Appendix J –
Revised Pre-Project East Bouldin Creek HEC-RAS Model

Exhibit J.1

Cumberland Bridge

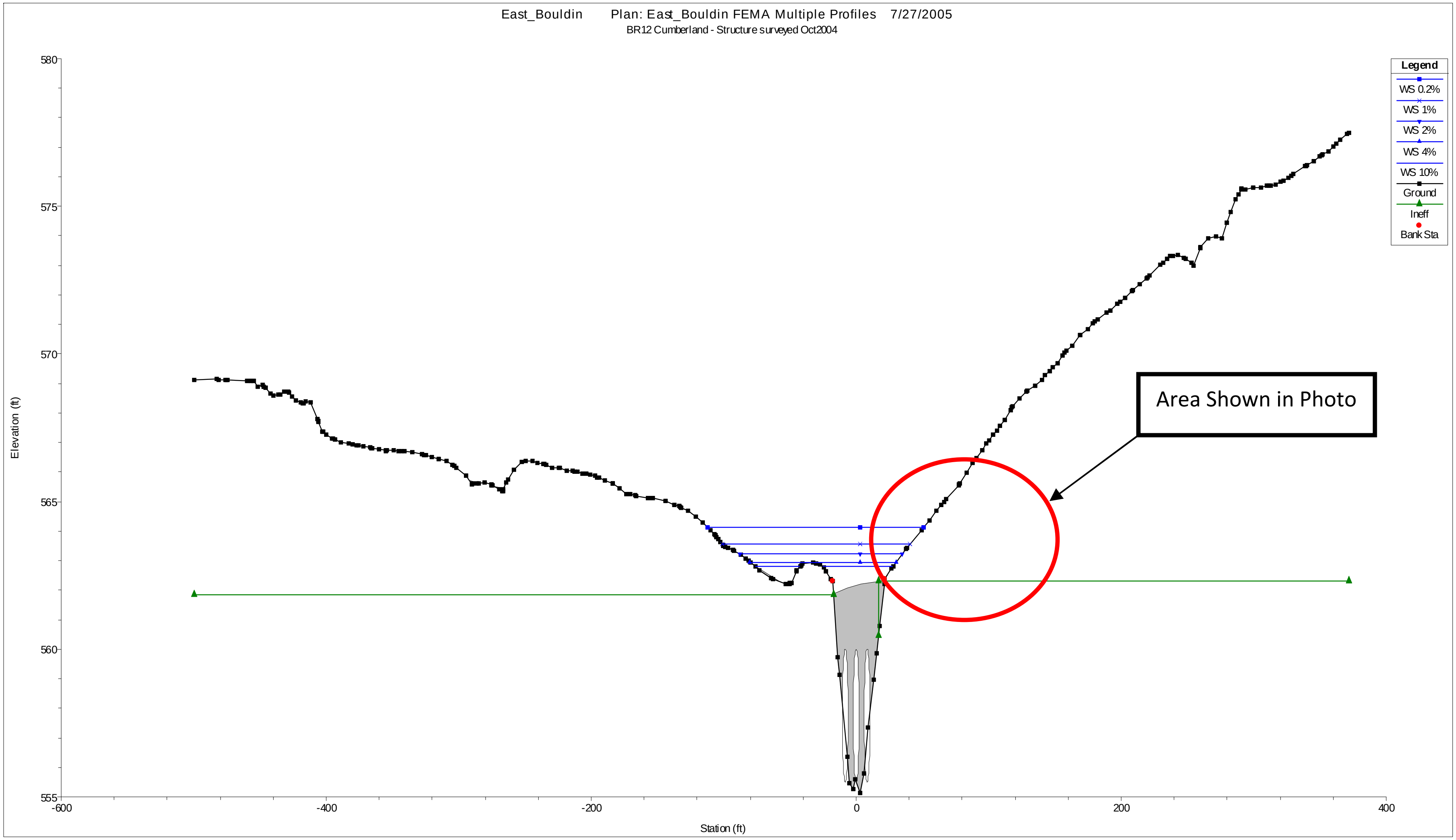

East_Bouldin Plan: East_Bouldin FEMA Multiple Profiles 7/27/2005
BR12 Cumberland - Structure surveyed Oct2004
Legend
WS 0.2%
WS 1%
WS 2%
WS 4%
WS 10%
Ground
Ineff
Bank Sta
Area Shown in Photo
Elevation (ft)
Station (ft)
580
575
570
565
560
555
-600
-400
-200
0
200
400

Exhibit J.2

Manning's "n" Coefficient

Review of Erosion Control Projects

Project	Date Completed	RAS Cross-section	Overbank or Channel	Effective FEMA RAS n value	ESD Revised n value
EBO ACWP PROJECT Govalle 1 near Post Oak	after 2006	5415	Right	0.08	0.035
EBO PRIVATE PROJECT Durwood St 250	after Eff RAS model	13462 BR D 13447	Chanel	0.05	0.047
EBO PROJECT Annie ST W 501	2000	no change	------	------	------
EBO PROJECT ECP 2 - W Annie St	1993	no change	------	------	------
EBO PROJECT ECP 8 - W Alpine	1996	no change	------	------	------
EBO PROJECT ECP 9 - Coleman Street	1997	no change	------	------	------
EBO PROJECT Gillis Park	2003	no change	------	------	------
EBO PROJECT Havana St	2009	16030 Culv D 16003	Left	0.07	0.08
EBO PROJECT S-3rd_605	planned project	no change	------	------	------
EBO PROJECT Wilson Street	2012	15107	Left Right	LOB = 0.07 ROB = 0.08	0.045
EBO PWD PROJECT Cumberland Road 405	2010	14252 Culv U 14298	Right	0.07	0.025

Exhibit J.3

Flow Change Locations

HEC_RAS Flow Change Locations for Revised Pre-Projec HEC-RAS Model Existing Land Use Conditions

HMS Model: Revised Pre-Project HMS

RAS Model: Revised Pre-Project RAS

HMS Flow Data Source Element	RAS Flow Change Location		Existing Land Use Conditions			
	Reach	RS	2-Year peak cfs	10-year peak cfs	25-year peak cfs	100-year peak cfs
JEBLDN030	Reach 1	19568	200	377	482	656
JEBLDN040	Reach 1	17716	205	444	572	783
JEBLDN060a	Reach 1	17192	224	552	771	1100
JEBLDN060	Reach 1	16447	256	617	842	1189
JEBLDN070	Reach 1	14096	571	1185	1670	2515
N/A	Culvert Split	12685	571	1135	1230	1195
N/A	Reach 2	12685	0.00001	50	440	1320
JEBLDN070	Reach 3	12071	571	1185	1670	2515
J_Crockett	Reach 3	10809	788	1620	2212	3234
J_Johanna	Reach 3	10559	826	1677	2282	3337
J_Mary	Reach 3	10203	851	1718	2334	3413
J_Annie	Reach 3	9840	923	1821	2454	3581
J_Milton	Reach 3	9537	927	1826	2460	3589
J_Monroe	Reach 3	9081	981	1907	2554	3715
JEBLDN090	Reach 3	6915	1071	2147	2649	3759
JEBLDN090a	Reach 3	4415	590	1201	1481	2081
JEBLDN100a	Reach 3	2447	644	1294	1552	2096
JEBLDN100	Reach 3	1534	708	1427	1765	2261
confluence w CR	Reach 3	1116	712	1438	1781	2305

HEC_RAS Flow Change Locations for Revised Pre-Projec HEC-RAS Model Ultimate Development Land Use Conditions

HMS Model: Revised Pre-Project HMS

RAS Model: Revised Pre-Project RAS

HEC-HMS Flow Data Source Element	RAS Flow Change Location		Ultimate Development Land Use Conditions			
	Reach	RS	2-Year peak cfs	10-year peak cfs	25-year peak cfs	100-year peak cfs
JEBLDN030	Reach 1	19568	200	377	482	656
JEBLDN040	Reach 1	17716	205	444	572	783
JEBLDN060a	Reach 1	17192	224	552	771	1100
JEBLDN060	Reach 1	16447	256	617	842	1189
JEBLDN070	Reach 1	14096	571	1185	1670	2515
N/A	Culvert Split	12685	571	1135	1230	1195
N/A	Reach 2	12685	0.00001	50	440	1320
JEBLDN070	Reach 3	12071	571.2	1184.8	1670	2515
J_Crockett	Reach 3	10809	820.1	1648.5	2239	3264
J_Johanna	Reach 3	10559	861.9	1708	2312	3368
J_Mary	Reach 3	10203	888.8	1751.9	2365	3445
J_Annie	Reach 3	9840	967.3	1859.4	2488	3618
J_Milton	Reach 3	9537	972.2	1865.1	2495	3626
J_Monroe	Reach 3	9081	1031.1	1950.4	2592	3753
JEBLDN090	Reach 3	6915	1136.8	2208.3	2695	3802
JEBLDN090a	Reach 3	4415	627.6	1235.4	1506	2104
JEBLDN100a	Reach 3	2447	683.4	1332.2	1578	2119
JEBLDN100	Reach 3	1534	753.5	1471.5	1801	2297
confluence w CR	Reach 3	1116	757	1483	1819	2343

Effective HEC-RAS Model

Effective HMS Flow Data Source	RAS Flow Change Location		2-Year peak	10-year peak	25-year peak	100-year peak
	Reach	RS	cfs	cfs	cfs	cfs
JEBLDN030	Reach 1	19568	199	370	480	650
JEBLDN040	Reach 1	17716	204	440	570	780
JEBLDN060a	Reach 1	17192	223	550	760	1090
JEBLDN060	Reach 1	16447	254	620	840	1180
JEBLDN070	Reach 1	14096	565	1180	1650	2440
N/A	Culvert Split	12685	N/A	1130	1210	1120
N/A	Reach 2	12685	N/A	50	440	1320
JEBLDN070	Reach 3	12071	565	1180	1650	2440
JEBLDN080	Reach 3	10412	858	1760	2390	3480
JEBLDN090	Reach 3	6915	1041	2160	2700	3710
JEBLDN090a	Reach 3	4415	573	1210	1510	2060
JEBLDN100a	Reach 3	2447	580	1150	1460	1950
JEBLDN100	Reach 3	1534	646	1260	1560	2080
confluence w CR	Reach 3	1116	648	1260	1570	2080

Exhibit J.4

Revised Pre-Project Model Results

and

Comparison to Effective Model

Revised Pre-Project HEC-RAS Results for Existing Land Use Conditions

		Effective FEMA				ESD Revised Pre-Project, Existing Land Use				Change in WS Elev from Effective		
Reach	River Sta	2-year WS Elev (ft)	10-year WS Elev (ft)	25-year WS Elev (ft)	100-year WS Elev (ft)	2-year WS Elev (ft)	10-year WS Elev (ft)	25-year WS Elev (ft)	100-year WS Elev (ft)	10-year (ft)	25-year (ft)	100-year (ft)
Reach 1	19568	2-year WS Elev Not Included in Effective FEMA study	654.72	654.86	655.07	654.44	654.73	654.87	655.08	0.01	0.01	0.01
Reach 1	19532		653.74	653.89	654.09	653.47	653.75	653.89	654.1	0.01	0	0.01
Reach 1	19488		652.06	652.23	652.47	651.72	652.07	652.24	652.48	0.01	0.01	0.01
Reach 1	19445		650.57	650.75	650.95	650.17	650.57	650.75	651.04	0.00	0	0.09
Reach 1	19401		648.46	648.63	648.85	648.13	648.47	648.64	648.86	0.01	0.01	0.01
Reach 1	19334		643.27	643.44	643.67	642.94	643.28	643.44	643.68	0.01	0	0.01
Reach 1	19312 FORT MCGRUDER		Inl Struct	Inl Struct	Inl Struct	Inl Struct	Inl Struct	Inl Struct	Inl Struct			
Reach 1	19291		639.92	640.18	640.52	639.39	639.94	640.19	640.54	0.02	0.01	0.02
Reach 1	19219		636.62	636.97	637.39	635.94	636.65	636.98	637.4	0.03	0.01	0.01
Reach 1	19146		635.02	635.38	635.84	634.29	635.04	635.39	635.85	0.02	0.01	0.01
Reach 1	19001		630.08	630.41	630.89	629.42	630.1	630.41	630.91	0.02	0	0.02
Reach 1	18835		626.36	626.7	627.15	625.67	626.38	626.71	627.17	0.02	0.01	0.02
Reach 1	18655		620.32	620.55	620.89	619.69	620.33	620.56	620.9	0.01	0.01	0.01
Reach 1	18497		618.56	618.98	619.48	617.59	618.59	618.99	619.5	0.03	0.01	0.02
Reach 1	18372		617.82	618.29	618.88	616.69	617.85	618.31	618.89	0.03	0.02	0.01
Reach 1	18235		617.80	618.27	618.85	616.68	617.83	618.28	618.86	0.03	0.01	0.01
Reach 1	18206		617.80	618.27	618.85	616.68	617.83	618.28	618.86	0.03	0.01	0.01
Reach 1	18167		617.67	618.09	618.6	616.61	617.7	618.1	618.61	0.03	0.01	0.01
Reach 1	18096		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 1	18025		614.44	614.73	615.16	613.74	614.42	614.71	615.17	-0.02	-0.02	0.01
Reach 1	17964		614.46	614.76	615.2	613.76	614.44	614.74	615.21	-0.02	-0.02	0.01
Reach 1	17923		614.46	614.76	615.19	613.76	614.44	614.74	615.21	-0.02	-0.02	0.02
Reach 1	17827		614.46	614.76	615.19	613.76	614.44	614.74	615.21	-0.02	-0.02	0.02
Reach 1	17814 DETENTION BASIN		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 1	17796		609.45	609.84	610.22	608.1	609.47	609.84	610.22	0.02	0	0
Reach 1	17781		609.38	609.78	610.15	607.92	609.41	609.79	610.16	0.03	0.01	0.01
Reach 1	17771		609.45	609.87	610.28	608	609.47	609.87	610.28	0.02	0	0
Reach 1	17744 ALPINE		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 1	17716		608.25	608.74	609.33	607.22	608.26	608.75	609.35	0.01	0.01	0.02
Reach 1	17646		605.83	606.24	606.77	604.82	605.84	606.26	606.78	0.01	0.02	0.01
Reach 1	17501		603.46	603.87	604.44	602.44	603.47	603.86	604.45	0.01	-0.01	0.01
Reach 1	17305		601.13	601.74	602.39	599.72	601.14	601.77	602.4	0.01	0.03	0.01
Reach 1	17192		599.56	600.14	601.1	598.17	599.56	600.18	601.12	0.00	0.04	0.02
Reach 1	17106		599.01	599.21	599.81	596.87	599.02	599.26	599.83	0.01	0.05	0.02
Reach 1	17070 LIGHTSEY		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 1	17034		596.02	596.73	597.65	594.16	596.01	596.77	597.68	-0.01	0.04	0.03
Reach 1	17014		594.43	595.19	596.24	592.94	594.43	595.23	596.27	0.00	0.04	0.03
Reach 1	17010		593.84	594.77	596.04	591.9	593.85	594.82	596.07	0.01	0.05	0.03
Reach 1	16967		593.23	594.08	595.29	591.44	593.24	594.12	595.33	0.01	0.04	0.04
Reach 1	16797		590.74	591.55	592.59	588.95	590.75	591.59	592.62	0.01	0.04	0.03
Reach 1	16639		589.39	590.01	590.72	587.66	589.39	590.02	590.74	0.00	0.01	0.02
Reach 1	16447		586.83	587.48	588.32	585.34	586.82	587.48	588.34	-0.01	0	0.02
Reach 1	16323		585.23	585.97	586.77	583.55	585.22	585.98	586.79	-0.01	0.01	0.02
Reach 1	16124		584.17	585.08	586.02	582.1	584.15	585.08	586.04	-0.02	0	0.02
Reach 1	16056		583.48	584.39	585.34	581.28	583.46	584.39	585.37	-0.02	0	0.03

Revised Pre-Project HEC-RAS Results for Existing Land Use Conditions

Reach	River Sta	Effective FEMA 2-year WS Elev (ft)	Effective FEMA 10-year WS Elev (ft)	Effective FEMA 25-year WS Elev (ft)	Effective FEMA 100-year WS Elev (ft)	ESD Revised Pre-Project, Existing Land Use 2-year WS Elev (ft)	ESD Revised Pre-Project, Existing Land Use 10-year WS Elev (ft)	ESD Revised Pre-Project, Existing Land Use 25-year WS Elev (ft)	ESD Revised Pre-Project, Existing Land Use 100-year WS Elev (ft)	Change in WS Elev from Effective 10-year (ft)	Change in WS Elev from Effective 25-year (ft)	Change in WS Elev from Effective 100-year (ft)
Reach 1	16030 HAVANA		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 1	16003		582.30	583.01	583.82	580.66	582.29	583.02	583.84	-0.01	0.01	0.02
Reach 1	15893		579.72	580.4	581.27	578.22	579.71	580.41	581.3	-0.01	0.01	0.03
Reach 1	15734		578.15	578.8	579.62	576.62	578.14	578.81	579.64	-0.01	0.01	0.02
Reach 1	15547		575.95	576.55	577.32	574.59	575.94	576.56	577.34	-0.01	0.01	0.02
Reach 1	15330		573.86	574.72	575.67	572.19	573.84	574.72	575.69	-0.02	0	0.02
Reach 1	15107		571.23	572.46	573.12	569.28	571.21	572.47	573.13	-0.02	0.01	0.01
Reach 1	15022		571.11	572.45	573.24	568.45	571.09	572.46	573.24	-0.02	0.01	0
Reach 1	14950		570.90	572.22	572.97	568.15	570.87	572.23	572.98	-0.03	0.01	0.01
Reach 1	14918 EL PASO		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 1	14885		567.69	568.33	569.15	566.29	567.68	568.34	569.17	-0.01	0.01	0.02
Reach 1	14794		566.45	567.17	568.11	564.81	566.44	567.18	568.13	-0.01	0.01	0.02
Reach 1	14628		564.03	564.67	565.4	562.57	564.02	564.67	565.42	-0.01	0	0.02
Reach 1	14471		563.12	563.45	564.1	560.92	563.1	563.46	564.12	-0.02	0.01	0.02
Reach 1	14363		562.88	563.1	563.72	559.62	562.87	563.11	563.75	-0.01	0.01	0.03
Reach 1	14298		562.79	562.95	563.55	559.38	562.78	562.96	563.59	-0.01	0.01	0.04
Reach 1	14252 CUMBERLAND		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 1	14206		557.21	558.46	560.09	555.44	557.23	558.51	560.23	0.02	0.05	0.14
Reach 1	14096		556.24	557.4	559.01	554.29	556.25	557.45	559.14	0.01	0.05	0.13
Reach 1	13965		555.18	556.4	558.05	553.13	555.2	556.45	558.17	0.02	0.05	0.12
Reach 1	13818		553.99	555.21	556.86	551.89	554	555.26	556.98	0.01	0.05	0.12
Reach 1	13624		552.37	553.61	555.37	550.22	552.38	553.65	555.52	0.01	0.04	0.15
Reach 1	13539		550.94	552.06	553.86	548.93	550.93	552.07	554.01	-0.01	0.01	0.15
Reach 1	13477		550.29	551.34	553.06	548.37	550.27	551.33	553.2	-0.02	-0.01	0.14
Reach 1	13462 PEDESTRIAN BRID		Bridge	Bridge	Bridge	Bridge	Bridge	Bridge	Bridge			
Reach 1	13447		549.56	550.48	551.75	547.8	549.54	550.48	551.76	-0.02	0	0.01
Reach 1	13393		549.24	550.21	551.59	547.45	549.25	550.25	551.65	0.01	0.04	0.06
Reach 1	13268		548.09	549.01	550.48	546.33	548.11	549.05	550.37	0.02	0.04	-0.11
Reach 1	13058		546.45	546.94	547.34	545.13	546.46	546.95	547.68	0.01	0.01	0.34
Reach 1	13056 LOW WATER CROSS		Inl Struct	Inl Struct	Inl Struct	Inl Struct	Inl Struct	Inl Struct	Inl Struct			
Reach 1	12945		545.06	545.5	546.63	543.21	545.06	545.52	546.73	0.00	0.02	0.1
Reach 1	12812		542.68	544.17	545.15	540.99	542.72	544.19	545.21	0.04	0.02	0.06
Culvert Split	12685		539.90	541.03	542.29	538.18	539.88	540.9	542.26	-0.02	-0.13	-0.03
Culvert Split	12636		539.23	540.15	541.54	537.54	539.24	540.05	541.52	0.01	-0.1	-0.02
Culvert Split	12587.1		538.60	539.76	541.2	536.91	538.61	539.67	541.19	0.01	-0.09	-0.01
Culvert Split	12538.2		537.96	539.37	540.87	536.27	537.97	539.29	540.86	0.01	-0.08	-0.01
Culvert Split	12489.3		537.32	538.98	540.53	535.63	537.33	538.91	540.53	0.01	-0.07	0
Culvert Split	12440.4		537.16	538.6	540.2	534.99	537.07	538.53	540.2	-0.09	-0.07	0
Culvert Split	12391.5		536.82	538.21	539.87	534.36	536.74	538.15	539.88	-0.08	-0.06	0.01
Culvert Split	12342.6		536.48	537.82	539.53	533.96	536.42	537.77	539.55	-0.06	-0.05	0.02
Culvert Split	12293.7		536.14	537.43	539.2	534.17	536.09	537.39	539.22	-0.05	-0.04	0.02
Culvert Split	12244.8		535.80	537.04	538.86	534.25	535.77	537.01	538.89	-0.03	-0.03	0.03
Culvert Split	12195.9		535.47	536.65	538.53	534.23	535.45	536.63	538.56	-0.02	-0.02	0.03
Culvert Split	12147		534.70	535.78	537.78	534.04	534.71	535.77	537.82	0.01	-0.01	0.04
Reach 2	12685		542.13	543.19	543.92	541	542.15	543.2	543.96	0.02	0.01	0.04

Revised Pre-Project HEC-RAS Results for Existing Land Use Conditions

		Effective FEMA				ESD Revised Pre-Project, Existing Land Use				Change in WS Elev from Effective		
Reach	River Sta	2-year WS Elev (ft)	10-year WS Elev (ft)	25-year WS Elev (ft)	100-year WS Elev (ft)	2-year WS Elev (ft)	10-year WS Elev (ft)	25-year WS Elev (ft)	100-year WS Elev (ft)	10-year (ft)	25-year (ft)	100-year (ft)
Reach 2	12636.0*		541.78	542.77	543.63	540.71	541.8	542.78	543.67	0.02	0.01	0.04
Reach 2	12587.1*		541.18	542.29	543.2	540.01	541.21	542.3	543.25	0.03	0.01	0.05
Reach 2	12538.2*		540.58	541.7	542.82	539.29	540.6	541.72	542.87	0.02	0.02	0.05
Reach 2	12489.3*		539.55	540.68	542.12	538.69	539.56	540.7	542.18	0.01	0.02	0.06
Reach 2	12440.4*		539.03	540.28	541.49	537.97	539.04	540.3	541.55	0.01	0.02	0.06
Reach 2	12391.5*		538.84	540.18	541.42	537.97	538.86	540.2	541.49	0.02	0.02	0.07
Reach 2	12342.6*		538.68	540.09	541.33	537.75	538.71	540.12	541.4	0.03	0.03	0.07
Reach 2	12293.7*		538.50	539.93	541.14	536.75	538.52	539.96	541.21	0.02	0.03	0.07
Reach 2	12244.8*		538.37	539.73	540.78	536.59	538.39	539.77	540.85	0.02	0.04	0.07
Reach 2	12195.9*		538.34	539.6	540.49	536.59	538.36	539.64	540.56	0.02	0.04	0.07
Reach 2	12147		538.33	539.47	540.32	536.59	538.34	539.53	540.41	0.01	0.06	0.09
Reach 3	12071		534.75	535.85	538.07	532.85	534.76	535.84	538.13	0.01	-0.01	0.06
Reach 3	11925		532.42	533.31	534.33	530.56	532.44	533.34	534.42	0.02	0.03	0.09
Reach 3	11657		528.44	529.31	530.45	526.98	528.44	529.35	530.54	0.00	0.04	0.09
Reach 3	11444		526.90	528.33	529.52	524.68	526.92	528.38	529.61	0.02	0.05	0.09
Reach 3	11338		526.41	527.98	529.15	523.94	526.43	528.03	529.25	0.02	0.05	0.1
Reach 3	11211		526.16	527.79	528.98	523.75	526.18	527.84	529.07	0.02	0.05	0.09
Reach 3	11160 LIVE OAK		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	11110		524.13	525.01	526.24	522.53	524.14	525.05	526.39	0.01	0.04	0.15
Reach 3	11001		521.91	522.74	523.83	520.93	522.64	523.54	524.79	0.73	0.8	0.96
Reach 3	10809		520.90	521.9	523.19	519.71	521.77	522.76	524.08	0.87	0.86	0.89
Reach 3	10618		519.53	520.58	521.96	517.28	519.56	520.49	521.53	0.03	-0.09	-0.43
Reach 3	10559		519.59	520.63	522.01	517.25	519.64	520.57	521.63	0.05	-0.06	-0.38
Reach 3	10530 JOHANNA		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	10502		519.30	520.49	521.96	516.34	518.65	519.99	521.43	-0.65	-0.5	-0.53
Reach 3	10412		516.72	517.83	519.18	513.72	516.66	517.61	519.03	-0.06	-0.22	-0.15
Reach 3	10284		516.93	517.85	518.66	513.35	516.85	517.8	518.67	-0.08	-0.05	0.01
Reach 3	10203		516.81	517.71	518.43	513.16	516.73	517.65	518.43	-0.08	-0.06	0
Reach 3	10171 MARY		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	10139		512.98	514.03	515.42	510.45	513.06	514.11	515.51	0.08	0.08	0.09
Reach 3	10067		512.66	513.8	515.13	509.87	512.8	513.91	515.25	0.14	0.11	0.12
Reach 3	9925		512.18	513.29	514.44	509.21	512.39	513.46	514.66	0.21	0.17	0.22
Reach 3	9840		511.74	512.82	513.72	508.58	511.89	512.92	513.78	0.15	0.1	0.06
Reach 3	9807 ANNIE		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	9774		509.56	510.67	512.15	507.55	509.7	510.77	512.28	0.14	0.1	0.13
Reach 3	9673		508.78	509.93	511.51	506.8	508.93	510.04	511.66	0.15	0.11	0.15
Reach 3	9537		508.18	509.25	510.82	506.36	508.33	509.37	510.95	0.15	0.12	0.13
Reach 3	9348		507.54	508.57	510.22	505.9	507.69	508.69	510.36	0.15	0.12	0.14
Reach 3	9156		506.04	506.47	507.04	505.15	506.2	506.58	507.26	0.16	0.11	0.22
Reach 3	9081		506.17	506.71	507.53	505.16	506.31	506.81	507.71	0.14	0.1	0.18
Reach 3	9052 MONROE		Bridge	Bridge	Bridge	Bridge	Bridge	Bridge	Bridge			
Reach 3	9024		503.81	505	506.44	501.66	504.14	505.25	506.71	0.33	0.25	0.27
Reach 3	8942		501.63	502.78	503.83	499.93	501.92	502.97	504	0.29	0.19	0.17
Reach 3	8857		500.39	501.52	503.06	498.11	500.69	501.77	503.28	0.30	0.25	0.22
Reach 3	8764		500.19	501.37	502.87	497.9	500.5	501.62	503.06	0.31	0.25	0.19

Revised Pre-Project HEC-RAS Results for Existing Land Use Conditions

		Effective FEMA				ESD Revised Pre-Project, Existing Land Use				Change in WS Elev from Effective		
Reach	River Sta	2-year WS Elev (ft)	10-year WS Elev (ft)	25-year WS Elev (ft)	100-year WS Elev (ft)	2-year WS Elev (ft)	10-year WS Elev (ft)	25-year WS Elev (ft)	100-year WS Elev (ft)	10-year (ft)	25-year (ft)	100-year (ft)
Reach 3	8722 ELIZABETH		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	8679		498.11	499.04	501	496.54	498.35	499.25	501.32	0.24	0.21	0.32
Reach 3	8591		496.74	497.56	498.64	494.86	497	497.74	498.83	0.26	0.18	0.19
Reach 3	8373		494.17	495.36	496.75	492.76	494.44	495.65	496.97	0.27	0.29	0.22
Reach 3	8244		492.56	494.5	495.94	490.2	493.05	494.88	496.12	0.49	0.38	0.18
Reach 3	8022		491.94	494.13	495.52	488.67	492.51	494.53	495.67	0.57	0.4	0.15
Reach 3	7832		491.53	493.91	495.33	488.02	492.14	494.33	495.47	0.61	0.42	0.14
Reach 3	7780		491.55	493.92	495.34	488.06	492.16	494.34	495.48	0.61	0.42	0.14
Reach 3	7742 SOUTH FIRST STR		Bridge	Bridge	Bridge	Bridge	Bridge	Bridge	Bridge			
Reach 3	7704		486.48	487.5	488.86	484.89	486.76	487.71	489.11	0.28	0.21	0.25
Reach 3	7609		483.75	484.5	485.47	482.53	483.94	484.65	485.66	0.19	0.15	0.19
Reach 3	7393		480.66	481.41	482.54	479.44	480.85	481.62	482.76	0.19	0.21	0.22
Reach 3	7126		467.08	467.99	469.44	464.85	467.06	467.9	469.48	-0.02	-0.09	0.04
Reach 3	6915		465.00	465.8	467.16	463.1	464.98	465.73	467.22	-0.02	-0.07	0.06
Reach 3	6735		464.32	465.29	466.88	461.98	464.3	465.2	466.95	-0.02	-0.09	0.07
Reach 3	6568		463.21	464.11	465.58	460.93	463.19	464.03	465.64	-0.02	-0.08	0.06
Reach 3	6418		461.99	462.83	464.24	459.95	461.97	462.75	464.3	-0.02	-0.08	0.06
Reach 3	6253		459.43	459.93	460.68	457.93	459.42	459.88	460.72	-0.01	-0.05	0.04
Reach 3	6124		458.68	459.18	460.01	457.19	458.68	459.15	460.05	0.00	-0.03	0.04
Reach 3	5916		456.55	457.2	458.29	454.94	456.51	457.11	458.27	-0.04	-0.09	-0.02
Reach 3	5717		455.97	456.68	457.83	454.14	455.9	456.56	457.79	-0.07	-0.12	-0.04
Reach 3	5591		455.06	455.77	456.91	453.23	454.92	455.56	456.77	-0.14	-0.21	-0.14
Reach 3	5415		454.20	454.89	456	452.49	454.2	454.85	456.11	0.00	-0.04	0.11
Reach 3	5247		453.66	454.4	455.58	451.93	453.64	454.33	455.63	-0.02	-0.07	0.05
Reach 3	5129		453.34	454.11	455.33	451.41	453.32	454.04	455.38	-0.02	-0.07	0.05
Reach 3	4941		452.89	453.68	454.95	450.84	452.87	453.61	455	-0.02	-0.07	0.05
Reach 3	4822		452.05	452.72	453.79	450.23	452.03	452.66	453.83	-0.02	-0.06	0.04
Reach 3	4781		451.47	452.03	452.9	449.86	451.45	451.98	452.92	-0.02	-0.05	0.02
Reach 3	4735		451.33	451.91	452.82	449.72	451.31	451.86	452.84	-0.02	-0.05	0.02
Reach 3	4655		451.35	451.95	452.93	449.67	451.33	451.9	452.96	-0.02	-0.05	0.03
Reach 3	4625		451.02	451.59	452.51	449.4	451	451.54	452.53	-0.02	-0.05	0.02
Reach 3	4608		450.62	451.16	452	449.09	450.6	451.11	451.99	-0.02	-0.05	-0.01
Reach 3	4593		450.37	450.91	451.75	448.83	450.35	450.86	451.72	-0.02	-0.05	-0.03
Reach 3	4571		450.32	450.89	451.78	448.71	450.3	450.84	451.75	-0.02	-0.05	-0.03
Reach 3	4545		450.33	450.92	451.86	448.65	450.31	450.87	451.84	-0.02	-0.05	-0.02
Reach 3	4477		449.95	450.52	451.41	447.35	449.93	450.47	451.34	-0.02	-0.05	-0.07
Reach 3	4476		Lat Struct	Lat Struct	Lat Struct	Lat Struct	Lat Struct	Lat Struct	Lat Struct			
Reach 3	4415		450.12	450.74	451.72	447.28	450.1	450.69	451.67	-0.02	-0.05	-0.05
Reach 3	4220		450.00	450.59	451.53	447.01	449.98	450.54	451.47	-0.02	-0.05	-0.06
Reach 3	4022		449.76	450.29	451.11	446.7	449.74	450.25	451.04	-0.02	-0.04	-0.07
Reach 3	3855		449.67	450.21	451.05	446.58	449.65	450.16	450.96	-0.02	-0.05	-0.09
Reach 3	3817 SOUTH FIRST STR		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	3779		448.08	448.36	449.34	445.29	448.07	448.33	448.8	-0.01	-0.03	-0.54
Reach 3	3778		Lat Struct	Lat Struct	Lat Struct	Lat Struct	Lat Struct	Lat Struct	Lat Struct			
Reach 3	3631		446.00	446.86	449.22	444.45	445.97	446.78	448.52	-0.03	-0.08	-0.7

Revised Pre-Project HEC-RAS Results for Existing Land Use Conditions

		Effective FEMA				ESD Revised Pre-Project, Existing Land Use				Change in WS Elev from Effective		
Reach	River Sta	2-year WS Elev (ft)	10-year WS Elev (ft)	25-year WS Elev (ft)	100-year WS Elev (ft)	2-year WS Elev (ft)	10-year WS Elev (ft)	25-year WS Elev (ft)	100-year WS Elev (ft)	10-year (ft)	25-year (ft)	100-year (ft)
Reach 3	3454		445.71	446.65	449.15	444.2	445.68	446.56	448.41	-0.03	-0.09	-0.74
Reach 3	3231		445.24	446.4	449.09	442.74	445.2	446.29	448.3	-0.04	-0.11	-0.79
Reach 3	2977		444.90	446.13	448.94	442.22	444.86	446.02	448.09	-0.04	-0.11	-0.85
Reach 3	2773		444.74	446.04	448.92	441.71	444.7	445.93	448.05	-0.04	-0.11	-0.87
Reach 3	2707		444.75	446.04	448.91	441.72	444.7	445.93	448.04	-0.05	-0.11	-0.87
Reach 3	2629		444.46	445.74	448.65	441.54	444.42	445.63	447.71	-0.04	-0.11	-0.94
Reach 3	2539 CONGRESS AVENUE		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	2447		442.60	443.21	443.82	441.1	443	443.49	444.31	0.40	0.28	0.49
Reach 3	2362		441.84	442.44	443.04	440.4	442.24	442.73	443.49	0.40	0.29	0.45
Reach 3	2257		440.98	441.61	442.24	439.41	441.41	441.94	442.73	0.43	0.33	0.49
Reach 3	2001		439.31	440	440.77	437.66	439.81	440.55	441.4	0.50	0.55	0.63
Reach 3	1823		438.48	439.18	440.05	436.85	439.03	439.9	440.77	0.55	0.72	0.72
Reach 3	1534		437.71	438.51	439.49	435.97	438.34	439.33	440.29	0.63	0.82	0.8
Reach 3	1327		436.36	437.38	438.55	433.42	437.18	438.39	439.48	0.82	1.01	0.93
Reach 3	1116		435.30	436.14	437.2	433.08	435.97	437.03	438.22	0.67	0.89	1.02
Reach 3	1036 RIVERSIDE		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	956		433.76	434.3	434.89	432.33	434.19	434.8	435.41	0.43	0.5	0.52
Reach 3	682		433.14	433.68	434.28	431.74	433.57	434.18	434.81	0.43	0.5	0.53

Revised Pre-Project HEC-RAS Results for Ultimate Development Land Use Conditions

		Effective FEMA				ESD Revised Pre-Project, Ultimate Land Use				Change in WS Elev from Effective		
Reach	River Sta	2-year WS Elev (ft)	10-year WS Elev (ft)	25-year WS Elev (ft)	100-year WS Elev (ft)	2-year WS Elev (ft)	10-year WS Elev (ft)	25-year WS Elev (ft)	100-year WS Elev (ft)	10-year (ft)	25-year (ft)	100-year (ft)
Reach 1	19568	2-year WS Elev Not Included in Effective FEMA study	654.72	654.86	655.07	654.44	654.73	654.87	655.08	0.01	0.01	0.01
Reach 1	19532		653.74	653.89	654.09	653.47	653.75	653.89	654.1	0.01	0	0.01
Reach 1	19488		652.06	652.23	652.47	651.72	652.07	652.24	652.48	0.01	0.01	0.01
Reach 1	19445		650.57	650.75	650.95	650.17	650.57	650.75	651.04	0.00	0	0.09
Reach 1	19401		648.46	648.63	648.85	648.13	648.47	648.64	648.86	0.01	0.01	0.01
Reach 1	19334		643.27	643.44	643.67	642.94	643.28	643.44	643.68	0.01	0	0.01
Reach 1	19312 FORT MCGRUDER		Inl Struct	Inl Struct	Inl Struct	Inl Struct	Inl Struct	Inl Struct	Inl Struct			
Reach 1	19291		639.92	640.18	640.52	639.39	639.94	640.19	640.54	0.02	0.01	0.02
Reach 1	19219		636.62	636.97	637.39	635.94	636.65	636.98	637.4	0.03	0.01	0.01
Reach 1	19146		635.02	635.38	635.84	634.29	635.04	635.39	635.85	0.02	0.01	0.01
Reach 1	19001		630.08	630.41	630.89	629.42	630.1	630.41	630.91	0.02	0	0.02
Reach 1	18835		626.36	626.7	627.15	625.67	626.38	626.71	627.17	0.02	0.01	0.02
Reach 1	18655		620.32	620.55	620.89	619.69	620.33	620.56	620.9	0.01	0.01	0.01
Reach 1	18497		618.56	618.98	619.48	617.59	618.59	618.99	619.5	0.03	0.01	0.02
Reach 1	18372		617.82	618.29	618.88	616.69	617.85	618.31	618.89	0.03	0.02	0.01
Reach 1	18235		617.80	618.27	618.85	616.68	617.83	618.28	618.86	0.03	0.01	0.01
Reach 1	18206		617.80	618.27	618.85	616.68	617.83	618.28	618.86	0.03	0.01	0.01
Reach 1	18167		617.67	618.09	618.6	616.61	617.7	618.1	618.61	0.03	0.01	0.01
Reach 1	18096		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 1	18025		614.44	614.73	615.16	613.74	614.42	614.71	615.17	-0.02	-0.02	0.01
Reach 1	17964		614.46	614.76	615.2	613.76	614.44	614.74	615.21	-0.02	-0.02	0.01
Reach 1	17923		614.46	614.76	615.19	613.76	614.44	614.74	615.21	-0.02	-0.02	0.02
Reach 1	17827		614.46	614.76	615.19	613.76	614.44	614.74	615.21	-0.02	-0.02	0.02
Reach 1	17814 DETENTION BASIN		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 1	17796		609.45	609.84	610.22	608.1	609.47	609.84	610.22	0.02	0	0
Reach 1	17781		609.38	609.78	610.15	607.92	609.41	609.79	610.16	0.03	0.01	0.01
Reach 1	17771		609.45	609.87	610.28	608	609.47	609.87	610.28	0.02	0	0
Reach 1	17744 ALPINE		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 1	17716		608.25	608.74	609.33	607.22	608.26	608.75	609.35	0.01	0.01	0.02
Reach 1	17646		605.83	606.24	606.77	604.82	605.84	606.26	606.78	0.01	0.02	0.01
Reach 1	17501		603.46	603.87	604.44	602.44	603.47	603.86	604.45	0.01	-0.01	0.01
Reach 1	17305		601.13	601.74	602.39	599.72	601.14	601.77	602.4	0.01	0.03	0.01
Reach 1	17192		599.56	600.14	601.1	598.17	599.56	600.18	601.12	0.00	0.04	0.02
Reach 1	17106		599.01	599.21	599.81	596.87	599.02	599.26	599.83	0.01	0.05	0.02
Reach 1	17070 LIGHTSEY		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 1	17034		596.02	596.73	597.65	594.16	596.01	596.77	597.68	-0.01	0.04	0.03
Reach 1	17014		594.43	595.19	596.24	592.94	594.43	595.23	596.27	0.00	0.04	0.03
Reach 1	17010		593.84	594.77	596.04	591.9	593.85	594.82	596.07	0.01	0.05	0.03
Reach 1	16967		593.23	594.08	595.29	591.44	593.24	594.12	595.33	0.01	0.04	0.04
Reach 1	16797		590.74	591.55	592.59	588.95	590.75	591.59	592.62	0.01	0.04	0.03
Reach 1	16639		589.39	590.01	590.72	587.66	589.39	590.02	590.74	0.00	0.01	0.02
Reach 1	16447		586.83	587.48	588.32	585.34	586.82	587.48	588.34	-0.01	0	0.02
Reach 1	16323		585.23	585.97	586.77	583.55	585.22	585.98	586.79	-0.01	0.01	0.02
Reach 1	16124		584.17	585.08	586.02	582.1	584.15	585.08	586.04	-0.02	0	0.02
Reach 1	16056		583.48	584.39	585.34	581.28	583.46	584.39	585.37	-0.02	0	0.03
Reach 1	16030 HAVANA		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			

Revised Pre-Project HEC-RAS Results for Ultimate Development Land Use Conditions

		Effective FEMA				ESD Revised Pre-Project, Ultimate Land Use				Change in WS Elev from Effective		
Reach	**River Sta**	**2-year WS Elev (ft)**	**10-year WS Elev (ft)**	**25-year WS Elev (ft)**	**100-year WS Elev (ft)**	**2-year WS Elev (ft)**	**10-year WS Elev (ft)**	**25-year WS Elev (ft)**	**100-year WS Elev (ft)**	**10-year (ft)**	**25-year (ft)**	**100-year (ft)**
Reach 1	16003		582.30	583.01	583.82	580.66	582.29	583.02	583.84	-0.01	0.01	0.02
Reach 1	15893		579.72	580.4	581.27	578.22	579.71	580.41	581.3	-0.01	0.01	0.03
Reach 1	15734		578.15	578.8	579.62	576.62	578.14	578.81	579.64	-0.01	0.01	0.02
Reach 1	15547		575.95	576.55	577.32	574.59	575.94	576.56	577.34	-0.01	0.01	0.02
Reach 1	15330		573.86	574.72	575.67	572.19	573.84	574.72	575.69	-0.02	0	0.02
Reach 1	15107		571.23	572.46	573.12	569.28	571.21	572.47	573.13	-0.02	0.01	0.01
Reach 1	15022		571.11	572.45	573.24	568.45	571.09	572.46	573.24	-0.02	0.01	0
Reach 1	14950		570.90	572.22	572.97	568.15	570.87	572.23	572.98	-0.03	0.01	0.01
Reach 1	14918 EL PASO		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 1	14885		567.69	568.33	569.15	566.29	567.68	568.34	569.17	-0.01	0.01	0.02
Reach 1	14794		566.45	567.17	568.11	564.81	566.44	567.18	568.13	-0.01	0.01	0.02
Reach 1	14628		564.03	564.67	565.4	562.57	564.02	564.67	565.42	-0.01	0	0.02
Reach 1	14471		563.12	563.45	564.1	560.92	563.1	563.46	564.12	-0.02	0.01	0.02
Reach 1	14363		562.88	563.1	563.72	559.62	562.87	563.11	563.75	-0.01	0.01	0.03
Reach 1	14298		562.79	562.95	563.55	559.38	562.78	562.96	563.59	-0.01	0.01	0.04
Reach 1	14252 CUMBERLAND		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 1	14206		557.21	558.46	560.09	555.44	557.23	558.51	560.23	0.02	0.05	0.14
Reach 1	14096		556.24	557.4	559.01	554.29	556.25	557.45	559.14	0.01	0.05	0.13
Reach 1	13965		555.18	556.4	558.05	553.13	555.2	556.45	558.17	0.02	0.05	0.12
Reach 1	13818		553.99	555.21	556.86	551.89	554	555.26	556.98	0.01	0.05	0.12
Reach 1	13624		552.37	553.61	555.37	550.22	552.38	553.65	555.52	0.01	0.04	0.15
Reach 1	13539		550.94	552.06	553.86	548.93	550.93	552.07	554.01	-0.01	0.01	0.15
Reach 1	13477		550.29	551.34	553.06	548.37	550.27	551.33	553.2	-0.02	-0.01	0.14
Reach 1	13462 PEDESTRIAN BRID		Bridge	Bridge	Bridge	Bridge	Bridge	Bridge	Bridge			
Reach 1	13447		549.56	550.48	551.75	547.8	549.54	550.48	551.76	-0.02	0	0.01
Reach 1	13393		549.24	550.21	551.59	547.45	549.25	550.25	551.65	0.01	0.04	0.06
Reach 1	13268		548.09	549.01	550.48	546.33	548.11	549.05	550.37	0.02	0.04	-0.11
Reach 1	13058		546.45	546.94	547.34	545.13	546.46	546.95	547.68	0.01	0.01	0.34
Reach 1	13056 LOW WATER CROSS		Inl Struct	Inl Struct	Inl Struct	Inl Struct	Inl Struct	Inl Struct	Inl Struct			
Reach 1	12945		545.06	545.5	546.63	543.21	545.06	545.52	546.73	0.00	0.02	0.1
Reach 1	12812		542.68	544.17	545.15	540.99	542.72	544.19	545.21	0.04	0.02	0.06
Culvert Split	12685		539.90	541.03	542.29	538.18	539.88	540.9	542.26	-0.02	-0.13	-0.03
Culvert Split	12636		539.23	540.15	541.54	537.54	539.24	540.05	541.52	0.01	-0.1	-0.02
Culvert Split	12587.1		538.60	539.76	541.2	536.91	538.61	539.67	541.19	0.01	-0.09	-0.01
Culvert Split	12538.2		537.96	539.37	540.87	536.27	537.97	539.29	540.86	0.01	-0.08	-0.01
Culvert Split	12489.3		537.32	538.98	540.53	535.63	537.33	538.91	540.53	0.01	-0.07	0
Culvert Split	12440.4		537.16	538.6	540.2	534.99	537.07	538.53	540.2	-0.09	-0.07	0
Culvert Split	12391.5		536.82	538.21	539.87	534.36	536.74	538.15	539.88	-0.08	-0.06	0.01
Culvert Split	12342.6		536.48	537.82	539.53	533.96	536.42	537.77	539.55	-0.06	-0.05	0.02
Culvert Split	12293.7		536.14	537.43	539.2	534.17	536.09	537.39	539.22	-0.05	-0.04	0.02
Culvert Split	12244.8		535.80	537.04	538.86	534.25	535.77	537.01	538.89	-0.03	-0.03	0.03
Culvert Split	12195.9		535.47	536.65	538.53	534.23	535.45	536.63	538.56	-0.02	-0.02	0.03
Culvert Split	12147		534.70	535.78	537.78	534.04	534.71	535.77	537.82	0.01	-0.01	0.04
Reach 2	12685		542.13	543.19	543.92	541	542.15	543.2	543.96	0.02	0.01	0.04
Reach 2	12636.0*		541.78	542.77	543.63	540.71	541.8	542.78	543.67	0.02	0.01	0.04
Reach 2	12587.1*		541.18	542.29	543.2	540.01	541.21	542.3	543.25	0.03	0.01	0.05

Revised Pre-Project HEC-RAS Results for Ultimate Development Land Use Conditions

Reach	River Sta	Effective FEMA				ESD Revised Pre-Project, Ultimate Land Use				Change in WS Elev from Effective		
		2-year WS Elev (ft)	10-year WS Elev (ft)	25-year WS Elev (ft)	100-year WS Elev (ft)	2-year WS Elev (ft)	10-year WS Elev (ft)	25-year WS Elev (ft)	100-year WS Elev (ft)	10-year (ft)	25-year (ft)	100-year (ft)
Reach 2	12538.2*		540.58	541.7	542.82	539.29	540.6	541.72	542.87	0.02	0.02	0.05
Reach 2	12489.3*		539.55	540.68	542.12	538.69	539.56	540.7	542.18	0.01	0.02	0.06
Reach 2	12440.4*		539.03	540.28	541.49	537.97	539.04	540.3	541.55	0.01	0.02	0.06
Reach 2	12391.5*		538.84	540.18	541.42	537.97	538.86	540.2	541.49	0.02	0.02	0.07
Reach 2	12342.6*		538.68	540.09	541.33	537.75	538.71	540.12	541.4	0.03	0.03	0.07
Reach 2	12293.7*		538.50	539.93	541.14	536.75	538.52	539.96	541.21	0.02	0.03	0.07
Reach 2	12244.8*		538.37	539.73	540.78	536.59	538.39	539.77	540.85	0.02	0.04	0.07
Reach 2	12195.9*		538.34	539.6	540.49	536.59	538.36	539.64	540.56	0.02	0.04	0.07
Reach 2	12147		538.33	539.47	540.32	536.59	538.34	539.53	540.41	0.01	0.06	0.09
Reach 3	12071		534.75	535.85	538.07	532.85	534.76	535.84	538.13	0.01	-0.01	0.06
Reach 3	11925		532.42	533.31	534.33	530.56	532.44	533.34	534.42	0.02	0.03	0.09
Reach 3	11657		528.44	529.31	530.45	526.98	528.44	529.35	530.54	0.00	0.04	0.09
Reach 3	11444		526.90	528.33	529.52	524.68	526.92	528.38	529.61	0.02	0.05	0.09
Reach 3	11338		526.41	527.98	529.15	523.94	526.43	528.03	529.25	0.02	0.05	0.1
Reach 3	11211		526.16	527.79	528.98	523.75	526.18	527.84	529.07	0.02	0.05	0.09
Reach 3	11160 LIVE OAK		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	11110		524.13	525.01	526.24	522.53	524.14	525.05	526.39	0.01	0.04	0.15
Reach 3	11001		521.91	522.74	523.83	521	522.69	523.58	524.83	0.78	0.84	1
Reach 3	10809		520.90	521.9	523.19	519.81	521.82	522.8	524.11	0.92	0.9	0.92
Reach 3	10618		519.53	520.58	521.96	517.41	519.62	520.52	521.55	0.09	-0.06	-0.41
Reach 3	10559		519.59	520.63	522.01	517.38	519.69	520.6	521.65	0.10	-0.03	-0.36
Reach 3	10530 JOHANNA		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	10502		519.30	520.49	521.96	516.45	518.72	520.03	521.47	-0.58	-0.46	-0.49
Reach 3	10412		516.72	517.83	519.18	513.84	516.73	517.68	519.06	0.01	-0.15	-0.12
Reach 3	10284		516.93	517.85	518.66	513.54	516.92	517.84	518.7	-0.01	-0.01	0.04
Reach 3	10203		516.81	517.71	518.43	513.36	516.8	517.68	518.46	-0.01	-0.03	0.03
Reach 3	10171 MARY		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	10139		512.98	514.03	515.42	511.39	513.14	514.14	515.55	0.16	0.11	0.13
Reach 3	10067		512.66	513.8	515.13	511.12	512.88	513.95	515.29	0.22	0.15	0.16
Reach 3	9925		512.18	513.29	514.44	510.86	512.47	513.5	514.69	0.29	0.21	0.25
Reach 3	9840		511.74	512.82	513.72	510.62	511.97	512.94	513.81	0.23	0.12	0.09
Reach 3	9807 ANNIE		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	9774		509.56	510.67	512.15	507.68	509.78	510.83	512.33	0.22	0.16	0.18
Reach 3	9673		508.78	509.93	511.51	506.94	509.01	510.1	511.71	0.23	0.17	0.2
Reach 3	9537		508.18	509.25	510.82	506.5	508.4	509.42	511	0.22	0.17	0.18
Reach 3	9348		507.54	508.57	510.22	506.03	507.76	508.75	510.41	0.22	0.18	0.19
Reach 3	9156		506.04	506.47	507.04	505.24	506.23	506.6	507.28	0.19	0.13	0.24
Reach 3	9081		506.17	506.71	507.53	505.26	506.35	506.83	507.74	0.18	0.12	0.21
Reach 3	9052 MONROE		Bridge	Bridge	Bridge	Bridge	Bridge	Bridge	Bridge			
Reach 3	9024		503.81	505	506.44	501.78	504.23	505.3	506.76	0.42	0.3	0.32
Reach 3	8942		501.63	502.78	503.83	500.08	502	503.01	504.02	0.37	0.23	0.19
Reach 3	8857		500.39	501.52	503.06	498.31	500.78	501.83	503.32	0.39	0.31	0.26
Reach 3	8764		500.19	501.37	502.87	498.07	500.59	501.68	503.1	0.40	0.31	0.23
Reach 3	8722 ELIZABETH		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	8679		498.11	499.04	501	496.65	498.42	499.3	501.32	0.31	0.26	0.32
Reach 3	8591		496.74	497.56	498.64	495.01	497.05	497.77	498.86	0.31	0.21	0.22

Revised Pre-Project HEC-RAS Results for Ultimate Development Land Use Conditions

		Effective FEMA				ESD Revised Pre-Project, Ultimate Land Use				Change in WS Elev from Effective		
Reach	River Sta	2-year WS Elev (ft)	10-year WS Elev (ft)	25-year WS Elev (ft)	100-year WS Elev (ft)	2-year WS Elev (ft)	10-year WS Elev (ft)	25-year WS Elev (ft)	100-year WS Elev (ft)	10-year (ft)	25-year (ft)	100-year (ft)
Reach 3	8373		494.17	495.36	496.75	492.9	494.51	495.73	497	0.34	0.37	0.25
Reach 3	8244		492.56	494.5	495.94	490.3	493.19	494.97	496.15	0.63	0.47	0.21
Reach 3	8022		491.94	494.13	495.52	488.89	492.68	494.62	495.69	0.74	0.49	0.17
Reach 3	7832		491.53	493.91	495.33	488.25	492.31	494.43	495.5	0.78	0.52	0.17
Reach 3	7780		491.55	493.92	495.34	488.29	492.34	494.44	495.5	0.79	0.52	0.16
Reach 3	7742 SOUTH FIRST STR		Bridge	Bridge	Bridge	Bridge	Bridge	Bridge	Bridge			
Reach 3	7704		486.48	487.5	488.86	485.01	486.82	487.76	489.17	0.34	0.26	0.31
Reach 3	7609		483.75	484.5	485.47	482.61	483.99	484.69	485.69	0.24	0.19	0.22
Reach 3	7393		480.66	481.41	482.54	479.54	480.9	481.66	482.79	0.24	0.25	0.25
Reach 3	7126		467.08	467.99	469.44	465	467.17	467.97	469.54	0.09	-0.02	0.1
Reach 3	6915		465.00	465.8	467.16	463.24	465.08	465.79	467.28	0.08	-0.01	0.12
Reach 3	6735		464.32	465.29	466.88	462.14	464.41	465.28	467.01	0.09	-0.01	0.13
Reach 3	6568		463.21	464.11	465.58	461.1	463.29	464.1	465.7	0.08	-0.01	0.12
Reach 3	6418		461.99	462.83	464.24	460.1	462.07	462.82	464.34	0.08	-0.01	0.1
Reach 3	6253		459.43	459.93	460.68	458.05	459.48	459.92	460.76	0.05	-0.01	0.08
Reach 3	6124		458.68	459.18	460.01	457.31	458.74	459.19	460.08	0.06	0.01	0.07
Reach 3	5916		456.55	457.2	458.29	455.05	456.58	457.16	458.32	0.03	-0.04	0.03
Reach 3	5717		455.97	456.68	457.83	454.27	455.99	456.61	457.83	0.02	-0.07	0
Reach 3	5591		455.06	455.77	456.91	453.36	455	455.62	456.82	-0.06	-0.15	-0.09
Reach 3	5415		454.20	454.89	456	452.61	454.28	454.91	456.15	0.08	0.02	0.15
Reach 3	5247		453.66	454.4	455.58	452.05	453.73	454.39	455.68	0.07	-0.01	0.1
Reach 3	5129		453.34	454.11	455.33	451.55	453.42	454.1	455.43	0.08	-0.01	0.1
Reach 3	4941		452.89	453.68	454.95	450.99	452.96	453.67	455.05	0.07	-0.01	0.1
Reach 3	4822		452.05	452.72	453.79	450.36	452.11	452.72	453.88	0.06	0	0.09
Reach 3	4781		451.47	452.03	452.9	449.98	451.52	452.03	452.95	0.05	0	0.05
Reach 3	4735		451.33	451.91	452.82	449.83	451.39	451.9	452.87	0.06	-0.01	0.05
Reach 3	4655		451.35	451.95	452.93	449.79	451.4	451.95	453	0.05	0	0.07
Reach 3	4625		451.02	451.59	452.51	449.51	451.07	451.59	452.56	0.05	0	0.05
Reach 3	4608		450.62	451.16	452	449.19	450.67	451.16	452.02	0.05	0	0.02
Reach 3	4593		450.37	450.91	451.75	448.92	450.42	450.9	451.75	0.05	-0.01	0
Reach 3	4571		450.32	450.89	451.78	448.8	450.38	450.88	451.78	0.06	-0.01	0
Reach 3	4545		450.33	450.92	451.86	448.74	450.38	450.91	451.87	0.05	-0.01	0.01
Reach 3	4477		449.95	450.52	451.41	447.43	450.01	450.52	451.37	0.06	0	-0.04
Reach 3	4476		Lat Struct	Lat Struct	Lat Struct	Lat Struct	Lat Struct	Lat Struct	Lat Struct			
Reach 3	4415		450.12	450.74	451.72	447.44	450.18	450.73	451.7	0.06	-0.01	-0.02
Reach 3	4220		450.00	450.59	451.53	447.18	450.05	450.58	451.5	0.05	-0.01	-0.03
Reach 3	4022		449.76	450.29	451.11	446.88	449.81	450.29	451.06	0.05	0	-0.05
Reach 3	3855		449.67	450.21	451.05	446.75	449.73	450.2	450.99	0.06	-0.01	-0.06
Reach 3	3817 SOUTH FIRST STR		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	3779		448.08	448.36	449.34	445.42	448.11	448.36	448.82	0.03	0	-0.52
Reach 3	3778		Lat Struct	Lat Struct	Lat Struct	Lat Struct	Lat Struct	Lat Struct	Lat Struct			
Reach 3	3631		446.00	446.86	449.22	444.59	446.07	446.85	448.6	0.07	-0.01	-0.62
Reach 3	3454		445.71	446.65	449.15	444.33	445.79	446.64	448.49	0.08	-0.01	-0.66
Reach 3	3231		445.24	446.4	449.09	442.88	445.34	446.38	448.4	0.10	-0.02	-0.69
Reach 3	2977		444.90	446.13	448.94	442.39	445.01	446.12	448.19	0.11	-0.01	-0.75
Reach 3	2773		444.74	446.04	448.92	441.91	444.86	446.02	448.15	0.12	-0.02	-0.77

Revised Pre-Project HEC-RAS Results for Ultimate Development Land Use Conditions

		Effective FEMA				ESD Revised Pre-Project, Ultimate Land Use				Change in WS Elev from Effective		
Reach	**River Sta**	**2-year WS Elev (ft)**	**10-year WS Elev (ft)**	**25-year WS Elev (ft)**	**100-year WS Elev (ft)**	**2-year WS Elev (ft)**	**10-year WS Elev (ft)**	**25-year WS Elev (ft)**	**100-year WS Elev (ft)**	**10-year (ft)**	**25-year (ft)**	**100-year (ft)**
Reach 3	2707		444.75	446.04	448.91	441.92	444.86	446.02	448.14	0.11	-0.02	-0.77
Reach 3	2629		444.46	445.74	448.65	441.74	444.58	445.72	447.81	0.12	-0.02	-0.84
Reach 3	2539 CONGRESS AVENUE		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	2447		442.60	443.21	443.82	441.25	443.09	443.53	444.35	0.49	0.32	0.53
Reach 3	2362		441.84	442.44	443.04	440.55	442.32	442.78	443.53	0.48	0.34	0.49
Reach 3	2257		440.98	441.61	442.24	439.57	441.5	441.99	442.77	0.52	0.38	0.53
Reach 3	2001		439.31	440	440.77	437.82	439.92	440.62	441.48	0.61	0.62	0.71
Reach 3	1823		438.48	439.18	440.05	437	439.15	439.99	440.86	0.67	0.81	0.81
Reach 3	1534		437.71	438.51	439.49	436.11	438.47	439.42	440.39	0.76	0.91	0.9
Reach 3	1327		436.36	437.38	438.55	433.67	437.34	438.5	439.58	0.98	1.12	1.03
Reach 3	1116		435.30	436.14	437.2	433.29	436.11	437.15	438.33	0.81	1.01	1.13
Reach 3	1036 RIVERSIDE		Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert			
Reach 3	956		433.76	434.3	434.89	432.48	434.28	434.86	435.47	0.52	0.56	0.58
Reach 3	682		433.14	433.68	434.28	431.88	433.66	434.25	434.87	0.52	0.57	0.59

Exhibit J.5

Flood Early Warning System Data

FEWS Data Analysis

Corresponding RAS Station: **7780**

FEWS Data: 08157600 - CEB

Time and Date	8157600 Level_FT Max	08157600_Q Level_Qual Qual	8157600 Rain_IN Total	08157600_Q Rain_Qual Qual	Approximate Return Period*
7/27/2005	4.97	1	2.90	76	
7/2/2002	4.72	1	2.95	104	
10/6/1998	5.43	5	3.05	10	2-year
9/12/2009	7.67	10	3.13	133	2-year
2/20/2003	4.43	1	3.23	76	2-year
6/9/1997	6.19	5	3.28	76	2-year
11/2/2000	6.14	1	3.72	76	2-year
6/9/2004	5.58	1	3.82	76	2-year
8/30/2001	5.08	1	3.87	76	2-year
9/7/2010	6.3	1	4.86	1	5-year
10/17/1998	7.01	5	6.55	76	10-year

*Approximate return period determined by comparison to DCM Table 2-3

COA Drainage Criteria Manual Table 2-3

Return Period	24-hour Rinfall Depth IN
2-year	3.44
5-year	4.99
10-year	6.10
25-year	7.64
50-year	8.87
100-year	10.20
500-year	13.50

Depth Data for Revised Pre-project RAS Model with Existing Land Use
Station 7780

Return Period	WS Elev	Channel Bottom Elev	Depth FT
2-year	488.06	479.02	9.04
10-year	492.12	479.02	13.10
25-year	494.50	479.02	15.48
100-year	495.48	479.02	16.46

Depth Data for Revised Pre-project RAS Model with Ultimate Development Land Use
Station 7780

Return Period	WS Elev	Channel Bottom Elev	Depth FT
2-year	488.28	479.02	9.26
10-year	492.30	479.02	13.28
25-year	494.50	479.02	15.48
100-year	495.49	479.02	16.47

Depth Data for Effective FEMA Model
Station 7780

Return Period	WS Elev	Channel Bottom Elev	Depth FT
10-year	491.55	479.02	12.53
25-year	493.92	479.02	14.90
50-year	494.91	479.02	15.89
100-year	495.34	479.02	16.32
500-year	496.04	479.02	17.02

Appendix K –
Proposed Alternative 1
Storm Drain System

Exhibit K.1

Map of Proposed Inlet Drainage Areas

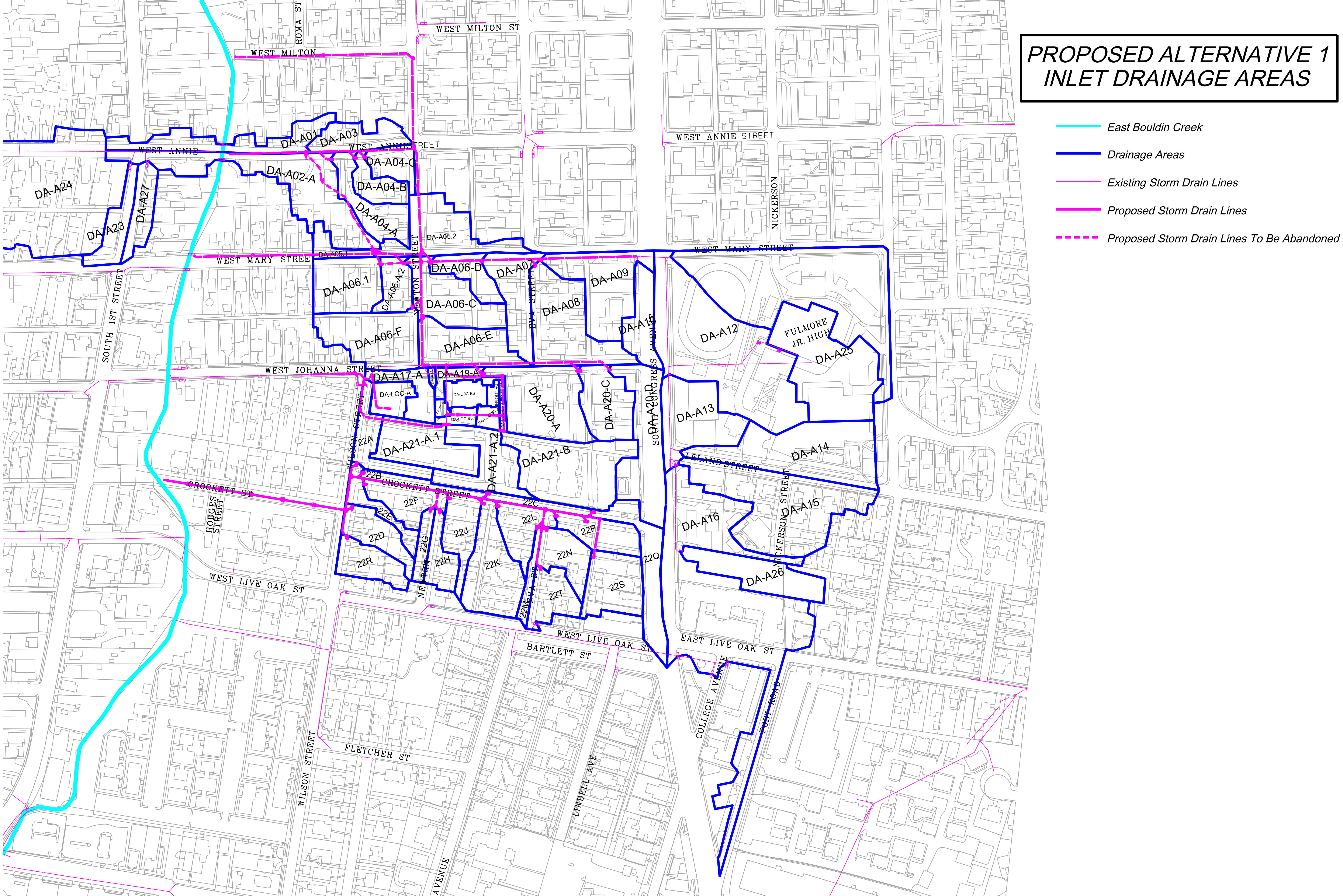

PROPOSED ALTERNATIVE 1
INLET DRAINAGE AREAS
East Bouldin Creek
Drainage Areas
Existing Storm Drain Lines
Proposed Storm Drain Lines
Proposed Storm Drain Lines To Be Abandoned
WEST MILTON ST
WEST MILTON
ROMA ST
WEST ANNIE
WEST ANNIE STREET
WEST MARY STREET
SOUTH 1ST STREET
NEWTON STREET
EVA STREET
NICKERSON
WEST JOHANNA STREET
FULMORE JR. HIGH
SOUTH CONGRESS AVENUE
WILSON STREET
LELAND STREET
CROCKETT ST
CROCKETT STREET
HODGES STREET
NICKERSON STREET
WEST LIVE OAK ST
EAST LIVE OAK ST
BARTLETT ST
COLLEGE AVENUE
POST ROAD
FLETCHER ST
LINDELL AVE
AVENUE
DA-A01
DA-A03
DA-A02-A
DA-A04-C
DA-A04-B
DA-A04-A
DA-A05.1
DA-A05.2
DA-A24
DA-A27
DA-A23
DA-A06.1
DA-A06-A.2
DA-A06-D
DA-A06-C
DA-A06-F
DA-A06-E
DA-A07
DA-A08
DA-A09
DA-A11
DA-A12
DA-A25
DA-A13
DA-A14
DA-A15
DA-A16
DA-A26
DA-A17-A
DA-A19-A
DA-LOC-A
DA-LOC-B3
DA-A20-A
DA-A20-C
DA-A20-D
DA-A21-A.1
DA-A21-A.2
DA-A21-B
22A
22B
22C
22D
22E
22F
22G
22H
22J
22K
22L
22M
22N
22P
22Q
22R
22S
22T

Exhibit K.2

Map of Proposed System and Pipe Diameters

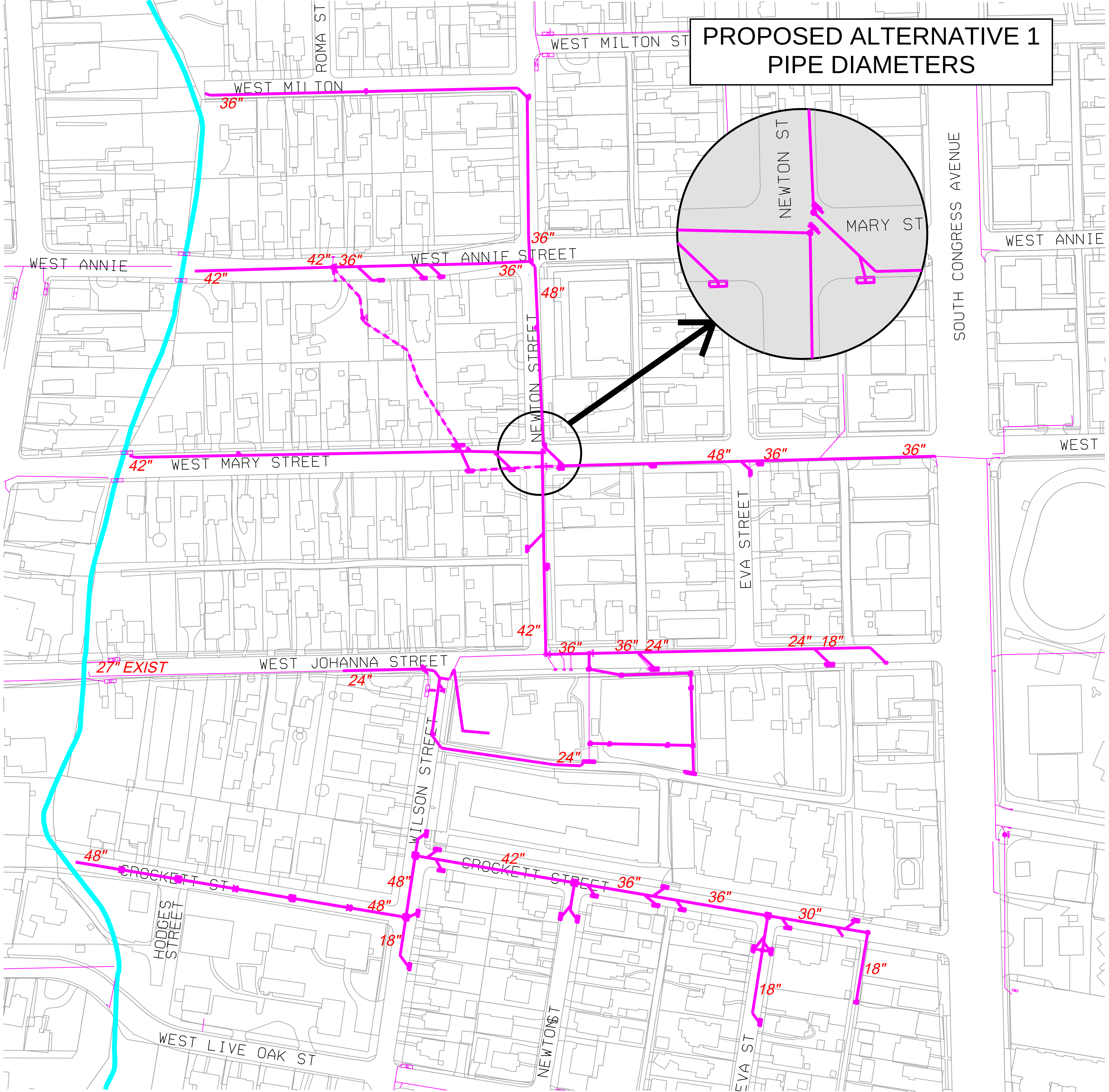

PROPOSED ALTERNATIVE 1
PIPE DIAMETERS
WEST MILTON ST
WEST MILTON
ROMA ST
36"
WEST ANNIE STREET
WEST ANNIE
42"
36"
48"
NEWTON STREET
NEWTON ST
MARY ST
SOUTH CONGRESS AVENUE
WEST MARY STREET
WEST
EVA STREET
WEST JOHANNA STREET
27" EXIST
24"
18"
WILSON STREET
CROCKETT ST
CROCKETT STREET
HODGES STREET
30"
WEST LIVE OAK ST
EVA ST

Exhibit K.3

Inlet Calculations for Proposed Storm Drain System

and

Ultimate Land Use Conditions

Exhibit K.3.1

Inlet Calculations for Storm Drain Systems

Outfalling at East Bouldin Creek and:

Johanna Street

Mary Street

Annie Street

Milton Street

Ultimate Development Conditions for Proposed Alternate 1 System

Name	Area	Area	Ex_%IC	Area 700	Area 800	Area not 700 or 800	%IC 700	%IC 800	Ult_%IC not 700 or 800	Ult_%IC	Area IC within 100
	SF	sq mi		SF	SF	SF					SF
Calc Notes -->	(1)	(2)	(3)	(4)	(5)	(6)	(15)	(16)	(17)	(18)	
DA-A04-A	27878	0.001000	36%	0	2698	25180	0%	67%	65%	65.2%	16853
DA-A04-B	16366	0.000587	28%	0	1380	14986	0%	55%	65%	64.1%	11146
DA-A04-C	15698	0.000563	49%	0	8561	7137	0%	68%	65%	66.8%	5276
DA-A06-A.2	16934	0.000607	49%	0	5036	11898	0%	44%	65%	58.9%	5912
DA-A06-C	40321	0.001446	41%	0	11130	29191	0%	79%	65%	68.8%	21269
DA-A06-D	18359	0.000659	48%	0	7509	10850	0%	79%	65%	70.6%	7953
DA-A06-E	39010	0.001399	55%	0	15582	23428	0%	79%	65%	70.5%	14376
DA-A06-F	48617	0.001744	41%	0	14808	33809	0%	71%	65%	67.0%	24354
DA-A17-A	17466	0.000627	46%	0	6213	11253	0%	91%	80%	83.9%	0
DA-A19-A	9304	0.000334	74%	0	4916	4388	0%	91%	80%	85.7%	0
DA-A20-A	57639	0.002068	35%	0	11536	46103	0%	63%	80%	76.6%	0
DA-A20-C	33462	0.001200	71%	0	6326	27136	0%	71%	94%	89.7%	0
DA-A20-D	55349	0.001985	91%	0	43145	12204	0%	93%	95%	93.2%	0
DA-A21-A.2	36530	0.001310	83%	0	7453	29077	0%	94%	84%	86.1%	0
DA-A21-B	67407	0.002418	64%	0	7288	60119	0%	89%	85%	85.1%	0

(1) Drainage Area
(2) Area (sq mi) = Area / 27,878,400
(3) Ex_%IC = 1 - (sum(remaining pervious area)) / Area
(4) Area 700 = area that is LU category 700
(5) Area 800 = area that is LU category 800
(6) Area not 700 or 800 = (Area) - (Area 700) - (Area 800)
(7) Area Pervious 700 = remaining pervious area within LU category 700
(15) %IC 700 = 1 - (Area Pervious 700)/(Area 700)
(16) %IC 800 = 1 - (Area Pervious 800)/(Area 800)
(17) Ult_%IC not 700 or 800 = weighted average for area not within LU categories 700 or 800
(18) Ult_%IC = weighted average

Impervious Cover Breakdown

Note: This tab assumes that the increase in impervious cover for SF lots (FLUM Category 100) is entirely concrete/roofs; for all other LU categories, the increase in impervious cover is the same proportion of asphalt/concrete as the existing conditions

Ref: IC_PROP.xlsx

Average Existing %IC within LU Category 100 = 39%

Average Ultimate %IC within LU Category 100 = 65%

				Area of IC within each FLUM Category and DA (Ult Conditions)			Ultimate Development Conditions					
	Total Area	Ult %IC	Total Area of IC for Ult conditions	100	All other LU Categories	Existing % of IC that is Asphalt	For LU 100, % of IC area that is Asphalt	Area Asphalt within LU 100	Area Asphalt within all other LU s	Total Area Asphalt within DA	Total Area Concrete within DA	Total Area Grass within DA
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
DA-A04-A	27878	65.2%	18166	16853	1313	14.2%	8.4%	1420	186	1606	16560	9712
DA-A04-B	16366	64.1%	10494	11146	0	14.2%	8.4%	936	0	936	9558	5872
DA-A04-C	15698	66.8%	10480	5276	5204	70.0%	41.5%	2189	3641	5830	4650	5218
DA-A06-A.2	16934	58.9%	9975	5912	4063	23.2%	13.7%	812	941	1754	8221	6959
DA-A06-C	40321	68.8%	27756	21269	6487	42.2%	25.0%	5325	2738	8063	19693	12565
DA-A06-D	18359	70.6%	12966	7953	5013	52.5%	31.1%	2476	2631	5107	7859	5394
DA-A06-E	39010	70.5%	27502	14376	13126	47.9%	28.4%	4082	6283	10365	17137	11508
DA-A06-F	48617	67.0%	32549	24354	8195	42.6%	25.3%	6150	3489	9638	22911	16068
DA-A17-A	17466	83.9%	14651	0	14651	57.1%	33.9%	0	8362	8362	6289	2815
DA-A19-A	9304	85.7%	7970	0	7970	52.8%	31.3%	0	4209	4209	3761	1334
DA-A20-A	57639	76.6%	44155	0	44155	24.4%	14.5%	0	10777	10777	33378	13484
DA-A20-C	33462	89.7%	30020	0	30020	33.6%	20.0%	0	10096	10096	19923	3442
DA-A20-D	55349	93.2%	51595	0	51595	78.3%	46.4%	0	40377	40377	11218	3754
DA-A21-A.2	36530	86.1%	31464	0	31464	51.7%	30.7%	0	16280	16280	15185	5066
DA-A21-B	67407	85.1%	57361	0	57361	23.0%	13.6%	0	13166	13166	44196	10046

Equation

(1) Claculated elsewhere from FLUM
(2) Total area IC = total area x Ult % IC
(3) Claculated elsewhere from FLUM
(4) Area IC within all other FLUM cagegories except 100 = (2) - (3) or zero if result is negative
(5) Calculated from GIS files
(6) (6) = (5) x .39 / .65
(7) (7) = (6) x (3)
(8) (8) = (4) x (5)
(9) (9) = (7) + (8)
(10) (10) = (2) - (9)
(11) (11) = Total Area - (9) - (10)

Annie Street Storm Drain Improvements
C Values - Ultimate Development Conditions for Proposed Alternative 1 System

																						0.37	0.42	0.46	0.53						
																						0.25	0.30	0.34	0.41						
Drainage Input				Asphalt		Concrete		Grass		Total	Asphalt	Concrete	Grass	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	Combined				Grass Area	
Basin	Area (sf)	Drainage Area EX %IC	Area IC (sf)	Asph. % of IC	Asph.. Area (sf)	Conc. % of IC	Conc. Area (sf)	Grass Percentile	Grass Area (sf)	Area (acres)	Asp. Area (acres)	Conc. Area (acres)	Grass Area (acres)	Asph.C2	Asph.C10	Asph.C25	Asph. C100	Conc. C2	Conc. C10	Conc. C25	Conc. C100	Grass C2	Grass C10	Grass C25	Grass C100	Comb. C2	Comb. C10	Comb. C25	Comb. C100	Condition	Slope
DA-A04-A	27878			5.76%	1606.03	59.40%	16560.32	34.84%	9711.65	0.64	0.04	0.38	0.22	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.60	0.67	0.72	0.80	Fair	average
DA-A04-B	16366			5.72%	935.68	58.40%	9558.22	35.88%	5872.10	0.38	0.02	0.22	0.13	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.60	0.67	0.71	0.80	Fair	average
DA-A04-C	15698			37.14%	5829.91	29.62%	4650.14	33.24%	5217.95	0.36	0.13	0.11	0.12	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.37	0.42	0.46	0.53	0.62	0.69	0.73	0.82	Fair	steep
DA-A06-A.2	16934			10.36%	1753.70	48.55%	8221.00	41.10%	6959.30	0.39	0.04	0.19	0.16	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.58	0.64	0.69	0.77	Fair	average
DA-A06-C	40321			20.00%	8063.11	48.84%	19692.69	31.16%	12565.20	0.93	0.19	0.45	0.29	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.62	0.69	0.73	0.82	Fair	average
DA-A06-D	18359			27.82%	5106.93	42.81%	7858.57	29.38%	5393.50	0.42	0.12	0.18	0.12	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.62	0.69	0.74	0.82	Fair	average
DA-A06-E	39010			26.57%	10364.93	43.93%	17137.27	29.50%	11507.80	0.90	0.24	0.39	0.26	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.62	0.69	0.74	0.82	Fair	average
DA-A06-F	48617			19.82%	9638.17	47.13%	22911.03	33.05%	16067.80	1.12	0.22	0.53	0.37	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.61	0.68	0.72	0.81	Fair	average
DA-A17-A	17466			47.88%	8362.30	36.01%	6289.10	16.11%	2814.60	0.40	0.19	0.14	0.06	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.67	0.75	0.80	0.88	Fair	average
DA-A19-A	9304			45.24%	4209.07	40.43%	3761.33	14.33%	1333.60	0.21	0.10	0.09	0.03	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.68	0.76	0.81	0.89	Fair	average
DA-A20-A	57639			18.70%	10776.53	57.91%	33378.42	23.39%	13484.05	1.32	0.25	0.77	0.31	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.65	0.72	0.77	0.85	Fair	average
DA-A20-C	33462			30.17%	10096.42	59.54%	19923.43	10.29%	3442.15	0.77	0.23	0.46	0.08	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.70	0.78	0.83	0.91	Fair	average
DA-A20-D	55349			72.95%	40377.07	20.27%	11217.73	6.78%	3754.20	1.27	0.93	0.26	0.09	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.25	0.30	0.34	0.41	0.70	0.78	0.83	0.92	Fair	flat
DA-A21-A.2	36530			44.57%	16279.71	41.57%	15184.69	13.87%	5065.60	0.84	0.37	0.35	0.12	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.68	0.76	0.81	0.89	Fair	average
DA-A21-B	67407			19.53%	13165.79	65.57%	44195.66	14.90%	10045.55	1.55	0.30	1.01	0.23	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.68	0.76	0.81	0.89	Fair	average
total area	500340																														

DESIGNER NOTES

Basis for Calculations:

Area of imervious cover that is asphalt versus concrete is calculated on Impervious Cover Breakdown sheet
Area of grass = total area - asphalt area - area concrete

Annie Street Storm Drain Improvements
Time of Concentration (Ultimate Conditions for Proposed Alternative 1 System)

Equation in cell ==>		**(1)**	**(2)**			**(3)**	**(4)**	**(5)**			**(6)**	**(7)**	**(8)**			**(9)**	**(10)**			**(9)**	**(10)**
Drainage Input				Sheet Flow - roof/pavement					Sheet Flow - overland					Shallow Conc. 1 - unpaved				Shallow Conc. 2 - unpaved			
Basin	Area (acres)	Calc. Tc	Tc used mins	Sheet Flow Length (ft)	Sheet Flow Slope (ft/ft)	n	P	tc1 mins	Sheet Flow Length (ft)	Sheet Flow Slope (ft/ft)	n	P	tc1 mins	Shallow Flow Length (ft)	Shallow Flow Slope (ft/ft)	n	tc2 mins	Shallow Flow Length (ft)	Shallow Flow Slope (ft/ft)	n	tc3 mins
DA-A04-A	0.64	3.77	5.00	98.76	0.012	0.02	3.44	2.33	0.00	--	0.15	3.44	0.00	54.05	0.052	0.05	0.24	42.96	0.104	0.05	0.14
DA-A04-B	0.38	1.30	5.00	28.40	0.032	0.02	3.44	0.57	0.00	--	0.15	3.44	0.00	56.69	0.101	0.05	0.18	44.06	0.033	0.05	0.25
DA-A04-C	0.36	2.72	5.00	19.03	0.046	0.02	3.44	0.36	15.82	0.034	0.15	3.44	1.76	54.20	0.020	0.05	0.40	28.24	0.140	0.05	0.08
DA-A06-C	0.93	3.42	5.00	22.33	0.029	0.02	3.44	0.49	15.41	0.033	0.15	3.44	1.73	208.20	0.045	0.05	1.02	0.00	--	--	0.00
DA-A06-D	0.42	1.72	5.00	54.31	0.041	0.02	3.44	0.87	0.00	--	0.15	3.44	0.00	71.03	0.032	0.05	0.41	0.00	--	--	0.00
DA-A06-E	0.90	5.47	5.47	18.33	0.019	0.02	3.44	0.50	47.89	0.040	0.15	3.44	3.97	76.36	0.042	0.025	0.31	84.50	0.034	--	0.48
DA-A06-F	1.12	3.32	5.00	66.12	0.017	0.02	3.44	1.46	0.00	--	0.15	3.44	0.00	0.00	--	0.05	0.00	0.00	--	--	0.00
DA-A17-A	0.40	7.89	7.89	0.00	--	0.02	3.44	0.00	86.50	0.027	0.15	3.44	7.51	56.06	0.066	0.05	0.23	0.00	--	--	0.00
DA-A19-A	0.21	6.89	6.89	0.00	--	0.02	3.44	0.00	89.56	0.039	0.15	3.44	6.62	0.00	--	0.05	0.00	0.00	--	--	0.00
DA-A20-A	1.32	2.19	5.00	39.63	0.048	0.02	3.44	0.63	0.00	--	0.15	3.44	0.00	105.11	0.015	0.05	0.89	0.00	--	--	0.00
DA-A20-C	0.77	2.47	5.00	73.47	0.048	0.02	3.44	1.04	0.00	--	0.15	3.44	0.00	0.00	--	0.05	0.00	0.00	--	--	0.00
DA-A20-D	1.27	3.42	5.00	66.63	0.035	0.02	3.44	1.09	0.00	--	0.15	3.44	0.00	0.00	--	0.05	0.00	0.00	--	--	0.00
DA-A21-B	1.55	2.89	5.00	48.62	0.010	0.02	3.44	1.38	0.00	--	0.15	3.44	0.00	128.56	0.043	0.05	0.64	0.00	--	--	0.00
DA-A06-A.2	0.39	1.35	5.00	52.39	0.076	0.02	3.44	0.66	0.00	--	0.15	3.44	0.00	54.34	0.015	0.05	0.46	0.00	--	--	0.00
DA-A21-A.2	0.84	2.89	5.00	81.73	0.031	0.02	3.44	1.35	0.00	--	0.15	3.44	0.00	0.00	--	0.05	0.00	0.00	--	--	0.00

Equations

(1) Calculated Tc = Sheet Flow Tc + Shallwo Concentrated Tc + Gutter Flow Tc
(2) Tc used = min (5, Calculated Tc)
(3) n = 0.020 for roofs/pavement
(4) See DCM Table 2-3: 2-year 24-hour rainfall
(5) DCM EQ 2-3: Sheet Flow Tc for roofs/pavement (mins) = $0.42 * (nL)^{0.8} / (P^{0.5} * S^{0.4})$
(6) n = 0.15 for Grass, short-grass prairie; See DCM Table 2-2
(7) See DCM Table 2-3: 2-year 24-hour rainfall
(8) DCM EQ 2-3Sheet Flow for roofs/pavement (mins) = $0.42 * (nL)^{0.8} / (P^{0.5} * S^{0.4})$
(9) Given in DCM Section 2.4.2.B
(10) DCM EQ 2-4: Unpaved Shallow Concentrated Tc = $L / (60(16.1345)(S^{0.5}))$
(11) Given in DCM Section 2.4.2.B; cells hilighted in green use the unpaved equation
(12) DCM EQ 2-5: Paved Shallow Concentrated Tc = $L / (60(20.3282)(S^{0.5}))$; cells hilighted in green use the unpaved equation
(13) $V = k * S^{0.5}$ Reference: Richard McCuen, Hydrologic Analysis and Design (New Jersey: Prentice Hall 1998), p. 143.
(14) Tc = L / (60 * V)

Annie Street Storm Drain Improvements
Time of Concentration (Ultimate Conditions for Proposed Alternative 1 System)

Equation in cell ==>			(11)	(12)			(11)	(12)			(13)	(14)			(13)	(14)			(13)	(14)
	Shallow Conc. 3 - paved				Shallow Conc. 4 - paved				Gutter 1 (paved)				Gutter 2 (paved)				Gutter 3			
Basin	Shallow Flow Length (ft)	Shallow Flow Slope (ft/ft)	n	tc4 mins	Shallow Flow Length (ft)	Shallow Flow Slope (ft/ft)	n	tc5 mins	Channel Length (ft)	slope	Channel Min. V (fps)	tc6 mins	Channel Length (ft)	slope	Channel Min. V (fps)	tc7	Channel Length (ft)	slope	Channel Min. V (fps)	tc8
DA-A04-A	161.83	0.033	0.050	0.92	51.79	51.790	0.025	0.01	102.15	0.068	12.06	0.14	0.00	--	--	0.00	0.00	--	--	0.00
DA-A04-B	22.99	0.132	0.050	0.07	105.21	105.210	0.050	0.01	165.73	0.073	12.51	0.22	0.00	--	--	0.00	0.00	--	--	0.00
DA-A04-C	22.63	0.093	0.025	0.06	0.00	0.000	0.025	0.00	51.97	0.087	13.62	0.06	0.00	--	--	0.00	0.00	--	--	0.00
DA-A06-C	35.22	0.072	0.025	0.11	85.20	85.200	0.025	0.01	44.68	0.054	10.73	0.07	0.00	--	--	0.00	0.00	--	--	0.00
DA-A06-D	55.32	0.043	0.025	0.22	0.00	0.000	0.025	0.00	131.99	0.044	9.71	0.23	0.00	--	--	0.00	0.00	--	--	0.00
DA-A06-E	59.91	0.053	0.025	0.21	24.23	24.230	0.025	0.00	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00
DA-A06-F	298.49	0.019	0.025	1.76	0.00	0.000	0.025	0.00	23.02	0.007	3.74	0.10	0.00	--	--	0.00	0.00	--	--	0.00
DA-A17-A	25.68	0.019	0.025	0.15	0.00	0.000	0.025	0.00	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00
DA-A19-A	16.69	0.108	0.025	0.04	0.00	0.000	0.025	0.00	118.69	0.035	8.71	0.23	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
DA-A20-A	52.64	0.025	0.025	0.27	119.32	119.320	0.025	0.01	193.00	0.034	8.53	0.38	0.00	--	--	0.00	0.00	--	--	0.00
DA-A20-C	248.66	0.023	0.025	1.35	0.00	0.000	0.025	0.00	30.79	0.016	5.90	0.09	0.00	--	--	0.00	0.00	--	--	0.00
DA-A20-D	119.41	0.013	0.025	0.85	0.00	0.000	0.025	0.00	351.55	0.009	4.45	1.32	102.60	0.053	10.67	0.16	0.00	--	--	0.00
DA-A21-B	160.83	0.024	0.025	0.86	97.47	97.470	0.025	0.01	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00
DA-A06-A.2	55.83	0.064	0.025	0.18	0.00	0.000	0.025	0.00	22.97	0.026	7.48	0.05	0.00	--	--	0.00	0.00	--	--	0.00
DA-A21-A.2	332.26	0.032	0.025	1.53	0.00	0.000	0.025	0.00	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00

RUNOFF COMPUTATIONS (Ultimate Conditions for Proposed Alternative 1 System)

			2 Year Storm Event			10 Year Storm Event			25 Year Storm Event			100 Year Storm Event		
Drainage Area Number	Drainage Area (acres)	Time of Concentration Tc (min)	Runoff Coefficient C2	Intensity I2	Design Flow Q2 (cfs)	Runoff Coefficient C10	Intensity I10	Design Flow Q10 (cfs)	Runoff Coefficient C25	Intensity I25	Design Flow Q25 (cfs)	Runoff Coefficient C100	Intensity I100	Design Flow Q100 (cfs)
DA-A04-A	0.64	5.00	0.60	5.76	2.22	0.67	8.57	3.69	0.72	10.11	4.65	0.80	12.54	6.44
DA-A04-B	0.38	5.00	0.60	5.76	1.29	0.67	8.57	2.15	0.71	10.11	2.71	0.80	12.54	3.76
DA-A04-C	0.36	5.00	0.62	5.76	1.28	0.69	8.57	2.12	0.73	10.11	2.67	0.82	12.54	3.69
DA-A06-A.2	0.39	5.00	0.58	5.76	1.29	0.64	8.57	2.14	0.69	10.11	2.71	0.77	12.54	3.76
DA-A06-C	0.93	5.00	0.62	5.76	3.28	0.69	8.57	5.44	0.73	10.11	6.86	0.82	12.54	9.48
DA-A06-D	0.42	5.00	0.62	5.76	1.51	0.69	8.57	2.50	0.74	10.11	3.15	0.82	12.54	4.35
DA-A06-E	0.90	5.47	0.62	5.62	3.13	0.69	8.37	5.19	0.74	9.89	6.54	0.82	12.30	9.07
DA-A06-F	1.12	5.00	0.61	5.76	3.90	0.68	8.57	6.48	0.72	10.11	8.17	0.81	12.54	11.30
DA-A17-A	0.40	7.89	0.67	5.03	1.36	0.75	7.50	2.25	0.80	8.89	2.84	0.88	11.19	3.96
DA-A19-A	0.21	6.89	0.68	5.26	0.76	0.76	7.84	1.27	0.81	9.27	1.59	0.89	11.62	2.21
DA-A20-A	1.32	5.00	0.65	5.76	4.94	0.72	8.57	8.17	0.77	10.11	10.28	0.85	12.54	14.18
DA-A20-C	0.77	5.00	0.70	5.76	3.10	0.78	8.57	5.12	0.83	10.11	6.42	0.91	12.54	8.81
DA-A20-D	1.27	5.00	0.70	5.76	5.13	0.78	8.57	8.49	0.83	10.11	10.65	0.92	12.54	14.62
DA-A21-A.2	0.84	5.00	0.68	5.76	3.30	0.76	8.57	5.45	0.81	10.11	6.85	0.89	12.54	9.41
DA-A21-B	1.55	5.00	0.68	5.76	6.09	0.76	8.57	10.06	0.81	10.11	12.64	0.89	12.54	17.37
	0.00	0.00	0.00	7.79	0.00	0.00	11.60	0.00	0.00	13.54	0.00	0.00	16.09	0.00
	0.00	0.00	0.00	7.79	0.00	0.00	11.60	0.00	0.00	13.54	0.00	0.00	16.09	0.00
	0.00	0.00	0.00	7.79	0.00	0.00	11.60	0.00	0.00	13.54	0.00	0.00	16.09	0.00
	--	0.00							--	13.54	--	--	16.09	--
	--	0.00							--	13.54	--	--	16.09	--
	--	0.00							--	13.54	--	--	16.09	--

From DCM Section 2.4.3, Table 2-5:

	2-year	10-year	25-year	100-year
a=	54.767	70.820	82.9360	118.3000
b=	11.051	10.396	10.7460	13.1850
c=	0.8116	0.7725	0.7634	0.7736

Ultimate Development Conditions for Proposed Alternative 1 System

CURB INLETS ON GRADE, Type G-1 OR Type G-3, parabolic crown

25 YEAR STORM

Equation in cell ==>								(1)							(2)				(3)	
DRAINAGE AREA	**Prop or Exist Inlet**	**Prop or Exist Drainage Area**	**INLET (StormCAD)**	**Drainage_ID (GIS)**	**Ultimate Outfall Location ALT1**	**STREET NAME**	**DRAINAGE AREA** *(ac.)*	**DISCHARGE FROM DRAINAGE AREA** *(cfs)*	**1st UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**2nd UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**3rd UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**TOTAL RUNOFF** *(cfs)* **Q**	**Hig elev** *(ft)*	**low elev** *(ft)*	**length** *(ft)*	**SLOPE** *(ft/ft)* $S_o = S_L$	**Street Width (FOC-FOC)** *(ft)* **W**
DA-A04-A	**Prop**	**Prop**	I-PR-A4-A	N/A	EBC/Annie	Annie St.	0.64	4.65	DA-A04-B	0.00					4.65				0.0712	40.0
DA-A04-B	**Prop**	**Prop**	I-PR-A4-B	N/A	EBC/Annie	Annie St.	0.38	2.71	DA-A04-C	0.00					2.71				0.0743	40.0
DA-A04-C	**Prop**	**Prop**	I-PR-A4-C	N/A	EBC/Annie	Annie St.	0.36	2.67	none						2.67				0.0743	40.0
DA-A06-C	**Prop**	**Prop**	I-PR-A6-C	N/A	EBC/Mary	Mary St.	0.93	6.86	DA-A06-D	0.00	DA-A06-E	0.53	DA-A06-F	0.11	7.50				0.0331	41.5
DA-A06-D	**Prop**	**Prop**	I-PR-A6-D	N/A	EBC/Annie/Milton	Mary St.	0.42	3.15	DA-A07	0.00					3.15				0.0495	41.5
DA-A06-E	**Prop**	**Prop**	I-PR-A6-E	N/A	EBC/Mary	Newton St.	0.90	6.54	none						6.54				0.0267	31.5
DA-A06-F	**Prop**	**Prop**	I-PR-A6-F	N/A	EBC/Mary	Newton St.	1.12	8.17	none						8.17				0.0168	31.5
DA-A07	**Prop**	**Exist**	I-PR-A7	N/A	EBC/Annie/Milton	Mary St.	0.78	4.99	DA-A08	0.77	DA-A09	1.14			6.89				0.0199	40.5
DA-A08	**Prop**	**Exist**	I-PR-A8	N/A	EBC/Annie/Milton	Eva St.	1.39	9.51	none						9.51				0.0196	32.5
DA-A09	**Prop**	**Exist**	I-PR-A9	N/A	EBC/Annie/Milton	Mary St.	1.21	10.12	none						10.12				0.0341	41.0
DA-A20-A	**Prop**	**Prop**	I-PR-A20-A	N/A	EBC/Mary	Johanna St	1.32	10.28	DA-A20-C	0.00					10.28				0.0359	32.0
DA-A20-C	**Prop**	**Prop**	I-PR-A20-C	N/A	EBC/Mary	Johanna St	0.77	6.42	DA-A20-D	5.61					12.03				0.0220	32.0
DA-A20-D	**Prop**	**Prop**	I-PR-A20-D	N/A	EBC/Mary	Johanna St	1.27	10.65	none						10.65				0.0608	32.0
DA-A21-B	**prop**	**Prop**	I-PR-21-B	N/A	EBC/Mary	alley	1.55	12.64	none						12.64	565.00	561.00	122.03	0.0328	13.5
Inlet 21823 (DS of grate inlet DA-A22)	**Exist**	**Prop bypass to this inlet**	I-PR-21823	21823	EBC/Johanna	Wilson St	0.00	0.00	DA-A22-A	2.60					2.60				0.0175	29.8

Equations in cell

- **(1)** DCM EQ 2-1: $Q_{peak} = CiA$
- **(2)** Total flow = sum of discharge from drainage area and carry over flow
- **(3)** So = (high elev - low elev)/length
- **(4)** See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
- **(5)** DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
  For DA-A26 only, use straight crown equation since the driveway does not have a parabolic crown: HEC-22 EQ 4-3: d = T * Sx
- **(6)** Sx measured in Field by ESD 3-3-15 or 3-31-15
- **(7)** For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
- **(8)** measured in field, lidar or record drawing; see "Crown Height Calcs" tab
- **(9)** Hec-22 EQ B-11: $Yo = (2H/B)*x - (H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
  For DA-A26 only, use straight crown equation, HEC-22 EQ 4-2. If T calculated from HEC-22 EQ 4-2 is greater than B, use T=B
  HEC-22 EQ 4-2: $T = [Qn / (Ku * Sx^{1.67} * SL^{0.5})]^{0.375}$; where n = 0.012 (HEC-22 Table 4-3) and Ku = 0.56
- **(10)** Given in DCM EQ 4-10
- **(11)** a_{DIG} was measured in the field by ESD or DIG Data consultants. a_{DIG} = (upstream curb height) - (depth from top of curb to inlet gutter)
- **(12)** See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation; for proposed curb inlets, aHEC22 = 6.75 - 18*Sx
  $a_{HEC22} = a_{DIG} - W*Sx$
- **(13)** DCM EQ 4-9: $S'w = a_{HEC22} / (12*W)$
- **(14)** DCM EQ 4-9: Sw = S'w + Sx
- **(15)** HEC 22 EQ 4-4: For W < T, Eo = 1 / (1 + Sw/Sx/(((1 + Sw/Sx / (T/W))^2.67) - 1)); For T < W, Eo = 1
- **(16)** DCM EQ 4-9: Se = Sx + S'w*Eo
- **(17)** See DCM Table 2-2
- **(18)** DCM EQ 4-10: $L_T = K_T * Q\text{^}0.42 * S_L\text{^}0.3 * [1/ (n*Se)]\text{^}0.6$
- **(19)** DCM EQ 4-8: $E = 1 - [1 - (L/L_T)]\text{^}1.8$
- **(20)** DCM EQ 4-14: Qi = E * Q
- **(21)** DCM EQ 4-15: Qb = Q - Qi

Ultimate Development Conditions for Proposed Alternative 1 System

CURB INLETS ON GRADE, Type G-1 OR Type G-3, parabolic crown

100 YEAR STORM

Equation in cell ==>								(1)							(2)				(3)	
DRAINAGE AREA	**Prop or Exist Inlet**		**INLET ID (StormCAD)**	**Drainage_ID (GIS)**	**Ultimate Outfall Location ALT1**	**STREET NAME**	**DRAINAGE AREA** *(ac.)*	**DISCHARGE FROM DRAINAGE AREA** *(cfs)*	**1st UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**2nd UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**3rd UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**TOTAL RUNOFF** *(cfs)* **Q**	**Hig elev** *(ft)*	**low elev** *(ft)*	**length** *(ft)*	**SLOPE** *(ft/ft)* $S_o = S_L$	**Street Width (FOC-FOC)** *(ft)* **W**
DA-A04-A	**Prop**	**Prop**	I-PR-A4-A	N/A	EBC/Annie	Annie St.	0.64	6.44	DA-A04-B	0.01					6.45				0.0712	40.0
DA-A04-B	**Prop**	**Prop**	I-PR-A4-B	N/A	EBC/Annie	Annie St.	0.38	3.76	DA-A04-C	0.01					3.76				0.0743	40.0
DA-A04-C	**Prop**	**Prop**	I-PR-A4-C	N/A	EBC/Annie	Annie St.	0.36	3.69	none						3.69				0.0743	40.0
DA-A06-C	**Prop**	**Prop**	I-PR-A6-C	N/A	EBC/Mary	Mary St.	0.93	9.48	DA-A06-D	0.05	DA-A06-E	1.32	DA-A06-F	1.09	11.95				0.0331	41.5
DA-A06-D	**Prop**	**Prop**	I-PR-A6-D	N/A	EBC/Annie/Milton	Mary St.	0.42	4.35	DA-A07	0.70					5.05				0.0495	41.5
DA-A06-E	**Prop**	**Prop**	I-PR-A6-E	N/A	EBC/Mary	Newton St.	0.90	9.07	none						9.07				0.0267	31.5
DA-A06-F	**Prop**	**Prop**	I-PR-A6-F	N/A	EBC/Mary	Newton St.	1.12	11.30	none						11.30				0.0168	31.5
DA-A07	**Prop**	**Exist**	I-PR-A7	N/A	EBC/Annie/Milton	Mary St.	0.78	7.00	DA-A08	1.97	DA-A09	2.79			11.76				0.0199	40.5
DA-A08	**Prop**	**Exist**	I-PR-A8	N/A	EBC/Annie/Milton	Eva St.	1.39	13.28	none						13.28				0.0196	32.5
DA-A09	**Prop**	**Exist**	I-PR-A9	N/A	EBC/Annie/Milton	Mary St.	1.21	13.89	none						13.89				0.0341	41.0
DA-A20-A	**Prop**	**Prop**	I-PR-A20-A	N/A	EBC/Mary	Johanna St	1.32	14.18	DA-A20-C	1.89					16.07				0.0359	32.0
DA-A20-C	**Prop**	**Prop**	I-PR-A20-C	N/A	EBC/Mary	Johanna St	0.77	8.81	DA-A20-D	8.70					17.52				0.0220	32.0
DA-A20-D	**Prop**	**Prop**	I-PR-A20-D	N/A	EBC/Mary	Johanna St	1.27	14.62	none						14.62				0.0608	32.0
DA-A21-B	**Prop**	**Prop**	I-PR-21-B	N/A	EBC/Mary	alley	1.55	17.37	none						17.37	565.00	561.00	122.03	0.0328	13.5
Inlet 21823 (DS of grate inlet DA-A22)	**Exist**	**Prop bypass to this inlet**	I-PR-21823	21823	EBC/Johanna	Wilson St	0.00	0.00	DA-A22-A	3.60					3.60				0.0175	29.8

Ultimate Development Conditions for Proposed System

CURB INLETS ON GRADE, Type G-1 OR Type G-3, parabolic crown

25 YEAR STORM

DRAINAGE AREA	Curb Height (in)	Curb Height (ft)	CURB OPENING HEIGHT (in)	CURB OPENING HEIGHT (ft) h	Split (ft) CS	High or low gutter	K_o	K_1	K_2	K_3	WATER FLOW DEPTH (ft) Yo = d	Is Yo > 1.4*h?	Over Curb?	ESD Field Measured Street Cross Slope Sx	Dist. Curb to Crown (ft) B	Crown Height (ft) H	Quadratic Formula T = min(x1, x2); x = [-b +/- (b^2 - 4ac)^0.5] / 2a — a H / B^2	b -(2H/B)	c Yo	x1	x2	PONDED WIDTH (ft) T	Half CLEAR WIDTH (ft)	Over Crown?	DEPTH OVER CROWN	Outside ROW?
Equation in cell ==>								(4)			(5)			(6)	(7)	(8)						(9)				
DA-A04-A	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	2.89	0	0.2776	no	**no**	0.028	20.0	0.30	0.0008	-0.0300	0.2776	25.4693	14.5307	14.53	**5.5**	no	0.00	no
DA-A04-B	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	2.89	0	0.2286	no	**no**	0.032	20.0	0.85	0.0021	-0.0850	0.2286	37.1003	2.8997	2.90	**17.1**	no	0.00	no
DA-A04-C	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	2.89	0	0.2274	no	**no**	0.032	20.0	0.85	0.0021	-0.0850	0.2274	37.1170	2.8830	2.88	**17.1**	no	0.00	no
DA-A06-C	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	2.89	0	0.3739	no	**no**	0.043	20.8	0.80	0.0019	-0.0771	0.3739	35.8932	5.6068	5.61	**15.1**	no	0.00	no
DA-A06-D	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	2.89	0	0.2583	no	**no**	0.043	20.8	0.80	0.0019	-0.0771	0.2583	37.8240	3.6760	3.68	**17.1**	no	0.00	no
DA-A06-E	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	3.03	0	0.3876	no	**no**	0.014	15.8	0.18	0.0007	-0.0229	0.3876	--	--	~~15.75~~	~~**0.0**~~	over crown	0.21	no
DA-A06-F	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	3.03	0	0.4503	no	**no**	0.026	15.8	0.55	0.0022	-0.0698	0.4503	22.4547	9.0453	~~9.05~~	~~**6.7**~~	no	0.00	no
DA-A07	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	2.89	0	0.3965	no	**no**	0.045	20.3	0.94	0.0023	-0.0928	0.3965	35.6483	4.8517	4.85	**15.4**	no	0.00	no
DA-A08	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	3.03	0	0.4616	no	**no**	0.010	16.3	0.17	0.0006	-0.0209	0.4616	--	--	~~16.25~~	~~**0.0**~~	over crown	0.29	no
DA-A09	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	2.89	0	0.4126	no	**no**	0.054	20.5	0.81	0.0019	-0.0790	0.4126	34.8584	6.1416	6.14	**14.4**	no	0.00	no
DA-A20-A	6.0	0.5	6.25	0.52	0.5	low	2.70	0.50	2.74	-0.215	0.4862	no	**no**	0.027	16.0	0.68	0.0027	-0.0850	0.4862	24.5417	7.4583	7.46	**8.5**	no	0.00	no
DA-A20-C	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	3.03	0	0.4892	no	**no**	0.022	16.0	0.55	0.0021	-0.0688	0.4892	21.3201	10.6799	10.68	**5.3**	no	0.00	no
DA-A20-D	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	3.03	0	0.3973	no	**no**	0.024	16.0	0.57	0.0022	-0.0713	0.3973	24.8070	7.1930	7.19	**8.8**	no	0.00	no
DA-A21-B	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	3.03	0	0.4655	no	**no**	**0.050**	6.8	**0.40**	0.0088	-0.1185	0.4655	--	--	6.75				
Inlet 21823 (DS of grate inlet DA-A22)	8.0	0.7	6.00	0.50	0.0	N/A	2.85	0.50	3.03	0	0.3063	no	**no**	0.035	14.9	0.34	0.0015	-0.0456	0.3063	19.5891	10.2109	~~10.21~~	~~**4.7**~~	no	0.00	no

Equations in cell

- **(1)** DCM EQ 2-1: Q_{peak} = CiA
- **(2)** Total flow = sum of discharge from drainage area and carry over flow
- **(3)** So = (high elev - low elev)/length
- **(4)** See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
- **(5)** DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
  For DA-A26 only, use straight crown equation since the driveway does not have a parabolic crown: HEC-22 EQ 4-3: d = T * Sx
- **(6)** Sx measured in Field by ESD 3-3-15 or 3-31-15
- **(7)** For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
- **(8)** measured in field, lidar or record drawing; see "Crown Height Calcs" tab
- **(9)** Hec-22 EQ B-11: Yo = (2H/B)*x - $(H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
  For DA-A26 only, use straight crown equation, HEC-22 EQ 4-2. If T calculated from HEC-22 EQ 4-2 is greater than B, use T=B
  HEC-22 EQ 4-2: $T = [Qn / (Ku * Sx^{1.67} * SL^{0.5})]^{0.375}$; where n = 0.012 (HEC-22 Table 4-3) and Ku = 0.56
- **(10)** Given in DCM EQ 4-10
- **(11)** a_{DIG} was measured in the field by ESD or DIG Data consultants. a_{DIG} = (upstream curb height) - (depth from top of curb to inlet gutter)
- **(12)** See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation; for proposed curb inlets, aHEC22 = 6.75 - 18*Sx
  $a_{HEC22} = a_{DIG}$ - W*Sx
- **(13)** DCM EQ 4-9: S'w = a_{HEC22} / (12*W)
- **(14)** DCM EQ 4-9: Sw = S'w + Sx
- **(15)** HEC 22 EQ 4-4: For W < T, Eo = 1 / (1 + Sw/Sx/(((1 + Sw/Sx / (T/W))^2.67) - 1)); For T < W, Eo = 1
- **(16)** DCM EQ 4-9: Se = Sx + S'w*Eo
- **(17)** See DCM Table 2-2
- **(18)** DCM EQ 4-10: $L_T = K_T$ * Q^0.42 * S_L^0.3 * [1/ (n*Se)]^0.6
- **(19)** DCM EQ 4-8: E = 1 - [1 - (L/L_T)]^1.8
- **(20)** DCM EQ 4-14: Qi = E * Q
- **(21)** DCM EQ 4-15: Qb = Q - Qi

Ultimate Development Conditions for Proposed System

CURB INLETS ON GRADE, Type G-1 OR Type G-3, parabolic crown

100 YEAR STORM

DRAINAGE AREA	Curb Height (in)	Curb Height (ft)	CURB OPENING HEIGHT (in)	CURB OPENING HEIGHT (ft) h	Split (ft) CS	High or low gutter	K_o	K_1	K_2	K_3	WATER FLOW DEPTH (ft) Yo = d	Is Yo > 1.4*h?	Over Curb?	ESD Field Measured Street Cross Slope Sx	Dist. Curb to Crown (ft) B	Crown Height (ft) H	Quadratic Formula T = min(x1, x2); x = [-b +/- (b^2 - 4ac)^0.5] / 2a — a H / B^2	b -(2H/B)	c Yo	x1	x2	PONDED WIDTH (ft) T	CLEAR WIDTH (ft)	Over Crown?	DEPTH OVER CROWN	Outside ROW?
Equation in cell ==>								(4)			(5)			(6)	(7)	(8)						(9)				
DA-A04-A	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	2.89	0	0.3108	no	**no**	0.028	20.0	0.30	0.0008	-0.0300	0.3108	--	--	20.00	**0.0**	over crown	**0.01**	**no**
DA-A04-B	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	2.89	0	0.2561	no	**no**	0.032	20.0	0.85	0.0021	-0.0850	0.2561	36.7183	3.2817	3.28	**16.7**	no	**0.00**	**no**
DA-A04-C	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	2.89	0	0.2543	no	**no**	0.032	20.0	0.85	0.0021	-0.0850	0.2543	36.7428	3.2572	3.26	**16.7**	no	**0.00**	**no**
DA-A06-C	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	2.89	0	0.4393	no	**no**	0.043	20.8	0.80	0.0019	-0.0771	0.4393	34.6822	6.8178	6.82	**13.9**	no	**0.00**	**no**
DA-A06-D	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	2.89	0	0.3042	no	**no**	0.043	20.8	0.80	0.0019	-0.0771	0.3042	37.0859	4.4141	4.41	**16.3**	no	**0.00**	**no**
DA-A06-E	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	3.03	0	0.4316	no	**no**	0.014	15.8	0.18	0.0007	-0.0229	0.4316	--	--	~~15.75~~	~~**0.0**~~	over crown	**0.25**	**no**
DA-A06-F	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	3.03	0	0.5013	no	**over curb**	0.026	15.8	0.55	0.0022	-0.0698	0.5013	20.4386	11.0614	~~11.06~~	~~**4.7**~~	no	**0.00**	**no**
DA-A07	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	2.89	0	0.4770	no	**no**	0.045	20.3	0.94	0.0023	-0.0928	0.4770	34.4621	6.0379	6.04	**14.2**	no	**0.00**	**no**
DA-A08	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	3.03	0	0.5153	no	**over curb**	0.010	16.3	0.17	0.0006	-0.0209	0.5153	--	--	~~16.25~~	~~**0.0**~~	over crown	**0.35**	**no**
DA-A09	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	2.89	0	0.4603	no	**no**	0.054	20.5	0.81	0.0019	-0.0790	0.4603	33.9688	7.0312	7.03	**13.5**	no	**0.00**	**no**
DA-A20-A	6.0	0.5	6.25	0.52	0.5	low	2.70	0.50	2.74	-0.215	0.5721	no	**over curb**	0.027	16.0	0.68	0.0027	-0.0850	0.5721	22.3721	9.6279	9.63	**6.4**	no	**0.00**	**no**
DA-A20-C	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	3.03	0	0.5537	no	**over curb**	0.022	16.0	0.55	0.0021	-0.0688	0.5537	--	--	16.00	**0.0**	over crown	**0.00**	**no**
DA-A20-D	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	3.03	0	0.4412	no	**no**	0.024	16.0	0.57	0.0022	-0.0713	0.4412	23.6070	8.3930	8.39	**7.6**	no	**0.00**	**no**
DA-A21-B	6.0	0.5	6.25	0.52	0.0	N/A	2.85	0.50	3.03	0	0.5170	no	**over curb**	**0.050**	6.8	**0.40**	0.0088	-0.1185	0.5170	--	--	6.75		over crown	**0.12**	**no**
Inlet 21823 (DS of grate inlet DA-A22)	8.0	0.7	6.00	0.50	0.0	N/A	2.85	0.50	3.03	0	0.3411	no	**no**	0.035	14.9	0.34	0.0015	-0.0456	0.3411	--	--	~~14.90~~	~~**0.0**~~	over crown	**0.00**	**no**

Ultimate Development Conditions for Proposed System

CURB INLETS ON GRADE, Type G-1 OR Type G-3, parabolic crown

25 YEAR STORM

DRAINAGE AREA	K_T	GUTTER DEPRESSION (in) a_{DIG}	(in) a_{HEC22}	Gutter Depression Width (in)	Gutter Depression Width (ft) W	S'w	Sw	Eo	Se	Manning's n n	INLET LENGTH FOR TOTAL CAPTURE L_T	CURB INLET REDUCTION FACTOR (%)	CURB OPENING LENGTH (in)	CURB OPENING LENGTH (ft) L	INLET EFFICIENCY E	INTERCEPTED FLOW (cfs) Qi	BYPASS FLOW (cfs) Qb	INLET TYPE
Equation in cell ==>	**(10)**	**(11)**	**(12)**			**(13)**	**(14)**	**(15)**	**(16)**	**(17)**	**(18)**	**?**			**(19)**	**(20)**	**(21)**	
DA-A04-A	0.6		6.2	17.0	1.42	0.37	0.40	0.43	0.19	0.016	16.89	0%	120	10.00	0.80	3.72	0.93	Type G-1
DA-A04-B	0.6		6.2	18.0	1.50	0.34	0.38	0.99	0.37	0.016	9.06	0%	120	10.00	1.00	2.71	0.00	Type G-1
DA-A04-C	0.6		6.2	18.0	1.50	0.34	0.38	0.99	0.37	0.016	9.00	0%	120	10.00	1.00	2.67	0.00	Type G-1
DA-A06-C	0.6		6.0	18.0	1.50	0.33	0.38	0.84	0.32	0.016	11.89	0%	120	10.00	0.96	7.22	0.27	Type G-1
DA-A06-D	0.6		6.0	18.0	1.50	0.33	0.38	0.95	0.36	0.016	8.70	0%	120	10.00	1.00	3.15	0.00	Type G-1
DA-A06-E	0.6		6.5	18.0	1.50	0.36	0.38	0.57	0.22	0.016	13.28	0%	120	10.00	0.92	6.02	0.53	Type G-1
DA-A06-F	0.6		6.3	18.0	1.50	0.35	0.38	0.71	0.28	0.016	11.02	0%	120	10.00	0.99	8.06	0.11	Type G-1
DA-A07	0.6		5.9	18.0	1.50	0.33	0.38	0.88	0.34	0.016	9.59	0%	120	10.00	1.00	6.89	0.00	Type G-1
DA-A08	0.6		6.6	18.0	1.50	0.37	0.38	0.64	0.24	0.016	13.30	0%	120	10.00	0.92	8.74	0.77	Type G-1
DA-A09	0.6		5.8	18.0	1.50	0.32	0.38	0.76	0.30	0.016	14.22	0%	120	10.00	0.89	8.99	1.14	Type G-1
DA-A20-A	0.6		6.3	18.0	1.50	0.35	0.38	0.80	0.30	0.016	14.37	0%	180	15.00	1.00	10.28	0.00	Type G-1
DA-A20-C	0.6		6.4	18.0	1.50	0.35	0.38	0.67	0.26	0.016	14.66	0%	180	15.00	1.00	12.03	0.00	Type G-1
DA-A20-D	0.6		6.3	18.0	1.50	0.35	0.38	0.83	0.32	0.016	16.69	0%	60	5.00	0.47	5.04	5.61	Type G-1
DA-A21-B	0.6		5.9	18.0	1.50	0.33	0.38	0.73	0.29	0.016	15.78	0%	240	20.00	1.00	12.64	0.00	
Inlet 21823 (DS of grate inlet DA-A22)	0.6	3.5	2.9	18.0	1.50	0.16	0.19	0.47	0.11	0.016	11.94	0%	88	7.33	0.82	2.13	0.47	Type G-1

Equations in cell

- **(1)** DCM EQ 2-1: Q_{peak} = CiA
- **(2)** Total flow = sum of discharge from drainage area and carry over flow
- **(3)** So = (high elev - low elev)/length
- **(4)** See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
- **(5)** DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
  For DA-A26 only, use straight crown equation since the driveway does not have a parabolic crown: HEC-22 EQ 4-3: d = T * Sx
- **(6)** Sx measured in Field by ESD 3-3-15 or 3-31-15
- **(7)** For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
- **(8)** measured in field, lidar or record drawing; see "Crown Height Calcs" tab
- **(9)** Hec-22 EQ B-11: $Yo = (2H/B)*x - (H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
  For DA-A26 only, use straight crown equation, HEC-22 EQ 4-2. If T calculated from HEC-22 EQ 4-2 is greater than B, use T=B
  HEC-22 EQ 4-2: $T = [Qn / (Ku * Sx^{1.67} * SL^{0.5})]^{0.375}$; where n = 0.012 (HEC-22 Table 4-3) and Ku = 0.56
- **(10)** Given in DCM EQ 4-10
- **(11)** a_{DIG} was measured in the field by ESD or DIG Data consultants. a_{DIG} = (upstream curb height) - (depth from top of curb to inlet gutter)
- **(12)** See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation; for proposed curb inlets, aHEC22 = 6.75 - 18*Sx
  $a_{HEC22} = a_{DIG}$ - W*Sx
- **(13)** DCM EQ 4-9: S'w = a_{HEC22} / (12*W)
- **(14)** DCM EQ 4-9: Sw = S'w + Sx
- **(15)** HEC 22 EQ 4-4: For W < T, Eo = 1 / (1 + Sw/Sx/(((1 + Sw/Sx / (T/W))^2.67) - 1)); For T < W, Eo = 1
- **(16)** DCM EQ 4-9: Se = Sx + S'w*Eo
- **(17)** See DCM Table 2-2
- **(18)** DCM EQ 4-10: $L_T = K_T$ * Q^0.42 * S_L^0.3 * [1/ (n*Se)]^0.6
- **(19)** DCM EQ 4-8: E = 1 - [1 - (L/L_T)]^1.8
- **(20)** DCM EQ 4-14: Qi = E * Q
- **(21)** DCM EQ 4-15: Qb = Q - Qi

Ultimate Development Conditions for Proposed System

CURB INLETS ON GRADE, Type G-1 OR Type G-3, parabolic crown

100 YEAR STORM

DRAINAGE AREA	K_T	GUTTER DEPRESSION (in) a_{DIG}	(in) a_{HEC22}	Gutter Depression Width (in)	Gutter Depression Width (ft) W	S'w	Sw	Eo	Se	Manning's n n	INLET LENGTH FOR TOTAL CAPTURE L_T	CURB INLET REDUCTION FACTOR (%)	CURB OPENING LENGTH (in)	CURB OPENING LENGTH (ft) L	INLET EFFICIENCY E	INTERCEPTED FLOW (cfs) Qi	BYPASS FLOW (cfs) Qb	INLET TYPE
Equation in cell ==>	**(10)**	**(11)**	**(12)**			**(13)**	**(14)**	**(15)**	**(16)**	**(17)**	**(18)**	**?**			**(19)**	**(20)**	**(21)**	
DA-A04-A	0.6		6.2	17.0	1.42	0.37	0.40	0.30	0.14	0.016	23.30	0%	120	10.00	0.64	4.10	2.35	Type G-1
DA-A04-B	0.6		6.2	18.0	1.50	0.34	0.38	0.98	0.37	0.016	10.45	0%	120	10.00	1.00	3.75	0.01	Type G-1
DA-A04-C	0.6		6.2	18.0	1.50	0.34	0.38	0.98	0.37	0.016	10.36	0%	120	10.00	1.00	3.68	0.01	Type G-1
DA-A06-C	0.6		6.0	18.0	1.50	0.33	0.38	0.75	0.29	0.016	15.27	0%	120	10.00	0.85	10.19	1.76	Type G-1
DA-A06-D	0.6		6.0	18.0	1.50	0.33	0.38	0.91	0.35	0.016	10.85	0%	120	10.00	0.99	5.00	0.05	Type G-1
DA-A06-E	0.6		6.5	18.0	1.50	0.36	0.38	0.57	0.22	0.016	15.22	0%	120	10.00	0.85	7.74	1.32	Type G-1
DA-A06-F	0.6		6.3	18.0	1.50	0.35	0.38	0.61	0.24	0.016	13.76	0%	120	10.00	0.90	10.21	1.09	Type G-1
DA-A07	0.6		5.9	18.0	1.50	0.33	0.38	0.80	0.31	0.016	12.63	0%	120	10.00	0.94	11.07	0.70	Type G-1
DA-A08	0.6		6.6	18.0	1.50	0.37	0.38	0.64	0.24	0.016	15.29	0%	120	10.00	0.85	11.31	1.97	Type G-1
DA-A09	0.6		5.8	18.0	1.50	0.32	0.38	0.70	0.28	0.016	16.96	0%	120	10.00	0.80	11.09	2.79	Type G-1
DA-A20-A	0.6		6.3	18.0	1.50	0.35	0.38	0.67	0.26	0.016	18.98	0%	180	15.00	0.94	15.10	0.96	Type G-1
DA-A20-C	0.6		6.4	18.0	1.50	0.35	0.38	0.45	0.18	0.016	21.13	0%	180	15.00	0.89	15.63	1.89	Type G-1
DA-A20-D	0.6		6.3	18.0	1.50	0.35	0.38	0.77	0.29	0.016	19.96	0%	60	5.00	0.40	5.92	8.70	Type G-1
DA-A21-B	0.6		5.9	18.0	1.50	0.33	0.38	0.73	0.29	0.016	18.03	0%	240	20.00	1.00	17.37	0.00	
Inlet 21823 (DS of grate inlet DA-A22)	0.6	3.5	2.9	18.0	1.50	0.16	0.19	0.32	0.09	0.016	15.88	0%	88	7.33	0.67	2.42	1.18	Type G-1

Ultimate Development Conditions for Proposed Alternative 1 System

CURB INLETS IN SUMPS, Type S-1, parabolic crown and SUBMERGED CURB INLETS ON GRADE, parabolic crown

25 YEAR STORM

DRAINAGE AREA	Prop or Exist Inlet	Pop or Exist Drainage Area	INLET (StormCAD)	INLET GIS ID	Ultimate Outfall Location ALT1	STREET	DRAINAGE AREA	DRAINAGE AREA (ac.)	DISCHARGE FROM DRAINAGE AREA (cfs)	1st UPSTREAM DRAINAGE AREA	1st CARRY OVER FLOW (cfs)	2nd UPSTREAM DRAINAGE AREA	2nd CARRY OVER FLOW (cfs)	3rd UPSTREAM DRAINAGE AREA	3rd CARRY OVER FLOW (cfs)	4th UPSTREAM DRAINAGE AREA	4th CARRY OVER FLOW (cfs)	5th UPSTREAM DRAINAGE AREA	5th CARRY OVER FLOW (cfs)	TOTAL RUNOFF (cfs) Q	Hig elev (ft)	low elev (ft)	length (ft)	SLOPE (ft/ft) $S_o = S_L$
Equation in cell ==>									(1)											(2)				(3)
DA-A05.1	n/a	exist	N/A		N/A	Mary	DA-A05.1	0.21	1.70	none										1.70	539.00	536.00	117.67	0.025
DA-A05.2	n/a	exist	N/A		N/A	Mary	DA-A05.2	1.04	8.06	none										8.06	539.00	536.00	87.15	0.034
DA-A05	Prop	exist	I-PR-A5	2181	EBC/Mary	Mary	DA-A05	0.00	0.00	DA-A05.1	1.70	DA-A05.2	8.06	DA-A06-A	0.59					10.36				N/A
DA-A06.1	n/a	exist	N/A		N/A	Mary	DA-A06.1	0.84	6.15	none										6.15				0.024
DA-A06-A.2	n/a	prop	N/A		N/A	Mary	DA-A06-A.2	0.39	2.71	DA-A06-C	0.27									2.98				0.039
DA-A06-A	Prop	prop	I-PR-A6-A	2185	EBC/Mary	Mary	DA-A06-A	0.00	0.00	DA-A06.1	6.15	DA-A06-A.2	2.98							9.13				N/A
DA-A18	Exist	prop bypass	I-PR-A18		EBC/Mary	Johanna	DA-A18-A	0.03	0.26	DA-A17-A	2.35									2.61	553.50	550.00	161.82	0.022
DA-A19-A	Exist	prop	I-PR-A19		EBC/Mary	Johanna	DA-A19-A	0.21	1.59	DA-A20-A	0.00	DA-A18	0.59							2.18	553.50	550.00	94.36	0.037
DA-A21.1	n/a	prop	N/A		N/A	alley	DA-A21-A.1	0.90	7.44	none										7.44	557.00	555.00	126.00	0.016
DA-A21-A.2	n/a	prop	N/A		N/A	alley	DA-A21-A.2	0.84	6.85	DA-A21-B	0.00									6.85	558.00	555.00	107.69	0.028
DA-A21-A	Prop	prop	I-PR-A21-A		EBC/Johanna	alley	DA-A21-A	0.00	0.00	DA-A21-A.1	7.44	DA-A21-A.2	6.85							14.29				N/A

Equations in Cells

- **(1)** DCM EQ 2-1: $Q_{peak} = CiA$
- **(2)** Total flow = sum of discharge from drainage area and carry over flow
- **(3)** So = (high elev - low elev)/length
- **(4)** See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
- **(5)** DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
- **(6)** Sx measured in Field by ESD 3-3-15 or 3-31-15
- **(7)** For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
- **(8)** measured in field, lidar or record drawing; see "Crown Height Calcs" tab
- **(9)** HEC-22 EQ B-11: Yo = (2H/B)*x - (H/B2)*x2 ; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
- **(10)** a_{DIG} was measured in the field by ESD or DIG Data consultants. a_{DIG} = (upstream curb height) - (depth from top of curb to inlet gutter)
- **(11)** See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation
  $a_{HEC22} = a_{DIG} - W*Sx$
- **(12)** If d > 1.4*h, use orifice EQ, else use weir EQ
- **(13)** See DCM EQ 4-1: For depressed curb inlet, Cw = 2.3; for curb inlets without depression, Cw = 3.0
- **(14)** HEC-22 EQ 4-31a or DCM EQ 4-4a: $d_o = d_i - (h/2)$; where di = Yo + a_{HEC22}/12; for proposed inlets, do = di - (h/2)sinθ, where sinθ = 0.937
- **(15)** See DCM EQ 4-4: Co = 0.67
- **(16)** DCM EQ 4-1: $Qi = Cw * (L + 1.8*W) * d^{1.5}$
- **(17)** DCM EQ 4-4a: $Qi = Co * h * L * (2*g*do)^{0.5}$
- **(18)** Qover = Q - Qi

100 YEAR STORM

DRAINAGE AREA	Prop or Exist Inlet		INLET (StormCAD)	INLET GIS ID	Ultimate Outfall Location ALT1	STREET	DRAINAGE AREA	DRAINAGE AREA (ac.)	DISCHARGE FROM DRAINAGE AREA (cfs)	1st UPSTREAM DRAINAGE AREA	1st CARRY OVER FLOW (cfs)	2nd UPSTREAM DRAINAGE AREA	2nd CARRY OVER FLOW (cfs)	3rd UPSTREAM DRAINAGE AREA	3rd CARRY OVER FLOW (cfs)	4th UPSTREAM DRAINAGE AREA	4th CARRY OVER FLOW (cfs)	5th UPSTREAM DRAINAGE AREA	5th CARRY OVER FLOW (cfs)	TOTAL RUNOFF (cfs) Q	Hig elev (ft)	low elev (ft)	length (ft)	SLOPE (ft/ft) $S_o = S_L$
Equation in cell ==>									(1)											(2)				(3)
DA-A05.1	n/a	exist	*N/A*		N/A	Mary	DA-A05.1	0.21	2.35	none										2.35	539.00	536.00	117.67	0.025
DA-A05.2	n/a	exist	*N/A*		N/A	Mary	DA-A05.2	1.04	11.11	none										11.11	539.00	536.00	87.15	0.034
DA-A05	Prop	exist	I-PR-A5	2181	EBC/Mary	Mary	DA-A05	0.00	0.00	DA-A05.1	2.35	DA-A05.2	11.11	DA-A06-A	3.92					17.37				N/A
DA-A06.1	n/a	exist	N/A		N/A	Mary	DA-A06.1	0.84	8.50	none										8.50				0.024
DA-A06-A.2	n/a	prop	N/A		N/A	Mary	DA-A06-A.2	0.39	3.76	DA-A06-C	1.76									5.52				0.039
DA-A06-A	Prop	prop	I-PR-A6-A	2185	EBC/Mary	Mary	DA-A06-A	0.00	0.00	DA-A06.1	8.50	DA-A06-A.2	5.52							14.03				N/A
DA-A18	Exist	exist	I-PR-A18		EBC/Mary	Johanna	DA-A18-A	0.03	0.35	DA-A17-A	3.83									4.18	553.50	550.00	161.82	0.022
DA-A19-A	Exist	prop	I-PR-A19		EBC/Mary	Johanna	DA-A19-A	0.21	2.21	DA-A20-A	0.96	DA-A18	0.00							3.18	553.50	550.00	94.36	0.037
DA-A21.1	n/a	prop	N/A		N/A	alley	DA-A21-A.1	0.90	10.22	none										10.22	557.00	555.00	126.00	0.016
DA-A21-A.2	n/a	prop	N/A		N/A	alley	DA-A21-A.2	0.84	9.41	DA-A21-B	0.00									9.41	558.00	555.00	107.69	0.028
DA-A21-A	Prop	prop	I-PR-A21-A		EBC/Johanna	alley	DA-A21-A	0.00	0.00	DA-A21-A.1	10.22	DA-A21-A.2	9.41							19.63				N/A

Ultimate Development Conditions for Proposed Alternative 1 System

CURB INLETS IN SUMPS, Type S-1, parabolic crown and SUBMERGED CURB INLETS ON GRADE, parabolic crown

25 YEAR STORM

Equation in cell ==>							(4)			(5)		(6)	(7)	(8)						(9)				
DRAINAGE AREA	Street Width (FOC-FOC) (ft)	Curb Height (in)	Curb Height (ft)	Split (ft) CS	High or low gutter	K_o	K_1	K_2	K_3	WATER FLOW DEPTH (ft) Yo = d	Over Curb?	ESD Field Measured Street Cross Slope Sx	Dist. Curb to Crown (ft) B	Crown Height (ft) H	Quadratic Formula T = min(x1, x2); x = [-b +/- (b^2 - 4ac)^0.5] / 2a — a H / B^2	b -(2H/B)	c Yo	x1	x2	PONDED WIDTH (ft) T	CLEAR WIDTH (ft)	Over Crown?		Outside ROW?
DA-A05.1	41.5	6.0	0.5	0.0	N/A	2.85	0.50	2.89	0.000	0.234														
DA-A05.2	41.5	6.0	0.5	0.0	N/A	2.85	0.50	2.89	0.000	0.381														
DA-A05	41.5	6.0	0.5	0.0	N/A	2.85	0.50	2.89	0.000	0.381	**no**	0.022	20.8	0.44	0.001	-0.042	0.381	28.365	13.135	13.1	**7.6**	no		no
DA-A06.1	41.5	6.0	0.5	0.0	N/A	2.85	0.50	2.89	0.000	0.369														
DA-A06-A.2	41.5	6.0	0.5	0.0	N/A	2.85	0.50	2.89	0.000	0.264														
DA-A06-A	41.5	6.0	0.5	0.0	N/A	2.85	0.50	2.89	0.000	0.369	**no**	0.017	20.8	0.44	0.001	-0.042	0.369	29.087	12.413	12.4	**8.3**	no		no
DA-A18	32.0	9.5	0.8	0.0	N/A	2.85	0.50	3.03	0.000	0.296	**no**	0.039	16.0	0.60	0.002	-0.075	0.296	27.384	4.616	4.6	**11.4**	no		no
DA-A19-A	32.0	6.0	0.5	0.0	N/A	2.85	0.50	3.03	0.000	0.256	**no**	0.048	16.0	0.54	0.002	-0.068	0.256	27.612	4.388	4.4	**11.6**	no		no
DA-A21.1	38.1	6.0	0.5	0.0	N/A	2.85	0.50	3.03	0.000	0.441	**no**	0.090	38.1	1.45	N/A, crown not parabolic					4.9	~~33.2~~	no		
DA-A21-A.2	38.1	6.0	0.5	0.0	N/A	2.85	0.50	3.03	0.000	0.391	**no**	0.090	38.1	1.45	N/A, crown not parabolic					4.3	~~33.8~~	no		
DA-A21-A	38.1	**8.0**	0.7	0.0	N/A	2.85	0.50	3.03	0.000	0.441	**no**	0.090	38.1	1.45	0.001	-0.076	0.441	69.890	6.310	4.9	~~33.2~~	no		

Equations in Cells

(1) DCM EQ 2-1: Q_{peak} = CiA
(2) Total flow = sum of discharge from drainage area and carry over flow
(3) So = (high elev - low elev)/length
(4) See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
(5) DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
(6) Sx measured in Field by ESD 3-3-15 or 3-31-15
(7) For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
(8) measured in field, lidar or record drawing; see "Crown Height Calcs" tab
(9) HEC-22 EQ B-11: Yo = (2H/B)*x - (H/B2)*x2 ; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
(10) a_{DIG} was measured in the field by ESD or DIG Data consultants. a_{DIG} = (upstream curb height) - (depth from top of curb to inlet gutter)
(11) See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation
a_{HEC22} = a_{DIG} - W*Sx
(12) If d > 1.4*h, use orifice EQ, else use weir EQ
(13) See DCM EQ 4-1: For depressed curb inlet, Cw = 2.3; for curb inlets without depression, Cw = 3.0
(14) HEC-22 EQ 4-31a or DCM EQ 4-4a: d_o = d_i - (h/2); where di = Yo + a_{HEC22}/12; for proposed inlets, do = di - (h/2)sinθ, where sinθ = 0.937
(15) See DCM EQ 4-4: Co = 0.67
(16) DCM EQ 4-1: Qi = Cw * (L + 1.8*W) * $d^{1.5}$
(17) DCM EQ 4-4a: Qi = Co * h * L * $(2*g*do)^{0.5}$
(18) Qover = Q - Qi

100 YEAR STORM

Equation in cell ==>							(4)			(5)		(6)	(7)	(8)						(9)				
DRAINAGE AREA	Street Width (FOC-FOC) (ft)	Curb Height (in)	Curb Height (ft)	Split (ft) CS	High or low gutter	K_o	K_1	K_2	K_3	WATER FLOW DEPTH (ft) Yo = d	Over Curb?	ESD Field Measured Street Cross Slope Sx	Dist. Curb to Crown (ft) B	Crown Height (ft) H	Quadratic Formula T = min(x1, x2); x = [-b +/- (b^2 - 4ac)^0.5] / 2a — a H / B^2	b -(2H/B)	c Yo	x1	x2	PONDED WIDTH (ft) T	CLEAR WIDTH (ft)	Over Crown?	DEPTH OVER CROWN	Outside ROW?
DA-A05.1	41.5	6.0	0.5	0.0	N/A	2.85	0.50	2.89	0.000	0.262														
DA-A05.2	41.5	6.0	0.5	0.0	N/A	2.85	0.50	2.89	0.000	0.425														
DA-A05	41.5	6.0	0.5	0.0	N/A	2.85	0.50	2.89	0.000	0.425	no	0.000	20.8	0.00	0.000	0.000	0.425	--	--	20.8	**0.0**	over crown	**0.4**	**no**
DA-A06.1	41.5	6.0	0.5	0.0	N/A	2.85	0.50	2.89	0.000	0.413														
DA-A06-A.2	41.5	6.0	0.5	0.0	N/A	2.85	0.50	2.89	0.000	0.327														
DA-A06-A		6.0	0.5	0.0	N/A	2.85	0.50	2.89	0.000	0.413	no	0.017	0.0	0.00	--	--	0.413	--	--	0.0	**0.0**	over crown	**0.4**	**no**
DA-A18	32.0	9.5	0.8	0.0	N/A	2.85	0.50	3.03	0.000	0.346	no	0.039	16.0	0.60	0.002	-0.075	0.346	26.409	5.591	5.6	**10.4**	no	**0.0**	**no**
DA-A19-A	32.0	6.0	0.5	0.0	N/A	2.85	0.50	3.03	0.000	0.289	no	0.048	16.0	0.54	0.002	-0.068	0.289	26.903	5.097	5.1	**10.9**	no	**0.0**	**no**
DA-A21.1	38.1	6.0	0.5	0.0	N/A	2.85	0.50	3.03	0.000	0.489	no	0.028	38.1	1.45	N/A, crown not parabolic					17.5	~~20.6~~	no	**0.0**	**no**
DA-A21-A.2	38.1	6.0	0.5	0.0	N/A	2.85	0.50	3.03	0.000	0.434	no	0.028	38.1	1.45	N/A, crown not parabolic					15.5	~~22.6~~	no	**0.0**	**no**
DA-A21-A	38.1	**8.0**	0.7	0.0	N/A	2.85	0.50	3.03	0.000	0.489	no	0.028	38.1	1.45								no	**0.0**	**no**

Ultimate Development Conditions for Proposed Alternative 1 System

CURB INLETS IN SUMPS, Type S-1, parabolic crown and SUBMERGED CURB INLETS ON GRADE, parabolic crown

25 YEAR STORM

Equation in cell ==>	(10)	(11)									(12)	(13)	(14)	(15)			(16)	(17)	(18)	
DRAINAGE AREA	GUTTER DEPRESSION (in) a_{DIG}	(in) a_{HEC22}	CURB OPENING HEIGHT (in)	CURB OPENING HEIGHT (ft) h	Gutter Depression Width (in)	Gutter Depression Width (ft) W	CURB INLET LENGTH (in)	CURB INLET LENGTH (ft) L	(ft) $h + a_{HEC22}/12$	(ft) 1.4*h	If d > 1.4*h, use orifice EQ Else, use weir EQ	WEIR COEFFICIENT Cw	EFFECTIVE HEAD ON ORIFICE (ft) d_o	ORIFICE COEFFICIENT Co	GRAVITY (ft/s^2) g	CURB INLET REDUCTION FACTOR (%)	MAXIMUM CAPACITY FLOW WEIR EQ (cfs) Qi	MAXIMUM CAPACITY FLOW ORIFICE EQ (cfs) Qi	OVER CAPACITY FLOW (cfs) Q_{over}	INLET TYPE
DA-A05.1	[redacted]																			
DA-A05.2	[redacted]																			
DA-A05		6.35	6.25	0.52	18.00	1.50	240.0	20.00	1.05	1.92	weir EQ	3.00	0.67	0.67	32.2		16.00	----	**0.00**	TYPE S-1
DA-A06.1	[redacted]																			
DA-A06-A.2	[redacted]																			
DA-A06-A		6.44	6.25	0.52	18.00	1.50	120.0	10.00	1.06	1.92	weir EQ	3.00	0.66	0.67	32.2		8.54	----	~~0.59~~	TYPE S-1
DA-A18		6.59	10.00	0.83	17.00	1.42	53.0	4.42	1.38	2.23	weir EQ	3.00	0.43	0.67	32.2		3.37	----	~~0.00~~	TYPE S-1
DA-A19-A		5.89	7.00	0.58	18.00	1.50	62.0	5.17	1.07	1.98	weir EQ	3.00	0.45	0.67	32.2		3.05	----	**0.00**	TYPE S-1
DA-A21.1	[redacted]																			
DA-A21-A.2	[redacted]																			
DA-A21-A		5.13	6.25	0.52	18.00	1.50	240.0	20.00	0.95	1.92	weir EQ	3.00	0.62	0.67	32.2		19.91	----	**0.00**	TYPE S-1

Equations in Cells

(1) DCM EQ 2-1: $Q_{peak} = CiA$
(2) Total flow = sum of discharge from drainage area and carry over flow
(3) So = (high elev - low elev)/length
(4) See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
(5) DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
(6) Sx measured in Field by ESD 3-3-15 or 3-31-15
(7) For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
(8) measured in field, lidar or record drawing; see "Crown Height Calcs" tab
(9) HEC-22 EQ B-11: Yo = (2H/B)*x - (H/B2)*x2 ; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
(10) a_{DIG} was measured in the field by ESD or DIG Data consultants. a_{DIG} = (upstream curb height) - (depth from top of curb to inlet gutter)
(11) See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation
$a_{HEC22} = a_{DIG} - W*Sx$
(12) If d > 1.4*h, use orifice EQ, else use weir EQ
(13) See DCM EQ 4-1: For depressed curb inlet, Cw = 2.3; for curb inlets without depression, Cw = 3.0
(14) HEC-22 EQ 4-31a or DCM EQ 4-4a: $d_o = d_i - (h/2)$; where $di = Yo + a_{HEC22}/12$; for proposed inlets, do = di - (h/2)sinθ, where sinθ = 0.937
(15) See DCM EQ 4-4: Co = 0.67
(16) DCM EQ 4-1: $Qi = Cw * (L + 1.8*W) * d^{1.5}$
(17) DCM EQ 4-4a: $Qi = Co * h * L * (2*g*do)^{0.5}$
(18) Qover = Q - Qi

100 YEAR STORM

Equation in cell ==>	(10)	(11)									(12)	(13)	(14)	(15)			(16)	(17)	(18)	
DRAINAGE AREA	GUTTER DEPRESSION (in) a_{DIG}	(in) a_{HEC22}	CURB OPENING HEIGHT (in)	CURB OPENING HEIGHT (ft) h	Gutter Depression Width (in)	Gutter Depression Width (ft) W	CURB INLET LENGTH (in)	CURB INLET LENGTH (ft) L	(ft) $h + a_{HEC22}/12$	(ft) 1.4*h	If d > 1.4*h, use orifice EQ Else, use weir EQ	WEIR COEFFICIENT Cw	EFFECTIVE HEAD ON ORIFICE (ft) d_o	ORIFICE COEFFICIENT Co	GRAVITY (ft/s^2) g	CURB INLET REDUCTION FACTOR (%)	MAXIMUM CAPACITY FLOW WEIR EQ (cfs) Qi	MAXIMUM CAPACITY FLOW ORIFICE EQ (cfs) Qi	OVER CAPACITY FLOW (cfs) Q_{over}	INLET TYPE
DA-A05.1	[redacted]																			
DA-A05.2	[redacted]																			
DA-A05		6.75	6.25	0.52	18.00	1.50	240.0	20.00	1.08	1.92	weir EQ	3.00	0.74	0.67	32.2		18.90	----	**0.00**	TYPE S-1
DA-A06.1	[redacted]																			
DA-A06-A.2	[redacted]																			
DA-A06-A		6.44	6.25	0.52	18.00	1.50	120.0	10.00	1.06	1.92	weir EQ	3.00	0.71	0.67	32.2		10.11	----	~~3.92~~	TYPE S-1
DA-A18		6.59	10.00	0.83	17.00	1.42	53.0	4.42	1.38	2.23	weir EQ	3.00	0.48	0.67	32.2		4.25	----	~~0.00~~	TYPE S-1
DA-A19-A		5.89	7.00	0.58	18.00	1.50	62.0	5.17	1.07	1.98	weir EQ	3.00	0.49	0.67	32.2		3.67	----	**0.00**	TYPE S-1
DA-A21.1	[redacted]																			
DA-A21-A.2	[redacted]																			
DA-A21-A		6.25	6.25	0.52	18.00	1.50	240.0	20.00	1.04	1.92	weir EQ	3.00	0.77	0.67	32.2		23.30	----	**0.00**	TYPE S-1

Ultimate Development Conditions for Proposed System

GRATE INLETS ON GRADE, Type G-2 V-shaped gutter

Equations in cell

(1) DCM EQ 2-1: Q_{peak} = CiA
(2) Total flow = sum of discharge from drainage area and carry over flow
(3) So = (high elev - low elev)/length
(4) Sx = (Sx1 * Sx2) / (Sx1 + Sx2)
(5) See HEC-22 Figure 4-1.b.2; AB = width of parking lane between grate inlet and curb; BC = distance crown to grate inlet
(6) See DCM Table 2-2
(7) Given in HEC-22 EQ 4-2
(8) HEC-22 EQ 4-2 and EX 4-3: T' = [(Q * n)/(Ku * Sx^1.67 * So^0.5)]^0.375
(9) T,max = AB + BC
(10) T = min(T',Tmax)
(11) HEC-22 EQ 4-16: Eo = 1 - (1 - W_{grate}/T)^2.67
(12) If assume velocity in gutter is equal or less than splash over velocity, then R_f = 1
(13) Ku is given in HEC-22 EQ 4-19
(14) V calculated similarly to TR-55 Figure 3-1; V = k * $S^{0.5}$ where k = 46.3 for paved gutter; Ref: Hydrologic Analysis and Design by R. H. McCuen EQ 3-46 and Table 3-14.
(15) HEC-22 EQ 4-19: Rs = ratio of side flow intercepted to total side flow = 1 / [1 + (Ku * V^1.8) / (Sx * L^2.3)]
(16) HEC-22 EQ 4-20: E = Rf * Eo + Rs * (1 - Eo)
(17) See DCM 4.3.2.B
(18) DCM EQ 4-14: Qi = E * Q * Reduction Factor
(19) DCM EQ 4-15: Qb = Q - Qi

25 YEAR STORM

DRAINAGE AREA	Prop or Exist Inlet	Pop or Exist Drainage Area	INLET (StormCAD)	INLET GIS ID	Ultimate Outfall Location ALT1	STREET NAME	DRAINAGE AREA	DRAINAGE AREA (ac.)	DISCHARGE FROM DRAINAGE AREA (cfs)	1st UPSTREAM INLET /DRAINAGE AREA	1st CARRY OVER FLOW (cfs)	2nd UPSTREAM INLET /DRAINAGE AREA	2nd CARRY OVER FLOW (cfs)	TOTAL RUNOFF (cfs) Q	Hig elev (ft)	low elev (ft)	length (ft)	SLOPE (ft/ft) $S_o = S_L$	Street Width (FOC-FOC) (ft)	Curb Height (in)	Parking lane cross slope Sx1	Street Cross Slope Sx2	Sx
Equation in cell ==>									(1)					(2)				(3)					(4)
DA-A17-A	exist	**prop**	**I-PR-A17**	**84375**	EBC/Mary	Johanna St.	DA-A17-A	0.40	2.84	Inlet 21823 (DS of grate inlet DA-A22)	0.47			3.31	553.50	550.00	161.82	0.0216	30.5	6.0	0.042	0.064	0.025

100 YEAR STORM

DRAINAGE AREA	Prop or Exist Inlet	Pop or Exist Drainage Area	INLET ID (StormCAD)	INLET GIS ID	Ultimate Outfall Location ALT1	STREET NAME	DRAINAGE AREA	DRAINAGE AREA (ac.)	DISCHARGE FROM DRAINAGE AREA (cfs)	1st UPSTREAM INLET /DRAINAGE AREA	1st CARRY OVER FLOW (cfs)	2nd UPSTREAM INLET /DRAINAGE AREA	2nd CARRY OVER FLOW (cfs)	TOTAL RUNOFF (cfs) Q	Hig elev (ft)	low elev (ft)	length (ft)	SLOPE (ft/ft) $S_o = S_L$	Street Width (FOC-FOC) (ft)	Curb Height (in)	Parking lane cross slope Sx1	Street Cross Slope Sx2	Sx
Equation in cell ==>									(1)					(2)				(3)					(4)
DA-A17-A	exist	**prop**	**I-PR-A17**	**84375**	EBC/Mary	Johanna St.	DA-A17-A	0.40	3.96	Inlet 21823 (DS of grate inlet DA-A22)	1.18			5.14	553.50	550.00	161.82	0.0216	30.5	6.0	0.042	0.064	0.025

Ultimate Development Conditions for Proposed System

GRATE INLETS ON GRADE, Type G-2 V-shaped gutter

Equations in cell

- **(1)** DCM EQ 2-1: Q_{peak} = CiA
- **(2)** Total flow = sum of discharge from drainage area and carry over flow
- **(3)** So = (high elev - low elev)/length
- **(4)** Sx = (Sx1 * Sx2) / (Sx1 + Sx2)
- **(5)** See HEC-22 Figure 4-1.b.2; AB = width of parking lane between grate inlet and curb; BC = distance crown to grate inlet
- **(6)** See DCM Table 2-2
- **(7)** Given in HEC-22 EQ 4-2
- **(8)** HEC-22 EQ 4-2 and EX 4-3: T' = [(Q * n)/(Ku * Sx^1.67 * So^0.5)]^0.375
- **(9)** T,max = AB + BC
- **(10)** T = min(T',Tmax)
- **(11)** HEC-22 EQ 4-16: Eo = 1 - (1 - W_{grate}/T)^2.67
- **(12)** If assume velocity in gutter is equal or less than splash over velocity, then R_f = 1 See Vo calculations in Appendix I.
- **(13)** Ku is given in HEC-22 EQ 4-19
- **(14)** V calculated similarly to TR-55 Figure 3-1; V = k * $S^{0.5}$ where k = 46.3 for paved gutter; Ref: Hydrologic Analysis and Design by R. H. McCuen EQ 3-46 and Table 3-14.
- **(15)** HEC-22 EQ 4-19: Rs = ratio of side flow intercepted to total side flow = 1 / [1 + (Ku * V^1.8) / (Sx * L^2.3)]
- **(16)** HEC-22 EQ 4-20: E = Rf * Eo + Rs * (1 - Eo)
- **(17)** See DCM 4.3.2.B
- **(18)** DCM EQ 4-14: Qi = E * Q * Reduction Factor
- **(19)** DCM EQ 4-15: Qb = Q - Qi

25 YEAR STORM

DRAINAGE AREA	(ft) AB	(ft) BC	Manning's n	Ku	HYPOTHETICAL PONDED WIDTH (ft) T'	MAXIMUM PONDED WIDTH (ft) Tmax	PONDED WIDTH (ft) T	Gutter Depression Width (ft) W_{gutter}	Grate Width (in)	Grate Width (ft) W_{grate}	Eo	R_f	Ku	Grate Length (in)	Grate Length (ft) L	Gutter Velocity (ft/s) V	R_s	E	GRATE INLET REDUCTION FACTOR (%)	INTERCEPTED FLOW (cfs) Qi	BYPASS FLOW (cfs) Qb	INLET TYPE
Equation in cell ==>	(5)	(5)	(6)	(7)	(8)	(9)	(10)				(11)	(12)	(13)			(14)	(15)	(16)	(17)	(18)	(19)	
DA-A17-A	9.0	18.0	0.016	0.56	8.5	27.0	8.5	0.00	18.00	1.50	0.41	1.0	0.15	36.00	3.00	6.81	0.063	0.44	35%	0.95	2.35	Type G-2

100 YEAR STORM

DRAINAGE AREA	(ft) AB	(ft) BC	Manning's n	Ku	HYPOTHETICAL PONDED WIDTH (ft) T'	MAXIMUM PONDED WIDTH (ft) Tmax	PONDED WIDTH (ft) T	Gutter Depression Width (ft) W_{gutter}	Grate Width (in)	Grate Width (ft) W_{grate}	Eo	R_f	Ku	Grate Length (in)	Grate Length (ft) L	Gutter Velocity (ft/s) V	R_s	E	GRATE INLET REDUCTION FACTOR (%)	INTERCEPTED FLOW (cfs) Qi	BYPASS FLOW (cfs) Qb	INLET TYPE
Equation in cell ==>	(5)	(5)	(6)	(7)	(8)	(9)	(10)				(11)	(12)	(13)			(14)	(15)	(16)	(17)	(18)	(19)	
DA-A17-A	9.0	18.0	0.016	0.56	10.0	27.0	10.0	0.00	18.00	1.50	0.35	1.0	0.15	36.00	3.00	6.81	0.063	0.39	35%	1.31	3.83	Type G-2

Drainage Area Calculations for Live Oak Condos

Area Name	Area (ac) (1)	% IC on plans (2)	Max % IC by zoning	%IC used (3)	C25 (4)	C100 (5)	Tc (min) (6)	25-year intensity (in/hr) (7)	100-year intensity (in/hr)	Q25 (cfs) (8)	Q100 (cfs)	Ultimate Outfall Location
DA-LOC-A	0.250	0.9040	0.80	0.9040	0.84	0.92	5.0	10.11	12.54	2.11	2.90	Mary/EBC
DA-LOC-B3	0.253	0.8667	0.80	0.8667	0.82	0.91	5.0	10.11	12.54	2.09	2.88	Mary/EBC
DA-LOC-B4	0.069	0.9014	0.80	0.9014	0.83	0.92	5.0	10.11	12.54	0.58	0.80	Mary/EBC
DA-LOC-B5	0.054	0.5525	0.80	0.8000	0.79	0.87	5.0	10.11	12.54	0.43	0.59	Mary/EBC
DA-LOC-B6.1	0.092	0.8985	0.80	0.8985	0.83	0.92	5.0	10.11	12.54	0.78	1.07	Mary/EBC
DA-LOC-B6.2	0.079	0.8985	0.80	0.8985	0.83	0.92	5.0	10.11	12.54	0.67	0.92	Mary/EBC
DA-LOC-B6.3	0.033	0.8985	0.80	0.8985	0.83	0.92	5.0	10.11	12.54	0.27	0.38	Mary/EBC
DA-LOC-B6.4	0.018	0.8985	0.80	0.8985	0.83	0.92	5.0	10.11	12.54	0.16	0.21	Mary/EBC

Equations

(1) Areas are from SP-2014-0349C sheet 21; area B6 subdivisions were drawn and estimated in microstation

(2) %IC from SP-2014-0349C sheet 21

(3) max (IC on plans, IC by zoning)

(4) 25 year C value assumptions:

all impervious cover is concrete
C for concrete = 0.88
all pervious cover is grass, average slope, fair condition
C for pervious cover = 0.42

(5) 100 year C value assumptions:

all impervious cover is concrete
C for concrete = 0.97
all pervious cover is grass, average slope, fair condition
C for pervious cover = 0.49

(6) Tc from SP-2014-0349C sheet 21

(7) i = a/(Tc +b)^c

For 25 year storm:

a= 82.936
b= 10.746
c= 0.7634

For 100 year storm:

a= 118.3
b= 13.185
c= 0.7736

(8) Qpeak = CiA

Exhibit K.3.2

Inlet Calculations for Storm Drain System

Outfalling at East Bouldin Creek and:

Crockett Street

Impervious Cover Breakdown

Note: This tab assumes that the increase in impervious cover for SF lots is entirely concrete/roofs; for all other LU categories, the increase in impervious cover is the same proportion of asphalt/concrete as the existing conditions

Ref:

Existing %IC within LU Category 100 = 39%

Ultimate %IC within LU Category 100 = 65%

				Area of IC within each FLUM Category and DA (Ult Conditions)			Ultimate Development Conditions					
	Total Area	Ult %IC	Total Area of IC for Ult conditions	100	All other LU Categories	Existing % of IC that is Asphalt	For LU 100, % of IC area that is Asphalt	Area Asphalt within LU 100	Area Asphalt within all other LU s	Total Area Asphalt within DA	Total Area Concrete within DA	Total Area Grass within DA
DA-A22-A	22605	86.3%	19512	0	19512	72.2%	42.9%	0	14095	14095	5417	3093
DA-A22-B	10385	98.1%	10189	0	10189	99.2%	58.8%	0	10109	10109	81	196
DA-A22-C	8632	95.3%	8229	0	8229	98.3%	58.3%	0	8092	8092	137	403
DA-A22-D	22451	65.5%	14702	10039	4663	21.4%	12.7%	1273	996	2269	12433	7749
DA-A22-E	14237	66.6%	9487	12547	-3060	42.0%	24.9%	3128	-1286	1842	7645	4750
DA-A22-F	22258	68.6%	15272	5432	9840	48.0%	28.5%	1546	4722	6268	9004	6986
DA-A22-G	8811	65.9%	5809	8964	-3155	63.0%	37.4%	3352	-1989	1363	4446	3002
DA-A22-H	16045	67.2%	10785	2493	8292	28.1%	16.7%	416	2333	2749	8036	5260
DA-A22-J	22899	69.1%	15825	4108	11717	12.3%	7.3%	301	1447	1747	14078	7074
DA-A22-K	45563	66.9%	30482	11015	19467	22.2%	13.2%	1449	4318	5768	24714	15081
DA-A22-L	22569	66.7%	15043	25630	-10587	29.5%	17.5%	4482	-3121	1361	13682	7526
DA-A22-M	7518	72.2%	5424	11901	-6477	86.7%	51.4%	6118	-5613	505	4919	2094
DA-A22-N	22612	63.2%	14292	25274	-10982	33.9%	20.1%	5085	-3725	1360	12932	8320
DA-A22-P	22853	87.5%	20008	5466	14542	70.7%	42.0%	2293	10285	12578	7430	2845
DA-A22-Q	35001	98.2%	34362	0	34362	86.6%	51.4%	0	29761	29761	4602	639
DA-A22-R	22463	98.2%	22053	0	22053	20.0%	11.9%	0	4418	4418	17635	410
DA-A22-S	34083	98.2%	33461	0	33461	9.0%	5.4%	0	3018	3018	30443	622
DA-A22-T	22472	98.2%	22062	0	22062	28.1%	16.7%	0	6200	6200	15862	410

Annie Street Storm Drain Improvements
C Values - Ultimate Development Conditions for Proposed Alternative 1 - Crockett System

																									0.37	0.42	0.46	0.53					
																								0.25	0.30	0.34	0.41					
Drainage Input				Asphalt		Concrete		Grass		Total	Asphalt	Concrete	Grass	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	Combined				
Basin	Area (sf)	Drainage Area EX %IC	Area IC (sf)	Asph. % of IC	Asph.. Area (sf)	Conc. % of IC	Conc. Area (sf)	Grass Percentile	Grass Area (sf)	Area (acres)	Asp. Area (acres)	Conc. Area (acres)	Grass Area (acres)	Asph.C2	Asph.C10	Asph.C25	Asph. C100	Asph C500	Conc. C2	Conc. C10	Conc. C25	Conc. C100	Conc. C500	Grass C2	Grass C10	Grass C25	Grass C100	Comb. C2	Comb. C10	Comb. C25	Comb. C100	Comb. C500
DA-A22-A	22605			62.4%	14095	23.96%	5417	13.68%	3093	0.52	0.32	0.12	0.07	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.68	0.76	0.80	0.89	0.94
DA-A22-B	10385			97.3%	10109	0.78%	81	1.88%	196	0.24	0.23	0.00	0.00	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.72	0.80	0.85	0.94	0.99
DA-A22-C	8632			93.7%	8092	1.59%	137	4.67%	403	0.20	0.19	0.00	0.01	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.71	0.79	0.84	0.93	0.98
DA-A22-D	22451			10.1%	2269	55.38%	12433	34.52%	7749	0.52	0.05	0.29	0.18	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.60	0.67	0.72	0.80	0.86
DA-A22-E	14237			12.9%	1842	53.70%	7645	33.36%	4750	0.33	0.04	0.18	0.11	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.61	0.68	0.72	0.81	0.86
DA-A22-F	22258			28.2%	6268	40.45%	9004	31.39%	6986	0.51	0.14	0.21	0.16	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.61	0.68	0.73	0.81	0.87
DA-A22-G	8811			15.5%	1363	50.46%	4446	34.07%	3002	0.20	0.03	0.10	0.07	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.60	0.67	0.72	0.80	0.86
DA-A22-H	16045			17.1%	2749	50.08%	8036	32.78%	5260	0.37	0.06	0.18	0.12	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.61	0.68	0.73	0.81	0.86
DA-A22-J	22899			7.6%	1747	61.48%	14078	30.89%	7074	0.53	0.04	0.32	0.16	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.62	0.69	0.74	0.82	0.87
DA-A22-K	45563			12.7%	5768	54.24%	24714	33.10%	15081	1.05	0.13	0.57	0.35	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.61	0.68	0.73	0.81	0.86
DA-A22-L	22569			6.0%	1361	60.62%	13682	33.35%	7526	0.52	0.03	0.31	0.17	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.61	0.68	0.73	0.81	0.86
DA-A22-M	7518			6.7%	505	65.43%	4919	27.85%	2094	0.17	0.01	0.11	0.05	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.63	0.70	0.75	0.83	0.88
DA-A22-N	22612			6.0%	1360	57.19%	12932	36.79%	8320	0.52	0.03	0.30	0.19	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.59	0.66	0.71	0.79	0.85
DA-A22-P	22853			55.0%	12578	32.51%	7430	12.45%	2845	0.52	0.29	0.17	0.07	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.69	0.76	0.81	0.90	0.95
DA-A22-Q	35001			85.0%	29761	13.15%	4602	1.82%	639	0.80	0.68	0.11	0.01	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.73	0.80	0.85	0.94	0.99
DA-A22-R	22463			19.7%	4418	78.51%	17635	1.82%	410	0.52	0.10	0.40	0.01	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.74	0.82	0.87	0.96	0.99
DA-A22-S	34083			8.9%	3018	89.32%	30443	1.82%	622	0.78	0.07	0.70	0.01	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.74	0.82	0.87	0.96	0.99
DA-A22-T	22472			27.6%	6200	70.59%	15862	1.82%	410	0.52	0.14	0.36	0.01	0.73	0.81	0.86	0.95	1.00	0.75	0.83	0.88	0.97	1.00	0.33	0.38	0.42	0.49	0.74	0.82	0.87	0.96	0.99
Total Area	**383457**																															

DESIGNER NOTES
Basis for Calculations:

Area of imervious cover that is asphalt versus concrete is calculated on Impervious Cover Breakdown sheet
Area of grass = total area - asphalt area - area concrete

Annie Street Storm Drain Improvements
Time of Concentration (Ultimate Conditions for Proposed Alternative 1 - Crockett System)

Equation in cell ==>		(1)	(2)			(3)	(4)	(5)			(6)	(7)	(8)			(9)	(10)			(9)	(10)
Drainage Input				Sheet Flow - roof/pavement					Sheet Flow - overland					Shallow Conc. 1 - unpaved				Shallow Conc. 2 - unpaved			
Basin	Area (acres)	Calc. Tc	Tc used mins	Sheet Flow Length (ft)	Sheet Flow Slope (ft/ft)	n	P	tc1 mins	Sheet Flow Length (ft)	Sheet Flow Slope (ft/ft)	n	P	tc1 mins	Shallow Flow Length (ft)	Shallow Flow Slope (ft/ft)	n	tc2 mins	Shallow Flow Length (ft)	Shallow Flow Slope (ft/ft)	n	tc3 mins
DA-A22-A	0.52	2.3	5.0	0.0	0.000	0.02	3.44	0.0	0.0	0.000	0.15	3.44	0.0	0.0	0.000	0.05	0.0	0.0	0.000	0.05	0.0
DA-A22-B	0.24	1.3	5.0	0.0	0.000	0.02	3.44	0.0	0.0	0.000	0.15	3.44	0.0	0.0	0.000	0.05	0.0	0.0	0.000	0.05	0.0
DA-A22-C	0.20	0.7	5.0	0.0	0.000	0.02	3.44	0.0	0.0	0.000	0.15	3.44	0.0	0.0	0.000	0.05	0.0	0.0	0.000	0.05	0.0
DA-A22-D	0.52	4.8	5.0	0.0	0.000	0.02	3.44	0.0	27.0	0.022	0.15	3.44	3.2	232.0	0.029	0.05	1.4	29.0	0.100	0.05	0.1
DA-A22-E	0.33	8.3	8.3	0.0	0.000	0.02	3.44	0.0	74.0	0.028	0.15	3.44	6.5	207.0	0.025	0.05	1.4	40.0	0.077	0.05	0.1
DA-A22-F	0.51	1.6	5.0	9.0	0.022	0.02	3.44	0.3	0.0	0.000	0.15	3.44	0.0	115.0	0.017	0.05	0.9	36.0	0.092	0.05	0.1
DA-A22-G	0.20	3.5	5.0	0.0	0.000	0.02	3.44	0.0	26.0	0.023	0.15	3.44	3.0	0.0	0.000	0.05	0.0	0.0	0.000	0.05	0.0
DA-A22-H	0.37	6.8	6.8	0.0	0.000	0.02	3.44	0.0	54.0	0.020	0.15	3.44	5.7	0.0	0.000	0.05	0.0	0.0	0.000	0.05	0.0
DA-A22-J	0.53	2.7	5.0	27.0	0.019	0.02	3.44	0.7	0.0	0.000	0.15	3.44	0.0	289.0	0.028	0.05	1.8	0.0	0.000	0.05	0.0
DA-A22-K	1.05	14.8	14.8	0.0	0.000	0.02	3.44	0.0	132.0	0.017	0.15	3.44	12.7	329.0	0.029	0.05	2.0	0.0	0.000	0.05	0.0
DA-A22-L	0.52	8.1	8.1	0.0	0.000	0.02	3.44	0.0	91.0	0.035	0.15	3.44	7.0	188.0	0.028	0.05	1.2	0.0	0.000	0.05	0.0
DA-A22-M	0.17	1.6	5.0	0.0	0.000	0.02	3.44	0.0	0.0	0.000	0.15	3.44	0.0	71.0	0.023	0.05	0.5	0.0	0.000	0.05	0.0
DA-A22-N	0.52	10.7	10.7	0.0	0.000	0.02	3.44	0.0	104.0	0.019	0.15	3.44	9.9	130.0	0.044	0.050	0.6	0.0	0.000	0.05	0.0
DA-A22-P	0.52	1.1	5.0	0.0	0.000	0.02	3.44	0.0	0.0	0.000	0.15	3.44	0.0	106.0	0.030	0.05	0.6	0.0	0.000	0.05	0.0
DA-A22-Q	0.80	2.1	5.0	0.0	0.000	0.02	3.44	0.0	0.0	0.000	0.15	3.44	0.0	0.0	0.000	0.05	0.0	0.0	0.000	0.05	0.0
DA-A22-R	0.52	2.0	5.0	21.0	0.014	0.02	3.44	0.6	0.0	0.000	0.15	3.44	0.0	173.0	0.025	0.05	1.1	54.0	0.076	0.05	0.2
DA-A22-S	0.78	2.4	5.0	27.0	0.022	0.02	3.44	0.6	0.0	0.000	0.15	3.44	0.0	192.0	0.022	0.05	1.3	0.0	0.000	0.05	0.0
DA-A22-T	0.52	1.7	5.0	26.0	0.031	0.02	3.44	0.5	0.0	0.000	0.15	3.44	0.0	194.0	0.032	0.05	1.1	0.0	0.000	0.05	0.0

Equations

(1) Calculated Tc = Sheet Flow Tc + Shallow Concentrated Tc + Gutter Flow Tc
(2) Tc used = min (5, Calculated Tc)
(3) n = 0.020 for roofs/pavement
(4) See DCM Table 2-3: 2-year 24-hour rainfall
(5) DCM EQ 2-3: Sheet Flow Tc for roofs/pavement (mins) = $0.42 * (nL)^{0.8} / (P^{0.5} * S^{0.4})$
(6) n = 0.15 for Grass, short-grass prairie; See DCM Table 2-2
(7) See DCM Table 2-3: 2-year 24-hour rainfall
(8) DCM EQ 2-3Sheet Flow for roofs/pavement (mins) = $0.42 * (nL)^{0.8} / (P^{0.5} * S^{0.4})$
(9) Given in DCM Section 2.4.2.B
(10) DCM EQ 2-4: Unpaved Shallow Concentrated Tc = $L / (60(16.1345)(S^{0.5}))$
(11) Given in DCM Section 2.4.2.B; cells hilighted in green use the unpaved equation
(12) DCM EQ 2-5: Paved Shallow Concentrated Tc = $L / (60(20.3282)(S^{0.5}))$; cells hilighted in green use the unpaved equation
(13) $V = k * S^{0.5}$ Reference: Richard McCuen, Hydrologic Analysis and Design (New Jersey: Prentice Hall 1998), p. 143.
(14) $Tc = L / (60 * V)$

Annie Street Storm Drain Improvements
Time of Concentration (Ultimate Conditions for Proposed Alternative 1 - Crockett System)

Equation in cell ==>			**(11)**	**(12)**			**(11)**	**(12)**			**(13)**	**(14)**			**(13)**	**(14)**
	Shallow Conc. 3 - paved				Shallow Conc. 4 - paved				Gutter 1 (paved)				Gutter 2 (paved)			
Basin	Shallow Flow Length (ft)	Shallow Flow Slope (ft/ft)	n	tc4 mins	Shallow Flow Length (ft)	Shallow Flow Slope (ft/ft)	n	tc5 mins	Channel Length (ft)	slope	Channel Min. V (fps)	tc6 mins	Channel Length (ft)	slope	Channel Min. V (fps)	tc7
DA-A22-A	267.0	0.017	0.025	1.7	0.0	0.000	0.025	0.0	232.0	0.016	5.9	0.7	0.0	0.000	0.0	0.0
DA-A22-B	0.0	0.000	0.025	0.0	0.0	0.000	0.025	0.0	395.0	0.012	5.2	1.3	0.0	0.000	0.0	0.0
DA-A22-C	0.0	0.000	0.025	0.0	0.0	0.000	0.025	0.0	317.0	0.024	7.2	0.7	0.0	0.000	0.0	0.0
DA-A22-D	0.0	0.000	0.025	0.0	0.0	0.000	0.025	0.0	48.0	0.017	6.0	0.1	0.0	0.000	0.0	0.0
DA-A22-E	0.0	0.000	0.025	0.0	0.0	0.000	0.025	0.0	101.0	0.016	5.8	0.3	0.0	0.000	0.0	0.0
DA-A22-F	0.0	0.000	0.025	0.0	0.0	0.000	0.025	0.0	105.0	0.017	6.1	0.3	0.0	0.000	0.0	0.0
DA-A22-G	0.0	0.000	0.025	0.0	0.0	0.000	0.025	0.0	214.0	0.024	7.2	0.5	0.0	0.000	0.0	0.0
DA-A22-H	52.0	0.006	0.025	0.6	43.0	0.037	0.025	0.2	156.0	0.026	7.4	0.4	0.0	0.000	0.0	0.0
DA-A22-J	0.0	0.000	0.025	0.0	0.0	0.000	0.025	0.0	55.0	0.009	4.4	0.2	0.0	0.000	0.0	0.0
DA-A22-K	0.0	0.000	0.025	0.0	0.0	0.000	0.025	0.0	27.0	0.015	5.6	0.1	0.0	0.000	0.0	0.0
DA-A22-L	0.0	0.000	0.025	0.0	0.0	0.000	0.025	0.0	0.0	0.000	0.0	0.0	0.0	0.000	0.0	0.0
DA-A22-M	218.0	0.024	0.025	1.2	0.0	0.000	0.025	0.0	0.0	0.000	0.0	0.0	0.0	0.000	0.0	0.0
DA-A22-N	0.0	0.000	0.025	0.0	0.0	0.000	0.025	0.0	50.0	0.014	5.5	0.2	0.0	0.000	0.0	0.0
DA-A22-P	0.0	0.000	0.025	0.0	0.0	0.000	0.025	0.0	218.0	0.024	7.2	0.5	0.0	0.000	0.0	0.0
DA-A22-Q	103.0	0.023	0.025	0.6	54.0	0.031	0.025	0.2	343.0	0.015	5.6	1.0	120.0	0.023	7.1	0.3
DA-A22-R	0.0	0.000	0.025	0.0	0.0	0.000	0.025	0.0	37.0	0.022	6.8	0.1	0.0	0.000	0.0	0.0
DA-A22-S	69.0	0.017	0.025	0.4	0.0	0.000	0.025	0.0	0.0	0.000	0.0	0.0	0.0	0.000	0.0	0.0
DA-A22-T	0.0	0.000	0.025	0.0	0.0	0.000	0.025	0.0	0.0	0.000	0.0	0.0	0.0	0.000	0.0	0.0

Annie Street Storm Drain Improvements
Tc Data - Ultimate Development Conditions for Proposed Alternative 1 - Crockett System

	Sheet Flow - roof/pavement				Sheet Flow - overland				Shallow Conc 1 - unpaved				Shallow Conc 2 - unpaved			
Drainage Area	**Length**	**High elev**	**Low elev**	**slope**	**Length**	**High elev**	**Low elev**	**slope**	**Length**	**High elev**	**Low elev**	**slope**	**Length**	**High elev**	**Low elev**	**slope**
DA-A22-A				0.000				0.000				0.000				0.000
DA-A22-B				0.000				0.000				0.000				0.000
DA-A22-C				0.000				0.000				0.000				0.000
DA-A22-D				0.000	27.00	571.40	570.80	0.022	232.00	570.80	564.00	0.029	29.00	564.00	561.10	0.100
DA-A22-E				0.000	74.00	570.50	568.40	0.028	207.00	568.40	563.30	0.025	40.00	563.30	560.20	0.077
DA-A22-F	9.00	567.80	567.60	0.022				0.000	115.00	567.60	565.60	0.017	36.00	565.60	562.30	0.092
DA-A22-G				0.000	26.00	571.40	570.80	0.023				0.000				0.000
DA-A22-H				0.000	54.00	572.70	571.60	0.020				0.000				0.000
DA-A22-J	27.00	573.10	572.60	0.019				0.000	289.00	572.60	564.60	0.028				0.000
DA-A22-K				0.000	132.00	576.10	573.90	0.017	329.00	573.90	564.50	0.029				0.000
DA-A22-L				0.000	91.00	573.70	570.50	0.035	188.00	570.50	565.20	0.028				0.000
DA-A22-M				0.000				0.000	71.00	576.10	574.50	0.023				0.000
DA-A22-N				0.000	104.00	578.20	576.20	0.019	130.00	576.20	570.50	0.044				0.000
DA-A22-P				0.000				0.000	106.00	578.50	575.30	0.030				0.000
DA-A22-Q				0.000				0.000				0.000				0.000
DA-A22-R	21.00	571.60	571.30	0.014				0.000	173.00	571.30	567.00	0.025	54.00	567.00	562.90	0.076
DA-A22-S	27.00	581.40	580.80	0.022				0.000	192.00	580.80	576.50	0.022				0.000
DA-A22-T	26.00	579.30	578.50	0.031				0.000	194.00	578.50	572.20	0.032				0.000
				0.000				0.000				0.000				0.000

Annie Street Storm Drain Improvements

Tc Data - Ultimate Development Conditions for Proposed Alternative 1 - Crockett System

								0.37	0.42	0.46	0.53	0.60				
	Shallow Conc 3 - paved				**Shallow Conc 4 - paved**				**Gutter 1**				**Gutter 2**			
Drainage Area	**Length**	**High elev**	**Low elev**	**slope**	**Length**	**High elev**	**Low elev**	**slope**	**Length**	**High elev**	**Low elev**	**slope**	**Length**	**High elev**	**Low elev**	**slope**
DA-A22-A	267.00	563.10	558.50	0.017				0.000	232.00	558.50	554.70	0.016				0.000
DA-A22-B				0.000				0.000	395.00	564.40	559.50	0.012				0.000
DA-A22-C				0.000				0.000	317.00	572.30	564.60	0.024				0.000
DA-A22-D				0.000				0.000	48.00	561.10	560.30	0.017				0.000
DA-A22-E				0.000				0.000	101.00	560.20	558.60	0.016				0.000
DA-A22-F				0.000				0.000	105.00	562.30	560.50	0.017				0.000
DA-A22-G				0.000				0.000	214.00	570.80	565.60	0.024				0.000
DA-A22-H	52.00	571.60	571.30	0.006	43.00	571.30	569.70	0.037	156.00	569.70	565.70	0.026				0.000
DA-A22-J				0.000				0.000	55.00	564.60	564.10	0.009				0.000
DA-A22-K				0.000				0.000	27.00	564.90	564.50	0.015				0.000
DA-A22-L				0.000				0.000				0.000				0.000
DA-A22-M	218.00	574.50	569.30	0.024				0.000				0.000				0.000
DA-A22-N				0.000				0.000	50.00	570.50	569.80	0.014				0.000
DA-A22-P				0.000				0.000	218.00	575.30	570.10	0.024				0.000
DA-A22-Q	103.00	584.60	582.20	0.023	54.00	577.10	575.40	0.031	343.00	582.20	577.10	0.015	120.00	575.40	572.60	0.023
DA-A22-R				0.000				0.000	37.00	562.90	562.10	0.022				0.000
DA-A22-S	69.00	576.50	575.30	0.017				0.000				0.000				0.000
DA-A22-T				0.000				0.000				0.000				0.000
				0.000				0.000				0.000				0.000

RUNOFF COMPUTATIONS (Ultimate Conditions)

			2 Year Storm Event			10 Year Storm Event			25 Year Storm Event			100 Year Storm Event		
Drainage Area Number	Drainage Area (acres)	Time of Concentration Tc (min)	Runoff Coefficient C2	Intensity I2	Design Flow Q2 (cfs)	Runoff Coefficient C10	Intensity I10	Design Flow Q10 (cfs)	Runoff Coefficient C25	Intensity I25	Design Flow Q25 (cfs)	Runoff Coefficient C100	Intensity I100	Design Flow Q100 (cfs)
DA-A22-A	0.52	5.0	0.68	5.76	2.0	0.76	8.57	3.4	0.80	10.11	4.2	0.89	12.54	5.8
DA-A22-B	0.24	5.0	0.72	5.76	1.0	0.80	8.57	1.6	0.85	10.11	2.1	0.94	12.54	2.8
DA-A22-C	0.20	5.0	0.71	5.76	0.8	0.79	8.57	1.3	0.84	10.11	1.7	0.93	12.54	2.3
DA-A22-D	0.52	5.0	0.60	5.76	1.8	0.67	8.57	3.0	0.72	10.11	3.7	0.80	12.54	5.2
DA-A22-E	0.33	8.3	0.61	4.95	1.0	0.68	7.39	1.6	0.72	8.76	2.1	0.81	11.04	2.9
DA-A22-F	0.51	5.0	0.61	5.76	1.8	0.68	8.57	3.0	0.73	10.11	3.8	0.81	12.54	5.2
DA-A22-G	0.20	5.0	0.60	5.76	0.7	0.67	8.57	1.2	0.72	10.11	1.5	0.80	12.54	2.0
DA-A22-H	0.37	6.8	0.61	5.27	1.2	0.68	7.86	2.0	0.73	9.30	2.5	0.81	11.65	3.5
DA-A22-J	0.53	5.0	0.62	5.76	1.9	0.69	8.57	3.1	0.74	10.11	3.9	0.82	12.54	5.4
DA-A22-K	1.05	14.8	0.61	3.91	2.5	0.68	5.86	4.2	0.73	6.99	5.3	0.81	8.99	7.6
DA-A22-L	0.52	8.1	0.61	4.98	1.6	0.68	7.42	2.6	0.73	8.80	3.3	0.81	11.09	4.6
DA-A22-M	0.17	5.0	0.63	5.76	0.6	0.70	8.57	1.0	0.75	10.11	1.3	0.83	12.54	1.8
DA-A22-N	0.52	10.7	0.59	4.50	1.4	0.66	6.72	2.3	0.71	7.99	2.9	0.79	10.16	4.2
DA-A22-P	0.52	5.0	0.69	5.76	2.1	0.76	8.57	3.4	0.81	10.11	4.3	0.90	12.54	5.9
DA-A22-Q	0.80	5.0	0.73	5.76	3.4	0.80	8.57	5.5	0.85	10.11	6.9	0.94	12.54	9.5
DA-A22-R	0.52	5.00	0.74	5.76	2.19	0.82	8.57	3.61	0.87	10.11	4.52	0.96	12.54	6.19
DA-A22-S	0.78	5.00	0.74	5.76	3.34	0.82	8.57	5.50	0.87	10.11	6.88	0.96	12.54	9.42
DA-A22-T	0.52	5.00	0.74	5.76	2.19	0.82	8.57	3.61	0.87	10.11	4.52	0.96	12.54	6.19

From DCM Section 2.4.3, Table 2-5:

	2-year	10-year	25-year	100-year
a=	54.767	70.820	82.9360	118.3000
b=	11.051	10.396	10.7460	13.1850
c=	0.8116	0.7725	0.7634	0.7736

Ultimate Development Conditions for Proposed Crockett Street System

CURB INLETS ON GRADE (508S-3), Type G-1 OR Type G-3, parabolic crown

100 YEAR STORM

DRAINAGE AREA	STREET NAME	DRAINAGE AREA	DRAINAGE AREA (ac.)	DISCHARGE FROM DRAINAGE AREA (cfs)	1st UPSTREAM INLET /DRAINAGE AREA	CARRY OVER FLOW (cfs)	2nd UPSTREAM INLET /DRAINAGE AREA	CARRY OVER FLOW (cfs)	3rd UPSTREAM INLET /DRAINAGE AREA	CARRY OVER FLOW (cfs)	TOTAL RUNOFF (cfs) Q	SLOPE (ft/ft) $S_o = S_L$	Street Width (FOC-FOC) (ft) W
DA-A22-B	Crockett	DA-A22-B	0.24	2.82	DA-A22-C	0.00					2.82	0.0200	30.00
DA-A22-C	Crockett	DA-A22-C	0.20	2.31	DA-A22-Q	0.00					2.31	0.0100	30.00
DA-A22-D	Wilson	DA-A22-D	0.52	5.19	DA-A22-R	0.87					6.06	0.0050	35.00
DA-A22-E	Wilson	DA-A22-E	0.33	2.91	DA-A22-B	0.00	DA-A22-D	0.00	DA-A22-F	0.00	2.91	0.0082	35.00
DA-A22-F	Wilson	DA-A22-F	0.51	5.22	DA-A22-G	0.00	DA-A22-H	0.00	DA-A22-J	0.00	5.22	0.0070	30.00
DA-A22-G	Crockett	DA-A22-G	0.20	2.04							2.04	0.0140	25.00
DA-A22-H	Newton	DA-A22-H	0.37	3.47							3.47	0.0230	25.00
DA-A22-J	Newton	DA-A22-J	0.53	5.41	DA-A22-K	0.00					5.41	0.0040	30.00
DA-A22-K	Crockett	DA-A22-K	1.05	7.60	DA-A22-L	0.00					7.60	0.0040	30.00
DA-A22-L	Crockett	DA-A22-L	0.52	4.65	DA-A22-M	0.00	DA-A22-N	0.00	DA-A22-P	2.09	6.73	0.0020	30.00
DA-A22-M	Crockett	DA-A22-M	0.17	1.81							1.81	0.0040	27.00
DA-A22-N	Eva	DA-A22-N	0.52	4.18	DA-A22-T	0.05					4.23	0.0040	27.00
DA-A22-P	Crockett	DA-A22-P	0.52	5.92	DA-A22-S	5.69					11.61	0.0150	30.00
DA-A22-Q	Crockett	DA-A22-Q	0.80	9.52							9.52	0.0100	30.00
DA-A22-R	Crockett	DA-A22-R	0.52	6.19							6.19	0.0273	35.00
DA-A22-T	Crockett	DA-A22-T	0.52	6.19							6.19	0.0120	30.00

Equations in cell

(1) DCM EQ 2-1: Q_{peak} = CiA
(2) Total flow = sum of discharge from drainage area and carry over flow
(3) So = (high elev - low elev)/length
(4) See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
(5) DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
For DA-A26 only, use straight crown equation since the driveway does not have a parabolic crown: HEC-22 EQ 4-3: d = T * Sx
(6) Sx measured in Field by ESD 3-3-15 or 3-31-15
(7) For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
(8) measured in field, lidar or record drawing; see "Crown Height Calcs" tab
(9) Hec-22 EQ B-11: Yo = (2H/B)*x - $(H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
For DA-A26 only, use straight crown equation, HEC-22 EQ 4-2. If T calculated from HEC-22 EQ 4-2 is greater than B, use T=B
HEC-22 EQ 4-2: $T = [Qn / (Ku * Sx^{1.67} * SL^{0.5})]^{0.375}$; where n = 0.012 (HEC-22 Table 4-3) and Ku = 0.56
(10) Given in DCM EQ 4-10
(11) Not used for proposed curb inlet
(12) See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation; aHEC22 = 6.75 - 18*Sx
$a_{HEC22} = a_{DIG}$ - W*Sx
(13) DCM EQ 4-9: S'w = a_{HEC22} / (12*W)
(14) DCM EQ 4-9Sw = S'w + Sx
(15) HEC 22 EQ 4-4: For W < T, Eo = 1 / (1 + Sw/Sx/(((1 + Sw/Sx / (T/W))^2.67) - 1)); For T < W, Eo = 1
(16) DCM EQ 4-9: Se = Sx + S'w*Eo
(17) See DCM Table 2-2
(18) DCM EQ 4-10: $L_T = K_T$ * Q^0.42 * S_L^0.3 * [1/ (n*Se)]^0.6
(19) DCM EQ 4-8: E = 1 - [1 - (L/L_T)]^1.8
(20) DCM EQ 4-14: Qi = E * Q
(21) DCM EQ 4-15: Qb = Q - Qi

Ultimate Development CUltimate Development Conditions for Proposed Crockett Street System

CURB INLETS CURB INLETS ON GRADE (508S-3), Type G-1 OR Type G-3, parabolic crown

100 YEAR STORM **100 YEAR STORM**

DRAINAGE AREA	DRAINAGE AREA	Curb Height *(in)*	Curb Height *(ft)*	CURB OPENING HEIGHT *(in)*	CURB OPENING HEIGHT *(ft)* h	Split *(ft)* CS	High or low gutter	K_o	K_1	K_2	K_3	WATER FLOW DEPTH *(ft)* Yo = d	Over Curb or Gutter?	Contained within R.O.W. *Assume if flow depth (ft) <* 0.58
DA-A22-B	DA-A22-B	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.31	No	Yes
DA-A22-C	DA-A22-C	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.32	No	Yes
DA-A22-D	DA-A22-D	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.50	No	Yes
DA-A22-E	DA-A22-E	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.36	No	Yes
DA-A22-F	DA-A22-F	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.45	No	Yes
DA-A22-G	DA-A22-G	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.29	No	Yes
DA-A22-H	DA-A22-H	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.32	No	Yes
DA-A22-J	DA-A22-J	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.50	No	Yes
DA-A22-K	DA-A22-K	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.56	Over Curb	Yes
DA-A22-L	DA-A22-L	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.60	Over Curb	No
DA-A22-M	DA-A22-M	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.35	No	Yes
DA-A22-N	DA-A22-N	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.46	No	Yes
DA-A22-P	DA-A22-P	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.51	Over Curb	Yes
DA-A22-Q	DA-A22-Q	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.52	Over Curb	Yes
DA-A22-R	DA-A22-R	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.38	No	Yes
DA-A22-T	DA-A22-T	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.43	No	Yes

Equations in cell	**Equations in cell**	
(1)	**(1)**	DCM EQ 2-1: Q_{peak} = CiA
(2)	**(2)**	Total flow = sum of discharge from drainage area and carry over flow
(3)	**(3)**	So = (high elev - low elev)/length
(4)	**(4)**	See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
(5)	**(5)**	DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
		For DA-A26 only, use straight crown equation since the driveway does not have a parabolic crown: HEC-22 EQ 4-3: d = T * Sx
(6)	**(6)**	Sx measured in Field by ESD 3-3-15 or 3-31-15
(7)	**(7)**	For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
(8)	**(8)**	measured in field, lidar or record drawing; see "Crown Height Calcs" tab
(9)	**(9)**	Hec-22 EQ B-11: $Yo = (2H/B)*x - (H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
		For DA-A26 only, use straight crown equation, HEC-22 EQ 4-2. If T calculated from HEC-22 EQ 4-2 is greater than B, use T=B
		HEC-22 EQ 4-2: $T = [Qn / (Ku * Sx^{1.67} * SL^{0.5})]^{0.375}$; where n = 0.012 (HEC-22 Table 4-3) and Ku = 0.56
(10)	**(10)**	Given in DCM EQ 4-10
(11)	**(11)**	Not used for proposed curb inlet
(12)	**(12)**	See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation; aHEC22 = 6.75 - 18*Sx
		$a_{HEC22} = a_{DIG}$ - W*Sx
(13)	**(13)**	DCM EQ 4-9: S'w = a_{HEC22} / (12*W)
(14)	**(14)**	DCM EQ 4-9Sw = S'w + Sx
(15)	**(15)**	HEC 22 EQ 4-4: For W < T, Eo = 1 / (1 + Sw/Sx/(((1 + Sw/Sx / (T/W))^2.67) - 1)); For T < W, Eo = 1
(16)	**(16)**	DCM EQ 4-9: Se = Sx + S'w*Eo
(17)	**(17)**	See DCM Table 2-2
(18)	**(18)**	DCM EQ 4-10: $L_T = K_T$ * Q^0.42 * S_L^0.3 * [1/ (n*Se)]^0.6
(19)	**(19)**	DCM EQ 4-8: E = 1 - [1 - (L/L_T)]^1.8
(20)	**(20)**	DCM EQ 4-14: Qi = E * Q
(21)	**(21)**	DCM EQ 4-15: Qb = Q - Qi

Ultimate Development C Ultimate Development Conditions for Proposed Crockett Street System

CURB INLETS CURB INLETS ON GRADE (508S-3), Type G-1 OR Type G-3, parabolic crown

100 YEAR STORM	100 YEAR STORM													
DRAINAGE AREA	DRAINAGE AREA	ESD Field Measured Street Cross Slope	Dist. Curb to Crown	Crown Height	Quadratic Formula		T = min(x1, x2); x = [-b +/- (b^2 - 4ac)^0.5] / 2a			PONDED WIDTH	Over Crown?	Depth Over Crown		
		(ft/ft)	*(ft)*	*(ft)*	*a*	*b*	*c*	*x1*	*x2*	*(ft)*				*(in)*
		Sx	B	H	H / B^2	-(2H/B)	Yo			T			K_T	a_{HEC22}
DA-A22-B	DA-A22-B	0.0170	15.00	0.49	0.0022	-0.0653	0.3077	24.1489	5.8511	5.85	no	0.00	0.6	6.44
DA-A22-C	DA-A22-C	0.0550	15.00	1.10	0.0049	-0.1467	0.3231	27.6057	2.3943	2.39	no	0.00	0.6	5.76
DA-A22-D	DA-A22-D	0.0330	17.50	0.69	0.0023	-0.0789	0.4981	26.7291	8.2709	8.27	no	0.00	0.6	6.16
DA-A22-E	DA-A22-E	0.0113	17.50	0.95	0.0031	-0.1086	0.3607	31.2834	3.7166	3.72	no	0.00	0.6	6.55
DA-A22-F	DA-A22-F	0.0320	15.00	0.47	0.0021	-0.0627	0.4485	18.2094	11.7906	11.79	no	0.00	0.6	6.17
DA-A22-G	DA-A22-G	0.0330	12.50	0.70	0.0045	-0.1120	0.2934	22.0271	2.9729	2.97	no	0.00	0.6	6.16
DA-A22-H	DA-A22-H	0.0150	12.50	0.26	0.0017	-0.0416	0.3222	--	--	12.50	over crown	0.06	0.6	6.48
DA-A22-J	DA-A22-J	0.0310	15.00	0.46	0.0020	-0.0613	0.4978	--	--	15.00	over crown	0.04	0.6	6.19
DA-A22-K	DA-A22-K	0.0290	15.00	0.62	0.0028	-0.0827	0.5571	19.7795	10.2205	10.22	no	0.00	0.6	6.23
DA-A22-L	DA-A22-L	0.0410	15.00	0.77	0.0034	-0.1027	0.6000	22.0484	7.9516	7.95	no	0.00	0.6	6.01
DA-A22-M	DA-A22-M	0.0320	13.50	0.34	0.0019	-0.0504	0.3467	--	--	13.50	over crown	0.01	0.6	6.17
DA-A22-N	DA-A22-N	0.0320	13.50	0.34	0.0019	-0.0504	0.4590	--	--	13.50	over crown	0.12	0.6	6.17
DA-A22-P	DA-A22-P	0.0320	15.00	0.34	0.0015	-0.0453	0.5150	--	--	15.00	over crown	0.17	0.6	6.17
DA-A22-Q	DA-A22-Q	0.0360	15.00	0.87	0.0039	-0.1160	0.5157	24.5724	5.4276	5.43	no	0.00	0.6	6.10
DA-A22-R	DA-A22-R	0.0200	17.50	0.35	0.0011	-0.0400	0.3792	--	--	17.50	over crown	0.03	0.6	6.39
DA-A22-T	DA-A22-T	0.0200	15.00	0.27	0.0012	-0.0360	0.4341	--	--	15.00	over crown	0.16	0.6	6.39

Equations in cell	Equations in cell	
(1)	(1)	DCM EQ 2-1: $Q_{peak} = CiA$
(2)	(2)	Total flow = sum of discharge from drainage area and carry over flow
(3)	(3)	So = (high elev - low elev)/length
(4)	(4)	See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
(5)	(5)	DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
		For DA-A26 only, use straight crown equation since the driveway does not have a parabolic crown: HEC-22 EQ 4-3: d = T * Sx
(6)	(6)	Sx measured in Field by ESD 3-3-15 or 3-31-15
(7)	(7)	For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
(8)	(8)	measured in field, lidar or record drawing; see "Crown Height Calcs" tab
(9)	(9)	Hec-22 EQ B-11: $Yo = (2H/B)*x - (H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
		For DA-A26 only, use straight crown equation, HEC-22 EQ 4-2. If T calculated from HEC-22 EQ 4-2 is greater than B, use T=B
		HEC-22 EQ 4-2: $T = [Qn / (Ku * Sx^{1.67} * SL^{0.5})]^{0.375}$; where n = 0.012 (HEC-22 Table 4-3) and Ku = 0.56
(10)	(10)	Given in DCM EQ 4-10
(11)	(11)	Not used for proposed curb inlet
(12)	(12)	See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation; aHEC22 = 6.75 - 18*Sx
		$a_{HEC22} = a_{DIG} - W*Sx$
(13)	(13)	DCM EQ 4-9: $S'w = a_{HEC22} / (12*W)$
(14)	(14)	DCM EQ 4-9Sw = S'w + Sx
(15)	(15)	HEC 22 EQ 4-4: For W < T, Eo = 1 / (1 + Sw/Sx/(((1 + Sw/Sx / (T/W))^2.67) - 1)); For T < W, Eo = 1
(16)	(16)	DCM EQ 4-9: Se = Sx + S'w*Eo
(17)	(17)	See DCM Table 2-2
(18)	(18)	DCM EQ 4-10: $L_T = K_T * Q^{0.42} * S_L^{0.3} * [1/ (n*Se)]^{0.6}$
(19)	(19)	DCM EQ 4-8: $E = 1 - [1 - (L/L_T)]^{1.8}$
(20)	(20)	DCM EQ 4-14: Qi = E * Q
(21)	(21)	DCM EQ 4-15: Qb = Q - Qi

Ultimate Development C Ultimate Development Conditions for Proposed Crockett Street System

CURB INLETS CURB INLETS ON GRADE (508S-3), Type G-1 OR Type G-3, parabolic crown

100 YEAR STORM **100 YEAR STORM**

DRAINAGE AREA	DRAINAGE AREA	Gutter Depression Width (in)	Gutter Depression Width (ft) W	S'w	Sw	Eo	Se	Manning's n n	INLET LENGTH FOR TOTAL CAPTURE L_T	CURB INLET REDUCTION FACTOR (%)	CURB OPENING LENGTH (in)	CURB OPENING LENGTH (ft) L	INLET EFFICIENCY E	INTERCEPTED FLOW (cfs) Qi	BYPASS FLOW (cfs) Qb	INLET TYPE
DA-A22-B	DA-A22-B	18.00	1.50	0.36	0.38	0.93	0.35	0.016	6.42	0.00%	120.00	10.00	100.00%	2.82	0.00	Type G-1
DA-A22-C	DA-A22-C	18.00	1.50	0.32	0.38	0.99	0.37	0.016	4.63	0.00%	120.00	10.00	100.00%	2.31	0.00	Type G-1
DA-A22-D	DA-A22-D	18.00	1.50	0.34	0.38	0.71	0.28	0.016	6.76	0.00%	120.00	10.00	100.00%	6.06	0.00	Type G-1
DA-A22-E	DA-A22-E	18.00	1.50	0.36	0.38	0.99	0.37	0.016	4.81	0.00%	120.00	10.00	100.00%	2.91	0.00	Type G-1
DA-A22-F	DA-A22-F	18.00	1.50	0.34	0.38	0.53	0.21	0.016	8.16	0.00%	120.00	10.00	100.00%	5.22	0.00	Type G-1
DA-A22-G	DA-A22-G	18.00	1.50	0.34	0.38	0.99	0.37	0.016	4.88	0.00%	120.00	10.00	100.00%	2.04	0.00	Type G-1
DA-A22-H	DA-A22-H	18.00	1.50	0.36	0.38	0.67	0.26	0.016	8.81	0.00%	120.00	10.00	100.00%	3.47	0.00	Type G-1
DA-A22-J	DA-A22-J	18.00	1.50	0.34	0.38	0.42	0.18	0.016	7.91	0.00%	120.00	10.00	100.00%	5.41	0.00	Type G-1
DA-A22-K	DA-A22-K	18.00	1.50	0.35	0.38	0.63	0.25	0.016	7.44	0.00%	120.00	10.00	100.00%	7.60	0.00	Type G-1
DA-A22-L	DA-A22-L	18.00	1.50	0.33	0.38	0.69	0.27	0.016	5.43	0.00%	120.00	10.00	100.00%	6.73	0.00	Type G-1
DA-A22-M	DA-A22-M	18.00	1.50	0.34	0.38	0.46	0.19	0.016	4.74	0.00%	120.00	10.00	100.00%	1.81	0.00	Type G-1
DA-A22-N	DA-A22-N	18.00	1.50	0.34	0.38	0.46	0.19	0.016	6.77	0.00%	120.00	10.00	100.00%	4.23	0.00	Type G-1
DA-A22-P	DA-A22-P	18.00	1.50	0.34	0.38	0.41	0.17	0.016	16.28	0.00%	120.00	10.00	82.01%	9.52	2.09	Type G-1
DA-A22-Q	DA-A22-Q	18.00	1.50	0.34	0.38	0.87	0.33	0.016	9.00	0.00%	120.00	10.00	100.00%	9.52	0.00	Type G-1
DA-A22-R	DA-A22-R	18.00	1.50	0.36	0.38	0.43	0.17	0.016	15.07	0.00%	120.00	10.00	85.94%	5.32	0.87	Type G-1
DA-A22-T	DA-A22-T	18.00	1.50	0.36	0.38	0.51	0.20	0.016	10.75	0.00%	120.00	10.00	99.16%	6.13	0.05	Type G-1

Equations in cell	Equations in cell	
(1)	(1)	DCM EQ 2-1: Q_{peak} = CiA
(2)	(2)	Total flow = sum of discharge from drainage area and carry over flow
(3)	(3)	So = (high elev - low elev)/length
(4)	(4)	See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
(5)	(5)	DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
		For DA-A26 only, use straight crown equation since the driveway does not have a parabolic crown: HEC-22 EQ 4-3: d = T * Sx
(6)	(6)	Sx measured in Field by ESD 3-3-15 or 3-31-15
(7)	(7)	For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
(8)	(8)	measured in field, lidar or record drawing; see "Crown Height Calcs" tab
(9)	(9)	Hec-22 EQ B-11: Yo = $(2H/B)*x - (H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
		For DA-A26 only, use straight crown equation, HEC-22 EQ 4-2. If T calculated from HEC-22 EQ 4-2 is greater than B, use T=B
		HEC-22 EQ 4-2: $T = [Qn / (Ku * Sx^{1.67} * SL^{0.5})]^{0.375}$; where n = 0.012 (HEC-22 Table 4-3) and Ku = 0.56
(10)	(10)	Given in DCM EQ 4-10
(11)	(11)	Not used for proposed curb inlet
(12)	(12)	See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation; aHEC22 = 6.75 - 18*Sx
		$a_{HEC22} = a_{DIG}$ - W*Sx
(13)	(13)	DCM EQ 4-9: S'w = a_{HEC22} / (12*W)
(14)	(14)	DCM EQ 4-9Sw = S'w + Sx
(15)	(15)	HEC 22 EQ 4-4: For W < T, Eo = 1 / (1 + Sw/Sx/(((1 + Sw/Sx / (T/W))^2.67) - 1)); For T < W, Eo = 1
(16)	(16)	DCM EQ 4-9: Se = Sx + S'w*Eo
(17)	(17)	See DCM Table 2-2
(18)	(18)	DCM EQ 4-10: $L_T = K_T * Q^{0.42} * S_L^{0.3} * [1/ (n*Se)]^{0.6}$
(19)	(19)	DCM EQ 4-8: $E = 1 - [1 - (L/L_T)]^{1.8}$
(20)	(20)	DCM EQ 4-14: Qi = E * Q
(21)	(21)	DCM EQ 4-15: Qb = Q - Qi

Ultimate Development Conditions for Proposed Crockett Street System

CURB INLETS ON GRADE (508S-3), Type G-1 OR Type G-3, parabolic crown

25 YEAR STORM

DRAINAGE AREA	STREET NAME	DRAINAGE AREA	DRAINAGE AREA (ac.)	DISCHARGE FROM DRAINAGE AREA (cfs)	1st UPSTREAM INLET /DRAINAGE AREA	CARRY OVER FLOW (cfs)	2nd UPSTREAM INLET /DRAINAGE AREA	CARRY OVER FLOW (cfs)	3rd UPSTREAM INLET /DRAINAGE AREA	CARRY OVER FLOW (cfs)	TOTAL RUNOFF (cfs) Q	SLOPE (ft/ft) $S_o = S_L$	Street Width (FOC-FOC) (ft) W
DA-A22-B	Crockett	DA-A22-B	0.24	2.05	DA-A22-C	0.00					2.05	0.0200	30.00
DA-A22-C	Crockett	DA-A22-C	0.20	1.68	DA-A22-Q	0.00					1.68	0.0100	30.00
DA-A22-D	Wilson	DA-A22-D	0.52	3.75	DA-A22-R	0.18					3.93	0.0050	35.00
DA-A22-E	Wilson	DA-A22-E	0.33	2.07	DA-A22-B	0.00	DA-A22-D	0.00	DA-A22-F	0.00	2.07	0.0082	35.00
DA-A22-F	Wilson	DA-A22-F	0.51	3.77	DA-A22-G	0.00	DA-A22-H	0.00	DA-A22-J	0.00	3.77	0.0070	30.00
DA-A22-G	Crockett	DA-A22-G	0.20	1.47							1.47	0.0140	25.00
DA-A22-H	Newton	DA-A22-H	0.37	2.49							2.49	0.0230	25.00
DA-A22-J	Newton	DA-A22-J	0.53	3.91	DA-A22-K	0.00					3.91	0.0040	30.00
DA-A22-K	Crockett	DA-A22-K	1.05	5.30	DA-A22-L	0.00					5.30	0.0040	30.00
DA-A22-L	Crockett	DA-A22-L	0.52	3.31	DA-A22-M	0.00	DA-A22-N	0.00	DA-A22-P	0.90	4.20	0.0020	30.00
DA-A22-M	Crockett	DA-A22-M	0.17	1.31							1.31	0.0040	27.00
DA-A22-N	Eva	DA-A22-N	0.52	2.94	DA-A22-T	0.00					2.94	0.0040	27.00
DA-A22-P	Crockett	DA-A22-P	0.52	4.31	DA-A22-S	3.95					8.26	0.0150	30.00
DA-A22-Q	Crockett	DA-A22-Q	0.80	6.94							6.94	0.0100	30.00
DA-A22-R	Crockett	DA-A22-R	0.52	4.52							4.52	0.0273	35.00
DA-A22-T	Crockett	DA-A22-T	0.52	4.52							4.52	0.0120	30.00

Equations in cell

(1) DCM EQ 2-1: $Q_{peak} = CiA$

(2) Total flow = sum of discharge from drainage area and carry over flow

(3) So = (high elev - low elev)/length

(4) See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)

(5) DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]

For DA-A26 only, use straight crown equation since the driveway does not have a parabolic crown: HEC-22 EQ 4-3: d = T * Sx

(6) Sx measured in Field by ESD 3-3-15 or 3-31-15

(7) For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file

(8) measured in field, lidar or record drawing; see "Crown Height Calcs" tab

(9) Hec-22 EQ B-11: $Yo = (2H/B)*x - (H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B

For DA-A26 only, use straight crown equation, HEC-22 EQ 4-2. If T calculated from HEC-22 EQ 4-2 is greater than B, use T=B

HEC-22 EQ 4-2: $T = [Qn / (Ku * Sx^{1.67} * SL^{0.5})]^{0.375}$; where n = 0.012 (HEC-22 Table 4-3) and Ku = 0.56

(10) Given in DCM EQ 4-10

(11) Not used for proposed curb inlet

(12) See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation; aHEC22 = 6.75 - 18*Sx

$a_{HEC22} = a_{DIG} - W*Sx$

(13) DCM EQ 4-9: $S'w = a_{HEC22} / (12*W)$

(14) DCM EQ 4-9Sw = S'w + Sx

(15) HEC 22 EQ 4-4: For W < T, Eo = 1 / (1 + Sw/Sx/(((1 + Sw/Sx / (T/W))^2.67) - 1)); For T < W, Eo = 1

(16) DCM EQ 4-9: Se = Sx + S'w*Eo

(17) See DCM Table 2-2

(18) DCM EQ 4-10: $L_T = K_T * Q^{0.42} * S_L^{0.3} * [1/(n*Se)]^{0.6}$

(19) DCM EQ 4-8: $E = 1 - [1 - (L/L_T)]^{1.8}$

(20) DCM EQ 4-14: Qi = E * Q

(21) DCM EQ 4-15: Qb = Q - Qi

Ultimate Development C **Ultimate Development Conditions for Proposed Crockett Street System**

CURB INLETS CURB INLETS ON GRADE (508S-3), Type G-1 OR Type G-3, parabolic crown

25 YEAR STORM	25 YEAR STORM													
DRAINAGE AREA	**DRAINAGE AREA**	**Curb Height** *(in)*	**Curb Height** *(ft)*	**CURB OPENING HEIGHT** *(in)*	**CURB OPENING HEIGHT** *(ft)* **h**	**Split** *(ft)* **CS**	**High or low gutter**	**K_o**	**K_1**	**K_2**	**K_3**	**WATER FLOW DEPTH** *(ft)* **Yo = d**	**Over Curb or Gutter?**	**Contained within R.O.W.** ***Assume if depth <*** **0.58**
DA-A22-B	DA-A22-B	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.28	No	Yes
DA-A22-C	DA-A22-C	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.29	No	Yes
DA-A22-D	DA-A22-D	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.43	No	Yes
DA-A22-E	DA-A22-E	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.32	No	Yes
DA-A22-F	DA-A22-F	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.40	No	Yes
DA-A22-G	DA-A22-G	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.26	No	Yes
DA-A22-H	DA-A22-H	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.29	No	Yes
DA-A22-J	DA-A22-J	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.45	No	Yes
DA-A22-K	DA-A22-K	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.49	No	Yes
DA-A22-L	DA-A22-L	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.51	Over Curb	Yes
DA-A22-M	DA-A22-M	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.31	No	Yes
DA-A22-N	DA-A22-N	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.41	No	Yes
DA-A22-P	DA-A22-P	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.46	No	Yes
DA-A22-Q	DA-A22-Q	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.46	No	Yes
DA-A22-R	DA-A22-R	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.34	No	Yes
DA-A22-T	DA-A22-T	6.00	0.50	6.25	0.52	0.00	N/A	2.85	0.50	3.03	0.00	0.39	No	Yes

Equations in cell	**Equations in cell**	
(1)	**(1)**	DCM EQ 2-1: Q_{peak} = CiA
(2)	**(2)**	Total flow = sum of discharge from drainage area and carry over flow
(3)	**(3)**	So = (high elev - low elev)/length
(4)	**(4)**	See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
(5)	**(5)**	DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
		For DA-A26 only, use straight crown equation since the driveway does not have a parabolic crown: HEC-22 EQ 4-3: d = T * Sx
(6)	**(6)**	Sx measured in Field by ESD 3-3-15 or 3-31-15
(7)	**(7)**	For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
(8)	**(8)**	measured in field, lidar or record drawing; see "Crown Height Calcs" tab
(9)	**(9)**	Hec-22 EQ B-11: Yo = (2H/B)*x - $(H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
		For DA-A26 only, use straight crown equation, HEC-22 EQ 4-2. If T calculated from HEC-22 EQ 4-2 is greater than B, use T=B
		HEC-22 EQ 4-2: $T = [Qn / (Ku * Sx^{1.67} * SL^{0.5})]^{0.375}$; where n = 0.012 (HEC-22 Table 4-3) and Ku = 0.56
(10)	**(10)**	Given in DCM EQ 4-10
(11)	**(11)**	Not used for proposed curb inlet
(12)	**(12)**	See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation; aHEC22 = 6.75 - 18*Sx
		$a_{HEC22} = a_{DIG}$ - W*Sx
(13)	**(13)**	DCM EQ 4-9: S'w = a_{HEC22} / (12*W)
(14)	**(14)**	DCM EQ 4-9Sw = S'w + Sx
(15)	**(15)**	HEC 22 EQ 4-4: For W < T, Eo = 1 / (1 + Sw/Sx/(((1 + Sw/Sx / (T/W))^2.67) - 1)); For T < W, Eo = 1
(16)	**(16)**	DCM EQ 4-9: Se = Sx + S'w*Eo
(17)	**(17)**	See DCM Table 2-2
(18)	**(18)**	DCM EQ 4-10: $L_T = K_T$ * Q^0.42 * S_L^0.3 * [1/ (n*Se)]^0.6
(19)	**(19)**	DCM EQ 4-8: E = 1 - [1 - (L/L_T)]^1.8
(20)	**(20)**	DCM EQ 4-14: Qi = E * Q
(21)	**(21)**	DCM EQ 4-15: Qb = Q - Qi

Ultimate Development C **Ultimate Development Conditions for Proposed Crockett Street System**

CURB INLETS CURB INLETS ON GRADE (508S-3), Type G-1 OR Type G-3, parabolic crown

25 YEAR STORM **25 YEAR STORM**

DRAINAGE AREA	DRAINAGE AREA	ESD Field Measured Street Cross Slope	Dist. Curb to Crown	Crown Height	Quadratic Formula	T = min(x1, x2); x = [-b +/- (b^2 - 4ac)^0.5] / 2a				PONDED WIDTH	Over Crown?	Depth Over Crown		
		(ft/ft)	*(ft)*	*(ft)*	*a*	*b*	*c*	*x1*	*x2*	*(ft)*				*(in)*
		Sx	B	H	H / B^2	-(2H/B)	Yo			T			K_T	a_{HEC22}
DA-A22-B	DA-A22-B	0.0170	15.0000	0.4900	0.0022	-0.0653	0.2773	24.8834	5.1166	5.12	no	0.00	0.6	6.44
DA-A22-C	DA-A22-C	0.0550	15.0000	1.1000	0.0049	-0.1467	0.2911	27.8631	2.1369	2.14	no	0.00	0.6	5.76
DA-A22-D	DA-A22-D	0.0330	17.5000	0.6900	0.0023	-0.0789	0.4317	28.2074	6.7926	6.79	no	0.00	0.6	6.16
DA-A22-E	DA-A22-E	0.0113	17.5000	0.9500	0.0031	-0.1086	0.3223	31.7248	3.2752	3.28	no	0.00	0.6	6.55
DA-A22-F	DA-A22-F	0.0320	15.0000	0.4700	0.0021	-0.0627	0.4030	20.6645	9.3355	9.34	no	0.00	0.6	6.17
DA-A22-G	DA-A22-G	0.0330	12.5000	0.7000	0.0045	-0.1120	0.2635	22.3704	2.6296	2.63	no	0.00	0.6	6.16
DA-A22-H	DA-A22-H	0.0150	12.5000	0.2600	0.0017	-0.0416	0.2886	--	--	12.50	over crown	0.03	0.6	6.48
DA-A22-J	DA-A22-J	0.0310	15.0000	0.4600	0.0020	-0.0613	0.4474	17.4821	12.5179	12.52	no	0.00	0.6	6.19
DA-A22-K	DA-A22-K	0.0290	15.0000	0.6200	0.0028	-0.0827	0.4946	21.7462	8.2538	8.25	no	0.00	0.6	6.23
DA-A22-L	DA-A22-L	0.0410	15.0000	0.7700	0.0034	-0.1027	0.5136	23.6565	6.3435	6.34	no	0.00	0.6	6.01
DA-A22-M	DA-A22-M	0.0320	13.5000	0.3400	0.0019	-0.0504	0.3117	17.3921	9.6079	9.61	no	0.00	0.6	6.17
DA-A22-N	DA-A22-N	0.0320	13.5000	0.3400	0.0019	-0.0504	0.4072	--	--	13.50	over crown	0.07	0.6	6.17
DA-A22-P	DA-A22-P	0.0320	15.0000	0.3400	0.0015	-0.0453	0.4603	--	--	15.00	over crown	0.12	0.6	6.17
DA-A22-Q	DA-A22-Q	0.0360	15.0000	0.8700	0.0039	-0.1160	0.4647	25.2379	4.7621	4.76	no	0.00	0.6	6.10
DA-A22-R	DA-A22-R	0.0200	17.5000	0.3500	0.0011	-0.0400	0.3419	20.1631	14.8369	14.84	no	0.00	0.6	6.39
DA-A22-T	DA-A22-T	0.0200	15.0000	0.2700	0.0012	-0.0360	0.3913	--	--	15.00	over crown	0.12	0.6	6.39

Equations in cell	Equations in cell	
(1)	(1)	DCM EQ 2-1: $Q_{peak} = CiA$
(2)	(2)	Total flow = sum of discharge from drainage area and carry over flow
(3)	(3)	So = (high elev - low elev)/length
(4)	(4)	See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
(5)	(5)	DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
		For DA-A26 only, use straight crown equation since the driveway does not have a parabolic crown: HEC-22 EQ 4-3: d = T * Sx
(6)	(6)	Sx measured in Field by ESD 3-3-15 or 3-31-15
(7)	(7)	For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
(8)	(8)	measured in field, lidar or record drawing; see "Crown Height Calcs" tab
(9)	(9)	Hec-22 EQ B-11: $Yo = (2H/B)*x - (H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
		For DA-A26 only, use straight crown equation, HEC-22 EQ 4-2. If T calculated from HEC-22 EQ 4-2 is greater than B, use T=B
		HEC-22 EQ 4-2: $T = [Qn / (Ku * Sx^{1.67} * SL^{0.5})]^{0.375}$; where n = 0.012 (HEC-22 Table 4-3) and Ku = 0.56
(10)	(10)	Given in DCM EQ 4-10
(11)	(11)	Not used for proposed curb inlet
(12)	(12)	See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation; aHEC22 = 6.75 - 18*Sx
		$a_{HEC22} = a_{DIG} - W*Sx$
(13)	(13)	DCM EQ 4-9: $S'w = a_{HEC22} / (12*W)$
(14)	(14)	DCM EQ 4-9Sw = S'w + Sx
(15)	(15)	HEC 22 EQ 4-4: For W < T, Eo = 1 / (1 + Sw/Sx/(((1 + Sw/Sx / (T/W))^2.67) - 1)); For T < W, Eo = 1
(16)	(16)	DCM EQ 4-9: Se = Sx + S'w*Eo
(17)	(17)	See DCM Table 2-2
(18)	(18)	DCM EQ 4-10: $L_T = K_T * Q^{0.42} * S_L^{0.3} * [1/ (n*Se)]^{0.6}$
(19)	(19)	DCM EQ 4-8: $E = 1 - [1 - (L/L_T)]^{1.8}$
(20)	(20)	DCM EQ 4-14: Qi = E * Q
(21)	(21)	DCM EQ 4-15: Qb = Q - Qi

Ultimate Development C Ultimate Development Conditions for Proposed Crockett Street System

CURB INLETS CURB INLETS ON GRADE (508S-3), Type G-1 OR Type G-3, parabolic crown

25 YEAR STORM **25 YEAR STORM**

DRAINAGE AREA	DRAINAGE AREA	Gutter Depression Width (in)	Gutter Depression Width (ft) W	S'w	Sw	Eo	Se	Manning's n n	INLET LENGTH FOR TOTAL CAPTURE L_T	CURB INLET REDUCTION FACTOR (%)	CURB OPENING LENGTH (in)	CURB OPENING LENGTH (ft) L	INLET EFFICIENCY E	INTERCEPTED FLOW (cfs) Qi	BYPASS FLOW (cfs) Qb	INLET TYPE
DA-A22-B	DA-A22-B	18.00	1.50	0.36	0.38	0.96	0.36	0.016	5.54	0.00%	120.00	10.00	100.00%	2.05	0.00	Type G-1
DA-A22-C	DA-A22-C	18.00	1.50	0.32	0.38	1.00	0.37	0.016	4.05	0.00%	120.00	10.00	100.00%	1.68	0.00	Type G-1
DA-A22-D	DA-A22-D	18.00	1.50	0.34	0.38	0.80	0.31	0.016	5.28	0.00%	120.00	10.00	100.00%	3.93	0.00	Type G-1
DA-A22-E	DA-A22-E	18.00	1.50	0.36	0.38	1.00	0.37	0.016	4.16	0.00%	120.00	10.00	100.00%	2.07	0.00	Type G-1
DA-A22-F	DA-A22-F	18.00	1.50	0.34	0.38	0.65	0.26	0.016	6.40	0.00%	120.00	10.00	100.00%	3.77	0.00	Type G-1
DA-A22-G	DA-A22-G	18.00	1.50	0.34	0.38	0.99	0.37	0.016	4.24	0.00%	120.00	10.00	100.00%	1.47	0.00	Type G-1
DA-A22-H	DA-A22-H	18.00	1.50	0.36	0.38	0.67	0.26	0.016	7.66	0.00%	120.00	10.00	100.00%	2.49	0.00	Type G-1
DA-A22-J	DA-A22-J	18.00	1.50	0.34	0.38	0.51	0.21	0.016	6.27	0.00%	120.00	10.00	100.00%	3.91	0.00	Type G-1
DA-A22-K	DA-A22-K	18.00	1.50	0.35	0.38	0.74	0.28	0.016	5.87	0.00%	120.00	10.00	100.00%	5.30	0.00	Type G-1
DA-A22-L	DA-A22-L	18.00	1.50	0.33	0.38	0.79	0.31	0.016	4.13	0.00%	120.00	10.00	100.00%	4.20	0.00	Type G-1
DA-A22-M	DA-A22-M	18.00	1.50	0.34	0.38	0.64	0.25	0.016	3.51	0.00%	120.00	10.00	100.00%	1.31	0.00	Type G-1
DA-A22-N	DA-A22-N	18.00	1.50	0.34	0.38	0.46	0.19	0.016	5.82	0.00%	120.00	10.00	100.00%	2.94	0.00	Type G-1
DA-A22-P	DA-A22-P	18.00	1.50	0.34	0.38	0.41	0.17	0.016	14.11	0.00%	120.00	10.00	89.14%	7.36	0.90	Type G-1
DA-A22-Q	DA-A22-Q	18.00	1.50	0.34	0.38	0.91	0.35	0.016	7.70	0.00%	120.00	10.00	100.00%	6.94	0.00	Type G-1
DA-A22-R	DA-A22-R	18.00	1.50	0.36	0.38	0.51	0.20	0.016	11.99	0.00%	120.00	10.00	96.05%	4.35	0.18	Type G-1
DA-A22-T	DA-A22-T	18.00	1.50	0.36	0.38	0.51	0.20	0.016	9.43	0.00%	120.00	10.00	100.00%	4.52	0.00	Type G-1

Equations in cell	Equations in cell	
(1)	(1)	DCM EQ 2-1: Q_{peak} = CiA
(2)	(2)	Total flow = sum of discharge from drainage area and carry over flow
(3)	(3)	So = (high elev - low elev)/length
(4)	(4)	See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
(5)	(5)	DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
		For DA-A26 only, use straight crown equation since the driveway does not have a parabolic crown: HEC-22 EQ 4-3: d = T * Sx
(6)	(6)	Sx measured in Field by ESD 3-3-15 or 3-31-15
(7)	(7)	For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
(8)	(8)	measured in field, lidar or record drawing; see "Crown Height Calcs" tab
(9)	(9)	Hec-22 EQ B-11: Yo = $(2H/B)*x - (H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
		For DA-A26 only, use straight crown equation, HEC-22 EQ 4-2. If T calculated from HEC-22 EQ 4-2 is greater than B, use T=B
		HEC-22 EQ 4-2: $T = [Qn / (Ku * Sx^{1.67} * SL^{0.5})]^{0.375}$; where n = 0.012 (HEC-22 Table 4-3) and Ku = 0.56
(10)	(10)	Given in DCM EQ 4-10
(11)	(11)	Not used for proposed curb inlet
(12)	(12)	See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation; aHEC22 = 6.75 - 18*Sx
		$a_{HEC22} = a_{DIG}$ - W*Sx
(13)	(13)	DCM EQ 4-9: S'w = a_{HEC22} / (12*W)
(14)	(14)	DCM EQ 4-9Sw = S'w + Sx
(15)	(15)	HEC 22 EQ 4-4: For W < T, Eo = 1 / (1 + Sw/Sx/(((1 + Sw/Sx / (T/W))^2.67) - 1)); For T < W, Eo = 1
(16)	(16)	DCM EQ 4-9: Se = Sx + S'w*Eo
(17)	(17)	See DCM Table 2-2
(18)	(18)	DCM EQ 4-10: $L_T = K_T$ * Q^0.42 * S_L^0.3 * [1/ (n*Se)]^0.6
(19)	(19)	DCM EQ 4-8: E = 1 - [1 - (L/L_T)]^1.8
(20)	(20)	DCM EQ 4-14: Qi = E * Q
(21)	(21)	DCM EQ 4-15: Qb = Q - Qi

Ultimate Development Conditions for Proposed Crockett Street System

GRATE INLETS ON GRADE, Type G-2 V-shaped gutter

100 YEAR STORM

DRAINAGE AREA	STREET NAME	DRAINAGE AREA	DRAINAGE AREA (ac.)	DISCHARGE FROM DRAINAGE AREA (cfs)	1st UPSTREAM INLET /DRAINAGE AREA	1st CARRY OVER FLOW (cfs)	TOTAL RUNOFF (cfs) Q	Hig elev (ft)	low elev (ft)	length (ft)	SLOPE (ft/ft) $S_o = S_L$
DA-A22-A	Wilson St	DA-A22-A	0.52	5.81	DA-A22-E	0.0	5.8	556.0	554.0	114.1	0.0175
DA-A22-S	Alley	DA-A22-S	0.78	9.42			9.4				0.0180

25 YEAR STORM

DRAINAGE AREA	STREET NAME	DRAINAGE AREA	DRAINAGE AREA (ac.)	DISCHARGE FROM DRAINAGE AREA (cfs)	1st UPSTREAM INLET /DRAINAGE AREA	1st CARRY OVER FLOW (cfs)	TOTAL RUNOFF (cfs) Q	Hig elev (ft)	low elev (ft)	length (ft)	SLOPE (ft/ft) $S_o = S_L$
DA-A22-A	Wilson St	DA-A22-A	0.52	4.22	DA-A22-E	0.0	4.2	556.0	554.0	114.1	0.0175
DA-A22-S	Alley	DA-A22-S	0.78	6.88			6.9				0.018

Equations in cell

(1) DCM EQ 2-1: Q_{peak} = CiA
(2) Total flow = sum of discharge from drainage area and carry over flow
(3) So = (high elev - low elev)/length
(4) Sx = (Sx1 * Sx2) / (Sx1 + Sx2)
(5) See HEC-22 Figure 4-1.b.2; AB = width of parking lane between grate inlet and curb; BC = distance crown to grate inlet
(6) See DCM Table 2-2
(7) Given in HEC-22 EQ 4-2
(8) HEC-22 EQ 4-2 and EX 4-3: T' = [(Q * n)/(Ku * Sx^1.67 * So^0.5)]^0.375
(9) T,max = AB + BC
(10) T = min(T',Tmax)
(11) HEC-22 EQ 4-16: Eo = 1 - (1 - W_{grate}/T)^2.67
(12) If assume velocity in gutter is equal or less than splash over velocity, then R_f = 1
(13) Ku is given in HEC-22 EQ 4-19
(14) V calculated similarly to TR-55 Figure 3-1; V = k * $S^{0.5}$ where k = 46.3 for paved gutter; Ref: Hydrologic Analysis and Design by R. H. McCuen EQ 3-46 and Table 3-14.
(15) HEC-22 EQ 4-19: Rs = ratio of side flow intercepted to total side flow = 1 / [1 + (Ku * V^1.8) / (Sx * L^2.3)]
(16) HEC-22 EQ 4-20: E = Rf * Eo + Rs * (1 - Eo)
(17) See DCM 4.3.2.B
(18) DCM EQ 4-14: Qi = E * Q * Reduction Factor
(19) DCM EQ 4-15: Qb = Q - Qi

Ultimate Development C Ultimate Development Conditions for Proposed Crockett Street System

GRATE INLETS GRATE INLETS ON GRADE, Type G-2 V-shaped gutter

100 YEAR STORM **100 YEAR STORM**

DRAINAGE AREA	DRAINAGE AREA	Street Width (FOC-FOC) *(ft)*	Curb Height *(in)*	Parking lane cross slope Sx1	Street Cross Slope Sx2	Sx	*(ft)* AB	*(ft)* BC	Manning's n n	Ku	HYPOTHETICAL PONDED WIDTH *(ft)* T'	MAXIMUM PONDED WIDTH *(ft)* Tmax	PONDED WIDTH *(ft)* T
DA-A22-A	DA-A22-A	29.8	8.0	0.028	0.054	0.018	9.0	14.0	0.016	0.56	13.3	23.0	13.3
DA-A22-S	DA-A22-S	10.0	6.0	0.020	0.020	0.020	9.0	14.0	0.016	0.56	15.0	23.0	15.0

25 YEAR STORM **25 YEAR STORM**

DRAINAGE AREA	DRAINAGE AREA	Street Width (FOC-FOC) *(ft)*	Curb Height *(in)*	Parking lane cross slope Sx1	Street Cross Slope Sx2	Sx	*(ft)* AB	*(ft)* BC	Manning's n n	Ku	HYPOTHETICAL PONDED WIDTH *(ft)* T'	MAXIMUM PONDED WIDTH *(ft)* Tmax	PONDED WIDTH *(ft)* T
DA-A22-A	DA-A22-A	29.8	8.0	0.028	0.054	0.018	9.0	14.0	0.016	0.56	11.8	23.0	11.8
DA-A22-S	DA-A22-S	10.000	6.000	0.020	0.020	0.020	9.0	14.0	0.016	0.56	13.4	23.0	13.4

Equations in cell	Equations in cell	
(1)	(1)	DCM EQ 2-1: Q_{peak} = CiA
(2)	(2)	Total flow = sum of discharge from drainage area and carry over flow
(3)	(3)	So = (high elev - low elev)/length
(4)	(4)	Sx = (Sx1 * Sx2) / (Sx1 + Sx2)
(5)	(5)	See HEC-22 Figure 4-1.b.2; AB = width of parking lane between grate inlet and curb; BC = distance crown to grate inlet
(6)	(6)	See DCM Table 2-2
(7)	(7)	Given in HEC-22 EQ 4-2
(8)	(8)	HEC-22 EQ 4-2 and EX 4-3: T' = [(Q * n)/(Ku * Sx^1.67 * So^0.5)]^0.375
(9)	(9)	T,max = AB + BC
(10)	(10)	T = min(T',Tmax)
(11)	(11)	HEC-22 EQ 4-16: Eo = 1 - (1 - W_{grate}/T)^2.67
(12)	(12)	If assume velocity in gutter is equal or less than splash over velocity, then R_f = 1
(13)	(13)	Ku is given in HEC-22 EQ 4-19
(14)	(14)	V calculated similarly to TR-55 Figure 3-1; V = k * $S^{0.5}$ where k = 46.3 for paved gutter; Ref: Hydrologic Analysis and Design by R. H. McCuen EQ 3-46 and Table 3-14.
(15)	(15)	HEC-22 EQ 4-19: Rs = ratio of side flow intercepted to total side flow = 1 / [1 + (Ku * V^1.8) / (Sx * L^2.3)]
(16)	(16)	HEC-22 EQ 4-20: E = Rf * Eo + Rs * (1 - Eo)
(17)	(17)	See DCM 4.3.2.B
(18)	(18)	DCM EQ 4-14: Qi = E * Q * Reduction Factor
(19)	(19)	DCM EQ 4-15: Qb = Q - Qi

Ultimate Development C Ultimate Development Conditions for Proposed Crockett Street System

GRATE INLETS GRATE INLETS ON GRADE, Type G-2 V-shaped gutter

100 YEAR STORM **100 YEAR STORM**

DRAINAGE AREA	DRAINAGE AREA	Gutter Depression Width (ft) W_{gutter}	Grate Width (in)	Grate Width (ft) W_{grate}	Eo	R_f	Ku	Grate Length (in)	Grate Length (ft) L	Gutter Velocity (ft/s) V	R_s	E
DA-A22-A	DA-A22-A	0.0	18.0	1.5	0.27	1.0	0.15	108.0	9.0	6.1	0.424	0.58
DA-A22-S	DA-A22-S	0.0	48.0	4.0	0.56	1.0	0.15	48.0	4.0	6.2	0.108	0.61

25 YEAR STORM **25 YEAR STORM**

DRAINAGE AREA	DRAINAGE AREA	Gutter Depression Width (ft) W_{gutter}	Grate Width (in)	Grate Width (ft) W_{grate}	Eo	R_f	Ku	Grate Length (in)	Grate Length (ft) L	Gutter Velocity (ft/s) V	R_s	E
DA-A22-A	DA-A22-A	0.0	18.0	1.5	0.31	1.0	0.15	108.0	9.0	6.1	0.424	0.60
DA-A22-S	DA-A22-S	0.0	48.0	4.0	0.61	1.0	0.15	48.0	4.0	6.2	0.108	0.65

Equations in cell	Equations in cell	
(1)	(1)	DCM EQ 2-1: Q_{peak} = CiA
(2)	(2)	Total flow = sum of discharge from drainage area and carry over flow
(3)	(3)	So = (high elev - low elev)/length
(4)	(4)	Sx = (Sx1 * Sx2) / (Sx1 + Sx2)
(5)	(5)	See HEC-22 Figure 4-1.b.2; AB = width of parking lane between grate inlet and curb; BC = distance crown to grate inlet
(6)	(6)	See DCM Table 2-2
(7)	(7)	Given in HEC-22 EQ 4-2
(8)	(8)	HEC-22 EQ 4-2 and EX 4-3: T' = [(Q * n)/(Ku * Sx^1.67 * So^0.5)]^0.375
(9)	(9)	T,max = AB + BC
(10)	(10)	T = min(T',Tmax)
(11)	(11)	HEC-22 EQ 4-16: Eo = 1 - (1 - W_{grate}/T)^2.67
(12)	(12)	If assume velocity in gutter is equal or less than splash over velocity, then R_f = 1
(13)	(13)	Ku is given in HEC-22 EQ 4-19
(14)	(14)	V calculated similarly to TR-55 Figure 3-1; V = k * $S^{0.5}$ where k = 46.3 for paved gutter; Ref: Hydrologic Analysis and Design by R. H. McCuen EQ 3-46 and Table 3-14.
(15)	(15)	HEC-22 EQ 4-19: Rs = ratio of side flow intercepted to total side flow = 1 / [1 + (Ku * V^1.8) / (Sx * L^2.3)]
(16)	(16)	HEC-22 EQ 4-20: E = Rf * Eo + Rs * (1 - Eo)
(17)	(17)	See DCM 4.3.2.B
(18)	(18)	DCM EQ 4-14: Qi = E * Q * Reduction Factor
(19)	(19)	DCM EQ 4-15: Qb = Q - Qi

Ultimate Development C Ultimate Development Conditions for Proposed Crockett Street System

GRATE INLETS GRATE INLETS ON GRADE, Type G-2 V-shaped gutter

100 YEAR STORM | **100 YEAR STORM**

DRAINAGE AREA	DRAINAGE AREA	GRATE INLET REDUCTION FACTOR (%)	INTERCEPTED FLOW (cfs) Qi	BYPASS FLOW (cfs) Qb	INLET TYPE
DA-A22-A	DA-A22-A	35%	2.2	3.6	Type G-2
DA-A22-S	DA-A22-S	35%	3.7	5.7	Type G-2

25 YEAR STORM | **25 YEAR STORM**

DRAINAGE AREA	DRAINAGE AREA	GRATE INLET REDUCTION FACTOR (%)	INTERCEPTED FLOW (cfs) Qi	BYPASS FLOW (cfs) Qb	INLET TYPE
DA-A22-A	DA-A22-A	35%	1.6	2.6	Type G-2
DA-A22-S	DA-A22-S	35%	2.9	4.0	Type G-2

Equations in cell	Equations in cell	
(1)	(1)	DCM EQ 2-1: Q_{peak} = CiA
(2)	(2)	Total flow = sum of discharge from drainage area and carry over flow
(3)	(3)	So = (high elev - low elev)/length
(4)	(4)	Sx = (Sx1 * Sx2) / (Sx1 + Sx2)
(5)	(5)	See HEC-22 Figure 4-1.b.2; AB = width of parking lane between grate inlet and curb; BC = distance crown to grate inlet
(6)	(6)	See DCM Table 2-2
(7)	(7)	Given in HEC-22 EQ 4-2
(8)	(8)	HEC-22 EQ 4-2 and EX 4-3: T' = [(Q * n)/(Ku * Sx^1.67 * So^0.5)]^0.375
(9)	(9)	T,max = AB + BC
(10)	(10)	T = min(T',Tmax)
(11)	(11)	HEC-22 EQ 4-16: Eo = 1 - (1 - W_{grate}/T)^2.67
(12)	(12)	If assume velocity in gutter is equal or less than splash over velocity, then R_f = 1
(13)	(13)	Ku is given in HEC-22 EQ 4-19
(14)	(14)	V calculated similarly to TR-55 Figure 3-1; V = k * $S^{0.5}$ where k = 46.3 for paved gutter; Ref: Hydrologic Analysis and Design by R. H. McCuen EQ 3-46 and Table 3-14.
(15)	(15)	HEC-22 EQ 4-19: Rs = ratio of side flow intercepted to total side flow = 1 / [1 + (Ku * V^1.8) / (Sx * L^2.3)]
(16)	(16)	HEC-22 EQ 4-20: E = Rf * Eo + Rs * (1 - Eo)
(17)	(17)	See DCM 4.3.2.B
(18)	(18)	DCM EQ 4-14: Qi = E * Q * Reduction Factor
(19)	(19)	DCM EQ 4-15: Qb = Q - Qi

Exhibit K.4

Proposed System Code Compliance Summary

Summary of Street Flow for Proposed Alternative 1 Storm Drain Configuration and Ultimate Land UseConditions

				Street Geometry Summary						
Drainage Area	Inlet Type	Street Name	Street Classification	Longitudinal Slope	Street Width *(ft)*	Distance Curb to Crown *(ft)*	Curb Height *(ft)*	Crown Height *(ft)*	DCM Minimum Gutter Slope	DCM 3.3.1 Meets Gutter Slope Criteria?
DA-A04-A	Curb inlet on grade	Annie St.	A45 - City Collector	7.1%	40.0	20.0	0.5	0.30	0.4%	Yes
DA-A04-B	Curb inlet on grade	Annie St.	A45 - City Collector	7.4%	40.0	20.0	0.5	0.85	0.4%	Yes
DA-A04-C	Curb inlet on grade	Annie St.	A45 - City Collector	7.4%	40.0	20.0	0.5	0.85	0.4%	Yes
DA-A06-C	Curb inlet on grade	Mary St.	A45 - City Collector	3.3%	41.5	20.8	0.5	0.80	0.4%	Yes
DA-A06-D	Curb inlet on grade	Mary St.	A45 - City Collector	4.9%	41.5	20.8	0.5	0.80	0.4%	Yes
DA-A06-E	Curb inlet on grade	Newton St.	A40 - Local City/County Street	2.7%	31.5	15.8	0.5	0.18	0.4%	Yes
DA-A06-F	Curb inlet on grade	Newton St.	A40 - Local City/County Street	1.7%	31.5	15.8	0.5	0.55	0.4%	Yes
DA-A07	Curb inlet on grade	Mary St.	A45 - City Collector	2.0%	40.5	20.3	0.5	0.94	0.4%	Yes
DA-A08	Curb inlet on grade	Eva St.	A40 - Local City/County Street	2.0%	32.5	16.3	0.5	0.17	0.4%	Yes
DA-A09	Curb inlet on grade	Mary St.	A45 - City Collector	3.4%	41.0	20.5	0.5	0.81	0.4%	Yes
DA-A20-A	Curb inlet on grade	Johanna St	A45 - City Collector	3.6%	32.0	16.0	0.5	0.68	0.4%	Yes
DA-A20-C	Curb inlet on grade	Johanna St	A45 - City Collector	2.2%	32.0	16.0	0.5	0.55	0.4%	Yes
DA-A20-D	Curb inlet on grade	Johanna St	A45 - City Collector	6.1%	32.0	16.0	0.5	0.57	0.4%	Yes
DA-A21-B	Curb inlet on grade	alley	N/A	3.3%	13.5	6.8	0.5	0.40	0.4%	Yes
Inlet 21823 (DS of grate inlet DA-A22)	Curb inlet on grade	Wilson St	A40 - Local City/County Street	1.8%	29.8	14.9	0.7	0.34	0.4%	Yes
DA-A05	Curb inlet in sump	Mary St.	A45 - City Collector	2.5%	41.5	20.75	0.5	0.44	0.4%	Yes
DA-A06-A	Curb inlet in sump	Mary St.	A45 - City Collector	2.4%	41.5	20.75	0.5	0.44	0.4%	Yes
DA-A18	Curb inlet in sump	Johanna St	A45 - City Collector	2.2%	32.0	16	0.8	0.60	0.4%	Yes
DA-A19-A	Curb inlet in sump	Johanna St	A45 - City Collector	3.7%	32.0	16	0.5	0.54	0.4%	Yes
DA-A21-A	Curb inlet in sump	alley	N/A	1.6%	38.1	19.05	0.7	1.45	0.4%	Yes
DA-A17-A	Grate inlet on grade	Johanna St	A45 - City Collector	2.2%	30.5	15.25	0.5		0.4%	Yes

Summary of Street Flow for Proposed Alternative 1 Storm Drain Configuration and Ultimate Land UseConditions

	25 Year Storm								100 Year Storm						
Drainage Area	**Total Gutter Flow Q** *(cfs)*	**25 YR Flow Depth Yo** *(ft)*	**DCM 3.2.0 Meets Over Curb Criteria?**	**Spread T** *(ft)*	**Clear Width From Crown** *(ft)*	**DCM Minimum Clear Width - From Crown** *(ft)*	**DCM Minimum Clear Width - Total Clear Width** *(ft)*	**DCM 3.2.0 Meets Clear Width Criteria?**	**100 YR Flow Depth Yo** *(ft)*	**Water Depth Over Crown** *(ft)*	**DCM Maximum Depth Above Crown**	**DCM 3.2.0 Meets Over Crown Criteria?**	**Ground Height at ROW** *(ft)*	**Water Depth Over/Under ROW Ground Height** *(ft)*	**DCM 3.2.0 Water Contained within ROW?**
DA-A04-A	4.65	0.28	yes	14.5	5.5		12.00	See Total Clear Width Analysis		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A04-B	2.71	0.23	yes	2.9	17.1		12.00	Yes		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A04-C	2.67	0.23	yes	2.9	17.1		12.00	Yes		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A06-C	7.50	0.37	yes	5.6	15.1		12.00	Yes		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A06-D	3.15	0.26	yes	3.7	17.1		12.00	Yes		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A06-E	6.54	0.39	yes	15.8	0.0	0.00		Yes		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A06-F	8.17	0.45	yes	9.0	6.7	0.00		Yes		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A07	6.89	0.40	yes	4.9	15.4		12.00	Yes		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A08	9.51	0.46	yes	16.3	0.0	0.00		Yes		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A09	10.12	0.41	yes	6.1	14.4		12.00	Yes		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A20-A	10.28	0.49	yes	7.5	8.5		12.00	See Total Clear Width Analysis		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A20-C	12.03	0.49	yes	10.7	5.3		12.00	See Total Clear Width Analysis		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A20-D	10.65	0.40	yes	7.2	8.8		12.00	See Total Clear Width Analysis		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A21-B	12.64	0.47	yes	6.8	0.0	0.00		Yes		below crown	0.5	Yes	0.58	-0.58	Yes
Inlet 21823 (DS of grate inlet DA-A22)	2.60	0.31	yes	10.2	4.7	0.00		Yes		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A05	10.36	0.38	yes	13.1	7.6		12.00	See Total Clear Width Analysis		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A06-A	9.13	0.37	yes	12.4	8.3		12.00	See Total Clear Width Analysis		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A18	2.61	0.30	yes	4.6	11.4		12.00	See Total Clear Width Analysis		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A19-A	2.18	0.26	yes	4.4	11.6		12.00	See Total Clear Width Analysis		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A21-A	14.29	0.44	yes	4.9	14.2	0.00		Yes		below crown	0.5	Yes	0.58	-0.58	Yes
DA-A17-A	This inlet is in a v-notch gutter. As a result, flow depth does not accurately address DCM 3.2.0 requirement. The inlet for DA-A18 is immediately upstream of this inlet and is used to analyze street flow at this location.														

Summary of Street Flow for Proposed Alternative 1 Storm Drain Configuration and Ultimate Land UseConditions
Total Clear Width Analysis

Street Name	Location	Drainage Areas	Street Classification	DCM Minimum Clear Width - Total Clear Width *(ft)*	25-year Total Clear Width *(ft)*	DCM 3.2.0 Meets Clear Width Criteria?
Annie St.	between EBC and Newton	DA-A04-A and DA-A03	A45 - City Collector	12.0	12.5	Yes
Johanna St	between Newton and Eva	DA-A20-A and J1	A45 - City Collector	12.0	21.4	Yes
Johanna St	between Eva and Congress	DA-A20-C and J2	A45 - City Collector	12.0	12.4	Yes
Johanna St	between Eva and Congress	DA-A20-D and J2	A45 - City Collector	12.0	15.9	Yes
Mary St	between EBC and Newton	DA-A05 and DA-A06-A	A45 - City Collector	12.0	16.0	Yes
Johanna St	near Newton	DA-A18 and J1	A45 - City Collector	12.0	24.2	Yes
Johanna St	near Newton	DA-A19-A and J1	A45 - City Collector	12.0	24.5	Yes

Summary of Street Flow for Proposed Alternative 1 Storm Drain Configuration and Ultimate Land UseConditions - Crockett Street System

				Street Geometry Summary						DCM 3.3.1
Drainage Area	Inlet Type	Street Name	Street Classification	Longitudinal Slope	Street Width (ft)	Distance Curb to Crown (ft)	Curb Height (ft)	Crown Height (ft)	DCM Minimum Gutter Slope	Meets Gutter Slope Criteria?
DA-A22-B	Curb Inlet on grade	Crockett	A40 - Local City/County Street	2.00%	30.0	15.0	0.5	0.49	0.4%	Yes
DA-A22-C	Curb Inlet on grade	Crockett	A40 - Local City/County Street	1.00%	30.0	15.0	0.5	1.10	0.4%	Yes
DA-A22-D	Curb Inlet on grade	Wilson	A40 - Local City/County Street	0.50%	35.0	17.5	0.5	0.69	0.4%	Yes
DA-A22-E	Curb Inlet on grade	Wilson	A40 - Local City/County Street	0.82%	35.0	17.5	0.5	0.95	0.4%	Yes
DA-A22-F	Curb Inlet on grade	Wilson	A40 - Local City/County Street	0.70%	30.0	15.0	0.5	0.47	0.4%	Yes
DA-A22-G	Curb Inlet on grade	Crockett	A40 - Local City/County Street	1.40%	25.0	12.5	0.5	0.70	0.4%	Yes
DA-A22-H	Curb Inlet on grade	Newton	A40 - Local City/County Street	2.30%	25.0	12.5	0.5	0.26	0.4%	Yes
DA-A22-J	Curb Inlet on grade	Newton	A40 - Local City/County Street	0.40%	30.0	15.0	0.5	0.46	0.4%	Yes
DA-A22-K	Curb Inlet on grade	Crockett	A40 - Local City/County Street	0.40%	30.0	15.0	0.5	0.62	0.4%	Yes
DA-A22-L	Curb Inlet on grade	Crockett	A40 - Local City/County Street	0.20%	30.0	15.0	0.5	0.77	0.4%	No
DA-A22-M	Curb Inlet on grade	Crockett	A40 - Local City/County Street	0.40%	27.0	13.5	0.5	0.34	0.4%	Yes
DA-A22-N	Curb Inlet on grade	Eva	A40 - Local City/County Street	0.40%	27.0	13.5	0.5	0.34	0.4%	Yes
DA-A22-P	Curb Inlet on grade	Crockett	A40 - Local City/County Street	1.50%	30.0	15.0	0.5	0.34	0.4%	Yes
DA-A22-Q	Curb Inlet on grade	Crockett	A40 - Local City/County Street	1.00%	30.0	15.0	0.5	0.87	0.4%	Yes
DA-A22-R	Curb Inlet on grade	Crockett	A40 - Local City/County Street	2.73%	35.0	17.5	0.5	0.35	0.4%	Yes
DA-A22-T	Curb Inlet on grade	Crockett	A40 - Local City/County Street	1.20%	30.0	15	0.5	0.27	0.4%	Yes

Summary of Street Flow for Proposed Alternative 1 Storm Drain Configuration and Ultimate Land UseConditions - Crockett Street System

	25 Year Storm							100 Year Storm						
Drainage Area	Total Gutter Flow Q (cfs)	25 YR Flow Depth Yo (ft)	DCM 3.2.0 Meets Over Curb Criteria?	Spread T (ft)	Clear Width From Crown (ft)	DCM Minimum Clear Width - Total Clear Width (ft)	DCM 3.2.0 Meets Clear Width Criteria?	100 YR Flow Depth Yo (ft)	Water Depth Over Crown (ft)	DCM Maximum Depth Above Crown	DCM 3.2.0 Meets Over Crown Criteria?	Ground Height at ROW (ft)	Water Depth Over/Under ROW Ground Height (ft)	DCM 3.2.0 Water Contained within ROW?
DA-A22-B	2.05	0.28	yes	5.1	9.9	0.00	Yes	0.31	below crown	0.5	Yes	0.58	-0.28	Yes
DA-A22-C	1.68	0.29	yes	2.1	12.9	0.00	Yes	0.32	below crown	0.5	Yes	0.58	-0.26	Yes
DA-A22-D	3.93	0.43	yes	6.8	10.7	0.00	Yes	0.50	below crown	0.5	Yes	0.58	-0.09	Yes
DA-A22-E	2.07	0.32	yes	3.3	14.2	0.00	Yes	0.36	below crown	0.5	Yes	0.58	-0.22	Yes
DA-A22-F	3.77	0.40	yes	9.3	5.7	0.00	Yes	0.45	below crown	0.5	Yes	0.58	-0.13	Yes
DA-A22-G	1.47	0.26	yes	2.6	9.9	0.00	Yes	0.29	below crown	0.5	Yes	0.58	-0.29	Yes
DA-A22-H	2.49	0.29	yes	12.5	0.0	0.00	Yes	0.32	0.06	0.5	Yes	0.58	-0.26	Yes
DA-A22-J	3.91	0.45	yes	12.5	2.5	0.00	Yes	0.50	0.04	0.5	Yes	0.58	-0.09	Yes
DA-A22-K	5.30	0.49	yes	8.3	6.7	0.00	Yes	0.56	below crown	0.5	Yes	0.58	-0.03	Yes
DA-A22-L	4.20	0.51	over curb	6.3	8.7	0.00	Yes	0.60	below crown	0.5	Yes	0.58	0.02	No
DA-A22-M	1.31	0.31	yes	9.6	3.9	0.00	Yes	0.35	0.01	0.5	Yes	0.58	-0.24	Yes
DA-A22-N	2.94	0.41	yes	13.5	0.0	0.00	Yes	0.46	0.12	0.5	Yes	0.58	-0.12	Yes
DA-A22-P	8.26	0.46	yes	15.0	0.0	0.00	Yes	0.51	0.17	0.5	Yes	0.58	-0.07	Yes
DA-A22-Q	6.94	0.46	yes	4.8	10.2	0.00	Yes	0.52	below crown	0.5	Yes	0.58	-0.07	Yes
DA-A22-R	4.52	0.34	yes	14.8	2.7	0.00	Yes	0.38	0.03	0.5	Yes	0.58	-0.20	Yes
DA-A22-T	4.52	0.39	yes	15.0	0.0	0.00	Yes	0.43	0.16	0.5	Yes	0.58	-0.15	Yes

Exhibit K.5

Proposed StormCAD Profiles

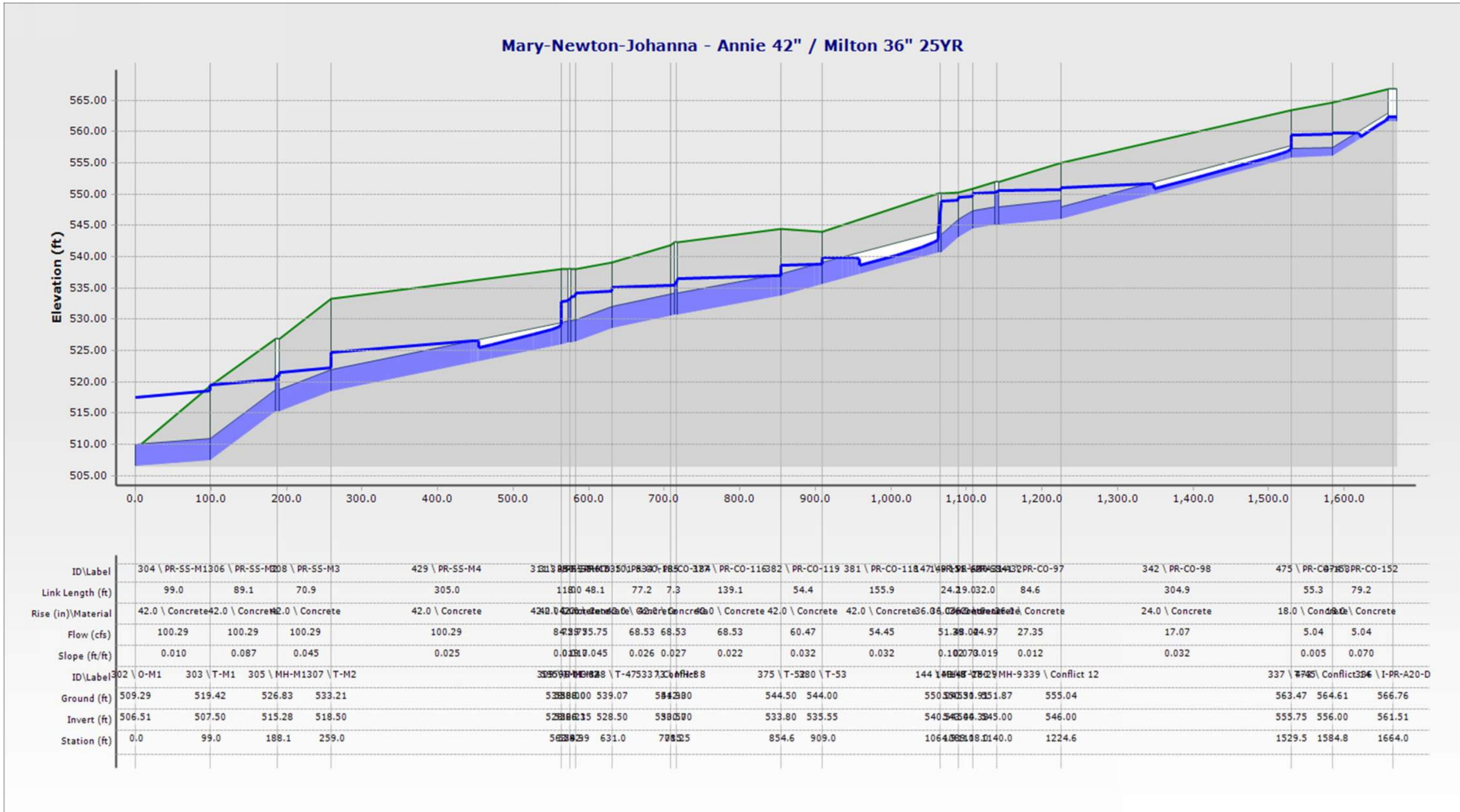
PROPOSED ALTERNATIVE 1 StormCAD LABELS

East Bouldin Creek

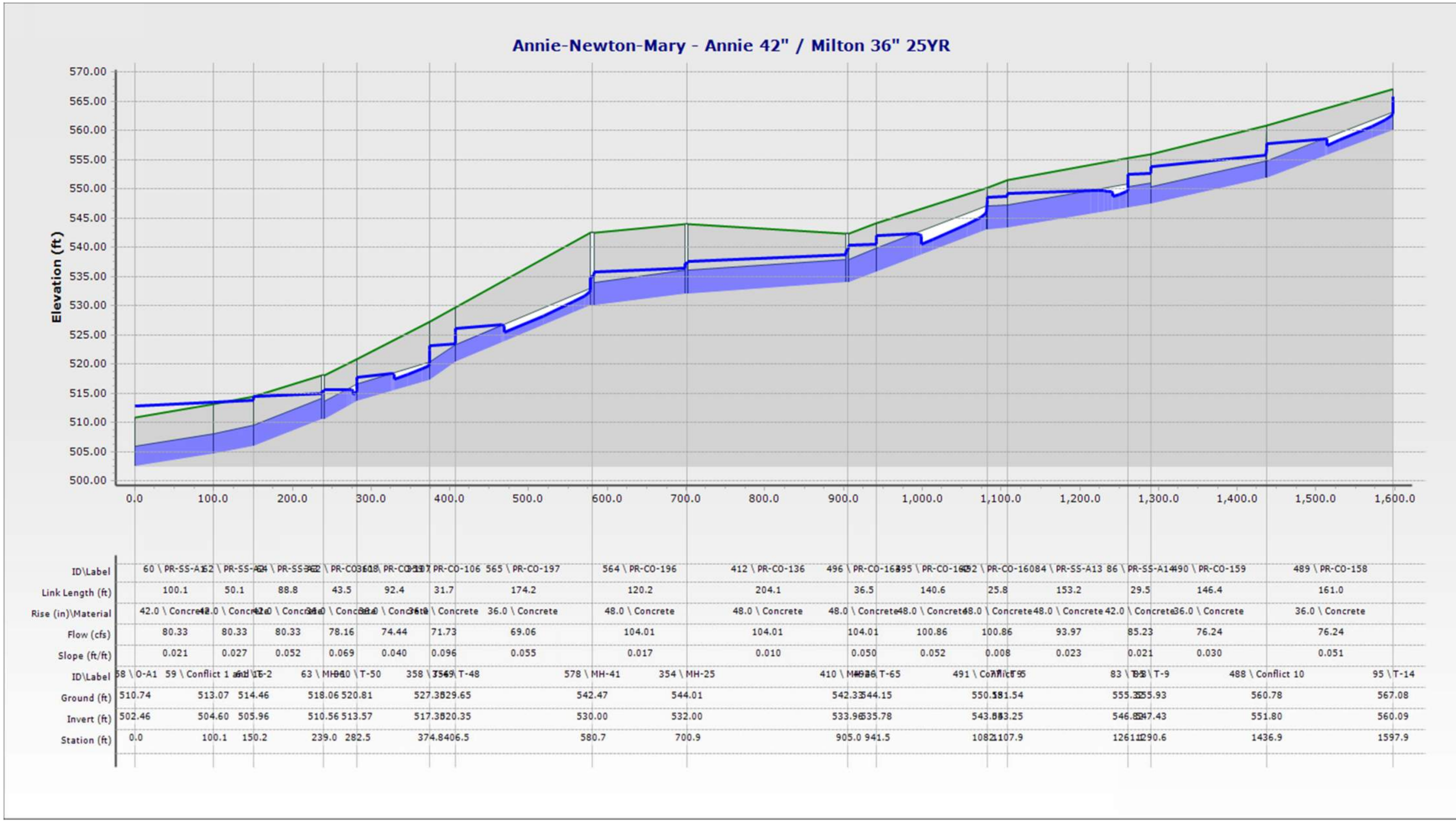
Existing Storm Drain Lines

Proposed Storm Drain Lines

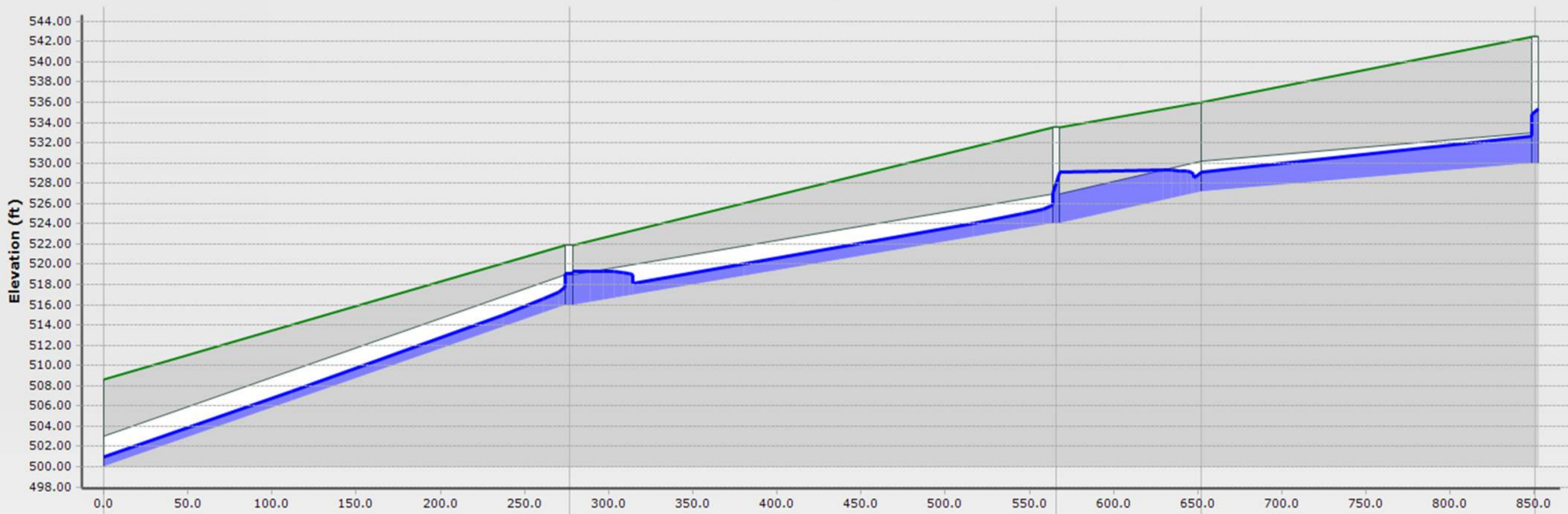
Proposed Storm Drain Lines To Be Abandoned



Mary-Newton-Johanna - Annie 42" / Milton 36" 25YR
Elevation (ft)
ID\Label
Link Length (ft)
Rise (in)\Material
Flow (cfs)
Slope (ft/ft)
ID\Label
Ground (ft)
Invert (ft)
Station (ft)

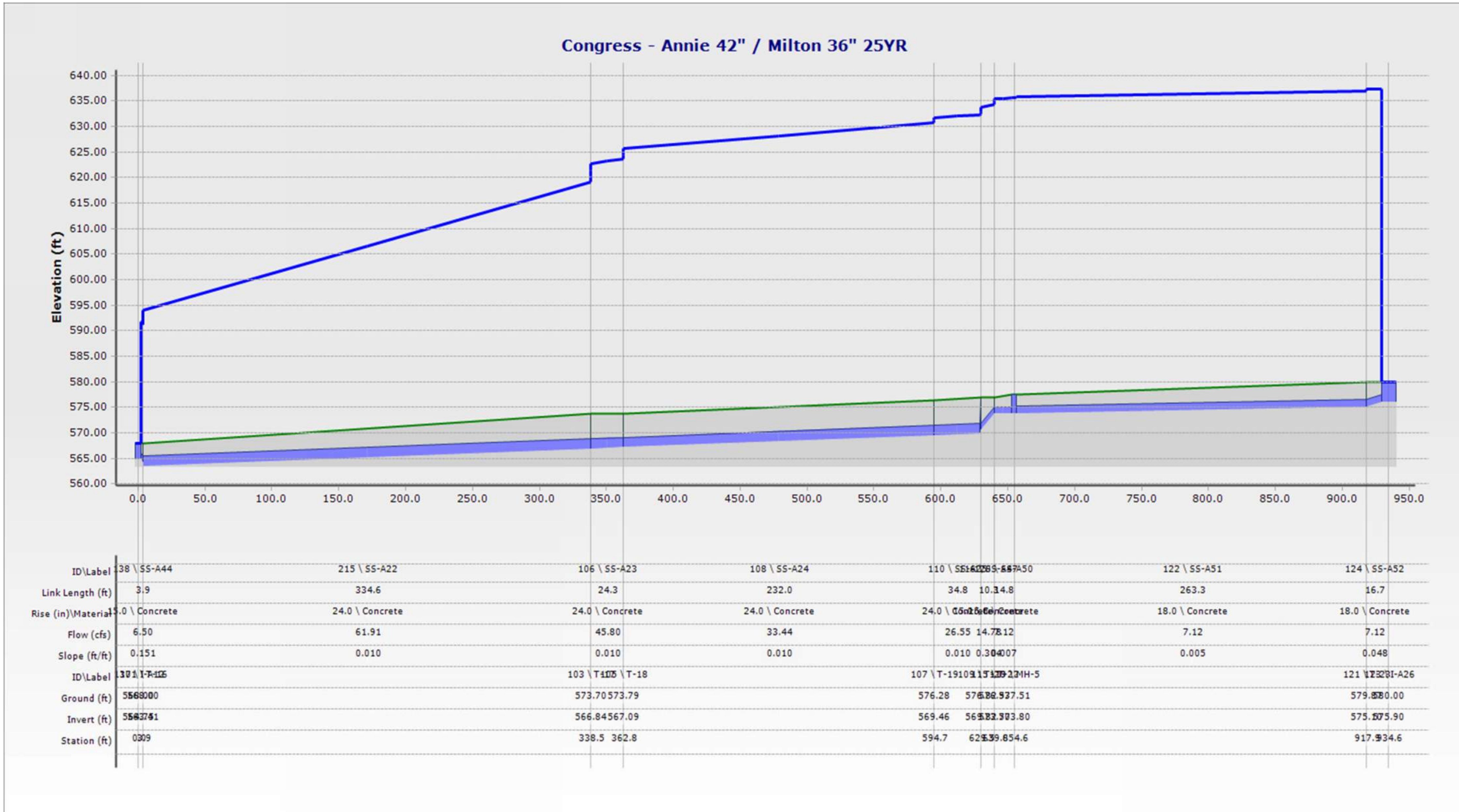

Annie-Newton-Mary - Annie 42" / Milton 36" 25YR
Elevation (ft)
570.00 565.00 560.00 555.00 550.00 545.00 540.00 535.00 530.00 525.00 520.00 515.00 510.00 505.00 500.00
0.0 100.0 200.0 300.0 400.0 500.0 600.0 700.0 800.0 900.0 1,000.0 1,100.0 1,200.0 1,300.0 1,400.0 1,500.0 1,600.0
ID\Label
60 \ PR-SS-A1 565 \ PR-CO-197 564 \ PR-CO-196 412 \ PR-CO-136 490 \ PR-CO-159 489 \ PR-CO-158
Link Length (ft)
100.1 50.1 88.8 43.5 92.4 31.7 174.2 120.2 204.1 36.5 140.6 25.8 153.2 29.5 146.4 161.0
Rise (in)\Material
42.0 \ Concrete 36.0 \ Concrete 48.0 \ Concrete 48.0 \ Concrete 36.0 \ Concrete 36.0 \ Concrete
Flow (cfs)
80.33 80.33 80.33 78.16 74.44 71.73 69.06 104.01 104.01 104.01 100.86 100.86 93.97 85.23 76.24 76.24
Slope (ft/ft)
0.021 0.027 0.052 0.069 0.040 0.096 0.055 0.017 0.010 0.050 0.052 0.008 0.023 0.021 0.030 0.051
ID\Label
59 \ Conflict 1 63 \ MH 578 \ MH-41 354 \ MH-25 488 \ Conflict 10 95 \ T-14
Ground (ft)
510.74 513.07 514.46 518.06 520.81 542.47 544.01 560.78 567.08
Invert (ft)
502.46 504.60 505.96 510.56 513.57 530.00 532.00 551.80 560.09
Station (ft)
0.0 100.1 150.2 239.0 282.5 580.7 700.9 905.0 941.5 1107.9 1436.9 1597.9

Milton-Newton - Annie 42" / Milton 36" 25YR

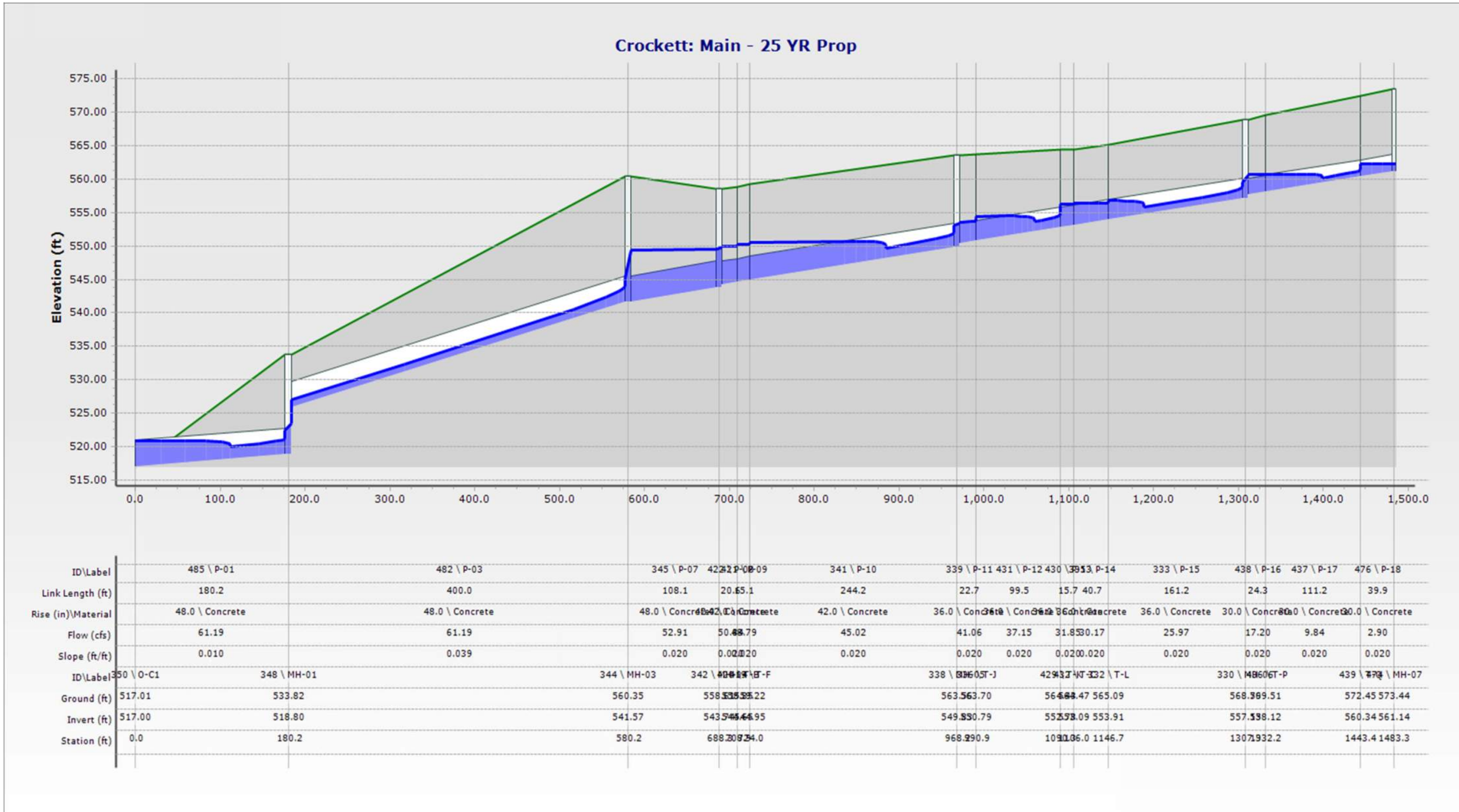


ID\Label	571 \ PR-CO-200	569 \ PR-CO-199	590 \ PR-CO-202	589 \ PR-CO-201
Link Length (ft)	276.5	289.3	86.2	198.4
Rise (in)\Material	36.0 \ Concrete	36.0 \ Concrete	36.0 \ Concrete	36.0 \ Concrete
Flow (cfs)	34.95	34.95	34.95	34.95
Slope (ft/ft)	0.058	0.028	0.036	0.014

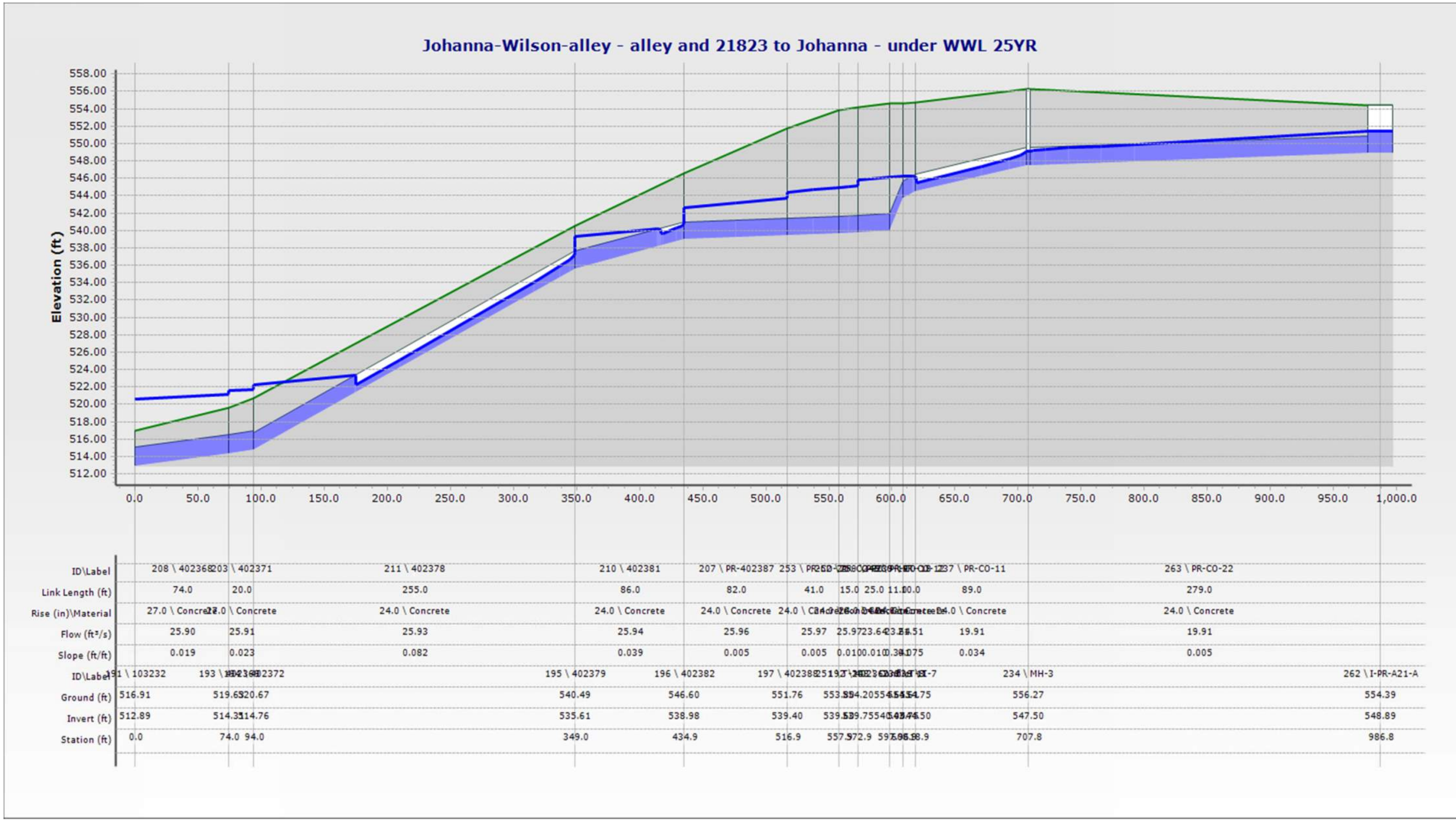
ID\Label	570 \ O-8	568 \ MH-40	566 \ MH-39	588 \ T-81	578 \ MH-41
Ground (ft)	508.61	521.84	533.49	536.02	542.47
Invert (ft)	500.00	516.00	524.00	527.13	530.00
Station (ft)	0.0	276.5	565.8	652.0	850.4

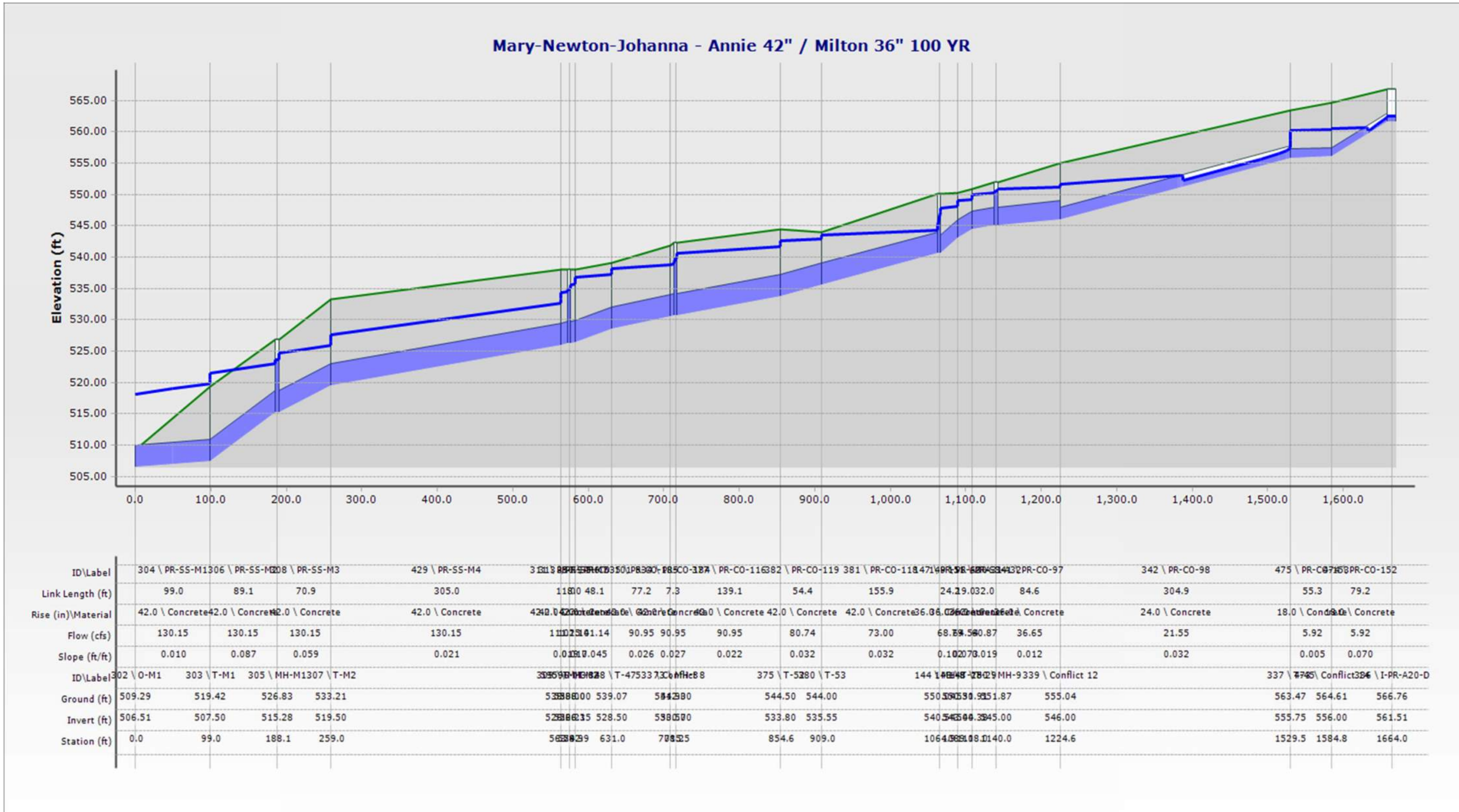


Congress - Annie 42" / Milton 36" 25YR
Elevation (ft)
640.00
635.00
630.00
625.00
620.00
615.00
610.00
605.00
600.00
595.00
590.00
585.00
580.00
575.00
570.00
565.00
560.00
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
550.0
600.0
650.0
700.0
750.0
800.0
850.0
900.0
950.0
ID\Label
Link Length (ft)
Rise (in)\Material
Flow (cfs)
Slope (ft/ft)
ID\Label
Ground (ft)
Invert (ft)
Station (ft)
215 \ SS-A22
334.6
24.0 \ Concrete
61.91
0.010
106 \ SS-A23
24.3
24.0 \ Concrete
45.80
0.010
108 \ SS-A24
232.0
24.0 \ Concrete
33.44
0.010
122 \ SS-A51
263.3
18.0 \ Concrete
7.12
0.005
124 \ SS-A52
16.7
18.0 \ Concrete
7.12
0.048
103 \ T-17
105 \ T-18
573.70 573.79
566.84 567.09
338.5 362.8
107 \ T-19
576.28
569.46
594.7
917.9
934.6



Crockett: Main - 25 YR Prop
Elevation (ft)
575.00
570.00
565.00
560.00
555.00
550.00
545.00
540.00
535.00
530.00
525.00
520.00
515.00
0.0
100.0
200.0
300.0
400.0
500.0
600.0
700.0
800.0
900.0
1,000.0
1,100.0
1,200.0
1,300.0
1,400.0
1,500.0
ID\Label
Link Length (ft)
Rise (in)\Material
Flow (cfs)
Slope (ft/ft)
ID\Label
Ground (ft)
Invert (ft)
Station (ft)
485 \ P-01
180.2
48.0 \ Concrete
61.19
0.010
482 \ P-03
400.0
48.0 \ Concrete
61.19
0.039
345 \ P-07
108.1
52.91
0.020
341 \ P-10
244.2
42.0 \ Concrete
45.02
0.020
339 \ P-11
22.7
41.06
0.020
431 \ P-12
99.5
37.15
0.020
333 \ P-15
161.2
36.0 \ Concrete
25.97
0.020
438 \ P-16
24.3
17.20
0.020
437 \ P-17
111.2
9.84
0.020
476 \ P-18
39.9
2.90
0.020
348 \ MH-01
533.82
518.80
180.2
344 \ MH-03
560.35
541.57
580.2
517.01
517.00
0.0
565.09
553.91
1146.7
572.45
573.44
560.34
561.14
1443.4
1483.3


Johanna-Wilson-alley - alley and 21823 to Johanna - under WWL 25YR
Elevation (ft)
558.00
556.00
554.00
552.00
550.00
548.00
546.00
544.00
542.00
540.00
538.00
536.00
534.00
532.00
530.00
528.00
526.00
524.00
522.00
520.00
518.00
516.00
514.00
512.00
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
550.0
600.0
650.0
700.0
750.0
800.0
850.0
900.0
950.0
1,000.0
ID\Label
211 \ 402378
210 \ 402381
207 \ PR-402387
263 \ PR-CO-22
Link Length (ft)
74.0
20.0
255.0
86.0
82.0
41.0
89.0
279.0
Rise (in)\Material
24.0 \ Concrete
24.0 \ Concrete
24.0 \ Concrete
24.0 \ Concrete
Flow (ft³/s)
25.90
25.91
25.93
25.94
25.96
25.97
19.91
19.91
Slope (ft/ft)
0.019
0.023
0.082
0.039
0.005
0.005
0.034
0.005
ID\Label
195 \ 402379
196 \ 402382
234 \ MH-3
262 \ I-PR-A21-A
Ground (ft)
516.91
540.49
546.60
551.76
556.27
554.39
Invert (ft)
512.89
535.61
538.98
539.40
547.50
548.89
Station (ft)
0.0
349.0
434.9
516.9
707.8
986.8


Mary-Newton-Johanna - Annie 42" / Milton 36" 100 YR
Elevation (ft)
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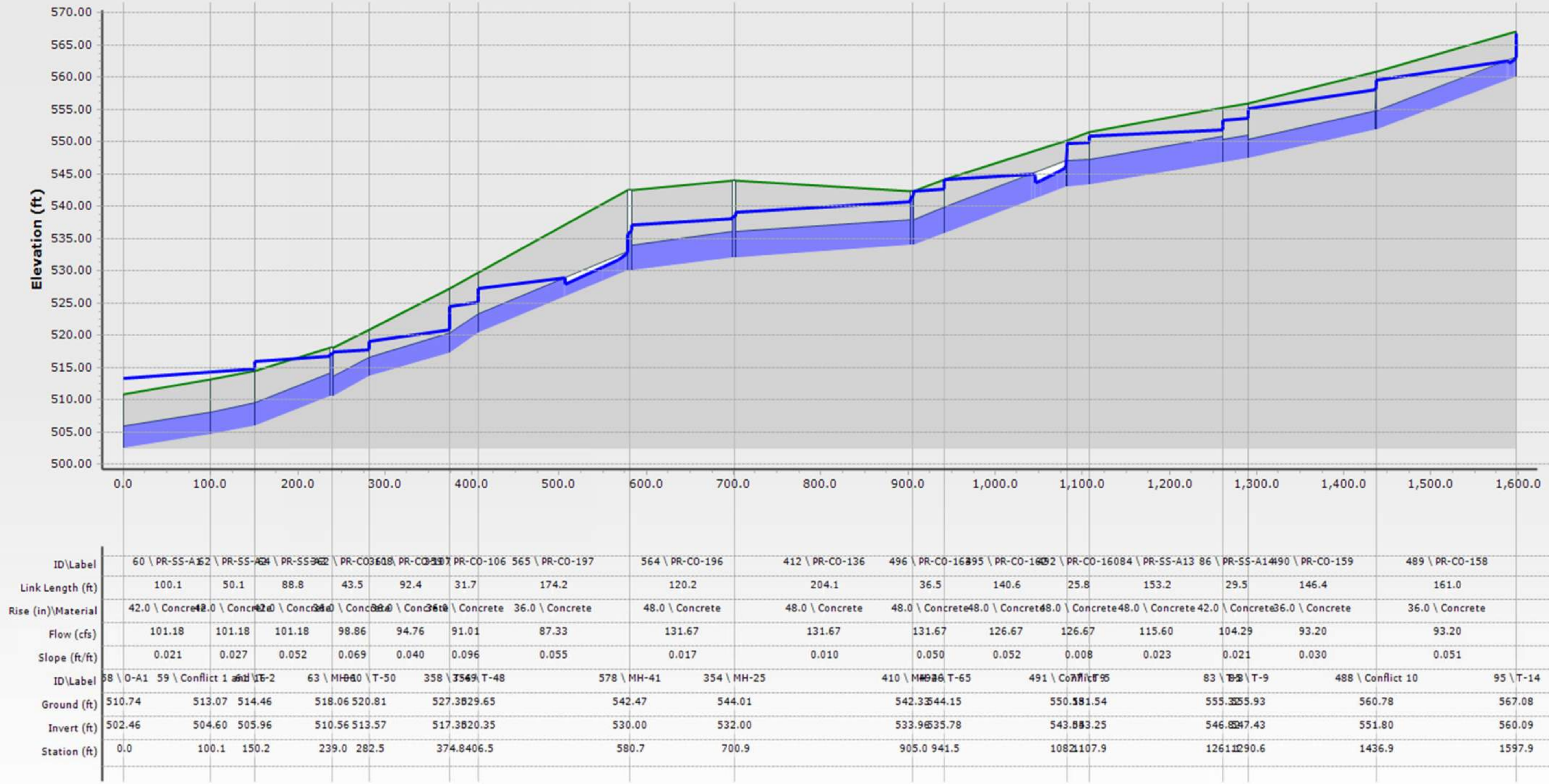
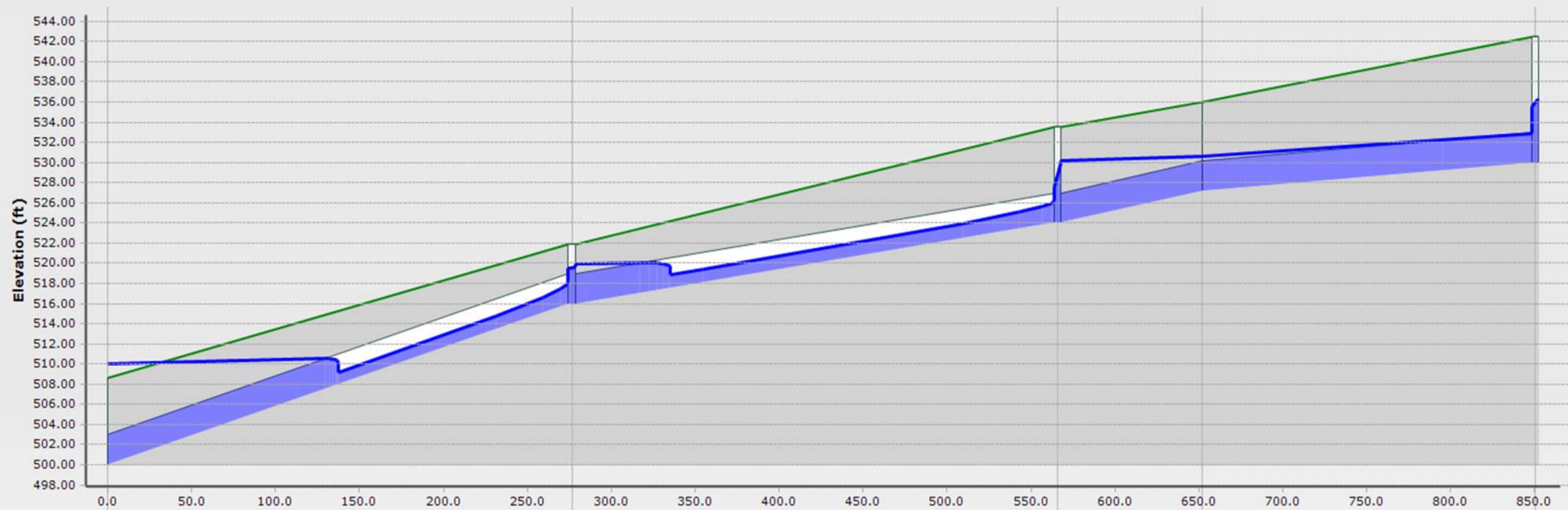
560.00
555.00
550.00
545.00
540.00
535.00
530.00
525.00
520.00
515.00
510.00
505.00
0.0
100.0
200.0
300.0
400.0
500.0
600.0
700.0
800.0
900.0
1,000.0
1,100.0
1,200.0
1,300.0
1,400.0
1,500.0
1,600.0
ID\Label
Link Length (ft)
Rise (in)\Material
Flow (cfs)
Slope (ft/ft)
ID\Label
Ground (ft)
Invert (ft)
Station (ft)

Annie-Newton-Mary - Annie 42" / Milton 36" 100 YR

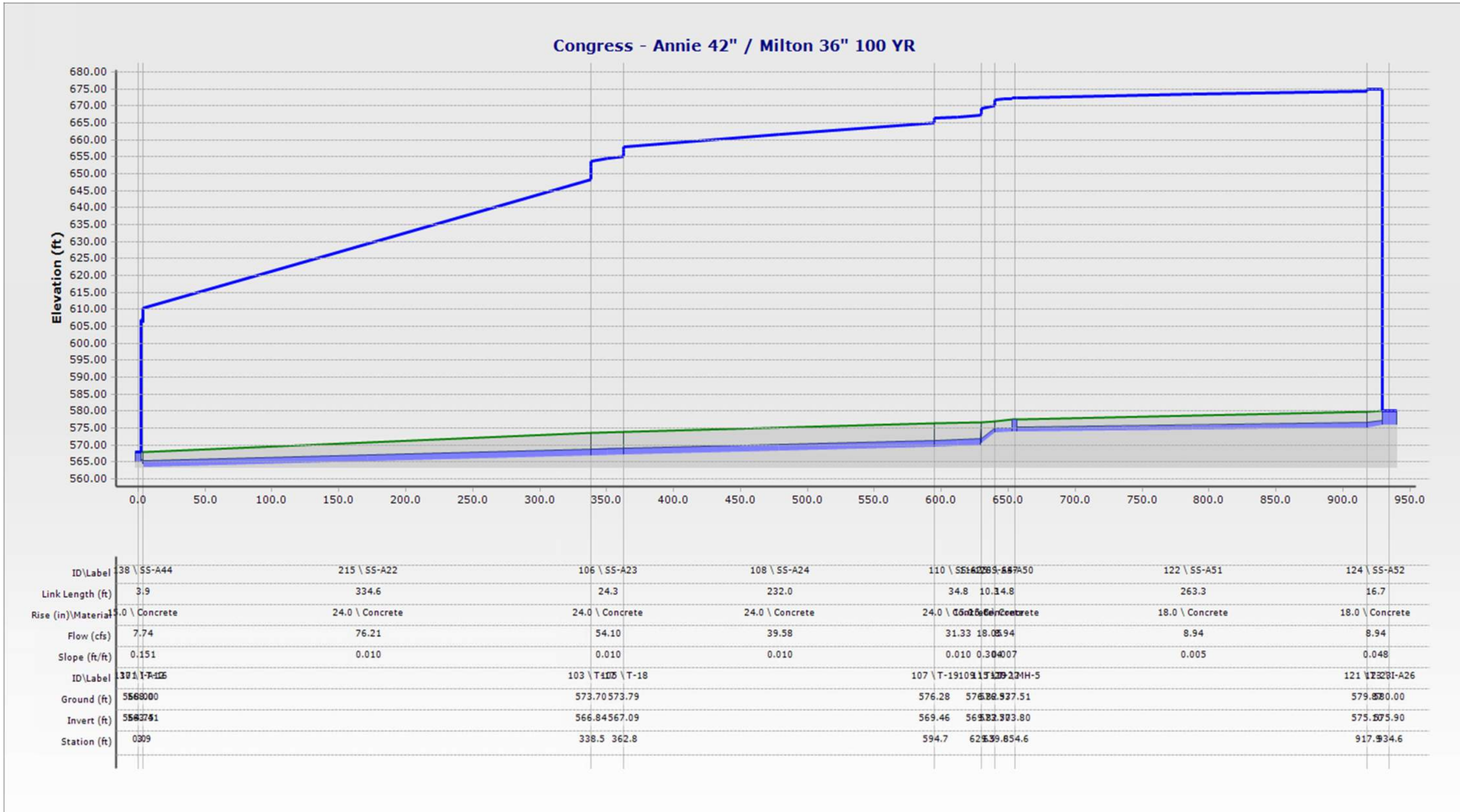


Milton-Newton - Annie 42" / Milton 36" 100 YR

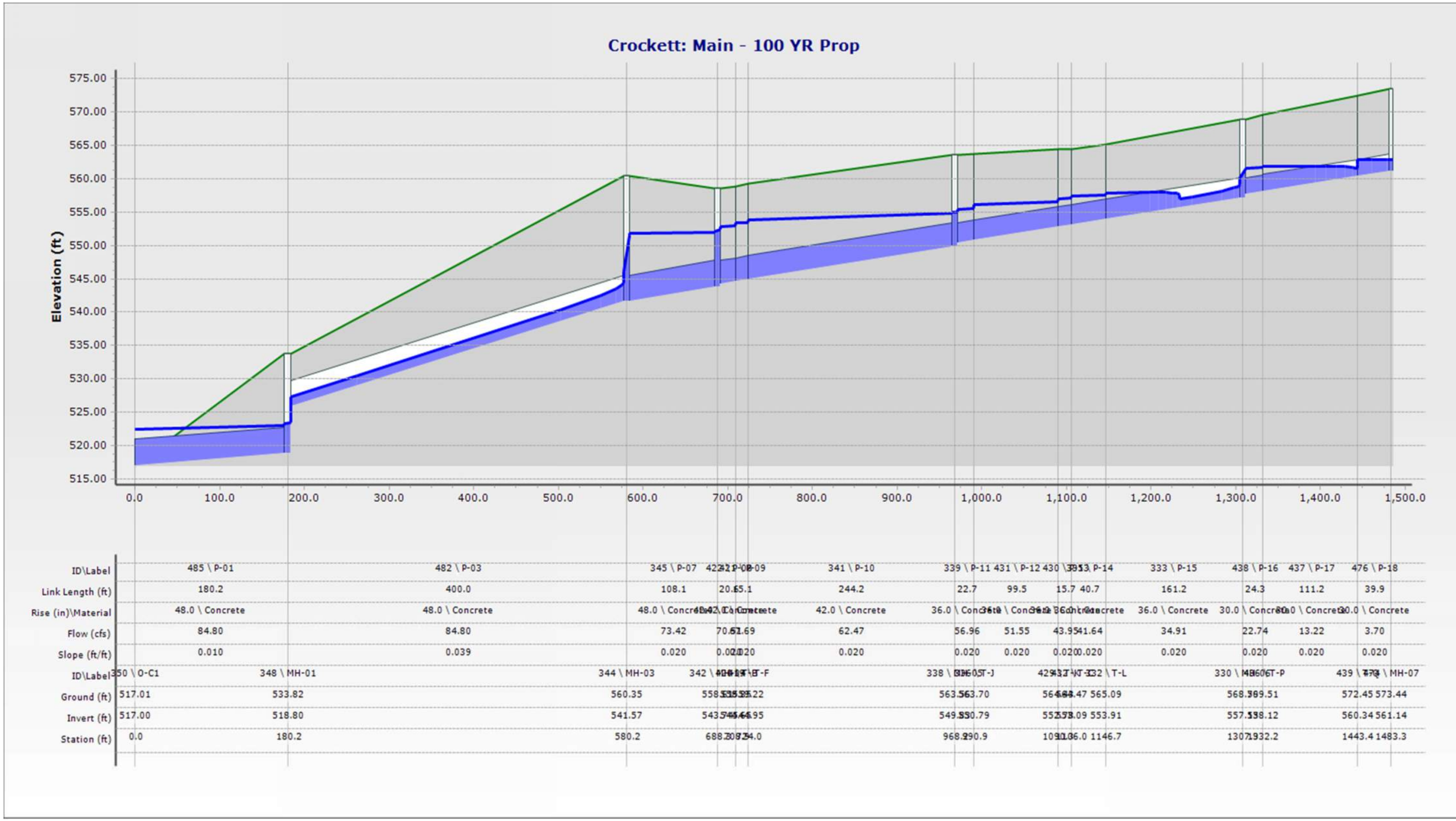


ID\Label	571 \ PR-CO-200	569 \ PR-CO-199	590 \ PR-CO-202	589 \ PR-CO-201
Link Length (ft)	276.5	289.3	86.2	198.4
Rise (in)\Material	36.0 \ Concrete	36.0 \ Concrete	36.0 \ Concrete	36.0 \ Concrete
Flow (cfs)	44.34	44.34	44.34	44.34
Slope (ft/ft)	0.058	0.028	0.036	0.014

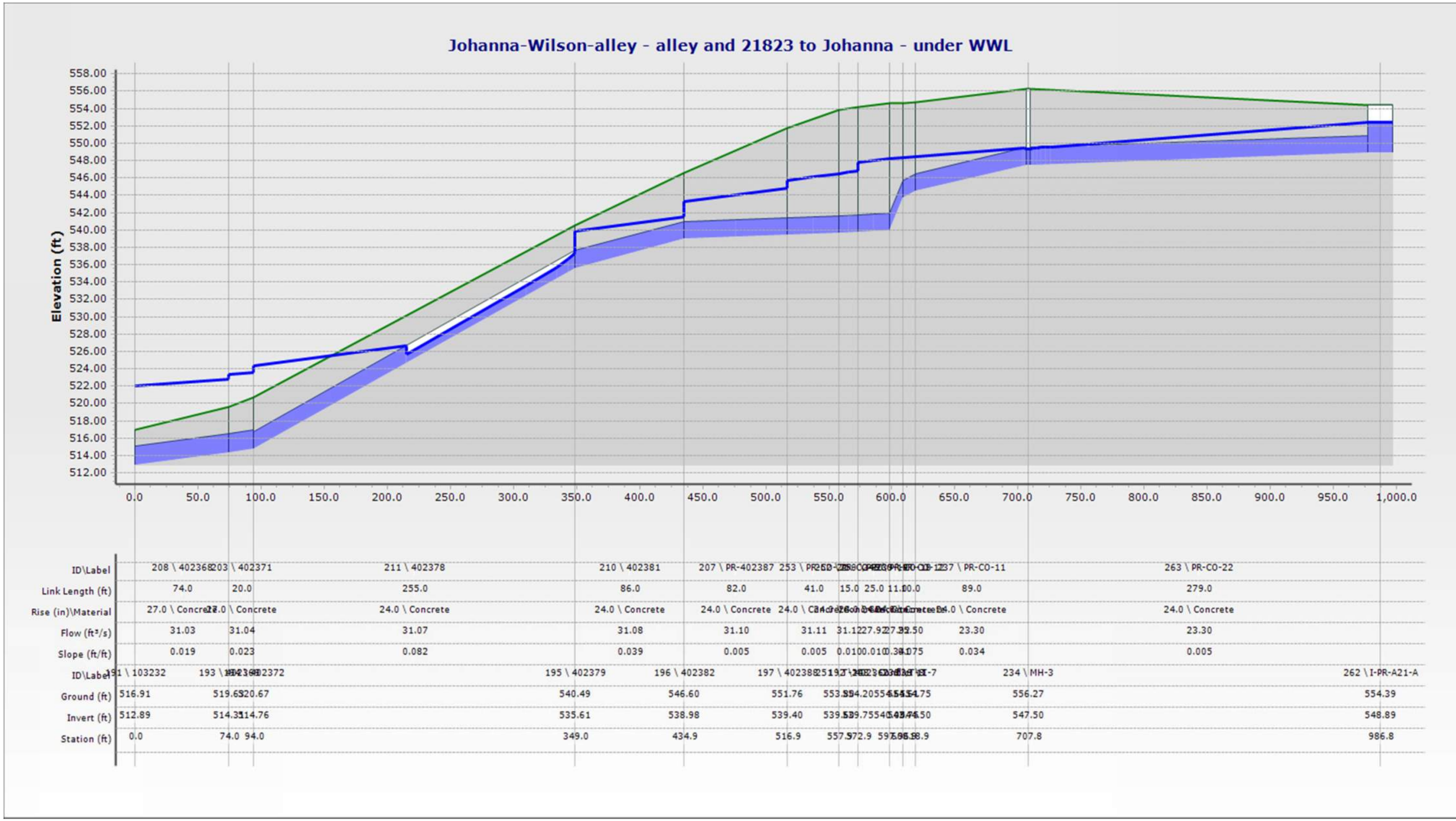
ID\Label	570 \ O-8	568 \ MH-40	566 \ MH-39	588 \ T-81	578 \ MH-41
Ground (ft)	508.61	521.84	533.49	536.02	542.47
Invert (ft)	500.00	516.00	524.00	527.13	530.00
Station (ft)	0.0	276.5	565.8	652.0	850.4



Congress - Annie 42" / Milton 36" 100 YR
Elevation (ft)
ID\Label
Link Length (ft)
Rise (in)\Material
Flow (cfs)
Slope (ft/ft)
ID\Label
Ground (ft)
Invert (ft)
Station (ft)
215 \ SS-A22
334.6
24.0 \ Concrete
76.21
0.010
106 \ SS-A23
24.3
24.0 \ Concrete
54.10
0.010
108 \ SS-A24
232.0
24.0 \ Concrete
39.58
0.010
122 \ SS-A51
263.3
18.0 \ Concrete
8.94
0.005
124 \ SS-A52
16.7
18.0 \ Concrete
8.94
0.048



Crockett: Main - 100 YR Prop
Elevation (ft)
575.00
570.00
565.00
560.00
555.00
550.00
545.00
540.00
535.00
530.00
525.00
520.00
515.00
0.0
100.0
200.0
300.0
400.0
500.0
600.0
700.0
800.0
900.0
1,000.0
1,100.0
1,200.0
1,300.0
1,400.0
1,500.0
ID\Label
Link Length (ft)
Rise (in)\Material
Flow (cfs)
Slope (ft/ft)
ID\Label
Ground (ft)
Invert (ft)
Station (ft)
485 \ P-01
180.2
48.0 \ Concrete
84.80
0.010
482 \ P-03
400.0
48.0 \ Concrete
84.80
0.039
345 \ P-07
108.1
73.42
0.020
341 \ P-10
244.2
42.0 \ Concrete
62.47
0.020
339 \ P-11
22.7
56.96
431 \ P-12
99.5
51.55
333 \ P-15
161.2
36.0 \ Concrete
34.91
438 \ P-16
24.3
22.74
437 \ P-17
111.2
13.22
476 \ P-18
39.9
3.70
350 \ O-C1
517.01
517.00
348 \ MH-01
533.82
518.80
180.2
344 \ MH-03
560.35
541.57
580.2
332 \ T-L
565.09
553.91
1146.7
572.45
573.44
560.34
561.14
1443.4
1483.3



Johanna-Wilson-alley - alley and 21823 to Johanna - under WWL
Elevation (ft)
ID\Label
Link Length (ft)
Rise (in)\Material
Flow (ft³/s)
Slope (ft/ft)
ID\Label
Ground (ft)
Invert (ft)
Station (ft)
211 \ 402378
210 \ 402381
207 \ PR-402387
263 \ PR-CO-22
195 \ 402379
196 \ 402382
234 \ MH-3
262 \ I-PR-A21-A

Exhibit K.6

Proposed Live Oak Condominiums Record Drawings

REVISIONS							
Number	Description	Revise (R) Add (A) Void (V) Sheet No.'s	Total # Sheets in Plan Set	Net Change Imp. Cover (sq.ft.)	Total Site Imp. Cover (sq. ft.)/%	City of Austin Approval-Date	Date Imaged

SITE PLAN FOR
LIVE OAK CONDOMINIUMS

211 WEST JOHANNA STREET
AUSTIN, TX 78704

LAND STATUS DETERMINATION: C8I-2014-0234

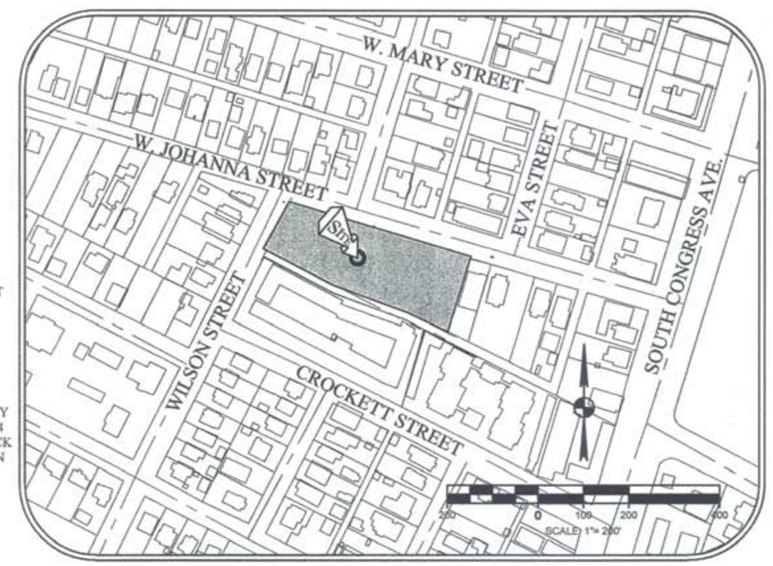
OWNER:
JUSTIN METCALF
BCC LIVE OAK, LLC
515 CONGRESS AVE. SUITE 1515
AUSTIN, TEXAS 78701
P (512)474-4000

ENGINEER:
JAMES R. MCCANN, P.E.
PAPE-DAWSON ENGINEERS
7800 SHOAL CREEK BLVD., SUITE 220-WEST
AUSTIN, TEXAS 78757
P (512) 454-8711
F (512) 459-8867

LANDSCAPE ARCHITECT:
JENNIFER L. ORR
STUDIO BALCONES
702 SAN ANTONIO STREET
AUSTIN, TX 78701
P (512) 383-8815

ARCHITECT:
BRETT RHODE
RHODE PARTNERS
515 CONGRESS AVENUE, SUITE 1600
AUSTIN, TEXAS 78701
P (512) 551-0439

CONSOLIDATED SITE DEVELOPMENT PLAN AUSTIN, TEXAS



THIS PROJECT CONSISTS OF THE CONSTRUCTION OF 38 RESIDENTIAL UNITS IN 3 MULTI-FAMILY BUILDINGS ON A 1.397 ACRE SITE WITH ASSOCIATED PARKING, AND UTILITY IMPROVEMENTS. THE TOTAL IMPERVIOUS COVER IS 56.81%.

THIS SITE IS SUBJECT TO SUBCHAPTER E OF THE LAND DEVELOPMENT CODE (COMMERCIAL DESIGN STANDARDS).

THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE ASSOCIATED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.

RELEASE OF THIS APPLICATION DOES NOT CONSTITUTE A VERIFICATION OF ALL DATA, INFORMATION, AND CALCULATIONS SUPPLIED BY THE APPLICANT. THE ENGINEER OF RECORD IS SOLELY RESPONSIBLE FOR THE COMPLETENESS, ACCURACY, AND ADEQUACY OF HIS/HER SUBMITTAL, WHETHER OR NOT THE APPLICATION IS REVIEWED FOR CODE COMPLIANCE BY THE CITY ENGINEER.

A FEE-IN-LIEU OF PARKLAND DEDICATION HAS BEEN PAID FOR 38 DWELLING UNITS.

SUBMITTED BY:

I, JAMES R. MCCANN P.E. #92595 DO HEREBY CERTIFY THAT THE ENGINEERING WORK SUBMITTED HEREIN COMPLIES WITH ALL THE PROVISIONS OF THE TEXAS ENGINEERING PRACTICE ACT. I HEREBY ACKNOWLEDGE THAT ANY MISREPRESENTATION REGARDING THIS CERTIFICATION CONSTITUTES A VIOLATION OF THE ACT, AND MAY RESULT IN CRIMINAL, CIVIL, AND/OR ADMINISTRATIVE PENALTIES AGAINST ME, AS AUTHORIZED BY THE ACT.

STATE OF TEXAS — JAMES R. McCANN — 92595 — LICENSED PROFESSIONAL ENGINEER

PAPE-DAWSON ENGINEERS
JAMES R. McCANN, P.E. — 03/11/15 DATE

REVIEWED BY:

CITY OF AUSTIN PLANNING AND DEVELOPMENT DEPT. — DATE

INDUSTRIAL WASTE — DATE

AUSTIN WATER UTILITY — DATE

AUSTIN FIRE DEPARTMENT — DATE

SUBMITTAL DATE
SEPTEMBER 4, 2014

DEVELOPMENT PERMIT NUMBER
SP-2014-0349C

ALL RESPONSIBILITY FOR THE ADEQUACY OF THESE PLANS REMAINS WITH THE ENGINEER WHO PREPARED THEM. IN ACCEPTING THESE PLANS, THE CITY OF AUSTIN MUST RELY UPON THE ADEQUACY OF THE WORK OF THE DESIGN ENGINEER.

SITE PLAN / PERMIT DATA:

SUBMITTAL DATE:	SEPTEMBER 4, 2014
CASE NUMBER:	SP-2014-0349C
PROJECT ADDRESS:	211 WEST JOHANNA STREET AUSTIN, TEXAS 78704
PROPERTY OWNER:	BCC LIVE OAK LCC
PRINCIPAL STREET:	WEST JOHANNA STREET (AN URBAN ROADWAY)
WATERSHED:	EAST BOULDIN CREEK
NEIGHBORHOOD PLAN:	BOULDIN CREEK
ZONING:	MF-3-NP
PROPOSED USE:	RESIDENTIAL MULTIFAMILY
LEGAL DESCRIPTION:	LOTS 1-3, PORTION OF LOT 4 BLOCK B6, LOTS 11-15 BLOCK B7 OF RL SWEETMAN ADD'N
RELATED CASE NUMBERS:	C8I-2014-0234 C14-02-0031
FIRM PANEL:	48453C0585H
MAPSCO GRID:	614M, 614R

FIRE FLOW REQUIREMENTS

BUILDING A - TYPE V-A: 26,274 SF
REQUIRED FLOW: 1500 GPM
3,000 GPM (MINIMUM FIRE FLOW)
1,500 GPM (50% AUTOMATIC SPRINKLER SYSTEM REDUCTION W/ 1,500 GPM MIN.)

BUILDING B - TYPE V-B: 6,562 SF
REQUIRED FLOW: 1500 GPM
2,250 GPM (MINIMUM FIRE FLOW)
1,500 GPM (50% AUTOMATIC SPRINKLER SYSTEM REDUCTION W/ 1,500 GPM MIN.)

BUILDING C - TYPE V-B: 10,779 SF
REQUIRED FLOW: 1500 GPM
2,750 GPM (MINIMUM FIRE FLOW)
1,500 GPM (50% AUTOMATIC SPRINKLER SYSTEM REDUCTION W/ 1,500 GPM MIN.)

THIS PROJECT IS LOCATED IN THE EAST BOULDIN CREEK WATERSHED, AN URBAN WATERSHED, AND IT IS SUBJECT TO THE COMPREHENSIVE WATERSHED ORDINANCE.

NO PORTION OF THIS TRACT IS WITHIN THE BOUNDARIES OF THE 100-YEAR FLOODPLAIN OF ANY WATERWAY THAT IS WITHIN THE LIMITS OF STUDY OF THE FEDERAL EMERGENCY MANAGEMENT AGENCY FLOOD INSURANCE RATE MAP NO. 48453C0585H, DATED SEPTEMBER 26, 2008, WITHIN TRAVIS COUNTY, TEXAS.

THIS PROJECT IS NOT LOCATED OVER THE EDWARDS AQUIFER RECHARGE ZONE.

I, JAMES R. MCCANN P.E. #92595 , CERTIFY THESE PLANS ARE, TO THE BEST OF MY KNOWLEDGE, COMPLETE WITH ACCURATE TECHNICAL DATA AND IN GENERAL COMPLIANCE WITH THE REQUIREMENTS OF THE COMPREHENSIVE WATERSHED ORDINANCE

APPROVED VARIANCES AND WAIVERS:

VICINITY MAP
NOT TO SCALE

FIRE HYDRANT FLOW TEST

HYDRANT # 166892
GRID H20
STATIC PRESSURE 72 PSI
RESIDUAL PRESSURE 68PSI
FLOW RATE 1101 GPM

WATER PRESSURE ZONE CENTRAL

PAPE-DAWSON ENGINEERS
7800 SHOAL CREEK BLVD SUITE 220 WEST | AUSTIN TEXAS 78757 | PHONE: 512.454.8711 FAX: 512.459.8867
TEXAS BOARD OF PROFESSIONAL ENGINEERS, FIRM REGISTRATION # 470

Sheet List Table

SITE PLAN RELEASE

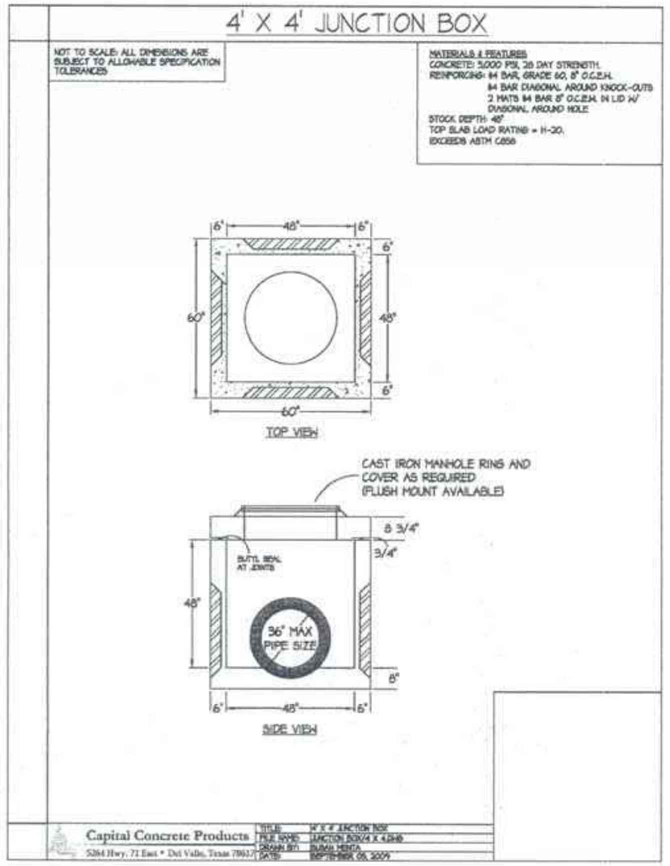
SITE PLAN APPROVAL SHEET 01 OF 38
FILE NUMBER ______ APPLICATION DATE 09/04/2014
APPROVED BY COMMISSION ______ UNDER SECTION ______ OF
CHAPTER ______ OF THE CITY OF AUSTIN CODE.
EXPIRATION DATE (25-5-112, LDC) ______ CASE MANAGER CHRISTINE BARTON-HOLMES
PROJECT EXPIRATION DATE ORD. #970905-A) ______ DWPZ ______ DDZ ______

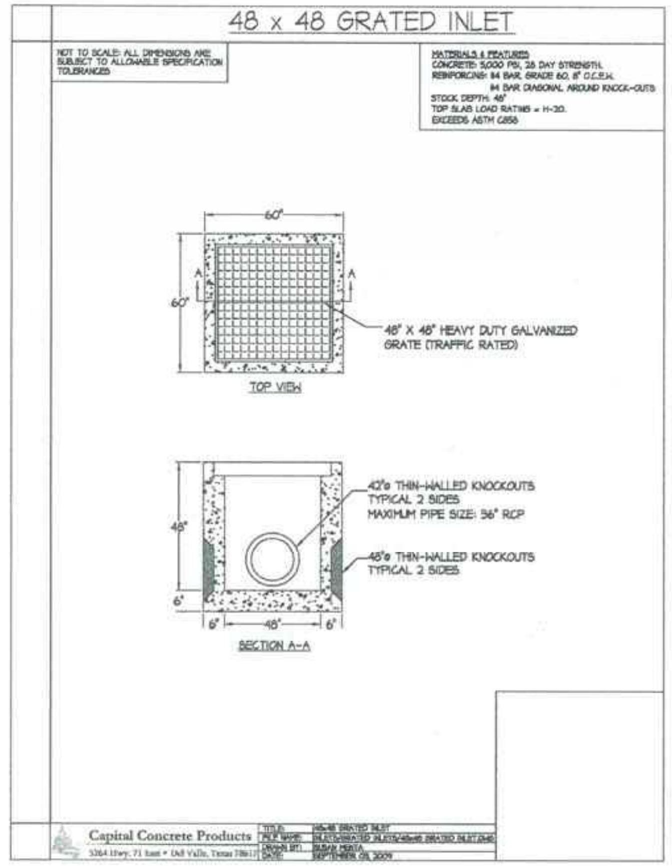
Director, Watershed Protection and Development Review

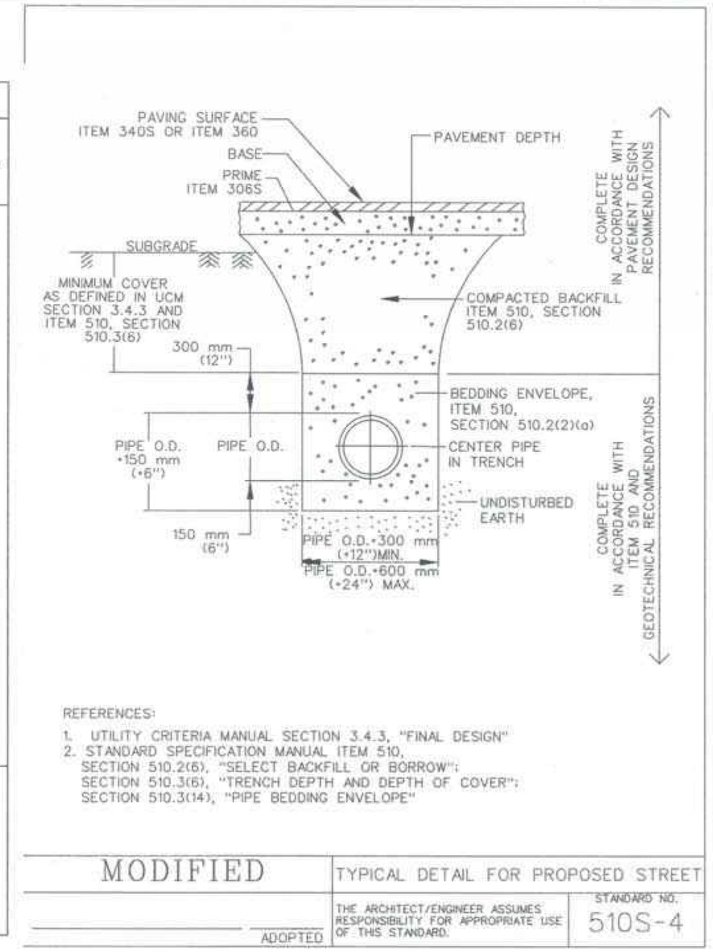
RELEASED FOR GENERAL COMPLIANCE: ZONING
Rev. 1 ______ Correction 1 ______
Rev. 2 ______ Correction 2 ______
Rev. 3 ______ Correction 3 ______

Final plat must be recorded by the Project Expiration Date, if applicable. Subsequent Site Plans Plans which do not comply with the Code current at the time of filing, and all required Building Permits and/or a notice of construction (if a building permit is not required), must also be approved prior to the Project Expiration Date.

SP-2014-0349C
50826-00







REVISIONS:

STATE OF TEXAS
JAMES R. McCANN
92595
LICENSED PROFESSIONAL ENGINEER

PAPE-DAWSON ENGINEERS
7800 SHOAL CREEK BLVD | AUSTIN, TEXAS 78757 | PHONE: 512.454.8711
SUITE 220 WEST | FAX: 512.459.8867
TEXAS BOARD OF PROFESSIONAL ENGINEERS, FIRM REGISTRATION # 470

LIVE OAK CONDOMINIUMS
211 WEST JOHANNA STREET
AUSTIN, TEXAS 78704

STORM DRAIN DETAILS (2 OF 2)

SITE PLAN RELEASE

SITE PLAN APPROVAL SHEET 25 OF 38

FILE NUMBER SP-2014-0349C APPLICATION DATE 09/04/2014

APPROVED BY COMMISSION ______ UNDER SECTION ______ OF

CHAPTER ______ OF THE CITY OF AUSTIN CODE.

EXPIRATION DATE (25-5-112, LDC) ______ CASE MANAGER CHRISTINE BARTON-HOLMES

PROJECT EXPIRATION DATE ORD. #970905-A) ______ DWPZ ______ DDZ ______

Director, Watershed Protection and Development Review

RELEASED FOR GENERAL COMPLIANCE: ZONING

Rev. 1 ______ Correction 1 ______
Rev. 2 ______ Correction 2 ______
Rev. 3 ______ Correction 3 ______

Final plat must be recorded by the Project Expiration Date, if applicable. Subsequent Site Plans Plans which do not comply with the Code current at the time of filing, and all required Building Permits and/or a notice of construction (if a building permit is not required), must also be approved prior to the Project Expiration Date.

JOB NO. 50626-00

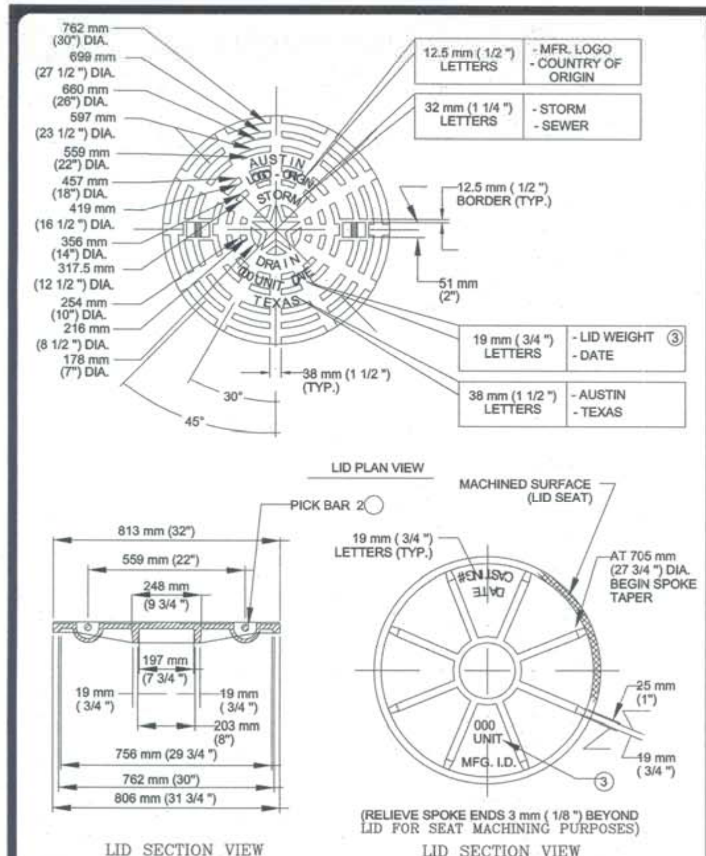
DATE March 2015

DESIGNER HJG

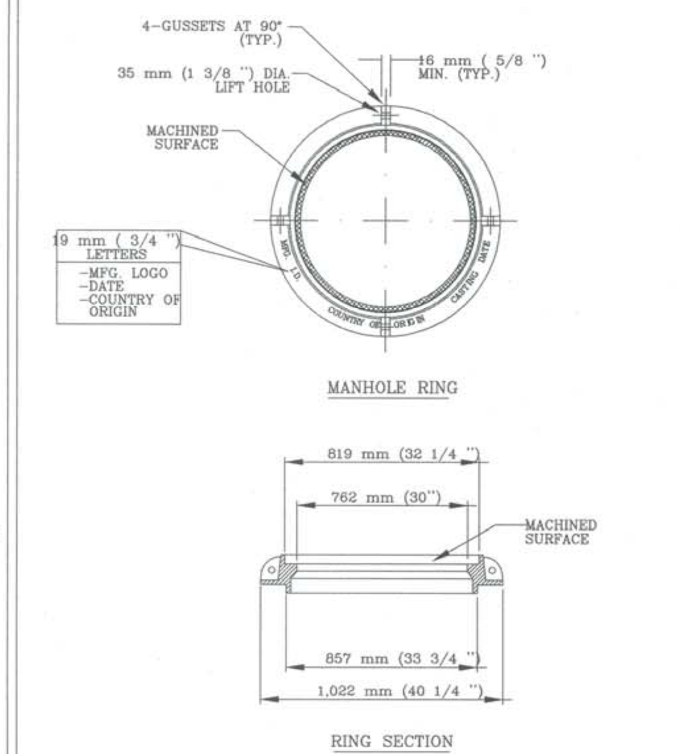
CHECKED ______ DRAWN HJG

SHEET 25 OF 38

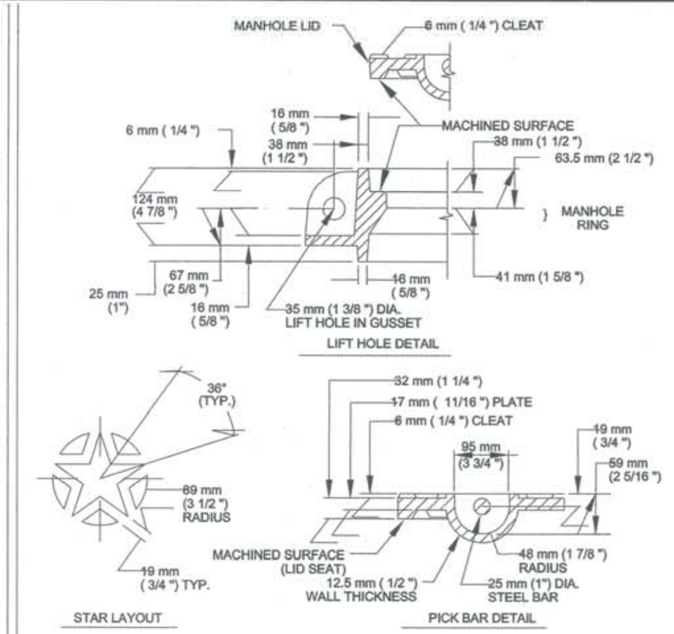
THIS DOCUMENT HAS BEEN PRODUCED FROM MATERIAL THAT WAS STORED AND/OR TRANSMITTED ELECTRONICALLY AND MAY HAVE BEEN INADVERTENTLY ALTERED. RELY ONLY ON FINAL HARDCOPY MATERIALS BEARING THE CONSULTANT'S SIGNATURE AND SEAL.



CITY OF AUSTIN DEPARTMENT OF WATERSHED PROTECTION AND DEVELOPMENT REVIEW	STORM DRAIN MANHOLE RING AND 813 mm (32") COVER	
RECORD COPY SIGNED BY GEORGE E. OSWALD 2/14/02 ADOPTED	THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD.	STANDARD NO. 503S-4S 1 OF 3



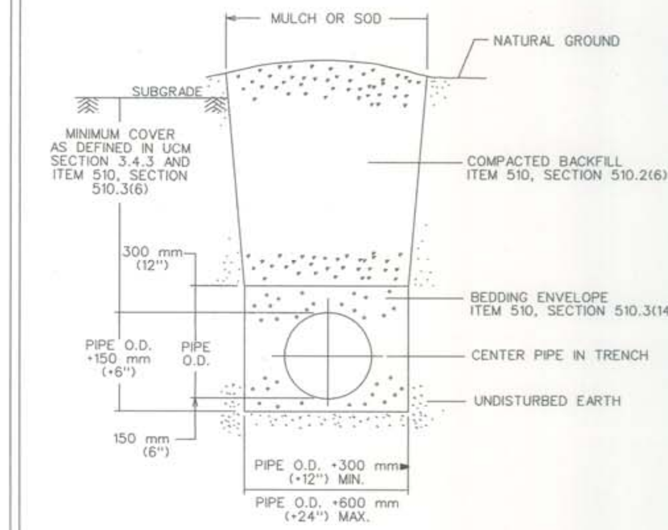
CITY OF AUSTIN DEPARTMENT OF WATERSHED PROTECTION AND DEVELOPMENT REVIEW	STORM DRAIN MANHOLE RING AND 813 mm (32") COVER	
RECORD COPY SIGNED BY GEORGE E. OSWALD 2/14/02 ADOPTED	THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD.	STANDARD NO. 503S-4S 2 OF 3



NOTES:

1. ALL CORNERS AND EDGES SHALL HAVE A 1.5 mm (1/16 ") MINIMUM RADIUS.
2. LIDS SHALL BE CAST WITH TWO 25 mm (1") DIA. STEEL PICK BARS.
3. LID WEIGHTS SHALL BE 935 N (210 LBS.) FOR CAST IRON OR 779 N (175 LBS.) FOR DUCTILE IRON. WEIGHT SHALL BE CAST ON BOTH TOP AND BOTTOM OF LID.
4. MANUFACTURER SHALL PROVIDE INDEPENDENT TESTING LABORATORY REPORT ON 25,000 POUND PROOF LOAD TEST CONDUCTED ACCORDING TO AASHTO M-306.
5. FILLETS SHALL BE 6 mm (1/4 ") RADIUS UNLESS OTHERWISE SPECIFIED.
6. MANUFACTURER SHALL REMOVE EXCESS IRON AND MACHINE FINISH SEATING SURFACES TO NOTED DIMENSIONS.

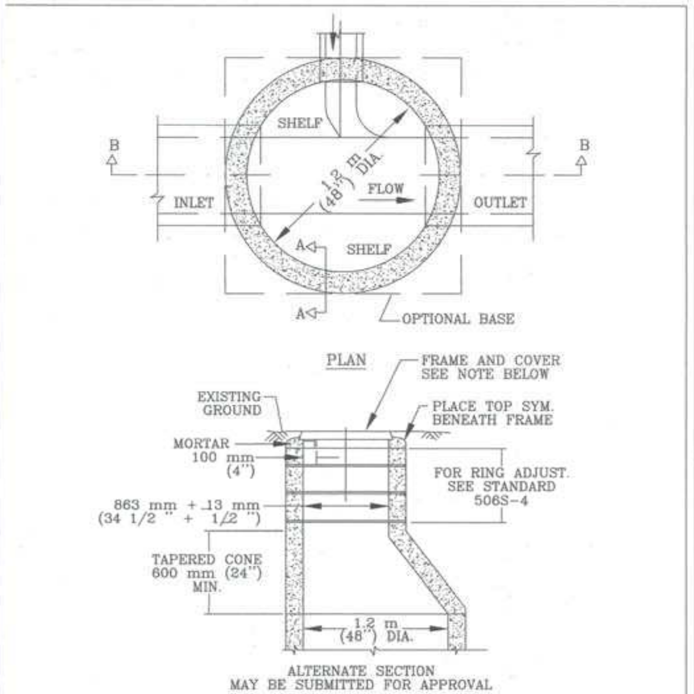
CITY OF AUSTIN DEPARTMENT OF WATERSHED PROTECTION AND DEVELOPMENT REVIEW	STORM DRAIN MANHOLE RING AND 813 mm (32") COVER	
RECORD COPY SIGNED BY GEORGE E. OSWALD 2/14/02 ADOPTED	THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD.	STANDARD NO. 503S-4S 3 OF 3



REFERENCES:

1. UTILITY CRITERIA MANUAL SECTION 3.4.3, "FINAL DESIGN"
2. STANDARD SPECIFICATION MANUAL ITEM 510, SECTION 510.2(6), "SELECT BACKFILL OR BORROW"; SECTION 510.3(6), "TRENCH DEPTH AND DEPTH OF COVER"; SECTION 510.3(14), "PIPE BEDDING ENVELOPE"

CITY OF AUSTIN DEPARTMENT OF PUBLIC WORKS	TYPICAL TRENCH DETAIL WITH UNFINISHED SURFACE	
RECORD COPY SIGNED BY BILL GARDNER 03/13/06 ADOPTED	THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD.	STANDARD NO. 510S-5

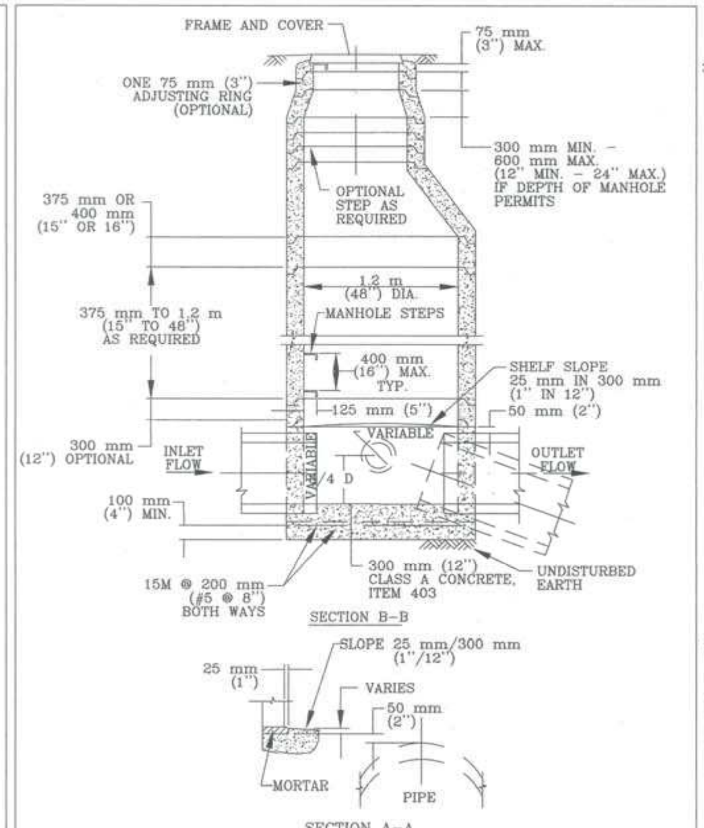


NOTE:
USE 800 mm (32") FRAME AND COVER.

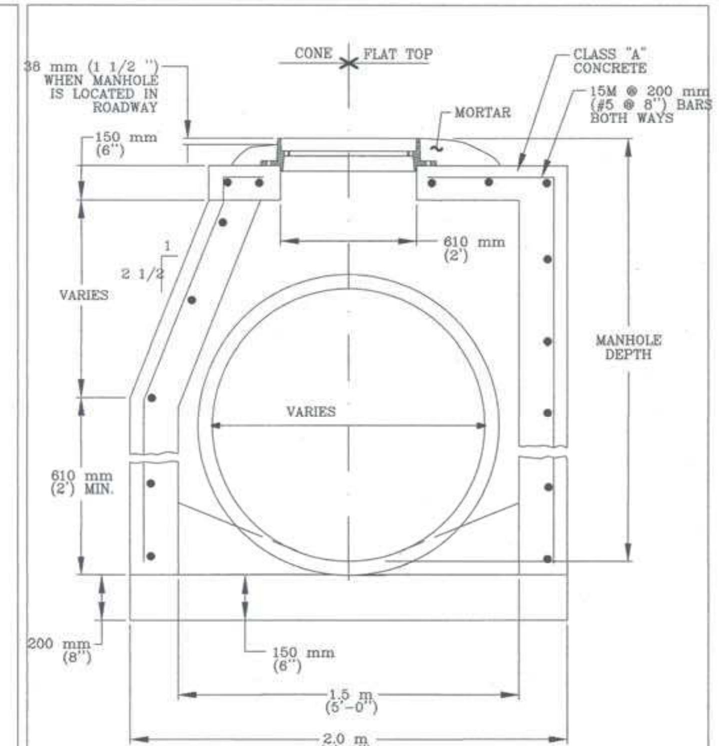
MINIMUM MANHOLE DIA.	MINIMUM PIPE SIZE
1.2 m (4')	450 TO 600 mm (18 TO 24")
1.5 m (5')	750 mm TO 1.1 m (30 TO 42")
1.8 m (6')	1.2 TO 1.4 m (48 TO 54")
2.1 m (7')	1.5 TO 1.7 m (60 TO 66")

SIZE TO BE USED IS DEPENDENT ON DRAIN ANGLES.

CITY OF AUSTIN DEPARTMENT OF WATERSHED PROTECTION AND DEVELOPMENT REVIEW	PRE-CAST CONCRETE STORM DRAIN MANHOLE	
RECORD COPY SIGNED BY GEORGE E. OSWALD 2/14/02 ADOPTED	THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD.	STANDARD NO. 506S-3 1 OF 2



CITY OF AUSTIN DEPARTMENT OF WATERSHED PROTECTION AND DEVELOPMENT REVIEW	PRE-CAST CONCRETE STORM DRAIN MANHOLE	
RECORD COPY SIGNED BY GEORGE E. OSWALD 2/14/02 ADOPTED	THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD.	STANDARD NO. 506S-3 2 OF 2



CITY OF AUSTIN DEPARTMENT OF WATERSHED PROTECTION AND DEVELOPMENT REVIEW	STORM DRAIN MANHOLE DETAIL	
RECORD COPY SIGNED BY GEORGE E. OSWALD 2/14/02 ADOPTED	THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD.	STANDARD NO. 506S-11

SITE PLAN RELEASE

SITE PLAN APPROVAL SHEET 24 OF 38

FILE NUMBER SP-2014-0349C APPLICATION DATE 09/04/2014

APPROVED BY COMMISSION ______ UNDER SECTION ______ OF

CHAPTER ______ OF THE CITY OF AUSTIN CODE.

EXPIRATION DATE (25-5-112, LDC) ______ CASE MANAGER CHRISTINE BARTON-HOLMES

PROJECT EXPIRATION DATE ORD. #970905-A) ______ DWPZ ______ DDZ ______

Director, Watershed Protection and Development Review

RELEASED FOR GENERAL COMPLIANCE: ______ ZONING ______

Rev. 1 ______ Correction 1 ______
Rev. 2 ______ Correction 2 ______
Rev. 3 ______ Correction 3 ______

Final plat must be recorded by the Project Expiration Date, if applicable. Subsequent Site Plans Plans which do not comply with the Code current at the time of filing, and all required Building Permits and/or a notice of construction (if a building permit is not required), must also be approved prior to the Project Expiration Date.

REVISIONS:

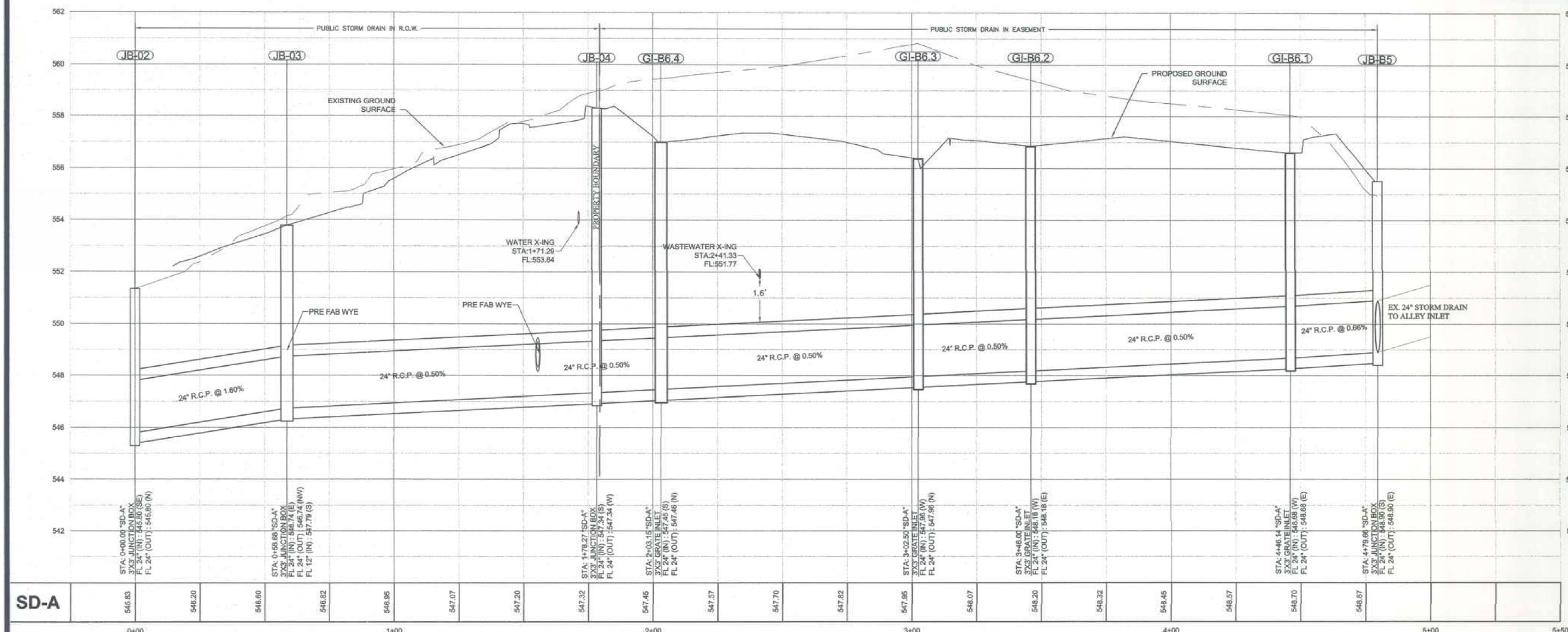
STATE OF TEXAS
JAMES R. McCANN
92595
LICENSED
PROFESSIONAL ENGINEER

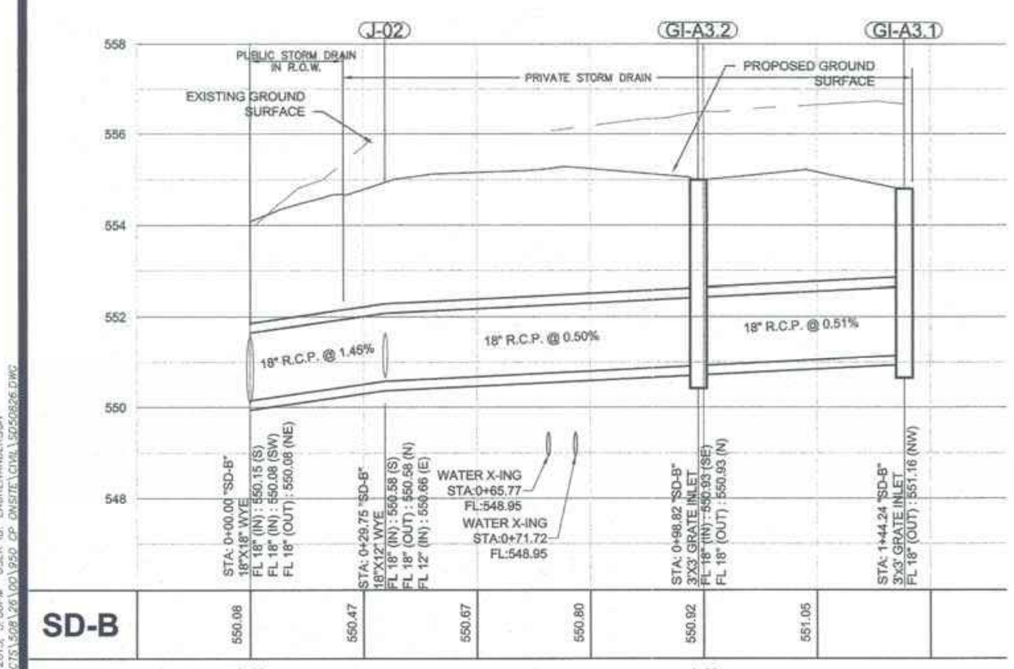
PAPE-DAWSON ENGINEERS

7800 SHOAL CREEK BLVD SUITE 220 WEST | AUSTIN, TEXAS 78757 | PHONE: 512.454.8711 FAX: 512.459.8867
TEXAS BOARD OF PROFESSIONAL ENGINEERS, FIRM REGISTRATION # 470

LIVE OAK CONDOMINIUMS
211 WEST JOHANNA STREET AUSTIN, TEXAS 78704
STORM DRAIN DETAILS (1 OF 2)

JOB NO. 50826-00
DATE March 2015
DESIGNER HJG
CHECKED ______ DRAWN HJG
SHEET 24 OF 38





SCALE: 1"= 20'

20 0 20 40

SITE PLAN RELEASE

SITE PLAN APPROVAL SHEET 23 OF 38

FILE NUMBER SP-2014-0349C APPLICATION DATE 09/04/2014

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Director, Watershed Protection and Development Review

RELEASED FOR GENERAL COMPLIANCE: ZONING

Rev. 1 ______ Correction 1 ______

Rev. 2 ______ Correction 2 ______

Rev. 3 ______ Correction 3 ______

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03/11/15

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TEXAS BOARD OF PROFESSIONAL ENGINEERS, FIRM REGISTRATION # 470

LIVE OAK CONDOMINIUMS
211 WEST JOHANNA STREET
AUSTIN, TEXAS 78704

STORM LINE PROFILE

JOB NO. 50826-00

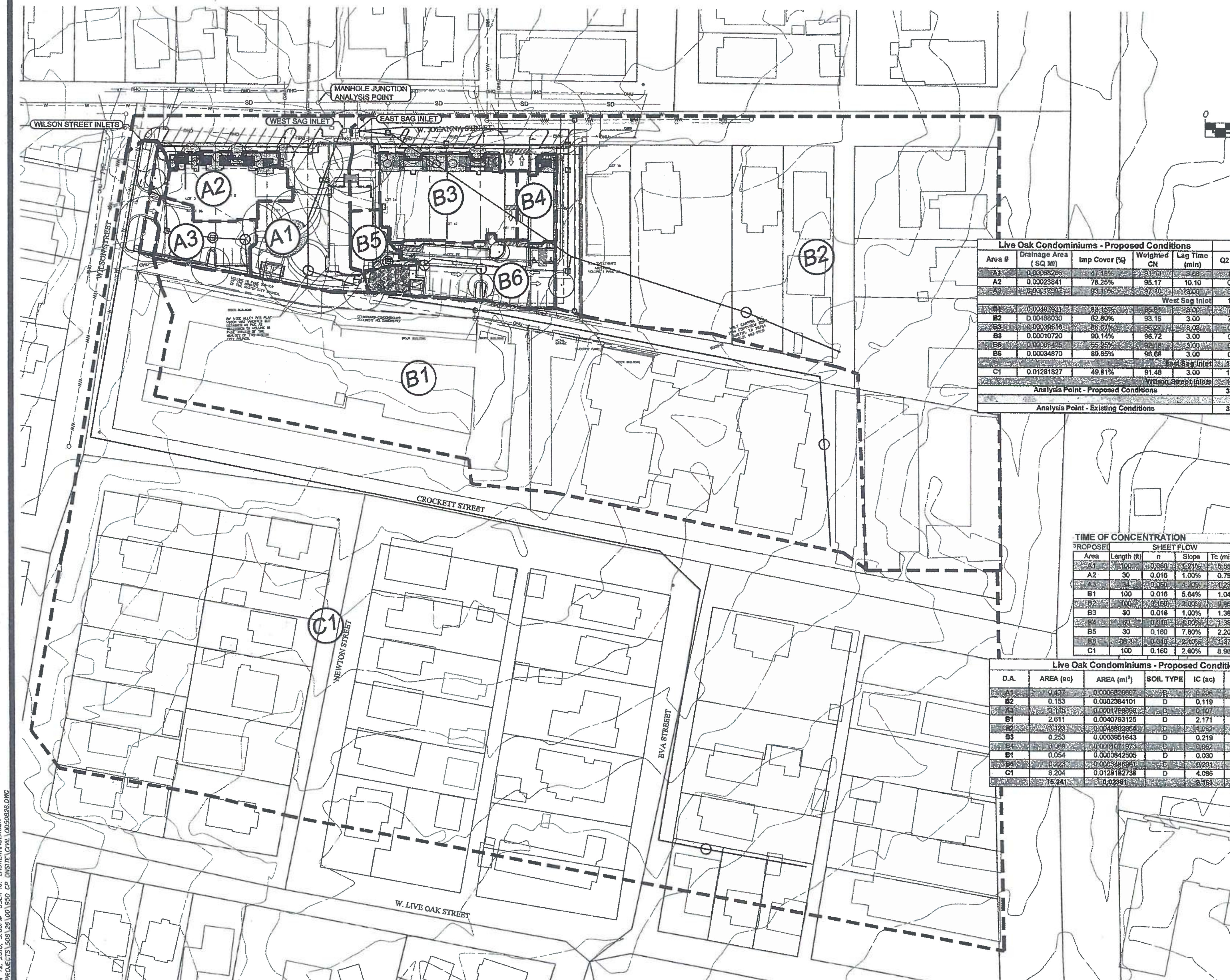
DATE March 2015

DESIGNER HJG

CHECKED ______ DRAWN HJG

SHEET 23 OF 38

DATE: Mar 12, 2015, 5:06PM USER ID: LAURENANDERSON
File: H:\PROJECTS\508\26\00\950 CP ONSITE\CIVIL\5082600.DWG



NOTES

1. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES BEFDRE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE ASSOCIATED BY THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.
2. POSITIVE DRAINAGE SHALL BE MAINTAINED ON ALL SURFACE AREAS WITHIN THE SCOPE OF THIS PROJECT.
3. CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER OF ANY QUESTIONS THAT MAY ARISE CONCERNING THE INTENT, PLACEMENT, OR LIMITS OF DIMENSIONS OR GRADES NECESSARY FROM CONSTRUCTION DF THIS PROJECT.
4. CONTRACTOR SHALL VERIFY THE EXACT LOCATION OF UNDERGROUND UTILITIES AND DRAINAGE STRUCTURES WHETHER SHOWN ON THE PLANS OR NDT.
5. ALL R.C.P. SHALL BE MINIMUM CLASS III.

LEGEND

- WATER LINE
- WASTEWATER LINE
- STORM DRAIN LINE
- CURB INLET
- GRATE INLET
- GATE VALVE
- FIRE HYDRANT
- EXISTING GATE VALVE
- EXISTING FIRE HYDRANT
- EXISTING WATER LINE
- EXISTING WASTEWATER LINE
- EXISTING STORM DRAIN LINE
- EXISTING CONTOUR LINE - 5'
- EXISTING CONTOUR LINE - 1'
- PROPOSED CONTOUR LINE - 5'
- PROPOSED CONTOUR LINE - 1'
- #01 Q_{25}: Q25 Q_{100}: Q100 — INLET # Q=25/100 YEAR
- HEADWALL

Live Oak Condominiums - Proposed Conditions					Peak Flows			
Area #	Drainage Area (SQ MI)	Imp Cover (%)	Weighted CN	Lag Time (min)	Q2 (cfs)	Q10 (cfs)	Q25 (cfs)	Q100 (cfs)
A1	0.00068266	47.18%	91.13	3.58	1.1	2.2	2.8	3.9
A2	0.00023841	78.25%	95.17	10.10	0.4	0.8	1.0	1.4
A3	0.00017987	93.10%	97.10	3.00	0.4	0.6	0.8	1.1
				West Sag Inlet	1.9	3.7	4.7	6.3
B1	0.00407931	83.15%	95.81	3.00	7.8	14.2	17.5	24.0
B2	D.00488030	62.80%	93.16	3.00	7.5	14.2	18.0	24.4
B3	0.00039516	86.67%	96.27	8.03	0.8	1.4	1.7	2.3
B3	0.00010720	90.14%	96.72	3.00	0.6	D.4	0.5	0.6
B5	0.00008425	55.25%	92.18	3.00	0.1	0.3	0.4	0.5
B6	0.00034870	89.85%	96.68	3.00	0.7	1.2	1.9	2.1
				East Sag Inlet	16.1	30.0	37.9	51.0
C1	0.01281827	49.81%	91.48	3.00	17.5	34.2	43.7	59.4
				Wilson Street Inlets	17.5	34.2	43.7	59.4
Analysis Point - Proposed Conditions					33.5	64.1	81.6	110.5
Analysis Point - Existing Conditions					33.5	64.5	82.1	111.3

TIME OF CONCENTRATION

PROPOSED	SHEET FLOW				SHALLOW CONCENTRATED FLOW				CHANNEL FLOW			TIME OF CONC	LAG TIME
Area	Length (ft)	n	Slope	Tc (min.)	Length (ft)	(Y or N)	Slope	Tc (min.)	V (FT/S)	Length (ft)	Tc (min.)		
A1	100	0.060	1.21%	5.55	93.12	N	5.52%	0.41				5.96	3.58
A2	30	0.016	1.00%	0.79								5.00	3.00
A3	34	0.050	4.20%	1.23	31.91	Y	2.32%	0.17	4.20	78.82	0.31	5.00	3.00
B1	100	0.016	5.64%	1.04	498.47	Y	2.70%	2.49				5.00	3.00
B2	100	0.160	2.00%	9.95	180.6	N	5.00%	0.83	5.00	779.85	2.60	13.38	8.03
B3	30	0.016	1.00%	1.38								5.00	3.00
B4	30	0.016	1.00%	1.38								5.00	3.00
B5	30	0.160	7.80%	2.20					5.00	21.80	0.07	5.00	3.00
B6	86.3	0.016	2.10%	1.47					5.00	183.20	0.44	5.00	3.00
C1	100	0.160	2.60%	8.96	1215.72	Y	1.60%	7.88				16.84	10.10

Live Oak Condominiums - Proposed Conditions							CURVE NUMBER					
D.A.	AREA (ac)	AREA (mi²)	SOIL TYPE	IC (ac)	PC (ac)	%IC	perv CN		Imp CN		Weighted CN	Initial Abs
A1	0.437	0.0006826607	D	0.206	0.23	47.18%	85	19.62	98	20.20	91.13	0.19
B2	0.153	0.0002384101	D	0.119	0.03	78.25%	85	2.82	98	11.70	95.17	0.10
A3	0.115	0.0001799869	D	0.107	0.01	93.10%	85	0.68	98	10.51	97.10	0.06
B1	2.611	0.0040793125	D	2.171	0.44	83.15%	85	37.40	98	212.73	95.81	0.09
B2	3.123	0.0048802954	D	1.962	1.16	62.80%	85	98.75	98	192.24	93.16	0.15
B3	0.253	0.0003951643	D	0.219	0.03	86.67%	85	2.87	98	21.48	96.27	0.08
B4	0.069	0.0001071673	D	0.062	0.01	90.14%	85	0.58	98	6.06	96.72	0.07
B1	0.054	0.0000842505	D	0.030	0.02	55.25%	85	2.05	96	2.92	92.18	0.17
B6	0.223	0.0003486961	D	0.201	0.02	89.85%	85	1.93	98	19.65	96.68	0.07
C1	8.204	0.0128182738	D	4.086	4.12	49.81%	85	349.97	98	400.47	91.48	0.19
	15.241	0.02381		9.163	6.078	76.26%						

SITE PLAN RELEASE

SITE PLAN APPROVAL SHEET 21 OF 38

FILE NUMBER SP-2014-0349C APPLICATION DATE 09/04/2014

APPROVED BY COMMISSION ______ UNDER SECTION ______ OF

CHAPTER ______ OF THE CITY OF AUSTIN CODE.

EXPIRATION DATE (25-5-112, LDC) ______ CASE MANAGER CHRISTINE BARTON-HOLMES

PROJECT EXPIRATION DATE ORD. #970905-A) ______ DWPZ ______ DDZ ______

Director, Watershed Protection and Development Review

RELEASED FOR GENERAL COMPLIANCE: ZONING

Rev. 1 ______ Correction 1 ______
Rev. 2 ______ Correction 2 ______
Rev. 3 ______ Correction 3 ______

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REVISIONS:

STATE OF TEXAS
JAMES R. McCANN
92595
LICENSED
PROFESSIONAL ENGINEER
03/11/15

PAPE-DAWSON ENGINEERS
7800 SHOAL CREEK BLVD SUITE 220 WEST | AUSTIN, TEXAS 78757 | PHONE: 512.454.8711 FAX: 512.459.8867
TEXAS BOARD OF PROFESSIONAL ENGINEERS, FIRM REGISTRATION # 470

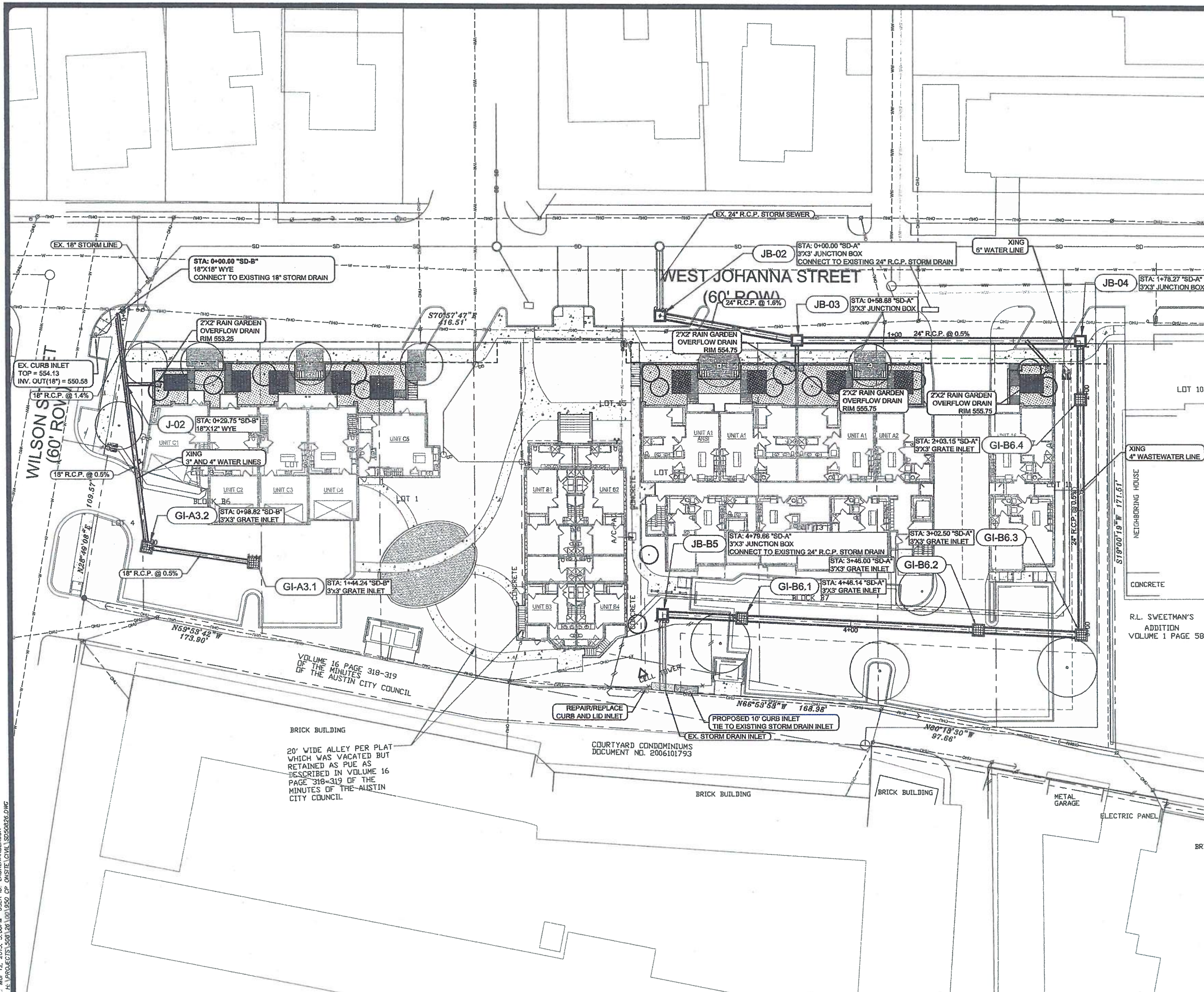
LIVE OAK CONDOMINIUMS
211 WEST JOHANNA STREET
AUSTIN, TEXAS 78704

PROPOSED DRAINAGE PLAN

JOB NO. 50826-00
DATE March 2015
DESIGNER HJG
CHECKED ______ DRAWN HJG
SHEET 21 OF 38

DATE: Mar 12, 2015, 5:06PM USER ID: LAURENANDERSON
File: H:\PROJECTS\508\26\00\950 CP ONSITE\CIVIL\CO050826.DWG

SP-2014-0349C



DATE: Mar 12, 2015, 5:06PM USER ID: LAURENANDERSON
File: H:\PROJECTS\508\26\00\950 CP ONSITE\CIVIL\SD50826.DWG

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LEGEND

- WATER LINE
- WASTEWATER LINE
- STORM DRAIN LINE
- CURB INLET
- GRATE INLET
- GATE VALVE
- FIRE HYDRANT
- EXISTING GATE VALVE
- EXISTING FIRE HYDRANT
- EXISTING WATER LINE
- EXISTING WASTEWATER LINE
- EXISTING STORM DRAIN LINE

REVISIONS:

STATE OF TEXAS
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LIVE OAK CONDOMINIUMS
211 WEST JOHANNA STREET
AUSTIN, TEXAS 78704
STORM DRAIN PLAN

SITE PLAN RELEASE

SITE PLAN APPROVAL SHEET 22 OF 38

FILE NUMBER SP-2014-0349C APPLICATION DATE 09/04/2014

APPROVED BY COMMISSION ______ UNDER SECTION ______ OF

CHAPTER ______ OF THE CITY OF AUSTIN CODE.

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Director, Watershed Protection and Development Review

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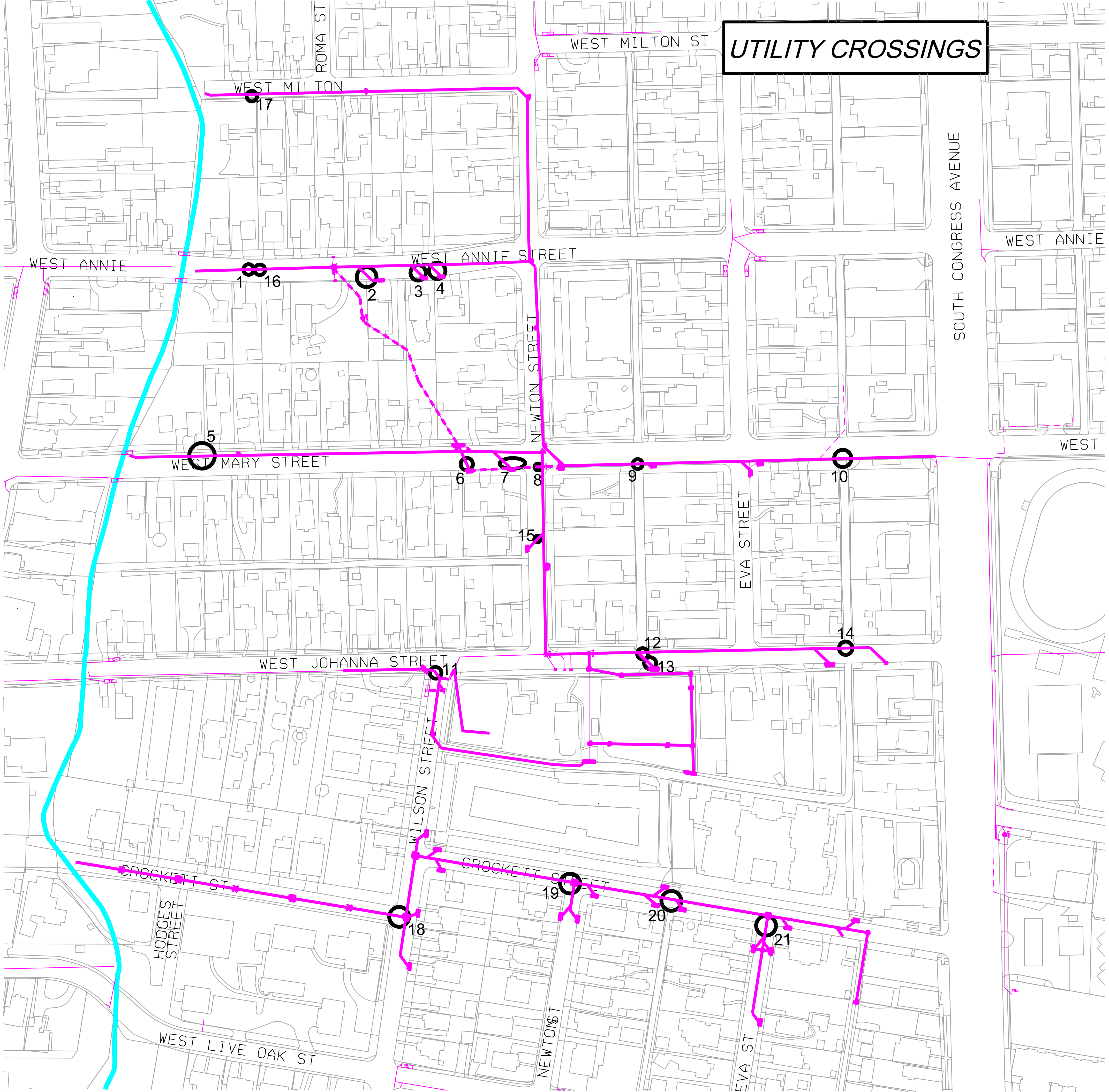
JOB NO. 50826-00
DATE March 2015
DESIGNER HJG
CHECKED ______ DRAWN HJG
SHEET 22 OF 38

Exhibit K.7

Analysis of Existing Utility Crossings


UTILITY CROSSINGS
WEST MILTON ST
WEST MILTON
ROMA ST
WEST ANNIE
WEST ANNIE STREET
SOUTH CONGRESS AVENUE
NEWTON STREET
WEST MARY STREET
WEST
EVA STREET
WEST JOHANNA STREET
WILSON STREET
CROCKETT ST
CROCKETT STREET
HODGES STREET
NEWTON ST
EVA ST
WEST LIVE OAK ST
1
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3
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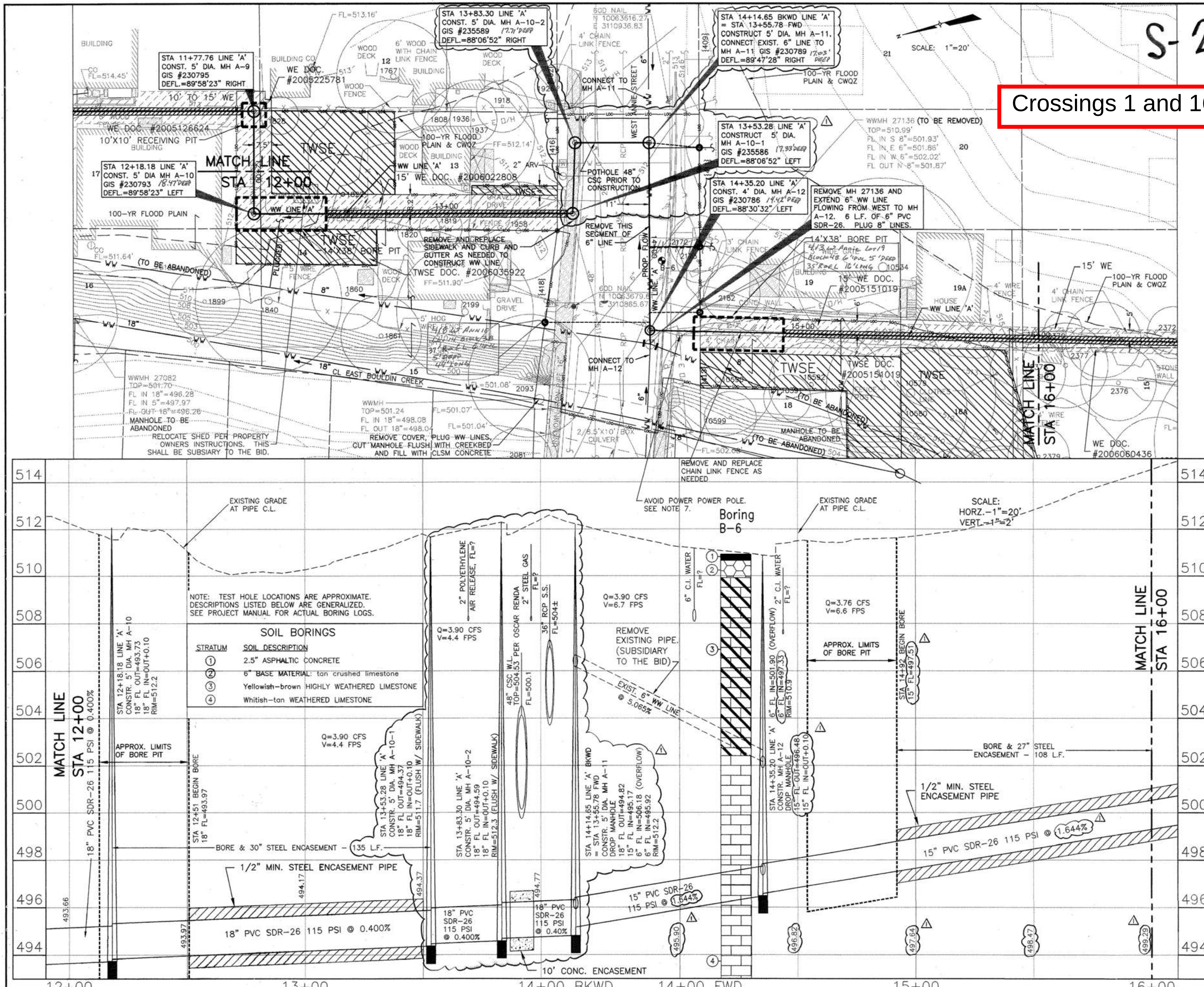
21

Wastewater Utility Crossings with Proposed Storm Drain Lines

Conflict ID	WWL Size	Crossing Description	Elev Soffit	Elev Invert	Level of Confidence in Record Drawing Info	Notes
Crossing 1	15"	Prop SS crosses WWL	496.32	494.82	high	deep ACWP line
Crossing 2	6"	Prop SS crosses WWL	520.0	520.5	low	older line
Crossing 3	6"	Prop SS crosses WWL	522.75	522.25	very low	older line; elevations on drawing not consistent with Lidar; line on profile approx 5' below ground; use ground elev - 5'
Crossing 4	6"	Prop SS crosses WWL	524.75	524.25	very low	older line; elevations on drawing not consistent with Lidar; line on profile approx 5' below ground; use ground elev - 5'
Crossing 5		WPD's Mary Street Emergency Relief Line crosses WWL				Resolved as part of Mary Street Emergency Relief Line design
Crossing 6	8"	Prop SS crosses WWL	528.5	527.5	high	ACWP line
Crossing 7	6"	Prop SS crosses WWL	529.5	528.25	high	ACWP line
Crossing 8	6"	Prop SS crosses WWL	536.5	536	low	older line connecting to ACWP MH with drop MH
Crossing 9	8"	Prop SS crosses WWL	?	543	very low	old line (1930s), record drawing is missing profile info; invert of exist 24" line at approx 543, hold invert of proposed 42" line at same elevation
Crossing 10	6"	Prop SS crosses WWL	?	555.8	very low	old line (1940s), record drawing is missing profile info, but notes 5' deep manhole; assume FL of WWL is at bottom of manhole = approx 555.8
Crossing 11	8"	Prop SS crosses WWL	544.5	542.5	medium	WWL installed as part of Johanna SS improvements in 1980s; exact location of conflict off profile
Crossing 12	8"	Prop SS crosses WWL	550.2	549.2	medium	ACWP line
Crossing 13	8"	Prop SS crosses WWL	551.62	550.62	very low	aperture cards unavailable for Community Development District 18 Phase 2 (line on Johanna from Eva flowing west); GIS notes that manhole is 5' deep (layer: AUSTIN.WWManhole Object ID 348709; GIS also notes subproject ID 4926.099); assume WWL FL = ground elev - 5' = 550.62
Crossing 14	6"	Prop SS crosses WWL	560.12	559.62	very low	record drawing is missing profile information, but notes manhole is 5' deep; assume FL = ground elev - 5'
Crossing 15	6"	Prop SS crosses WWL	538.75	538.25	low	older line
Crossing 16	8"?	Prop SS crosses unknown utility line	507.0	505.6	low	owner of line unknown; ACWP plans show WW line crossing, but it's not on AWU GIS; **suspect it's a WW lateral;** elevation estimated from video inspection report and video
Crossing 17	18"	Prop SS crosses WWL	493.98	492.48	medium	ACWP line
Crossing 18	6"	Prop SS crosses WWL	552.0	551.5	low	older line
Crossing 19	10"	Prop SS crosses WWL	?	?	very low	older line, profile is missing information
Crossing 20	6"	Prop SS crosses WWL	?	?	very low	older line, profile is missing information
Crossing 21	6"	Prop SS crosses WWL	?	?	very low	older line, profile is missing information

S-2007-0023

Crossings 1 and 16



SCALE

LEGEND

- PROP. OPEN CUT WW LINE
- PROP. MANHOLE
- PROP. WW SERVICE
- PROP. CLEANOUT
- PROP. BORED WW LINE
- PROP. EASEMENT
- PROP. TEMP. EASEMENT
- CONSTRUCTION LIMITS
- BORE OR RECEIVING PIT

SEE SHEET 3 FOR SURVEY BASE LEGEND

SURVEY INFORMATION PROVIDED BY MARTINEZ, WRIGHT, & MENDEZ, INC., AUSTIN, TEXAS

NOTES:

1. BORE PIT SIZE AND LOCATION ARE APPROXIMATE. CONTRACTOR MAY EXCHANGE BORE PITS FOR RECEIVING PITS.
2. MANHOLES NOT IN PAVEMENT REQUIRE BOLTED COVERS PER C.O.A. STD. 503S-3W.
3. MANHOLE RINGS SHALL BE SET 6" ABOVE EXISTING NATURAL GROUND OR FLUSH WITH EXISTING PAVEMENT.
4. ENCASEMENT DIAMETER SHOWN IS MINIMUM. THE CONTRACTOR SHALL SIZE CASING TO ASSURE HORIZONTAL ALIGNMENT AND GRADE AS SHOWN FOR THE CARRIER PIPE. ANY INCREASES IN CASING SIZE REQUIRED TO MEET HORIZONTAL ALIGNMENT AND GRADE SHALL BE AT NO COST TO OWNER.
5. SOILS BORING LOCATIONS ARE APPROXIMATE. SEE SHEET 3 FOR KEY TO SOILS SYMBOLS.
6. REMOVAL AND/OR ABANDONMENT OF EXISTING PIPE WILL NOT BE PAID FOR DIRECTLY BUT SHALL BE SUBSIDIARY TO THE BID.
7. MAINTAIN MINIMUM 5' CLEARANCE FROM EDGE OF POWER POLE TO BORE PIT.

EASEMENT ABBREVIATIONS

AE = ACCESS EASEMENT
TIAEE = TEMPORARY INGRESS AND EGRESS EASEMENT
TSAAMSS = TEMPORARY STAGING AREA AND MATERIAL STORAGE SITE
TWSE = TEMPORARY WORKING SPACE EASEMENT
WE = WASTEWATER EASEMENT

APPROVED: STEVEN VARGAS, PE AWU 01-23-2008

LOT NO.	OWNER
13, 14	GEORGE ROBERT McLAUGHLIN & AUDRA WERT DOC.#2004020582 O.P.R.T.C.T. TCAD#0400000321
16, 17	JOVITA'S INC. VOL.13146,PG.2023 R.P.R.T.C.T. TCAD#0400000301
18, 19, 20	PETRA T VILLEGAS VOL.10520,PG.853 R.P.R.T.C.T. TCAD#0402010225 (LOTS 18&19) TCAD#0402010203 (LOT 20)
18A, 19A	CYNTHIA & RALPH BRETTSCHNEIDER DOC. #2005022593 O.P.R.T.C.T. TCAD#0402010226

REV NO.	BY	DATE	REVISION DESCRIPTION
1		11/21/07	ADD MH A-10-1, A-10-2, RELOCATE MH A-11

G. A. HARUTUNIAN 11/21/07

KURKJIAN ENGINEERING Corporation, engineering & environmental consultants, 111 W. ANDERSON LANE SUITE D-202 AUSTIN, TEXAS 78752 PH. (512) 371-3535 FAX (512) 371-7333

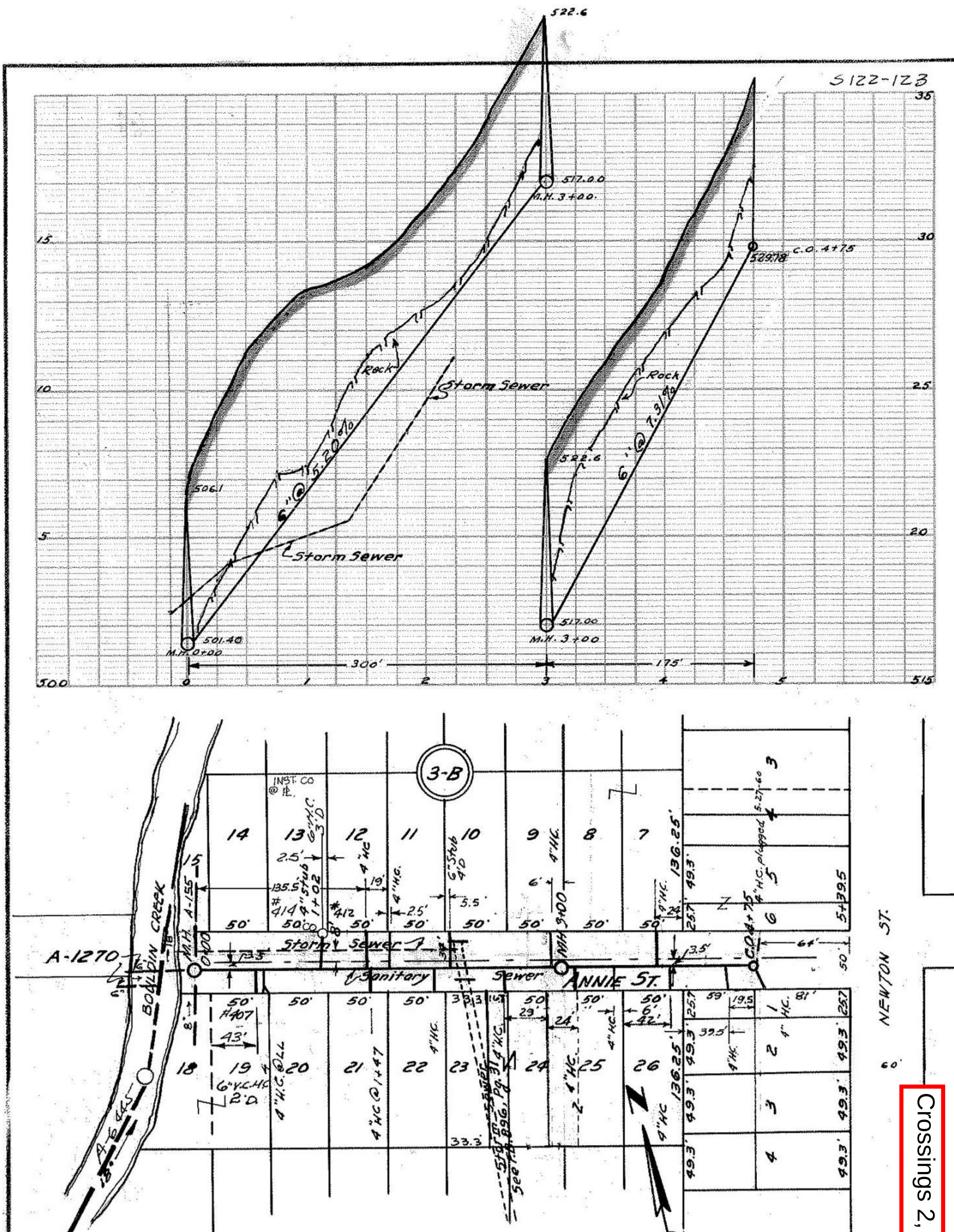
AUSTIN CLEAN WATER PROGRAM
GOVALLE 1 - NEWTON STREET AREA WASTEWATER IMPROVEMENTS
WASTEWATER LINE 'A'
PLAN & PROFILE FROM STA 12+00 TO 16+00

acwp

NOTES	NAME	DATE
SURVEY BY	MWM	11/04
DRAWN BY	MCM	11/04
CHECKED BY	FCH	11/04
DESIGNED BY	MM/GH	11/04
REVIEWED BY	GAH	11/04
SCALE: H.)1"=20' V.)1"=2'		
CADD REF. NO.:		
CADD DIR.:		

SHEET NUMBER 15 OF 38

123



Crossings 2, 3 and 4

SEWER LOCATIONS

AUSTIN, TEXAS

M.R. 8-19
"JULY 1968"
6-12-64 800-471-S321

BUILT BY DOZIER CON. CO. DATE

FIELD BOOK 825A P. 13 / 896 P. 32 DATE 5-3-'30 / 6-8-36 LOCATION ANNIE ST

DAILY REPORT NO. DATE 12-68 FROM BOULDIN CREEK

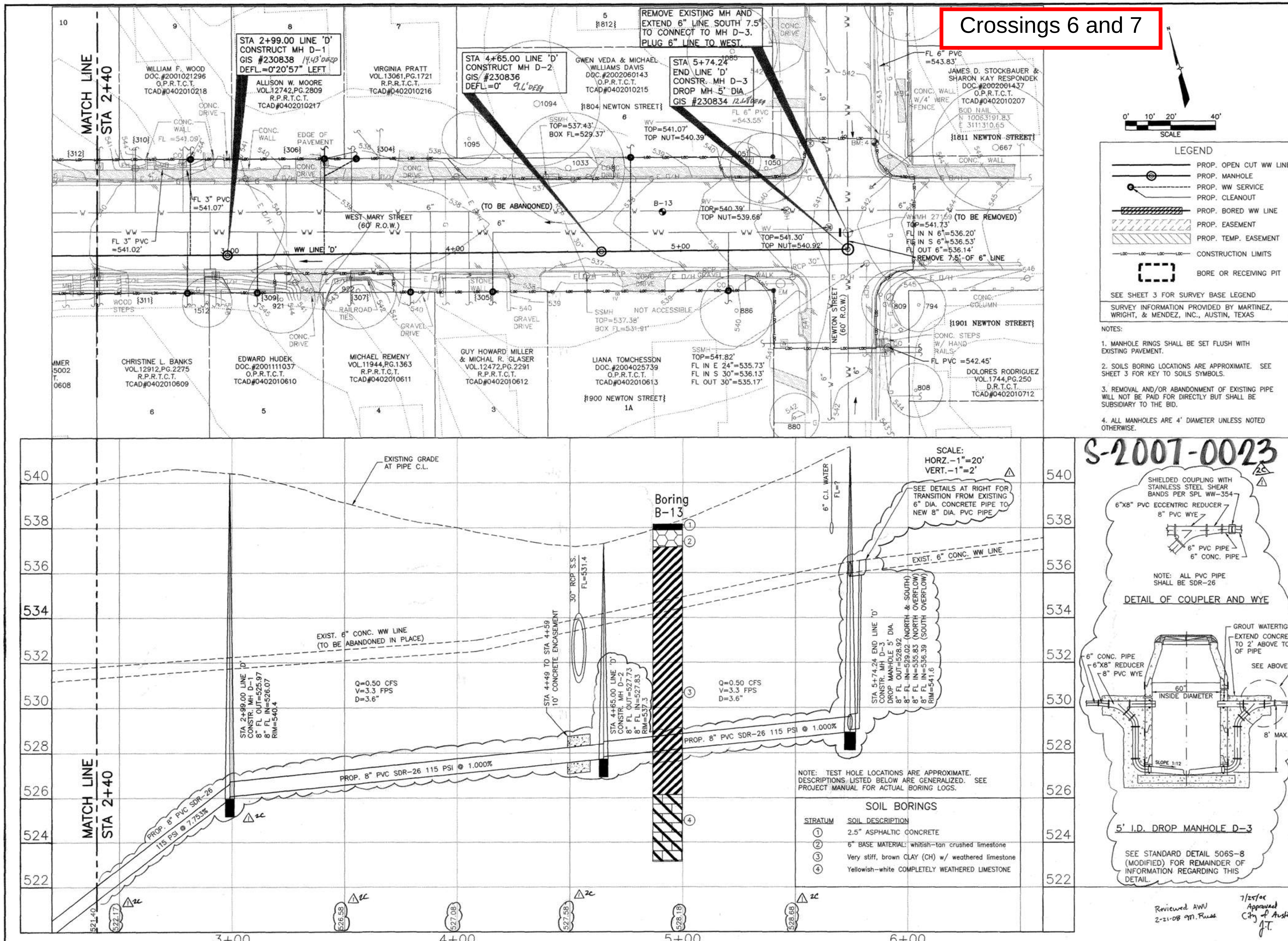
DRAWN BY J.T. WILLIAMS DATE 7-12-30 TO NEWTON ST.

CHECKED BY W.K. KINGSBURY DATE 4-72 JOB NO. G-33 SHEET NO. 208

C. F. PEASE CO. CHICAGO

A

Crossings 6 and 7



REV. NO.	BY	DATE	REVISION DESCRIPTION
1	GAH	1/24/08	LOWER LINE 'D', CHANGE SLOPE OF PIPE CHANGE MH D-3 TO 5' DIA DROP MH

G. A. NARUTUNIAN 35394 REGISTERED PROFESSIONAL ENGINEER, STATE OF TEXAS 2/13/08

KURKJIAN ENGINEERING engineering & environmental consultants
111 W. ANDERSON LANE SUITE D-202 AUSTIN, TEXAS 78752 PH. (512) 371-3535 FAX: (512) 371-7333
• Civil • Environmental • Structural • Water Treatment • Wastewater Treatment • Solid Waste

AUSTIN CLEAN WATER PROGRAM
GOVALLE 1 -NEWTON STREET AREA WASTEWATER IMPROVEMENTS

WASTEWATER LINE 'D'
PLAN & PROFILE FROM STA 2+40 TO END

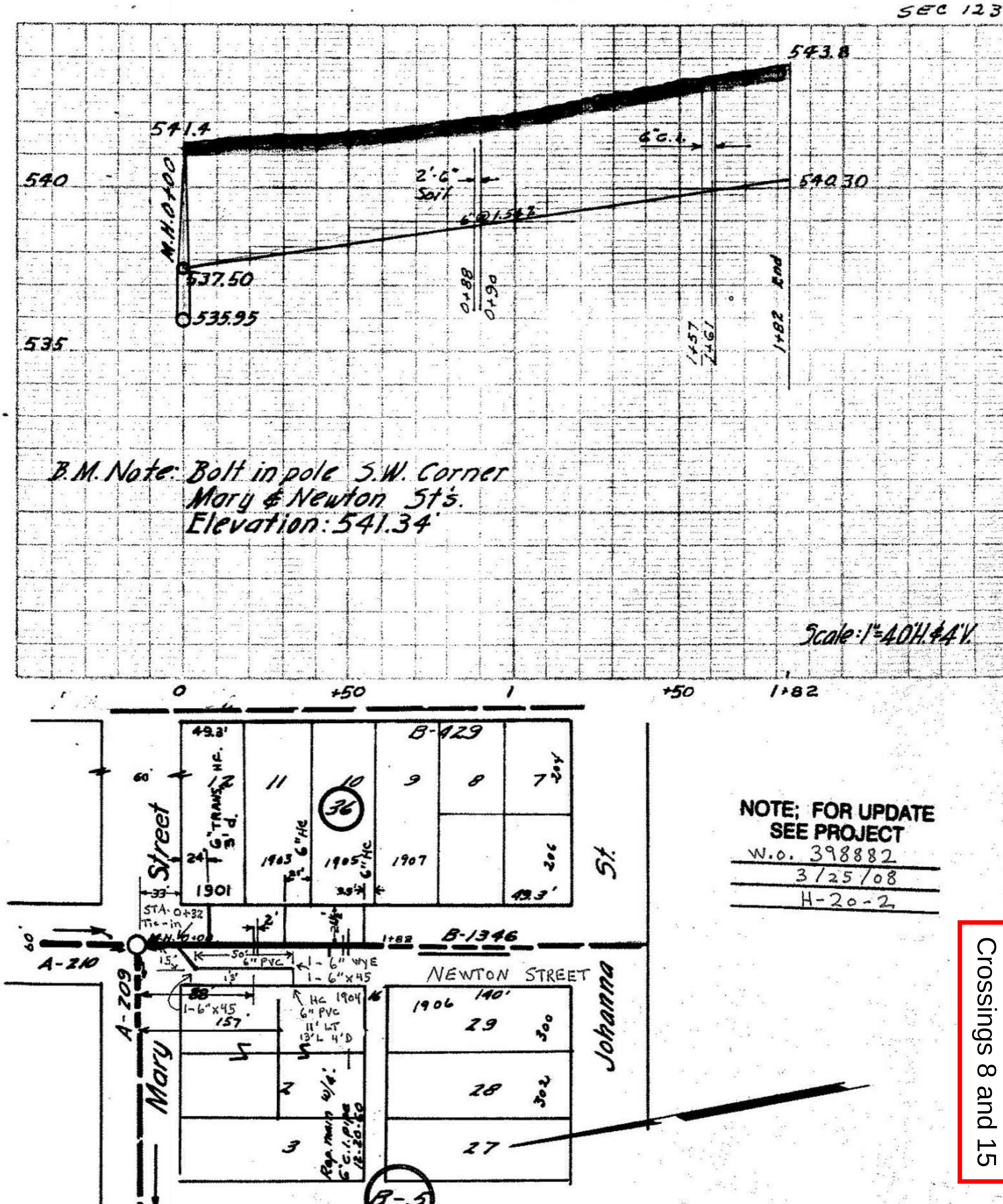
acwp

NOTES	NAME	DATE
SURVEY BY	MWM	11/04
DRAWN BY	MCM	11/04
CHECKED BY	FCH	11/04
DESIGNED BY	MM/GH	11/04
REVIEWED BY	GAH	11/04
SCALE: H.)1"=20' V.)1"=2'		
CADD REF. NO.:		
CADD DIR.: SP-2007-0310ACWP		
SHEET NUMBER	22 OF 38	

95601

Crossings 8 and 15

SEC 123



NOTE; FOR UPDATE
SEE PROJECT
W.O. 398882
3/25/08
H-20-2

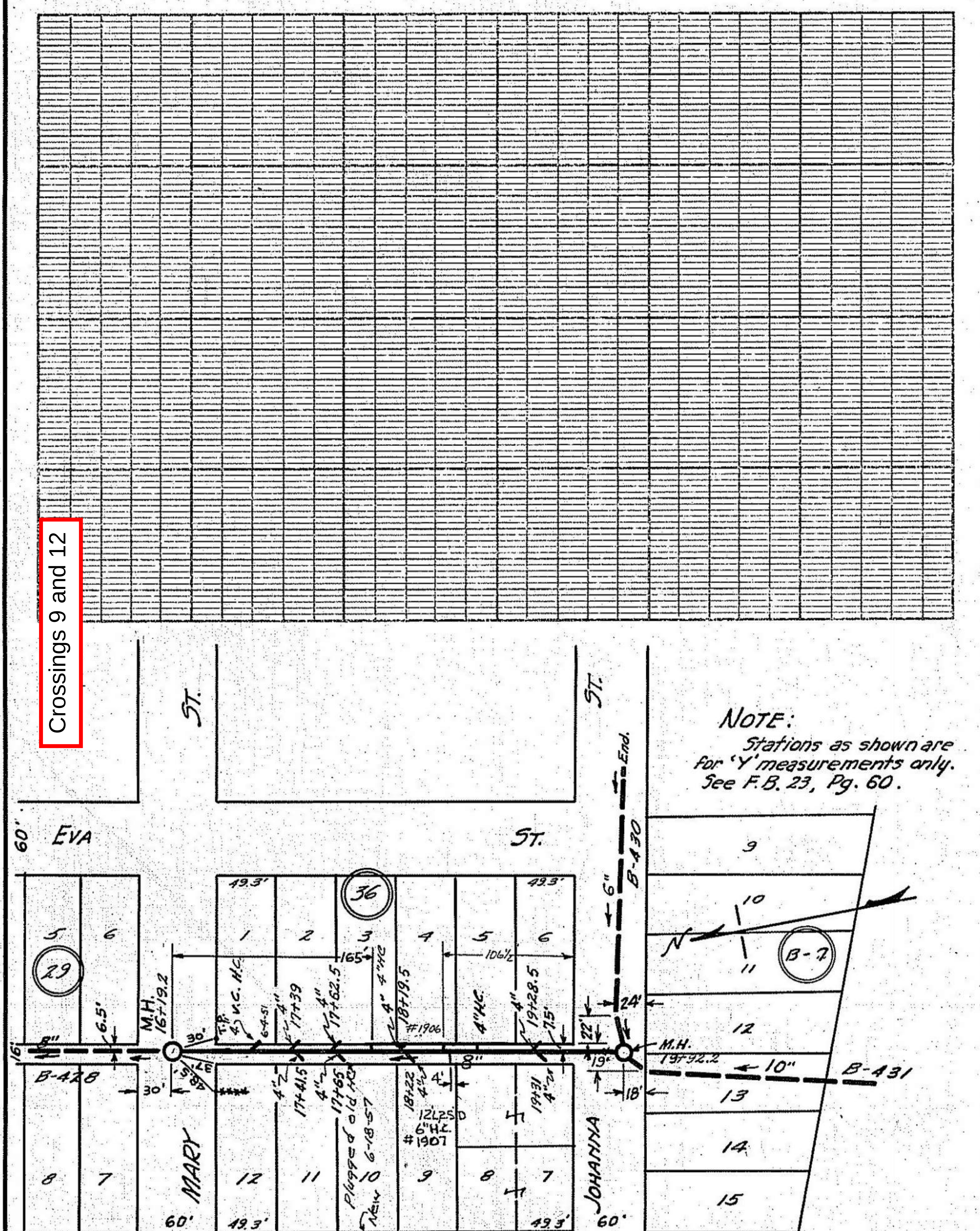
Project Summary: Tied into existing 6" V.C. WW main at STA. 0+32 and installed ± 79' of 6" PVC at ± .68% for H.C. at 1904 Newton St.

SEWER LOCATIONS
AUSTIN, TEXAS

W.O. 83132300-802-251 AUG.'70
W.O. 83132100-802-251 AUG.'70

BUILT BY CITY FORCES	DATE DEC. 1930	
FIELD BOOK 830 P. 37	DATE DEC. 18, 1930	LOCATION NEWTON STREET
DAILY REPORT NO.	DATE	FROM MARY STREET
DRAWN BY BARRON	DATE FEB. 25, 1931	TO SOUTH TO ALLEY
CHECKED BY Beavens	DATE APR. 3, 1931.	JOB NO. T. 112 SHEET NO. B 287

NOTE: FOR UPDATE
SEE PROJECT
2007-0018
INSTALL 8" PVC



SEWER LOCATIONS

AUSTIN, TEXAS W.O. 83132100-802-251 AUG. '70
W.O. 83132300-802-251 DATE: AUG. '70
MR-2-79
6" NEWTON ST.

RELAY 6' OF 8" CI 8-70 WO# 83474400

BUILT BY OLD SYSTEM DATE ____

FIELD BOOK 843 Pg. 7 DATE 1932

DAILY REPORT NO. 23 Pg. 60 DATE 10-70

DRAWN BY VWP-WNO-IDW DATE 8-10-32

CHECKED BY GIESEN DATE 8-30-32

LOCATION NEWTON ST. ALLEY

FROM MARY ST.

TO JOHANNA ST.

JOB NO. ____ SHEET NO. 429

CITY OF AUSTIN, TEXAS
AUSTIN WATER UTILITY

S-2007-0018
H-20-2 & 3
J-20-1 & 4
J-21-4

ACWP GOVALLE 2: TRAVIS HEIGHTS WASTEWATER IMPROVEMENTS CONSTRUCTION DOCUMENTS
F.D.U. NO. 4570-2307-4563
SUB PROJECT ID NO. 4926.099

WASTEWATER ID NO. 2007-0018

CONTRACT NO.: S030007

MAYOR
WILL WYNN

CITY COUNCIL MEMBERS

BETTY DUNKERLEY, MAYOR PRO TEM
LEE LEFFINGWELL, PLACE 1
MIKE MARTINEZ, PLACE 2
JENNIFER KIM, PLACE 3
BETTY DUNKERLEY, PLACE 4
BREWSTER MCCRACKEN, PLACE 5
SHERYL COLE, PLACE 6

CITY MANAGER
TOBY HAMMETT FUTRELL

As-Built drawings reviewed by AWU Maps & Records staff.
[redacted] Acceptance: 1-7-10

Crossings 9 and 12

SHEET INDEX:

FOR EXPANDED SHEET LIST, SEE SHEET C3.

JOB # 2007-0018
BEGIN Dec 2007
COMPLETE May 2009
CONTRACTOR Haeselin Construction
FOREMAN
INSPECTOR Steven Casanova / Brett Clemens

MH manufacturer & coating:
- Hansen
- Spraywall

- Tracer Tape used for WW pipe

NOTES:

1. THIS PROJECT IS PERMITTED AS PART OF THE AUSTIN CLEAN WATER PROGRAM. SPECIAL ORDINANCES APPLY TO THIS PROGRAM. AN ADMINISTRATIVE VARIANCE FROM SECTION 25-8-361 IS REQUIRED AND IS ALLOWED UNDER THESE ORDINANCES. REFER TO CITY OF AUSTIN ORDINANCE 020B72-115, APPROVED JUNE 27, 2002, AND AMENDED BY ORDINANCE 030731-55, EFFECTIVE JULY 31, 2003.
2. CONTRACTOR SHALL NOTIFY THE WATER & WASTEWATER UTILITY DEPARTMENT A MINIMUM OF 24 HOURS PRIOR TO COMMENCING CONSTRUCTION OR CLEARING OPERATIONS.
3. CONTRACTOR SHALL CALL "ONE CALL" CENTER AT 1-800-344-8377 FOR UTILITY LOCATIONS AT LEAST 48 HOURS PRIOR TO COMMENCING ANY WORK IN CITY EASEMENTS OR STREET RIGHT-OF-WAYS.
4. THIS PROJECT IS LOCATED WITHIN THE EAST BOULDIN AND BLUNN CREEK WATERSHEDS, WHICH ARE CLASSIFIED AS URBAN WATERSHEDS, AND SHALL BE DEVELOPED, CONSTRUCTED, AND MAINTAINED IN ACCORDANCE WITH CHAPTER 25 OF THE CODE OF THE CITY OF AUSTIN.
5. NO PORTION OF [redacted] THIS PROJECT IS LOCATED WITHIN PARKLAND OR LAND USED FOR PARK PURPOSES. (IF SUCH LAND IS INCLUDED, DOCUMENTATION OF PARKS AND RECREATION DEPARTMENT APPROVAL IS REQUIRED AT THE TIME OF SUBMITTAL FOR WPORD APPROVAL.)
6. A PORTION OF SITE 1 OF THIS PROJECT IS LOCATED WITHIN THE 100-YEAR FLOODPLAIN PER CITY OF AUSTIN AND/OR FEDERAL EMERGENCY MANAGEMENT AGENCY FLOOD INSURANCE RATE MAP COMMUNITY PANEL 48453C0185E DATED JUNE 16, 1993.
7. THIS PROJECT IS NOT WITHIN THE EDWARDS AQUIFER RECHARGE ZONE AS DEFINED BY THE CITY OF AUSTIN. THIS PROJECT IS NOT WITHIN THE EDWARDS AQUIFER RECHARGE ZONE AS REGULATED BY THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ).
8. THERE ARE NO CRITICAL ENVIRONMENTAL FEATURES WITHIN 150-FEET OF ANY PORTION OF THE PROJECT. A FIELD INVESTIGATION HAS BEEN PERFORMED AS PART OF THIS PROJECT
9. THE STANDARD SHEETS INCLUDED IN THIS PLAN SET WERE PROVIDED BY THE CITY OF AUSTIN FOR USE ON AUSTIN CLEAN WATER PROGRAM PROJECTS ONLY. IF ANY MODIFICATIONS TO THE SHEETS WERE MADE, THEY ARE CLEARLY INDICATED ON THE SHEET ITSELF AND IN THE COVER SHEET.
10. ADDITIONAL TRENCH E/S CONTROL: TRIANGULAR SEDIMENT FILTER DIKE WILL BE INSTALLED ACROSS FULL WIDTH OF TRAFFIC CLOSURE AND DOWNSTREAM OF CONSTRUCTION AREA, PERPENDICULAR TO CURB. FILTER DIKE TO FOLLOW ACTIVE CONSTRUCTION. REMOVING AND RE-SETTING FILTER DIKE IS CONSIDERED SUBSIDIARY TO BARRICADES AND TRAFFIC HANDLING.
11. PROJECT SCHEDULE MUST BE APPROVED BY THE ENVIRONMENTAL INSPECTOR. INSTALLATION AND REMOVAL OF TEMPORARY AND PERMANENT EROSION/SEDIMENTATION CONTROLS MUST BE REFLECTED IN THE SCHEDULE, BY STATION NUMBER. THE ENVIRONMENTAL INSPECTOR MUST BE NOTIFIED A MINIMUM OF 48 HRS IN ADVANCE OF TRANSITION BETWEEN PHASES.
12. THE ENVIRONMENTAL INSPECTOR HAS THE AUTHORITY TO CHANGE OR MODIFY EROSION/SEDIMENTATION CONTROLS, PER SECTION 25-8-183 OF THE CITY OF AUSTIN'S LAND DEVELOPMENT CODE.
13. APPROPRIATE EASEMENTS/APPROVALS MUST BE SECURED AND DOCUMENTED FOR PROJECT AREAS LOCATED OUTSIDE OF RIGHT-OF-WAYS. NO WORK SHALL BE PERFORMED WITHIN THESE AREAS UNTIL ASSOCIATED RIGHT OF ENTRY HAS BEEN SECURED. ADDITIONALLY, THIS PROJECT WILL NOT BE CONSIDERED COMPLETE UNTIL ALL RECORDED EASEMENT DOCUMENT NUMBERS HAVE BEEN OBTAINED AND SHOWN ON THE PLANS.
14. CONTRACTOR SHALL STAKE ALL PROPOSED SERVICE CONNECTIONS LOCATED WITHIN THE CRITICAL ROOT ZONE OF TREES 8" IN CALIPER AND LARGER AT LEAST 21 CALENDAR DAYS PRIOR TO CONSTRUCTION OF SUCH SERVICES. STAKING SHALL CONSIST OF A LATH WITH NAIL AND PAINT MARKINGS. IN CASES WHERE A STAKE CANNOT BE PLACED WITHOUT DAMAGING PROPERTY, CONTRACTOR MAY USE PAINT ONLY. ONCE STAKING IS COMPLETED, IT IS THE CONTRACTOR'S RESPONSIBILITY TO INFORM THE CITY OF AUSTIN'S CONSTRUCTION INSPECTOR WITHIN 24 HOURS. THE CITY OF AUSTIN'S CONSTRUCTION INSPECTOR WILL THEN COORDINATE A FIELD REVIEW OF THE SERVICE LOCATIONS WITH THE ENVIRONMENTAL INSPECTOR AND PROPERTY OWNERS. SERVICE LINE LOCATIONS MAY BE ADJUSTED BASED ON THE REVIEW AND WILL BE RESTAKED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE CONTRACT. ALL SERVICE LINE STAKING SHALL BE MAINTAINED UNTIL THE SERVICE IS INSTALLED.

CORRECTIONS RECORD

NO.	DESCRIPTION	BY	REVISE (R) ADD (D) VOID (V) SHEET NO.'s	TOTAL # SHEETS IN PLAN SET	NET CHANGE IMP. COVER (sq.ft.)	TOTAL SITE IMP. COVER (sq.ft.)/%	CITY OF AUSTIN APPROVAL/ DATE	DATE IMAGED
1A	ADD STAGING AREA (REPLACE)	RAW	R 1,2,&30	67	Ø	Ø	3/20/08 J.T.	
2	Various/Loc/Traffic Control changes		(R) 33,34,35,36 37,39,56	(D) 31A / 68	Ø	Ø	4/21/08 J.T.	
3	SITE 1 - EASEMENT CHANGE		(R) 6,17,31	68	Ø	Ø	7/22/08 J.T.	
4	SITES: 1,5,&12 WW/LOC/TCP		(R) 6,9,11,22,31 39,36,40		Ø	Ø	5/14/09 AM	
5	SITES: 1,5,7,8 & 11		(R) 15,20,32-34,37 38,39-42,44 & 45 (D) 40A, 42A, 55A, 57A, & 58A	75	Ø	Ø		

PROJECT INFORMATION:

12 PROJECT LOCATIONS IN AND NEAR THE FOLLOWING STREETS:
NEWNING DRIVE, ACADEMY DRIVE, HILLSIDE AVENUE, RAVINE DRIVE, THE CIRCLE, SOUTH CONGRESS AVENUE, GIBSON STREET, JAMES STREET, NICKERSON STREET, DRAKE AVENUE, AVONDALE ROAD, MARIPOSA DRIVE, FARMERS DRIVE, ALGARITA AVENUE, POST ROAD, EAST LIVE OAK STREET, WILSON STREET, FLETCHER STREET, WEST JOHANNA STREET, WEST MARY STREET.

FOR DETAILED PROJECT LOCATIONS SEE SHEET C3.

OWNER:
AUSTIN WATER UTILITY
CITY OF AUSTIN, TEXAS
P.O. BOX 1088
AUSTIN, TEXAS 78767

CONTACT:
JOE HOEPKEN, P.E.
AUSTIN CLEAN WATER PROGRAM
811 BARTON SPRINGS RD., SUITE 400
AUSTIN, TEXAS
512-474-5500

SUBMITTAL PREPARED BY:

Jose I. Guerra, Inc.
Consulting Engineers
2401 South IH-35 Suite 210
Austin, Texas 78741
(512) 445-2090
Structural • Civil • Mechanical • Electrical

CONTACT:
JORGE DONOSO, P.E.
COMPANY NAME: JOSE I. GUERRA, INC.
ADDRESS: 2401 SOUTH I-35, AUSTIN, TEXAS 78741
TELEPHONE NUMBER: (512) 445-2090

APPROVALS:

SUBMITTED FOR APPROVAL BY:

PROJECT ENGINEER – JORGE DONOSO, P.E. DATE

NOTES
WATERSHED PROTECTION AND DEVELOPMENT REVIEW APPROVAL DOES NOT CONSTITUTE UTILITY ALIGNMENT/ASSIGNMENT APPROVAL.

RELEASE OF THIS APPLICATION DOES NOT CONSTITUTE A VERIFICATION OF ALL DATA, INFORMATION AND CALCULATIONS SUPPLIED BY THE APPLICANT. THE ENGINEER OF RECORD IS SOLELY RESPONSIBLE FOR THE COMPLETENESS, ACCURACY AND ADEQUACY OF HIS/HER SUBMITTAL, WHETHER OR NOT THE APPLICATION IS REVIEWED FOR CODE COMPLIANCE BY CITY ENGINEERS.

APPROVED BY:
AUSTIN WATER UTILITY — 10-05-2007 — DATE

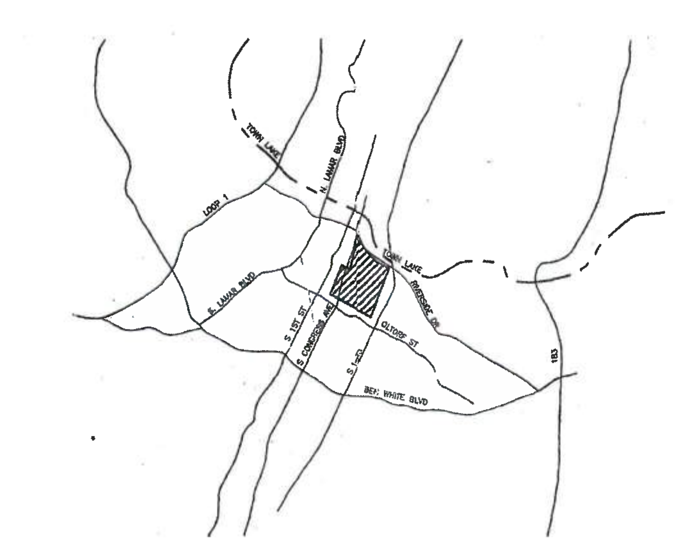
APPROVED BY:
WATERSHED PROTECTION AND DEVELOPMENT REVIEW DEPARTMENT — 11-30-2007 — DATE

SP-2007-0609 ACWP
SITE PLAN / DEVELOPMENT PERMIT NUMBER

10/25/2007
SUBMITTAL DATE

APPROVED BY:
[redacted]

STATE OF TEXAS — J.P. DONOSO — 57372 — REGISTERED PROFESSIONAL ENGINEER — 4-23-07



LEGEND
PROJECT LOCATION: THIS PROJECT HAS 12 INDIVIDUAL CONSTRUCTION SITES. SEE SHEET C3 FOR MORE DETAILED KEY MAP.

GOVALLE 2
TRAVIS HEIGHTS WASTEWATER IMPROVEMENTS

CITY GRIDS: AS LISTED PER SITE — LOCATION MAP — N.T.S.

REV. NO.	BY	DATE	REVISION DESCRIPTION

Jose I. Guerra, Inc.
Consulting Engineers
2401 South IH-35 Suite 210, Austin, Texas 78741, (512) 445-2090
Structural • Civil • Mechanical • Electrical

AUSTIN CLEAN WATER PROGRAM
GOVALLE 2: TRAVIS HEIGHTS WASTEWATER IMPROVEMENTS

COVER SHEET

acwp

SP-2007-0609ACWP

NOTES	NAME	DATE
SURVEY BY	MA	03/05
DRAWN BY	HBO	04/07
CHECKED BY	CC	04/07
DESIGNED BY	JPD	04/07
REVIEWED BY	JPD	04/07
SCALE:		NONE
CADD REF. NO.: 04066		
CADD DIR.: FELIX SOLIS		

C1

SHEET NUMBER 1 OF 67

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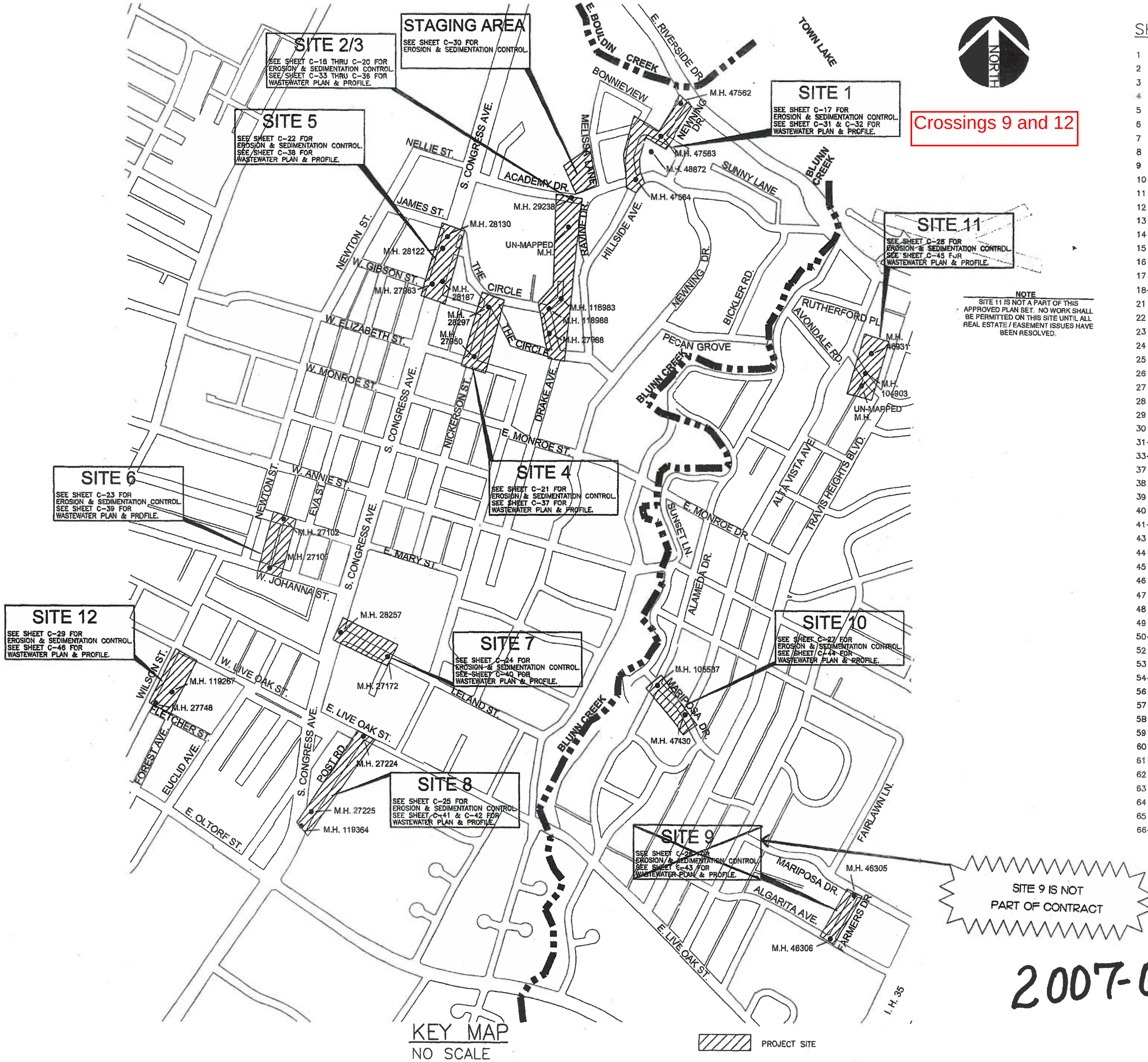
94136



2007-0018

SHEET INDEX:

1	COVER SHEET: PROJECT INFORMATION
2	GENERAL NOTES, LEGEND & TREE LIST
3	KEY MAP
4	TREE PROTECTION NOTES & DETAILS
5	EROSION/SEDIMENTATION NOTES & DETAILS
6	LAYOUT, BENCHMARK & TREE LIST – SITE 1
7	LAYOUT, BENCHMARK & TREE LIST – SITE 2/3
8	LAYOUT, BENCHMARK & TREE LIST – SITE 4
9	LAYOUT, BENCHMARK & TREE LIST – SITE 5
10	LAYOUT, BENCHMARK & TREE LIST – SITE 6
11	LAYOUT, BENCHMARK & TREE LIST – SITE 7
12	LAYOUT, BENCHMARK & TREE LIST – SITE 8
13	LAYOUT, BENCHMARK & TREE LIST – SITE 9
14	LAYOUT, BENCHMARK & TREE LIST – SITE 10
15	LAYOUT, BENCHMARK & TREE LIST – SITE 11
16	LAYOUT, BENCHMARK & TREE LIST – SITE 12
17	EROSION/SEDIMENTATION CONTROL PLAN: SITE 1
18–20	EROSION/SEDIMENTATION CONTROL PLAN: SITE 2/3
21	EROSION/SEDIMENTATION CONTROL PLAN: SITE 4
22	EROSION/SEDIMENTATION CONTROL PLAN: SITE 5
23	EROSION/SEDIMENTATION CONTROL PLAN: SITE 6
24	EROSION/SEDIMENTATION CONTROL PLAN: SITE 7
25	EROSION/SEDIMENTATION CONTROL PLAN: SITE 8
26	EROSION/SEDIMENTATION CONTROL PLAN: SITE 9
27	EROSION/SEDIMENTATION CONTROL PLAN: SITE 10
28	EROSION/SEDIMENTATION CONTROL PLAN: SITE 11
29	EROSION/SEDIMENTATION CONTROL PLAN: SITE 12
30	E/S CONTROL PLAN: ACADEMY DRIVE STAGING AREA
31–32	PLAN AND PROFILE: SITE 1
33–36	PLAN AND PROFILE: SITE 2/3
37	PLAN AND PROFILE: SITE 4
38	PLAN AND PROFILE: SITE 5
39	PLAN AND PROFILE: SITE 6
40	PLAN AND PROFILE: SITE 7
41–42	PLAN AND PROFILE: SITE 8
43	PLAN AND PROFILE: SITE 9
44	PLAN AND PROFILE: SITE 10
45	PLAN AND PROFILE: SITE 11
46	PLAN AND PROFILE: SITE 12
47	SITE AND UTILITY DETAILS
48	SITE AND UTILITY DETAILS
49	SITE AND UTILITY DETAILS
50–51	TRAFFIC CONTROL PLAN: SITE 1
52	TRAFFIC CONTROL PLAN: SITE 2/3
53	TRAFFIC CONTROL PLAN: SITE 4
54–55	TRAFFIC CONTROL PLAN: SITE 5
56	TRAFFIC CONTROL PLAN: SITE 6
57	TRAFFIC CONTROL PLAN: SITE 7
58	TRAFFIC CONTROL PLAN: SITE 8
59	TRAFFIC CONTROL PLAN: SITE 9
60	TRAFFIC CONTROL PLAN: SITE 10
61	TRAFFIC CONTROL PLAN: SITE 11
62	TRAFFIC CONTROL NOTES & DETAILS: 8D4S–1
63	TRAFFIC CONTROL NOTES & DETAILS: 8D4S–2
64	TRAFFIC CONTROL NOTES & DETAILS: 8D4S–3
65	TRAFFIC CONTROL NOTES & DETAILS: 8D4S–4
66–67	TRAFFIC CONTROL NOTES & DETAILS: 8D4S–5

APPROVED AS REVISED
NOV 20 20
CITY OF AUSTIN

REV NO.	BY	DATE	REVISION DESCRIPTION

STATE OF TEXAS — REGISTERED PROFESSIONAL ENGINEER — 57372
4-23-07

Jose I. Guerra, Inc.
Consulting Engineers
2401 South IH-35 Suite 210, Austin, Texas 78741, (512) 445-2090
Structural • Civil • Mechanical • Electrical

AUSTIN CLEAN WATER PROGRAM
GOVALLE 2: TRAVIS HEIGHTS WASTEWATER IMPROVEMENTS

KEY MAP FOR SITES 1 – 12

acwp

SP-2007-0609ACWP

NOTES	NAME	DATE
SURVEY BY	MA	03/05
DRAWN BY	HBO	04/07
CHECKED BY	CC	04/07
DESIGNED BY	JPD	04/07
REVIEWED BY	JPD	04/07
SCALE:		NONE
CADD REF. NO.: 04066		
CADD DIR.: FELIX SOLIS		
	C3	
SHEET NUMBER	3 OF 67	

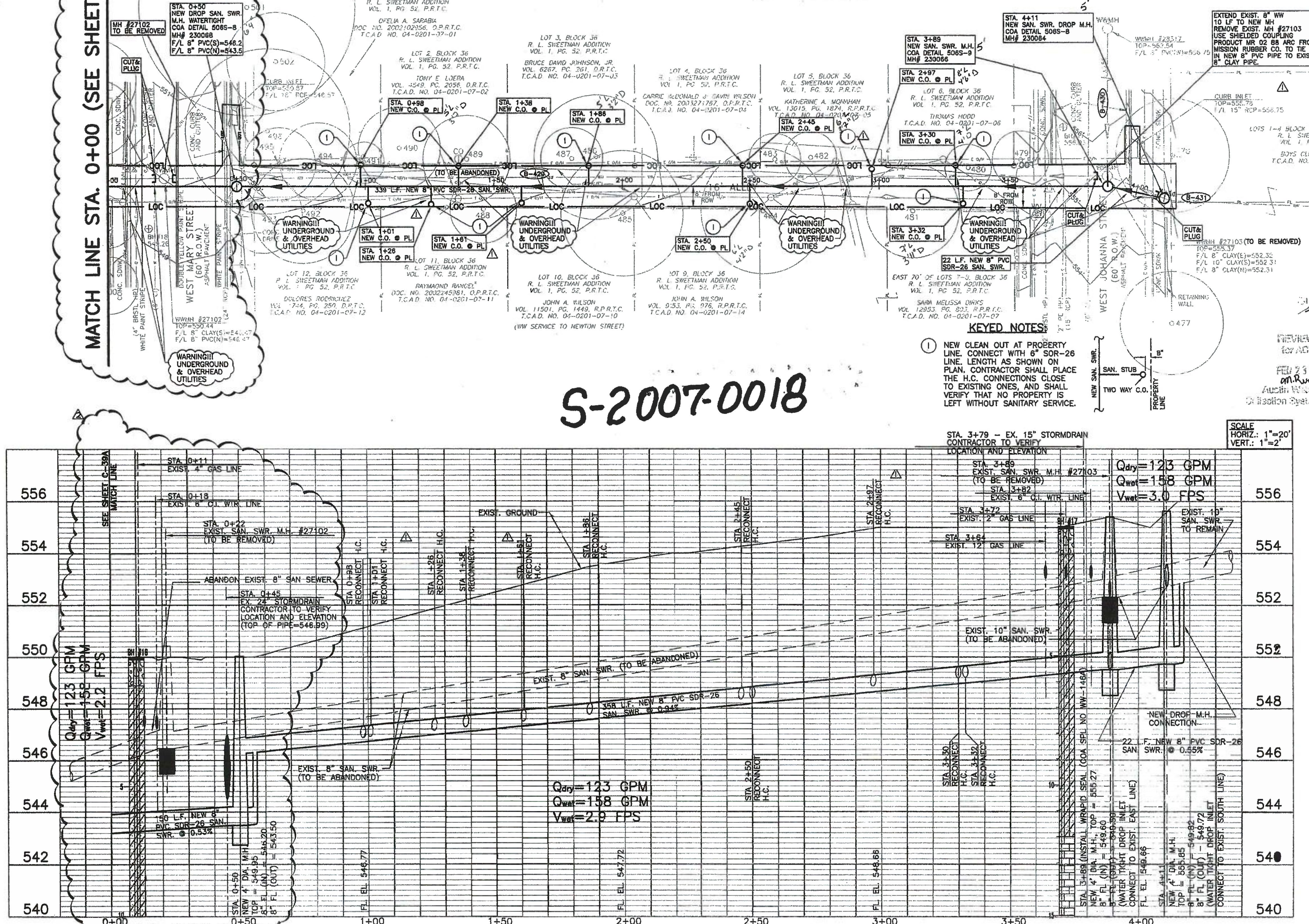
CADFILE:F:\04066\CADFILES\4066C-3.DWG Plotted: Apr 23, 07 @ 4:04 am by: cesar Scale: 1:1

94138

Crossings 9 and 12

GENERAL NOTES:

1. FOR PLACEMENT OF EROSION & SEDIMENTATION CONTROLS & TREE PROTECTION FENCING, SEE EROSION & SEDIMENTATION CONTROL PLANS.
2. WATER LINE CROSSING:
   - FIELD VERIFY LOCATION AND ELEVATION OF WATER LINE PRIOR TO INSTALLATION OF SAN. SWR. IF CLEARANCE IS LESS THAN 2 FT VERT, ALERT ENGINEER FOR DIRECTION.
   - WHERE INDICATED, SAN. SWR. TO BE ENCASED (COA DETAIL 505S-1)
3. GEOTECHNICAL BORING INFORMATION PRESENTED ON THIS SHEET WAS PROVIDED BY HOLT ENGINEERING INC. REFER TO SUBSURFACE INVESTIGATION AND PRELIMINARY GEOTECHNICAL DATA REPORT, APRIL 2005. REFERENCE BORE LOG SHEETS C-47 THRU C-50, FOR ADDITIONAL DETAILS.
4. CONTRACTOR TO FIELD VERIFY ALL UTILITIES BOTH VERTICALLY AND HORIZONTALLY PRIOR TO COMMENCING CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY DAMAGE TO EXISTING UTILITIES.
5. AN EFFORT HAS BEEN MADE TO LOCATE ALL KNOWN HOUSE CONNECTIONS TO THE EXISTING LINE THAT WILL BE REPLACED. ALL EXISTING HOUSE CONNECTIONS ~~SHALL BE RECONNECTED TO THE NEW LINE.~~
6. ALL SERVICES INSTALLED WITH CASTINGS ON CLEANOUTS. (5)



S-2007-0018

REVIEWED for ACWP FEB 23 2009 Austin Water Utility Collection System Services

REV. NO.	BY	DATE	REVISION DESCRIPTION
1	CC	06/04/07	ADDENDUM #2
4	CC	04/09/08	CORRECTION #2
5	CC	01/20/09	ADDED NOTE

STATE OF TEXAS — MARK T. BURSON — 66334 — REGISTERED PROFESSIONAL ENGINEER — 2/23/09

Jose I. Guerra, Inc.
Consulting Engineers
2401 South IH-35 Suite 210, Austin, Texas 78741, (512) 445-2090
Structural • Civil • Mechanical • Electrical

AUSTIN CLEAN WATER PROGRAM
GOVALLE 2: TRAVIS HEIGHTS WASTEWATER IMPROVEMENTS
SITE 6: ALLEY BETWEEN W. MARY ST. AND W. JOHANNA ST. WASTEWATER PLAN AND PROFILE

acwp Austin Clean Water Program

NOTES	NAME	DATE
SURVEY BY	MA	10/08
DRAWN BY	PLN	10/08
CHECKED BY	CC	10/08
DESIGNED BY	CC	10/08
REVIEWED BY	MTB	10/08

SCALE: H.)1"=20' V.)1"=2'

CADD REF. NO.: 04066

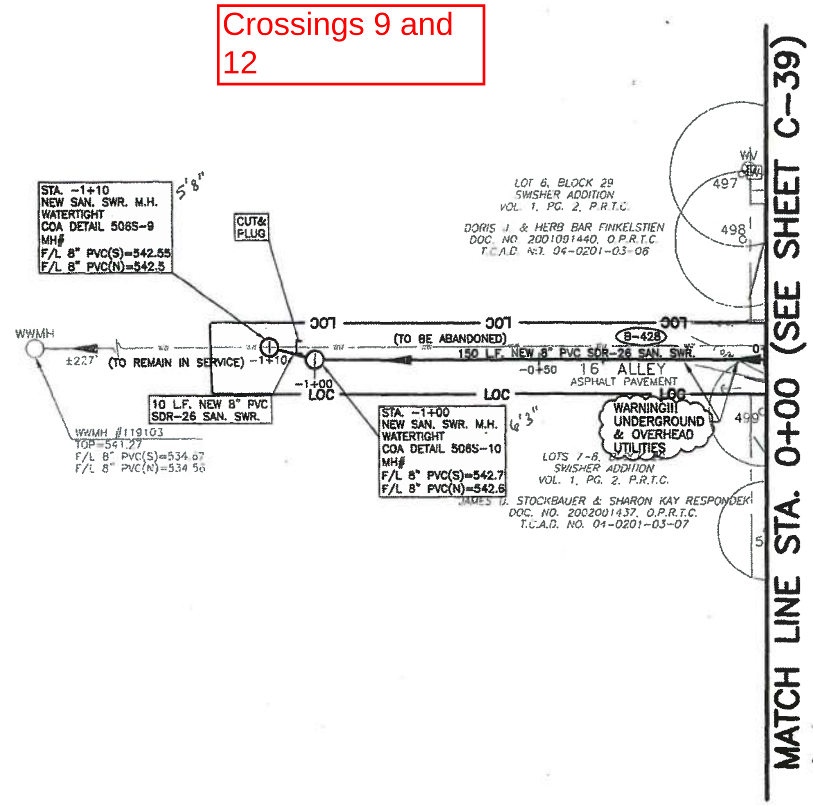
CADD DIR.: FELIX SOLIS

C39

SHEET NUMBER 39 OF 67

9/1/09

Crossings 9 and 12



GENERAL NOTES:

1. FOR PLACEMENT OF EROSION & SEDIMENTATION CONTROLS & TREE PROTECTION FENCING, SEE EROSION & SEDIMENTATION CONTROL PLANS.
2. WATER LINE CROSSING:
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   - WHERE INDICATED, SAN. SWR. TO BE ENCASED (COA DETAIL 505S-1)
3. GEOTECHNICAL BORING INFORMATION PRESENTED ON THIS SHEET WAS PROVIDED BY HOLT ENGINEERING INC. REFER TO SUBSURFACE INVESTIGATION AND PRELIMINARY GEOTECHNICAL DATA REPORT, APRIL 2005. REFERENCE BORE LOG SHEETS C-47 THRU C-50, FOR ADDITIONAL DETAILS.
4. CONTRACTOR TO FIELD VERIFY ALL UTILITIES BOTH VERTICALLY AND HORIZONTALLY PRIOR TO COMMENCING CONSTRUCTION. CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY DAMAGE TO EXISTING UTILITIES.
5. AN EFFORT HAS BEEN MADE TO LOCATE ALL KNOWN HOUSE CONNECTIONS TO THE EXISTING LINE THAT WILL BE REPLACED. ALL EXISTING HOUSE CONNECTIONS SHALL BE RECONNECTED TO THE NEW LINE.

SCALE: 1"=20'

APPROVED AND RELEASED
APR 2 1 2008
CITY OF AUSTIN

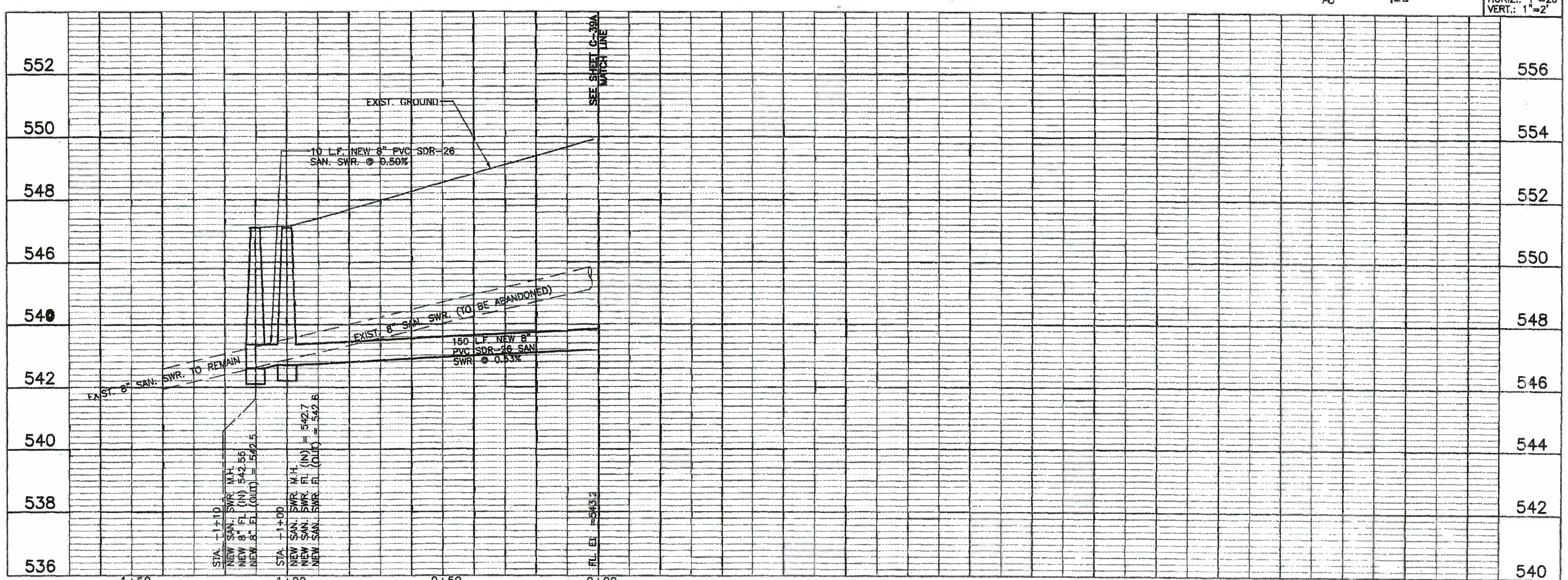
REVIEWED for ACWP
APR 1 4 2008
Austin Water Utility
Collection System Services

S-2007-0018

KEYED NOTES:

1. NEW CLEAN OUT AT PROPERTY LINE. CONNECT WITH 6" SDR-26 LINE. LENGTH AS SHOWN ON PLAN. CONTRACTOR SHALL PLACE THE H.C. CONNECTIONS CLOSE TO EXISTING ONES, AND SHALL VERIFY THAT NO PROPERTY IS LEFT WITHOUT SANITARY SERVICE.

SCALE
HORIZ.: 1"=20'
VERT.: 1"=2'



REV. NO.	BY	DATE	REVISION DESCRIPTION
2	CC	04/09/08	CORRECTION #2

Jose I. Guerra, Inc.
Consulting Engineers
Structural • Civil • Mechanical • Electrical
Austin, Texas 78741, (512) 445-2090

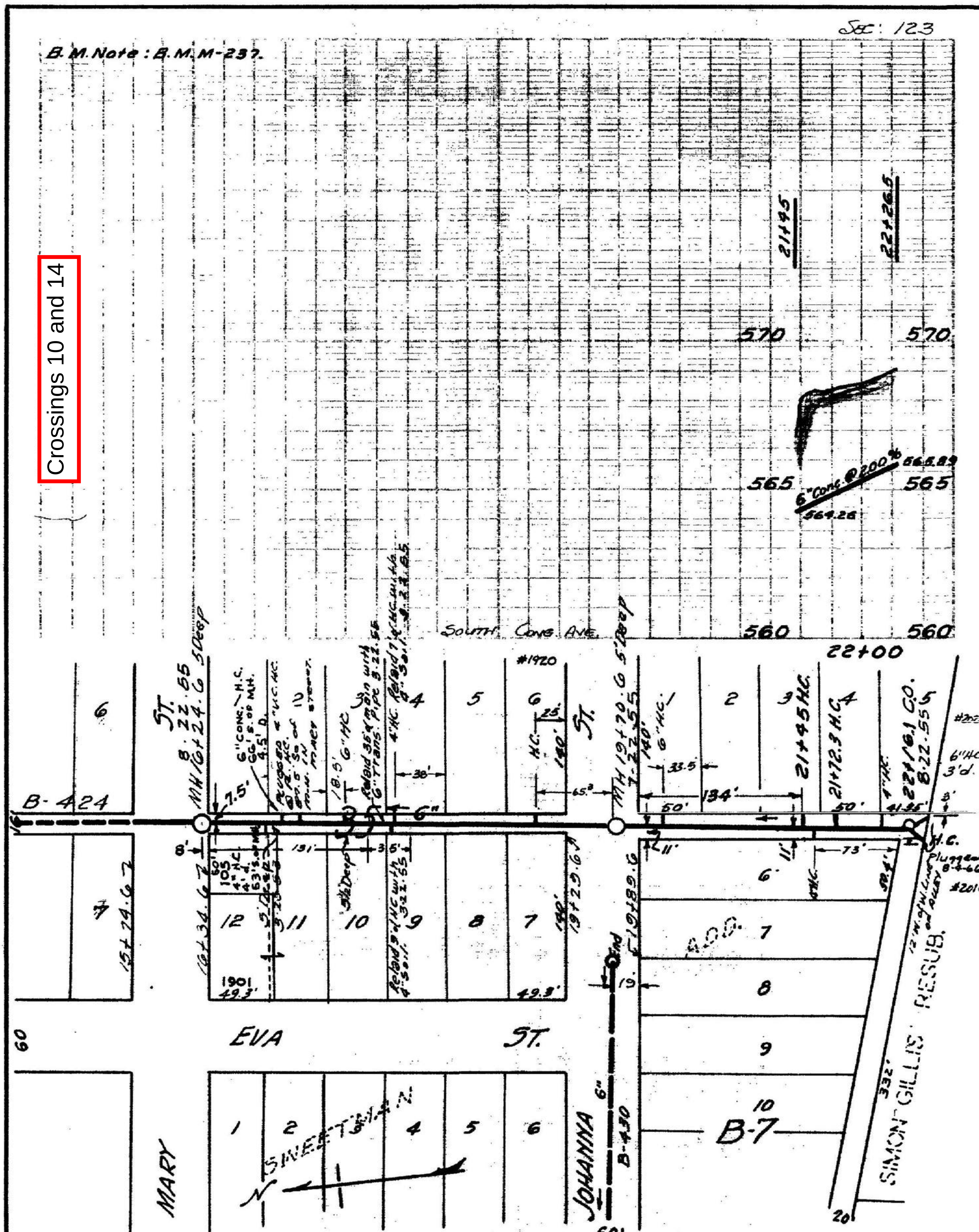
AUSTIN CLEAN WATER PROGRAM
GOVALLE 2: TRAVIS HEIGHTS WASTEWATER IMPROVEMENTS
SITE 6: ALLEY BETWEEN W. MARY ST. AND W. JOHANNA ST.
WASTEWATER PLAN AND PROFILE

acwp

NOTES	NAME	DATE
SURVEY BY	MA	03/05
DRAWN BY	JJT	04/07
CHECKED BY	CC	04/07
DESIGNED BY	JPD	04/07
REVIEWED BY	JPD	04/07
SCALE:	H.)1"=20' V.)1"=2'	
CADD REF. NO.: 04066		
CADD DIR.: FELIX SOLIS		

C39A

SHEET NUMBER 39 A OF 67



SEWER LOCATIONS

AUSTIN, TEXAS

CITY FORCES 7-22-55
CITY FORCES 9-30-40

W.O. 2335 S-321
040135E
AUG. '70

BUILT BY OLD SYSTEM DATE

FIELD BOOK 1292, P. 37 843 Pg. 748 DATE 9-25-40 1932

DAILY REPORT NO. DATE 10-70

DRAWN BY V.W.P.-W.N.O.-J.D.W. B. F. PRIEST DATE 10-29-40 8-10-32

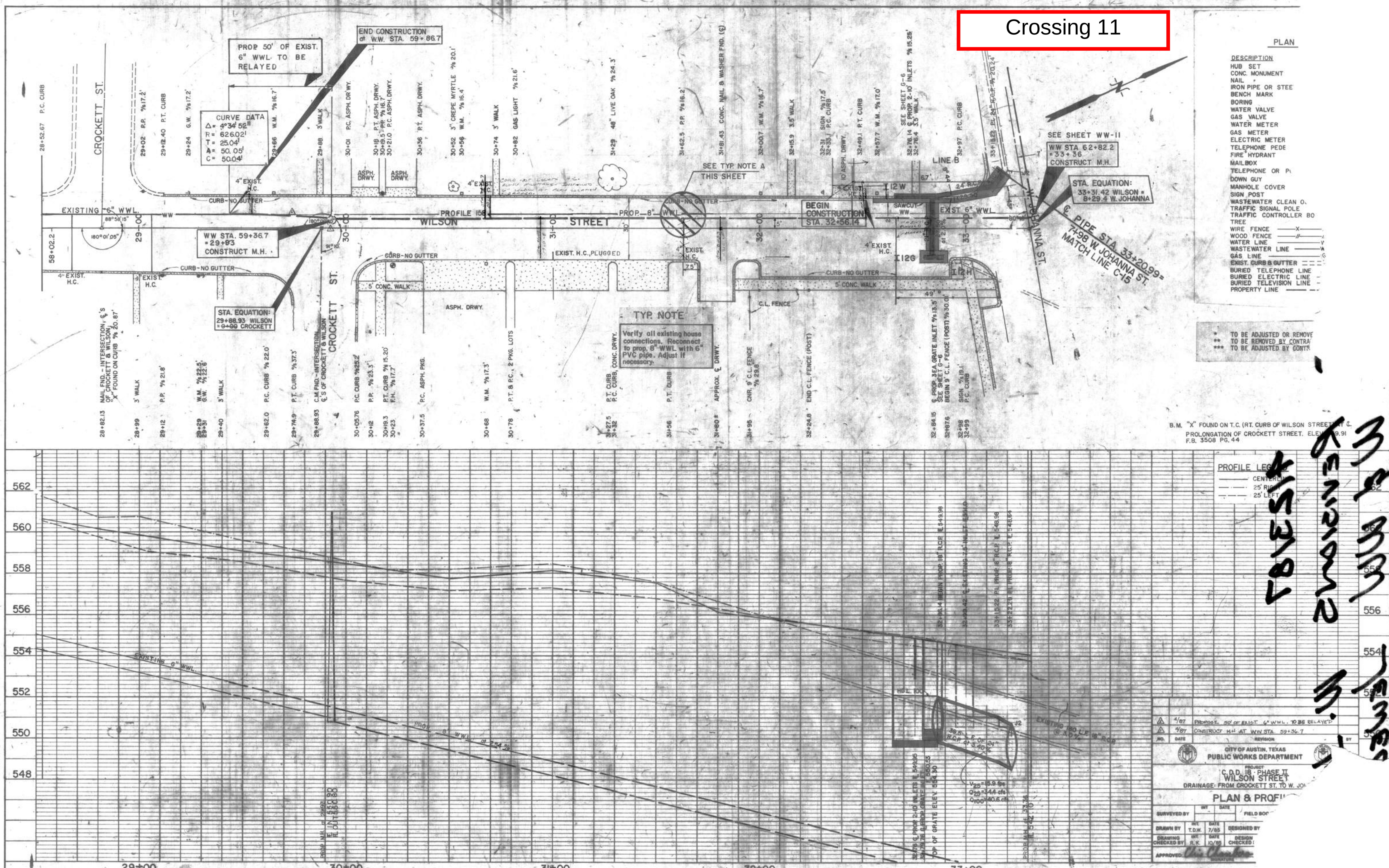
W.O. 83132100-802-251
W.O. 83132300-802-251 AUG. '70

LOCATION EVA ST. ALLEY

FROM N.P.L. MARY ST.

TO S. OF S.P.L. JOHANNA ST.

Crossing 11



PLAN
CROCKETT ST.
WILSON STREET
W. JOHANNA ST.
PROP. 50' OF EXIST. 6" WWL TO BE RELAYED
END CONSTRUCTION at W.W. STA. 59+86.7
CURVE DATA
Δ= 4°34'52"
R= 626.02'
T= 25.04'
A= 50.05'
C= 50.04'
EXISTING 6" WWL
WW STA. 59+36.7 =29+93 CONSTRUCT M.H.
STA. EQUATION: 29+88.93 WILSON =0+00 CROCKETT
SEE TYP NOTE A THIS SHEET
BEGIN CONSTRUCTION STA. 32+56.14
SEE SHEET WW-II
WW STA 62+82.2 =33+36 CONSTRUCT M.H.
STA. EQUATION: 33+31.42 WILSON = 8+29.4 W. JOHANNA
℄ PIPE STA. 33+20.99= 7+98 W. JOHANNA ST. MATCH LINE C-15
LINE B
EXIST. H.C. PLUGGED
CURB-NO GUTTER
5' CONC. WALK
ASPH. DRWY.
C.L. FENCE
TYP. NOTE
Verify all existing house connections. Reconnect to prop. 8" WWL with 6" PVC pipe. Adjust if necessary.
DESCRIPTION
HUB SET
CONC. MONUMENT
NAIL
IRON PIPE OR STEEL
BENCH MARK
BORING
WATER VALVE
GAS VALVE
WATER METER
GAS METER
ELECTRIC METER
TELEPHONE PEDESTAL
FIRE HYDRANT
MAILBOX
TELEPHONE OR POWER POLE
DOWN GUY
MANHOLE COVER
SIGN POST
WASTEWATER CLEAN OUT
TRAFFIC SIGNAL POLE
TRAFFIC CONTROLLER BOX
TREE
WIRE FENCE
WOOD FENCE
WATER LINE
WASTEWATER LINE
GAS LINE
EXIST. CURB & GUTTER
BURIED TELEPHONE LINE
BURIED ELECTRIC LINE
BURIED TELEVISION LINE
PROPERTY LINE
* TO BE ADJUSTED OR REMOVED
** TO BE REMOVED BY CONTRACTOR
*** TO BE ADJUSTED BY CONTRACTOR
B.M. "X" FOUND ON T.C. (RT. CURB OF WILSON STREET AT ℄ PROLONGATION OF CROCKETT STREET. ELEV. 559.91 F.B. 3508 PG. 44
PROFILE LEGEND
CENTERLINE
25' RIGHT
25' LEFT
EXISTING 6" WWL
PROP. 8" WWL @ 0.54%
EXISTING 180 LF 18" RCP
562
560
558
556
554
552
550
548
29+00
30+00
31+00
32+00
33+00
PROPOSED 50' OF EXIST. 6" WWL TO BE RELAYED
CONSTRUCT MH AT WW STA. 59+36.7
NO. DATE REVISION BY
CITY OF AUSTIN, TEXAS
PUBLIC WORKS DEPARTMENT
C.D.D. 18 PHASE II
WILSON STREET
DRAINAGE: FROM CROCKETT ST. TO W. JOHANNA
PLAN & PROFILE
SURVEYED BY
DRAWN BY T.D.W. 7/85
DRAWING CHECKED BY
DESIGNED BY
DESIGN CHECKED BY
APPROVED
WW-

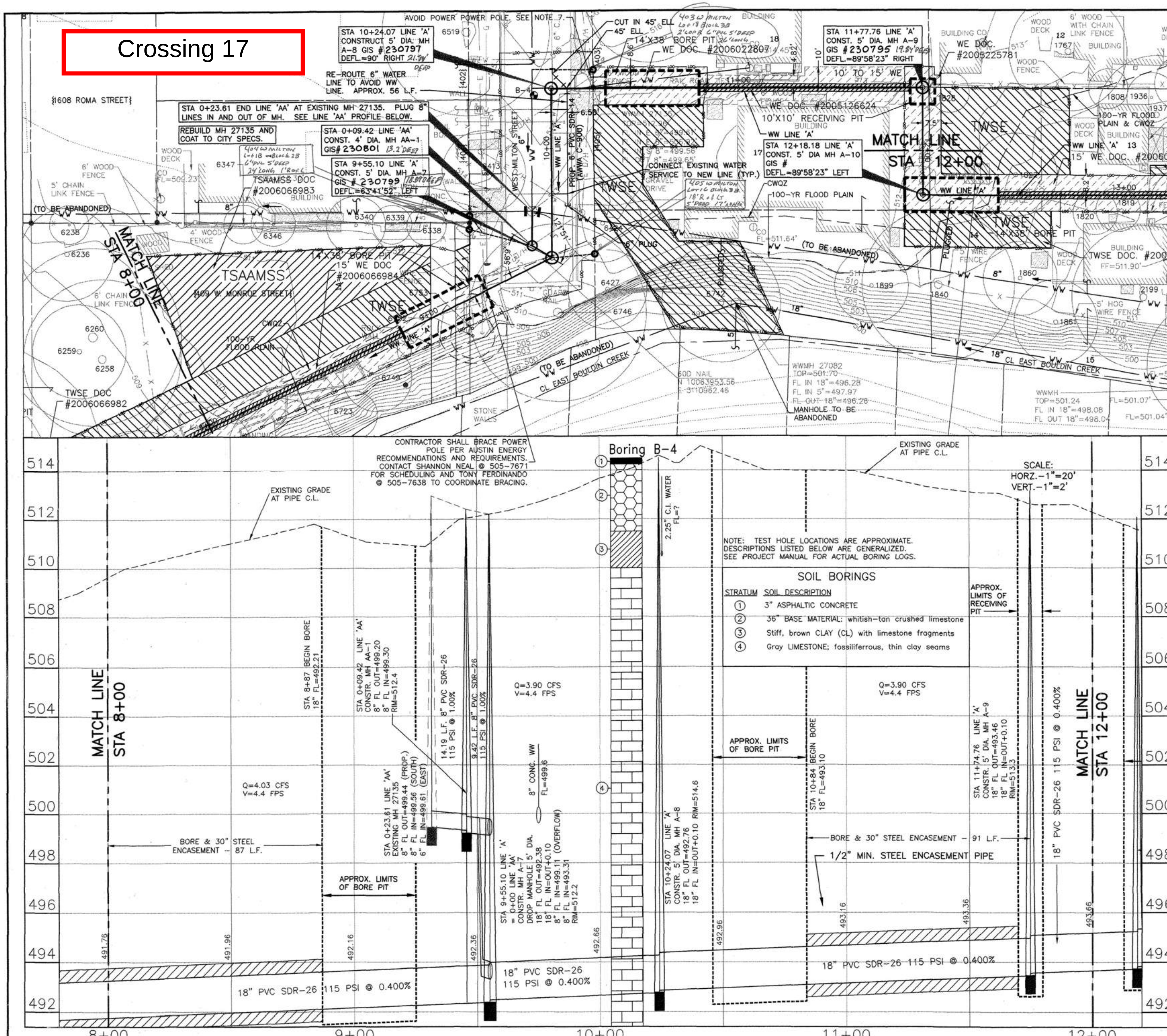
Crossing 16

CCTV Inspection Summary

Ticket number: 13-7644
Inspection I.D.: 03
Pipe Name: 21640
Address: 312 W Annie St
Start: 228365
End: 102153
Direction: Downstream
Level Inspection: 1
Size: 36”
Material: RCP
Footage Inspected: 247.4’

Summary:
The pipe exits the manhole and heads west down W Annie St. There is a utility boar though the pipe at 21.9’ there was longitudinal crack though out the pipe. At 237’ the joint was separated and open, you could see sediment though the joint. we ended the inspection at the outfall under the bridge on W Annie St.

S-2007-0023



LEGEND

PROP. OPEN CUT WW LINE	
PROP. MANHOLE	
PROP. WW SERVICE	
PROP. CLEANOUT	
PROP. BORED WW LINE	
PROP. EASEMENT	
PROP. TEMP. EASEMENT	
CONSTRUCTION LIMITS	
BORE OR RECEIVING PIT	

SEE SHEET 3 FOR SURVEY BASE LEGEND

SURVEY INFORMATION PROVIDED BY MARTINEZ, WRIGHT, & MENDEZ, INC., AUSTIN, TEXAS

NOTES:

1. BORE PIT SIZE AND LOCATION ARE APPROXIMATE. CONTRACTOR MAY EXCHANGE BORE PITS FOR RECEIVING PITS.
2. MANHOLES NOT IN PAVEMENT REQUIRE BOLTED COVERS PER C.O.A. STD. 503S-3W.
3. MANHOLE RINGS SHALL BE SET 6" ABOVE EXISTING NATURAL GROUND OR FLUSH WITH EXISTING PAVEMENT.
4. ENCASEMENT DIAMETER SHOWN IS MINIMUM. THE CONTRACTOR SHALL SIZE CASING TO ASSURE HORIZONTAL ALIGNMENT AND GRADE AS SHOWN FOR THE CARRIER PIPE. ANY INCREASES IN CASING SIZE REQUIRED TO MEET HORIZONTAL ALIGNMENT AND GRADE SHALL BE AT NO COST TO OWNER.
5. SOILS BORING LOCATIONS ARE APPROXIMATE. SEE SHEET 3 FOR KEY TO SOILS SYMBOLS.
6. REMOVAL AND/OR ABANDONMENT OF EXISTING PIPE WILL NOT BE PAID FOR DIRECTLY BUT SHALL BE SUBSIDIARY TO THE BID.
7. MAINTAIN MINIMUM 5' CLEARANCE FROM EDGE OF POWER POLE TO BORE PIT.

WATER LINE RELOCATION NOTE:

CONTRACTOR SHALL COORDINATE WITH HOMEOWNERS WHEN DISCONNECTING AND RECONNECTING WATER SERVICE TO LIMIT SERVICE INTERRUPTION TO NO MORE THAN 3 HOURS.

EASEMENT ABBREVIATIONS

AE = ACCESS EASEMENT
TIAEE = TEMPORARY INGRESS AND EGRESS EASEMENT
TSAAMSS = TEMPORARY STAGING AREA AND MATERIAL STORAGE SITE
TWSE = TEMPORARY WORKING SPACE EASEMENT
WE = WASTEWATER EASEMENT

APPROVED AND RELEASED

JUN 12 2007

CITY OF AUSTIN

AWU: Steve Vargas, P.E. 05-25-2007

LOT NO.	OWNER
2	MANTREVAN LTD. VOL.13336,PG.224 TCAD#0400000408
1	AMANDA PARDO VOL.12882,PG.1431 TCAD#0400000409
18	MICHAEL LYNN JONES DOC.#2001003888 TCAD#0400000302
17	JOVITA'S INC. VOL.13146,PG.2023 TCAD#0400000301
13	GEORGE ROBERT McLAUGHLIN & AUDRA WERT DOC.#2004020582 TCAD#0400000321
12	TERESA C. ELLIOTT DOC.#19991028 TCAD#0400000317

REVISION DESCRIPTION | DATE | REV NO. | BY

G. A. HARUTUNIAN 35394 — 3/7/07

KURKJIANENGINEERING engineering & environmental consultants
111 W. ANDERSON LANE SUITE D-202 AUSTIN, TEXAS 78752 PH. (512) 371-3535 FAX: (512) 371-7333
• Civil • Environmental • Structural • Water Treatment • Wastewater Treatment • Solid Waste

AUSTIN CLEAN WATER PROGRAM
GOVALLE 1 -NEWTON STREET AREA WASTEWATER INPROVEMENTS

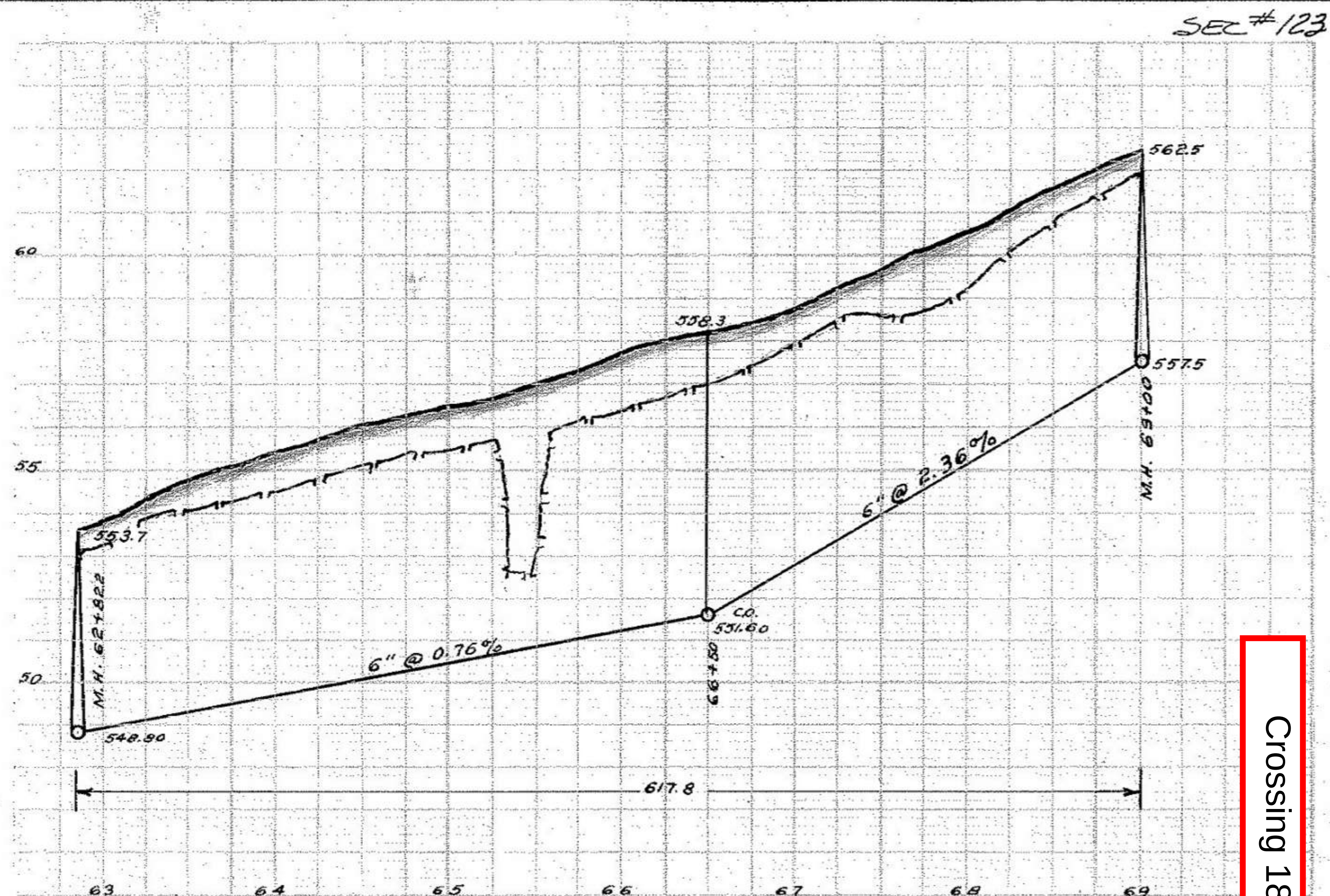
WASTEWATER LINE 'A'
PLAN & PROFILE FROM STA 8+00 TO 12+00

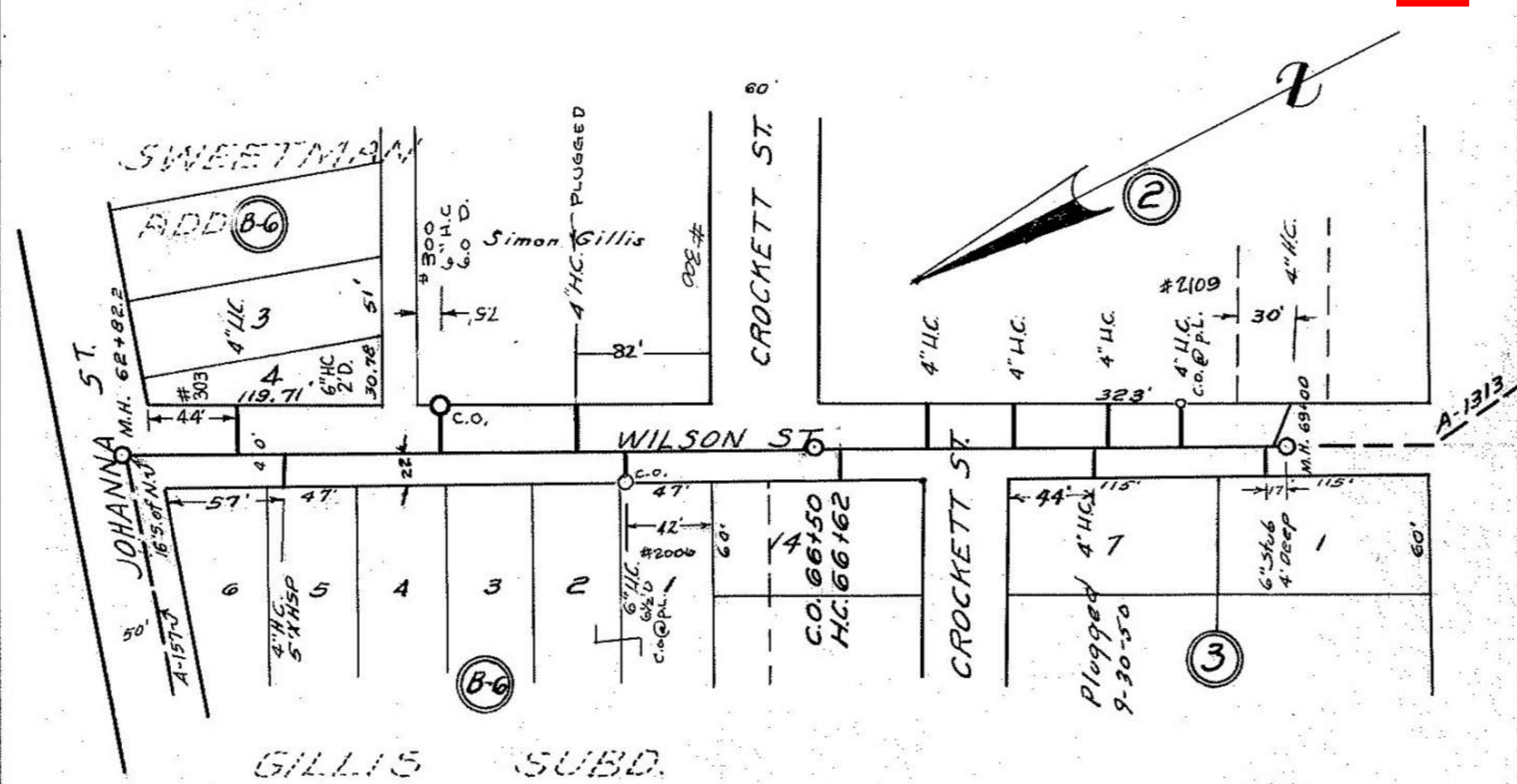
acwp

NOTES	NAME	DATE
SURVEY BY	MWM	11/04
DRAWN BY	MCM	11/04
CHECKED BY	FCH	11/04
DESIGNED BY	MM/GH	11/04
REVIEWED BY	GAH	11/04
SCALE: H.)1"=20' V.)1"=2'		
CADD REF. NO.:		
CADD DIR.:		
SP-2007-0310ACWP		
SHEET NUMBER	14 OF 38	

95593

123
122





SEWER LOCATIONS

AUSTIN, TEXAS

BUILT BY CITY FORCES DOZIER CON. CO. DATE AUG. 7-1944 W.O. 44-5323

FIELD BOOK 825-A P27 DATE 4-15-'30 LOCATION JOHANNA ST.

DAILY REPORT NO. DATE 12-75 FROM BOULDIN CREEK

DRAWN BY Allene Wallace J.T. WILLIAMS DATE 9-12-44 6-19-'30 6-3-92/3-30-94 TO EAST

CHECKED BY W.K. KINGSBURY DATE JOB NO. G-2 SHEET NO. 158

C. F. PEASE CO., CHICAGO

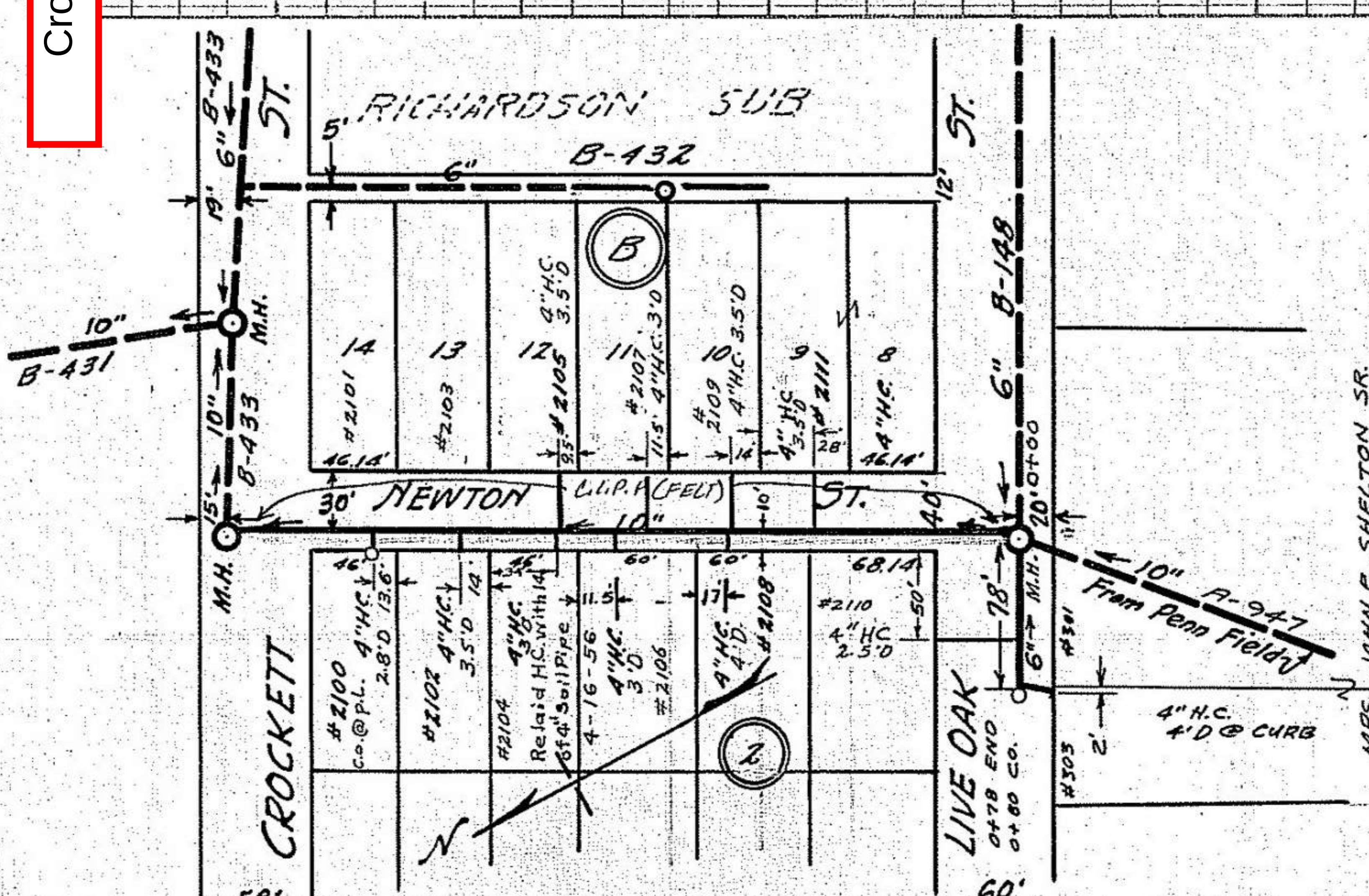
A

123

UPDATED:
MAY 2007
C.I.P.P. (FELT)
A-20

SEC 123

Crossing 19



NOTE:
ALL H.C. DEPTHS @ CURB-LINE
1-7-64

SEWER LOCATIONS

AUSTIN, TEXAS 1/8/64 H.O. 800-743-
WO 800 635 5321-3

CITY FORCES 12-17-59

BUILT BY OLD SYSTEM DATE

FIELD BOOK 843 Pg. 8 DATE 1932 LOCATION NEWTON ST.

DAILY REPORT NO. DATE FROM CROCKETT ST.

DRAWN BY V.W.P.-W.N.O.-J.D.W DATE 8-11-32 1-6-95 TO LIVE OAK ST.

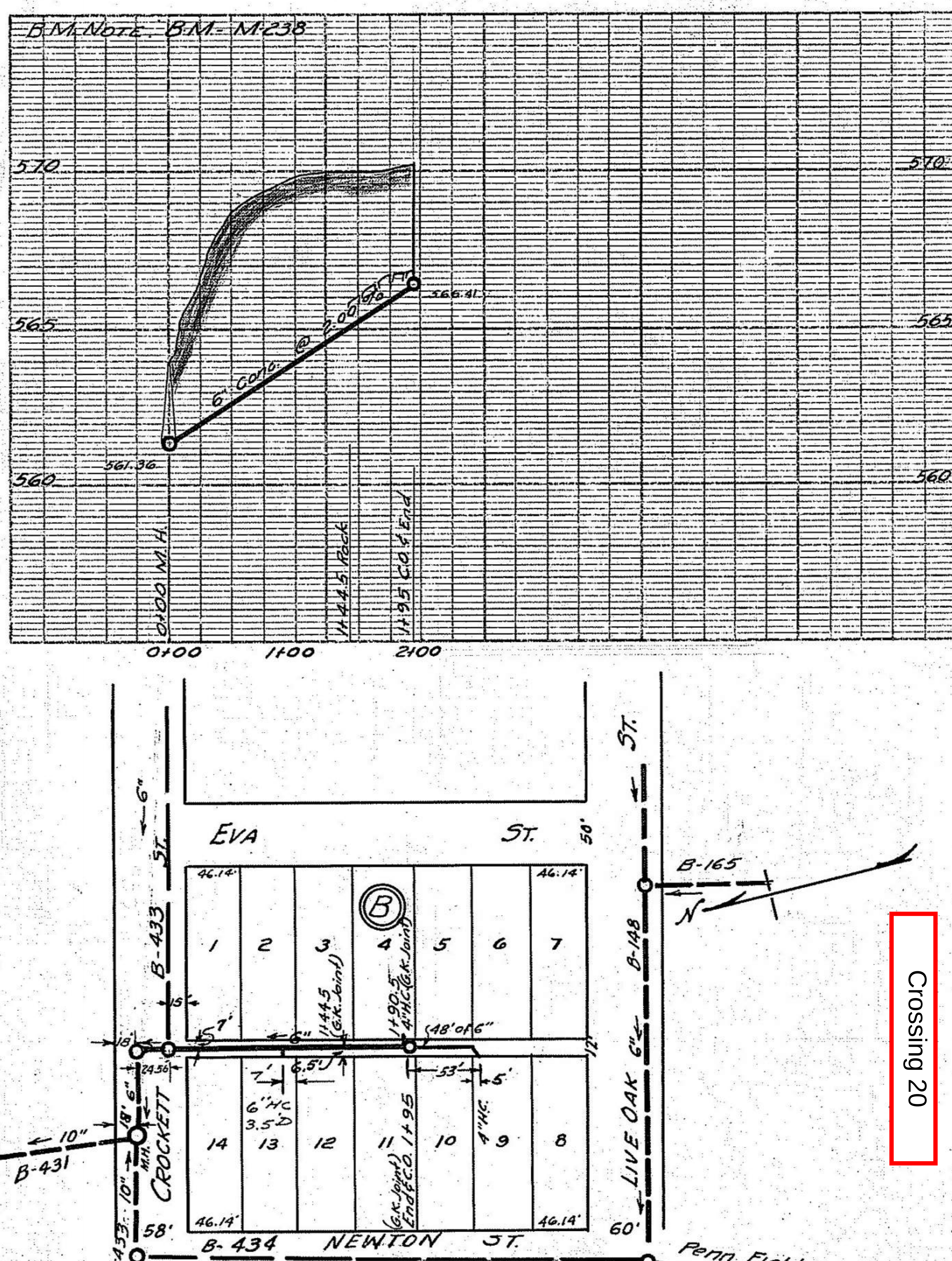
CHECKED BY GIESEN DATE 8-30-32 JOB NO. SHEET NO. 434

C. F. PEASE CO., CHICAGO

B

123

NOTE: FOR UPDATE
S-2006-2030
D. RODRIGUEZ
HANSEN COATING
ON M.H.



Crossing 20

SEWER LOCATIONS

AUSTIN, TEXAS

BUILT BY CITY FORCES / OLD SYSTEM DATE May, 1945 9-30-46 — W.O. 83-5322

FIELD BOOK 1416 Pg. 5 / 843 Pg. 8 DATE June-3-1945 / 1932 — LOCATION NEWTON ST. ALLEY

DAILY REPORT NO. ____ DATE ____ — FROM CROCKETT ST.

DRAWN BY A.W. / V.W.P.-W.N.O.-J.D.W. DATE 7-13-44 / 8-10-32 — TO LIVE OAK ST.

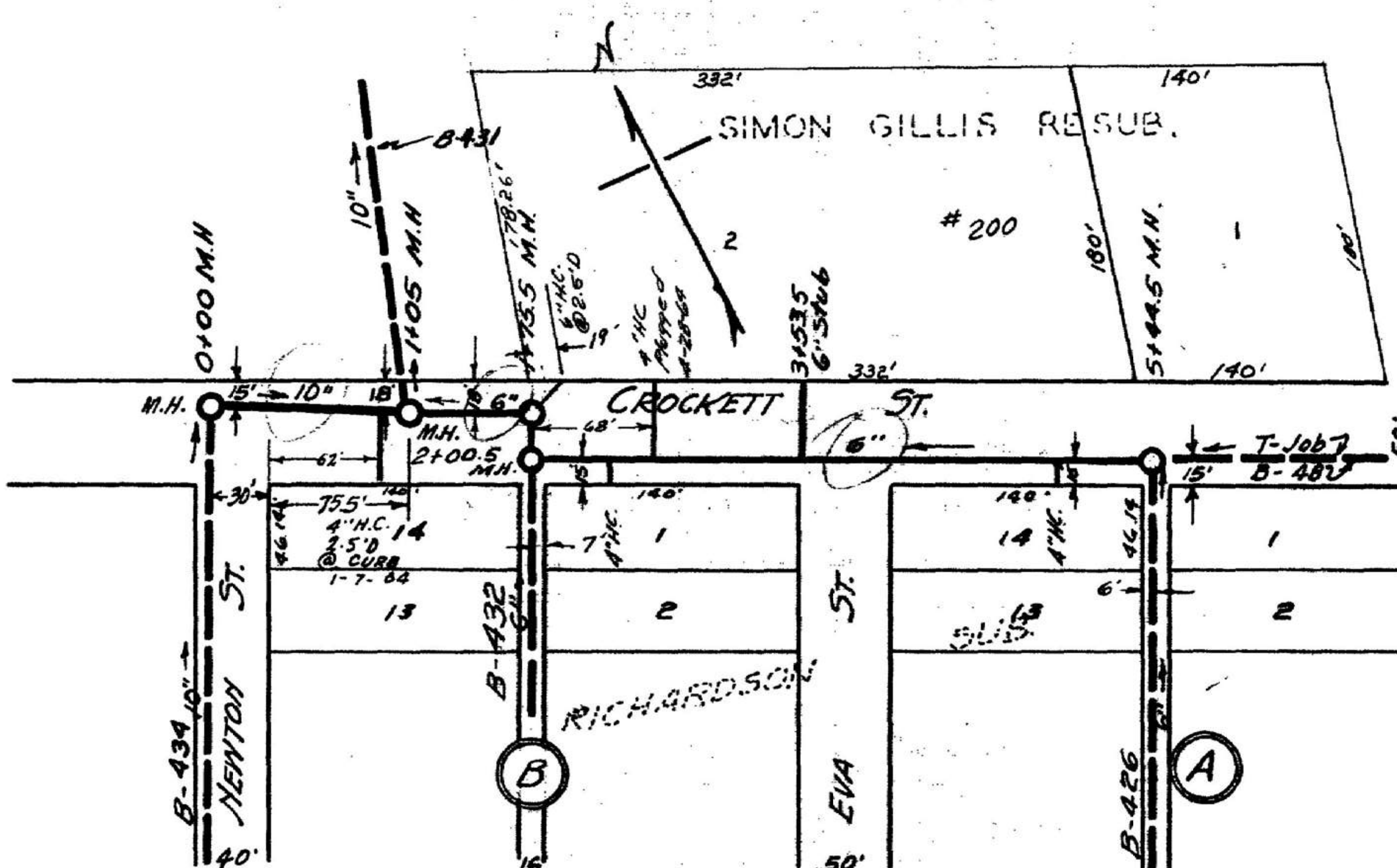
CHECKED BY Allene Wallace / GIESEN DATE 6-8-45 / 8-30-32 — JOB NO. ____ SHEET NO. 432

C. F. PEASE CO., CHICAGO

B

Sec 123

Crossing 21



SEWER LOCATIONS

AUSTIN, TEXAS

BUILT BY *CITY FORCES* / *OLD SYSTEM* DATE *June 20. 44* *W.O 29-5-322*

FIELD BOOK *843 Pg. 8* DATE *1932* LOCATION *CROCKETT ST.*

DAILY REPORT NO. ____ DATE *8-16* FROM *NEWTON ST.*

DRAWN BY *Allene Wallace* / *V.W.P.-W.N.D.-J.D.W.* DATE *7-13-44* / *8-10-30* TO *EVA ST. ALLEY*

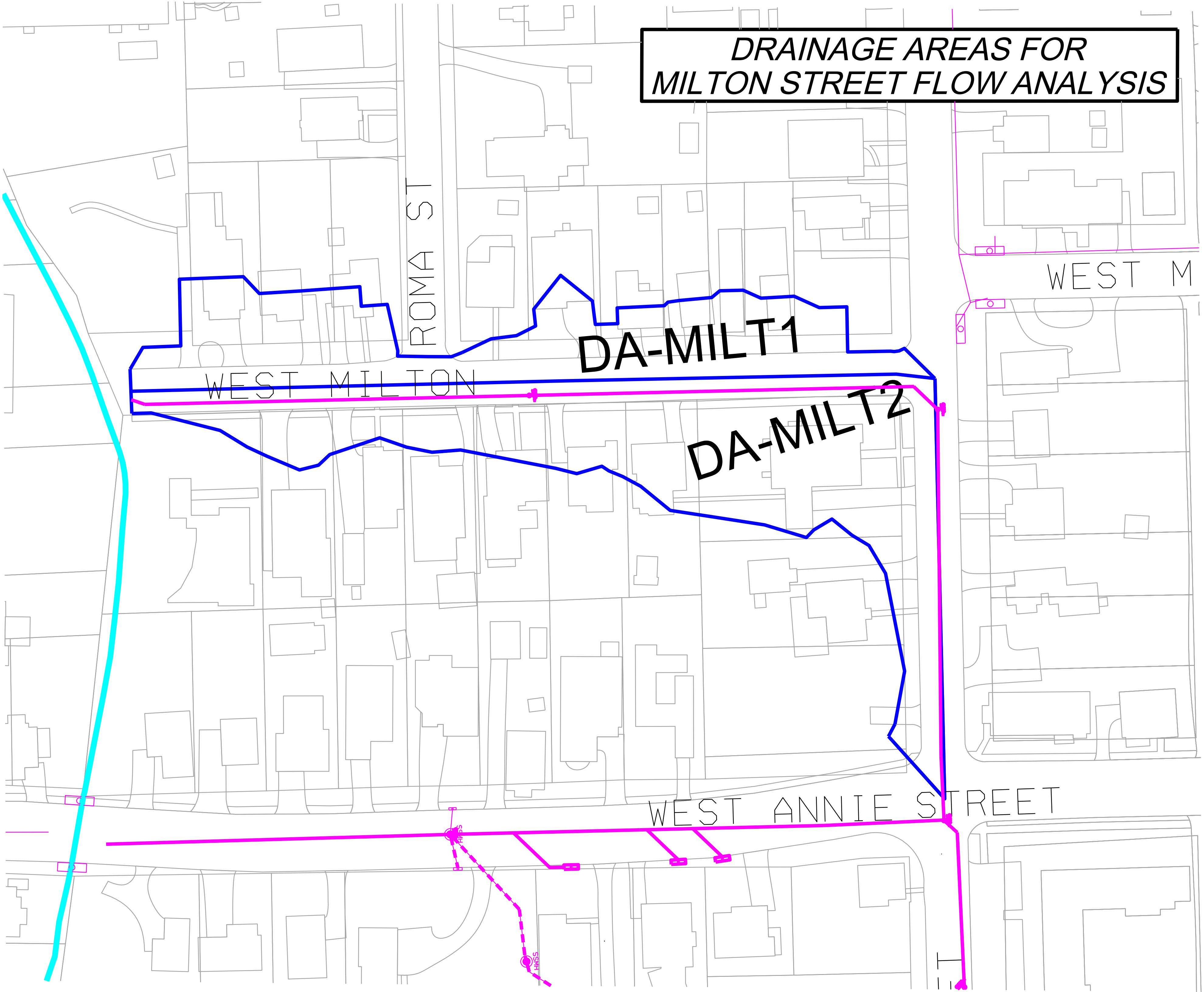
CHECKED BY *GIESEN* DATE *9-20-32* JOB NO. ____ SHEET NO. *433*

C. F. PEASE CO., CHICAGO

B

Exhibit K.8

Milton Street Flow Analysis


DRAINAGE AREAS FOR
MILTON STREET FLOW ANALYSIS
DA-MILT1
DA-MILT2
WEST MILTON
ROMA ST
WEST M
WEST ANNIE STREET

RUNOFF COMPUTATIONS (Ultimate Development Conditions for Existing System)

	25 Year Storm Event			100 Year Storm Event		
Drainage Area Number	Runoff Coefficient C25	Intensity I25	Design Flow Q25 (cfs)	Runoff Coefficient C100	Intensity I100	Design Flow Q100 (cfs)
DA-MILT1	0.78	10.11	4.73	0.87	12.54	6.54
DA-MILT2	0.78	10.11	7.71	0.87	12.54	10.66

	25-year		100-year
a=	82.9360	a=	118.3000
b=	10.7460	b=	13.1850
c=	0.7634	c=	0.7736

Ultimate Development Conditions for Existing System

CURB INLETS ON GRADE, Type G-1 OR Type G-3, parabolic crown

Equations in cell

(1) DCM EQ 2-1: Q_{peak} = CiA
(2) Total flow = sum of discharge from drainage area and carry over flow
(3) So = (high elev - low elev)/length
(4) See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
(5) DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
For DA-A26 only, use straight crown equation since the driveway does not have a parabolic crown: HEC-22 EQ 4-3: d = T * Sx
(6) Sx measured in Field by ESD 3-3-15 or 3-31-15
(7) For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
(8) measured in field, lidar or record drawing; see "Crown Height Calcs" tab
(9) Hec-22 EQ B-11: Yo = (2H/B)*x - $(H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
For DA-A26 only, use straight crown equation, HEC-22 EQ 4-2. If T calculated from HEC-22 EQ 4-2 is greater than B, use T=B
HEC-22 EQ 4-2: $T = [Qn / (Ku * Sx^{1.67} * SL^{0.5})]^{0.375}$; where n = 0.012 (HEC-22 Table 4-3) and Ku = 0.56
(10) Given in DCM EQ 4-10
(11) a_{DIG} was measured in the field by ESD or DIG Data consultants. a_{DIG} = (upstream curb height) - (depth from top of curb to inlet gutter)
(12) See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation
$a_{HEC22} = a_{DIG}$ - W*Sx
(13) DCM EQ 4-9: S'w = a_{HEC22} / (12*W)
(14) DCM EQ 4-9Sw = S'w + Sx
(15) HEC 22 EQ 4-4: For W < T, Eo = 1 / (1 + Sw/Sx/(((1 + Sw/Sx / (T/W))^2.67) - 1)); For T < W, Eo = 1
(16) DCM EQ 4-9: Se = Sx + S'w*Eo
(17) See DCM Table 2-2
(18) DCM EQ 4-10: $L_T = K_T$ * Q^0.42 * S_L^0.3 * [1/ (n*Se)]^0.6
(19) DCM EQ 4-8: E = 1 - [1 - (L/L_T)]^1.8
(20) DCM EQ 4-14: Qi = E * Q
(21) DCM EQ 4-15: Qb = Q - Qi

25 YEAR STORM

Equation in cell ==>				(1)	(2)				(3)									(4)			(5)		
DRAINAGE AREA	STREET NAME	DRAINAGE AREA	DRAINAGE AREA (ac.)	DISCHARGE FROM DRAINAGE AREA (cfs)	TOTAL RUNOFF (cfs) Q	Hig elev (ft)	low elev (ft)	length (ft)	SLOPE (ft/ft) $S_o = S_L$	Street Width (FOC-FOC) (ft) W	Curb Height (in)	Curb Height (ft)	CURB OPENING HEIGHT (in)	CURB OPENING HEIGHT (ft) h	Split (ft) CS	High or low gutter	K_o	K_1	K_2	K_3	WATER FLOW DEPTH (ft) Yo = d	Is Yo > 1.4*h?	Over Curb?
DA-MILT1	Milton St	DA-MILT1	0.60	4.73	4.73	532.00	510.00	543.60	0.0405	31.0	6.0	0.5	none	none	0.0	N/A	2.85	0.50	2.89	0	0.3078		**no**
DA-MILT2	Milton St	DA0MILT2	0.98	7.71	7.71				0.0405	31.0	6.0	0.5	none	none	0.0	N/A	2.85	0.50	2.89	0	0.3645		**no**

100 YEAR STORM

DRAINAGE AREA	STREET NAME	DRAINAGE AREA	DRAINAGE AREA (ac.)	DISCHARGE FROM DRAINAGE AREA (cfs)	TOTAL RUNOFF (cfs) Q	Hig elev (ft)	low elev (ft)	length (ft)	SLOPE (ft/ft) $S_o = S_L$	Street Width (FOC-FOC) (ft) W	Curb Height (in)	Curb Height (ft)	CURB OPENING HEIGHT (in)	CURB OPENING HEIGHT (ft) h	Split (ft) CS	High or low gutter	K_o	K_1	K_2	K_3	WATER FLOW DEPTH (ft) Yo = d	Is Yo > 1.4*h?	Over Curb?
DA-MILT1	Milton St	DA-MILT1	0.60	6.54	6.54				0.0405	31.0	6.0	0.5	none	none	0.0	N/A	2.85	0.50	2.89	0	0.3444		no
DA-MILT2	Milton St	DA-MILT2	0.98	10.66	10.66				0.0405	31.0	6.0	0.5	none	none	0.0	N/A	2.85	0.50	2.89	0	0.4079		no

Ultimate Development Conditions for Existing System

CURB INLETS ON GRADE, Type G-1 OR Type G-3, parabolic crown

Equations in cell

(1) DCM EQ 2-1: Q_{peak} = CiA
(2) Total flow = sum of discharge from drainage area and carry over flow
(3) So = (high elev - low elev)/length
(4) See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
(5) DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
For DA-A26 only, use straight crown equation since the driveway does not have a parabolic crown: HEC-22 EQ 4-3: d = T * Sx
(6) Sx measured in Field by ESD 3-3-15 or 3-31-15
(7) For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
(8) measured in field, lidar or record drawing; see "Crown Height Calcs" tab
(9) Hec-22 EQ B-11: Yo = (2H/B)*x - $(H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
For DA-A26 only, use straight crown equation, HEC-22 EQ 4-2. If T calculated from HEC-22 EQ 4-2 is greater than B, use T=B
HEC-22 EQ 4-2: $T = [Qn / (Ku * Sx^{1.67} * SL^{0.5})]^{0.375}$; where n = 0.012 (HEC-22 Table 4-3) and Ku = 0.56
(10) Given in DCM EQ 4-10
(11) a_{DIG} was measured in the field by ESD or DIG Data consultants. a_{DIG} = (upstream curb height) - (depth from top of curb to inlet gutter)
(12) See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation
$a_{HEC22} = a_{DIG}$ - W*Sx
(13) DCM EQ 4-9: S'w = a_{HEC22} / (12*W)
(14) DCM EQ 4-9Sw = S'w + Sx
(15) HEC 22 EQ 4-4: For W < T, Eo = 1 / (1 + Sw/Sx/(((1 + Sw/Sx / (T/W))^2.67) - 1)); For T < W, Eo = 1
(16) DCM EQ 4-9: Se = Sx + S'w*Eo
(17) See DCM Table 2-2
(18) DCM EQ 4-10: $L_T = K_T$ * Q^0.42 * S_L^0.3 * [1/ (n*Se)]^0.6
(19) DCM EQ 4-8: E = 1 - [1 - (L/L_T)]^1.8
(20) DCM EQ 4-14: Qi = E * Q
(21) DCM EQ 4-15: Qb = Q - Qi

25 YEAR STORM

Equation in cell ==>				(1)	(2)				(3)									(4)			(5)		
DRAINAGE AREA	STREET NAME	DRAINAGE AREA	DRAINAGE AREA (ac.)	DISCHARGE FROM DRAINAGE AREA (cfs)	TOTAL RUNOFF (cfs) Q	Hig elev (ft)	low elev (ft)	length (ft)	SLOPE (ft/ft) $S_o = S_L$	Street Width (FOC-FOC) (ft) W	Curb Height (in)	Curb Height (ft)	CURB OPENING HEIGHT (in)	CURB OPENING HEIGHT (ft) h	Split (ft) CS	High or low gutter	K_o	K_1	K_2	K_3	WATER FLOW DEPTH (ft) Yo = d	Is Yo > 1.4*h?	Over Curb?
DA-MILT1	Milton St	DA-MILT1	0.60	4.73	4.73	532.00	510.00	543.60	0.0405	31.0	6.0	0.5	none	none	0.0	N/A	2.85	0.50	2.89	0	0.3078		**no**
DA-MILT2	Milton St	DA0MILT2	0.98	7.71	7.71				0.0405	31.0	6.0	0.5	none	none	0.0	N/A	2.85	0.50	2.89	0	0.3645		**no**

100 YEAR STORM

DRAINAGE AREA	STREET NAME	DRAINAGE AREA	DRAINAGE AREA (ac.)	DISCHARGE FROM DRAINAGE AREA (cfs)	TOTAL RUNOFF (cfs) Q	Hig elev (ft)	low elev (ft)	length (ft)	SLOPE (ft/ft) $S_o = S_L$	Street Width (FOC-FOC) (ft) W	Curb Height (in)	Curb Height (ft)	CURB OPENING HEIGHT (in)	CURB OPENING HEIGHT (ft) h	Split (ft) CS	High or low gutter	K_o	K_1	K_2	K_3	WATER FLOW DEPTH (ft) Yo = d	Is Yo > 1.4*h?	Over Curb?
DA-MILT1	Milton St	DA-MILT1	0.60	6.54	6.54				0.0405	31.0	6.0	0.5	none	none	0.0	N/A	2.85	0.50	2.89	0	0.3444		no
DA-MILT2	Milton St	DA-MILT2	0.98	10.66	10.66				0.0405	31.0	6.0	0.5	none	none	0.0	N/A	2.85	0.50	2.89	0	0.4079		no

Exhibit K.9

Structural Analysis of Annie Street and Mary Street Bridges and Record Drawings

Dube, Kiersten

From: Moin, Pirouz
Sent: Wednesday, August 05, 2015 1:33 PM
To: Dube, Kiersten
Cc: Massie-Gore, Jennifer; Odufuye, Adewale
Subject: RE: Annie Street and Mary Street Culvert bridges

Kiersten,
I concur – that mostly captures the highlights.
Please let me know if you need additional details.

Pirouz Moin, P.E. | Supervising Engineer | Infrastructure Management Group |
Office of the City Engineer | Public Works Department | City of Austin | Phone: 512-974-8769

From: Dube, Kiersten
Sent: Wednesday, August 05, 2015 11:43 AM
To: Moin, Pirouz
Cc: Massie-Gore, Jennifer; Odufuye, Adewale
Subject: Annie Street and Mary Street Culvert bridges

Hi Pirouz,

Thanks so much for meeting with us this morning. Here is a summary of my notes from the meeting. Please let me know if this is accurate or if you have any revisions.

1. Annie Street and Mary Street culvert bridges (over East Bouldin Creek) are based on the same design, although some elevations are different.

2. One 42" storm drain through the Annie Street culvert bridge with invert matched to existing invert works, but structural support must be added to the backfill side of the bridge.

3. One 48" storm drain through the Annie Street bridge or Mary Street culvert bridge would most likely work, although more structural engineering investigation is needed. The bridge support would need to be larger.
    a. For roughly estimating the cost of structural support/footing for a 48" line, add 2' width to the 42" support detail and continue the support up to the top of the culvert.

4. If a 36" storm drain is proposed, additional structural support for the culvert bridge is not needed, but at least one length of pipe needs to be properly supported. This is to prevent the pipe from settling differently from the culvert and breaking the joint between bridge and pipe.

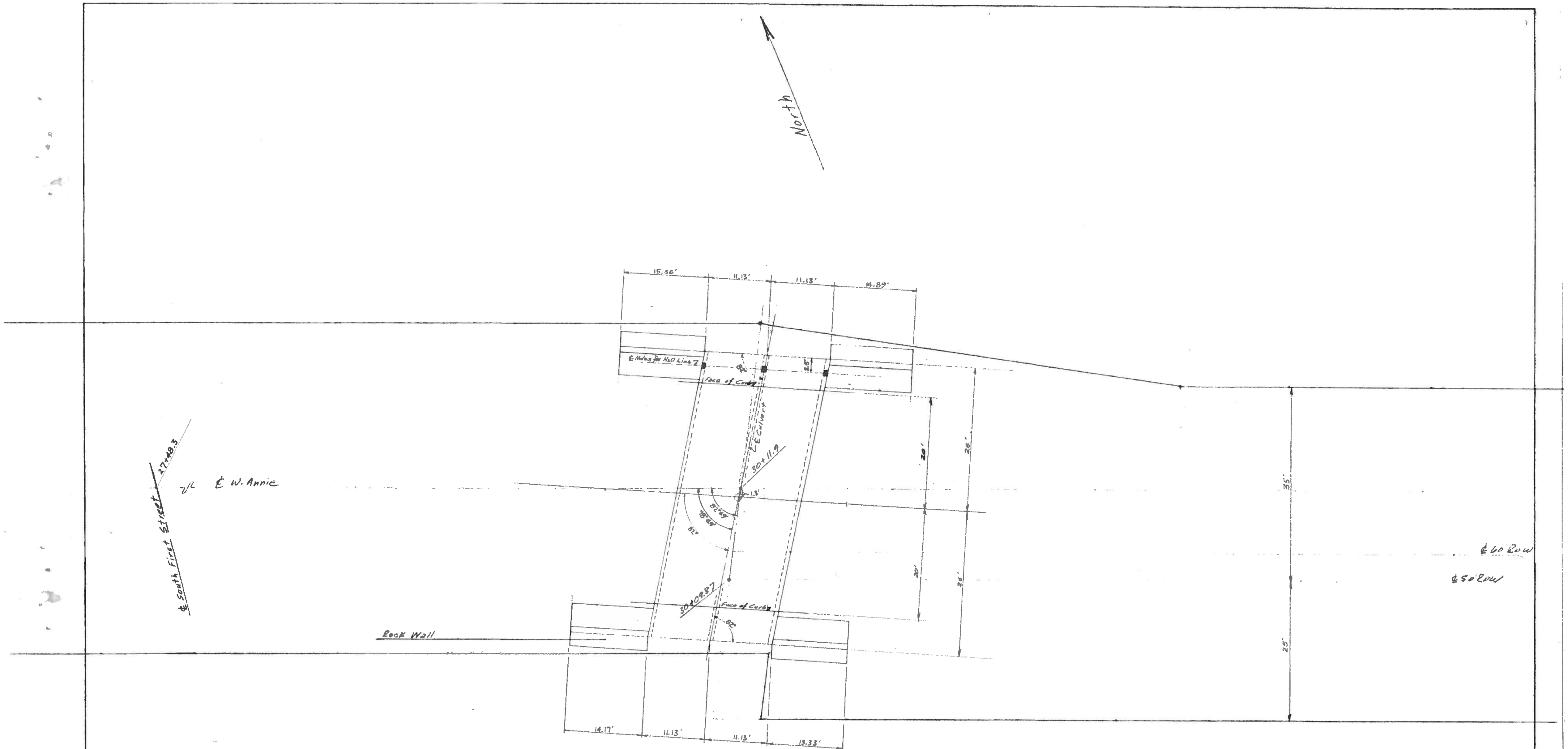
5. Two 36" pipes through the bridge is possible, but they must be far enough apart so the load calculations are separate (approximately 8-10').

    a. A very large bridge support would be necessary for two pipes through the bridge.

6. Pirouz is willing to look at Crockett Street and Milton Street outfalls. Although these streets do not have bridges, the proposed outfall pipes penetrate retaining walls.

Thank you,

Kiersten Dube
Project Coordinator
City of Austin
Engineering Services Division
512.974.7134
kiersten.dube@austintexas.gov



Elevations will be as shown on plan sheets 5A 417 a & b.

Sketch showing change in location of culvert in E. Bouldin Creek @ W. Annie St.

The entire structure, without changing originally planned skew angle & positions of wingwalls in relation to the barrel, was moved 1.8' south from old ℄ Annie west of creek & rotated axis of culvert 4° ⟲.

This change is due to originally planned ROW not being acquired.

L.T.M. & B.F.P. 2-9-60

Field Book	Page
2255	72
2422	22

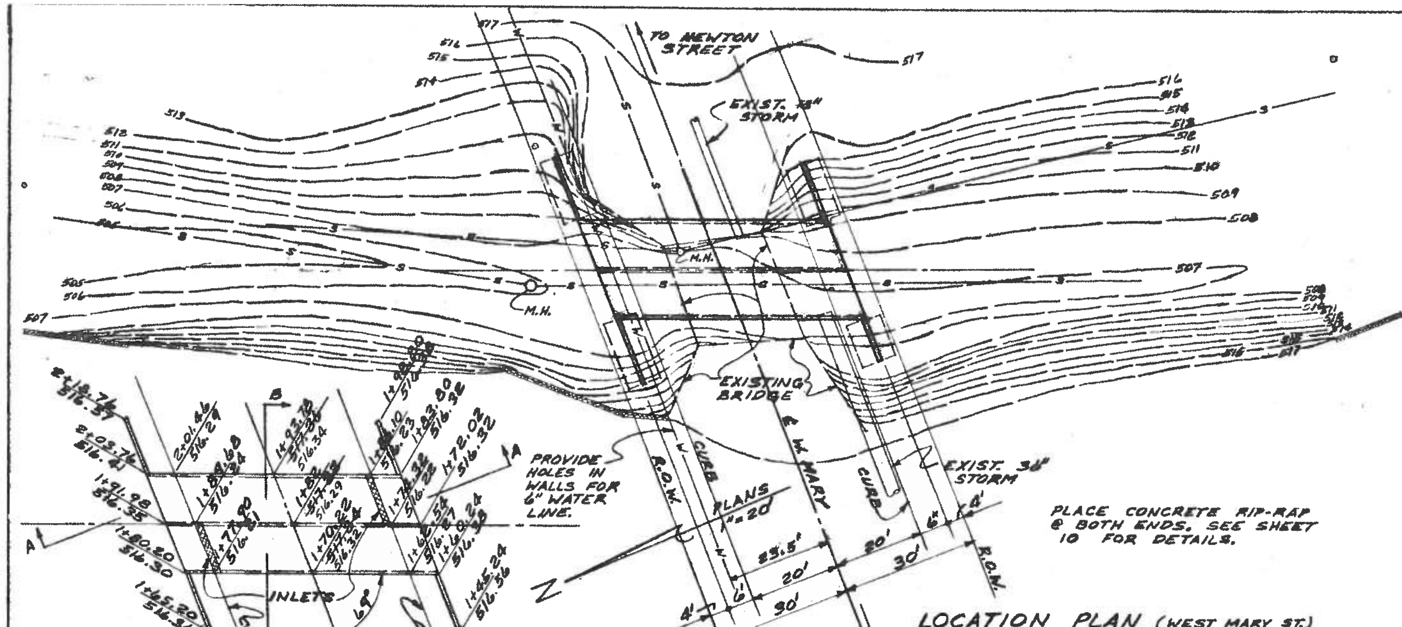
Scale: 1" = 10'

Sheet 1a of 10

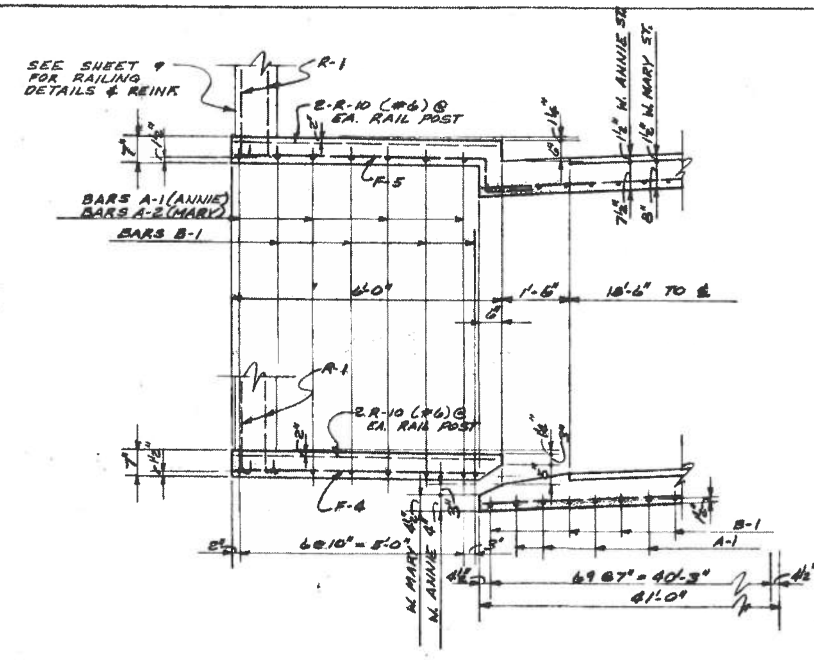
Cab.	Draw	No.
5	A	417 k

5-A
351-450
Drawer
2nd Half
- For Refile -

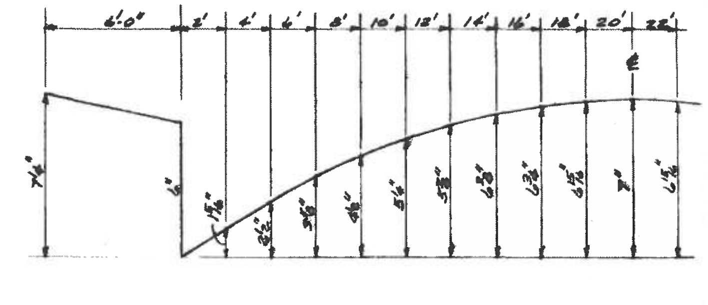
Trim Line



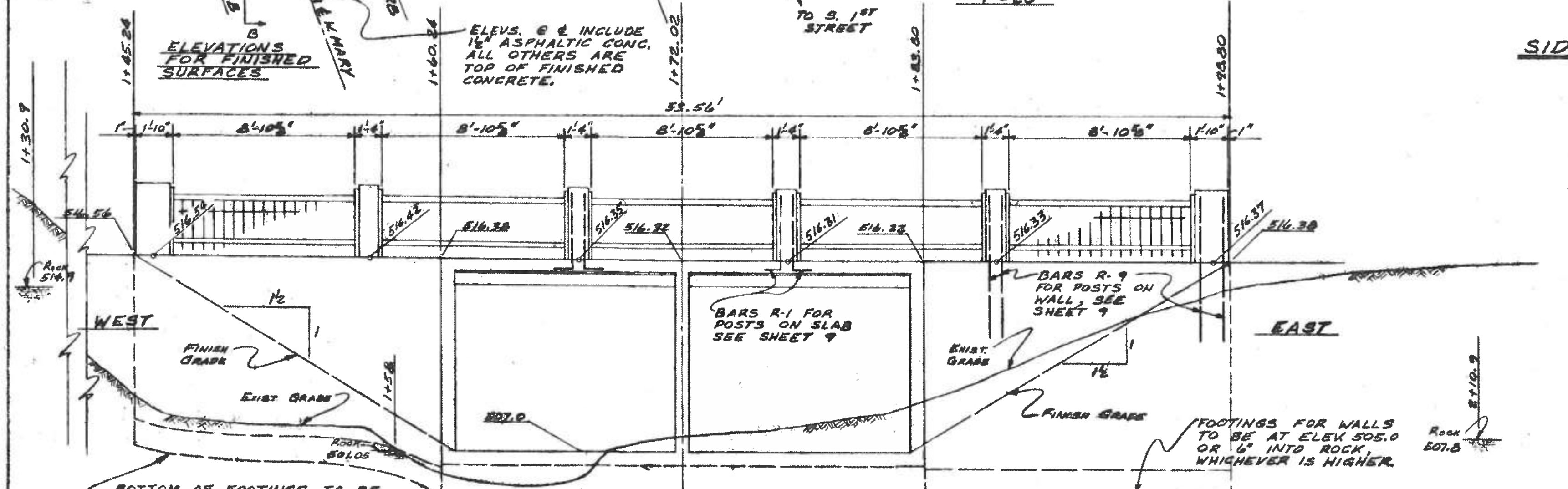
LOCATION PLAN (WEST MARY ST.)
1" = 20'



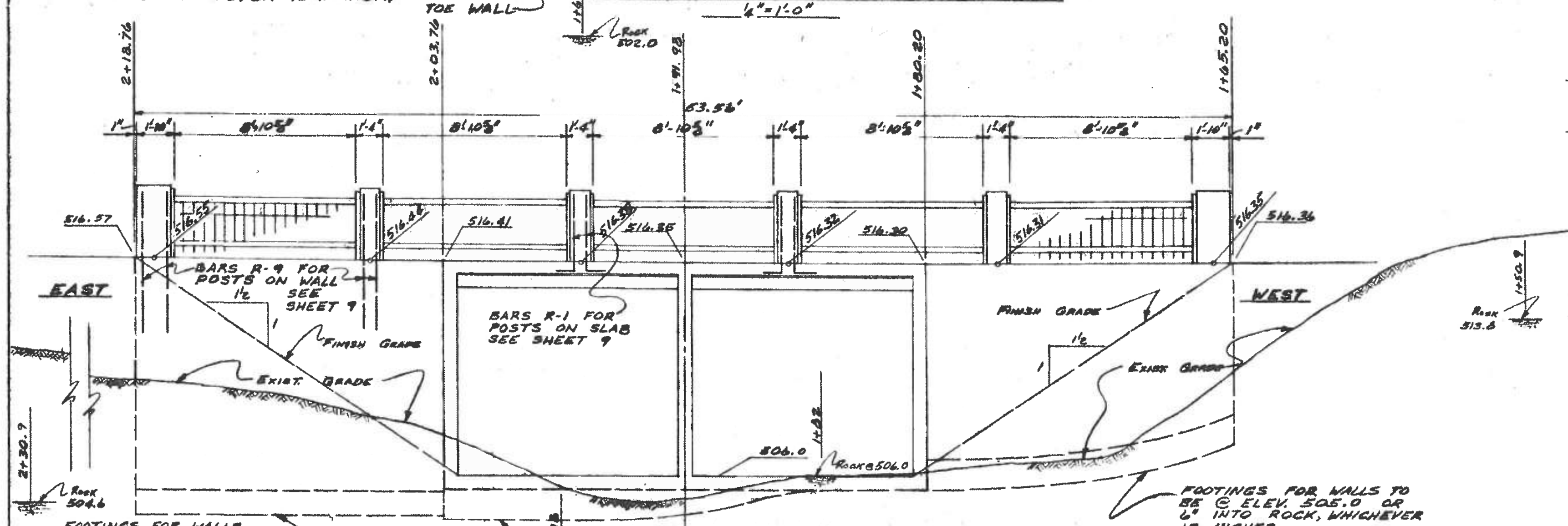
SIDEWALK, CURB & INLET DETAILS
½" = 1'-0"



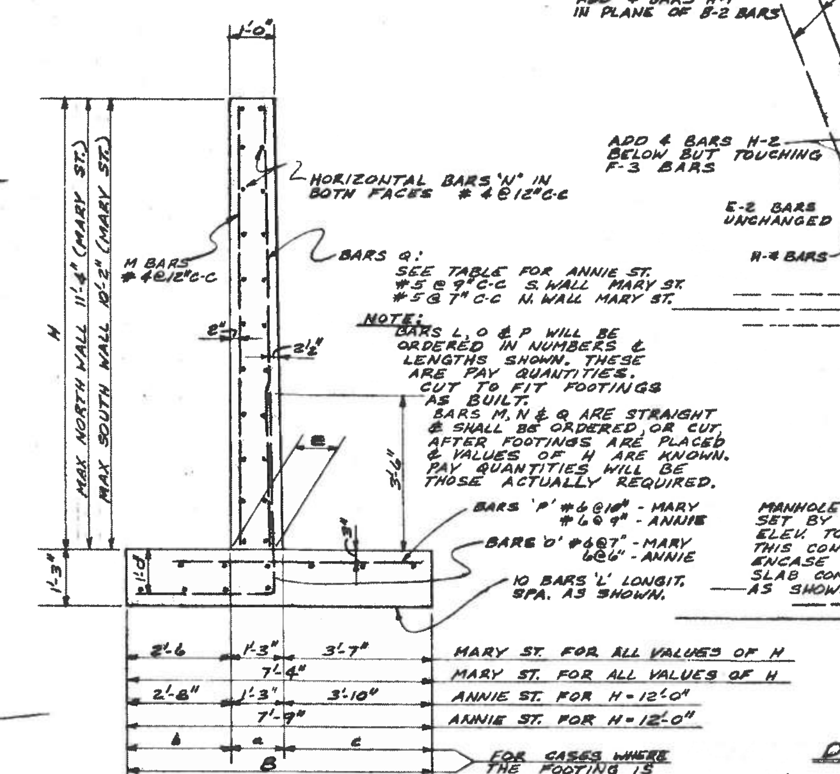
ROADWAY CROWN
SCALE: ¼" = 1'-0" HORIZ. 3" = 1'-0" VERT.



SOUTH ELEVATION (WEST MARY ST.)
¼" = 1'-0"



NORTH ELEVATION (WEST MARY ST.)
¼" = 1'-0"

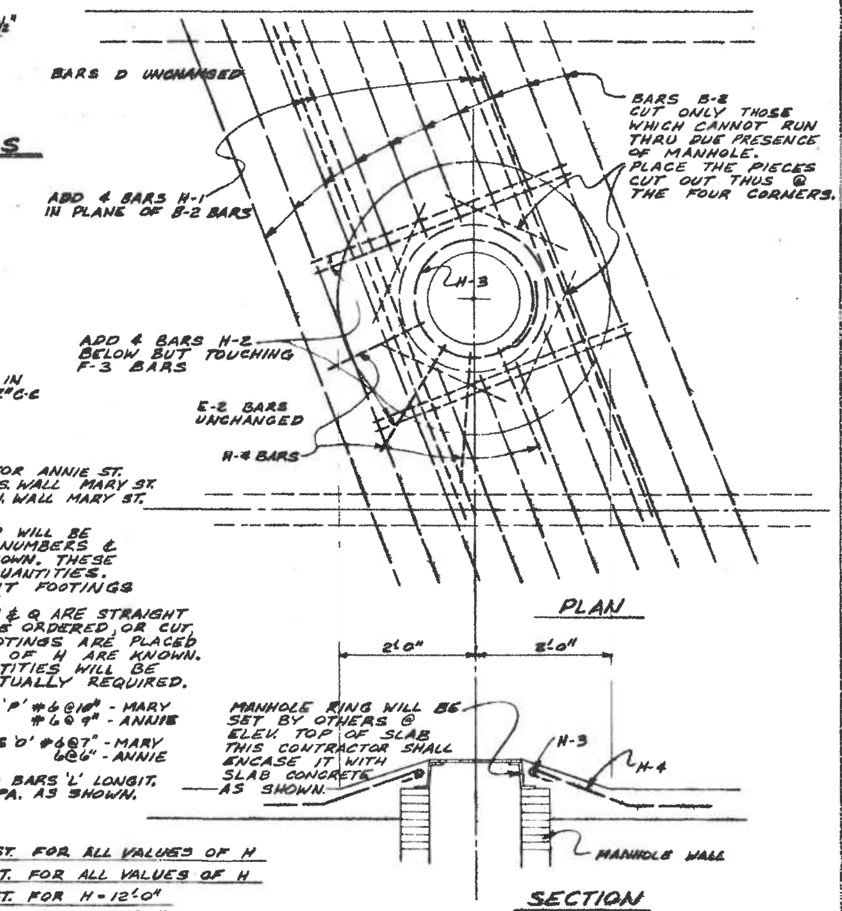


TYPICAL WINGWALL SECTION
½" = 1'-0"

FOR CASES WHERE THE FOOTING IS SEATED ON ROCK & WHERE H IS LESS THAN 12', USE THE TABLE BELOW FOR FOOTING DIMENSIONS. (ANNIE ST. ONLY)

FOR ANNIE ST. ONLY, FOR DIFFERENT VALUES OF H:

TABLE OF FOOTING DIMENSIONS & WALL REINF.						
H	= OR > 7'	8'	9'	10'	11'	12'
a	1'-0"	1'-1"	1'-1½"	1'-2"	1'-2½"	1'-3"
b	1'-9"	2'-0"	2'-2"	2'-4"	2'-6"	2'-8"
c	2'-5"	2'-8"	2'-11½"	3'-3½"	3'-7"	3'-10"
B	5'-2"	5'-9"	6'-3"	6'-9½"	7'-3½"	7'-9"
Z	9½"	10½"	11"	11½"	1'-0"	1'-0½"
Q Bars	#4@12"	#4@12"	#4@10"	#5@9"	#5@8"	#5@6"



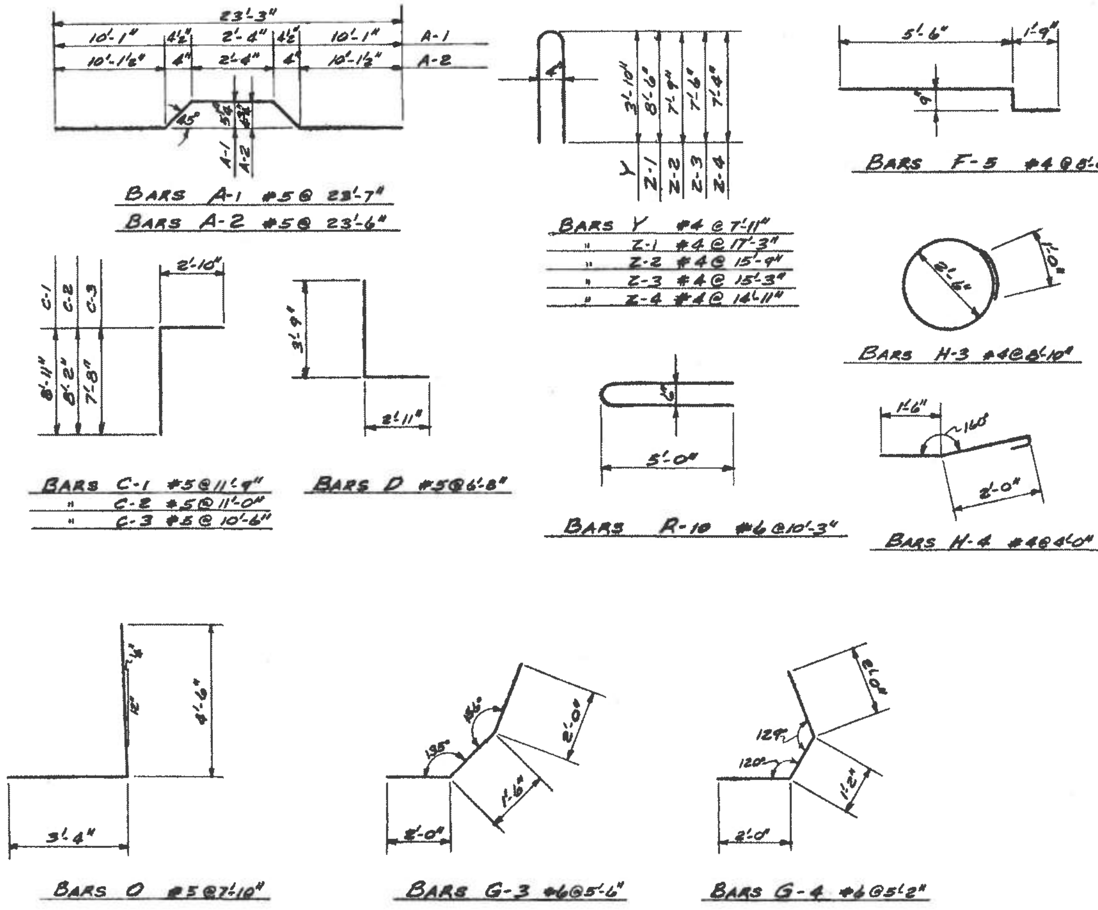
DETAILS OF BOTTOM SLAB AT SAN. SEWER MAN-HOLE
WEST MARY ST. ONLY
½" = 1'-0"

CONTRACT 60-D-1

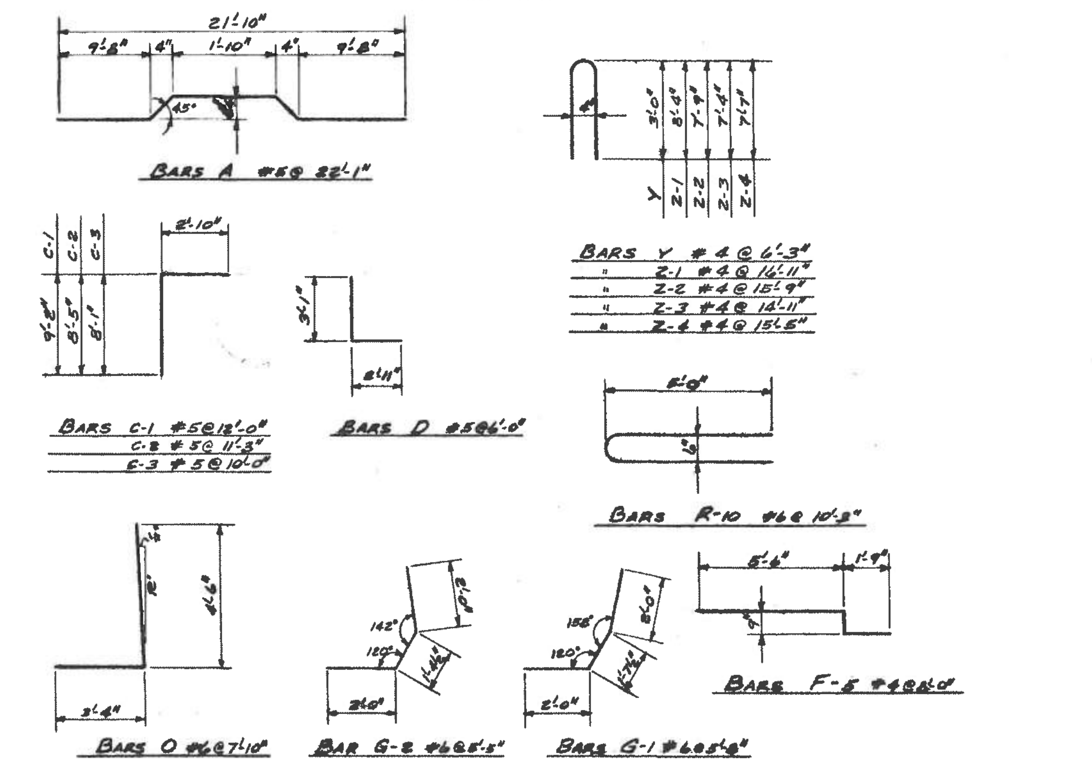
CITY OF AUSTIN, TEXAS
DEPARTMENT OF PUBLIC WORKS

WEST MARY ST. & WEST ANNIE ST. BRIDGES @ E. BOULDIN CREEK 2 of 3

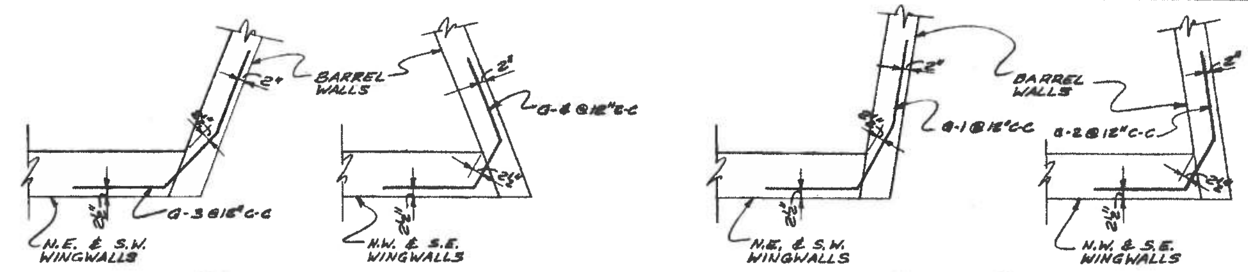
Scale AS NOTED
Design by P.V.R
Drawn by F.A.S
Checked by R.V.R 1-18-60
Grades by
See Folder File:
Approved: Director of Public Works
Date 3-7-60
Fd Bk: 2255 78,79; 2027 53; 2325 43; 2117 33; 1818 2
Sheet 2 of 10
Cab. 5 Drw. A Number 417 b



BAR BENDING DIAGRAMS W. MARY ST.
NO SCALE



BAR BENDING DIAGRAMS W. ANNIE ST.
NO SCALE



BARREL TO WINGWALL CONN. DTLS.
$\frac{1}{2}$" = 1'-0"

QUANTITIES:	W. ANNIE	W. MARY
CONCRETE	127.8 C.Y.	141.5 C.Y.
REINF. STEEL	16,649 LBS	17,651 LBS
CONC. RIP-RAP	8.4 C.Y.	9.2 C.Y.
UNCLASSIFIED EXCAV.	161 C.Y.	189 C.Y.
STD. BRIDGE RAIL	~~107.9~~ 101.9 FT.	406.8 FT.
EARTH EMBANKMENT	581 C.Y.	293 C.Y.
18" CONC. PIPE	—	4 FT.
36" CONC. PIPE	23 FT.	17 FT.

WEST MARY ST. - BARREL

	MARK	SHAPE	NO.	SIZE	SPA.	LENGTH	WEIGHT	LOCATION
	A-1	⌒	35	5	14"	23'-7"	861	ROADWAY SLAB TRANS.
	A-2	⌒	8	5	SHOWN	23'-6"	196	SIDEWALK SLAB LONGIT.
	B-1	—	43	5	14"	23'-3"	1042	ROADWAY SLAB TRANS. & SIDEWALK SLAB LONGIT.
	B-2	—	63	5	10"	23'-3"	1528	BOT. SLAB TRANS.
	C-1	┌	16	5	8"	11'-9"	196	O.S. WALLS AS SHOWN
	C-2	┌	118	5	8"	11'-0"	1354	"
	C-3	┌	32	5	8"	10'-6"	351	"
	D	└	166	5	8"	6'-8"	1155	O.S. WALLS @ BOT. SLAB
	E-1	—	45	6	14"	5'-8"	383	TOP SLAB TRANS. @ I.S. WALL
	E-2	—	78	6	8"	6'-0"	703	BOT. SLAB TRANS. @ I.S. WALL
*	F-1	—	27	4	SHOWN	57'-1"	1030	TOP SLAB LONGIT.
*	F-2	—	33	4	18"	57'-1"	1258	WALLS HORIZ.
*	F-3	—	27	4	SHOWN	57'-1"	1030	BOT. SLAB LONGIT.
	F-4	—	22	4	12	5'-6"	81	WALKS @ INLET - TRANS.
	F-5	⌐	26	4	12	8'-0"	139	WALKS @ CURB - TRANSV.
	G-3	THESE BARS LISTED WITH WINGWALL STEEL						
	G-4	THESE BARS LISTED WITH WINGWALL STEEL						
	H-1	—	4	6	SHOWN	12'-0"	72	BOTTOM SLAB
	H-2	—	4	6	SHOWN	6'-0"	36	ABOUT THE
	H-3	○	1	4	"	8'-10"	6	MANHOLE COVER
	H-4	⌒	8	4	"	4'-0"	21	AS SHOWN
	M-1	—	6	4	18"	9'-9"	39	O.S. WALL VERT.
	M-2	—	38	4	18"	9'-2"	233	IN I.S. FACE @
	M-3	—	14	4	18"	8'-0"	75	LOCATIONS SHOWN
	R-10	⊏	8	6	SHOWN	10'-3"	123	WALK SLAB TRANS. @ POSTS
	Y	U	56	4	12"	7'-11"	296	CTR. WALL-VERT. @ BOT. SLAB
	Z-1	∩	6	4	12"	17'-3"	69	CENTER WALL VERT.
	Z-2	∩	34	4	12"	15'-9"	358	INTO TOP SLAB
	Z-3	∩	6	4	12"	15'-3"	61	@ LOCATIONS
	Z-4	∩	11	4	12"	14'-11	110	SHOWN
					TOTAL		12,806	

WEST MARY ST. - ONE NORTH WINGWALL - TWO REQ'D

MARK	SHAPE	NO.	SIZE	SPA.	LENGTH	WEIGHT	LOCATION
L	—	10	4	SHOWN	14'-8"	98	FOOTINGS - LONGIT.
M-1	—	15	4	12"	11'-0"	110	FRONT FACE-VERT
N	—	22	4	12"	14'-8"	215	BOTH FACES HORIZ
O	┘	26	6	7"	7'-10"	306	FOOTING TO WALL
P	—	18	6	10"	5'-10"	158	FOOTING-TOP REAR-TRANS.
Q-1	—	26	5	7"	11'-0"	298	REAR FACE-VERT.
G-3	┘	11	6	12"	5'-6"	91	N.E. WALL TO BARREL WALL
G-4	┘	11	6	12"	5'-2"	85	N.W. WALL TO BARREL WALL
TOTAL FOR TWO WALLS						2546	

WEST MARY ST. - ONE SOUTH WINGWALL - TWO REQ'D

MARK	SHAPE	NO.	SIZE	SPA.	LENGTH	WEIGHT	LOCATION
L	—	10	4	SHOWN	14'-8"	98	FOOTING - LONGIT.
M-2	—	15	4	12"	10'-0"	100	FRONT FACE-VERT.
N	—	20	4	12"	14'-8"	198	BOTH FACES HORIZ.
O	┘	26	6	7"	7'-10"	306	FOOTING TO WALL
P	—	18	6	10"	5'-10"	158	FOOTING-TOP REAR-TRANSV.
Q-2	—	20	5	9"	10'-0"	209	REAR FACE VERT.
G-3	┘	10	6	12"	5'-6"	83	S.W. WALL TO BARREL WALL
G-4	┘	10	6	12"	5'-2"	78	S.E. WALL TO BARREL WALL
TOTAL FOR TWO WALLS						2299	

WEST ANNIE ST. - BARREL

	MARK	SHAPE	NO.	SIZE	SPA.	LENGTH	WEIGHT	LOCATION
	A	⌒	43	5	SHOWN	22'-1"	990	ROADWAY SLAB TRANS. SIDEWALK SLAB LONGIT.
	B-1	—	43	5	SHOWN	21'-10"	979	"
	B-2	—	63	5	10"	21'-8"	1424	BOT. SLAB-TRANS.
	C-1	┌	16	5	8"	12'-0"	200	O.S. WALLS AS SHOWN
	C-2	┌	124	5	8"	11'-3"	1455	"
	C-3	┌	18	5	8"	10'-11"	205	"
	D	└	158	5	8"	6'-0"	989	O.S. WALLS @ BOT. SLAB
	E-1	—	45	6	14"	5'-8"	383	TOP SLAB-TRANS. @ I.S. WALL
	E-2	—	78	6	8"	6'-0"	703	BOT. SLAB-TRANS. @ I.S. WALL
*	F-1	—	27	4	SHOWN	54'-0"	974	TOP SLAB LONGIT.
*	F-2	—	33	4	"	54'-0"	1190	WALLS HORIZ.
*	F-3	—	27	4	"	54'-0"	974	BOT. SLAB LONGIT.
	F-4	—	20	4	12"	5'-6"	73	WALK SLAB @ INLET-TRANS.
	F-5	—	24	4	12"	8'-0"	128	WALK SLAB @ CURB-TRANS.
	G-1	THESE BARS LISTED WITH WINGWALL STEEL						
	G-2	THESE BARS LISTED WITH WINGWALL STEEL						
	M-1	—	8	4	18"	9'-3"	49	O.S. WALL VERT.
	M-2	—	48	4	18"	8'-6"	272	IN I.S. FACE
	M-3	—	8	4	18"	8'-0"	43	@ LOCATIONS
	M-4	—	8	4	18"	8'-4"	44	SHOWN
	R-10	⊏	8	6	SHOWN	10'-2"	123	WALK SLAB TRANS. @ POSTS
	Y	U	54	4	12"	6'-3"	225	CTR. WALL @ BOT. SLAB VERT.
	Z-1	∩	6	4	12"	16'-11"	68	CENTER WALL
	Z-2	∩	36	4	12"	15'-9"	379	VERT. INTO TOP
	Z-3	∩	6	4	12"	14'-11"	60	SLAB @
	Z-4	∩	6	4	12"	15'-5"	62	LOCATIONS SHOWN
					TOTAL		11,998	

WEST ANNIE ST. - N.E. WINGWALL

MARK	SHAPE	NO.	SIZE	SPA.	LENGTH	WEIGHT	LOCATION
L1	—	10	4	SHOWN	14'-6"	97	FOOTING - LONGIT.
M	—	15	4	12"			FRONT FACE VERT.
N	—		4	12"	14'-6"		BOTH FACES HORIZ.
O	┘	30	6	6"	7'-10"	353	FOOTING TO WALL
P	—	20	6	9"	5'-8"	170	FOOTING-TOP REAR-TRANSV.
Q	—		SEE	TABLE			REAR FACE-VERT.
G-1	┘	11	6	12"	5'-8"	94	CORNER-WALL TO BARREL
							EST. TOTAL 1217#

WEST ANNIE ST. - N.W. WINGWALL

MARK	SHAPE	NO.	SIZE	SPA.	LENGTH	WEIGHT	LOCATION
L2	—	10	4	SHOWN	15'-0"	100	FOOTING LONGIT.
M	—	15	4	12"			FRONT FACE VERT.
N	—		4	12"	15'-0"		BOTH FACES HORIZ.
O	┘	31	6	6"	7'-10"	365	FOOTING TO WALL
P	—	20	6	9"	5'-8"	170	FOOTING-TOP REAR-TRANSV.
Q	—		SEE	TABLE			REAR FACE VERT.
G-2	┘	9	6	12"	5'-8"	73	CORNER WALL TO BARREL
							EST. TOTAL 1217#

WEST ANNIE ST. - S.E. WINGWALL

MARK	SHAPE	NO.	SIZE	SPA.	LENGTH	WEIGHT	LOCATION
L	—	10	4	SHOWN	13'-0"	87	FOOTING - LONGIT
M	—	13	4	12"			FRONT FACE - VERT.
N	—		4	12"	13'-0"		BOTH FACES - HORIZ.
O	┘	27	6	6"	7'-10"	318	FOOTING TO WALL
P	—	18	6	9"	5'-8"	153	FOOTING-TOP REAR-TRANS.
Q	—		SEE	TABLE			REAR FACE - VERT.
G-2	┘	8	6	12"	5'-5"	65	CORNER-WALL TO BARREL
							EST. TOTAL 1072#

WEST ANNIE ST. - S.W. WINGWALL

MARK	SHAPE	NO.	SIZE	SPA.	LENGTH	WEIGHT	LOCATION
L	—	10	4	SHOWN	16'-0"	107	FOOTING - LONGIT.
M	—	14	4	12"			FRONT FACE - VERT.
N	—		4	12"	13'-9"		BOTH FACES HORIZ.
O	┘	28	6	6"	7'-10"	329	FOOTING TO WALL
P	—	19	6	9"	5'-8"	162	FOOTING-TOP REAR-TRANS.
Q	—		SEE	TABLE			REAR FACE - VERT.
G-1	┘	9	6	12"	5'-8"	76	CORNER-WALL TO BARREL
							EST. TOTAL 1151 #

* LENGTH INCLUDES 1'-8" FOR ONE LAP

NOTE:
FIGURES FOR BLANK SPACES IN BAR LISTS ARE TO BE SUPPLIED AFTER FOOTINGS ARE IN PLACE. THE PAY QUANTITIES WILL THEN BE COMPUTED ON THE BASIS OF THIS ADDITIONAL INFORMATION.

GENERAL NOTES FOR THE BRIDGES ON W. MARY ST., W. ANNIE ST. & W. ELIZABETH ST.:

DIMENSIONS ON THE BAR BENDING DETAILS ARE OUT-TO-OUT OF BARS; DIMENSIONS OR SPACINGS ON THE DRAWINGS ARE TO CENTERS OF BARS (SEE SPECS.).

SLAB BOLSTERS & BAR CHAIRS ARE REQUIRED FOR THE SUPPORT OF REINFORCING BARS IN THE SLABS (SEE SPECS.). BOLSTERS 1" HIGH SHALL BE USED WHERE THE DETAILS SHOW 1½" FROM FACE OF CONCRETE TO CENTER OF BARS. LEGS OF THESE BOLSTERS & CHAIRS SHALL BE GALVANIZED TO PREVENT RUST SPOTS.

THE CONTRACTOR SHALL CHECK THE BENDING DETAILS & THE BAR LISTS & BE RESPONSIBLE FOR THEIR ACCURACY. HE SHALL SUBMIT HIS SHOP DRAWINGS IN TRIPLICATE FOR APPROVAL & SHALL NOT START FABRICATION FOR ANY STRUCTURE UNTIL THE ENGINEER HAS APPROVED THE SHOP DRAWINGS.

CONCRETE SHALL DEVELOP A COMPRESSIVE STRENGTH @ 28 DAYS OF 3500 POUNDS PER SQUARE INCH (SEE SPECS.).

EARTHWORK, WITH 1½ TO 1 SIDE SLOPES, SHALL BE MADE TO PROVIDE A COMPACTED SUBGRADE TO FULL CROWN WIDTH READY FOR THE INSTALLATION OF PAVING BY OTHERS.

CONTRACT 60-D-1

AUSTIN, TEXAS
DEPARTMENT OF PUBLIC WORKS

WEST MARY ST. & WEST ANNIE ST. BRIDGES @ E. BOULDIN CREEK 3 of 3

Scale NO SCALE
by P.V.P.
Drawn by F.A.S.
Checked by P.V.P.
Grades by

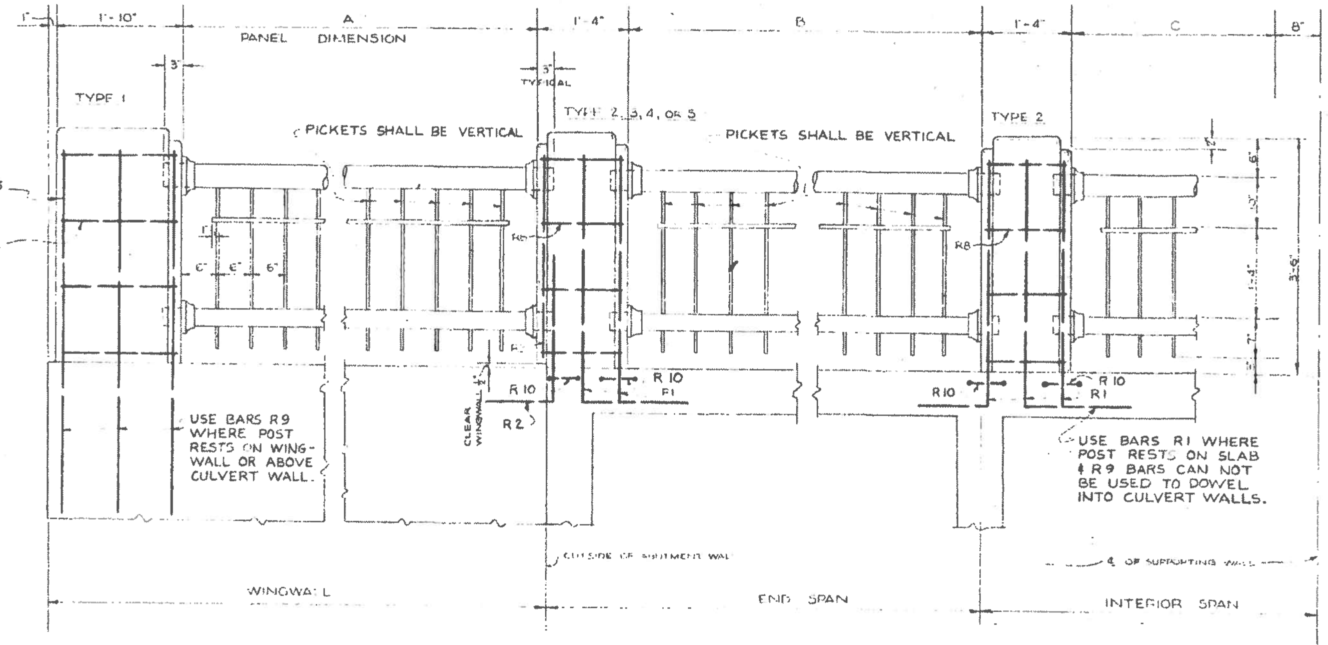
F.B.	
2255	72,79
2027	53
2325	43
2117	33
1818	2

Sheet 3 of 10

Approved: [signature]
Director of Public Works

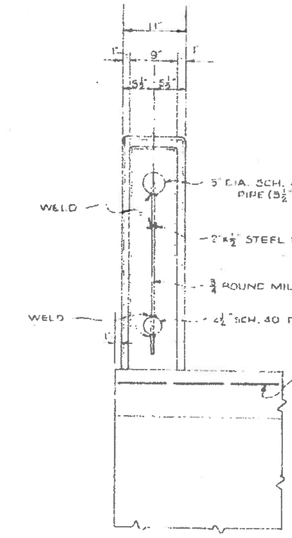
Cab.	Drawer	Number
5	A	417c

4



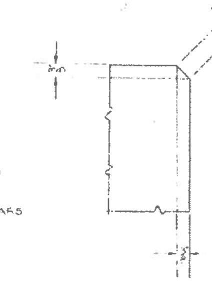
TYPICAL ELEVATION
1" = 1'-0"

NOTE: LENGTH OF PIPE EQUALS PANEL DIMENSION PLUS 6".

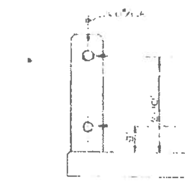


SECTION

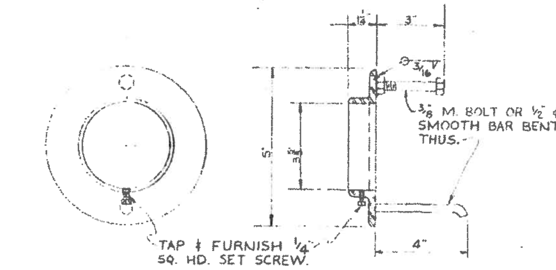
TYPICAL OF ALL POSTS



CHAMFER



DESIGN FORCES ON RAIL

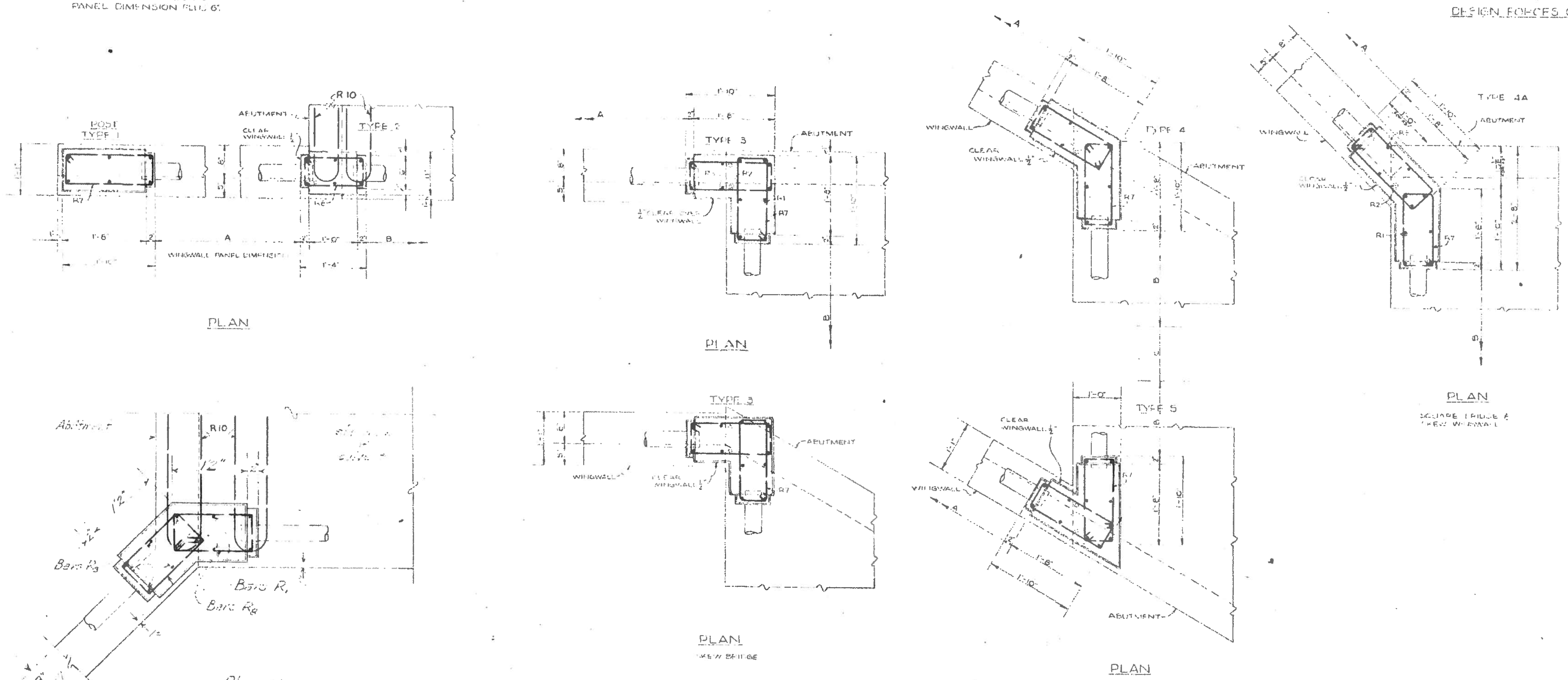


PIPE FLANGE

THIS MAY BE A WELDMENT MADE OF ¼" PLATE OR OF 1¼" × 1¼" × ¼" L, OR IT MAY BE A MALLEABLE CASTING 5/16" MIN. THICKNESS.

NOTE:

1. ALL EXPOSED METAL SHALL BE GIVEN ONE PROTECTIVE COAT OF RED LEAD AND TWO COATS OF ALUMINUM PAINT.
2. FACE OF CONCRETE POSTS SHALL BE GIVEN CARBORUNDUM STONE RUBBED FINISH.
3. THIS DESIGN IS NOT TO BE USED WHEN PANEL DIMENSION (A, B, OR C) EXCEEDS 10'-0".



END POSTS

BAR SCHEDULE

MARK	NO	SIZE	LENGTH	BENT	USE IN TYPE
R1		#5	4'-7"		1 TO 5
R2		#5	3'-2"		2 TO 5
R3		#5	3'-0"	STRAIGHT	2 TO 5
R10		#6	10'-0"	4'-10½" OR TO SUIT WIDTH OF WALK	1 TO 5
R7		#2	4'-3"	1'-8"	1, 3, 4 & 5
R8		#2	3'-3"	1'-2"	2
R9		#6	6'-6"		

CONTRACT No. -D-

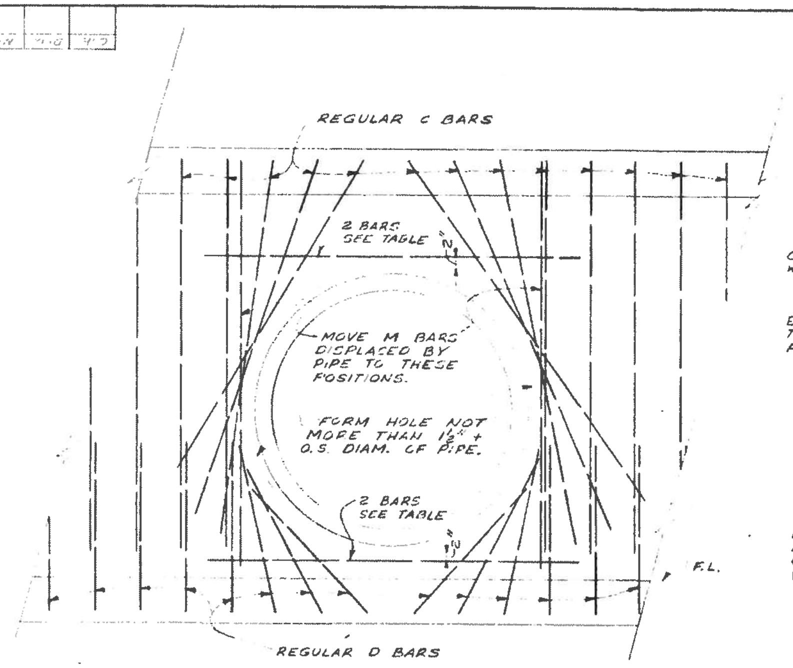
CITY OF AUSTIN, TEXAS
DEPARTMENT OF PUBLIC WORKS

BRIDGE RAIL STANDARDS

Scale AS SHOWN
Designed by LEWALLEN
Drawn by
Checked by
Date 1-23-58

Approved [signature] Director of Public Works

Sheet 9 of 10 Sheets
Cab.	Draw.	Number
5	A	417 i



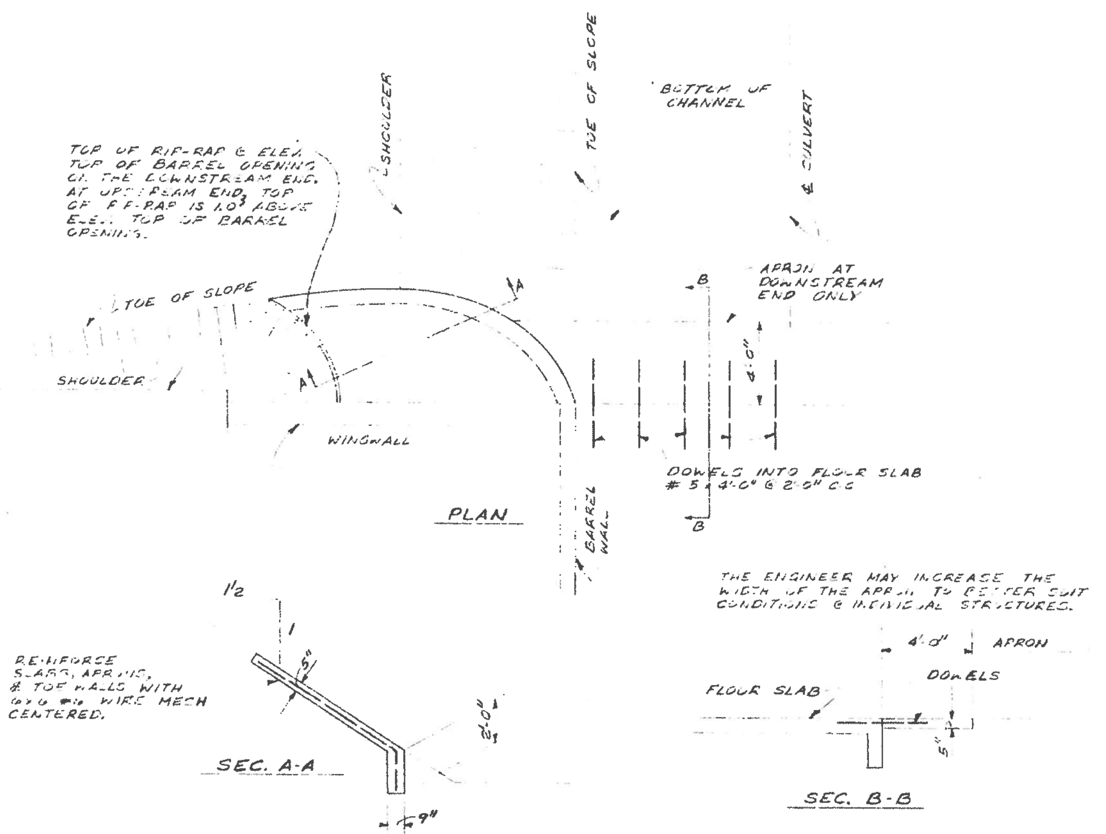
CUT HORIZONTAL BARS WITHOUT DISPLACING THEM.

EXTRA BARS SUBSIDIARY TO CONCRETE PIPE ITEM FOR PAYMENT:

FOR	60" ϕ	—	4 #7 x 7'-0"
"	54" ϕ	—	4 #7 x 6'-6"
"	48" ϕ	—	4 #7 x 6'-0"
"	42" ϕ	—	4 #7 x 5'-6"
"	36" ϕ	—	4 #7 x 5'-0"
"	30" ϕ	—	4 #6 x 4'-6"
"	24" ϕ	—	4 #6 x 3'-6"
"	18" ϕ	—	4 #5 x 3'-0"

COMPLETELY FILL THE OPENING BETWEEN THE PIPE & THE SIDES OF THE HOLE IN THE CULVERT WALL WITH 1:2 MORTAR OR 1:1 GROUT.

DETAIL FOR STORM SEWER CONNECTION TO WALL OF CULVERT



DETAILS OF CONCRETE RIP-RAP FOR CULVERT ENDS

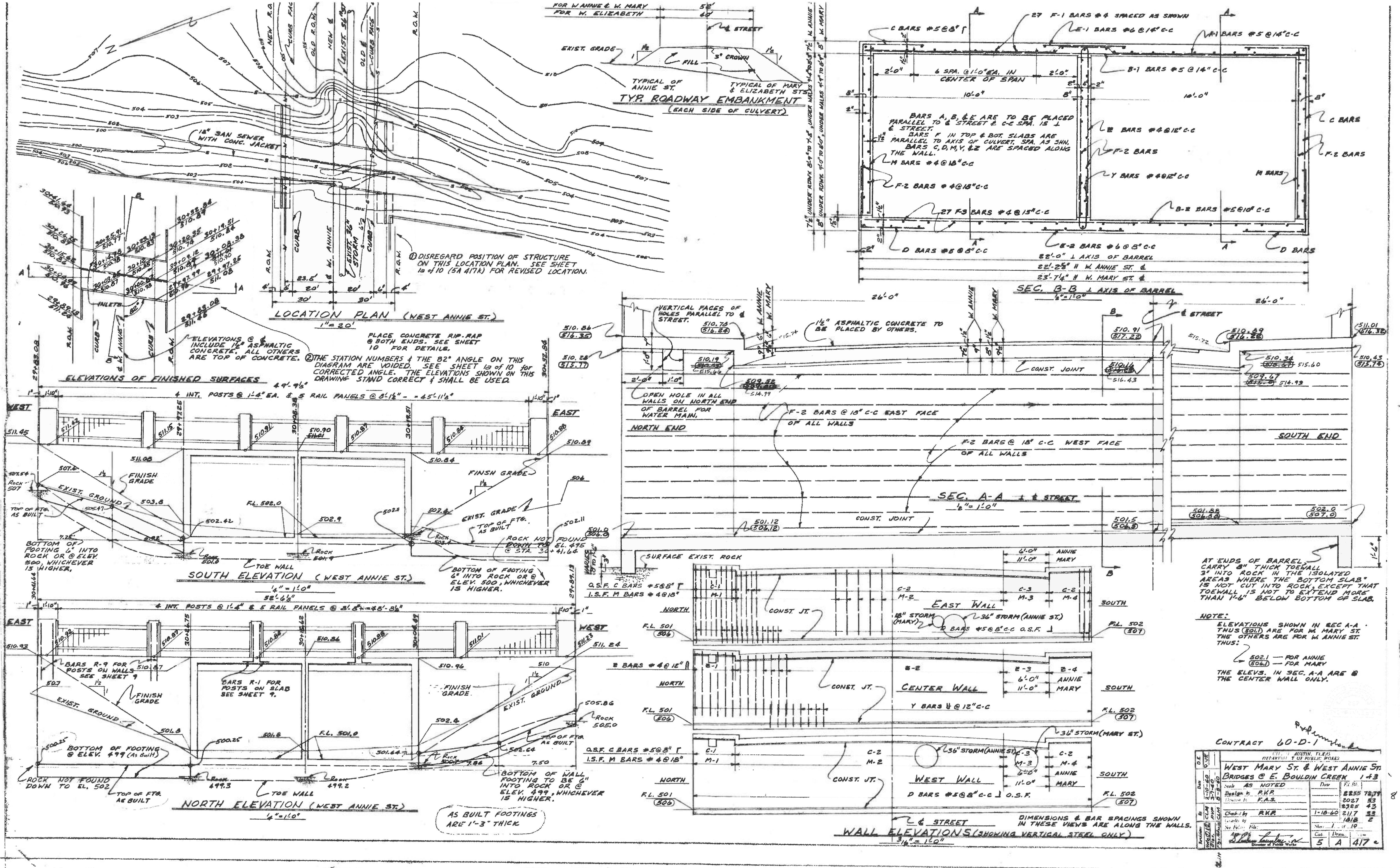
NOTE:
CONCRETE RIP-RAP TO BE PLACED AT CULVERT ENDS WHERE CALLED FOR IN THE PLANS OR SPECIFICATIONS. THIS DETAIL IS SHOWN FOR A SQUARE END CULVERT. SKEWED CULVERTS SHALL BE PROTECTED IN A SIMILAR MANNER.

DETAIL FOR STORM SEWER CONN.
DETAILS OF CONCRETE RIP-RAP
CONTRACT NO. 60-D-1

MISC. STANDARD CULVERT & BRIDGE DETAILS

Scale AS NOTED		
Designed by P.V.F.	1-11-60	
Drawn by F.A.S.	1-18-60	
Issued by		
Checked by P.V.F.	1-5-60	
	5	A	417

~~5 A 418~~



LOCATION PLAN (WEST ANNIE ST.) 1"=20'
① DISREGARD POSITION OF STRUCTURE ON THIS LOCATION PLAN. SEE SHEET 12 of 10 (5A 417A) FOR REVISED LOCATION.
18" SAN SEWER WITH CONC. JACKET
TYP. ROADWAY EMBANKMENT (EACH SIDE OF CULVERT)
FOR W. ANNIE & W. MARY 52'
FOR W. ELIZABETH 60'
EXIST. GRADE
FILL
3" CROWN
TYPICAL OF ANNIE ST.
TYPICAL OF MARY & ELIZABETH STS.
ELEVATIONS OF FINISHED SURFACES
ELEVATIONS @ ℄ INCLUDE 1½" ASPHALTIC CONCRETE. ALL OTHERS ARE TOP OF CONCRETE.
PLACE CONCRETE RIP-RAP @ BOTH ENDS. SEE SHEET 10 FOR DETAILS.
② THE STATION NUMBERS & THE 82° ANGLE ON THIS DIAGRAM ARE VOIDED. SEE SHEET 12 of 10 for CORRECTED ANGLE. THE ELEVATIONS SHOWN ON THIS DRAWING STAND CORRECT & SHALL BE USED.
SOUTH ELEVATION (WEST ANNIE ST.) ¼"=1'-0"
BOTTOM OF FOOTING 6" INTO ROCK OR @ ELEV. 500, WHICHEVER IS HIGHER.
ROCK NOT FOUND DOWN TO EL. 495 @ STA. 32+41.64
NORTH ELEVATION (WEST ANNIE ST.) ¼"=1'-0"
BOTTOM OF FOOTING @ ELEV. 499 (As Built)
ROCK NOT FOUND DOWN TO EL. 502
BOTTOM OF WALL FOOTING TO BE 6" INTO ROCK OR @ ELEV. 499, WHICHEVER IS HIGHER.
AS BUILT FOOTINGS ARE 1'-3" THICK
SEC. B-B ⊥ AXIS OF BARREL ¼"=1'-0"
BARS A, B, & E ARE TO BE PLACED PARALLEL TO ℄ STREET & C-C SPA. IS ⊥ ℄ STREET.
BARS F IN TOP & BOT. SLABS ARE PARALLEL TO AXIS OF CULVERT. SPA. AS SHN.
BARS C, D, M, Y, & Z ARE SPACED ALONG THE WALL.
22'-0" ⊥ AXIS OF BARREL
22'-2⅝" ∥ W. ANNIE ST. ℄
23'-7¼" ∥ W. MARY ST. ℄
SEC. A-A ⊥ ℄ STREET ⅛"=1'-0"
OPEN HOLE IN ALL WALLS ON NORTH END OF BARREL FOR WATER MAIN.
1½" ASPHALTIC CONCRETE TO BE PLACED BY OTHERS.
F-2 BARS @ 18" C-C EAST FACE OF ALL WALLS
F-2 BARS @ 18" C-C WEST FACE OF ALL WALLS
AT ENDS OF BARREL CARRY 8" THICK TOEWALL 3" INTO ROCK IN THE ISOLATED AREAS WHERE THE BOTTOM SLAB IS NOT CUT INTO ROCK, EXCEPT THAT TOEWALL IS NOT TO EXTEND MORE THAN 1'-6" BELOW BOTTOM OF SLAB.
NOTE: ELEVATIONS SHOWN IN SEC A-A THUS (501.) ARE FOR W. MARY ST. THE OTHERS ARE FOR W. ANNIE ST. THUS: 502.1 — FOR ANNIE (506.1) — FOR MARY
THE ELEVS. IN SEC. A-A ARE @ THE CENTER WALL ONLY.
EAST WALL
CENTER WALL
WEST WALL
WALL ELEVATIONS (SHOWING VERTICAL STEEL ONLY) 3/16"=1'-0"
DIMENSIONS & BAR SPACINGS SHOWN IN THESE VIEWS ARE ALONG THE WALLS.
CONTRACT 60-D-1
CITY OF AUSTIN, TEXAS DEPARTMENT OF PUBLIC WORKS
WEST MARY ST. & WEST ANNIE ST. BRIDGES @ E. BOULDIN CREEK
Scale AS NOTED
Design by P.V.P.
Drawn by F.A.S.
Checked by R.V.P.
Sheet 1 of 10
5 A 417