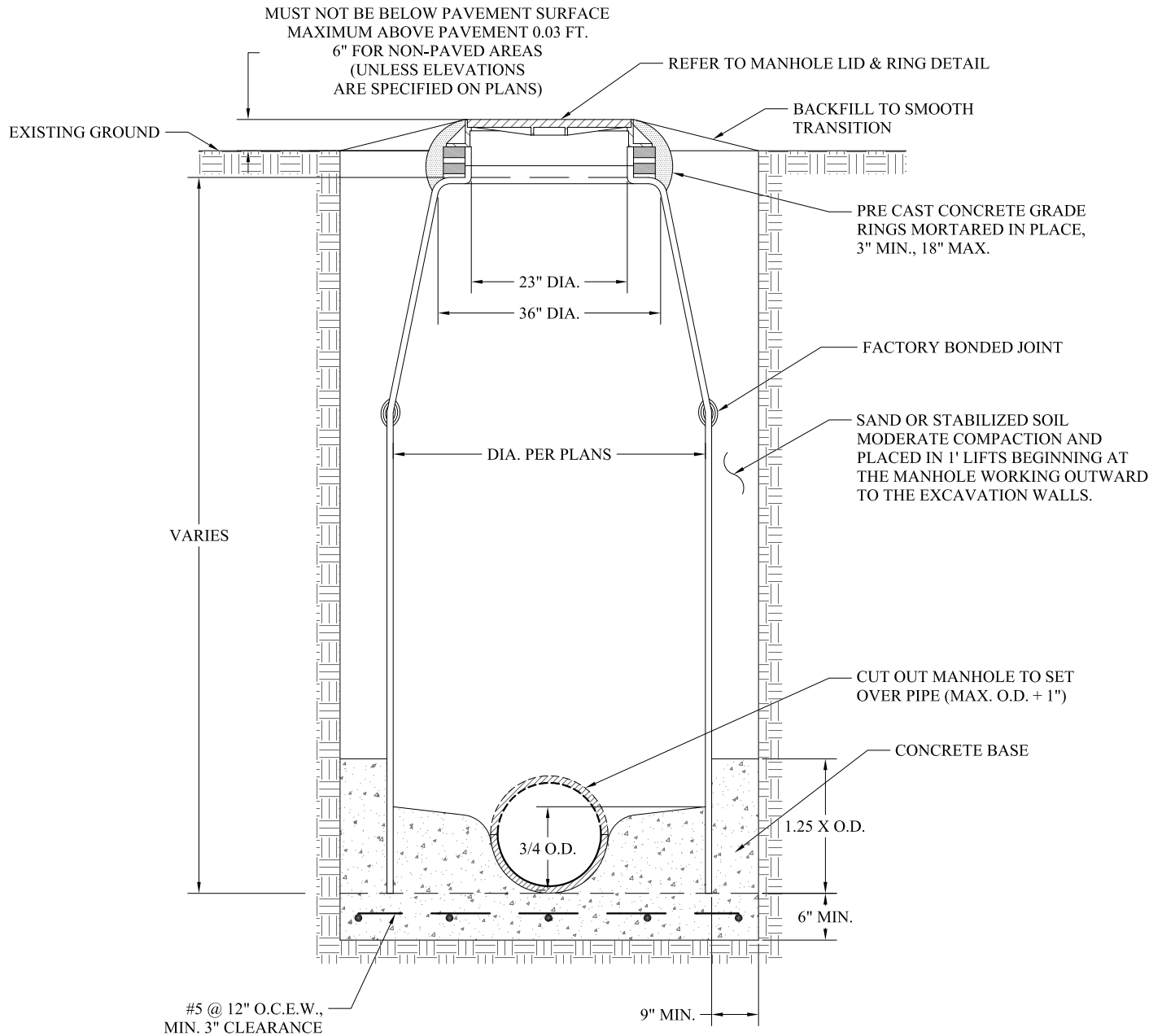


## NOTES:

1. MANHOLE LID & RING SHALL BE EAST JORDAN IRON WORKS (EJIW) V-1177 (24") OR APPROVED EQUAL WITH THE ABOVE DETAILS.
2. WATER TIGHT LID & RING SHALL BE EJIW V-1342 (24") OR APPROVED EQUAL WITH THE ABOVE DETAILS.
3. MANHOLE LID AND RING SHALL BE MACHINE FITTED WITH TWO (2) PICK BAR SLOTS.
4. MANHOLE RING AND COVER SHALL BE CAST IRON, MEETING THE LATEST REVISION OF ASTM A-48 CLASS 30 WITH A HIGHWAY LOAD RATING OF H-20.



# MANHOLE - TYPE B



## NOTES

1. CONCRETE BASE TO BE POURED IN PLACE IN TRENCH.
2. MANHOLE CUTOUT TO BE MADE AT TIME OF INSTALLATION.
3. MANHOLE TO BE INSTALLED BY INSERTING INTO WET CONCRETE BASE.
4. FLOW LINE INVERT MAY BE CHANNEL FORMED IN CONCRETE FLOOR OR PIPE SECTION WITH TOP CUT OUT.
5. SEAL CONCRETE TO PIPE WITH ELASTOMERIC GASKET SEAL.
6. CONTRACTOR SHALL VERIFY MANHOLE DEPTHS, INLET AND OUTLET ELEVATIONS.
7. CONCRETE SHALL BE PLACED A MINIMUM OF 6" BEYOND ALL CONNECTIONS.
8. CONTRACTOR SHALL VERIFY MANHOLE DEPTHS, INLET AND OUTLET ELEVATIONS.

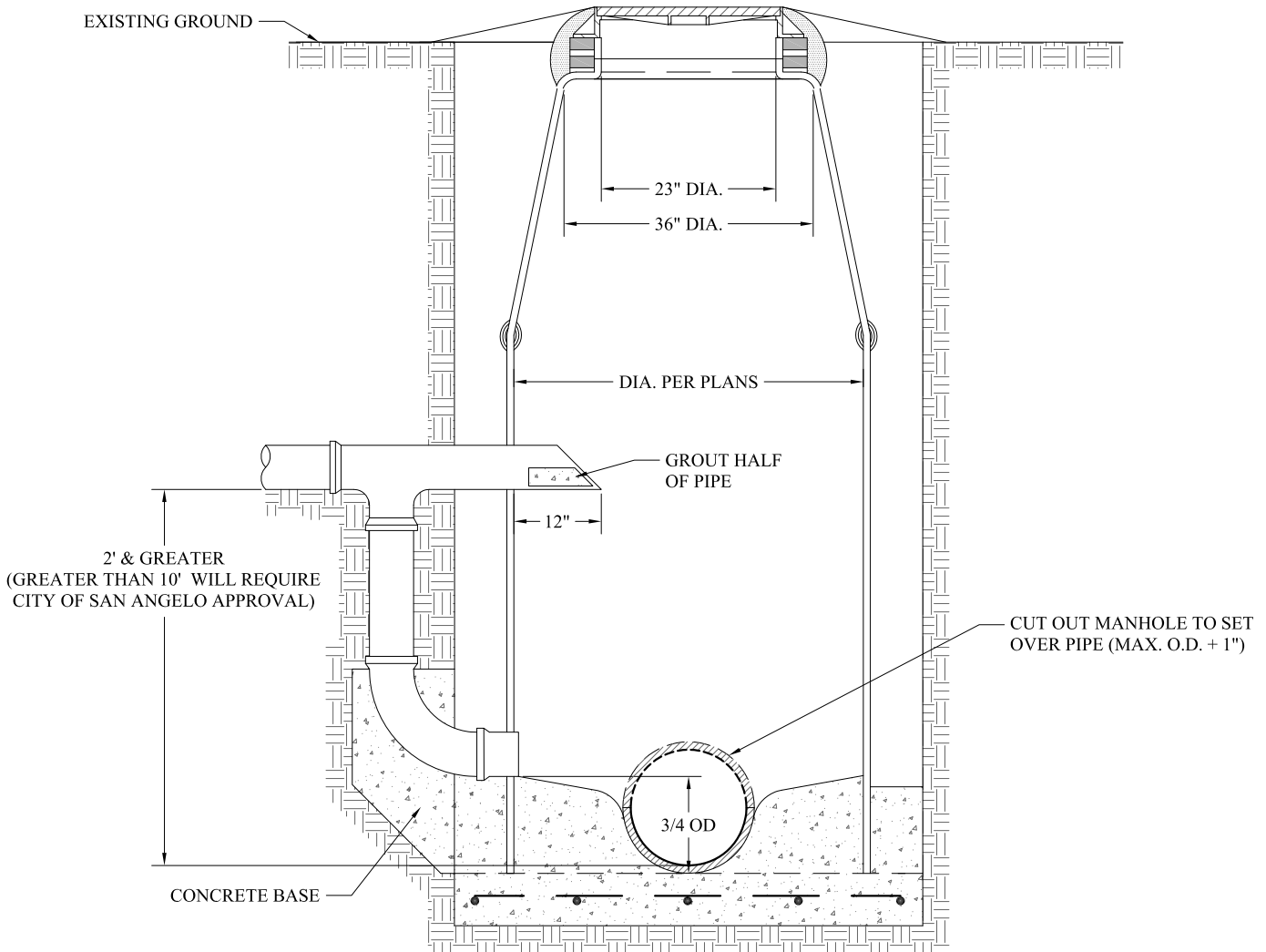
**CITY OF SAN ANGELO**

MANHOLE - TYPE B

W-SA-MH-B



# DROP MANHOLE



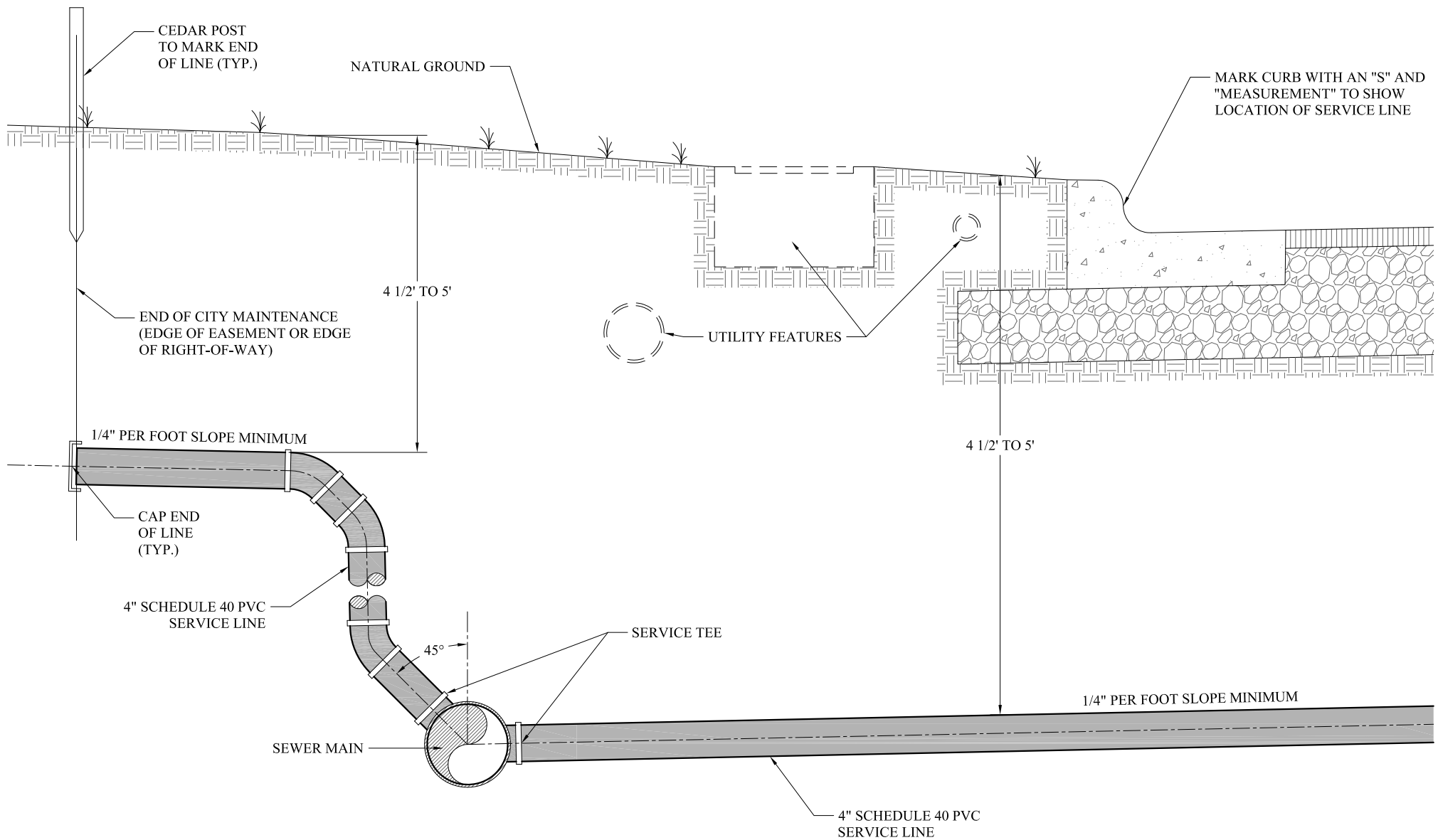
## NOTES

1. CONSTRUCTION OF THE DROP MANHOLE IS IDENTICAL WITH THE STANDARD MANHOLE A AND B IN EVERY RESPECT EXCEPT THE METHOD OF ENTRANCE OF THE SEWAGE FROM THE LATERALS. THIS ENTRANCE SHALL BE CONSTRUCTED AS SHOWN ABOVE.
2. WHEN ENTERING AN EXISTING MANHOLE WITH A NEW LINE AND THE DIFFERENCE IN ELEVATION OF THE TWO INVERTS EXCEEDS 2' THE METHOD OF ENTRANCE SHALL BE AS ABOVE.
3. REFER TO SANITARY SEWER STANDARD MANHOLE LID DETAIL.
4. BACKFILL SHALL BE COMPACTED IN 6" HORIZONTAL LAYERS MINIMUM DENSITY 95% MODIFIED PROCTOR.

**CITY OF SAN ANGELO**

DROP MANHOLE

W-SA-MH-D

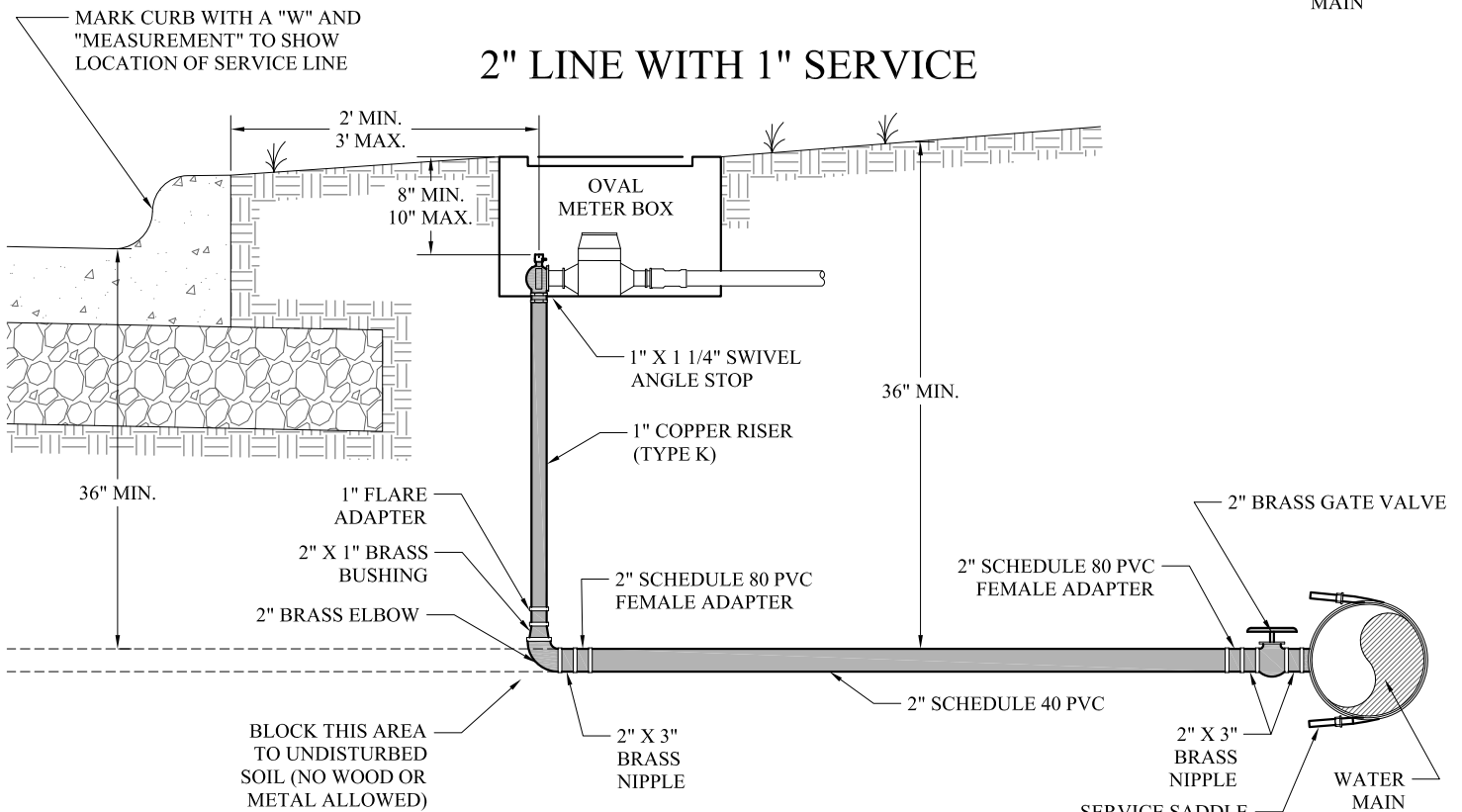
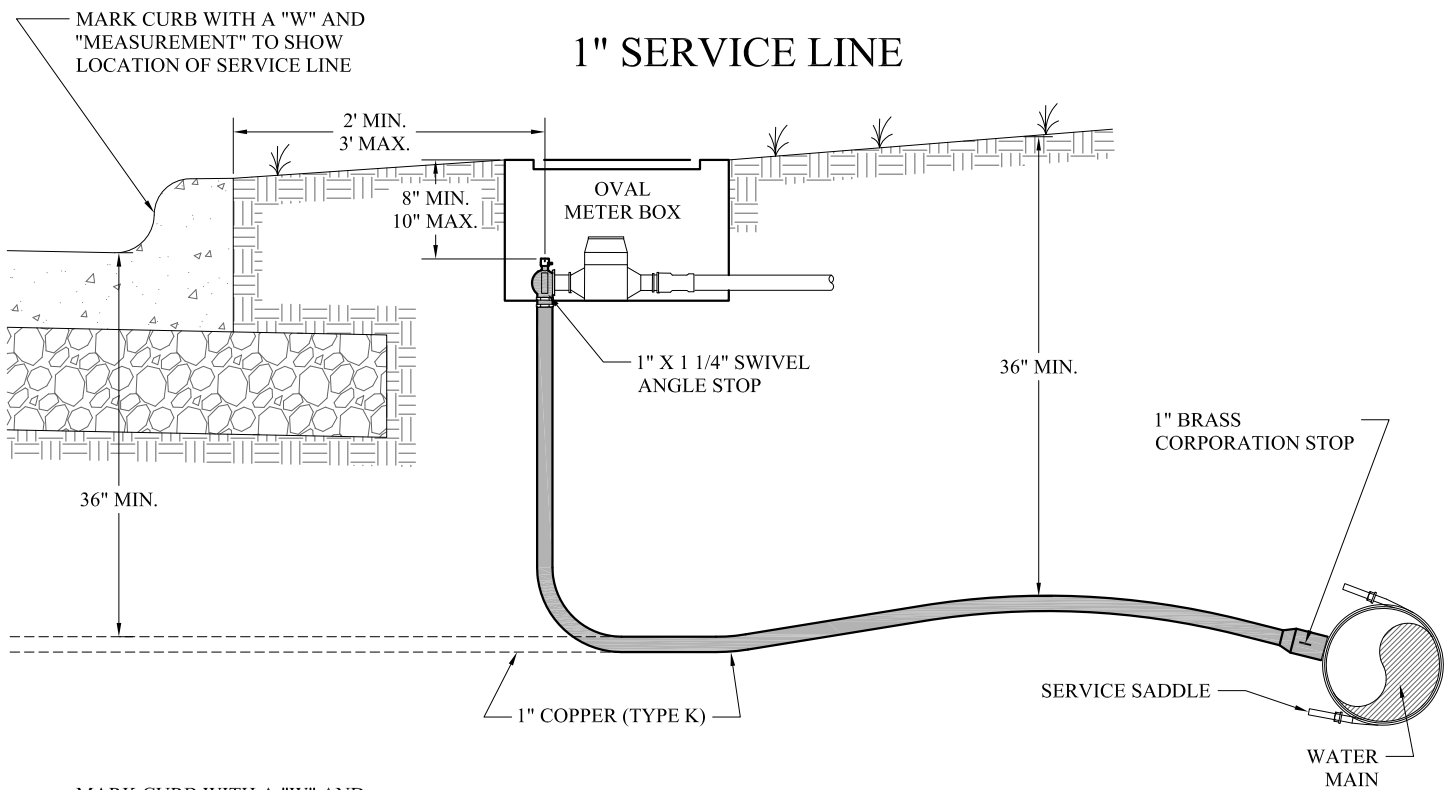


**NOTES:**

1. SEWER SERVICE LINE: 4" MINIMUM SIZE, SCHEDULE 40 PVC.
2. SERVICE LINE PIPE TO BE STANDARD 20' JOINTS, UNLESS TOTAL LENGTH OF SERVICE LINE IS LESS THAN 10', OR UNLESS APPROVED OTHERWISE BY THE CITY.
3. ALL JOINTS SHALL BE GLUED.
4. WHERE BENDS ARE NEEDED, MAXIMUM DEGREE ALLOWABLE SHALL BE 45°

## SEWER PIPE SLOPES

SIZE OF PIPE (INCHES)	MINIMUM SLOPE (%)	MAXIMUM SLOPE (%)
6	0.50	12.35
8	0.33	8.40
10	0.25	6.23
12	0.20	4.88
15	0.15	3.62
18	0.11	2.83
21	0.09	2.30
24	0.08	1.93
27	0.06	1.65
30	0.055	1.43
33	0.05	1.26
36	0.045	1.12
39	0.04	1.01
>39	*	*
* FOR PIPES LARGER THAN 39 INCHES IN DIAMETER, THE SLOPE IS DETERMINED BY MANNING'S FORMULA TO MAINTAIN A VELOCITY GREATER THAN 2.0 FEET PER SECOND AND LESS THAN 10.0 FEET PER SECOND WHEN FLOWING FULL.		



**NOTES**

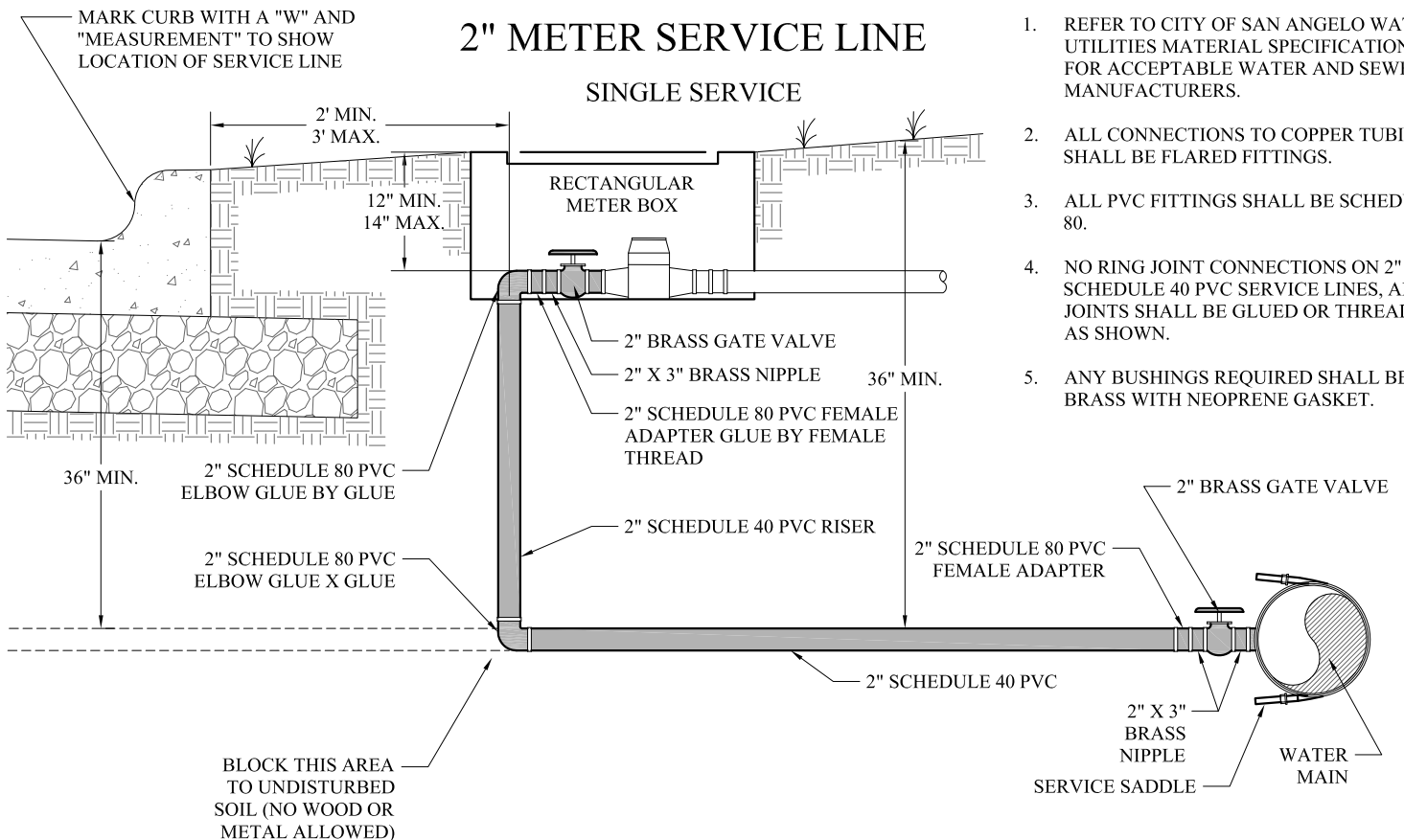
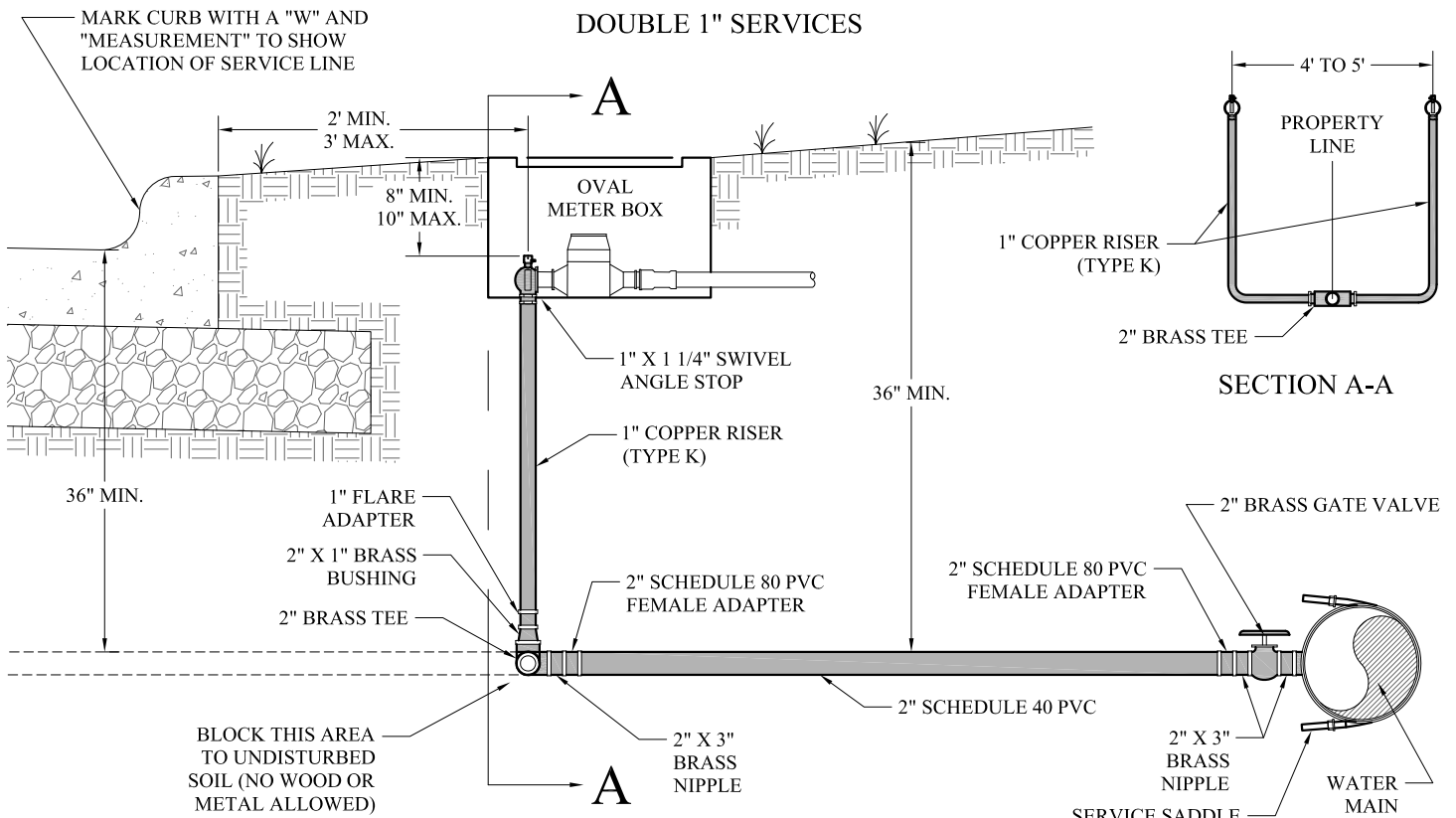
1. REFER TO CITY OF SAN ANGELO WATER UTILITIES MATERIAL SPECIFICATIONS FOR ACCEPTABLE WATER AND SEWER MANUFACTURERS.
2. ALL CONNECTIONS TO COPPER TUBING SHALL BE FLARED FITTINGS.
3. ALL PVC FITTINGS SHALL BE SCHEDULE 80.
4. NO RING JOINT CONNECTIONS ON 2" SCHEDULE 40 PVC SERVICE LINES, ALL JOINTS SHALL BE GLUED OR THREADED AS SHOWN.
5. ANY BUSHINGS REQUIRED SHALL BE BRASS WITH NEOPRENE GASKET.

**CITY OF SAN ANGELO**

1" SERVICE LINES

## 2" SERVICE LINE

### DOUBLE 1" SERVICES



#### NOTES

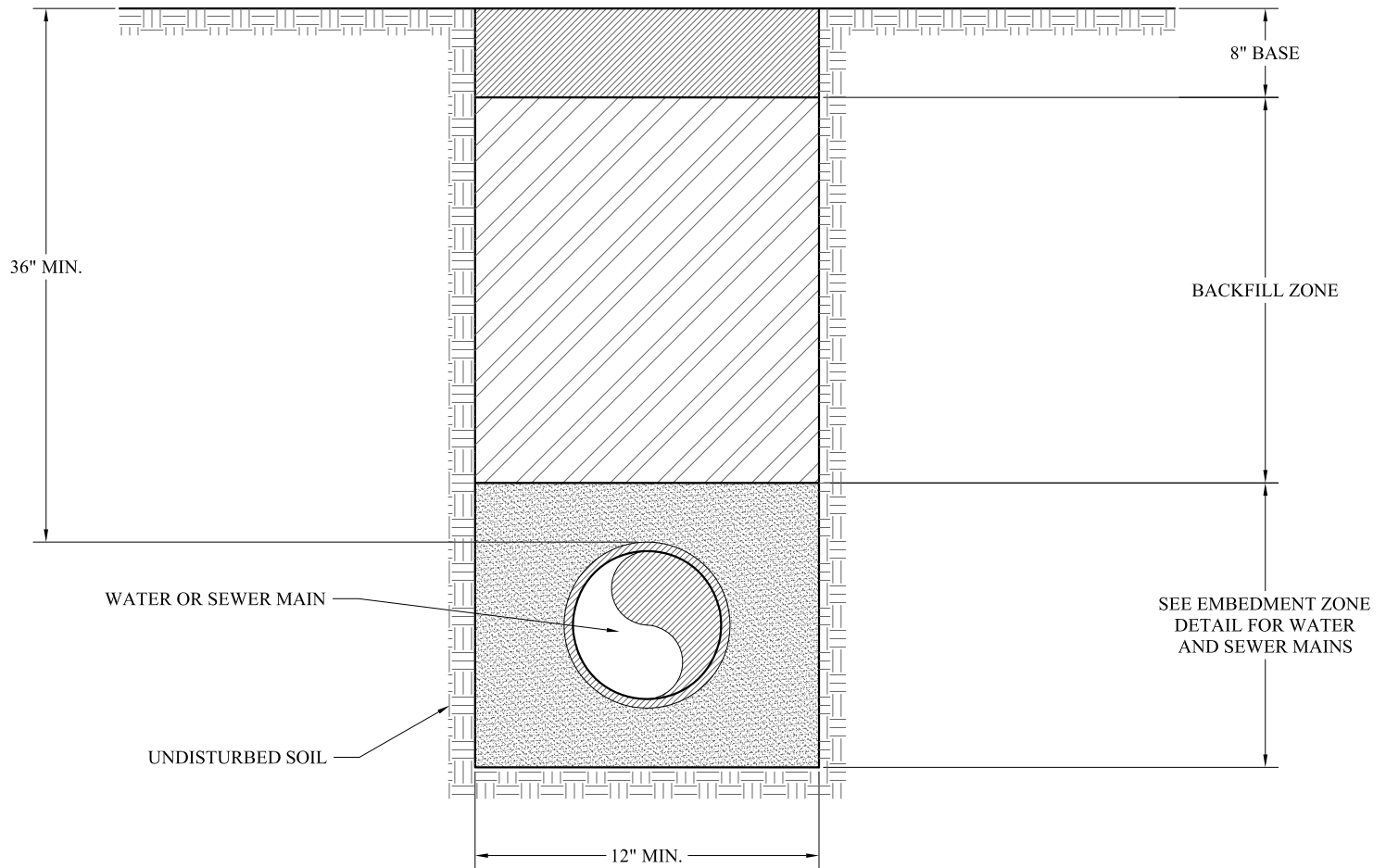
1. REFER TO CITY OF SAN ANGELO WATER UTILITIES MATERIAL SPECIFICATIONS FOR ACCEPTABLE WATER AND SEWER MANUFACTURERS.
2. ALL CONNECTIONS TO COPPER TUBING SHALL BE FLARED FITTINGS.
3. ALL PVC FITTINGS SHALL BE SCHEDULE 80.
4. NO RING JOINT CONNECTIONS ON 2" SCHEDULE 40 PVC SERVICE LINES, ALL JOINTS SHALL BE GLUED OR THREADED AS SHOWN.
5. ANY BUSHINGS REQUIRED SHALL BE BRASS WITH NEOPRENE GASKET.

**CITY OF SAN ANGELO**

2" SERVICE LINES

# UTILITY TRENCH SECTION

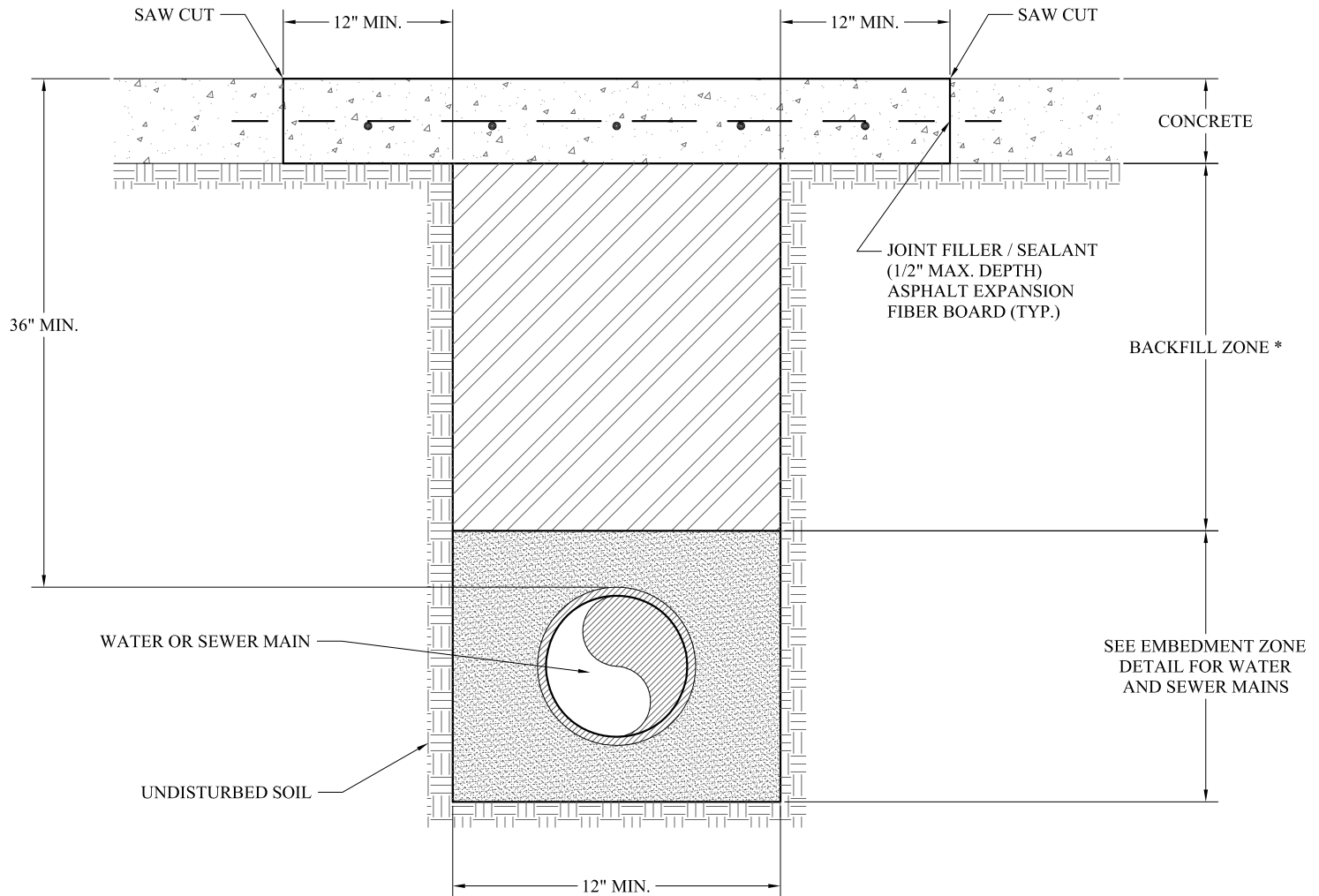
## UNPAVED STREETS, ALLEYS & DRIVEWAYS



- BASE:** FLEXIBLE BASE PER CITY OF SAN ANGELO SPECIFICATIONS. THICKNESS PER CITY OF SAN ANGELO STANDARD STREET SPECIFICATIONS COMPACTED IN 6" LAYERS. MINIMUM DENSITY 95% MODIFIED PROCTOR.
- BACKFILL ZONE:** WHERE PULVERIZED OR GRANULAR MATERIAL IS AVAILABLE FROM EXCAVATION WHICH IS FREE OF SHARP EDGED STONES, OR STONES LARGER THAN 3" IN DIAMETER, CLAY, ORGANIC MATTER, OR OTHER UNSUITABLE SUBSTANCES, HAS A  $PI \leq 20$  AND  $LL \leq 40$ , AND MEETS THE APPROVAL OF THE CITY. SUCH MATERIAL MAY BE USED FOR BACKFILL MATERIAL AS INSTRUCTED BY THE OWNER.

# UTILITY TRENCH SECTION

## RIGID PAVEMENT



**NOTES:**

**CONCRETE:** CLASS P, 3500 P.S.I. COMPRESSIVE; 555 P.S.I., FLEXURAL. BEND EXISTING REBAR INTO CENTER OF NEW CONCRETE. REPLACE AS NECESSARY WITH #4 REBAR ON 12" CENTERS EACH WAY AND DOWEL IN #4 REBAR 9" DEEP WITH 24" LAP SPLICE AND MUST BE ALLOWED TO CURE FOR A PERIOD OF NOT LESS THAN 72 HOURS, OR CLASS P, 3500 P.S.I. WITH 36 POUNDS OF NOVAMESH 850 PER CUBIC YARD WITH #4 REBAR DOWELS 9" DEEP AND 9" INTO THE TRENCH ON 18" CENTERS AND MUST BE ALLOWED TO CURE FOR A PERIOD OF NOT LESS THAN 24 HOURS.

**BACKFILL ZONE :** FLEXIBLE BASE PER CITY OF SAN ANGELO SPECIFICATIONS COMPACTED IN 6" HORIZONTAL LAYERS. MINIMUM DENSITY 95% MODIFIED PROCTOR. (UNLESS APPROVED OTHERWISE IN WRITING).

IF BASE PLUS BACKFILL ZONE DEPTH EXCEEDS 24", REMAINING BACKFILL ZONE (TO TOP OF EMBEDMENT ZONE) CAN CONSIST OF A PULVERIZED OR GRANULAR MATERIAL OBTAINED FROM TRENCH EXCAVATION, IF THE MATERIAL IS FREE OF SHARP EDGE STONES LARGER THAN 3" DIAMETER, CLAY, ORGANIC MATTER OR OTHER UNSUITABLE SUBSTANCES, HAS A  $PI \leq 20$  AND  $LL \leq 40$  AND MEETS APPROVAL OF THE CITY. ALL BACKFILLED MATERIAL SHALL BE COMPACTED TO A MINIMUM OF 95% MODIFIED PROCTOR, COMPACTED IN 6" HORIZONTAL LAYERS AT OR NEAR OPTIMUM MOISTURE CONTENT.

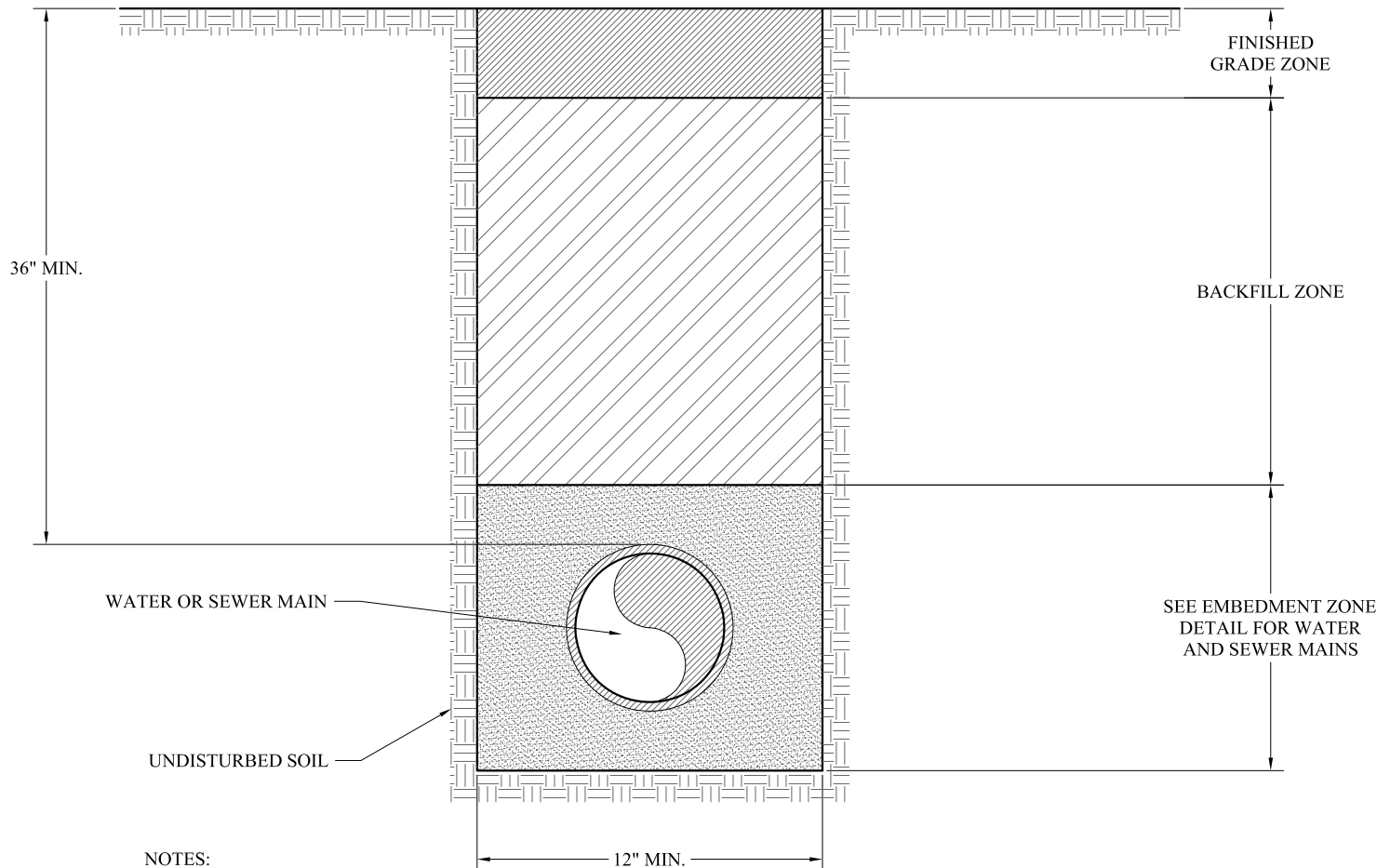
**CITY OF SAN ANGELO**

UTILITY TRENCH SECTION  
RIGID PAVEMENT

W-UTR-RIG

# UTILITY TRENCH SECTION

## OTHER UNPAVED AREAS



### NOTES:

#### BACKFILL ZONE:

OPTION #1: WHERE PULVERIZED OR GRANULAR MATERIAL IS AVAILABLE FROM EXCAVATION WHICH IS FREE OF SHARP EDGED STONES, OR STONES LARGER THAN 3" IN DIAMETER, CLAY, ORGANIC MATTER, OR OTHER UNSUITABLE SUBSTANCES, HAS A  $PI \leq 20$  AND  $LL \leq 40$ , AND MEETS THE APPROVAL OF THE CITY SUCH MATERIAL MAY BE USED FOR BACKFILL MATERIAL AS INSTRUCTED BY THE OWNER. BACKFILL SHALL BE COMPACTED TO DENSITIES EQUAL TO OR GREATER THAN THAT OF SURROUNDING SOIL.

OPTION #2: FLEXIBLE BASE PER CITY OF SAN ANGELO SPECIFICATIONS COMPACTED IN 6" HORIZONTAL LAYERS TO MINIMUM DENSITY 95% MODIFIED PROCTOR.

#### FINISHED GRADE ZONE:

BACKFILL SHALL MATCH EXISTING GROUND CONDITIONS (SEE OPTIONS BELOW) OR AS DIRECTED BY THE OWNER. PAYMENT SHALL BE PER BID ITEMS.

OPTION A: UTILIZE BACKFILL ZONE MATERIAL FROM OPTION #1

OPTION B: 6" TOP SOIL.

OPTION C: 8" FLEXIBLE BASE

**CITY OF SAN ANGELO**

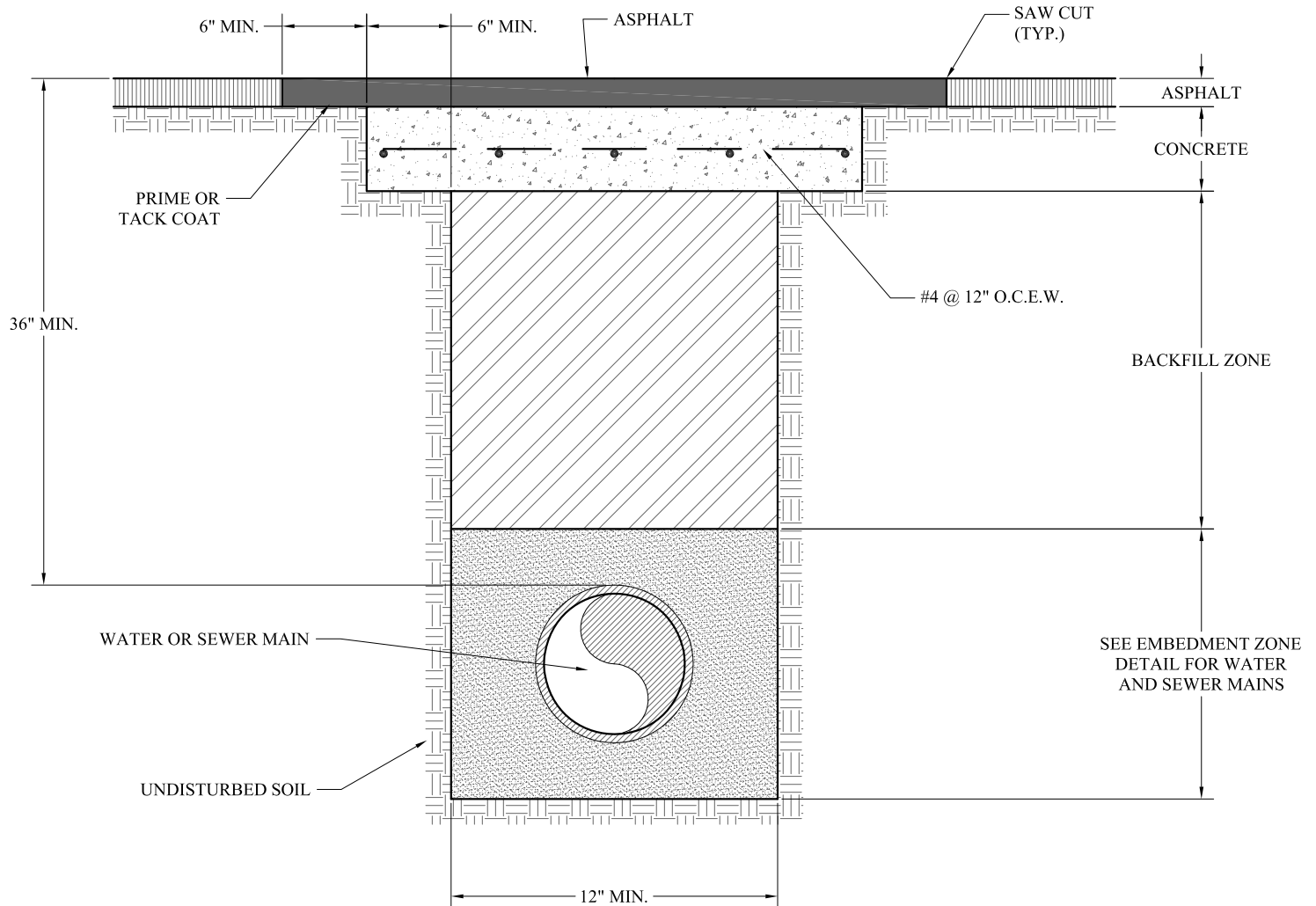
UTILITY TRENCH SECTION  
OTHER UNPAVED AREAS

W-UTR-OUA



# UTILITY TRENCH SECTION

## CONCRETE CAP BELOW ASPHALT



- ASPHALT:** 2" LAYER  
TYPE D, TXDOT HOT MIX OR  
TYPE D, TXDOT HOT MIX - COLD LAID  
(MUST HAVE PRIOR CITY APPROVAL)
- PRIME COAT:** TXDOT MC-30 ASPHALT AT THE RATE OF 0.25 TO 0.35  
GALLON PER SQUARE YARD OF SURFACE
- TACK COAT:** SHALL MEET THE REQUIREMENTS OF TXDOT ITEM 300  
"ASPHALTS, OILS, AND EMULSIONS"
- CONCRETE:** CLASS P, 3500 P.S.I., COMPRESSIVE; 555 P.S.I., FLEXURAL.  
FOR CUTS OVER 2' WIDE, INSTALL #4 REBAR ON 12"  
CENTERS EACH WAY.
- BACKFILL:** FLEXIBLE BASE PER CITY OF SAN ANGELO  
SPECIFICATIONS. COMPACTED IN 6" HORIZONTAL LAYERS  
MINIMUM DENSITY 95% MODIFIED PROCTOR

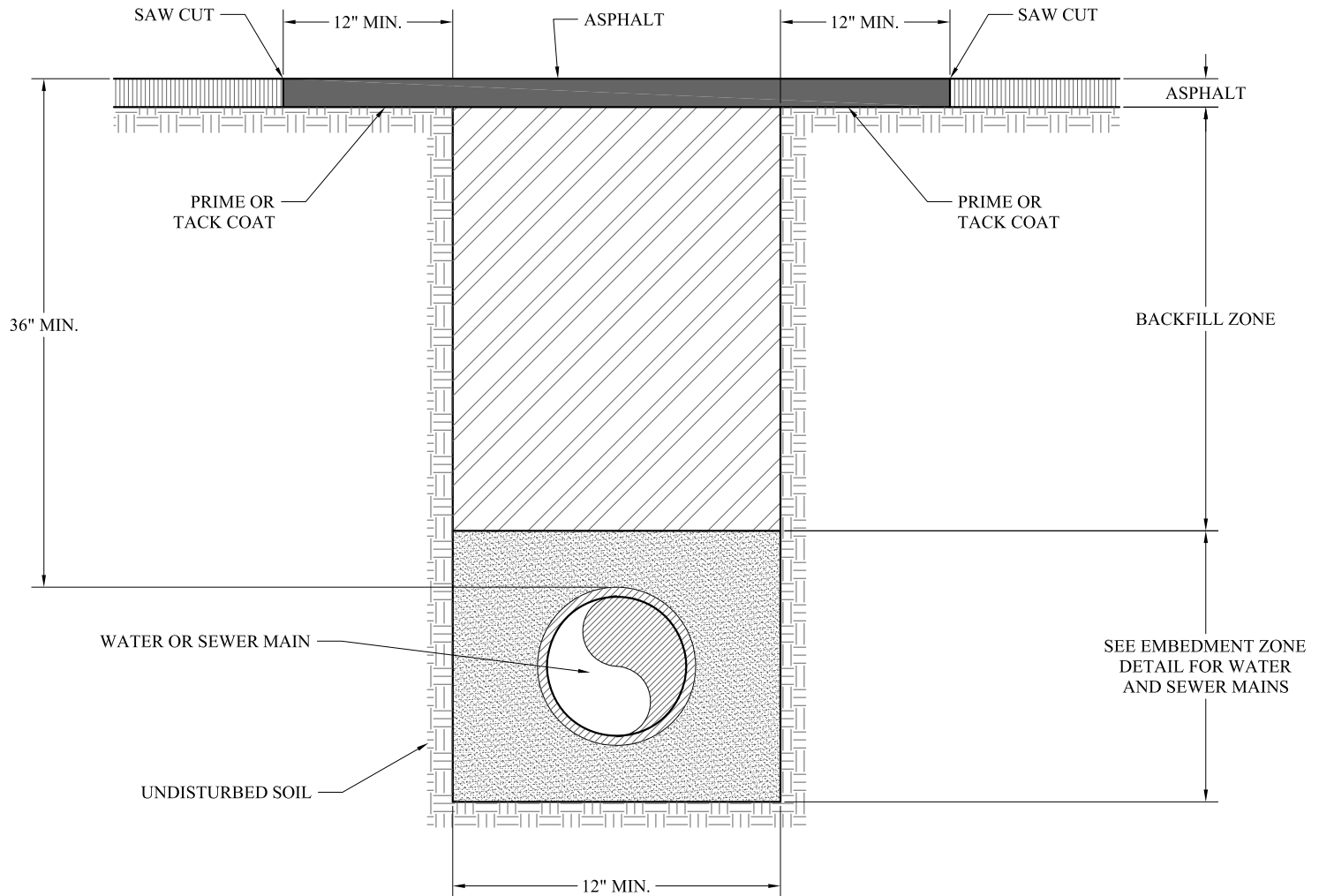
**CITY OF SAN ANGELO**

UTILITY TRENCH SECTION CONCRETE CAP  
BELOW ASPHALT

W-UTR-CCBA

# UTILITY TRENCH SECTION

## ASPHALT PAVEMENT

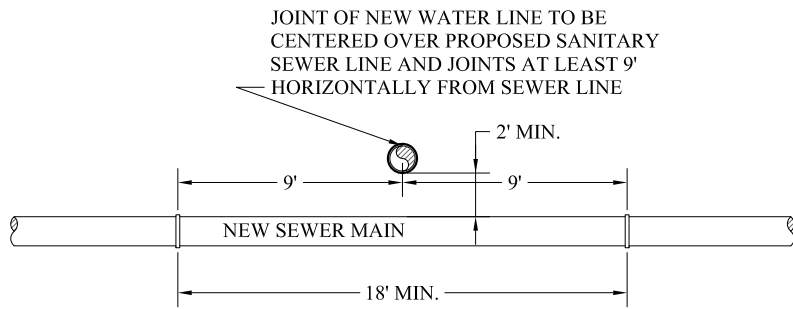


- ASPHALT:** 2" LAYER  
TYPE D, TXDOT HOT MIX OR  
TYPE D, TXDOT HOT MIX - COLD LAID  
(MUST HAVE PRIOR CITY APPROVAL)
- PRIME COAT:** TXDOT MC-30 ASPHALT AT THE RATE OF 0.25 TO 0.35 GALLON  
PER SQUARE YARD OF SURFACE
- TACK COAT:** SHALL MEET THE REQUIREMENTS OF TXDOT ITEM 300  
"ASPHALTS, OILS, AND EMULSIONS".
- BACKFILL ZONE:** FLEXIBLE BASE PER CITY OF SAN ANGELO SPECIFICATIONS  
COMPACTED IN 6" HORIZONTAL LAYERS. MINIMUM DENSITY  
95% MODIFIED PROCTOR. (UNLESS NOTED OTHERWISE IN  
WRITING).

**CITY OF SAN ANGELO**

UTILITY TRENCH SECTION  
ASPHALT PAVEMENT

W-UTR-ASP

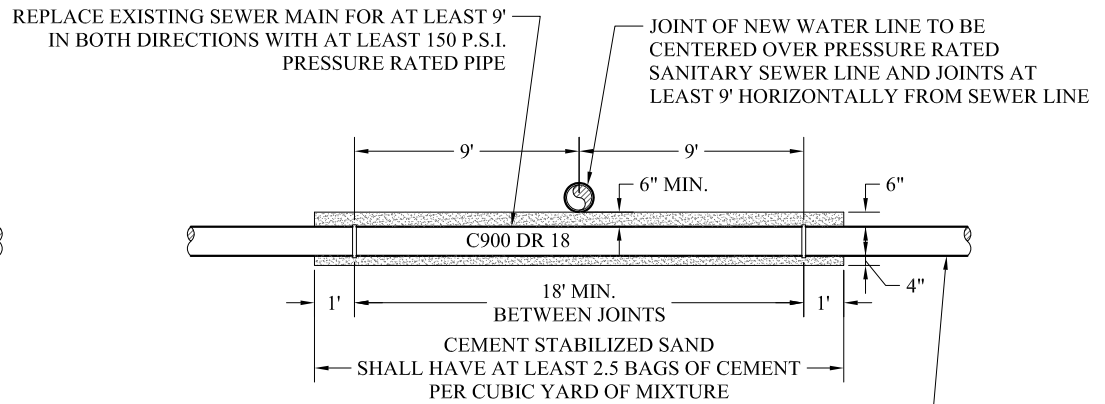


CONSTRUCTION SHALL BE IN ACCORDANCE WITH TCEQ CHAPTER 290, PUBLIC DRINKING WATER, SECTION 290.44(e)(4)(B)(i).

NOTE:  
USE THIS INSTALLATION WHEN MIN. 2.0' VERTICAL SEPARATION BETWEEN WATER AND SEWER IS POSSIBLE.

**CROSSING # 1**

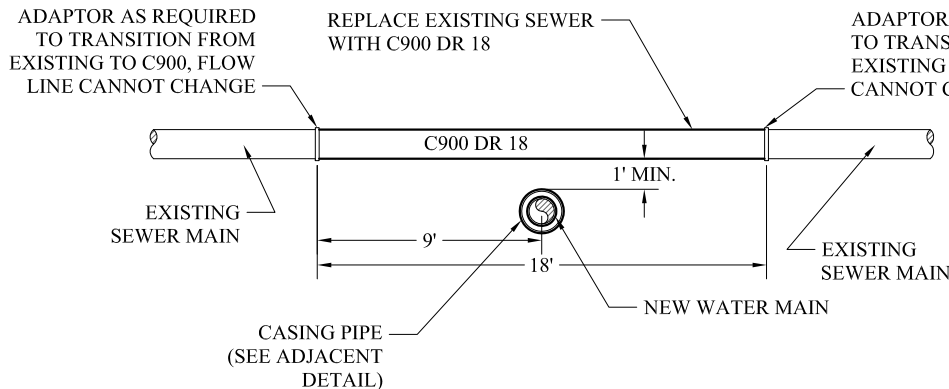
TYPICAL INSTALLATION OF NEW WATER LINE OVER NEW NON- PRESSURE RATED SANITARY SEWER LINE IN ACCORDANCE WITH TCEQ REGULATIONS



CONSTRUCTION SHALL BE IN ACCORDANCE WITH TCEQ CHAPTER 290, PUBLIC DRINKING WATER, SECTION 290.44(e)(4)(B)(v).

**CROSSING # 2**

TYPICAL INSTALLATION OF NEW WATER LINE OVER A PRESSURE RATED SANITARY SEWER LINE IN ACCORDANCE WITH TCEQ REGULATIONS

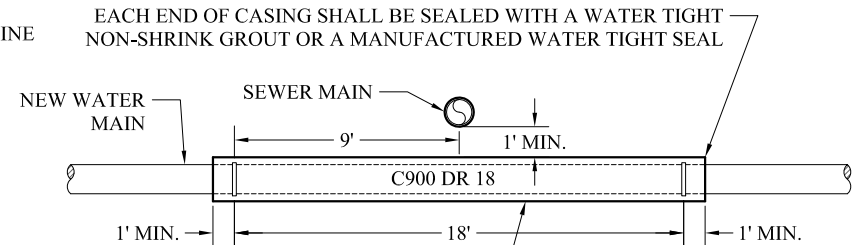


- NOTE:
1. IF STANDARD LENGTH OF PIPE IS LESS THAN 18', ADDITIONAL DETAILS WILL BE REQUIRED ALONG WITH COSA APPROVAL.
  2. IF A CROSSING NOT SHOWN HERE IS REQUIRED, CITY APPROVAL WILL BE REQUIRED PRIOR TO CONSTRUCTION.

NOTE:  
USE THIS INSTALLATION WHEN WATER CROSSES UNDER A WASTEWATER MAIN OR LATERAL. BOTH WATER AND WASTEWATER MUST PASS A PRESSURE AND LEAKAGE TEST AS SPECIFIED IN AWWA C600 STANDARDS

**CROSSING # 3**

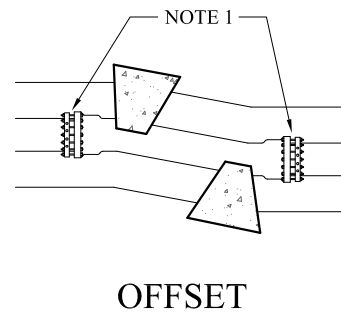
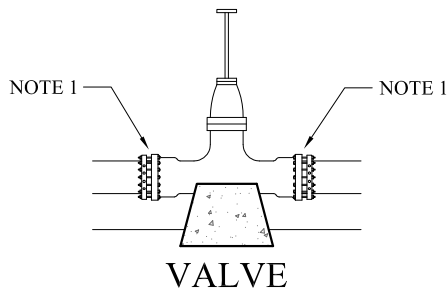
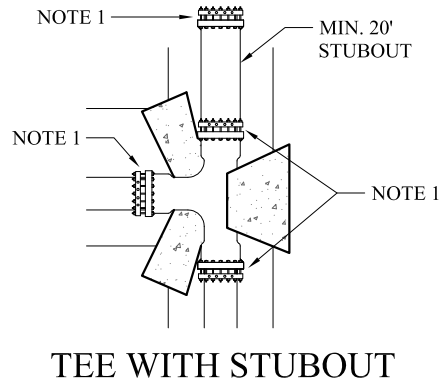
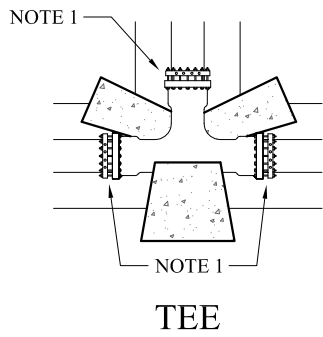
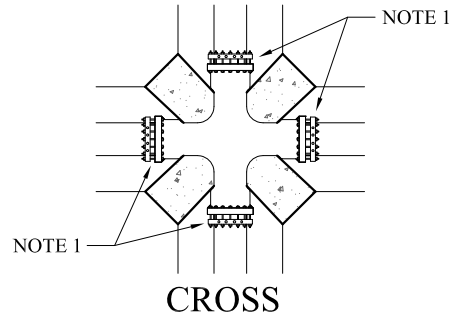
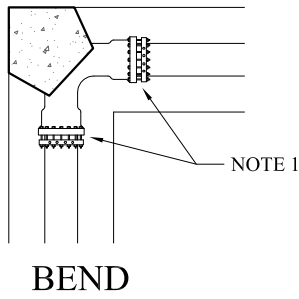
TYPICAL INSTALLATION OF NEW WATER LINE UNDER SANITARY SEWER LINE IN ACCORDANCE WITH TCEQ REGULATIONS



CASING PIPE TO BE DUCTILE IRON, STEEL PIPE, C900 PVC OR SDR 26 PVC WITH MECHANICAL OR WELDED JOINTS AS APPROPRIATE, TWO NOMINAL SIZES LARGER THAN THE WATER LINE. CASING PIPE A MINIMUM OF 18' TO ENCASE BOTH WATER LINE JOINTS. SPACERS PLACED AT 5' CENTERS.

WATER LINE SHALL BE ENCASED AS DESCRIBED IN TCEQ CHAPTER 290, PUBLIC DRINKING WATER, SECTION 290.44(e)(4)(B)(iv)(III).

# RETAINING GLAND, JOINT RESTRAINTS AND THRUST BLOCKING



**NOTES:**

1. ALL MECHANICAL JOINT CONNECTIONS ON BENDS SHALL BE EBBA IRON OR FORD "MEGA LUG" PIPE RESTRAINTS OR APPROVED EQUAL.
2. ALL CONCRETE TO BE 3,000 P.S.I. CONCRETE.

