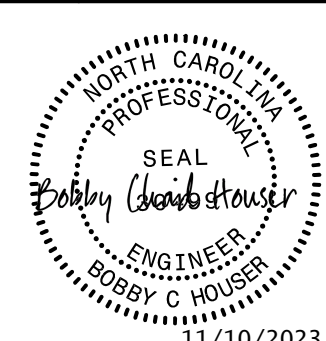
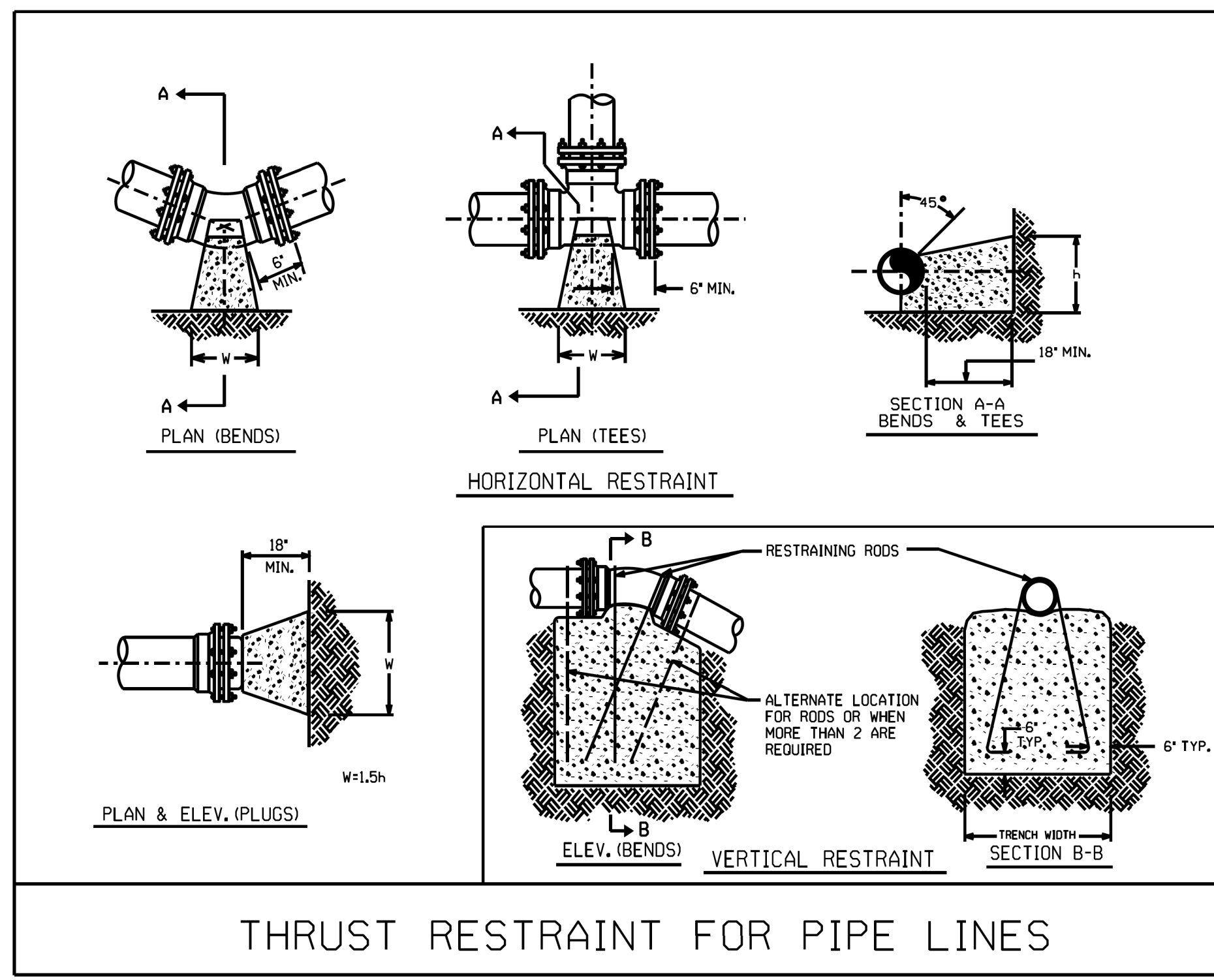


WATER TYPICAL DETAILS

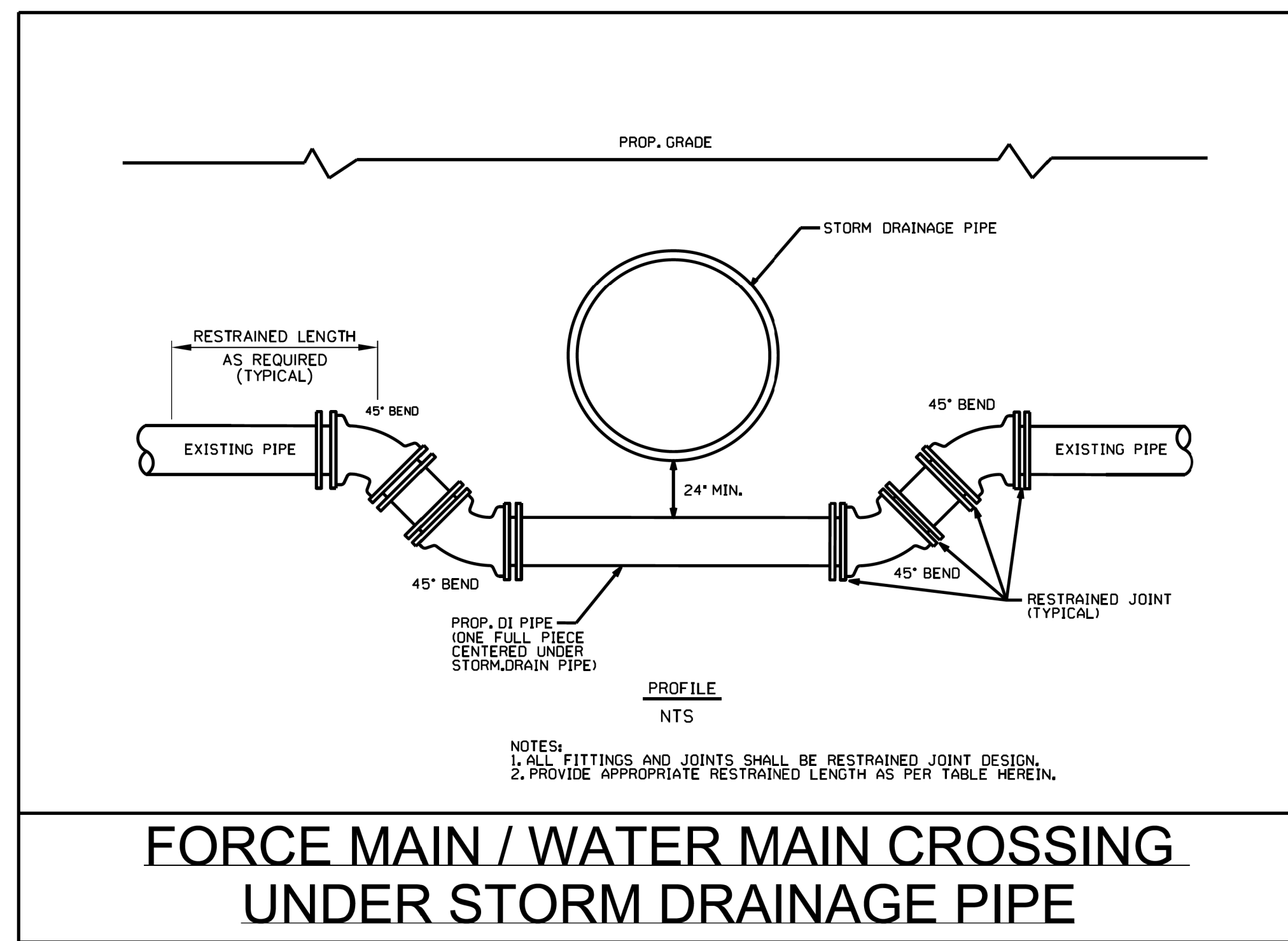
PROJECT REFERENCE NO. B-5845	SHEET NO. UC-3A
DESIGNED BY: BCH	
DRAWN BY: KSA	
CHECKED BY:	
APPROVED BY:	
REVISER:	
NORTH CAROLINA DEPARTMENT OF TRANSPORTATION DIVISION 12 PHONE: (980)552-4200	
UTILITY CONSTRUCTION PLANS ONLY	

UTILITY CONSTRUCTION

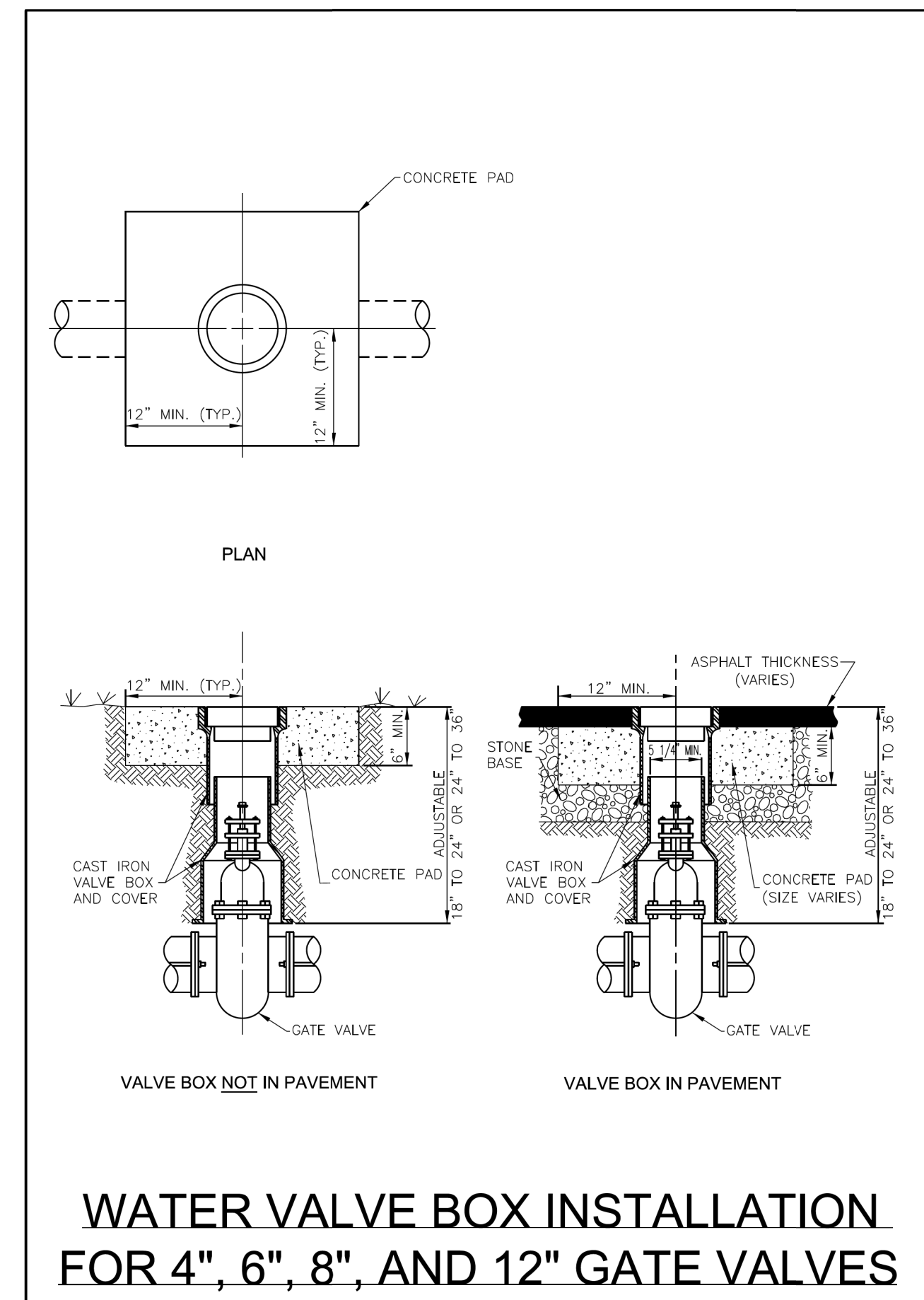
DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED



THRUST RESTRAINT FOR PIPE LINES

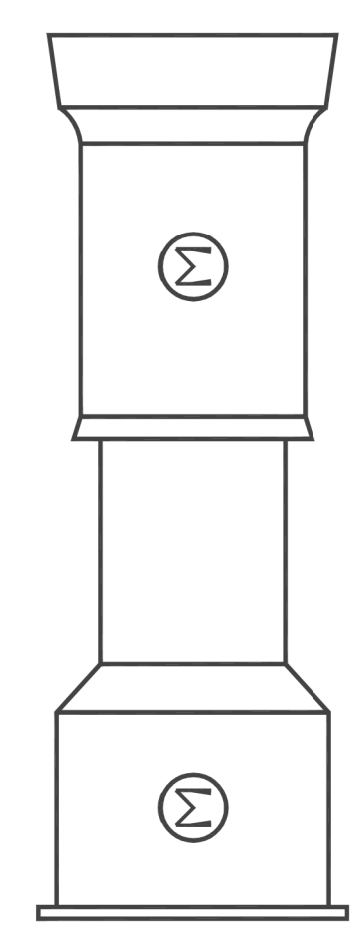


FORCE MAIN / WATER MAIN CROSSING UNDER STORM DRAINAGE PIPE

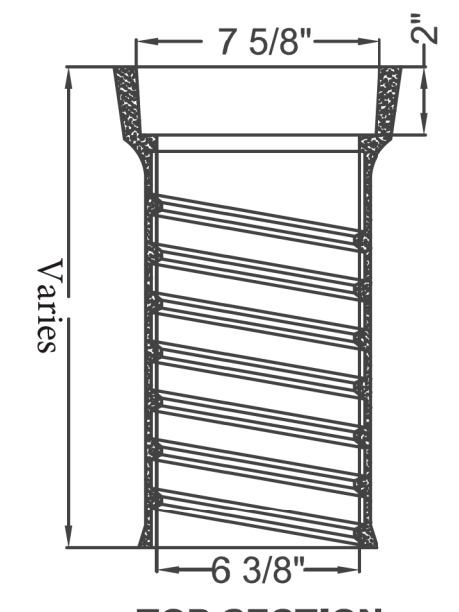


WATER VALVE BOX INSTALLATION FOR 4", 6", 8", AND 12" GATE VALVES

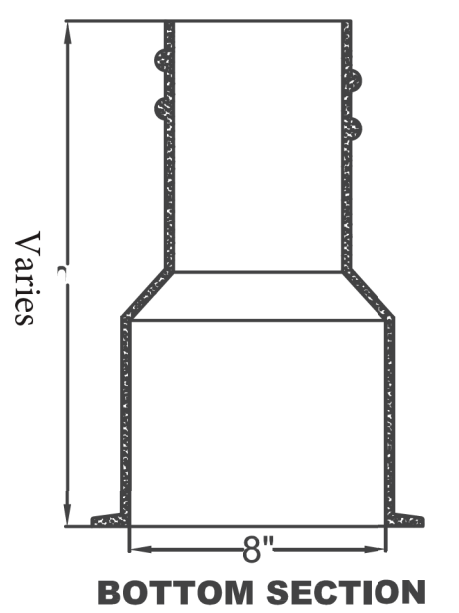
SCREW TYPE



VALVE BOX COMPLETE



TOP SECTION



BOTTOM SECTION

RESTRAINED JOINT DESIGN TABLE FOR DUCTILE IRON PIPE

FITTING	REQUIRED RESTRAINED LENGTH (FT) OF BARE D.I. PIPE BY DEPTH OF COVER									
	3 FT	4 FT	5 FT	6 FT	7 FT	8 FT	9 FT	10 FT		
HORIZONTAL BENDS										
6 INCH DIA - 11.25 DEG	3	2	2	2	2	1	1	1		
6 INCH DIA - 22.5 DEG	5	4	4	3	3	3	3	2		
6 INCH DIA - 45 DEG	11	9	8	7	7	6	5	5		
8 INCH DIA - 11.25 DEG	26	22	19	17	16	14	13	12		
8 INCH DIA - 22.5 DEG	3	3	2	2	2	2	2	2		
8 INCH DIA - 45 DEG	7	6	5	5	4	4	3	3		
12 INCH DIA - 11.25 DEG	14	12	10	9	8	8	7	7		
12 INCH DIA - 22.5 DEG	33	29	25	23	20	19	17	16		
12 INCH DIA - 45 DEG	5	4	4	3	3	3	2	2		
16 INCH DIA - 11.25 DEG	9	8	7	6	6	5	5	5		
16 INCH DIA - 22.5 DEG	20	17	15	13	12	11	10	10		
16 INCH DIA - 45 DEG	47	41	36	33	29	27	25	23		
20 INCH DIA - 11.25 DEG	6	5	5	4	4	4	3	3		
20 INCH DIA - 22.5 DEG	12	11	9	8	8	7	6	6		
20 INCH DIA - 45 DEG	25	22	19	17	16	14	13	12		
24 INCH DIA - 11.25 DEG	7	6	6	5	5	4	4	4		
24 INCH DIA - 22.5 DEG	15	13	11	10	9	9	8	7		
24 INCH DIA - 45 DEG	31	27	24	21	19	18	16	15		
30 INCH DIA - 90 DEG	74	65	57	52	47	43	40	37		
VERTICAL BENDS - DOWN										
6 INCH DIA - 11.25 DEG	7	6	6	5	4	4	4	3		
6 INCH DIA - 22.5 DEG	15	13	11	10	9	8	8	7		
6 INCH DIA - 45 DEG	31	27	23	21	19	17	16	15		
8 INCH DIA - 11.25 DEG	10	8	7	6	6	5	5	5		
8 INCH DIA - 22.5 DEG	19	17	15	13	12	11	10	9		
8 INCH DIA - 45 DEG	40	35	30	27	25	22	21	19		
12 INCH DIA - 11.25 DEG	14	12	10	9	8	8	7	7		
12 INCH DIA - 22.5 DEG	28	24	21	19	17	16	14	13		
12 INCH DIA - 45 DEG	57	50	44	39	35	32	30	28		
16 INCH DIA - 11.25 DEG	18	15	14	12	11	10	9	9		
16 INCH DIA - 22.5 DEG	36	31	27	25	22	20	19	17		
16 INCH DIA - 45 DEG	74	65	57	51	46	42	39	36		
20 INCH DIA - 11.25 DEG	22	19	17	15	14	12	11	11		
20 INCH DIA - 22.5 DEG	44	38	34	30	27	25	23	21		
20 INCH DIA - 45 DEG	91	79	70	63	57	52	48	44		
VERTICAL BENDS - UP										
6 INCH DIA - 11.25 DEG	3	2	2	2	2	1	1	1		
6 INCH DIA - 22.5 DEG	5	4	4	3	3	3	3	2		
6 INCH DIA - 45 DEG	11	9	8	7	7	6	5	5		
8 INCH DIA - 11.25 DEG	3	3	2	2	2	2	2	2		
8 INCH DIA - 22.5 DEG	7	6	5	5	4	4	3	3		
8 INCH DIA - 45 DEG	14	12	10	9	8	8	7	7		
12 INCH DIA - 11.25 DEG	5	4	4	3	3	3	2	2		
12 INCH DIA - 22.5 DEG	9	8	7	6	6	5	5	5		
12 INCH DIA - 45 DEG	20	17	15	13	12	11	10	10		
16 INCH DIA - 11.25 DEG	6	5	5	4	4	3	3	3		
16 INCH DIA - 22.5 DEG	12	11	9	8	8	7	6	6		
16 INCH DIA - 45 DEG	25	22	19	17	16	14	13	12		
20 INCH DIA - 11.25 DEG	7	6	6	5	5	4	4	4		
20 INCH DIA - 22.5 DEG	15	13	11	10	9	9	8	7		
20 INCH DIA - 45 DEG	31	27	24	21	19	18	16	15		
DEAD ENDS / VALVES										
6 INCH DIA	50	45	41	38	35	33	31	29		
8 INCH DIA	65	59	54	50	46	43	40	38		
10 INCH DIA	80	72	66	61	56	52	49	46		
12 INCH DIA	94	85	78	72	66	62	58	54		
16 INCH DIA	123	111	102	94	87	81	76	71		
20 INCH DIA	151	137	125	115	107	100	93	88		
REDUCERS										
3 FT	50	45	41	38	35	33	31	29		
12 INCH X 8 INCH										
TEES										
8" RUN X 8" BRANCH : RL = 1 FT	64	58	53	48	44	41	38	36		
8" RUN X 8" BRANCH : RL = 5 FT	59	52	47	42	39	35	32	30		
12" RUN X 12" BRANCH : RL = 1 FT	93	84	77	70	65	60	56	53		
12" RUN X 12" BRANCH : RL = 5 FT	88	79	71	65	59	54	50	47		

ASSUMPTIONS
LAYING CONDITION = TYPE 4
SOIL DESIGNATION = COHESIVE-GRANULAR
DESIGN PRESSURE = 200 PSI (TEST PRESSURE)
SAFETY FACTOR = 1.5

NOTES
1. RESTRAINED LENGTH IS MEASURED AS FOLLOWS:
A. HORIZONTAL/VERTICAL BENDS: ALONG EACH SIDE OF BEND.
B. HORIZONTAL/VERTICAL BENDS - OFFSET: ALONG THE OUTER SIDE OF EACH BEND.
ALL PIPE BETWEEN THE TWO BENDS SHALL BE RESTRAINED JOINT.
2. WHEN IT IS NOT POSSIBLE TO INSTALL THE RESTRAINED LENGTHS AS NOTED BY THIS TABLE, CONTRACTOR SHALL INSTALL THE APPROPRIATE CONCRETE THRUST RESTRAINTS AS PER THE DETAILS HEREIN.