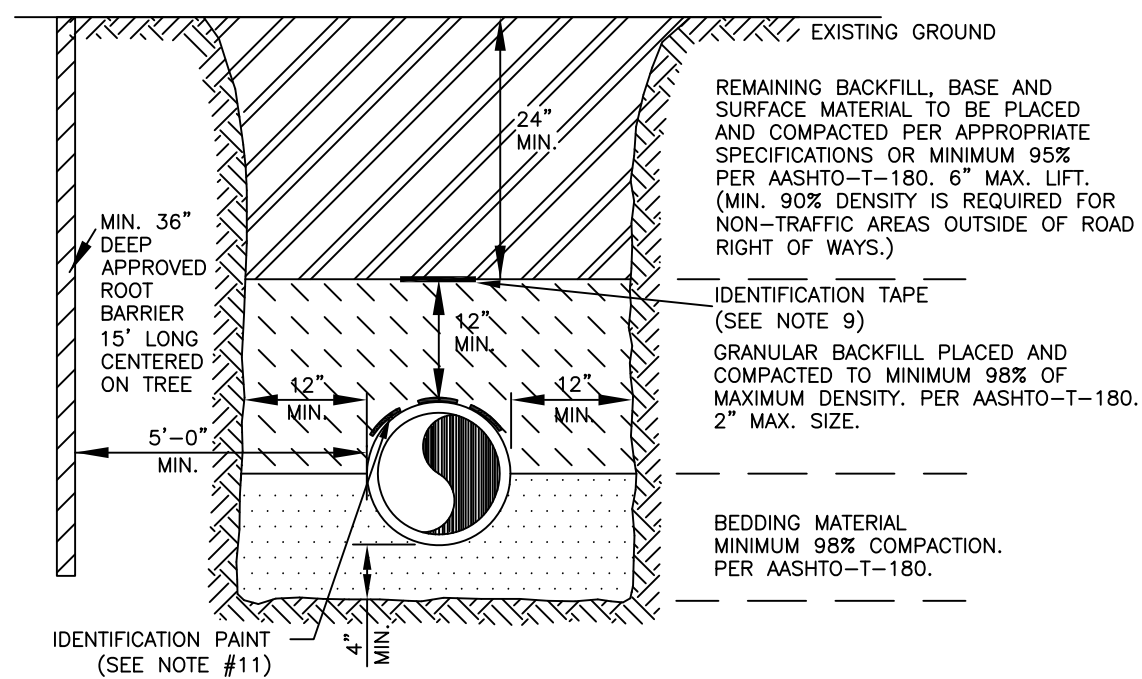


PIPE	THRUST BLOCK AREA REQ'D	REMARKS	NOTE: FOR OTHER FITTINGS USE THE FOLLOWING FACTORS.
4"	2.0 SQ. FT.	VALUES ARE FOR 90° BEND, BASED ON 2000 P.S.I. SAFE BEARING LOAD AND PIPE PRESSURE OF 150 P.S.I.	TEE 100%
6"	4.0 SQ. FT.	FOR OTHER SOILS & PRESSURES THE AREA REQUIRED IS IN DIRECT PROPORTION	45° BEND 71%
8"	6.6 SQ. FT.		22 1/2° BEND 39%
10"	10.0 SQ. FT.		11 1/4° BEND 20%
12"	14.0 SQ. FT.		DEAD END 100%
14"	18.6 SQ. FT.		

- NOTES:
- CONCRETE THRUST BLOCKS OR THRUST COLLARS MAY BE UTILIZED ONLY IF NECESSARY FOR CONNECTIONS TO AN EXISTING PIPING SYSTEM, OTHERWISE MECHANICAL RESTRAINTS SHALL BE USED. KEEP "T" BOLTS CLEAR OF CONCRETE, WRAPPED IN VISQUEEN FOR FUTURE ACCESS, WITH A MINIMUM OF 1" THICKNESS BETWEEN THE FITTING AND SOIL.
 - BETWEEN POURING CONCRETE, PLUGS SHALL BE WRAPPED WITH VISQUEEN AND A BOARD PLACED IN FRONT.
 - CONCRETE SHALL BE 2500 P.S.I. MINIMUM.
 - THE ENGINEER OF RECORD SHALL SUBMIT A THRUST BLOCK SIZE CALCULATION FOR TEE CONNECTIONS INTO UNRESTRAINED EXISTING MAINS LARGER THAN 14".
 - THE ENGINEER OF RECORD SHALL SUBMIT A PIPE RESTRAINT DESIGN FOR INLINE EXTENSIONS OF A EXISTING UNRESTRAINED MAIN IF MECHANICAL JOINT RESTRAINT CAN NOT BE INSTALLED ON THE EXISTING MAIN.

20W

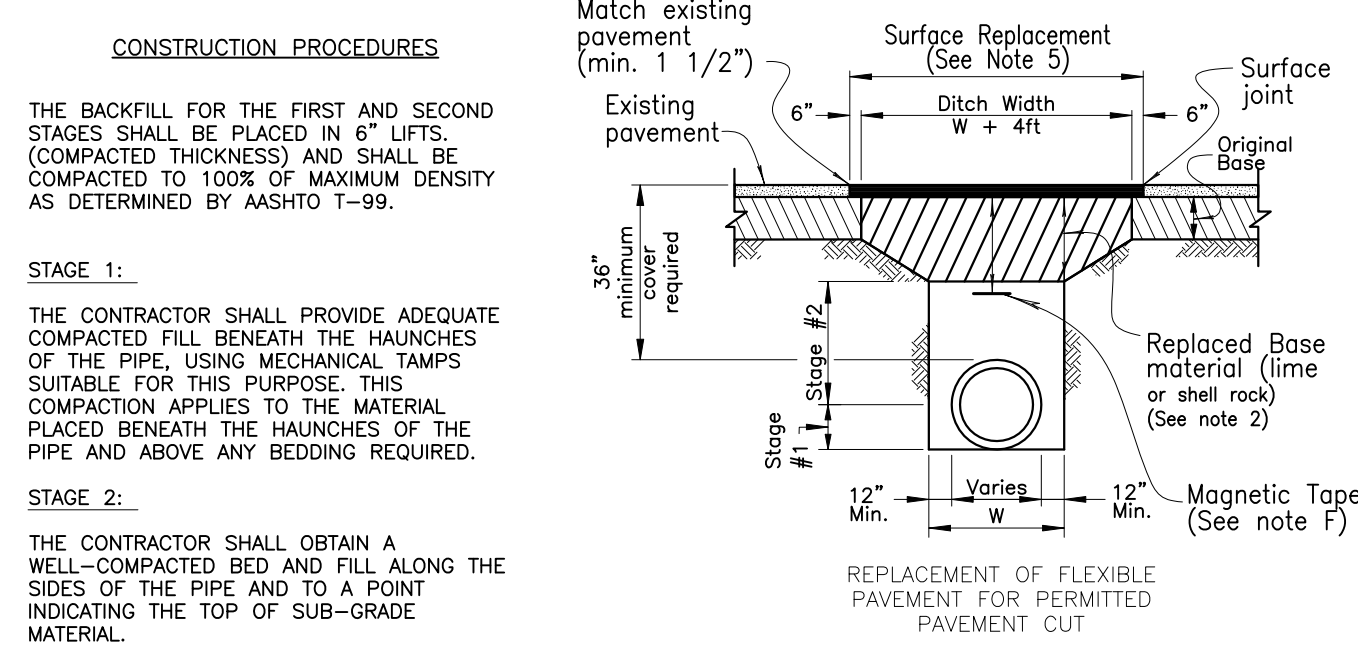
TYPICAL THRUST BLOCKS FOR PRESSURE PIPE



- NOTES:
- BEDDING SHALL CONSIST OF IN-SITU GRANULAR MATERIAL OR WASHED AND GRADED LIMEROCK 3/8" - 7/8" SIZING. UNSUITABLE IN-SITU MATERIALS SUCH AS MUCK, DEBRIS AND LARGER ROCKS SHALL BE REMOVED.
 - THE PIPE SHALL BE FULLY SUPPORTED FOR ITS ENTIRE LENGTH WITH APPROPRIATE COMPACTION UNDER THE PIPE HAUNCHES.
 - THE PIPE SHALL BE PLACED IN A DRY TRENCH.
 - BACKFILL SHALL BE FREE OF UNSUITABLE MATERIAL SUCH AS LARGE ROCK, MUCK AND DEBRIS.
 - DENSITY TESTS ARE REQUIRED IN 1 FT. LIFTS ABOVE THE PIPE AT INTERVALS OF 400' MAXIMUM. MINIMUM 1 SET OF TESTS FOR EACH WASTEWATER GRAVITY MAIN RUN, OR AS DIRECTED BY THE INSPECTOR.
 - THE DEVELOPER/CONTRACTOR SHALL BE RESPONSIBLE TO COMPLY WITH ALL TRENCH SAFETY LAWS AND REGULATIONS.
 - SEE SEPARATE DETAILS FOR "PIPE INSTALLATION UNDER EXISTING PAVEMENT - OPEN CUT."
 - THE AFFECTED AREA SHALL BE RESTORED TO EQUAL OR BETTER CONDITION OR AS SPECIFIED IN PERMIT/CONTRACT DOCUMENTS.
 - APPROVED MAGNETIC TAPE IS REQUIRED FOR: ALL POTABLE WATER MAINS, FORCE MAINS AND RECLAIMED WATER MAINS. THE TAPE SHALL BE INSTALLED MAX. 24" BELOW FINISHED GRADE.
 - ROOT BARRIER IS REQUIRED FOR APPROVED TREE INSTALLATION CLOSER THAN 10 FEET FROM UTILITY FACILITIES.
 - CONTINUOUS 4" WIDE PAINT STRIPING IS REQUIRED FOR DIP/PCCP WATER MAINS (BLUE), DIP SEWER MAINS (GREEN), AND DIP RECLAIMED WATER MAINS (PURPLE).
 - PERMANENT ABOVE GROUND UTILITY MARKER SHALL BE INSTALLED IF REQUIRED BY PROPERTY OWNER GRANTING THE PIPE INSTALLATION PERMIT.
 - FOR PIPE INSTALLATIONS IN ROAD RIGHTS-OF-WAY, ROAD OWNER'S PERMIT SPECIFICATIONS SHALL APPLY.

23W

TYPICAL TRENCH DETAIL/
ROOT BARRIER INSTALLATION DETAIL



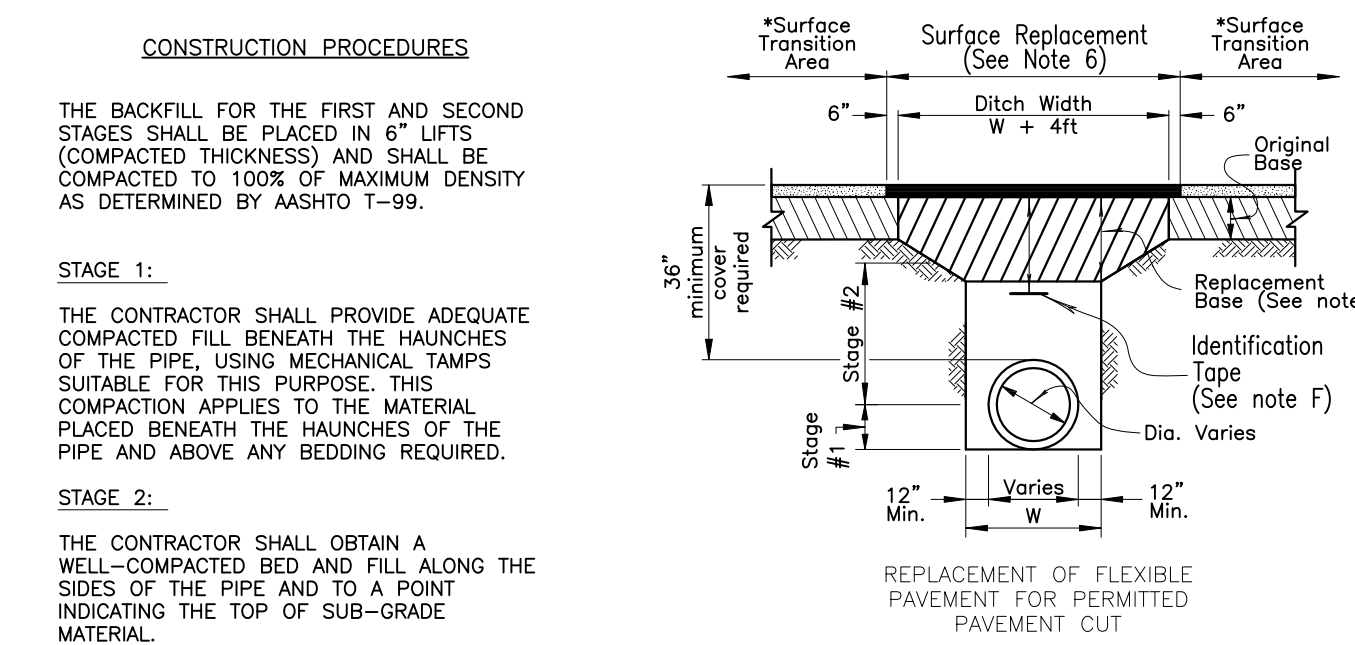
- CONSTRUCTION PROCEDURES
- THE BACKFILL FOR THE FIRST AND SECOND STAGES SHALL BE PLACED IN 6" LIFTS (COMPACTED THICKNESS) AND SHALL BE COMPACTED TO 100% OF MAXIMUM DENSITY AS DETERMINED BY AASHTO T-99.
 - THE CONTRACTOR SHALL PROVIDE ADEQUATE COMPACTED FILL BENEATH THE HAUNCHES OF THE PIPE, USING MECHANICAL TAMPS SUITABLE FOR THIS PURPOSE. THIS COMPACTION APPLIES TO THE MATERIAL PLACED BENEATH THE HAUNCHES OF THE PIPE AND ABOVE ANY BEDDING REQUIRED.
 - THE CONTRACTOR SHALL OBTAIN A WELL-COMPACTED BED AND FILL ALONG THE SIDES OF THE PIPE AND TO A POINT INDICATING THE TOP OF SUB-GRADE MATERIAL.
- CONSTRUCTION NOTES
- BEDDING SHALL CONSIST OF IN-SITU GRANULAR MATERIAL OR WASHED AND GRADED LIMEROCK 3/8" - 7/8" SIZING WITH EQUAL OR GREATER STRUCTURAL ADEQUACY AS EXISTING. UNSUITABLE IN-SITU MATERIALS SUCH AS MUCK, DEBRIS AND LARGER ROCKS SHALL BE REMOVED.
 - REPLACED BASE MATERIAL (PER LAND DEVELOPMENT DESIGN STANDARDS) OVER DITCH SHALL BE TWICE THE THICKNESS OF THE ORIGINAL BASE OR 12" MINIMUM, WHICHEVER IS GREATER.
 - ASPHALT CONCRETE PAVEMENT JOINTS SHALL BE MECHANICALLY SAWED AND BUTT-JOINTED.
 - BASE MATERIAL SHALL BE PLACED IN TWO OR THREE LAYERS (6" MAX. PER LAYER) AND EACH LAYER THOROUGHLY ROLLED OR TAMPED TO THE SPECIFIED DENSITY.
 - SURFACE MATERIAL WILL BE CONSISTENT WITH THE EXISTING SURFACE OR 1 1/2" SI ASPHALTIC CONCRETE WITH RC-70 PRIME COAT AT 0.10 GAL/SQ. YD.
 - PIPE SHALL BE PLACED IN A DRY TRENCH.

GENERAL NOTES

- ALL ROADWAY REPAIR WORK SHALL BE PERFORMED IN CONFORMANCE WITH APPLICABLE FOOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION AND COUNTY PPM# EL-0-3606.
- DENSITY TESTS SHALL BE TAKEN IN 1 FT LIFTS ABOVE THE PIPE AT INTERVALS OF 400 FT MAXIMUM (1 SET MINIMUM) OR AS DIRECTED BY THE CONSTRUCTION COORDINATION DIVISION. RESULTS SHALL BE SUBMITTED TO CONSTRUCTION COORDINATION DIVISION AS PART OF THEIR FIELD REVIEW.
- ENGINEER-OF-RECORD SHALL PROVIDE FULL-TIME INSPECTION DURING THE ENTIRETY OF THE OPEN-CUT OPERATION, BEGINNING WITH THE EXCAVATION AND CONTINUING THROUGH THE COMPLETION OF THE PAVING.
- IF THE PAVEMENT IS NOT COMPLETELY RESTORED IMMEDIATELY FOLLOWING THE OPEN CUT, A SMOOTH TEMPORARY PATCH (MINIMUM 1.25" ASPHALT) SHALL BE INSTALLED, PROPERLY MATCHING THE EXISTING GRADING OF THE ROADWAY. THE TEMPORARY PATCH SHALL BE ALLOWED TO REMAIN IN PLACE AND BE MAINTAINED FOR A PERIOD NO LONGER THAN 45 DAYS. THE COUNTY RETAINS THE RIGHT TO USE POSTED SURETY TO COMPLETE ANY RESTORATION WORK THAT HAS NOT BEEN COMPLETED IN THE 45 DAYS PERIOD. ALTERNATIVE TRENCH PROTECTION (STEEL PLATES OR OTHERS) MAY BE APPROVED BY THE CONSTRUCTION COORDINATION DIVISION.
- FOR THE FINAL RESTORATION, THE ROAD SHALL BE MILLED AND RESURFACED WITH 1-1/2" (ONE AND A HALF INCH) OF SII OR SI ASPHALT SURFACE COURSE FOR A FULL LANE WIDTH ENCRoACHED BY THE TRENCH.
- APPROVED MAGNETIC TAPE IS REQUIRED FOR ALL MAIN PRESSURE PIPES AND CONDUIT IN THE COUNTY'S RIGHT-OF-WAY. INSTALL TAPE 24" BELOW FINISHED GRADE.
- CONTINUOUS 4" WIDE PAINT STRIPING IS REQUIRED FOR DIP/PCCP WATER MAINS (BLUE), DIP SANITARY MAINS (GREEN), DIP RECLAIMED WATER MAINS (PURPLE), GAS MAINS (YELLOW), OR AS REQUIRED BY THE APWA.

24W

OPEN CUT PIPE INSTALLATION
NON-THOROUGHFARE ROAD



- CONSTRUCTION PROCEDURES
- THE BACKFILL FOR THE FIRST AND SECOND STAGES SHALL BE PLACED IN 6" LIFTS (COMPACTED THICKNESS) AND SHALL BE COMPACTED TO 100% OF MAXIMUM DENSITY AS DETERMINED BY AASHTO T-99.
 - THE CONTRACTOR SHALL PROVIDE ADEQUATE COMPACTED FILL BENEATH THE HAUNCHES OF THE PIPE, USING MECHANICAL TAMPS SUITABLE FOR THIS PURPOSE. THIS COMPACTION APPLIES TO THE MATERIAL PLACED BENEATH THE HAUNCHES OF THE PIPE AND ABOVE ANY BEDDING REQUIRED.
 - THE CONTRACTOR SHALL OBTAIN A WELL-COMPACTED BED AND FILL ALONG THE SIDES OF THE PIPE AND TO A POINT INDICATING THE TOP OF SUB-GRADE MATERIAL.
- CONSTRUCTION NOTES
- BEDDING SHALL CONSIST OF IN-SITU GRANULAR MATERIAL OR WASHED AND GRADED LIMEROCK 3/8" - 7/8" SIZING WITH EQUAL OR GREATER STRUCTURAL ADEQUACY AS EXISTING. UNSUITABLE IN-SITU MATERIALS SUCH AS MUCK, DEBRIS AND LARGER ROCKS SHALL BE REMOVED.
 - REPLACED BASE MATERIAL OVER DITCH SHALL BE 16" MINIMUM FOR THOROUGHFARE PLAN ROADS.
 - ASPHALT CONCRETE PAVEMENT JOINTS SHALL BE MECHANICALLY SAWED AND BUTT-JOINTED.
 - BASE MATERIAL (PER ROADWAY PRODUCTION DESIGN STANDARDS) SHALL BE PLACED IN TWO OR THREE LAYERS (6" MAX. PER LAYER) AND EACH LAYER THOROUGHLY ROLLED OR TAMPED TO THE SPECIFIED DENSITY.
 - * SURFACE TRANSITION AREA (SEE PLANS FOR LOCATION). OVERLAY OR MILL/RESURFACE FOR A DISTANCE OF 50' ON BOTH SIDES OF THE OPEN CUT AND TO A FULL LANE WIDTH.
 - 1" SII ASPHALTIC CONCRETE OVER 1 1/2" SI ASPHALTIC CONCRETE WITH RC-70 PRIME COAT AT 0.10 GAL/SQ. YD.
 - PIPE SHALL BE PLACED IN A DRY TRENCH.

GENERAL NOTES

- ALL ROADWAY REPAIR WORK SHALL BE PERFORMED IN CONFORMANCE WITH APPLICABLE FOOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION AND COUNTY PPM# EL-0-3606.
- DENSITY TESTS SHALL BE TAKEN IN 1 FT LIFTS ABOVE THE PIPE AT INTERVALS OF 400 FT MAXIMUM (1 SET MINIMUM) OR AS DIRECTED BY THE CONSTRUCTION COORDINATION DIVISION. RESULTS SHALL BE SUBMITTED TO CONSTRUCTION COORDINATION DIVISION AS PART OF THEIR FIELD REVIEW.
- ENGINEER-OF-RECORD WILL PROVIDE FULL-TIME INSPECTION DURING THE ENTIRETY OF THE OPEN-CUT OPERATION, BEGINNING WITH THE EXCAVATION AND CONTINUING THROUGH THE COMPLETION OF THE PAVING.
- IF THE PAVEMENT IS NOT COMPLETELY RESTORED IMMEDIATELY FOLLOWING THE OPEN CUT, A SMOOTH TEMPORARY PATCH (MINIMUM 1.25" ASPHALT) SHALL BE INSTALLED, PROPERLY MATCHING THE EXISTING GRADING OF THE ROADWAY. THE TEMPORARY PATCH SHALL BE ALLOWED TO REMAIN IN PLACE AND BE MAINTAINED FOR A PERIOD NO LONGER THAN 45 DAYS. THE COUNTY RETAINS THE RIGHT TO USE POSTED SURETY TO COMPLETE ANY RESTORATION WORK THAT HAS NOT BEEN COMPLETED IN THE 45 DAYS PERIOD. ALTERNATIVE TRENCH PROTECTION (STEEL PLATES OR OTHERS) MAY BE APPROVED BY THE CONSTRUCTION COORDINATION DIVISION.
- THE FINAL RESTORATION, THE ROAD SHALL BE MILLED/RESURFACED FOR A FULL LANE WIDTH OF THE TRAVEL LANES ENCRoACHED BY THE TRENCH AREA, INCLUDING A TRANSITION AREA OF 50 FT ON EACH SIDE OF THE TRENCH. THE PAVEMENT SHALL BE MILLED AND RESURFACED PER CONSTRUCTION NOTE 6.
- APPROVED MAGNETIC TAPE IS REQUIRED FOR ALL MAIN PRESSURE PIPES AND CONDUIT IN THE COUNTY'S RIGHT-OF-WAY. INSTALL TAPE 24" BELOW FINISHED GRADE.
- CONTINUOUS 4" WIDE PAINT STRIPING IS REQUIRED FOR DIP/PCCP WATER MAINS (BLUE), DIP SANITARY MAINS (GREEN), DIP RECLAIMED WATER MAINS (PURPLE), GAS MAINS (YELLOW), OR AS REQUIRED BY THE APWA.

25W

OPEN CUT PIPE INSTALLATION
THOROUGHFARE ROAD

MAXIMUM QUANTITY OF WATER (GALLONS PER HOUR) THAT MAY BE SUPPLIED TO MAINTAIN PRESSURE WITHIN 5 P.S.I. OF THE SPECIFIED TEST PRESSURE (MECHANICAL OR PUSH-ON JOINT, 18 FT. NOMINAL LENGTHS, PER 1000 FT. OF PIPE)

AVG. TEST PRESSURE-PSI	PIPE DIAMETER (INCHES)															
	2	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48
150	0.10	0.14	0.18	0.27	0.37	0.46	0.55	0.64	0.73	0.83	0.92	1.10	1.38	1.65	1.93	2.20
200	0.10	0.15	0.21	0.31	0.42	0.53	0.63	0.74	0.84	0.95	1.06	1.27	1.59	1.91	2.22	2.54

FORMULA BASIS: $L = \frac{(S \times (D) \times (P)^{1/2}}{148,000} \times 1/2$

L = MAXIMUM QUANTITY OF WATER TO BE ADDED (GALLONS PER HOUR)
S = LENGTH OF PIPE TESTED (FEET)
D = DIAMETER OF PIPE (INCHES)
P = TEST PRESSURE (P.S.I.)

- NOTES:
- TO OBTAIN THE MAXIMUM QUANTITY OF WATER FOR PIPE WITH 20 FT. NOMINAL LENGTHS, MULTIPLY THE QUANTITY CALCULATED FROM THE TABLE BY 0.9
 - THE MAXIMUM QUANTITY OF ADDED WATER FOR A PIPELINE IS CALCULATED BY MULTIPLYING THE QUANTITY PER HOUR AS OBTAINED FROM THE ABOVE TABLE, BY THE DURATION OF THE TEST IN HOURS, AND BY THE TOTAL LENGTH OF THE LINE BEING TESTED DIVIDED BY 1,000. IF THE LINE UNDER TEST CONTAINS SECTIONS OF VARIOUS DIAMETERS, THE MAXIMUM QUANTITY ADDED WILL BE THE SUM OF THE COMPUTED QUANTITIES FOR EACH SIZE.
 - MAXIMUM TEST LENGTH = 2,500 FEET PER SECTION.
 - THIS STANDARD SHALL REFLECT ANY REVISION OF A.W.W.A. C-600, HOWEVER, THE MAXIMUM QUANTITY OF WATER ADDED SHALL NOT EXCEED 50% OF THE RECOMMENDED LIMIT PER APPLICABLE A.W.W.A. C-600 STANDARD.
 - STANDARD TEST PRESSURE = 150 P.S.I.; 200 P.S.I. FOR MAINS LARGER THAN 24"
 - PRESSURE TEST DURATION TO BE MIN. 2 HOURS.

31W

POTABLE WATER MAIN PRESSURE TEST CRITERIA

DEFINITIONS

- DEPARTMENT - THE PALM BEACH COUNTY WATER UTILITIES DEPARTMENT.
- CONTRACTOR - UTILITY CONTRACTOR AND ALL UTILITY SUBCONTRACTORS.
- ENGINEER - ENGINEER RESPONSIBLE FOR INSPECTION AND CERTIFICATION.

PROCEDURE

- A PRE-CONSTRUCTION MEETING IS TO BE HELD PRIOR TO DELIVERY OF MATERIALS AND INITIATION OF ANY POTABLE WATER, RECLAIMED WATER AND/OR WASTEWATER SYSTEM CONSTRUCTION. THE MEETING SHALL BE ATTENDED BY THE DEPARTMENT, CONTRACTOR, ENGINEER AND OTHER INTERESTED PARTIES.
- ANY REVISIONS TO THE APPROVED PLANS SHALL BE CALLED TO THE ATTENTION OF THE DEPARTMENT PRIOR TO THE PRE-CONSTRUCTION MEETING. REVISED PLANS MUST BE APPROVED PRIOR TO THE MEETING.
- FIVE (5) COPIES OF THE CURRENT APPROVED MATERIAL LIST AND ALL NECESSARY SHOP DRAWINGS SHALL BE SUBMITTED FOR APPROVAL PRIOR TO SCHEDULING OF THE PRE-CONSTRUCTION MEETING.
- ALL APPLICABLE PERMITS MUST BE OBTAINED PRIOR TO PRECONSTRUCTION MEETING. (DOT, HEALTH DEPARTMENT, COUNTY ENGINEER, ETC.).
- THE CONTRACTOR SHALL MAINTAIN A CURRENT APPROVED SET OF CONSTRUCTION PLANS ON JOB SITE.
- ALL MATERIALS SUPPLIED SHALL CONFORM TO PRODUCT LIST AND SHOP DRAWINGS AS APPROVED PRIOR TO CONSTRUCTION. SUBSTITUTE MATERIALS SHALL NOT BE APPROVED AFTER DELIVERY TO THE JOB SITE. ALL REQUESTS FOR MATERIAL SUBSTITUTION SHALL BE APPROVED PRIOR TO DELIVERY OF THESE MATERIALS TO THE JOB SITE.
- THE LOCATIONS OF EXISTING UTILITIES SHOWN ON THE APPROVED PLANS ARE TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR. APPROVAL OF DEVELOPMENT PLANS BY THE DEPARTMENT IN NO WAY IMPLIES VERIFICATION OF THE ACCURACY OF THOSE PLANS OR FEATURES DEPICTED THEREON. ANY DISCREPANCY IN OR VARIATION FROM THE APPROVED PLANS IS TO BE BROUGHT TO THE ATTENTION OF THE DEPARTMENT BY THE ENGINEER AND CONTRACTOR. THE CONTRACTOR SHALL CONFIRM AND INSTALL (IF NECESSARY) ADEQUATE MECHANICAL PIPE / JOINT RESTRAINT ON EXISTING PIPES PRIOR TO CONNECTION.
- THE CONTRACTOR SHALL BE RESPONSIBLE AT ALL TIMES THROUGHOUT THE DURATION OF CONSTRUCTION FOR THE PROTECTION OF EXISTING AND NEWLY INSTALLED UTILITIES FROM DAMAGE OR DISRUPTION OF SERVICE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR TAKING SUCH MEASURES AS NECESSARY TO PROTECT THE HEALTH, SAFETY AND WELFARE OF THOSE PERSONS HAVING ACCESS TO THE WORK SITE.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING LOCATIONS FROM ALL OTHER UTILITY FACILITIES.
- THE CONTRACTOR OR ENGINEER SHALL SCHEDULE INSPECTIONS AND TESTS A MINIMUM OF 24-48 HOURS IN ADVANCE.
- NO CONNECTION TO OR ANY OTHER CONSTRUCTION SHALL BE PERFORMED ON AN EXISTING DEPARTMENT OWNED OR MAINTAINED MAIN OR STRUCTURE WITHOUT THE PRESENCE OF A DEPARTMENT INSPECTOR.
- FACILITIES PROPOSED HEREIN SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE APPROVED PLANS AND THE DEPARTMENT'S MINIMUM STANDARDS. CONFLICTS BETWEEN THE PRECEDING DOCUMENTS SHOULD BE CALLED TO THE ATTENTION OF THE DEPARTMENT FOR RESOLUTION. DEVIATIONS FROM THE APPROVED PLANS MUST BE APPROVED IN ADVANCE BY THE DEPARTMENT.
- UPON COMPLETION OF CONSTRUCTION, A FINAL INSPECTION SHALL VERIFY PROPER ADHERENCE TO ALL FACETS OF THE PLANS AND SPECIFICATIONS.

PRESSURE PIPE NOTES

- THERE SHALL BE 36" MINIMUM COVER FROM FINISHED GRADE TO TOP OF PIPE.
- DUCTILE IRON PIPE (DIP) THICKNESS SHALL CONFORM TO THE DEPARTMENT'S APPROVED MATERIAL LIST. POTABLE WATER AND RECLAIMED WATER MAINS DIP SHALL BE CEMENT LINED. FORCE MAIN DIP SHALL BE CERAMIC EPOXY LINED.
- PVC PRESSURE PIPE SHALL BE C-900, SDR-18, 150 PSI.
- ALL FITTINGS SHALL BE DUCTILE IRON WITH MECHANICAL JOINTS AND CEMENT OR APPROVED EPOXY LINING.
- POTABLE WATER, RECLAIMED WATER AND WASTEWATER FORCE MAIN VALVES 10 INCHES AND SMALLER SHALL BE RESILIENT SEAT GATE VALVES. TWELVE-INCH (12") OR LARGER FORCE MAIN VALVES SHALL BE RESILIENT SEAT GATE VALVES OR ECCENTRIC PLUG VALVES (IF APPROVED IN ADVANCE BY DEPARTMENT). POTABLE WATER AND RECLAIMED WATER MAIN VALVES LARGER THAN 10 INCHES SHALL BE BUTTERFLY VALVES.
- ALL TRENCHING, PIPE-LAYING, BACKFILL, PRESSURE TESTING, AND DISINFECTION MUST COMPLY WITH ALL APPLICABLE FEDERAL, STATE, COUNTY AND HEALTH DEPARTMENT STANDARDS AND REGULATIONS.

MIN. LENGTH OF PIPE (FEET) TO BE RESTRAINED

(SOURCES: EBAA IRON RESTRAINT LENGTH CALCULATION PROGRAM FOR PVC PIPE, RELEASE 3.1, AND DIPRA THRUST RESTRAINT FOR DUCTILE IRON PIPE, RELEASE 3.2)

FITTING TYPE	PIPE SIZE																								
	4"	6"	8"	10"	12"	16"	20"	24"	30"	36"	42"	48"	UPPER BEND	LOWER BEND	PLUG (DEAD END)	IN-LINE VALVE									
90° HORIZ. BEND	14	20	25	30	35	45	54	62	98	112	124	135	29	41	53	64	74	95	115	134	214	246	276	304	
45° HORIZ. BEND	6	8	11	13	15	19	22	26	41	46	51	56	12	19	24	29	34	39	48	56	89	102	114	126	
22.5° HORIZ. BEND	3	4	5	6	7	9	11	12	19	22	25	27	3	4	6	7	8	10	12	15	23	27	31	34	
11.25° HORIZ. BEND	1	2	3	3	4	4	5	6	10	11	12	13	1	2	3	3	4	4	5	6	7	11	13	15	16
90° VERT. OFFSET	29	41	53	64	74	95	115	134	214	246	276	304	7	10	13	16	19	25	30	35	57	66	74	83	
45° VERT. OFFSET	12	19	24	29	34	39	48	56	89	102	114	126	3	4	6	7	8	10	12	15	23	27	31	34	
22.5° VERT. OFFSET	6	9	12	14	17	19	23	27	43	49	55	60	1	2	4	4	4	5	6	7	11	13	15	16	
11.25° VERT. OFFSET	3	4	6	7	8	9	11	13	21	24	27	30	1	1	1	2	2	2	3	3	6	6	7	8	
PLUG (DEAD END)	32	45	59	70	83	107	129	151	214	246	276	304	32	45	45	45	45	55	65	80	110	125	140	155	
IN-LINE VALVE	32	45	45	45	45	55	65	80	110	125	140	155													
4"x 6"	23	-	-	-	-	-	-	-	-	-	-	-													
6"x 8"	21	35	-	-	-	-	-	-	-	-	-	-													
8"x 10"	18	34	47	-	-	-	-	-	-	-	-	-													
10"x 16"	16	32	46	58	-	-	-	-	-	-	-	-													
12"x 13"	13	30	44	57	69	-	-	-	-	-	-	-													
16"x 7"	26	41	55	67	90	-	-	-	-	-	-	-													
20"x 1	21	38	52	65	88	109	-	-	-	-	-	-													
24"x 1	16	34	49	62	86	108	129	-	-	-	-	-													
30"x 1	8	28	44	58	83	106	127	208	-	-	-	-													
36"x 1	1	22	39	54	80	103	124	206	240	-	-	-													
42"x 1	1	15	33	49	77	100	122	205	239	270	-	-													
48"x 1	1	7	27	44	73	97	120	203	238	269	298	-													
6"x 8"	23	-	-	-	-	-	-	-	-	-	-	-													
8"x 8"	38	25	-	-	-	-	-	-	-	-	-	-													
10"x 8"	57	43	24	-	-	-	-	-	-	-	-	-													
12"x 8"	72	60	44	41	-	-	-	-	-	-	-	-													
16"x 9"	99	90	78	75	45	-	-	-	-	-	-	-													
20"x 8"	123	116	107	105	81	45	-	-	-	-	-	-													
24"x 8"	146	140	132	131	111	82	45	-	-	-	-	-													
30"x 8"	209	204	197	188	177	153	118	75	-	-	-	-													
36"x 8"	243	236	233	226	217	196	168	135	74	-	-	-													
42"x 8"	273	270	265	259	252	234	211	183	133	72	-	-													
48"x 8"	301	298	294	289	283	268	24																		