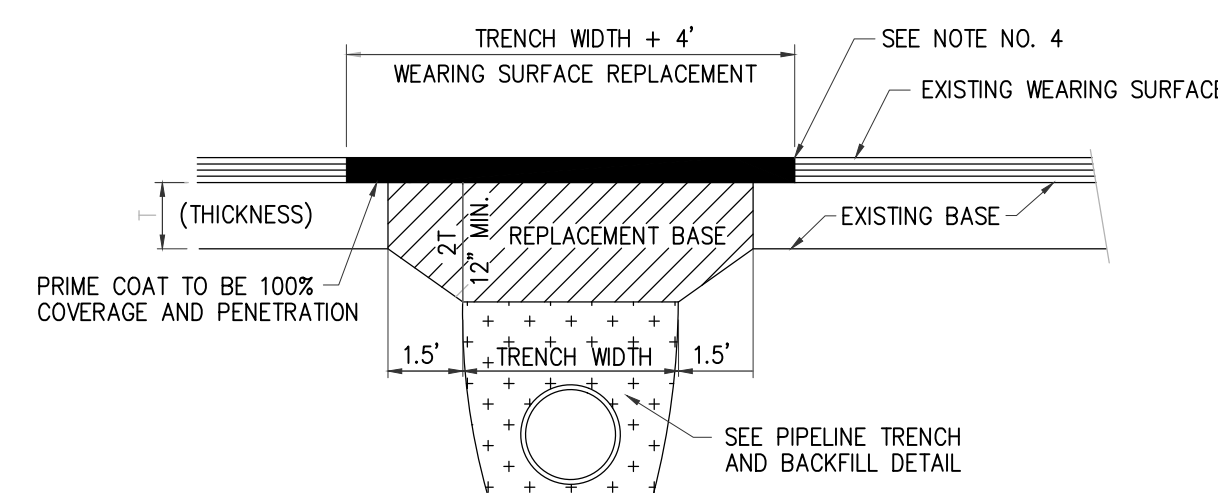


NOMINAL PIPE DIAMETER (INCHES)	PIPE LENGTH (IN FEET) TO BE RESTRAINED IN EACH DIRECTION FROM FITTING													TEE (BRANCH)	DEAD END & VALVE
	HORZ. 90° BEND	HORZ. 60° BEND	HORZ. 45° BEND	HORZ. 30° BEND	HORZ. 22.5° BEND	HORZ. 11.25° BEND	VERT. 90° BEND	VERT. 60° BEND	VERT. 45° BEND	VERT. 30° BEND	VERT. 22.5° BEND	VERT. 11.25° BEND			
4	31	18	13	8	6	3	65	37	27	17	13	6	32	65	
6	43	25	18	12	9	4	92	53	38	25	18	9	58	92	
8	56	32	23	15	11	5	118	68	49	32	23	12	84	118	
10	67	39	28	18	13	7	142	82	59	38	28	14	108	142	
12	78	45	32	21	16	8	167	96	69	45	33	16	132	167	
14	88	51	37	24	18	9	190	109	79	51	38	19	155	190	
16	98	57	41	26	20	10	212	123	88	57	42	21	177	212	
18	108	62	45	29	22	11	234	135	97	63	47	23	199	234	
20	118	68	49	32	23	12	256	148	106	69	51	25	221	256	
24	136	78	56	36	27	13	297	171	123	80	59	29	261	297	
30	160	92	66	43	32	16	354	205	147	95	70	35	318	354	
36	182	105	75	49	36	18	407	235	169	109	81	40	370	407	
42	202	116	84	54	40	20	455	263	188	122	90	45	417	455	
48	220	127	91	59	44	22	500	289	207	134	99	49	462	500	
54	237	137	98	64	47	23	542	313	224	145	108	53	503	542	
60	247	143	102	66	49	24	570	329	236	153	113	56	530	570	
64	256	148	106	69	51	25	594	343	246	159	118	59	554	594	

- NO THRUST BLOCKS ALLOWED!
- CHART EXTRACTED FROM DIPRA MANUAL, "THRUST RESTRAINT DESIGN FOR D.I.P.", 3RD EDITION, USING THE FOLLOWING DESIGN CRITERIA:
 

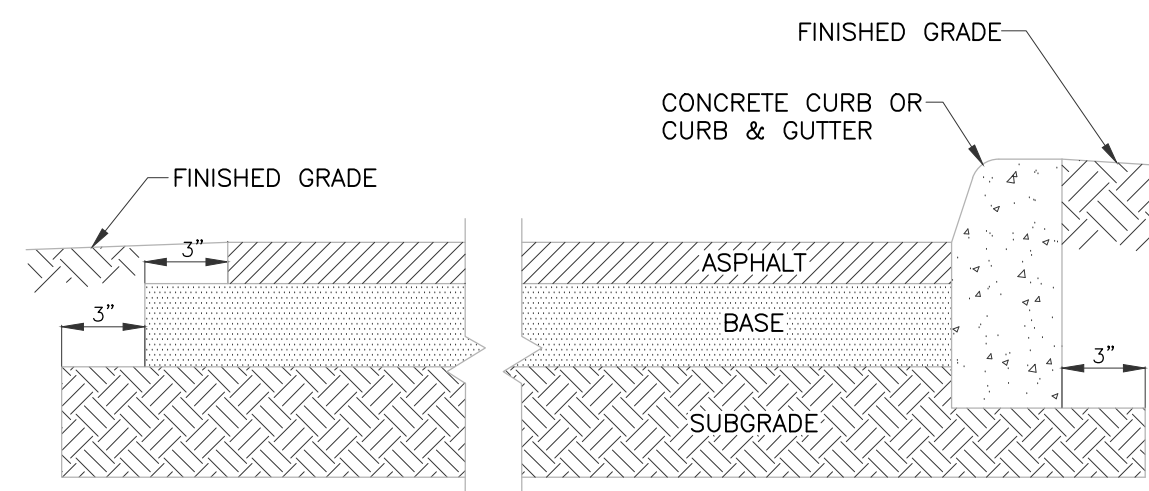
DESIGN PRESSURE = 150 PSI
TRENCH TYPE 2
SOIL TYPE = SAND / SILT
POLYWRAP REQUIRED = NO (MULTIPLY BY 1.50 FOR POLYWRAPPED PIPE)
MINIMUM COVER REQUIRED = 3 FEET
- TEE CALCULATIONS ARE BASED ON FULL OPENING TEE. CALCULATIONS MUST BE ADJUSTED IF RUN DIAMETER EXCEEDS TWICE THE BRANCH DIAMETER.
- MINIMUM NUMBER OF JOINTS TO BE RESTRAINED SHALL BE MINIMUM LENGTH AS LISTED ABOVE PLUS ONE FULL LENGTH.
- VALVES SHALL BE RESTRAINED AT EACH SIDE USING DEAD-END CRITERIA LISTED IN TABLE ABOVE.

DESIGN TABLE FOR THRUST RESTRAINT



- NOTES:
- TRENCH TO BE BACKFILLED WITH CLEAN, GRANULAR MATERIAL, IN SIX (6) INCH LIFTS, (MAX.), COMPACTED TO 98% MAXIMUM DENSITY PER A.A.S.H.T.O. T-180 SPECIFICATIONS.
  - REPLACEMENT BASE MATERIAL SHALL BE TWICE THE THICKNESS OF THE ORIGINAL BASE, OR 12", WHICHEVER IS GREATER.
  - BASE MATERIAL SHALL BE LOCAL LIMEROCK COMPACTED TO A MINIMUM OF 98% DENSITY PER A.A.S.H.T.O. FM-1180 SPECIFICATIONS.
  - ASPHALT CONCRETE PAVEMENT JOINTS SHALL BE MECHANICALLY SAWED IN STRAIGHT LINE PARALLEL TO THE PIPE.
  - WEARING SURFACE MATERIAL FOR ROADWAY SHALL BE TYPE S-1 ASPHALTIC CONCRETE (MINIMUM 1-1/2" THICK). BITUMINOUS PRIME COAT SHALL BE 100% COVERAGE AND PENETRATION.
  - RESTRIPE TO MATCH EXISTING.

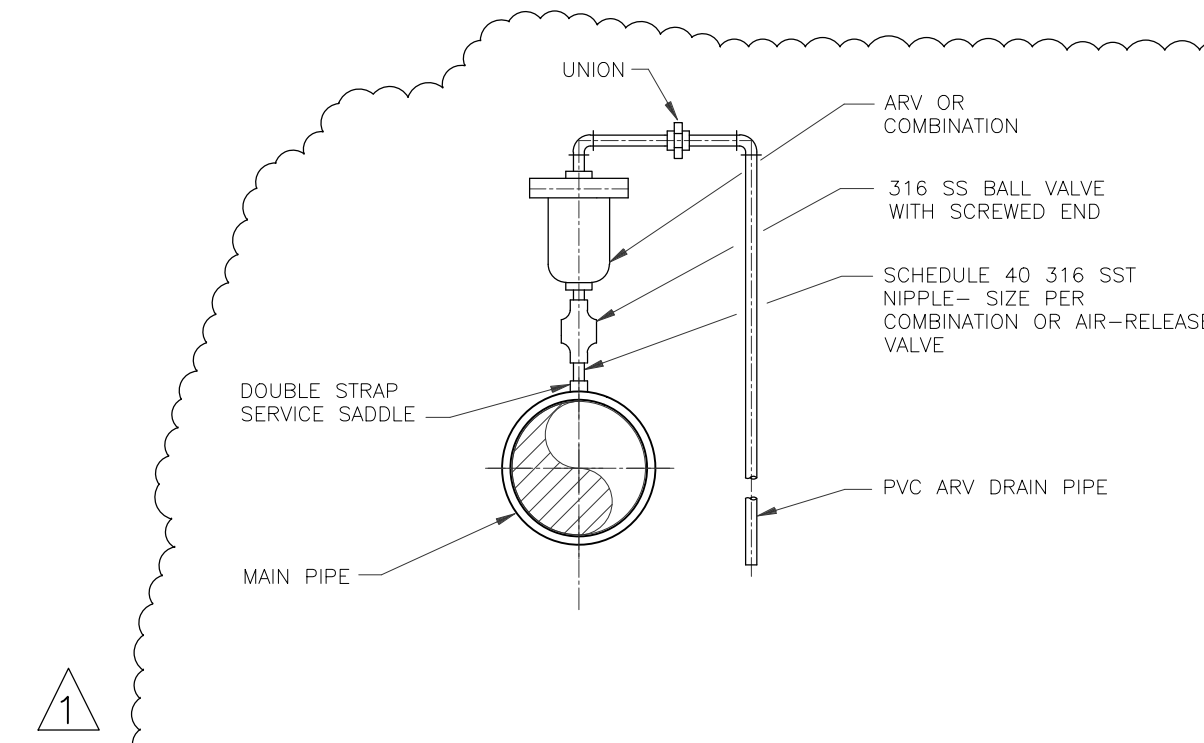
PAVEMENT REPLACEMENT AT PIPE TRENCH DETAIL



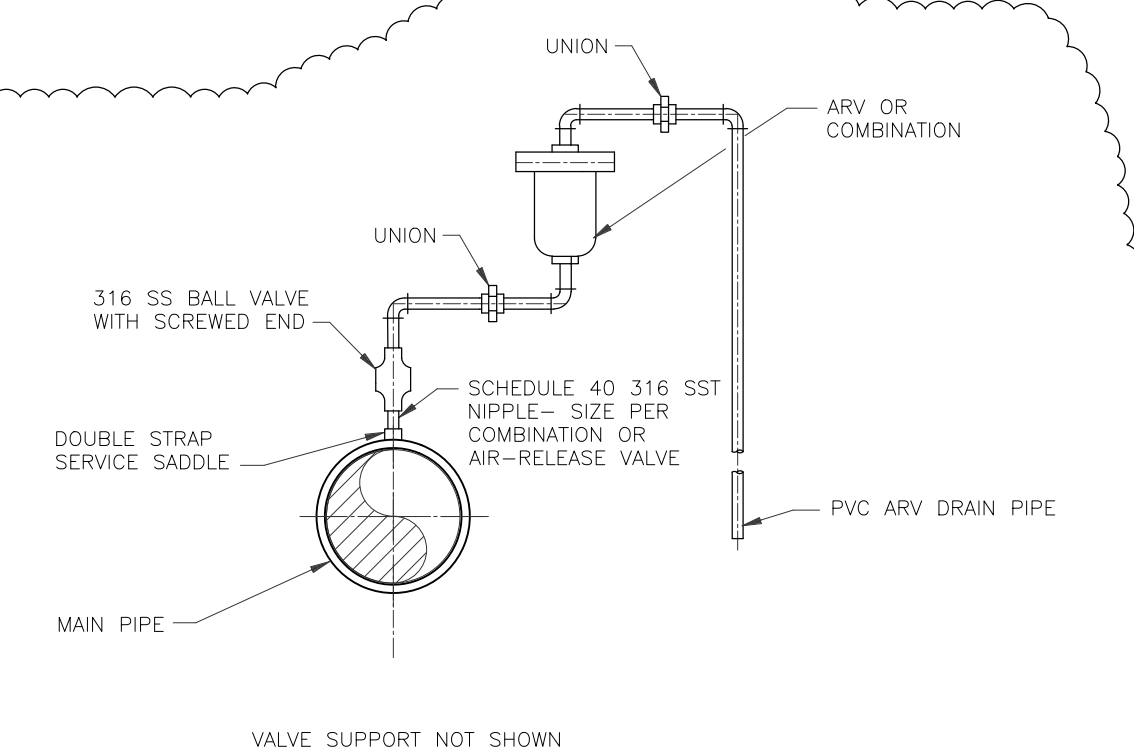
STRUCTURAL COURSE: MINIMUM 1 1/2" TYPE S-1 ASPHALTIC CONCRETE (TACK BETWEEN COURSES)

BASE: 12" LIMEROCK, PRIMED, COMPACTED TO 98% OF AASHTO T-180

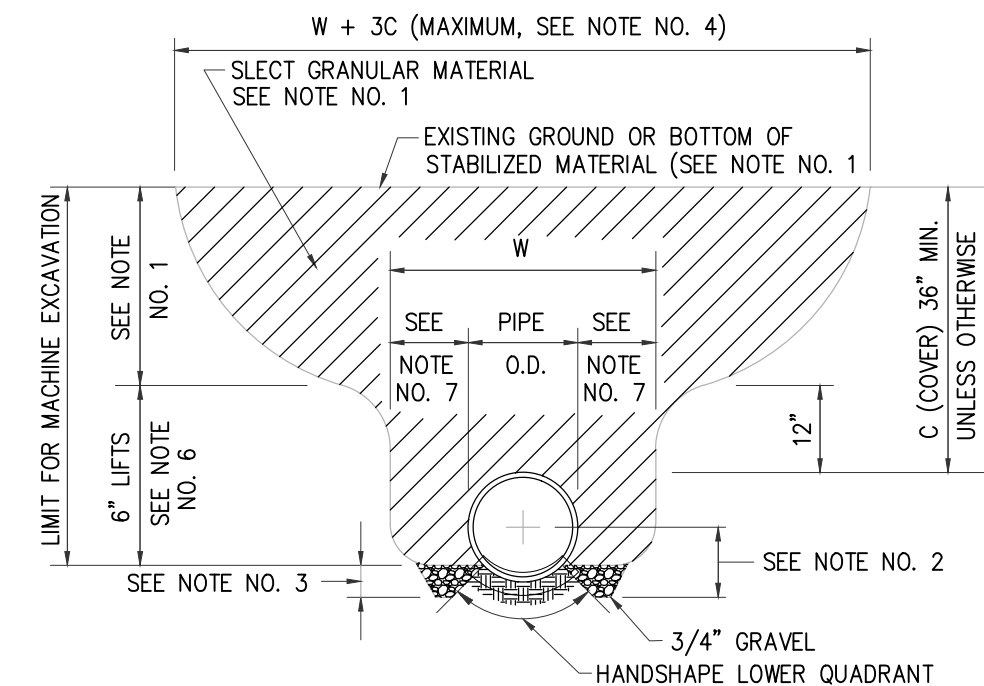
ASPHALT PAVEMENT SECTION OUTSIDE TRENCHED AREAS



AIR RELEASE OR COMBINATION VALVE DETAIL

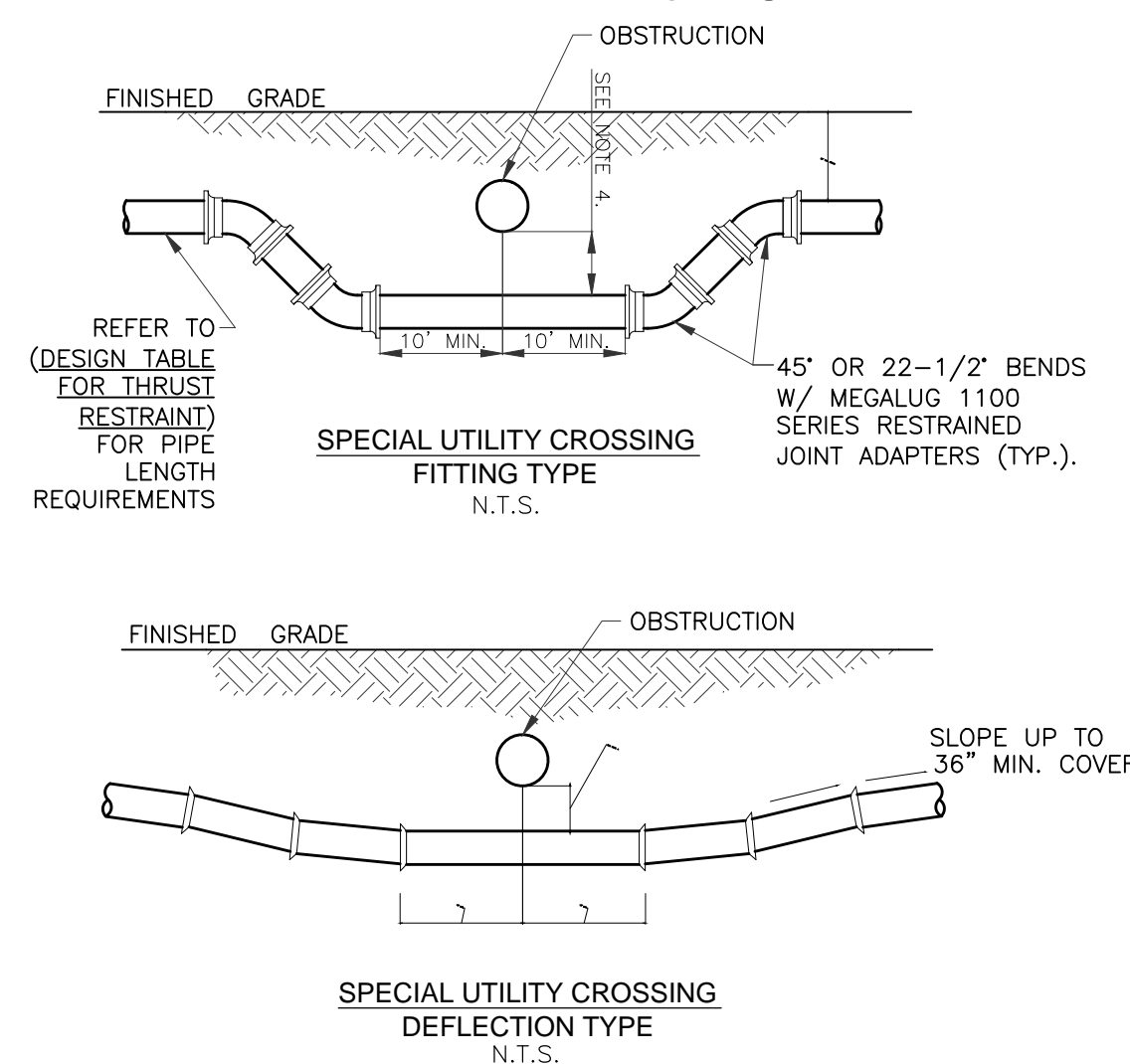


OFFSET AIR RELEASE OR COMBINATION VALVE DETAIL



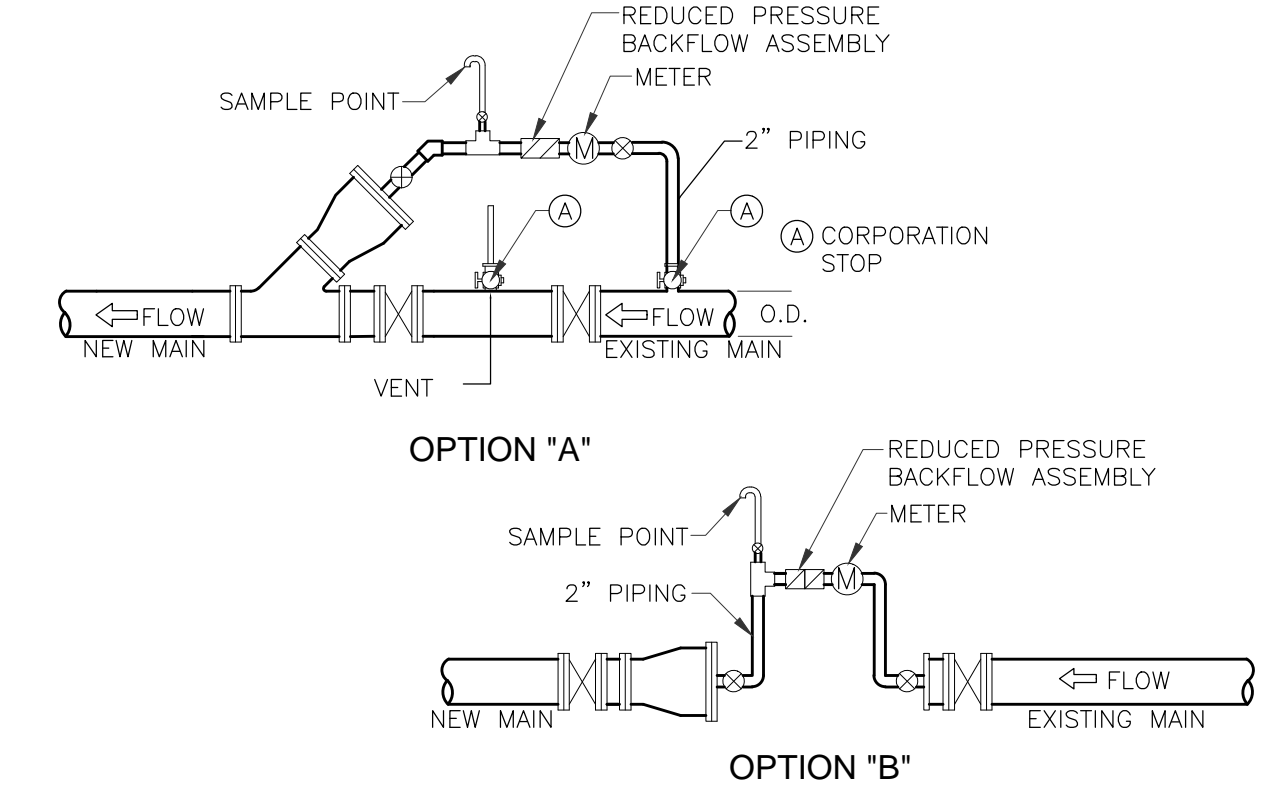
- NOTES:
- IF THE TRENCH IS LOCATED UNDER ASPHALT PAVEMENT, THE TRENCH IS TO BE BACKFILLED WITH CLEAN GRANULAR MATERIAL, IN 6" LIFTS (MAXIMUM), COMPACTED TO 98% MAXIMUM DENSITY PER A.A.S.H.T.O. T-180 SPECIFICATIONS. IF THE TRENCH IS LOCATED OUTSIDE OF PAVEMENT AREAS, THE TRENCH IS TO BE BACKFILLED WITH CLEAN GRANULAR MATERIAL IN 12" LIFTS (MAXIMUM), AND COMPACTED TO 100% MAXIMUM DENSITY PER A.A.S.H.T.O. T-99 SPECIFICATION, METHOD C.
  - FILL MATERIAL TO BE PLACED MANUALLY UP TO THE SPRING LINE OF THE PIPE AND COMPACTED BY HAND PRIOR TO ADDING ADDITIONAL MATERIAL.
  - AS AN ALTERNATE TO HANDSHAPING LOWER QUADRANT, CONTRACTOR MAY OVER EXCAVATE THE TRENCH AND BACKFILL WITH 4" OF 3/4" GRAVEL AS SHOWN.
  - IF "W+3C" EXCEEDS 12 FEET, THE TRENCH SHALL BE SHEETED AND BRACED OR OTHERWISE LIMITED TO NOT GREATER THAN 12 FEET.
  - CONTRACTOR IS RESPONSIBLE FOR MEETING ALL SAFETY STANDARDS FOR TRENCHING WIDTHS CONSIDERING O.S.H.A STANDARDS FOR SOIL TYPES, TRENCH WIDTHS, ANGLE OF REPOSE, ETC. IN ORDER TO PROPERLY PROTECT HIS EMPLOYEES.
  - IF USING P.V.C. PIPE, COMPACT MATERIAL UP TO 12" ABOVE PIPE BY HAND. IF USING D.I. PIPE COMPACT MATERIAL BY HAND UP TO TOP OF PIPE AND COMPACT REMAINING 12" TO 98% MAXIMUM DENSITY PER A.A.S.H.T.O. T-180 SPECIFICATIONS.
  - 12" MIN. OR OUTSIDE PIPE DIAMETER DIVIDED BY 2 WHICHEVER IS GREATER.

TYPICAL PIPELINE TRENCH AND BACKFILL



UTILITY CONFLICT CROSSING

- THE DEFLECTION TYPE CROSSING SHALL BE USED WHEREVER POSSIBLE. ONLY UNDER SPECIFIC ORDERS BY THE ENGINEER SHALL THE FITTING TYPE CROSSING BE ALLOWED.
- CONSTRUCT DEFLECTION CROSSING USING 75% OF MANUFACTURER'S MAXIMUM JOINT DEFLECTION.
- ALL MECHANICAL JOINTS SHALL BE RESTRAINED PER CITY STANDARDS.
- UNLESS SHOWN OTHERWISE, 12" MIN. CLEARANCE WILL BE REQUIRED FOR WATER AND SEWER MAIN CROSSINGS. 6" MIN. CLEARANCE WILL BE REQUIRED FOR OTHER TYPE OF UTILITIES CROSSINGS.
- IF DEFLECTION CANNOT BE OBTAINED THEN USE PIPE CASING AS SHOWN IN "PIPE CASING DETAIL"



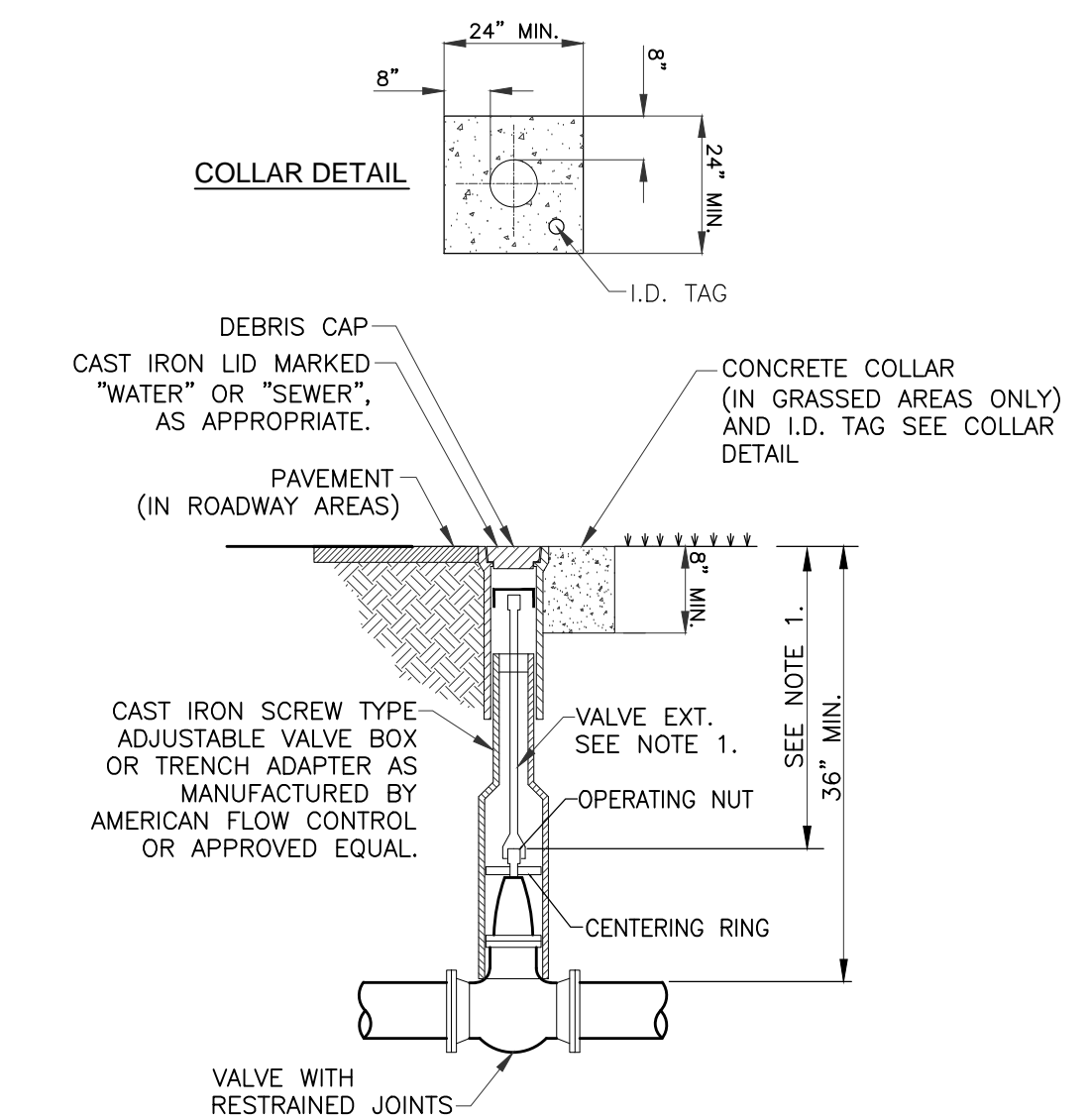
EXCEPT AS INDICATED BELOW FOR SHORT LENGTHS, EACH SECTION OF PIPELINE SHALL BE THOROUGHLY CLEANED WITH ONE POLYURETHANE FOAM PIG EACH TIME.

A CITY PUBLIC UTILITIES CONSTRUCTION COORDINATOR SHALL BE PRESENT AT THE TIME OF INSERTION AND EXIT OF THE PIGS. LINES SHALL BE PIGGED AND/OR FLUSHED UNTIL THE WATER RUNS CLEAR AND IS APPROVED BY THE PUBLIC UTILITIES REPRESENTATIVE. THE CITY REPRESENTATIVE SHALL BE GIVEN 48 HOURS MINIMUM NOTICE PRIOR TO PIGGING OR FLUSHING.

ON SHORT LENGTHS OF PIPELINE (100' MAX.) CLEANING MAY BE ACCOMPLISHED BY FLUSHING WITH WATER AT A MINIMUM VELOCITY OF 2.5 FEET PER SECOND. WATER REQUIRED FOR TESTING AND CLEANING SHALL BE SUPPLIED BY THE CITY AT THE CONTRACTOR'S EXPENSE. WATER SHALL BE FROM A POTABLE SOURCE SATISFACTORY TO THE CITY.

- REDUCER TO BE NEW MAIN SIZE PLUS 2" LARGER.
- WYE TO BE PLUGGED AND RESTRAINED AT THE END OF PIGGING.
- AT THE END OF THE PROJECT, ALL CORPORATIONS TO BE REMOVED AND CORPORATION PLUGS TO BE INSTALLED.
- SAMPLE POINT TO BE LOCATED AFTER BACKFLOW PREVENTER.
- ALL MATERIALS, PIPE AND FITTINGS TO BE TO W.P.B. SERVICE STANDARDS.
- INSTALL REDUCER WITH PIG INSIDE. ONLY ONE PIG WILL BE ALLOWED TO BE RUN THROUGH THE MAIN AT A TIME. PIPE EXTENSION CAP MAY BE REQUIRED.
- PIG AND FLUSH 12" LINES SEPARATELY FROM LARGER DIAMETER PIPES (ie 18", 24" AND 36").

PIGGING PROCEDURE



- WHEN TOP OF OPERATING NUT IS DEEPER THAN 36", A HIGH STRENGTH STEEL EXTENSION NUT SHALL BE REQUIRED TO BRING OPERATING NUT TO NOT MORE THAN 24" BELOW FINISHED GRADE. EXTENSION BOLTS & NUTS SHALL BE 316 STAINLESS STEEL. A STEEL CENTERING PLATE WELDED TO THE EXTENSION IS ALSO REQUIRED.
- VALVE BOXES IN PAVEMENT SHALL HAVE LOCKING COVERS & LIDS MARKED "WATER" OR "SEWER", AS APPROPRIATE.
- ALL VALVE BOXES SHALL BE PROVIDED WITH A DEBRIS CAP.
- A PLUMB DUCTILE IRON PIPE OR C-900 PVC RISER SHALL BE USED IF DEPTH SO REQUIRES, WITH APPROVAL.

VALVE BOX SETTING DETAIL

DATE	BY	REVISIONS
12/6/2011	DX	ADDENDUM 1

Date: 8/19/2011  
Scale: N/A  
Design By: DX  
Drawn By: PRC  
Check By: XX

EAST CENTRAL REGIONAL WATER RECLAMATION FACILITY (ECRWF) OPERATIONS BOARD  
FLOW EQUALIZATION BASIN  
RETURN FLOW PIPING SYSTEM IMPROVEMENTS

NOTES AND DETAILS  
SHEET 2

HOLTZ CONSULTING ENGINEERS, INC.  
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JUPITER, FLORIDA 33477  
PH. (561) 575-2005  
Cert. No. 26960

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License No. 55308

SHEET 10