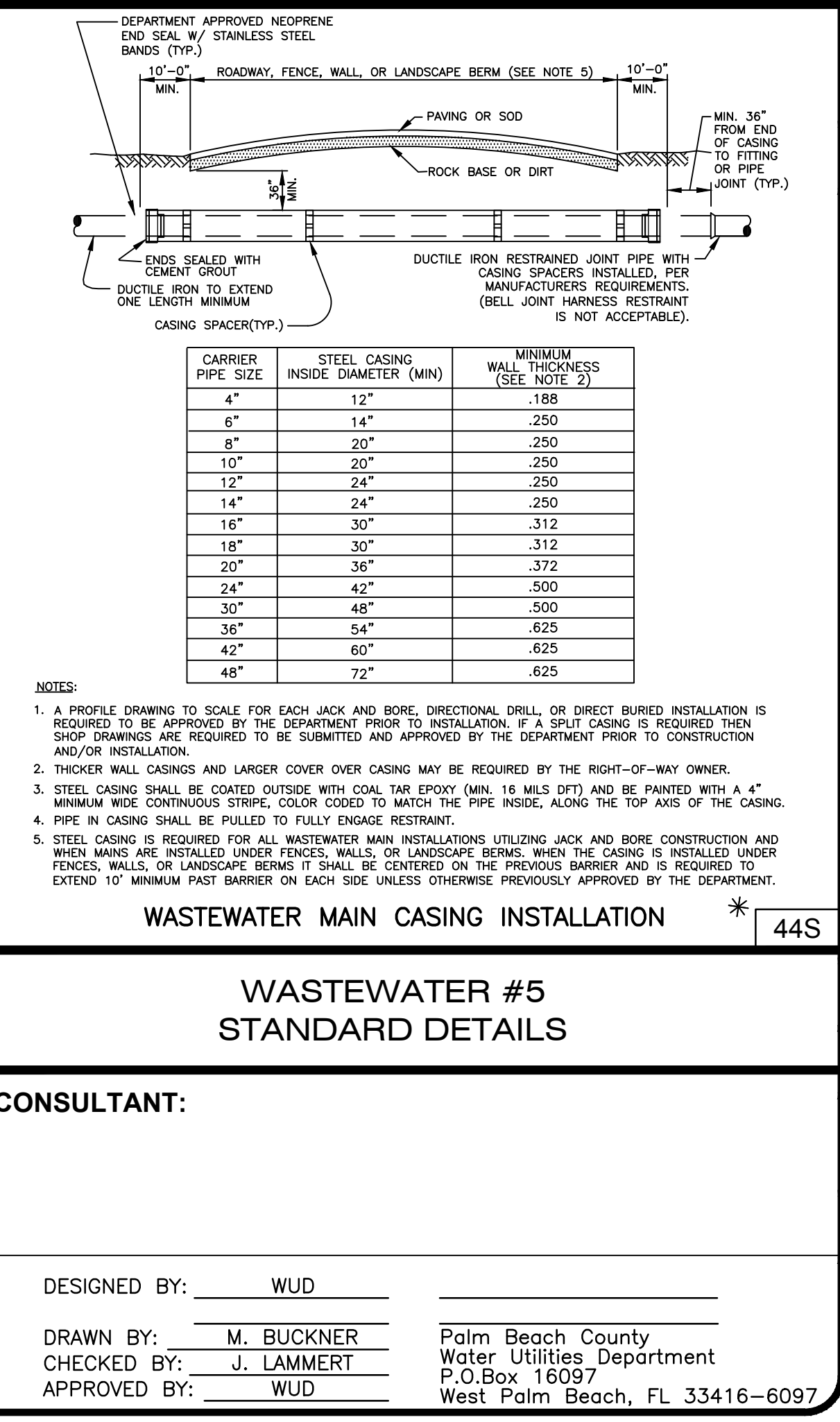
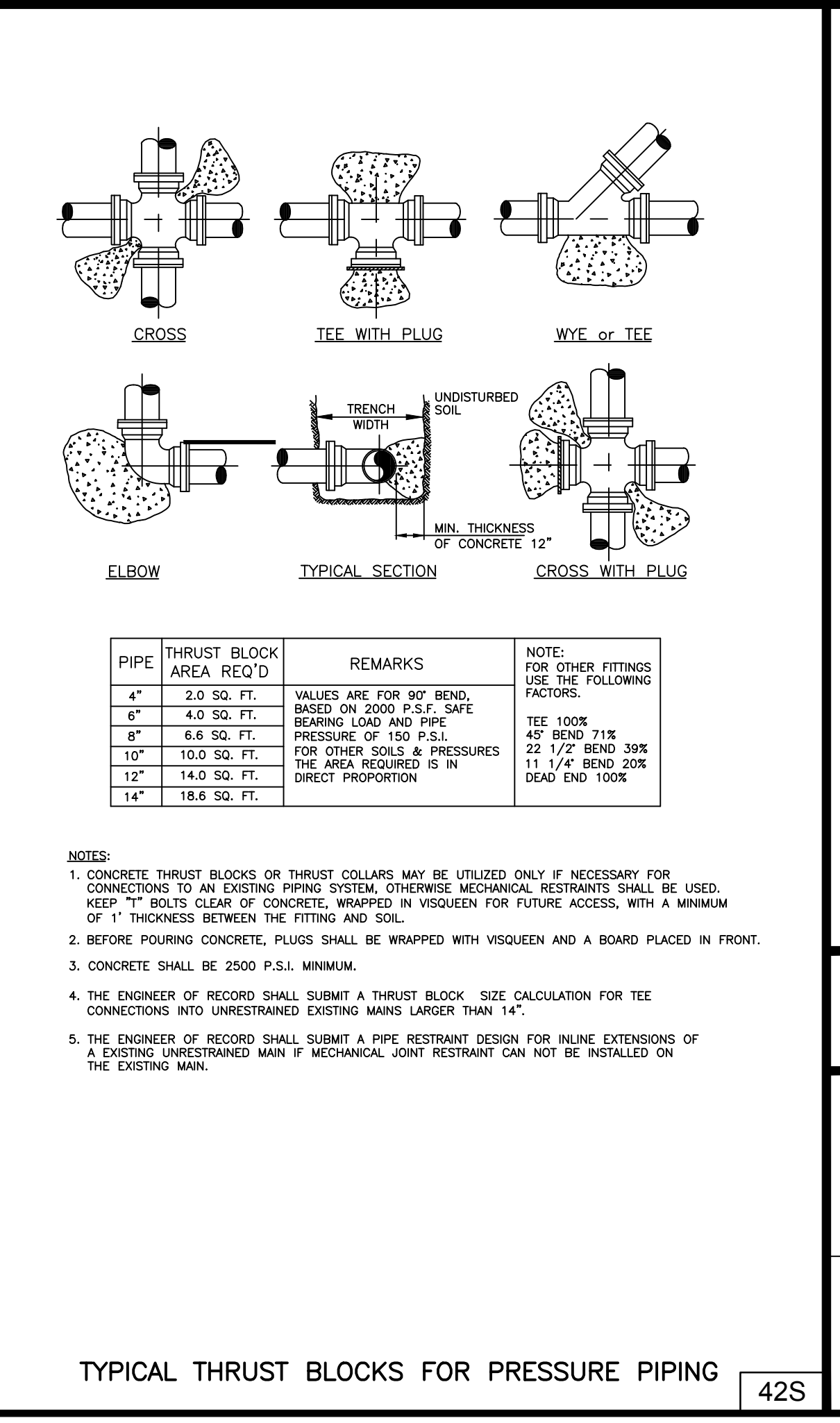
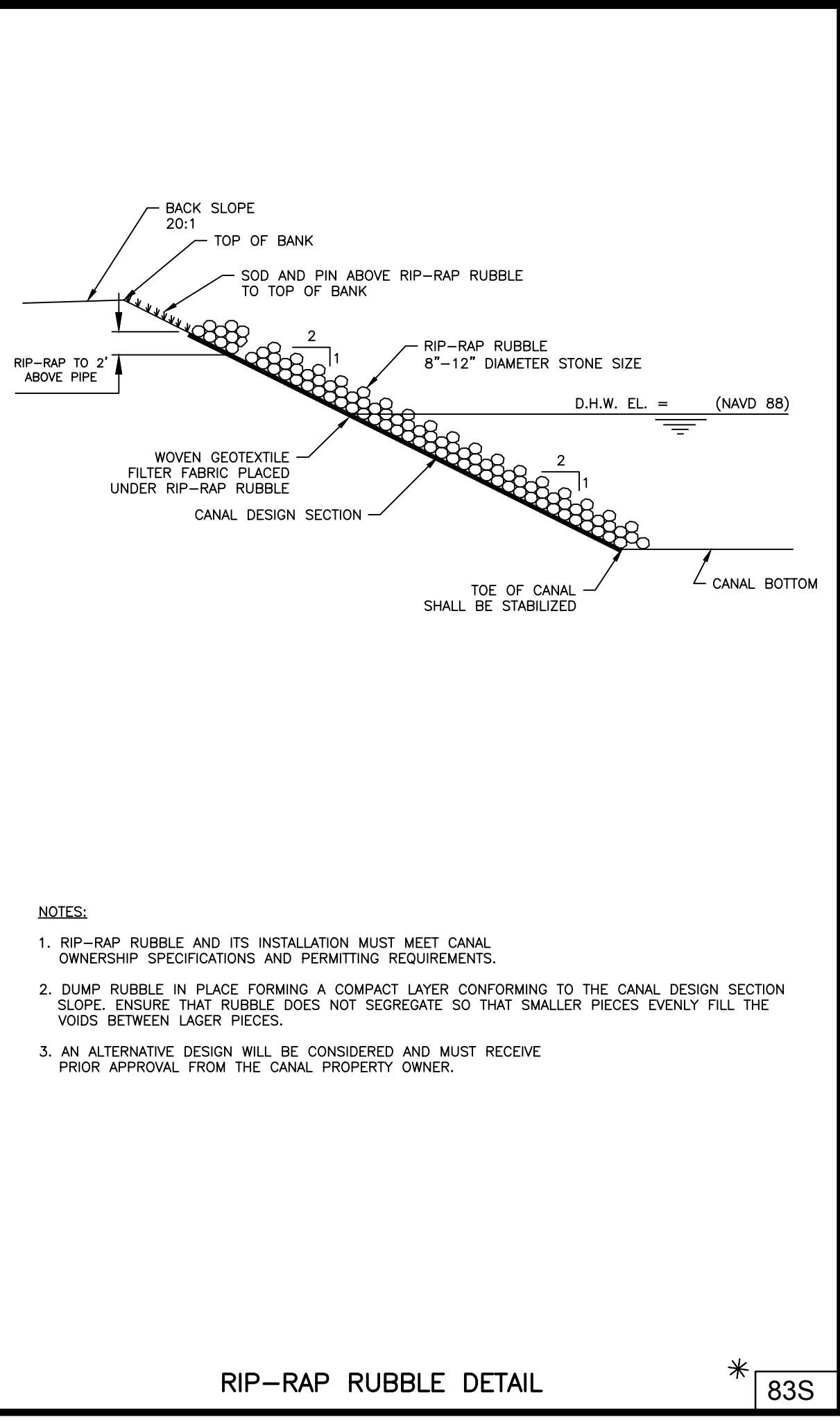
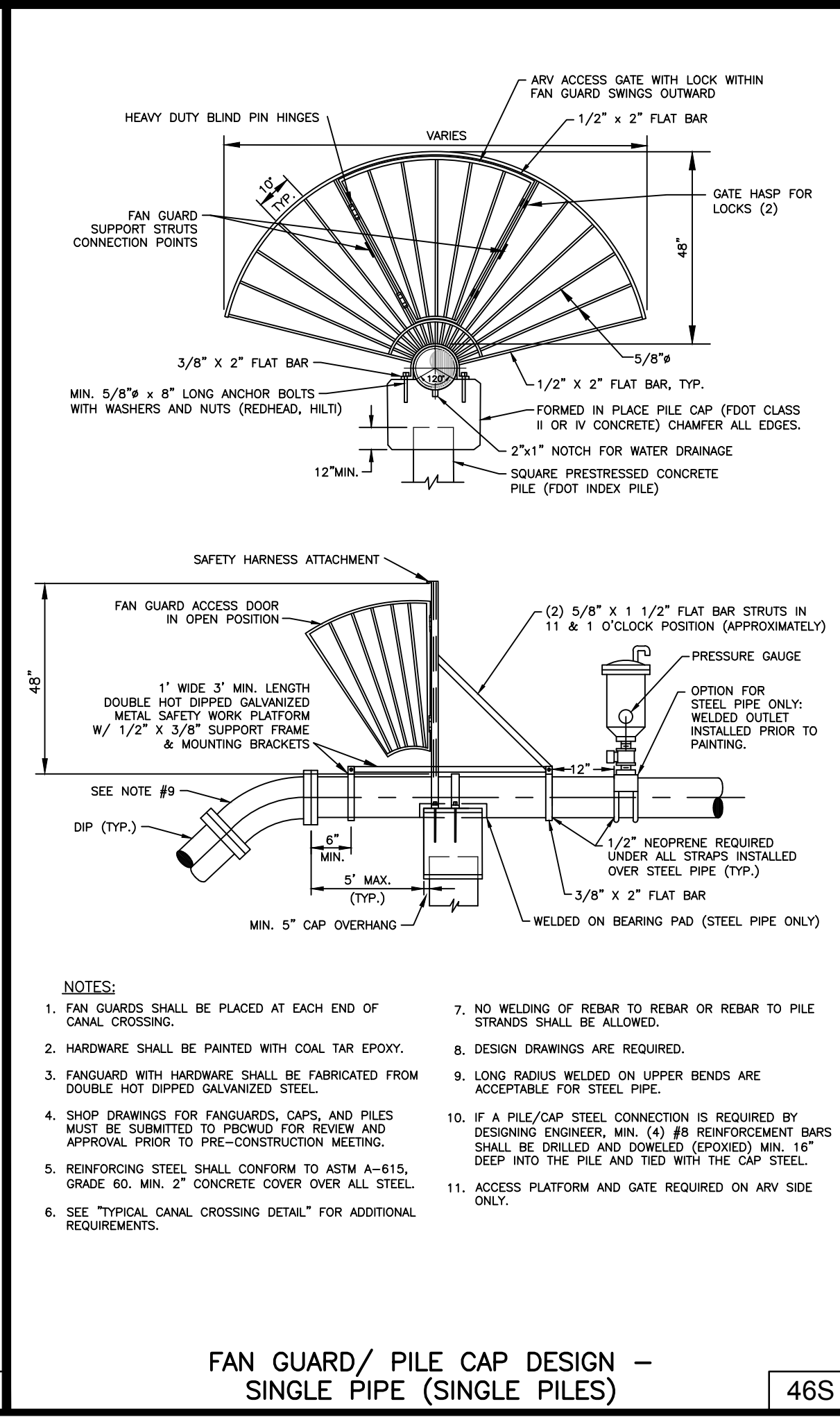
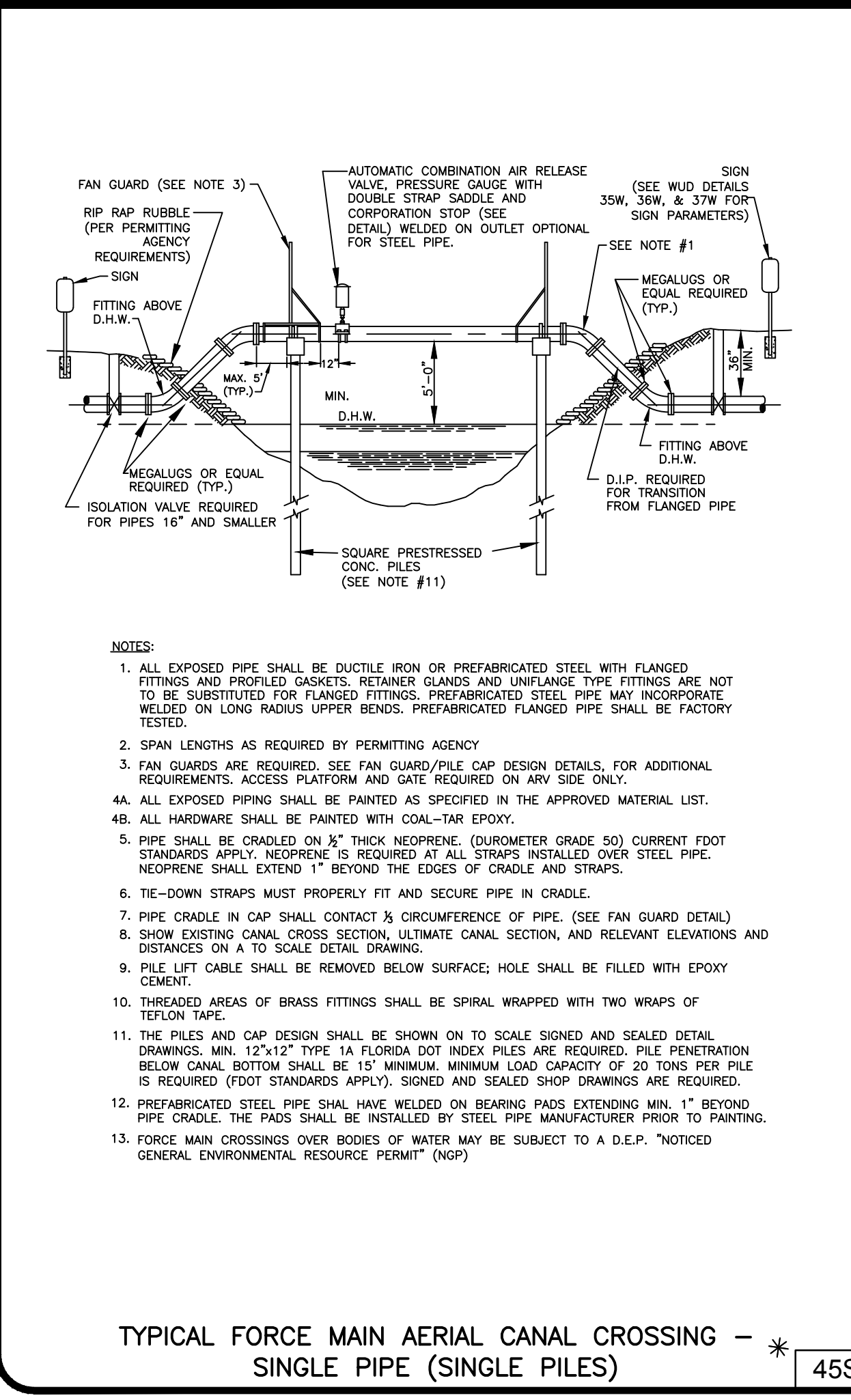


MECHANICAL THRUST RESTRAINT MINIMUM PIPE LENGTHS (FORCE MAINS)

(SOURCES: EBAA 1987, MECHANICAL THRUST 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"
90° HORIZ. BEND	14	20	25	30	35	45	54	62	73	84	93	101
45° HORIZ. BEND	6	8	11	13	15	19	22	26	30	35	38	42
22.5° HORIZ. BEND	3	4	5	6	7	9	11	12	15	17	18	20
11.25° HORIZ. BEND	1	2	3	3	4	4	5	6	7	8	9	10
90° VERT. OFFSET	29	41	53	64	74	95	115	134	160	185	207	228
45° VERT. OFFSET	7	10	13	16	19	23	30	35	42	49	56	62
22.5° VERT. OFFSET	12	19	24	29	34	39	48	56	66	77	86	94
11.25° VERT. OFFSET	3	4	6	7	8	10	12	15	18	20	23	26
PLUG (DEAD END)	6	9	12	14	17	19	23	27	32	37	41	45
IN-LINE VALVE	1	1	2	2	2	3	3	4	5	5	6	6
TEE RESTRAINT	32	45	59	70	83	107	129	151	160	185	207	228
REDUCER (LAGER RESTRAINT)	23	32	45	45	55	65	80	85	95	105	115	-
47X #	21	35	-	-	-	-	-	-	-	-	-	-
67X #	18	34	47	-	-	-	-	-	-	-	-	-
107X #	16	32	48	58	-	-	-	-	-	-	-	-
127X #	13	30	44	57	69	-	-	-	-	-	-	-
167X #	7	28	41	55	67	80	-	-	-	-	-	-
207X #	1	21	38	52	65	88	109	-	-	-	-	-
247X #	1	16	34	49	62	86	108	129	-	-	-	-
307X #	1	8	28	44	58	83	106	127	154	-	-	-
367X #	1	1	22	39	54	80	103	124	153	179	-	-
427X #	1	1	15	33	49	77	100	122	151	177	201	-
487X #	1	1	7	27	44	73	97	120	149	176	200	222
547X #	1	23	-	-	-	-	-	-	-	-	-	-
607X #	38	25	-	-	-	-	-	-	-	-	-	-
667X #	57	43	24	-	-	-	-	-	-	-	-	-
727X #	72	60	44	41	-	-	-	-	-	-	-	-
787X #	99	90	78	75	45	-	-	-	-	-	-	-
847X #	123	116	107	105	81	45	-	-	-	-	-	-
907X #	146	140	132	131	111	82	45	-	-	-	-	-
967X #	157	153	148	141	133	113	87	56	-	-	-	-
1027X #	182	179	175	169	163	147	128	101	56	-	-	-
1087X #	205	202	199	194	189	175	150	138	100	54	-	-
1147X #	226	224	221	217	213	201	187	169	138	98	53	-

NOTES:
1. THE DATA IN THE ABOVE TABLE ARE BASED UPON THE FOLLOWING INSTALLATION CONDITIONS:
SOIL TYPE-SAND TEST PRESSURE-150 PSI DEPTH OF BURY-3'
TRENCH TYPE-TYPICAL SAFETY FACTOR-1.5
MINIMUM PIPE LENGTH ALONG TEE RUN-5'
2. THE RESTRAINED PIPE LENGTHS APPLY TO DUCTILE IRON AND PVC PIPE.
3. ALL JOINTS BETWEEN UPPER AND LOWER BENDS SHALL BE RESTRAINED.
4. RESTRAINED PIPE LENGTHS APPLY TO PIPE ON BOTH SIDES OF VALVES AND FITTINGS.
5. MULTIPLY PIPE LENGTH BY 1.4 FOR POLYETHYLENE ENCASED PIPE.
6. RESTRAINED PIPE LENGTHS EQUAL TO AN "IN-LINE VALVE" CONDITION ARE REQUIRED AT EACH END OF A TRANSITION FROM HOPE PIPE TO OTHER PIPE MATERIALS.
7. DESIGN ENGINEER IS RESPONSIBLE FOR PROPER RESTRAINT PIPE LENGTH SIZING FOR THE PROJECT.



WASTEWATER #5 STANDARD DETAILS

CARRIER PIPE SIZE	STEEL CASING INSIDE DIAMETER (MIN)	MINIMUM WALL THICKNESS (SEE NOTE 2)
4"	12"	.188
6"	14"	.250
8"	20"	.250
10"	20"	.250
12"	24"	.250
14"	24"	.250
16"	30"	.312
18"	30"	.312
20"	36"	.372
24"	42"	.500
30"	48"	.500
36"	54"	.625
42"	60"	.625
48"	72"	.625

NOTE: FOR OTHER FITTINGS USE THE FOLLOWING FACTORS:
TEE 100%
45° BEND 71%
22 1/2° BEND 30%
11 1/4° BEND 20%
DEAD END 100%

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