NOTES:

1. A MAX. OF 4 AND A MIN. OF 2 THROAT RINGS SHALL BE USED AT EACH MANHOLE IN NEW OR EXISTING RIGHT-OF-WAY.
2. USE ADEKA SEALANT OR APPROVED EQUAL BETWEEN RING/COVER. ADJUSTMENT RINGS AND CHIMNEY OR CORBEL/CONE SECTION.
3. MANHOLE BASE THICKNESS AND FOUNDATION FROM FLOWLINE TO RIM AS FOLLOWS:

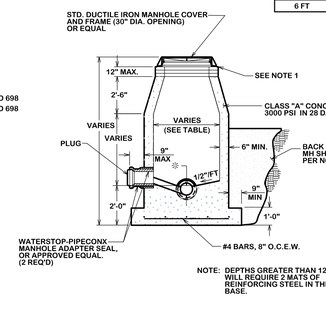
MANHOLE DEPTH (FT.)	BASE THICKNESS
0 - 12	8"
12 AND OVER	12"

4. MANHOLE LOCATION AND COMPACTION AS FOLLOWS:

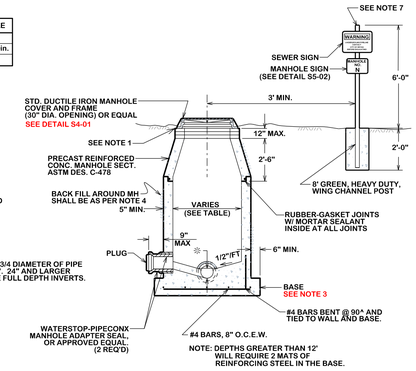
LOCATION	COMPACTION REQUIREMENT.
PAVEMENT	98 % STANDARD PROCTOR - ASTM D 698
LANDSCAPE AREA	90 % STANDARD PROCTOR - ASTM D 698

5. ~~NO RINGS ARE REQUIRED OUTSIDE OF STREET RIGHT-OF-WAY.~~
6. IN FLOODPLAINS OR AREAS OF CONCENTRATED FLOW, THE CONE SHALL EXTEND 1 FOOT ABOVE THE BASE FLOOD ELEVATION OR A BOLT DOWN WATER-TIGHT RING AND COVER SHALL BE USED, VENTED WHERE REQUIRED.
7. WARNING SIGN SHALL BE PLACED WHERE SEWER CROSSES OPEN FIELDS.

MANHOLE DIA.	MAIN SIZE
4 FT	<18in.
5 FT	≥18in. <30in.
6 FT	≥36in.



CAST IN PLACE MANHOLE



※ INVERT = 3/4 DIAMETER OF PIPE UP TO 24". 24" AND LARGER SHALL BE FULL DEPTH INVERTS.

PRE-CAST MANHOLE

STANDARD MANHOLE

S1-00

NOTES:

1. *FOR BEDDING AND TRENCHING WITHIN ALL EXISTING PAVED AREAS, SEE DETAILS FOR OPEN CUT STREETS. (Details ST4-00, ST4-01, ST4-02). THIS NOTE DOES NOT APPLY TO STREETS BEING RECONSTRUCTED.*
2. ALL BEDDING & INSTALLATION OF PVC PIPE SHALL BE IN ACCORDANCE TO ANSI/AWWA STANDARDS FOR PVC PIPE.
3. ALL BEDDING & INSTALLATION OF DUCTILE IRON PIPE SHALL BE IN ACCORDANCE TO ANSI/AWWA C150/A21.50.
4. COMPACTION SHALL BE ATTAINED BY MECHANICAL TAMPING.
5. ALL TRENCHES SHALL BE BACK FILLED AND TEMPORARY PAVING OR PLANKING PLACED AT THE END OF EACH WORKING DAY.
6. *EVERY 100 FEET PROVIDE A WATER STOP BLOCK COMPOSED OF CEMENT SAND OR IMPERVIOUS NATIVE MATERIAL DEPENDING ON EMBEDMENT. BLOCK SHALL BE 5 FEET IN LENGTH. NO BEDDING SAND IN THIS AREA.*

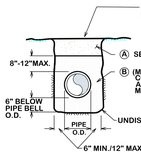
Ⓐ SELECT NATIVE MATERIAL
MATERIAL EXCAVATED FROM THE DITCH, (WHICH IS FREE OF ROCKS, LUMPS, CLODS, OR DEBRIS LARGER THAN TWO (2) INCHES IN THE LARGEST DIMENSION), COMPACTED TO A MINIMUM OF 90% OF MAXIMUM DENSITY AS DETERMINED BY ASTM D698 (STANDARD) AT A MOISTURE CONTENT WITHIN OPTIMUM TO +4% OF OPTIMUM UNDER NON-STRUCTURAL AREAS (ie...YARDS, PASTURES, EASEMENTS) (OPTION 1) AND TO A MINIMUM OF 98% OF MAXIMUM DENSITY AS DETERMINED BY ASTM D698 (STANDARD) AT A MOISTURE CONTENT WITHIN OPTIMUM TO +4% OF OPTIMUM UNDER NEW STREET AREAS AND STREETS TO BE RECONSTRUCTED. (OPTION 2)

Ⓑ GRANULAR MATERIAL
MATERIAL SHALL BE BANK RUN RIVER SAND WHICH IS FREE OF DETRIMENTAL QUANTITIES OF CLAY, DEBRIS, OR ORGANIC MATERIAL AND WHICH, WHEN TESTED BY STANDARD LABORATORY METHODS, MEET THE FOLLOWING REQUIREMENTS:

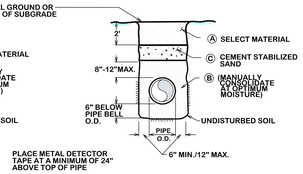
MAXIMUM LIQUID LIMIT	45
MAXIMUM PLASTICITY INDEX	15
MAXIMUM PERCENT PASSING NO. 200 SIEVE	35
MINIMUM PERCENT PASSING 3/4" SIEVE	100

THE MATERIAL SHALL BE FREE FLOWING AND WHEN WET, SHALL NOT ADHERE TO FORM A BALL WHEN PRESSED IN THE HAND.

Ⓒ CEMENT STABILIZED SAND



NON-STRUCTURAL AREAS

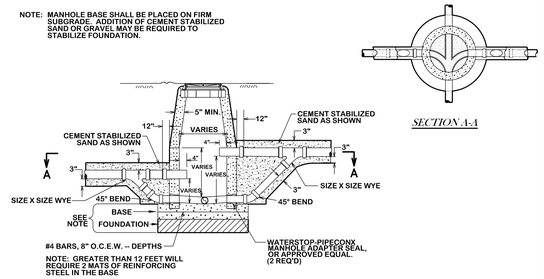


AREAS TO BE PAVED OR STREETS TO BE RECONSTRUCTED

BEDDING AND TRENCH FOR DI PIPE & PVC PIPE

S1-01

NOTE: MANHOLE BASE SHALL BE PLACED ON FIRM SUBGRADE. ADDITION OF CEMENT STABILIZED SAND OR GRAVEL MAY BE REQUIRED TO STABILIZE FOUNDATION.

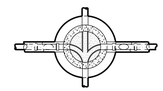


SECTION A-A

CITY OF COLLEGE STATION
OUTSIDE DROP MANHOLE

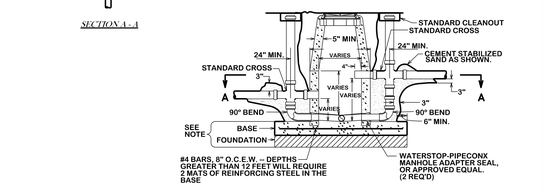
ONLY ALLOWED FOR MAIN LINE CONNECTIONS 60" AND LARGER

S2-00



SECTION A - A

NOTE: MANHOLE BASE SHALL BE PLACED ON FIRM SUBGRADE. ADDITION OF CEMENT STABILIZED SAND OR GRAVEL MAY BE REQUIRED TO STABILIZE FOUNDATION.



CITY OF BRYAN
OUTSIDE DROP MANHOLE

ONLY WHEN APPROVED BY CITY ENGINEER

S2-01

NOTE:
MANHOLE BASE SHALL BE PLACED ON FIRM SUBGRADE. ADDITION OF CEMENT STABILIZED SAND OR GRAVEL MAY BE REQUIRED TO STABILIZE FOUNDATION.

IN EXISTING MANHOLE, PLACE PVC ELBOW ON BENCH. GROUT NEW BENCH TO SPRINGLINE AND TROWEL SMOOTH. FORM SMOOTH CHANNEL TO INVERT.

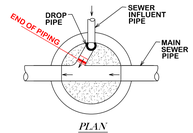
ALL NEW CONNECTION AT EXISTING MANHOLES SHALL BE BY CORING ONLY.

MANHOLE BOOTS SHALL BE SIZED SAME AS INCOMING PIPE.

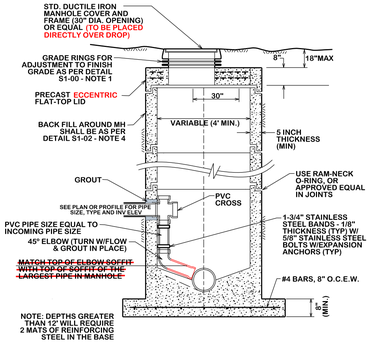
CROSS MUST BE A MINIMUM 24" BELOW CONE SECTION.

5 FOOT DIAMETER MANHOLE WILL BE REQUIRED FOR DROPS 12" AND GREATER.

IF THERE ARE TWO DROPS INSIDE MANHOLE ON OPPOSING SIDES, THEN MANHOLE I.D. SHOULD BE CENTERED BETWEEN THE TOW DROPS.



PLAN



STANDARD DROP MANHOLE

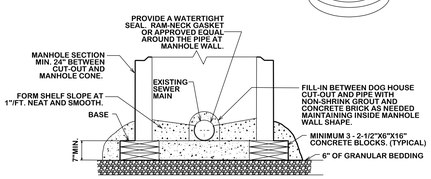
CITY OF BRYAN - DROP MANHOLE TO BE USED ON LINES UP TO 12" IN SIZE

CITY OF COLLEGE STATION - DROP MANHOLE TO BE USED ON LINES UP TO 4" IN SIZE

S2-02

NOTES:

1. FLOW SHALL BE MAINTAINED DURING CONSTRUCTION.
2. THIS DETAIL TO BE USED WHEN A 6" OR LARGER LATERAL NECESSITATES CONSTRUCTION OF A NEW MANHOLE.
3. FOR ADDITIONAL STANDARDS NOT SHOWN, SEE "STANDARD MANHOLE" DETAIL S1-02.
4. CONTRACTOR SHALL BE RESPONSIBLE FOR SUPPORT OF EXISTING SEWER DURING INSTALLATION OF MANHOLE.
5. DOGHOUSE OPENING MAY ONLY BE USED WHEN PLACING A NEW MANHOLE OVER AN EXISTING LINE; OTHERWISE, THE OPENING MUST BE CAST. SIZE, LOCATION, AND ANGLE OF ENTRY SHALL BE AS REQUIRED BY THE PLANS.
6. EXCAVATE TRENCH TO MIN. 13" BELOW BOTTOM OF EXISTING PIPE, COMPACT SUBGRADE. PLACE AND COMPACT 6" OF GRANULAR BEDDING. MONOLITHIC POUR OF MIN. 7" DEPTH, 6-SACK TOPPING MIX TO BE PLACED INSIDE, UNDER, AND OUTSIDE MANHOLE BARREL FROM SURFACE OF BEDDING, AROUND CONCRETE BLOCK RISERS, TO A POINT APPROXIMATELY AT THE SPRING LINE OF THE EXIST. PIPE.
7. DURING THE SAME POUR, THE FINISH MANHOLE SHELF SHALL BE FORMED AND FINISHED AROUND THE BARREL AND EXISTING PIPE AS SHOWN.
8. AFTER CONCRETE SHELF HAS CURED, THE EXISTING PIPE SHALL BE SAW-CUT ON BOTH SIDES TO THE FINISHED SHELF GRADE AND REMOVED, ONLY AFTER CITY-APPROVED, PASSING MANHOLE LEAKAGE TESTING. THE EXISTING PIPE SHALL FORM THE TROUGH OF THE MANHOLE AS SHOWN. FILE CUT PIPE TO GIVE SMOOTH EDGES.

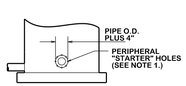


CITY OF COLLEGE STATION
GRAVITY SEWER DOGHOUSE MANHOLE

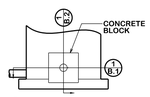
S3-00

NOTES:

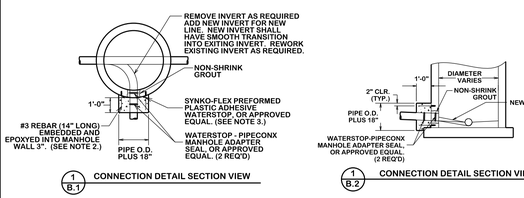
1. 1" DIA. "STARTER" HOLES SHALL BE DRILLED THROUGH WALL OF EXISTING MANHOLE SPACED 3" APART CENTER TO CENTER. AFTER "STARTER" HOLES HAVE BEEN INSTALLED AND APPROVED BY A CITY INSPECTOR, THE CONTRACTOR SHALL BEGIN REMOVING THE CONCRETE INSIDE THE PERIPHERAL "STARTER" HOLES. CONCRETE SHALL BE REMOVED WITH PNEUMATIC HAND TOOLS.
2. THE NUMBER OF REBAR DOWELS SHALL VARY WITH SIZE OF OPENING. REBAR SHALL NOT BE SPACED MORE THAN 12" CC.
3. WATERSTOP SHALL BE INSTALLED IN STRICT ACCORDANCE WITH MANUFACTURERS REQUIREMENTS.
4. CONCRETE SHALL BE 3,000 P.S.I.



1 A OPENING CREATION DETAIL



1 B MANHOLE CONNECTION DETAIL



1 B.1 CONNECTION DETAIL SECTION VIEW

1 B.2 CONNECTION DETAIL SECTION VIEW

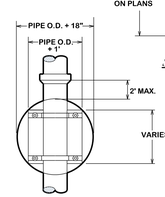
STANDARD MANHOLE TIE-IN

S3-01

NOTES:

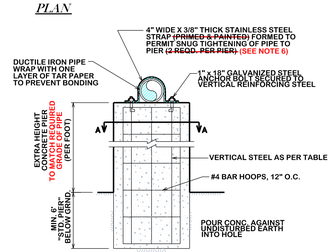
1. EACH PIER SHALL BE COMPLETED IN A SINGLE CONTINUOUS POUR.
2. CHAMFER EDGES 3/4".
3. CONTRACTOR SHALL CONSTRUCT CONCRETE PIER TO A MINIMUM DEPTH OF 6' OR TO A DEPTH WHERE A GOOD BEARING SOIL IS ENCOUNTERED.
4. ALL SHAFTS SHALL BE BORED VERTICALLY PLUMB WITHIN 2" TOLERANCE.
5. ALL INFORMATION SHOWN IS CITY MINIMUM. ALL PIERS SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER.
6. NUMBER OF STRAPS DEPENDENT ON SIZE OF PIERS. MIN. 1 STRAP PER PIER.

SECTION A-A



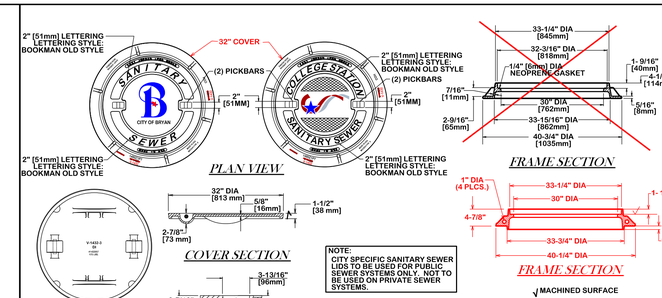
PIER DIAMETER	VERTICAL STEEL # 5 BARS
16"	8
24"	12
26"	14
30"	16
42"	24

PLAN



TYPICAL CONCRETE DRILLED PIER FOR AERIAL SEWER

S4-00

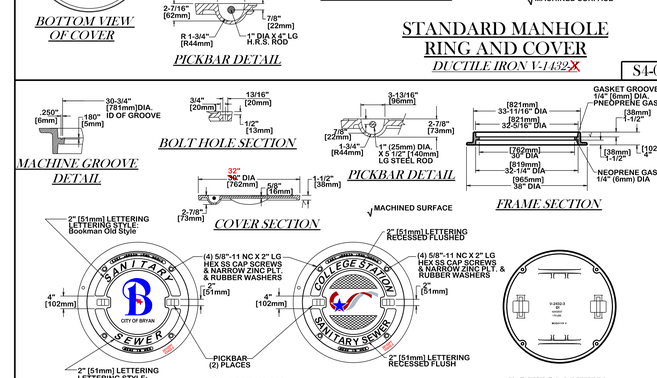


NOTE:
CITY SPECIFIC SANITARY SEWER LIDS TO BE USED FOR PUBLIC SEWER SYSTEMS ONLY. NOT TO BE USED ON PRIVATE SEWER SYSTEMS.

STANDARD MANHOLE RING AND COVER

DUCTILE IRON V-1432X

S4-01



NOTE:
CITY SPECIFIC SANITARY SEWER LIDS TO BE USED FOR PUBLIC SEWER SYSTEMS ONLY. NOT TO BE USED ON PRIVATE SEWER SYSTEMS.

WATER TIGHT MANHOLE RING AND COVER

DUCTILE IRON V-2432-3

S4-02

REVISIONS:

BRYAN - COLLEGE STATION STANDARD SEWER DETAILS

CITY OF COLLEGE STATION

CITY OF BRYAN
The Good Life, Texas Style.

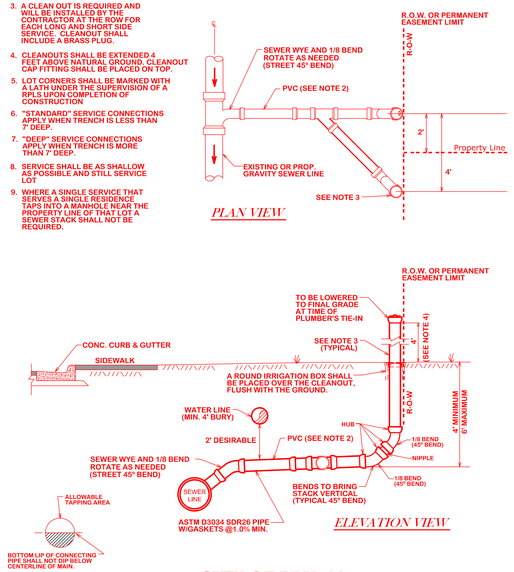
DRAWN BY: C.L.M.
DATE: 08-01-12
SCALE: N T S
APPROVED: W. P. K.

FIGURE:
S1

SHEET 1 OF 2

NOTE:

1. ALL MATERIAL SHALL BE ASTM D3034 SDR26 W/ GASKETS
2. ALL SERVICE CONNECTIONS & EXTENSIONS ARE TO BE INSTALLED WITH THE MAIN LINE CONSTRUCTION.
3. A CLEAN OUT IS REQUIRED AND WILL BE INSTALLED BY THE CONTRACTOR AT THE ROW FOR EACH LONG AND SHORT SIDE SERVICE. CLEANOUT SHALL INCLUDE A BRASS PLUG.
4. CLEANOUTS SHALL BE EXTENDED 4 FEET ABOVE NATURAL GROUND. CLEANOUT CAP FITTING SHALL BE PLACED ON TOP.
5. LOT CORNERS SHALL BE MARKED WITH A LATH UNDER THE SUPERVISION OF A RPLS UPON COMPLETION OF CONSTRUCTION
6. "STANDARD" SERVICE CONNECTIONS APPLY WHEN TRENCH IS LESS THAN 7' DEEP.
7. "DEEP" SERVICE CONNECTIONS APPLY WHEN TRENCH IS MORE THAN 7' DEEP.
8. SERVICE SHALL BE AS SHALLOW AS POSSIBLE AND STILL SERVICE LOT
9. WHERE A SINGLE SERVICE THAT SERVES A SINGLE RESIDENCE TAPS INTO A MANHOLE NEAR THE PROPERTY LINE OF THAT LOT A SEWER STACK SHALL NOT BE REQUIRED.

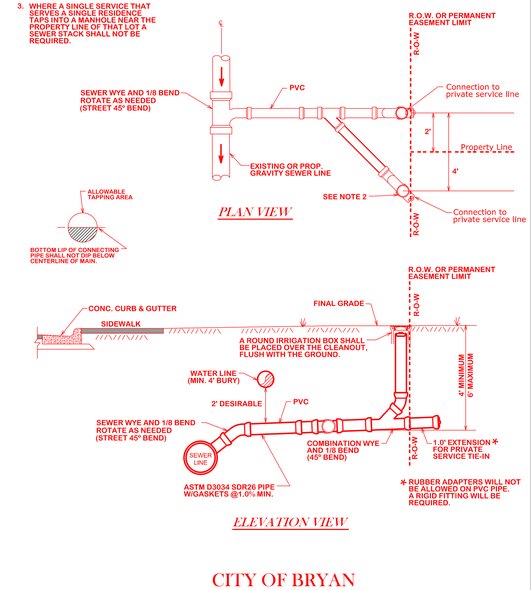


CITY OF BRYAN
STANDARD SEWER SERVICE CONNECTION

NEW CONSTRUCTION ONLY

NOTE:

1. ALL MATERIAL SHALL BE ASTM D3034 SDR26 W/ GASKETS
2. SERVICE SHALL BE AS SHALLOW AS POSSIBLE AND STILL SERVICE LOT
3. WHERE A SINGLE SERVICE THAT SERVES A SINGLE RESIDENCE TAPS INTO A MANHOLE NEAR THE PROPERTY LINE OF THAT LOT A SEWER STACK SHALL NOT BE REQUIRED.



CITY OF BRYAN
STANDARD SEWER SERVICE RE-CONNECTION

PLUMBER CONNECTION OR CIP RECONSTRUCTION

GENERAL NOTES:

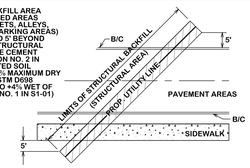
ALL AREAS WHERE EXISTING VEGETATION AND GRASS COVER HAVE BEEN BARED BY CONSTRUCTION SHALL BE ADEQUATELY BLOCK SODDED OR HYDROMULCHED AND WATERED UNTIL GROWTH IS ESTABLISHDED. IN DEVELOPED AREAS WHERE GRASS IS PRESENT, BLOCK SOD WILL BE REQUIRED. BARED AREAS SHALL BE SEEDED OR SODDED WITHIN 14 CALENDAR DAYS OF LAST DISTURBANCE.

APPROVED EROSION CONTROL MEASURES MUST BE INSTALLED DURING THE ENTIRE TIME THAT EARTH HAS BEEN BARED BY CONSTRUCTION AND SHALL STAY IN PLACE UNTIL ACCEPTABLE VEGETATIVE GROWTH IS ESTABLISHED AFTER CONSTRUCTION IS COMPLETE AND THEN REMOVED BY CONTRACTOR.

ALL EROSION CONTROL MEASURES SHOULD BE CLEANED OF SILT AFTER EVERY RAIN.

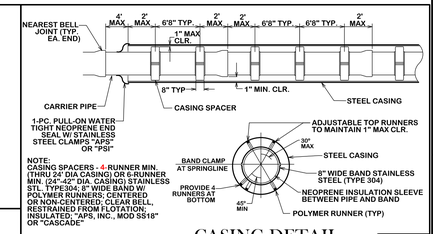
ESTABLISHMENT OF VEGETATION MAY BE A WARRANTY ITEM.

STRUCTURAL BACKFILL AREA INCLUDES ALL PAVED AREAS (SIDEWALKS, STREETS, ALLEYS, DRIVEWAYS AND PARKING AREAS) AND SHALL EXTEND 5' BEYOND THE CURB LINE. STRUCTURAL BACKFILL SHALL BE CEMENT STABILIZED (OPTION NO. 2 IN S1-01) OR EXCAVATED SOIL COMPACTED TO 98% MAXIMUM DRY DENSITY AS PER ASTM D698 WITHIN OPTIMUM TO +4% WET OF OPTIMUM (OPTION NO. 1 IN S1-01)



STRUCTURAL BACKFILL AREA

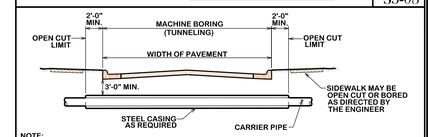
S5-00



NOTE:
CASING SPACERS - 4 RUNNER MIN. (THRU 24" DIA. CASING) OR 6 RUNNER MIN. (24"-42" DIA. CASING) STAINLESS STL. TYPE304; 8" WIDE BAND W/ POLYMER RUNNERS; CENTERED OR NON-CENTERED; CLEAR BELL, RESTRAINED FROM FLOTATION; INSULATED; "APS, INC., MOD SS18" OR "CASCADE"

CASING DETAIL

S5-03

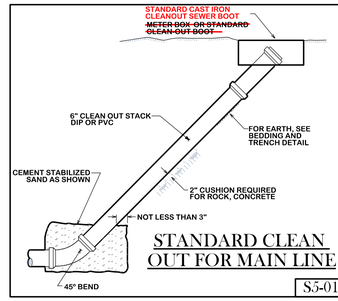


NOTE:

1. FOR MORE INFORMATION ON WATER AND SEWER LINE CROSSING SEE CITY STANDARD SPECIFICATION FOR WATER AND SEWER LINE CONSTRUCTION.
2. STEEL CASING SHALL BE AS SPECIFIED IN THE TECHNICAL SPECIFICATIONS.
3. DRY BORING PREFERRED, WET BORING ALLOWED ONLY WHEN APPROVED BY THE CITY ENGINEER.

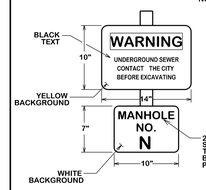
TYPICAL URBAN CITY STREET CROSSING

S5-04



STANDARD CLEAN OUT FOR MAIN LINE

S5-01

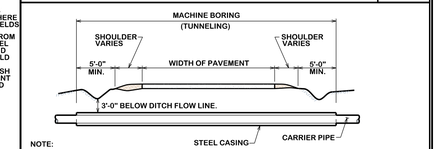


NOTES:

1. FURNISH AS SHOWN ON PLANS AND/OR AT EACH MANHOLE WHERE SEWER LINE CROSSES OPEN FIELDS
2. SIGNS TO BE CONSTRUCTED FROM 20 GA. STEEL BAKED ON ENAMEL FINISH. FURNISH ONE SIGN AND ONE POST FOR EACH OPEN FIELD AND AT OTHER LOCATIONS AS SHOWN ON THE PLANS. FURNISH SAME NUMBER OF REPLACEMENT SIGNS AS FOR EACH INSTALLED (OMITTING MANHOLE NUMBER ON MANHOLE SIGN) (NOT A SEPARATE PAY ITEM)
2" BLACK PRESSURE SENSITIVE NUMBERS TO BE ADDED AFTER BASIC SIGN HAS BEEN PAINTED

SEWER WARNING AND MANHOLE IDENTIFICATION SIGN

S5-02



NOTE:

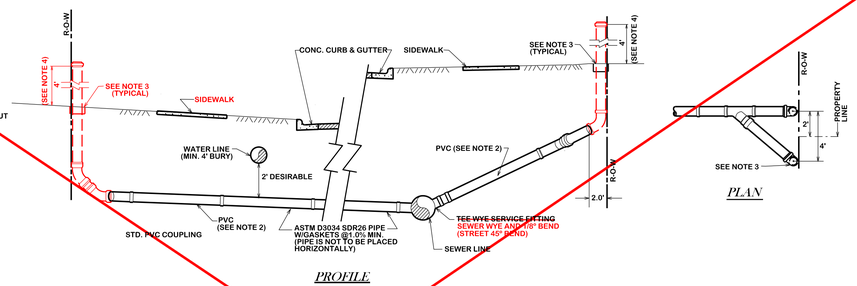
1. FOR MORE INFORMATION ON WATER AND SEWER LINE CROSSING SEE CITY STANDARD SPECIFICATION FOR WATER AND SEWER LINE CONSTRUCTION.
2. STEEL CASING SHALL BE AS SPECIFIED IN THE TECHNICAL SPECIFICATIONS.
3. DRY BORING IS REQUIRED.

TYPICAL RURAL STREET CROSSING

S5-05

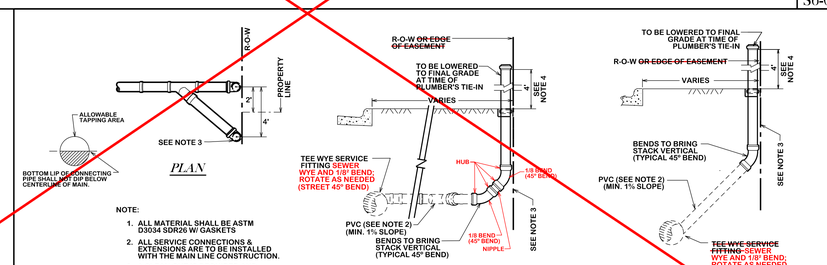
NOTE:

1. ALL MATERIAL SHALL BE ASTM D3034 SDR26 W/ GASKETS
2. ALL SERVICE CONNECTIONS & EXTENSIONS ARE TO BE INSTALLED WITH THE MAIN LINE CONSTRUCTION.
3. A CLEAN OUT IS REQUIRED AND WILL BE INSTALLED BY THE CONTRACTOR AT THE ROW FOR EACH LONG AND SHORT SIDE SERVICE. CLEANOUT SHALL INCLUDE A BRASS PLUG.
4. CLEANOUTS SHALL BE EXTENDED 4 FEET ABOVE NATURAL GROUND. CLEANOUT CAP FITTING SHALL BE PLACED ON TOP.
5. LOT CORNERS SHALL BE MARKED WITH A LATH UNDER THE SUPERVISION OF A RPLS UPON COMPLETION OF CONSTRUCTION



CITY OF BRYAN
SEWER SERVICE LINE CROSSING

S6-00



NOTE:

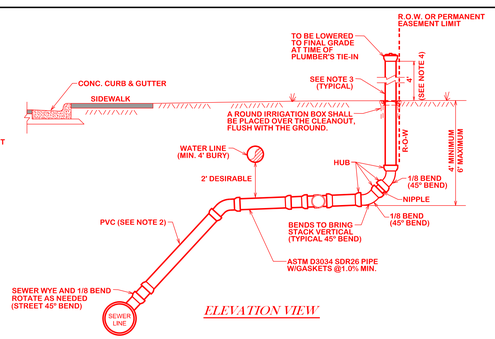
1. ALL MATERIAL SHALL BE ASTM D3034 SDR26 W/ GASKETS
2. ALL SERVICE CONNECTIONS & EXTENSIONS ARE TO BE INSTALLED WITH THE MAIN LINE CONSTRUCTION.
3. A CLEAN OUT IS REQUIRED AND WILL BE INSTALLED BY THE CONTRACTOR AT THE ROW FOR EACH LONG AND SHORT SIDE SERVICE. CLEANOUT SHALL INCLUDE A BRASS PLUG.
4. CLEANOUTS SHALL BE EXTENDED 4 FEET ABOVE NATURAL GROUND. CLEANOUT CAP FITTING SHALL BE PLACED ON TOP.

CITY OF BRYAN
SANITARY SEWER SERVICE CONNECTION

S6-01

NOTE:

1. ALL MATERIAL SHALL BE ASTM D3034 SDR26 W/ GASKETS
2. ALL SERVICE CONNECTIONS & EXTENSIONS ARE TO BE INSTALLED WITH THE MAIN LINE CONSTRUCTION.
3. A CLEAN OUT IS REQUIRED AND WILL BE INSTALLED BY THE CONTRACTOR AT THE ROW FOR EACH LONG AND SHORT SIDE SERVICE. CLEANOUT SHALL INCLUDE A BRASS PLUG.
4. CLEANOUTS SHALL BE EXTENDED 4 FEET ABOVE NATURAL GROUND. CLEANOUT CAP FITTING SHALL BE PLACED ON TOP.



CITY OF BRYAN
SEWER DEEP SERVICE CONNECTION

NEW CONSTRUCTION ONLY

S7-00

REVISIONS:
S6-00 & S6-01 revised 10/26/2012.

BRYAN - COLLEGE STATION STANDARD SEWER DETAILS

CITY OF COLLEGE STATION

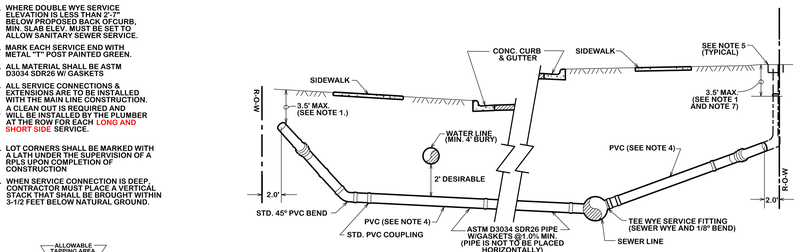
CITY OF BRYAN
The Good Life, Texas Style.

DRAWN BY: C.L.M.
DATE: 08-01-12
SCALE: N T S
APPROVED: W. P. K.

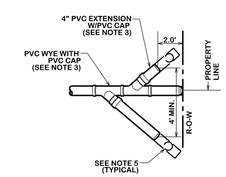
FIGURE:
S2
SHEET 2 OF 2

NOTE:

1. WHERE DOUBLE WYE SERVICE ELEVATION IS LESS THAN 2'-7' BELOW PROPOSED BACK OFCURB, MIN. SLAB ELEV. MUST BE SET TO ALLOW SANITARY SEWER SERVICE.
2. MARK EACH SERVICE END WITH METAL "T" POST PAINTED GREEN.
3. ALL MATERIAL SHALL BE ASTM D3034 SDR26 W/ GASKETS
4. ALL SERVICE CONNECTIONS & EXTENSIONS ARE TO BE INSTALLED WITH THE MAIN LINE CONSTRUCTION.
5. A CLEAN OUT IS REQUIRED AND WILL BE INSTALLED BY THE PLUMBER AT THE ROW FOR EACH LONG AND SHORT SIDE SERVICE.
6. LOT CORNERS SHALL BE MARKED WITH A LATH UNDER THE SUPERVISION OF A RPLS UPON COMPLETION OF CONSTRUCTION
7. WHEN SERVICE CONNECTION IS DEEP, CONTRACTOR MUST PLACE A VERTICAL STACK THAT SHALL BE BROUGHT WITHIN 3-1/2 FEET BELOW NATURAL GROUND.



PROFILE



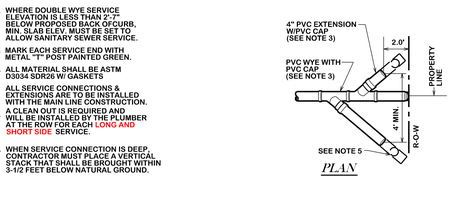
PLAN

CITY OF COLLEGE STATION
SEWER SERVICE LINE CROSSING

S8-00

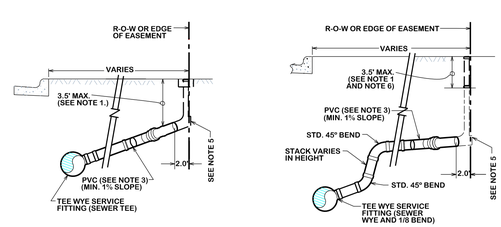
NOTE:

1. WHERE DOUBLE WYE SERVICE ELEVATION IS LESS THAN 2'-7' BELOW PROPOSED BACK OFCURB, MIN. SLAB ELEV. MUST BE SET TO ALLOW SANITARY SEWER SERVICE.
2. MARK EACH SERVICE END WITH METAL "T" POST PAINTED GREEN.
3. ALL MATERIAL SHALL BE ASTM D3034 SDR26 W/ GASKETS
4. ALL SERVICE CONNECTIONS & EXTENSIONS ARE TO BE INSTALLED WITH THE MAIN LINE CONSTRUCTION.
5. A CLEAN OUT IS REQUIRED AND WILL BE INSTALLED BY THE PLUMBER AT THE ROW FOR EACH LONG AND SHORT SIDE SERVICE.
6. WHEN SERVICE CONNECTION IS DEEP, CONTRACTOR MUST PLACE A VERTICAL STACK THAT SHALL BE BROUGHT WITHIN 3-1/2 FEET BELOW NATURAL GROUND.



PLAN

STANDARD CONNECTION PROFILE



DEEP CONNECTION PROFILE

CITY OF COLLEGE STATION
SANITARY SEWER SERVICE CONNECTION

S8-01

REVISIONS:
S8-00 & S8-01 revised 10/26/2012.

BRYAN - COLLEGE STATION STANDARD SEWER DETAILS

CITY OF COLLEGE STATION

CITY OF BRYAN
The Good Life, Texas Style.

DRAWN BY: C.L.M.
DATE: 08-01-12
SCALE: N T S
APPROVED: W. P. K.

FIGURE:
S3

SHEET 2 OF 2