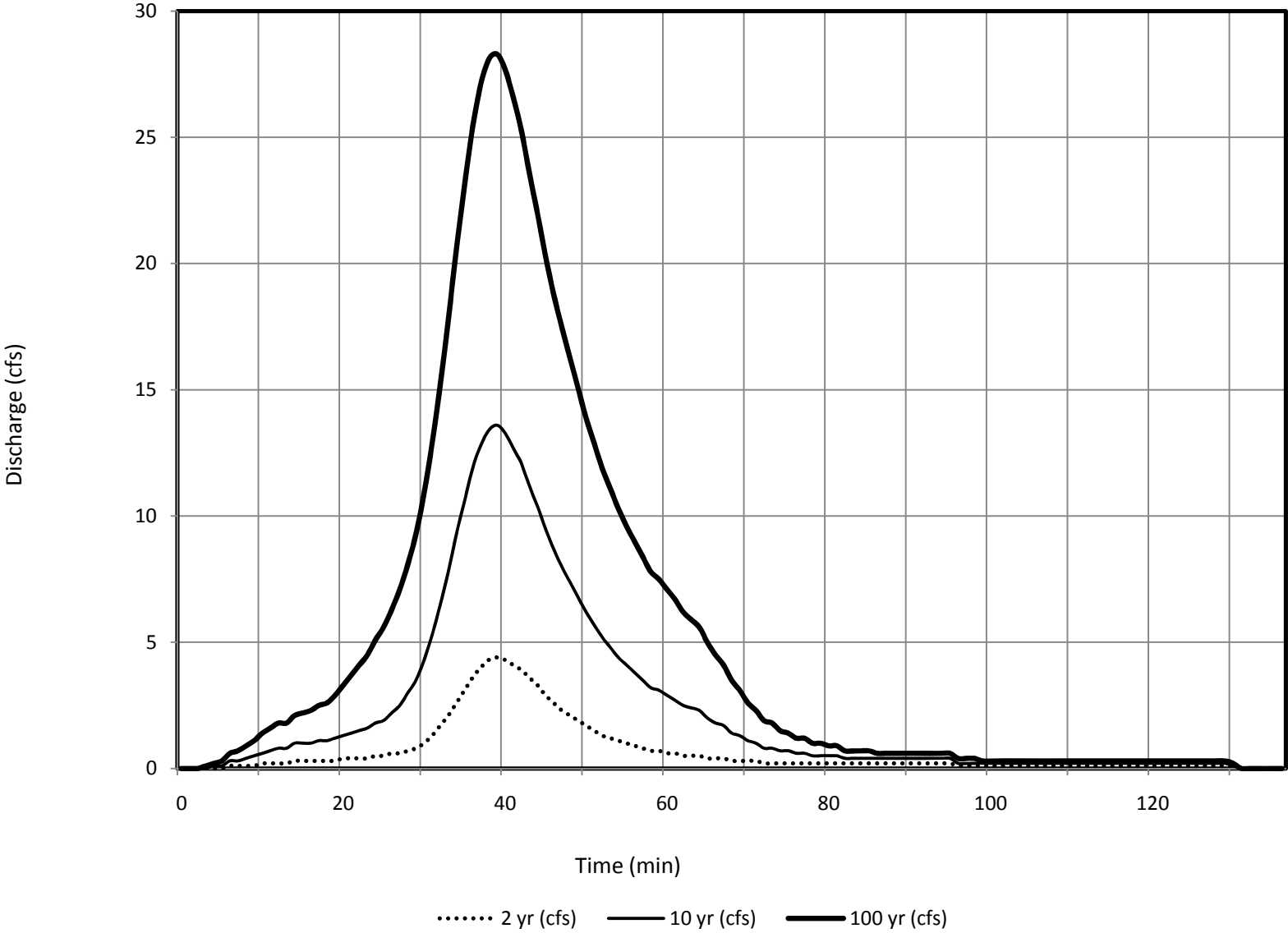
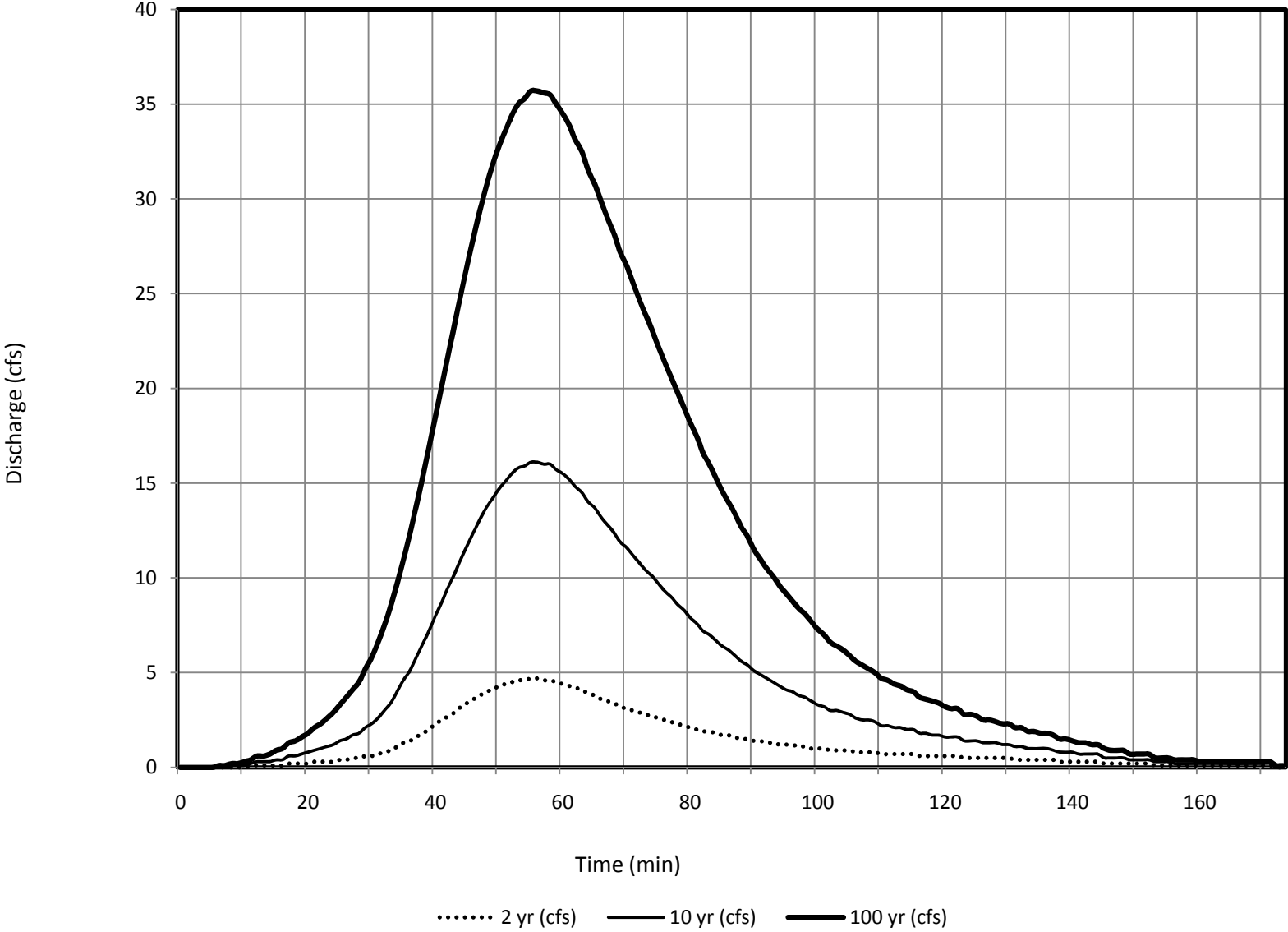
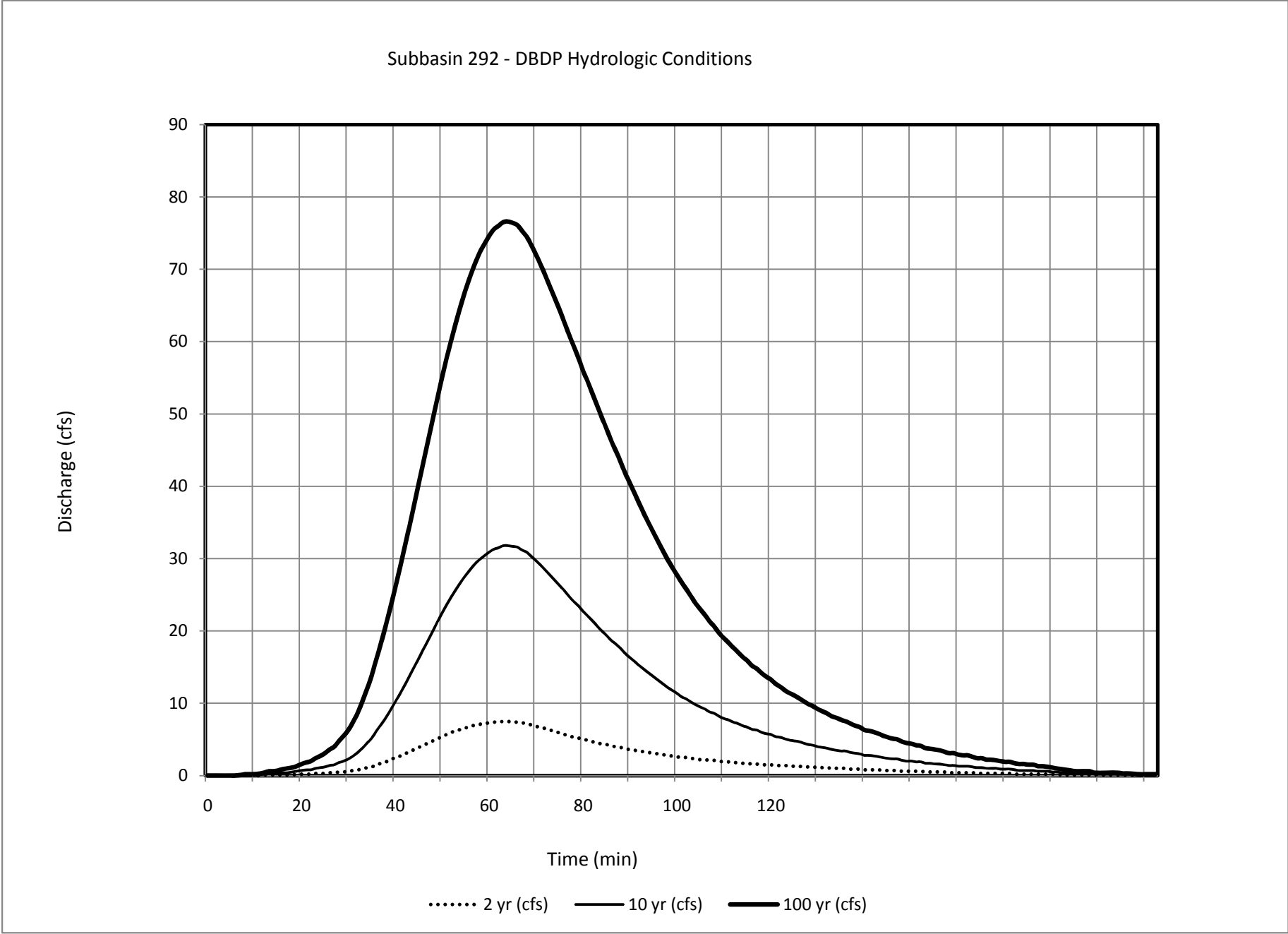


Subbasin 288 - DBDP Hydrologic Conditions

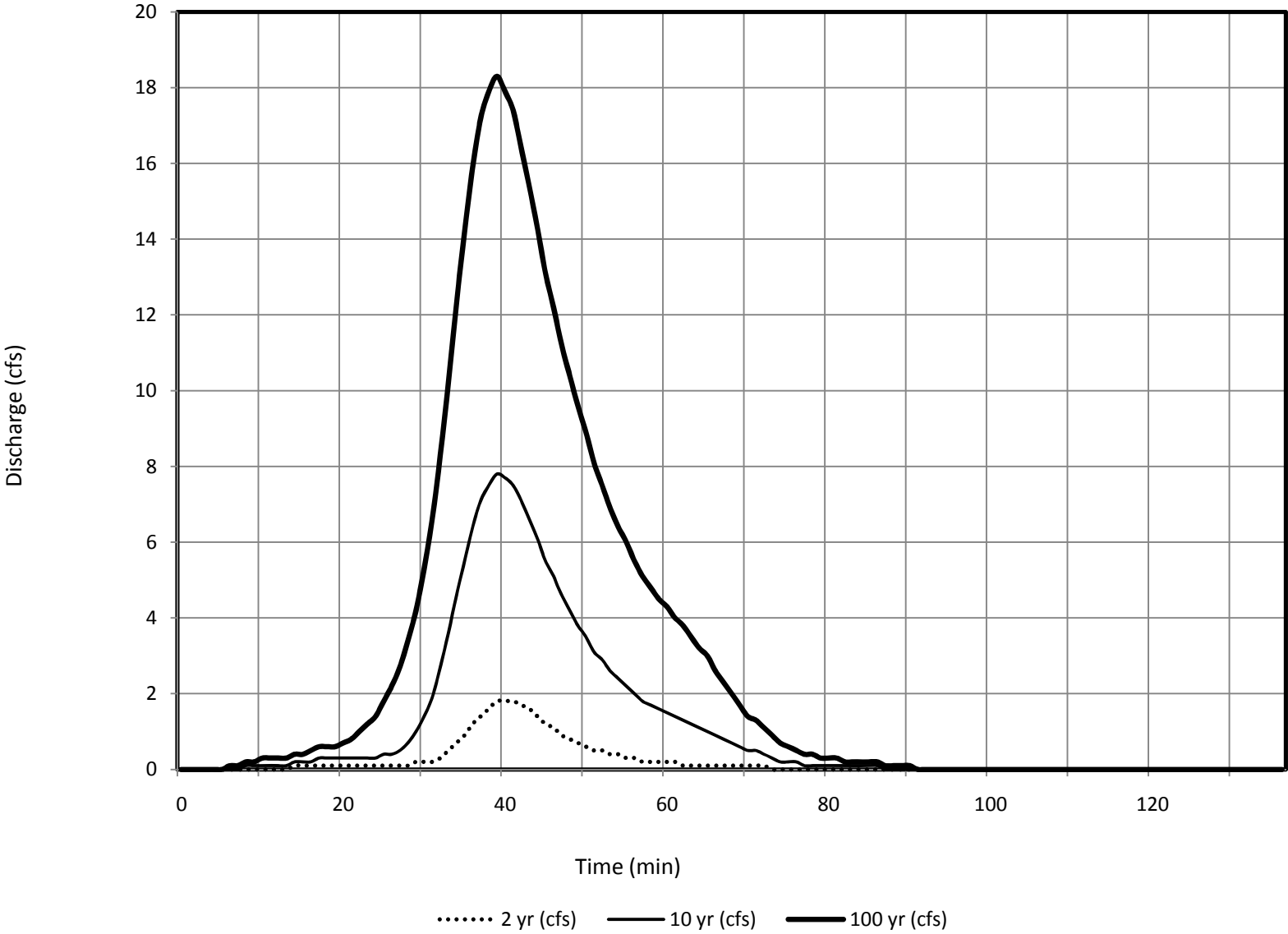


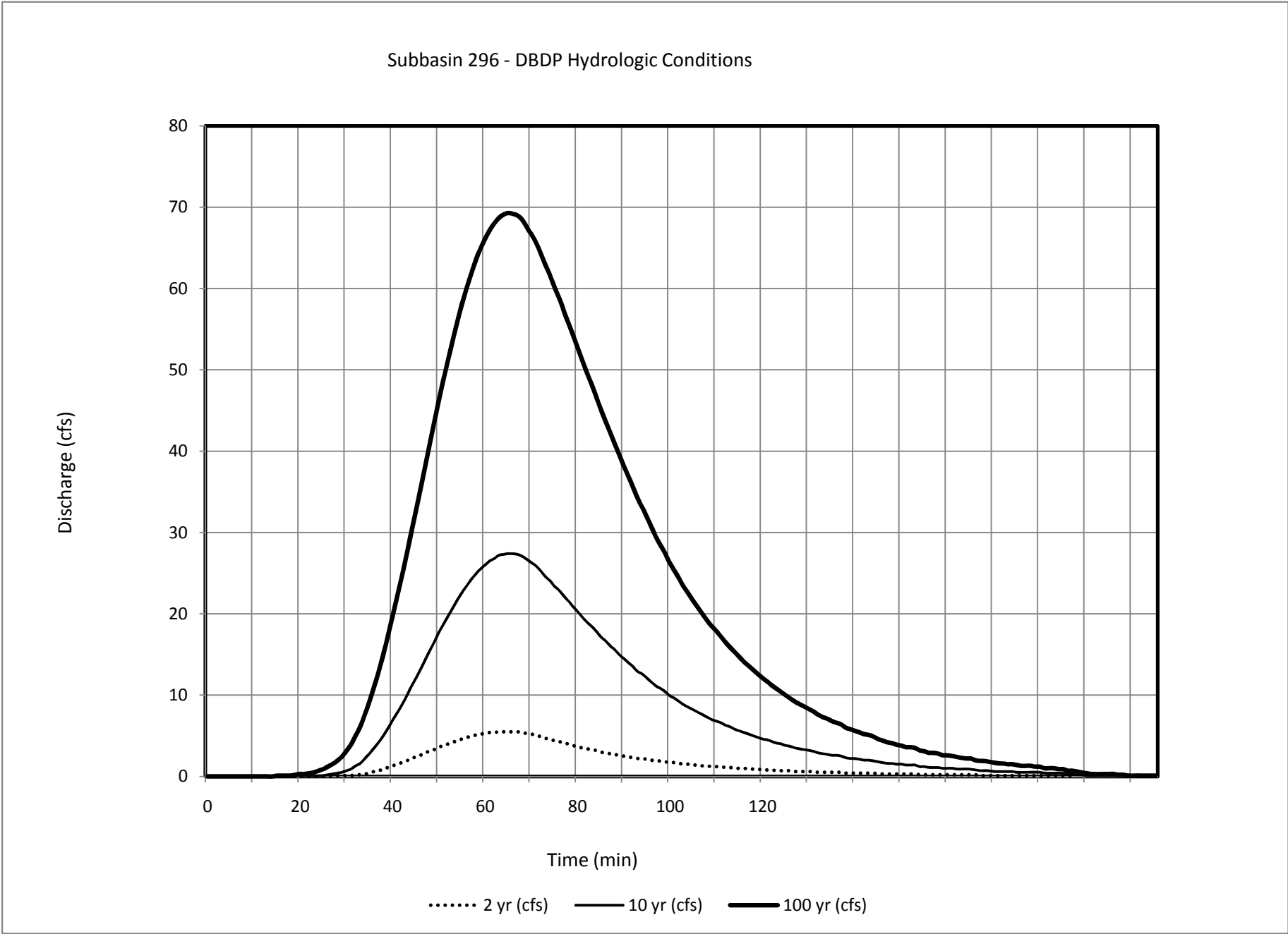
Subbasin 290 - DBDP Hydrologic Conditions



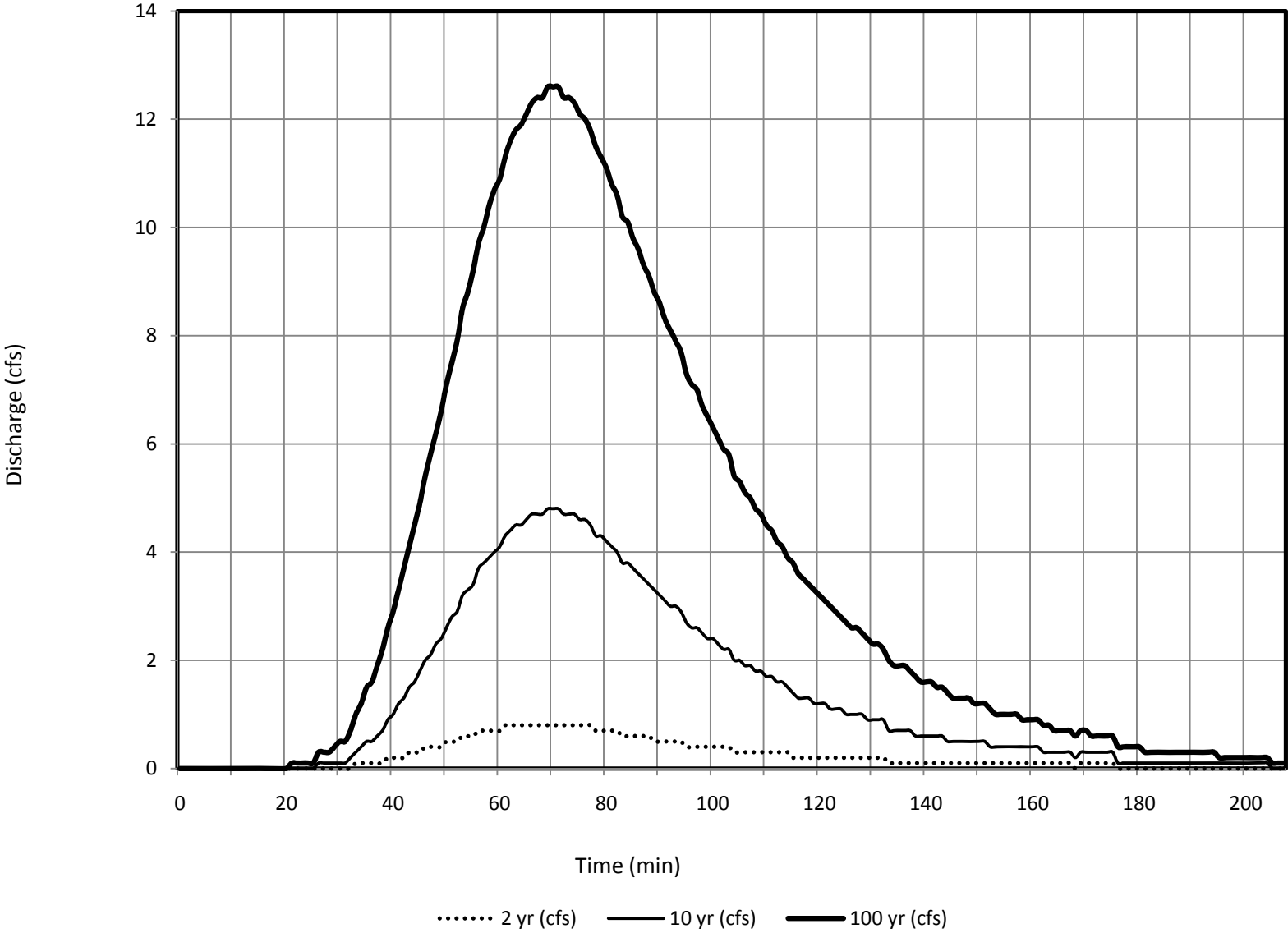


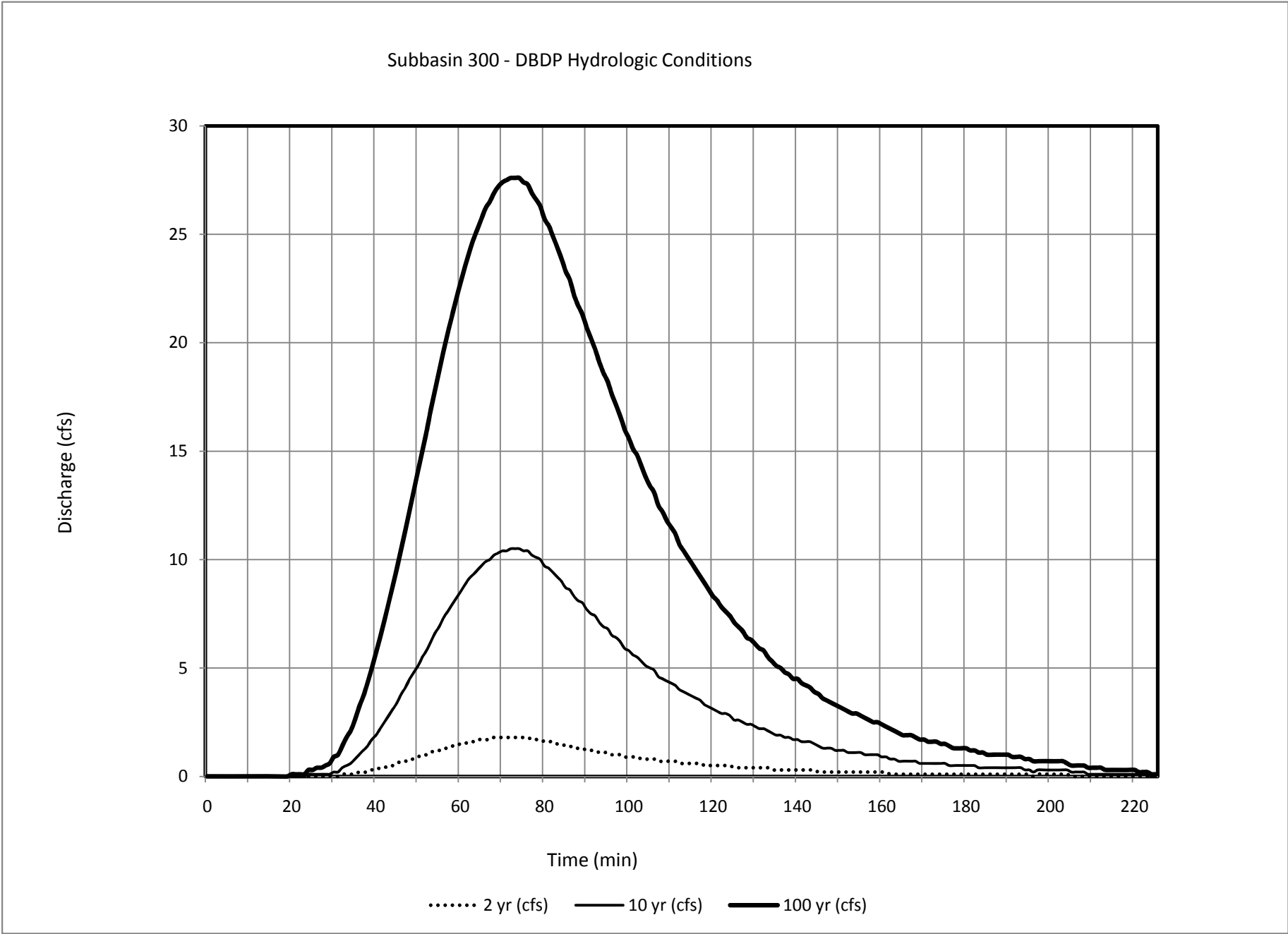
Subbasin 294 - DBDP Hydrologic Conditions



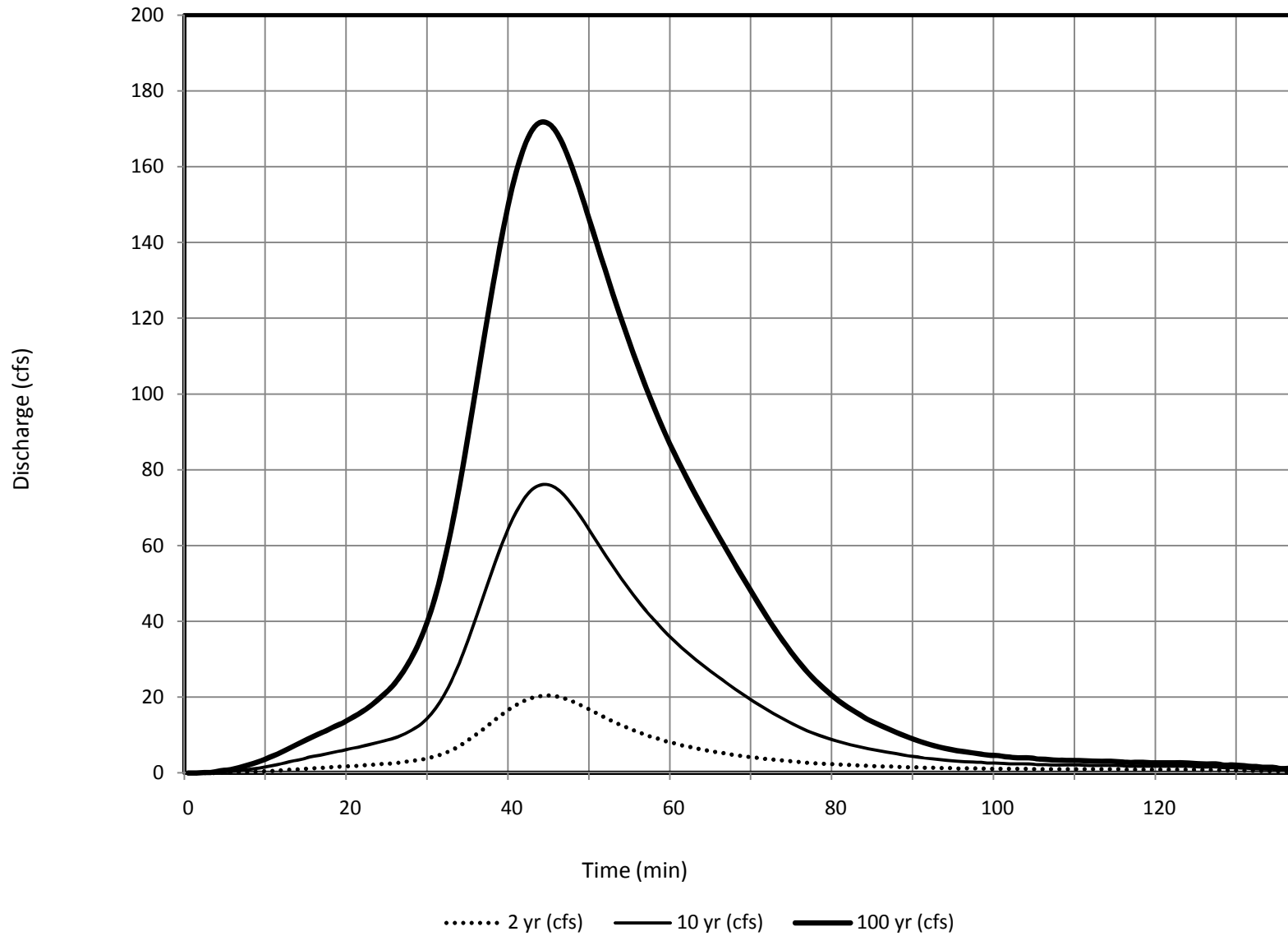


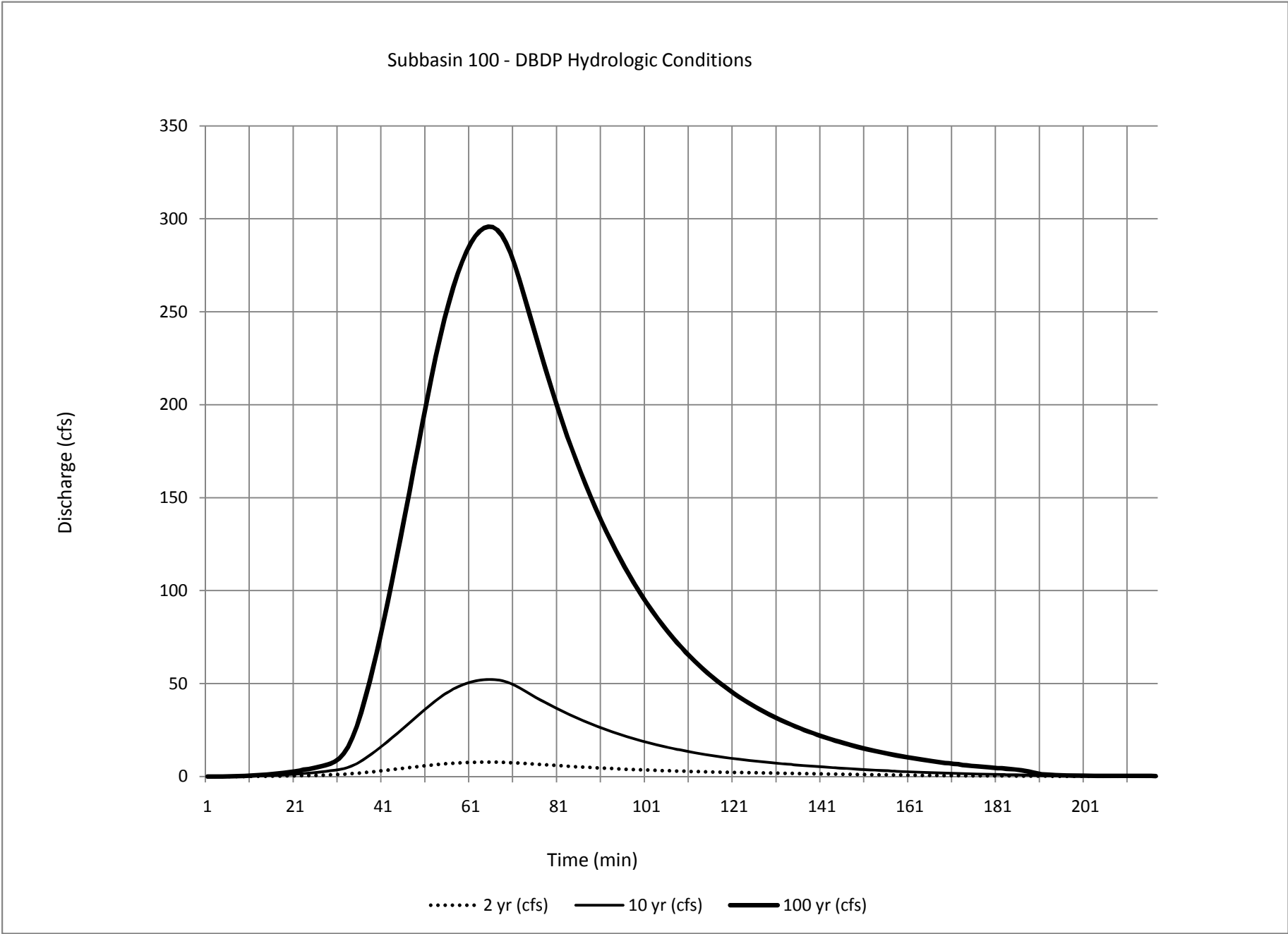
Subbasin 298 - DBDP Hydrologic Conditions





Subbasin 302 - DBDP Hydrologic Conditions





Subbasin Input Parameters									
Subbasin	Area (Acre)	% Imp	Init. Abs (in)	Moist Def	Suction (in)	Conductivity (in/hr)	Lag Time (hr)	Cp	D/S Element
100	3.56	42.12	0.24	0.25	10.75	0.04	0.14	0.60	7000
102	3.77	43.56	0.24	0.25	10.75	0.04	0.14	0.60	7002
104	3.09	42.12	0.24	0.25	10.75	0.04	0.14	0.60	7004
106	5.00	42.12	0.24	0.23	10.75	0.04	0.15	0.60	7008
108	2.96	42.12	0.24	0.25	10.75	0.04	0.15	0.60	1060
110	2.85	42.12	0.24	0.23	10.75	0.04	0.13	0.60	7012
112	3.56	59.15	0.20	0.23	10.75	0.04	0.14	0.60	7010
114	1.74	42.12	0.24	0.23	10.75	0.04	0.14	0.60	7004
116	7.07	48.13	0.23	0.23	10.75	0.04	0.14	0.60	7014
118	1.31	42.12	0.24	0.23	10.75	0.04	0.12	0.60	7006
120	3.90	42.12	0.24	0.23	10.75	0.04	0.14	0.60	7006
122	2.15	66.06	0.18	0.23	10.75	0.04	0.15	0.60	7008
124	2.46	42.12	0.24	0.23	10.75	0.04	0.13	0.60	7016
126	1.89	42.12	0.24	0.23	10.75	0.04	0.12	0.60	1014
128	1.76	42.12	0.24	0.23	10.75	0.04	0.14	0.60	1030
130	2.44	45.13	0.24	0.23	10.75	0.04	0.13	0.60	1032
132	6.24	43.12	0.24	0.23	10.75	0.04	0.15	0.60	1010
134	2.27	16.04	0.31	0.23	10.75	0.04	0.10	0.60	1010
136	3.13	43.12	0.24	0.23	10.75	0.04	0.13	0.60	1040
138	2.67	46.13	0.23	0.23	10.75	0.04	0.13	0.60	1056
140	2.51	42.12	0.24	0.23	10.75	0.04	0.11	0.60	1068
142	4.84	56.16	0.21	0.23	10.75	0.04	0.14	0.60	1066
144	2.99	42.12	0.24	0.23	10.75	0.04	0.11	0.60	1066
146	3.32	39.31	0.25	0.23	10.75	0.04	0.13	0.60	1038
148	4.39	42.12	0.24	0.23	10.75	0.04	0.15	0.60	1064
150	4.75	51.14	0.22	0.23	10.75	0.04	0.15	0.60	1064
152	4.92	50.14	0.22	0.23	10.75	0.04	0.12	0.60	7012
154	3.35	38.10	0.25	0.23	10.75	0.04	0.13	0.60	1002
156	3.72	45.13	0.24	0.23	10.75	0.04	0.15	0.60	1002
158	7.72	50.14	0.22	0.23	10.75	0.04	0.16	0.60	3004
160	3.83	48.13	0.23	0.23	10.75	0.04	0.17	0.60	3006
162	2.44	42.12	0.24	0.23	10.75	0.04	0.15	0.60	3006
164	1.28	42.12	0.24	0.23	10.75	0.04	0.12	0.60	3002
166	3.71	42.12	0.24	0.23	10.75	0.04	0.16	0.60	1000
168	2.45	42.12	0.24	0.25	10.75	0.04	0.12	0.60	1062
170	1.17	42.12	0.24	0.25	10.75	0.04	0.11	0.60	1060
172	3.18	42.12	0.24	0.23	10.75	0.04	0.14	0.60	1024
174	1.61	42.12	0.24	0.23	10.75	0.04	0.14	0.60	1020
176	5.74	47.13	0.23	0.23	10.75	0.04	0.15	0.60	1018
178	1.84	42.12	0.24	0.23	10.75	0.04	0.13	0.60	1016
180	4.06	47.13	0.23	0.23	10.75	0.04	0.13	0.60	1016
182	6.28	49.13	0.23	0.23	10.75	0.04	0.14	0.60	1044
184	4.74	61.16	0.20	0.23	10.75	0.04	0.14	0.60	1042
186	6.85	14.04	0.31	0.27	10.75	0.04	0.14	0.60	2000
188	3.18	10.02	0.32	0.27	10.75	0.04	0.12	0.60	1060
190	12.07	26.06	0.28	0.23	10.75	0.04	0.18	0.60	Canyon Lk Elem
192	3.61	42.12	0.24	0.23	10.75	0.04	0.13	0.60	7022
194	2.16	42.12	0.24	0.23	10.75	0.04	0.12	0.60	7020

Subbasin Input Parameters									
Subbasin	Area (Acre)	% Imp	Init. Abs (in)	Moist Def	Suction (in)	Conductivity (in/hr)	Lag Time (hr)	Cp	D/S Element
196	2.55	48.44	0.23	0.23	10.75	0.04	0.13	0.60	7018
198	3.91	42.12	0.24	0.23	10.75	0.04	0.14	0.60	6014
200	5.53	42.12	0.24	0.23	10.75	0.04	0.15	0.60	6006
202	2.67	42.12	0.24	0.23	10.75	0.04	0.12	0.60	6004
204	5.78	42.12	0.24	0.23	10.75	0.04	0.15	0.60	6020
206	3.49	42.12	0.24	0.23	10.75	0.04	0.14	0.60	6018
208	4.13	43.12	0.24	0.23	10.75	0.04	0.14	0.60	6002
210	9.66	52.14	0.22	0.25	10.75	0.04	0.17	0.60	5026
212	3.15	58.15	0.20	0.27	10.75	0.04	0.14	0.60	6000
214	4.26	42.12	0.24	0.24	10.75	0.04	0.13	0.60	5028
216	4.74	42.12	0.24	0.24	10.75	0.04	0.15	0.60	5030
218	2.30	42.12	0.24	0.25	10.75	0.04	0.13	0.60	5032
220	1.41	42.12	0.24	0.27	10.75	0.04	0.13	0.60	5032
222	2.53	50.14	0.22	0.27	10.75	0.04	0.12	0.60	5034
250	3.03	62.00	0.20	0.24	10.61	0.05	0.13	0.70	5000
252	2.23	47.00	0.23	0.24	10.75	0.04	0.13	0.70	5002
254	7.34	32.00	0.27	0.24	10.75	0.04	0.18	0.70	5004
256	3.15	47.00	0.23	0.24	10.45	0.46	0.13	0.70	5006
258	9.14	9.00	0.36	0.26	10.01	1.08	0.42	0.70	5006
260	6.35	39.00	0.38	0.24	10.64	0.20	0.18	0.70	5008
262	39.57	5.00	0.26	0.33	7.71	4.33	0.41	0.70	5020
266	26.64	4.00	0.29	0.24	10.71	0.09	0.18	0.70	5016
268	30.25	14.00	0.31	0.24	10.75	0.04	0.19	0.70	5018
270	3.27	36.00	0.28	0.24	10.75	0.04	0.41	0.70	5016
272	3.67	26.00	0.35	0.24	10.75	0.04	0.14	0.70	5012
274	12.06	20.00	0.38	0.23	10.75	0.04	0.16	0.70	1022
276	22.84	33.00	0.28	0.25	10.59	0.04	0.17	0.70	1026
278	9.20	2.00	0.39	0.26	10.75	0.04	0.38	0.70	1052
280	9.62	2.00	0.35	0.26	10.75	0.04	0.19	0.70	5014
282	53.49	10.00	0.30	0.24	10.41	0.04	0.23	0.70	1050
284	22.14	22.00	0.39	0.26	7.52	0.07	0.17	0.70	1054
286	5.62	31.00	0.28	0.24	9.17	0.05	0.16	0.70	1048
288	2.85	41.00	0.25	0.23	10.75	0.04	0.13	0.70	4012
290	6.33	42.00	0.27	0.24	8.63	0.06	0.42	0.70	4010
292	18.67	22.00	0.33	0.26	6.90	0.08	0.55	0.70	4008
294	1.82	11.00	0.36	0.25	8.03	0.07	0.13	0.70	4006
296	18.59	3.00	0.30	0.27	4.99	0.09	0.57	0.70	4004
298	4.04	8.00	0.39	0.26	6.84	0.08	0.65	0.70	4002
300	8.73	5.00	0.38	0.27	4.51	0.10	0.69	0.70	4002
302	21.83	34.00	0.39	0.28	3.47	0.11	0.22	0.70	4014
304	272.21	5.00	0.39	0.28	9.27	0.75	0.57	0.70	Cedar Cryn Dam

NOTE: SEE DBDPA SCHEMATICS (FIGS 11 AND 12) FOR ADDITIONAL CONNECTIVITY INFORMATION

RED DALE DRAINAGE BASIN DESIGN PLAN AMENDMENT
 TIME OF CONCENTRATION CALCULATIONS FOR HEC-HMS MODELING

DBDP_ID	FEC_ID	FLOW LENGTH (FT)	(1)			Curb and Gutter (Flowmaster)			Overland Flow Eq. 4-2-4			Channel flow (Flowmaster)			(2)	(3)	(4)
			T _{c, Eq 4-2-5} (min)	Velocity (curb)	Length Curb	T _{t, curb} (min)	Slope %	Length ft	T _{t, ovrlnd} (min)	Length channel	Velocity (channel)	T _{t, chnl} (min)	T _{c, total} (min)	T _{c, used} (minutes)	SCS LAG TIME (HR)		
100	797.75	14.43	2.77	547.14	3.292	0.8	250.61	20.713					24.005	14.43	0.144		
102	648.76	13.60	2.59	351.18	2.26	0.7	297.58	23.587					25.847	13.6	0.136		
104	684.18	13.80	2.59	445.22	2.865	0.7	238.96	21.137					24.002	13.8	0.138		
106	942.27	15.23	0.98	774.87	13.178	0.1	167.40	33.623					46.801	15.23	0.152		
108	955.76	15.31	3.79	508.50	2.236	1.5	300.00	18.416	147.26	1.98	1.240		21.892	15.31	0.153		
110	507.03	12.82	2.40	91.33	0.634	0.6	300.00	24.919	115.7	1.25	1.543		27.096	12.82	0.128		
112	751.57	14.18	2.59	489.72	3.151	0.7	261.85	22.126					25.277	14.18	0.142		
114	637.23	13.54	2.77	411.58	2.476	0.8	225.65	19.654					22.13	13.54	0.135		
116	636.03	13.53	2.40	0.00	0	0.9	300.00	21.798	336.03	1.53	3.66		25.458	13.53	0.135		
118	310.40	11.72	2.94	54.42	0.309	0.9	255.98	20.135					20.444	11.72	0.117		
120	641.20	13.56	4.03	269.75	1.116	1.7	300.00	17.671	71.45	2.11	0.564		19.351	13.56	0.136		
122	811.41	14.51	3.91	489.05	2.085	1.6	300.00	18.028	22.36	2.04	0.183		20.296	14.51	0.145		
124	583.73	13.24	3.91	0.00	0	1.6	300.00	18.028	283.73	2.04	2.318		20.346	13.24	0.132		
126	416.22	12.31	4.79	0.00	0	2.4	300.00	15.771	116.22	2.5	0.775		16.546	12.31	0.123		
128	634.29	13.52	3.66	221.45	1.008	1.4	300.00	18.841	112.84	1.91	0.985		20.834	13.52	0.135		
130	452.72	12.52	5.45	0.00	0	3.1	300.00	14.493	152.72	2.84	0.896		15.389	12.52	0.125		
132	960.56	15.34	2.77	784.40	4.72	0.8	176.16	17.366					22.086	15.34	0.153		
134	712.45	13.96	4.27	80.00	0.312	1.9	0.00	0	632.45	2.23	4.727		5.039	5.04	0.050		
136	594.37	13.30	4.79	317.16	1.104	1.9	277.21	16.375					17.479	13.3	0.133		
138	581.44	13.23	4.89	228.07	0.777	2.4	300.00	15.771	53.37	2.5	0.356		16.904	13.23	0.132		
140	369.09	12.05	5.71	197.25	0.576	3.4	171.84	10.64					11.216	12.05	0.112		
142	703.57	13.91	4.79	405.12	1.41	2.4	298.45	15.73					17.14	13.91	0.139		
144	656.06	13.64	4.27	569.69	2.224	1.9	86.37	9.14					11.364	11.36	0.114		
146	535.07	12.97	3.66	237.65	1.082	1.4	297.42	18.759					19.841	12.97	0.130		
148	950.22	15.28	2.40	845.91	5.874	0.6	104.31	14.694					20.568	15.28	0.153		
150	866.88	14.82	3.79	628.18	2.762	1.5	238.70	16.427					19.189	14.82	0.148		
152	410.45	12.28	3.66	0.00	0	1.4	300.00	18.841	110.45	1.91	0.964		19.805	12.28	0.123		
154	580.44	13.22	3.39	0.00	0	1.2	300.00	19.824	280.44	1.77	2.641		22.465	13.22	0.132		
156	844.07	14.69	3.25	679.77	3.486	1.1	164.30	15.098					18.584	14.69	0.147		
158	1,012.81	15.63	3.25	641.97	3.292	1.1	300.00	20.401	70.84	1.69	0.699		24.392	15.63	0.156		
160	1,236.19	16.87	3.53	1079.56	5.097	1.3	156.63	13.951					19.048	16.87	0.169		
162	938.69	15.21	2.59	56.11	0.361	0.7	300.00	23.683	582.58	1.35	7.192		31.236	15.21	0.152		
164	348.31	11.94	3.79	67.60	0.297	1.5	280.71	17.815					18.112	11.94	0.119		
166	992.19	15.51	3.25	717.43	3.679	1.1	274.76	19.524					23.203	15.51	0.155		
168	416.63	12.31	4.99	121.09	0.404	2.6	295.54	15.245					15.649	12.31	0.123		
170	867.26	14.82	3.79	821.47	3.612	1.5	45.79	7.195					10.807	10.81	0.108		
172	711.39	13.95	3.79	305.00	1.341	1.5	300.00	18.416	106.39	1.98	0.896		20.653	13.95	0.140		
174	686.37	13.81	2.94	593.31	3.363	0.9	93.06	12.14					15.503	13.81	0.138		
176	818.03	14.54	3.39	523.58	2.574	1.2	294.45	19.64					22.214	14.54	0.145		
178	514.43	12.86	3.91	195.06	0.831	1.6	300.00	18.028	19.37	2.04	0.158		19.017	12.86	0.129		
180	590.52	13.28	4.69	336.99	1.198	2.3	253.53	14.703					15.901	13.28	0.133		
182	747.31	14.15	5.08	347.81	1.141	2.7	300.00	15.169	99.5	2.65	0.626		16.936	14.15	0.142		
184	673.84	13.74	4.79	33.50	0.117	2.4	300.00	15.771	340.34	2.5	2.269		18.157	13.74	0.137		
186	752.52	14.18	3.91	557.31	2.376	1.6	195.21	14.543					16.919	14.18	0.142		
188	331.11	11.84	4.06	0.00	0	0.1	300.00	45.011	31.11	0.51	1.017		46.028	11.84	0.118		
190	1,407.14	17.82	4.24	0.00	0	1.2	250.00	18.097	1157.14	1.77	10.896		28.993	17.82	0.178		
192	555.61	13.09	4.99	82.14	0.274	2.6	300.00	15.359	173.47	2.61	1.108		16.741	13.09	0.131		
194	389.00	12.16	5.27	95.34	0.302	2.9	293.66	14.658					14.96	12.16	0.122		
196	460.40	12.56	4.27	163.29	0.637	1.9	297.11	16.952					17.589	12.56	0.126		
198	653.53	13.63	5.27	60.51	0.191	2.9	300.00	14.816	293.02	2.75	1.776		16.783	13.63	0.136		
200	934.94	15.19	4.48	258.06	0.96	2.1	300.00	16.481	376.88	2.34	2.684		20.125	15.19	0.152		

RED DALE DRAINAGE BASIN DESIGN PLAN AMENDMENT
 TIME OF CONCENTRATION CALCULATIONS FOR HEC-HMS MODELING

DBDP_ID	FEC_ID	FLOW LENGTH (FT)	(1)				Overland Flow Eq. 4-2-4			Channel flow (Flowmaster)			(2)		(3)	(4)
			T _{c, Eq 4-2-5} (min)	Curb and Gutter Velocity (curb)	Gutter Length (ft)	Flowmaster T _{t, curb} (min)	Slope %	Length ft	T _{t, ovrlnd} (min)	Length channel	Velocity (channel)	T _{t, chnl} (min)	T _{c, total} (min)	T _{c, used} (minutes)	SCS LAG TIME (HR)	
	202	564.37	13.14	3.66	564.37	2.57	1.4	0.00	0				2.57	2.57	0.026	
	204	881.92	14.90	5.79	351.45	1.012	3.5	300.00	13.924		230.47	3.02	1.272	16.208	14.9	0.149
	206	740.58	14.11	4.38	248.80	0.947	2	300.00	16.748		191.78	2.29	1.396	19.091	14.11	0.141
	208	662.94	13.68	4.38	206.19	0.785	2	300.00	16.748		156.75	2.29	1.141	18.674	13.68	0.137
	210	1,293.81	17.19	5.18	377.56	1.215	2.8	300.00	14.988		616.25	2.7	3.804	20.007	17.19	0.172
	212	635.99	13.53	3.66	378.64	1.724	1.4	257.35	17.45					19.174	13.53	0.135
	214	626.09	13.48	4.03	489.77	2.026	1.7	136.32	11.912					13.938	13.48	0.135
	216	850.78	14.73	2.94	595.90	3.378	0.9	254.88	20.092					23.47	14.73	0.147
	218	580.39	13.22	2.40	262.09	1.82	0.6	300.00	24.919		18.3	1.25	0.244	26.983	13.22	0.132
	220	544.26	13.02	0.98	335.46	5.705	0.1	208.80	37.551					43.256	13.02	0.130
	222	706.69	13.93	2.77	670.43	4.034	0.8	36.26	7.879					11.913	11.91	0.119
26	250	570.00	13.17	11.15	275.00	0.411	0.119	295.00	42.144		0	5.88	0	42.555	13.17	0.132
27	252	450.00	12.50	12.89	150.00	0.194	0.159	300.00	38.624		0	5.88	0	38.818	12.5	0.125
29	254	1,354.00	17.52	12.05	900.00	1.245	0.139	300.00	40.376		154	9.06	0.283	41.904	17.52	0.175
28	256	618.00	13.43		0.00		0.086	300.00	47.308		318	7.12	0.744	48.052	13.43	0.134
30	258	670.00	---		0.00		0.128	300.00	41.489		370	8.69	0.71	42.199	42.2	0.422
31	260	1,480.00	18.22	10.52	1180.00	1.869	0.106	300.00	44.153		0	5.88	0	46.022	18.22	0.182
36	262	2,050.00	---		0.00		0.161	300.00	38.465		1750	9.75	2.991	41.456	41.46	0.415
35	266	1,500.00	18.33	13.75	900.00	1.091	0.181	300.00	37.007		300	10.33	0.484	38.582	18.33	0.183
34	268	1,530.00	18.50	13.29	600.00	0.752	0.169	300.00	37.854		630	9.99	1.051	39.657	18.5	0.185
33	270	730.00	---		0.00		0.138	300.00	40.472		430	9.02	0.795	41.267	41.27	0.413
32	272	780.00	14.33	12.18	680.00	0.93	0.142	100.00	23.147		0	5.88	0	24.077	14.33	0.143
25	274	1,120.00	16.22	13.90	670.00	0.803	0.185	300.00	36.741		150	10.45	0.239	37.783	16.22	0.162
14	276	1,300.00	17.22	14.01	1000.00	1.19	0.188	300.00	36.546		0	5.88	0	37.736	17.22	0.172
17	278	715.00	---		0.00		0.18	300.00	37.075		415	10.31	0.671	37.746	37.75	0.378
19	280	1,590.00	18.83	13.17	1050.00	1.329	0.166	300.00	38.079		240	9.9	0.404	39.812	18.83	0.188
18	282	2,335.00	22.97	10.62	1500.00	2.354	0.108	300.00	43.882		535	7.98	1.117	47.353	22.97	0.230
15	284	1,220.00	16.78	12.68	700.00	0.92	0.154	300.00	39.033		220	9.53	0.385	40.338	16.78	0.168
16	286	1,000.00	15.56		0.00		0.083	300.00	47.865		700	7	1.667	49.532	15.56	0.156
68	288	600.00	13.33	8.05	100.00	0.207	0.062	300.00	52.702		200	6.05	0.551	53.46	13.33	0.133
67	290	1,180.00	---		0.00		0.135	300.00	40.767		880	8.93	1.642	42.409	42.41	0.424
66	292	1,400.00	---		0.00		0.065	300.00	51.886		1100	6.19	2.962	54.848	54.85	0.549
65	294	580.00	13.22	10.86	380.00	0.583	0.113	200.00	35.298		0	5.88	0	35.881	13.22	0.132
64	296	1,700.00	---		0.00		0.06	300.00	53.275		1400	5.95	3.922	57.197	57.2	0.572
63	298	885.00	---		0.00		0.037	300.00	62.49		585	4.67	2.088	64.578	64.58	0.646
61	300	1,124.00	---		0.00		0.031	300.00	66.247		824	4.28	3.209	69.456	69.46	0.695
62	302	2,115.00	21.75	5.21	415.00	1.328	0.026	300.00	70.206		1400	3.92	5.952	77.486	21.75	0.218
37	304	6,300.00	---		0.00		0.135	300.00	40.767		6000	6.05	16.529	57.296	57.3	0.573

- NOTES:
- (1) $T_{c, EQN 4-2-5} = L/180 + 10$, (min)
 - (2) $T_{c, total} = T_{t, curb} + T_{t, ovrlnd} + T_{t, chnl}$
 - (3) $T_{c, used} = \text{Minimum of } T_{c, EQN 4-2-5} \text{ and } T_{c, total}$
 - (4) $SCS \text{ Lag Time} = 0.6 * T_{c, used}$



Ferber
Engineering
Company, Inc.

APPENDIX B

DBDP and Existing Hydraulic Input Characteristics

HEC-HMS DBDPA CONVEYANCE ELEMENT INPUT

Element	Length (ft)	Slope (Ft/Ft)	Mannings n	Shape	Diameter (ft)	Width (ft)	Side Slope (xH:1V)	Left Bank n	Right Bank n	Cross Section
1	536.9	0.0050	0.013	Circle	3.5	---	---	---	---	---
7	538.1	0.0095	0.035	Trapezoid	---	10	2	---	---	---
9	73.7	0.0567	0.015	Rectangle	---	9	---	---	---	---
15	386.8	0.0210	0.015	Rectangle	---	3	---	---	---	---
17	463.3	0.0172	0.013	Circle	3	---	---	---	---	---
19	300.8	0.0263	0.013	Circle	3	---	---	---	---	---
21	321.1	0.0366	0.013	Circle	1.5	---	---	---	---	---
23	240.4	0.0113	0.013	Circle	1.5	---	---	---	---	---
25	303.8	0.0206	0.015	Eight Point	---	---	---	0.05	0.055	25' width, 2% typical
29	494.9	0.0231	0.015	Eight Point	---	---	---	0.055	0.055	20' width, 2% Typical
31	627.2	0.0251	0.015	Eight Point	---	---	---	0.055	0.055	20' width, 2% Typical
37	397.4	0.0064	0.013	Circle	4	---	---	---	---	---
39	346.4	0.0129	0.013	Circle	4	---	---	---	---	---
41	421.3	0.0070	0.013	Circle	4	---	---	---	---	---
43	225.7	0.0207	0.013	Circle	4	---	---	---	---	---
45	371.6	0.0295	0.013	Circle	3	---	---	---	---	---
47	468.7	0.0026	0.013	Circle	3	---	---	---	---	---
49	819.8	0.0199	0.013	Circle	2	---	---	---	---	---
51	1398.7	0.0868	0.013	Circle	1.25	---	---	---	---	---
53	123.6	0.0100	0.013	Circle	2	---	---	---	---	---
55	361.5	0.0121	0.015	Eight Point	---	---	---	0.05	0.05	25' width, 2% typical
59	138.4	0.0042	0.015	Eight Point	---	---	---	0.035	0.06	32' width, 2% NO BrkL
63	808.9	0.0050	0.013	Circle	3	---	---	---	---	---
65	282.8	0.0050	0.013	Eight Point	---	---	---	0.035	0.035	20' width, 2% Typical
67	361.2	0.0050	0.013	Eight Point	---	---	---	0.035	0.035	20' width, 2% Typical
75	274.4	0.0130	0.013	Circle	1	---	---	---	---	---
77	283.4	0.0035	0.013	Circle	1	---	---	---	---	---
79	149.3	0.0154	0.013	Circle	1.5	---	---	---	---	---
81	119.9	0.0010	0.035	Circle	3.5	---	---	---	---	---

HEC-HMS DBDPA CONVEYANCE ELEMENT INPUT

Element	Length (ft)	Slope (Ft/Ft)	Mannings n	Shape	Diameter (ft)	Width (ft)	Side Slope (xH:1V)	Left Bank n	Right Bank n	Cross Section
83	526.0	0.0164	0.013	Circle	2	---	---	---	---	---
85	649.2	0.0071	0.013	Circle	2	---	---	---	---	---
87	350.1	0.0118	0.013	Circle	2	---	---	---	---	---
89	264.9	0.0182	0.013	Circle	1.5	---	---	---	---	---
91	355.4	0.0167	0.013	Circle	1.5	---	---	---	---	---
93	558.1	0.0191	0.013	Circle	1.5	---	---	---	---	---
95	97.0	0.0203	0.013	Circle	1.5	---	---	---	---	---
97	623.2	0.0146	0.013	Circle	4	---	---	---	---	---
99	304.1	0.0160	0.013	Circle	4.5	---	---	---	---	---
101	351.1	0.0010	0.013	Circle	4.5	---	---	---	---	---
103	74.4	0.0010	0.013	Circle	4.5	---	---	---	---	---
105	1066.3	0.0239	0.013	Circle	3	---	---	---	---	---
107	199.9	0.0325	0.013	Circle	3	---	---	---	---	---
109	763.8	0.0849	0.015	Eight Point	---	---	---	0.04	0.07	33' width, flat xsec
111	126.5	0.0229	0.013	Circle	3	---	---	---	---	---
113	75.2	0.0498	0.013	Circle	3	---	---	---	---	---
115	474.4	0.0201	0.035	Rectangle	---	2	---	---	---	---
117	1256.9	0.0451	0.035	Triangle	---	---	2	---	---	---
119	191.5	0.0050	0.013	Circle	4	---	---	---	---	---
121	290.2	0.0050	0.013	Circle	3	---	---	---	---	---
123	374.6	0.0182	0.015	Eight Point	---	---	---	0.055	0.055	20' width, 2% Typical
131	738.4	0.0177	0.015	Eight Point	---	---	---	0.055	0.055	20' width, 2% Typical
135	524.6	0.0118	0.015	Eight Point	---	---	---	0.055	0.055	20' width, 2% Typical
137	439.2	0.0113	0.015	Eight Point	---	---	---	0.055	0.055	20' width, 2% Typical
139	427.6	0.0096	0.013	Circle	1.5	---	---	---	---	---
141	529.3	0.0027	0.015	Eight Point	---	---	---	0.045	0.045	24' width, TBC-CL Rd
143	1372.2	0.0545	0.035	Triangle	---	---	2	---	---	---
147	250.1	0.0210	0.013	Circle	4.5	---	---	---	---	---
8000	367.0	0.0050	0.013	Rectangle	---	20	---	---	---	---

HEC-HMS DBDPA CONVEYANCE ELEMENT INPUT

Element	Length (ft)	Slope (Ft/Ft)	Mannings n	Shape	Diameter (ft)	Width (ft)	Side Slope (xH:1V)	Left Bank n	Right Bank n	Cross Section
8002	350.0	0.0050	0.013	Rectangle	---	20	---	---	---	---
8004	388.0	0.0050	0.013	Rectangle	---	20	---	---	---	---
8006	698.0	0.0050	0.013	Circle	3.5	---	---	---	---	---
8008	786.0	0.0050	0.013	Circle	6	---	---	---	---	---
8010	225.0	0.0050	0.035	Trapezoid	---	3	1.5	---	---	---
8012	806.0	0.0050	0.013	Circle	3.5	---	---	---	---	---
8014	452.0	0.0050	0.013	Circle	7	---	---	---	---	---
8016	738.0	0.0050	0.013	Circle	6	---	---	---	---	---
8018	529.0	0.0050	0.013	Circle	5	---	---	---	---	---
8020	422.0	0.0050	0.013	Circle	4	---	---	---	---	---
8022	325.0	0.0050	0.013	Circle	4	---	---	---	---	---
8024	417.0	0.0050	0.013	Circle	3	---	---	---	---	---
8026	483.0	0.0050	0.013	Circle	3	---	---	---	---	---
8030	390.0	0.0050	0.035	Trapezoid	---	1	20	---	---	---
8034	909.0	0.0150	0.013	Circle	3	---	---	---	---	---
8040	1144.0	0.0050	0.013	Circle	5	---	---	---	---	---
8042	198.0	0.0050	0.013	Circle	4.5	---	---	---	---	---
8044	337.0	0.0050	0.013	Circle	4	---	---	---	---	---
8046	430.0	0.0050	0.013	Circle	3	---	---	---	---	---

**RED DALE DBDP AMENDMENT
DBDP ELEMENT RATING CURVES FOR HEC-HMS**

Diversion Element 1002		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
50	50	0
100	50	50
500	50	450
1000	50	950

Diversion Element 1014		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
50	50	0
100	100	0
160	160	0
500	160	340
1000	160	840

Diversion Element 1018		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
50	50	0
96.15	96.15	0
100	96.15	3.85
500	96.15	403.85
1000	96.15	903.85

Diversion Element 1020		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
50	50	0
100	100	0
116.6	116.6	0
500	116.6	383.4
1000	116.6	883.4

Diversion Element 1022		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
20	20	0
22.23	22.23	0
100	22.23	77.77
500	22.23	477.77
1000	22.23	977.77

Diversion Element 1024		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
4.39	4.39	0
10	4.39	5.61
100	4.39	95.61
500	4.39	495.61
1000	4.39	995.61

Diversion Element 1038		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
132.88	132.88	0
200	132.88	67.12
500	132.88	367.12
1000	132.88	867.12

Diversion Element 1040		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
181.08	181.08	0
200	181.08	18.92
500	181.08	318.92
1000	181.08	818.92

Diversion Element 1042		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
132.88	132.88	0
200	132.88	67.12
500	132.88	367.12
1000	132.88	867.12

Diversion Element 1044		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
200	200	0
230.15	230.15	0
500	230.15	269.85
1000	230.15	769.85

Diversion Element 1046		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
50	50	0
100	50	50
500	50	450
1000	50	950

Diversion Element 1048		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
32.61	32.61	0
100	32.61	67.39
500	32.61	467.39
1000	32.61	967.39

Diversion Element 1050		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
33	33	0
100	33	67
500	33	467
1000	33	967

Diversion Element 1052		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
15.32	15.32	0
100	15.32	84.68
500	15.32	484.68
1000	15.32	984.68

Diversion Element 1054		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
20	20	0
25.01	25.01	0
100	25.01	74.99
500	25.01	474.99
1000	25.01	974.99

RED DALE DBDP AMENDMENT
DBDP ELEMENT RATING CURVES FOR HEC-HMS

Diversion Element 3002		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
32.61	32.61	0
100	32.61	67.39
500	32.61	467.39
1000	32.61	967.39

Diversion Element 3004		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
2.35	2.35	0
10	2.35	7.65
100	2.35	97.65
500	2.35	497.65
1000	2.35	997.65

Diversion Element 3006		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
13.74	13.74	0
100	13.74	86.26
500	13.74	486.26
1000	13.74	986.26

Diversion Element 4002		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
39.55	39.55	0
100	39.55	60.45
500	39.55	460.45
1000	39.55	960.45

Diversion Element 4004		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
20	20	0
21.08	21.08	0
100	21.08	78.92
500	21.08	478.92
1000	21.08	978.92

Diversion Element 4006		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
28.52	28.52	0
100	28.52	71.48
500	28.52	471.48
1000	28.52	971.48

Diversion Element 4008		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
14.69	14.69	0
100	14.69	85.31
500	14.69	485.31
1000	14.69	985.31

Diversion Element 4010		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
15.14	15.14	0
100	15.14	84.86
500	15.14	484.86
1000	15.14	984.86

Diversion Element 4012		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
15.58	15.58	0
100	15.58	84.42
500	15.58	484.42
1000	15.58	984.42

Diversion Element 4014		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
11.44	11.44	0
100	11.44	88.56
500	11.44	488.56
1000	11.44	988.56

Diversion Element 5002		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
200	200	0
249	249	0
500	249	251
1000	249	751

Diversion Element 5004		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
250	250	0
285	285	0
500	285	215
1000	285	715

Diversion Element 5006		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
189	189	0
200	189	11
500	189	311
1000	189	811

Diversion Element 5008		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
189	189	0
200	189	11
500	189	311
1000	189	811

Diversion Element 5010		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
200	200	0
246.04	246.04	0
500	246.04	253.96
1000	246.04	753.96

Diversion Element 5012		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
20	20	0
21.1	21.1	0
100	22.2	77.8
500	23.3	476.7
1000	24.4	975.6

**RED DALE DBDP AMENDMENT
DBDP ELEMENT RATING CURVES FOR HEC-HMS**

Diversion Element 5016		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
41.85	41.85	0
100	41.85	58.15
500	41.85	458.15
1000	41.85	958.15

Diversion Element 5018		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
47.46	47.46	0
100	47.46	52.54
500	47.46	452.54
1000	47.46	952.54

Diversion Element 5024		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
13.75	13.75	0
100	13.75	86.25
500	13.75	486.25
1000	13.75	986.25

Diversion Element 5026		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
11.6	11.6	0
100	11.6	88.4
500	11.6	488.4
1000	11.6	988.4

Diversion Element 5030		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
35.37	35.37	0
100	35.37	64.63
500	35.37	464.63
1000	35.37	964.63

Diversion Element 6002		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
50	50	0
100	100	0
200	100	100
500	100	400
1000	100	900

Diversion Element 6004		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
50	50	0
100	50	50
500	50	450
1000	50	950

Diversion Element 7000		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
500	500	0
1000	1000	0
1100	1100	0
2000	1100	900

Diversion Element 7002		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
500	500	0
750	750	0
1000	750	250
2000	750	1250

Diversion Element 7004		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
500	500	0
750	750	0
1000	750	250
2000	750	1250

Diversion Element 7006		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
50	50	0
71	71	0
100	71	29
500	71	429
1000	71	929

Diversion Element 7008		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
250	250	0
293	293	0
500	293	207
1000	293	707

Diversion Element 7012		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
50	50	0
71	71	0
100	71	29
500	71	429
1000	71	929

Diversion Element 7014		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
400	400	0
442	442	0
500	442	58
1000	442	558

Diversion Element 7016		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
200	200	0
293	293	0
300	293	7
500	293	207
1000	293	707

RED DALE DBDP AMENDMENT
DBDP ELEMENT RATING CURVES FOR HEC-HMS

Diversion Element 7018		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
50	50	0
100	100	0
200	100	100
500	100	400
1000	100	900

Diversion Element 7020		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
50	50	0
100	100	0
200	100	100
500	100	400
1000	100	900

Diversion Element 7022		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
50	50	0
100	50	50
500	50	450
1000	50	950

Diversion Element 7024		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
50	50	0
100	50	50
500	50	450
1000	50	950

Diversion Element 7032		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
50	50	0
100	50	50
500	50	450
1000	50	950

Diversion Element 7034		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
50	50	0
100	100	0
200	100	100
500	100	400
1000	100	900

Diversion Element 7036		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
130	130	0
200	130	70
500	130	370
1000	130	870

Diversion Element 7038		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
160	160	0
200	160	40
500	160	340
1000	160	840

Diversion Element 7040		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
50	50	0
100	50	50
500	50	450
1000	50	950

HEC-HMS EXISTING CONVEYANCE ELEMENT INPUT

Element	Length (ft)	Slope (Ft/Ft)	Mannings n	Shape	Diameter (ft)	Width (ft)	Side Slope (xH:1V)	Left Bank n	Right Bank n	Cross Section
1	536.9	0.0122	0.013	Circle	3.5					
3	602.7	0.0049	0.035	Trapezoid		5	2			
5	580.1	0.0118	0.035	Trapezoid		5	2			
7	538.1	0.0095	0.035	Trapezoid		10	2			
9	73.7	0.0567	0.015	Rectangle		3				
15	386.8	0.0210	0.015	Rectangle		3				
17	463.3	0.0172	0.013	Circle	3					
19	300.8	0.0263	0.013	Circle	3					
21	321.1	0.0366	0.013	Circle	1.5					
23	240.4	0.0113	0.013	Circle	1.5					
25	303.8	0.0206	0.015	Eight Point				0.05	0.055	25' width, 2% typical
27	320.6	0.0010	0.015	Eight Point				0.055	0.055	20' width, 2% Typical
29	494.9	0.0231	0.015	Eight Point				0.055	0.055	20' width, 2% Typical
31	627.2	0.0251	0.015	Eight Point				0.055	0.055	20' width, 2% Typical
33	346.5	0.0100	0.015	Eight Point				0.055	0.055	20' width, 2% Typical
35	461.2	0.0050	0.015	Eight Point				0.05	0.07	32' width, 2% NO BrkL
37	397.4	0.0064	0.013	Circle	4					
39	346.4	0.0129	0.013	Circle	4					
41	421.3	0.0070	0.013	Circle	4					
43	225.7	0.0207	0.013	Circle	4					
45	371.6	0.0295	0.013	Circle	3					
47	468.7	0.0026	0.013	Circle	3					
49	819.8	0.0199	0.013	Circle	1.5					
51	1398.7	0.0868	0.013	Circle	1.25					
53	123.6	0.0100	0.013	Circle	2					
55	361.5	0.0121	0.015	Eight Point				0.05	0.05	25' width, 2% typical
57	209.5	0.0127	0.015	Eight Point				0.035	0.055	32' width, 2% NO BrkL
59	138.4	0.0042	0.015	Eight Point				0.035	0.06	32' width, 2% NO BrkL
63	808.9	0.0084	0.015	Eight Point				0.055	0.055	25' width, 2% typical

HEC-HMS EXISTING CONVEYANCE ELEMENT INPUT

Element	Length (ft)	Slope (Ft/Ft)	Mannings n	Shape	Diameter (ft)	Width (ft)	Side Slope (xH:1V)	Left Bank n	Right Bank n	Cross Section
65	282.8	0.0199	0.015	Eight Point				0.055	0.055	22' width, 2% No BrkL
67	361.2	0.0310	0.015	Eight Point				0.055	0.055	22' width, 2% No BrkL
69	367.2	0.0265	0.013	Circle	2					
71	445.3	0.0098	0.015	Eight Point				0.06	0.06	25' width, 2% typical
73	361.2	0.0065	0.015	Eight Point				0.06	0.06	25' width, 2% typical
75	274.4	0.0130	0.013	Circle	1					
77	283.4	0.0035	0.013	Circle	1					
79	149.3	0.0154	0.013	Circle	1.5					
81	119.9	0.0010	0.035	Circle	3.5					
83	526.0	0.0164	0.013	Circle	2					
85	649.2	0.0071	0.013	Circle	2					
87	350.1	0.0118	0.013	Circle	2					
89	264.9	0.0182	0.013	Circle	1.5					
91	355.4	0.0167	0.013	Circle	1.5					
93	558.1	0.0191	0.013	Circle	1.5					
95	97.0	0.0203	0.013	Circle	1.5					
97	623.2	0.0146	0.013	Circle	4					
99	304.1	0.0160	0.013	Circle	4.5					
101	351.1	0.0010	0.013	Circle	4.5					
103	74.4	0.0010	0.013	Circle	4.5					
105	1066.3	0.0239	0.013	Circle	3					
107	199.9	0.0325	0.013	Circle	3					
109	763.8	0.0849	0.015	Eight Point				0.04	0.07	33' width, flat xsec
111	126.5	0.0229	0.013	Circle	2					
113	75.2	0.0498	0.013	Circle	2					
115	474.4	0.0201	0.035	Rectangle		2				
117	1256.9	0.0451	0.035	Triangle			2			
119	191.5	0.0183	0.015	Eight Point				0.055	0.06	25' width, 2% typical
121	290.2	0.0048	0.015	Eight Point				0.055	0.055	25' width, 2% typical

HEC-HMS EXISTING CONVEYANCE ELEMENT INPUT

Element	Length (ft)	Slope (Ft/Ft)	Mannings n	Shape	Diameter (ft)	Width (ft)	Side Slope (xH:1V)	Left Bank n	Right Bank n	Cross Section
123	374.6	0.0182	0.015	Eight Point				0.055	0.055	20' width, 2% Typical
125	282.9	0.0086	0.015	Eight Point				0.055	0.055	25' width, 2% typical
127	324.9	0.0232	0.015	Eight Point				0.055	0.055	20' width, 2% Typical
129	417.0	0.0223	0.015	Eight Point				0.055	0.055	20' width, 2% Typical
131	738.4	0.0177	0.015	Eight Point				0.055	0.055	20' width, 2% Typical
133	208.9	0.0041	0.015	Eight Point				0.055	0.055	25' width, 2% typical
135	524.6	0.0118	0.015	Eight Point				0.055	0.055	20' width, 2% Typical
137	439.2	0.0113	0.015	Eight Point				0.055	0.055	20' width, 2% Typical
139	427.6	0.0096	0.013	Circle	1.5					
141	529.3	0.0027	0.015	Eight Point				0.045	0.045	24' width, TBC-CL Rd
143	1372.2	0.0545	0.035	Triangle			2			
145	725.6	0.0092	0.013	Circle	3					
147	250.1	0.0210	0.013	Circle	4.5					
149	500.0	0.0050	0.035	Trapezoid		1	20			

**RED DALE DBDP AMENDMENT
EXISTING ELEMENT RATING CURVES FOR HEC-HMS**

Diversion Element 1002		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
115	115	0
200	115	85
500	115	385
1000	115	885

Diversion Element 1004		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
50	50	0
100	100	0
500	500	0
1000	500	500
1500	500	1000

Diversion Element 1014		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
50	50	0
100	100	0
150.7	150.7	0
500	150.7	349.3
1000	150.7	849.3

Diversion Element 1016		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
20	20	0
21.2	21.2	0
100	21.2	78.8
500	21.2	478.8
1000	21.2	978.8

Diversion Element 1018		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
50	50	0
96.2	96.2	0
100	96.2	3.8
500	96.2	403.8
1000	96.2	903.8

Diversion Element 1020		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
116.6	116.6	0
200	116.6	83.4
500	116.6	383.4
1000	116.6	883.4

Diversion Element 1022		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
20	20	0
23.2	23.2	0
100	23.2	76.8
500	23.2	476.8
1000	23.2	976.8

Diversion Element 1024		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
4.4	4.4	0
10	4.4	5.6
100	4.4	95.6
500	4.4	495.6
1000	4.4	995.6

Diversion Element 1038		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
132.9	132.9	0
200	132.9	67.1
500	132.9	367.1
1000	132.9	867.1

Diversion Element 1040		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
181.1	181.1	0
200	181.1	18.9
500	181.1	318.9
1000	181.1	818.9

Diversion Element 1042		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
132.9	132.9	0
200	132.9	67.1
500	132.9	367.1
1000	132.9	867.1

Diversion Element 1044		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
200	200	0
230.2	230.2	0
300	230.2	69.8
1000	230.2	769.8

RED DALE DBDP AMENDMENT
EXISTING ELEMENT RATING CURVES FOR HEC-HMS

Diversion Element 1046		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
127.7	127.7	0
200	127.7	72.3
500	127.7	372.3
1000	127.7	872.3

Diversion Element 1048		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
27.5	27.5	0
100	27.5	72.5
500	27.5	472.5
1000	27.5	972.5

Diversion Element 1050		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
36.3	36.3	0
100	36.3	63.7
500	36.3	463.7
1000	36.3	963.7

Diversion Element 1052		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
15.3	15.3	0
100	15.3	84.7
500	15.3	484.7
1000	15.3	984.7

Diversion Element 1054		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
20	20	0
22.5	22.5	0
100	22.5	77.5
500	22.5	477.5
1000	22.5	977.5

Diversion Element 2002		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
46.1	46.1	0
100	46.1	53.9
500	46.1	453.9
1000	46.1	953.9

Diversion Element 2004		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
5	5	0
7.1	7.1	0
50	7.1	42.9
200	7.1	192.9
1000	7.1	992.9

Diversion Element 2006		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
5	5	0
7.1	7.1	0
50	7.1	42.9
200	7.1	192.9
1000	7.1	992.9

Diversion Element 3002		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
32.6	32.6	0
100	32.6	67.4
500	32.6	467.4
1000	32.6	967.4

Diversion Element 3004		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
2	2	0
2.4	2.4	0
50	2.4	47.6
200	2.4	197.6
1000	2.4	997.6

Diversion Element 3006		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
13.7	13.7	0
100	13.7	86.3
500	13.7	486.3
1000	13.7	986.3

Diversion Element 4002		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
39.6	39.6	0
100	39.6	60.4
500	39.6	460.4
1000	39.6	960.4

**RED DALE DBDP AMENDMENT
EXISTING ELEMENT RATING CURVES FOR HEC-HMS**

Diversion Element 4004		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
20	20	0
21.1	21.1	0
100	21.1	78.9
500	21.1	478.9
1000	21.1	978.9

Diversion Element 4006		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
28.5	28.5	0
100	28.5	71.5
500	28.5	471.5
1000	28.5	971.5

Diversion Element 4008		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
14.7	14.7	0
50	14.7	35.3
200	14.7	185.3
1000	14.7	985.3

Diversion Element 4010		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
15.1	15.1	0
50	15.1	34.9
200	15.1	184.9
1000	15.1	984.9

Diversion Element 4012		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
15.6	15.6	0
50	15.6	34.4
200	15.6	184.4
1000	15.6	984.4

Diversion Element 4014		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
11.4	11.4	0
50	11.4	38.6
200	11.4	188.6
1000	11.4	988.6

Diversion Element 5002		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
200	200	0
200.9	200.9	0
500	200.9	299.1
1000	200.9	799.1

Diversion Element 5004		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
200	200	0
300	200	100
500	200	300
1000	200	800

Diversion Element 5006		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
200	200	0
300	200	100
500	200	300
1000	200	800

Diversion Element 5008		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
200	200	0
300	200	100
500	200	300
1000	200	800

Diversion Element 5010		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
100	100	0
200	200	0
246	246	0
500	246	254
1000	246	754

Diversion Element 5012		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
20	20	0
21.1	21.1	0
100	21.1	78.9
500	21.1	478.9
1000	21.1	978.9

Diversion Element 5016		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
41.9	41.9	0
100	41.9	58.1
500	41.9	458.1
1000	41.9	958.1

Diversion Element 5018		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
47.5	47.5	0
100	47.5	52.5
500	47.5	452.5
1000	47.5	952.5

Diversion Element 5024		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
13.8	13.8	0
50	13.8	36.2
200	13.8	186.2
1000	13.8	986.2

Diversion Element 5026		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
11.6	11.6	0
25	11.6	13.4
200	11.6	188.4
1000	11.6	988.4

**RED DALE DBDP AMENDMENT
EXISTING ELEMENT RATING CURVES FOR HEC-HMS**

Diversion Element 5030		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
25	25	0
35.4	35.4	0
100	35.4	64.6
500	35.4	464.6
1000	35.4	964.6

Diversion Element 6008		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
14	14	0
50	14	36
250	14	236
1000	14	986

Diversion Element 6016		
Total (cfs)	Outflow (cfs)	Diversion (cfs)
0	0	0
10	10	0
14	14	0
50	14	36
250	14	236
1000	14	986





Ferber
Engineering
Company, Inc.

APPENDIX C

Phase III - Evergreen / Cottonwood Conceptual Plan and Profile



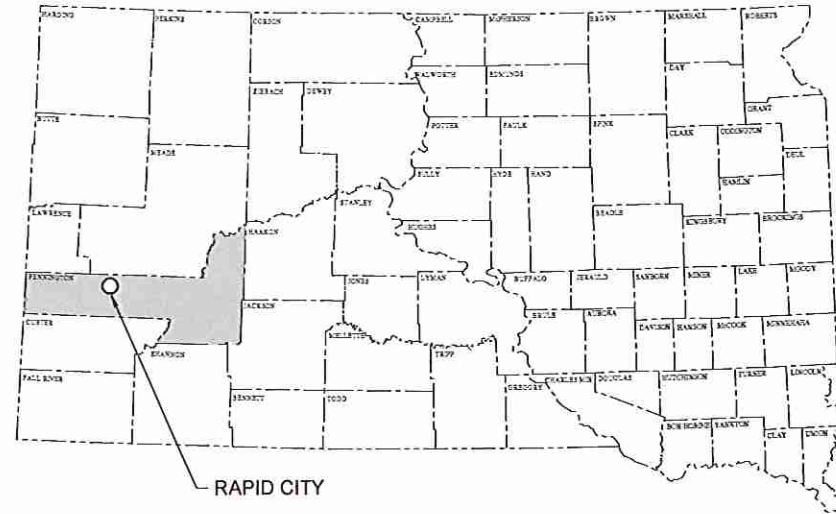
CITY of RAPID CITY
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

DOVER STREET DRAINAGE IMPROVEMENTS PHASE III - COTTONWOOD AND EVERGREEN DRAINAGE IMPROVEMENTS

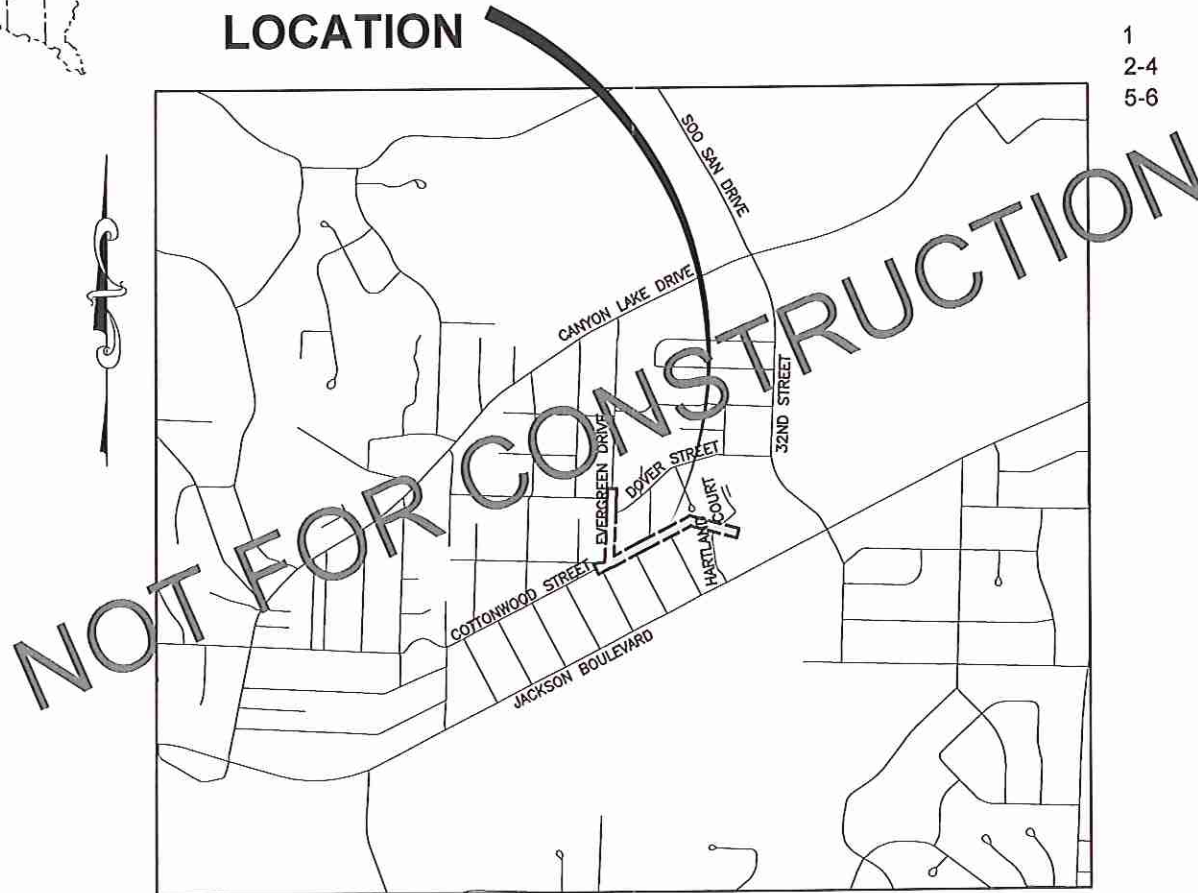
CITY OF RAPID CITY PROJECT NO. DR05-1452

CIP #50025

CONCEPTUAL DESIGN



PROJECT LOCATION



INDEX OF SHEETS

- 1 TITLE SHEET
- 2-4 COTTONWOOD STREET PLAN AND PROFILE
- 5-6 EVERGREEN DRIVE PLAN AND PROFILE

SITE MAP NOT TO SCALE

I, DAVID M. MUCK, CERTIFY THAT I HAVE READ AND UNDERSTAND THE PROVISIONS CONTAINED IN THE CITY OF RAPID CITY STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, CURRENT EDITION AND THE CITY OF RAPID CITY'S ADOPTED DESIGN CRITERIA MANUALS.

DAVID M. MUCK, PE/LS

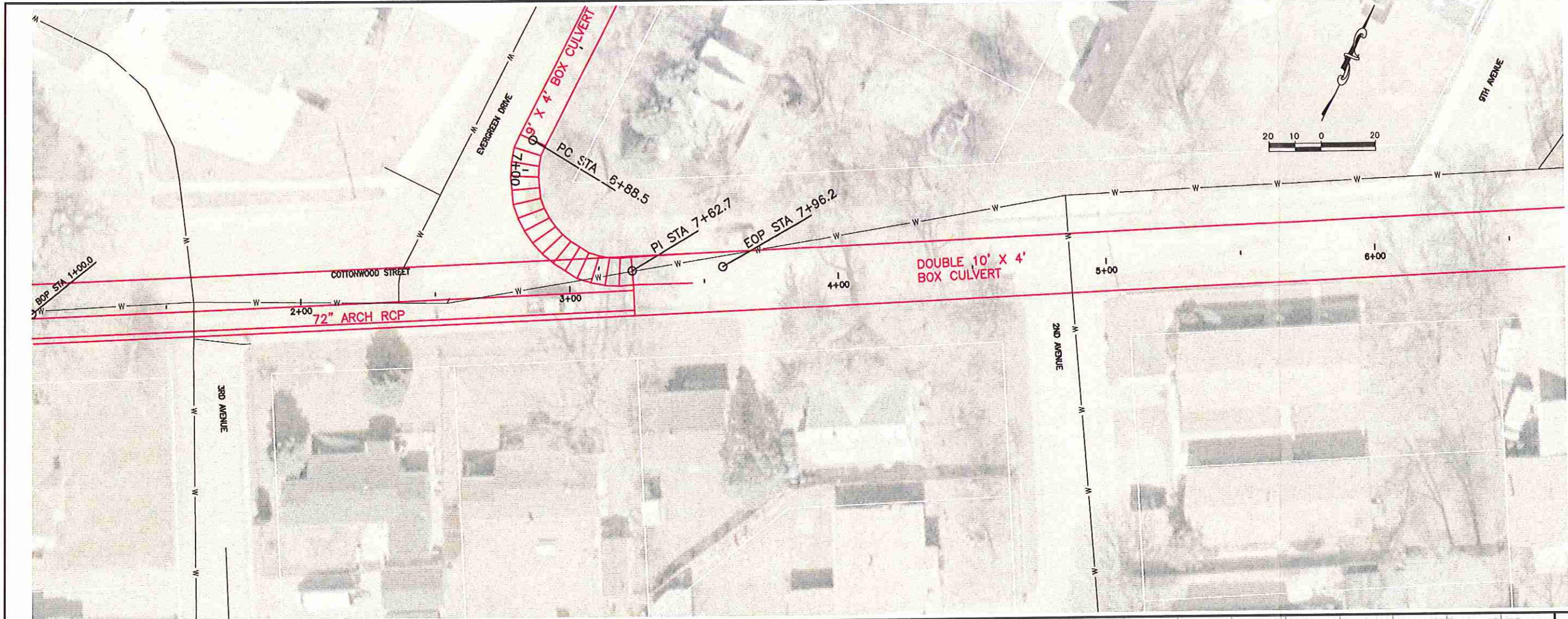


DEPARTMENT OF PUBLIC WORKS
ENGINEERING DIVISION
CITY OF RAPID CITY, SOUTH DAKOTA

Plan Set Number :

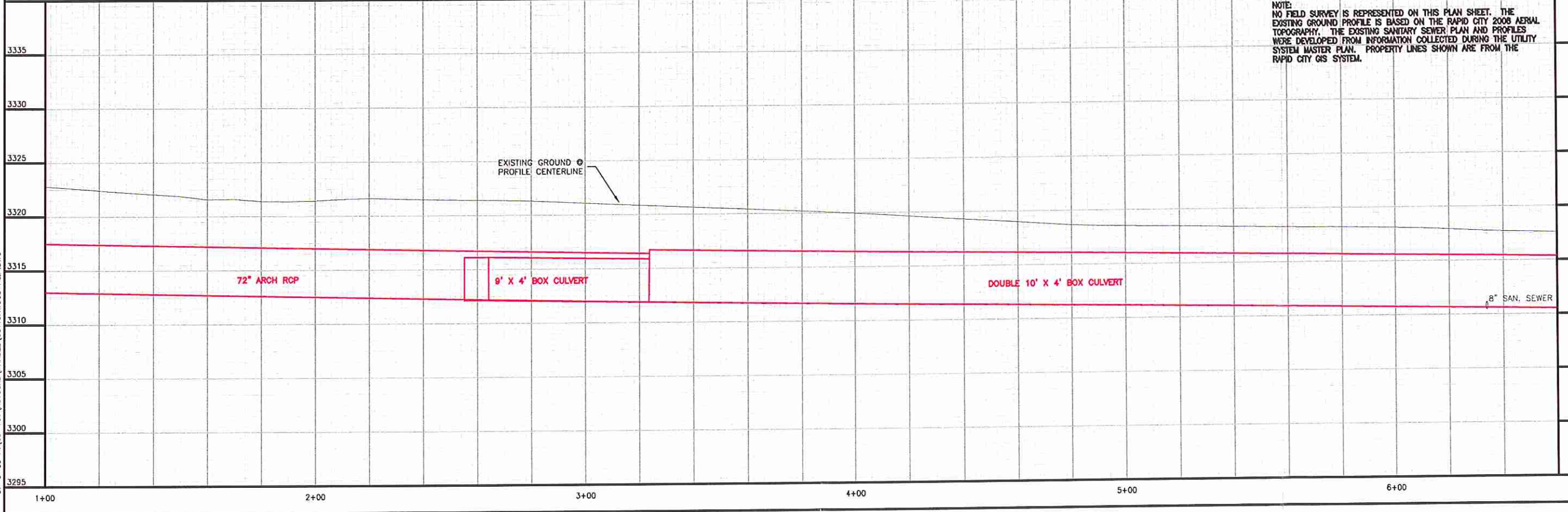
DOVER STREET DRAINAGE IMPROVEMENTS
PHASE III - CONCEPTUAL DESIGN
CITY OF RAPID CITY PROJECT NO. DR05-1452

P:\09-10\AutoCAD\PHASE2\1452TTLPHASE II.dwg



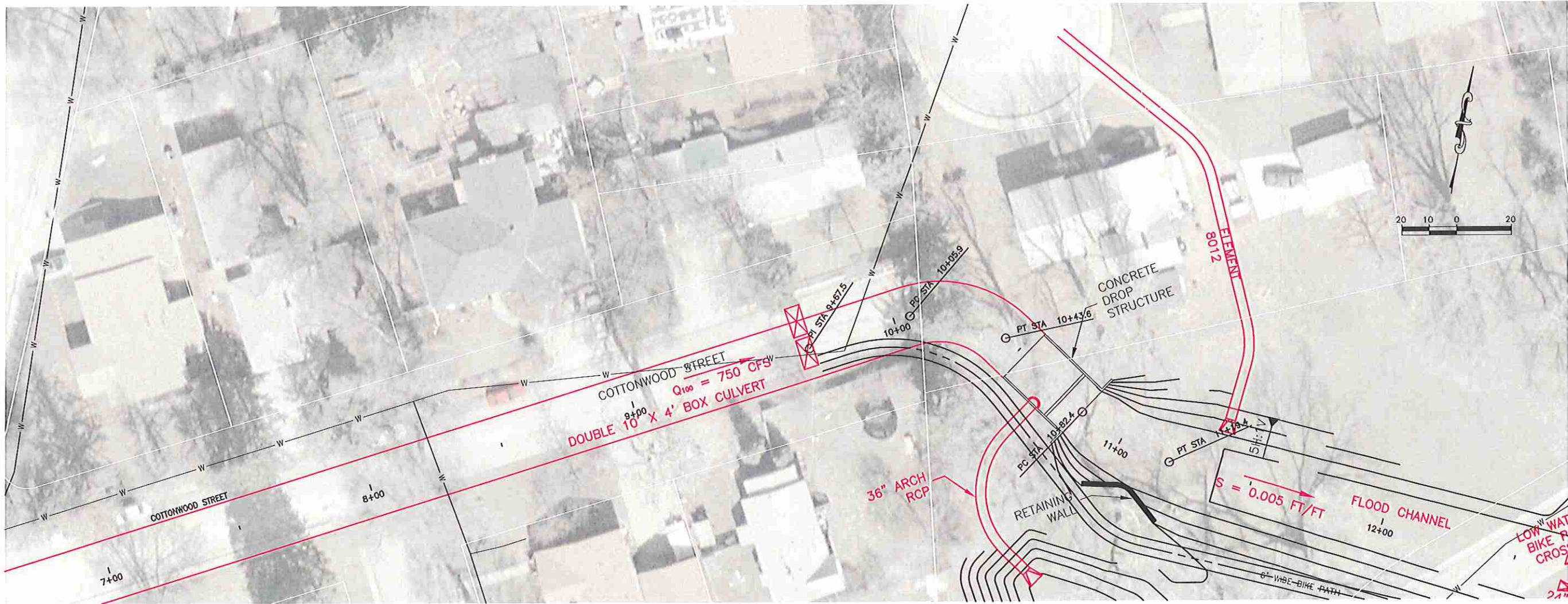
NOT FOR CONSTRUCTION

Scale:	AS SHOWN
Designed By:	Drawn By:
DAL	DRS
Design Date:	Print Date:
JUNE 2009	07-9-09
Internal Job No.:	
J09-101	
Surveyed By:	Survey Date:
SLAJUB	FEB 2009
Revisions:	

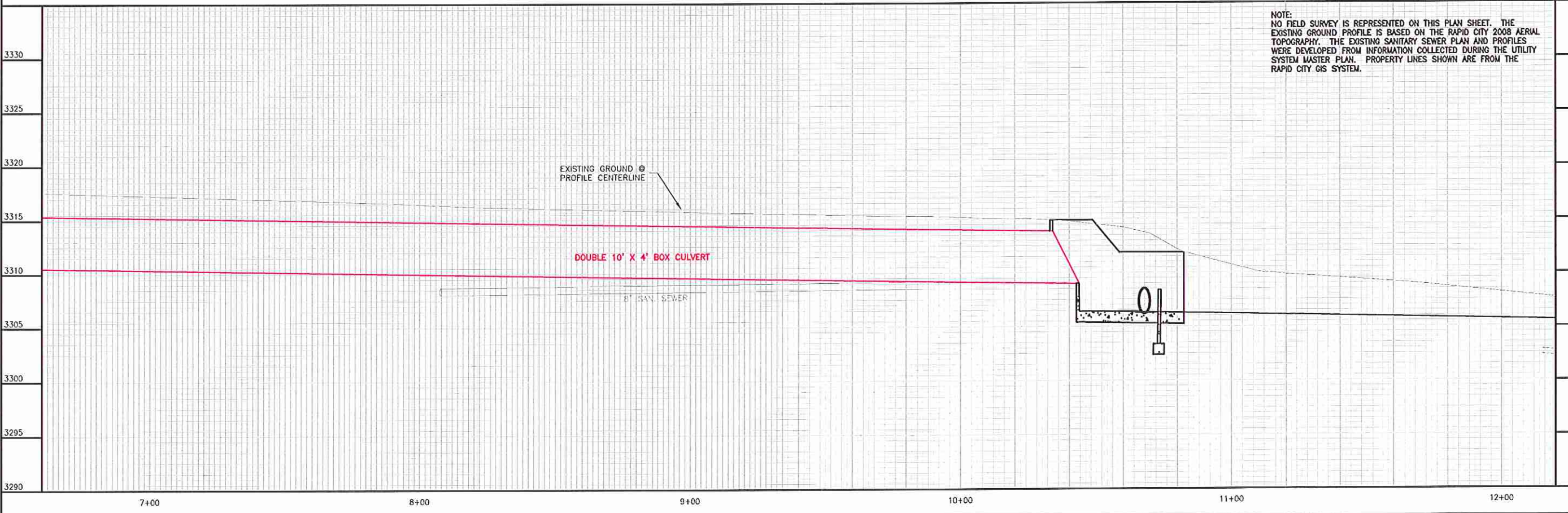


DOVER STREET DRAINAGE IMPROVEMENTS
PHASE III- CONCEPTUAL DESIGN

07-9-09 P:\09-101\AUTOCAD\PHASE2\COTTONWOOD P&P.DWG



NOTE:
 NO FIELD SURVEY IS REPRESENTED ON THIS PLAN SHEET. THE EXISTING GROUND PROFILE IS BASED ON THE RAPID CITY 2008 AERIAL TOPOGRAPHY. THE EXISTING SANITARY SEWER PLAN AND PROFILES WERE DEVELOPED FROM INFORMATION COLLECTED DURING THE UTILITY SYSTEM MASTER PLAN. PROPERTY LINES SHOWN ARE FROM THE RAPID CITY GIS SYSTEM.



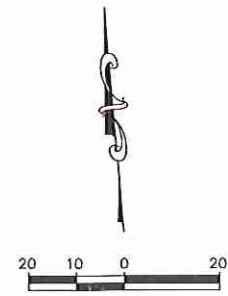
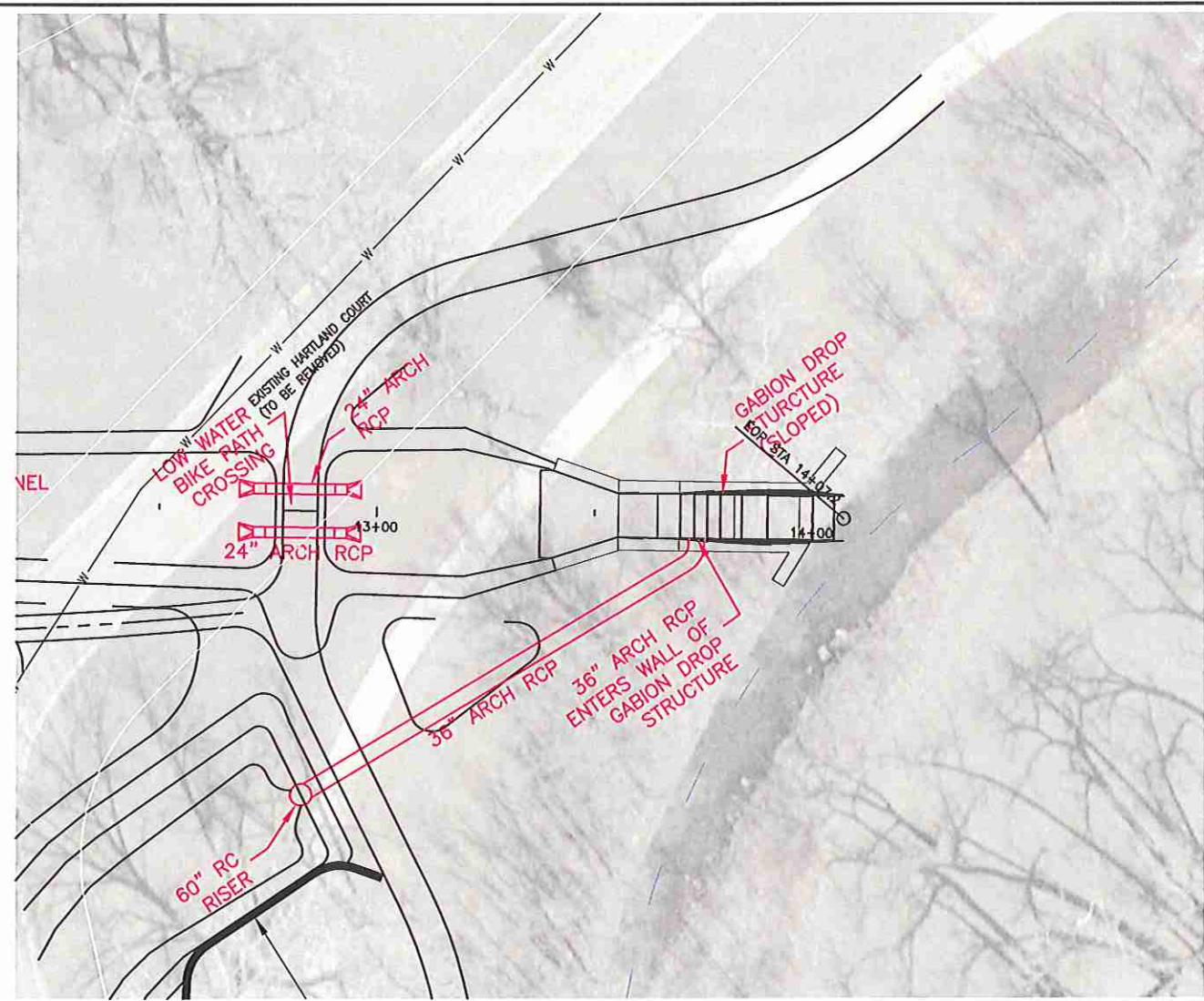
NOT FOR CONSTRUCTION

Scale: AS SHOWN
 Designed By: DAL
 Drawn By: DRS
 Design Date: JUNE 2009
 Print Date: 07-28-09
 Internal Job No: J09-101
 Surveyed By: SLAJUB
 Survey Date: FEB 2009

DOVER STREET DRAINAGE IMPROVEMENTS
 PHASE III - CONCEPTUAL DESIGN

Sheet Title:
 COTTONWOOD STREET
 PLAN AND PROFILE
 STA 6+60 TO 12+20

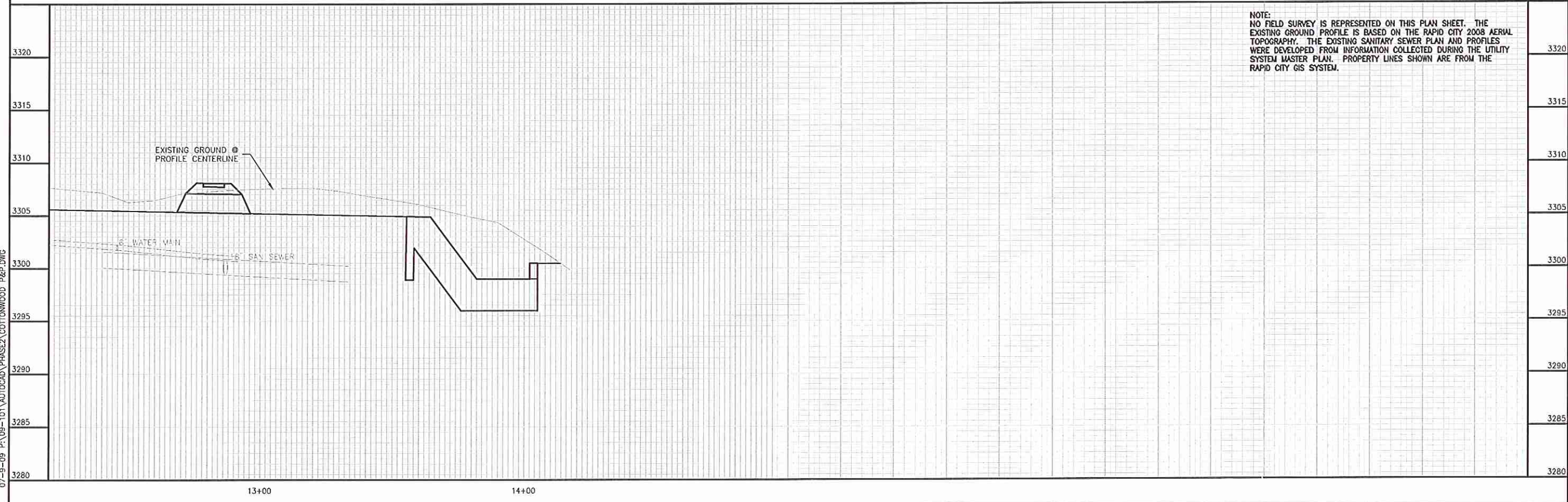
07-9-09 P:\09-101\AUTOCAD\PHASE2\COTTONWOOD P&P.DWG



NOT FOR CONSTRUCTION

Scale:	AS SHOWN
Designed By:	DAL
Drawn By:	DRS
Design Date:	JUNE 2009
Print Date:	07-9-09
Internal Job No:	J09-101
Surveyed By:	SLAJUB
Survey Date:	FEB 2009
Revisions:	

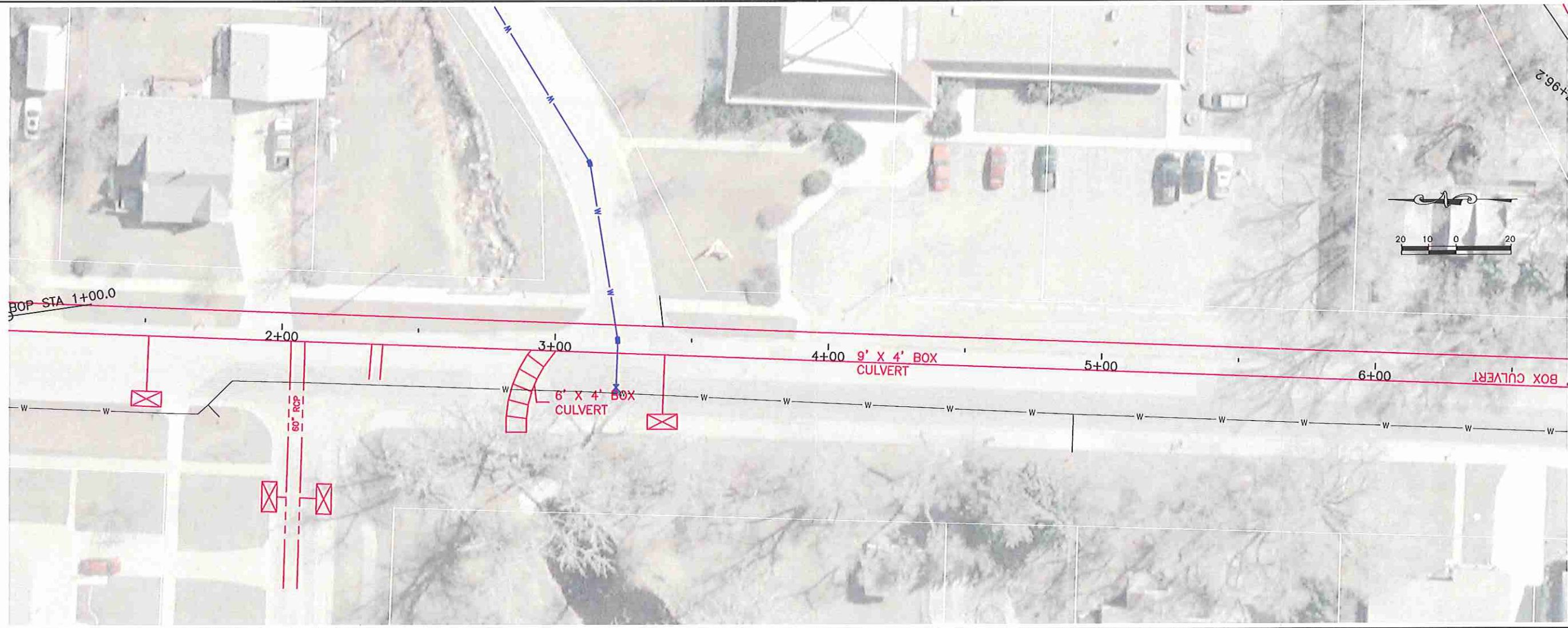
NOTE:
NO FIELD SURVEY IS REPRESENTED ON THIS PLAN SHEET. THE EXISTING GROUND PROFILE IS BASED ON THE RAPID CITY 2008 AERIAL TOPOGRAPHY. THE EXISTING SANITARY SEWER PLAN AND PROFILES WERE DEVELOPED FROM INFORMATION COLLECTED DURING THE UTILITY SYSTEM MASTER PLAN. PROPERTY LINES SHOWN ARE FROM THE RAPID CITY GIS SYSTEM.



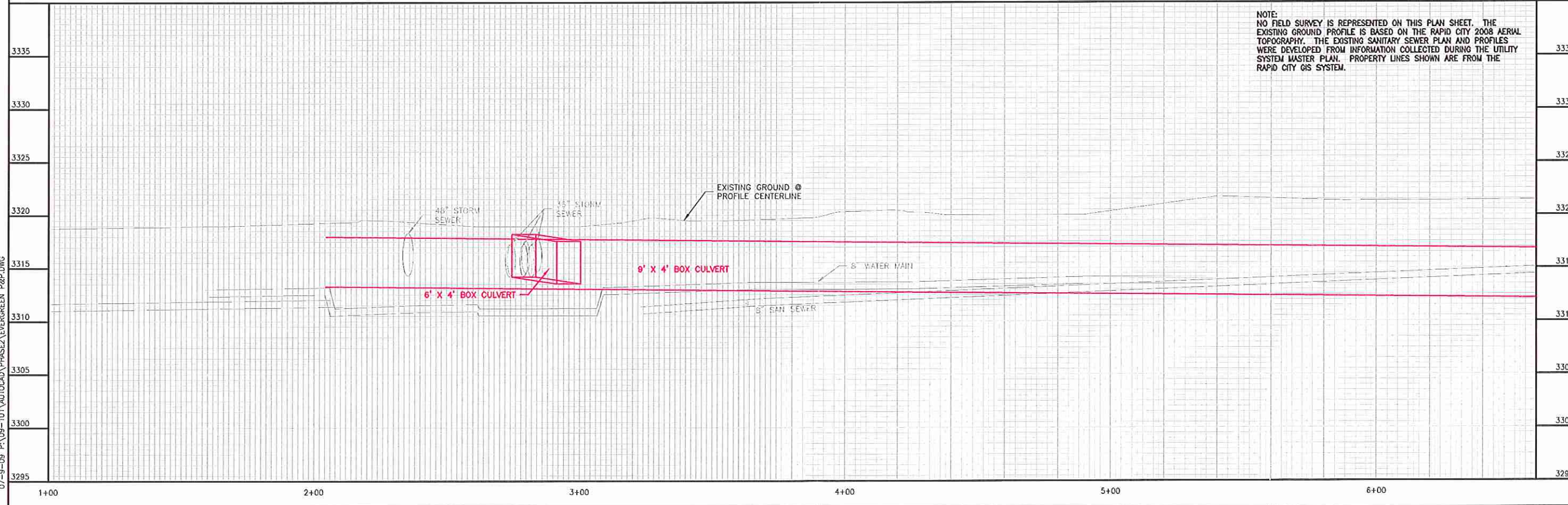
**DOVER STREET DRAINAGE IMPROVEMENTS
PHASE III - CONCEPTUAL DESIGN**

07-9-09 P:\09-101\AUTOCAD\PHASE3\COTTONWOOD_P&P.DWG

07-9-09 P:\09-101\AUTOCAD\PHASE2\EVERGREEN P&P.DWG



NOTE:
 NO FIELD SURVEY IS REPRESENTED ON THIS PLAN SHEET. THE EXISTING GROUND PROFILE IS BASED ON THE RAPID CITY 2008 AERIAL TOPOGRAPHY. THE EXISTING SANITARY SEWER PLAN AND PROFILES WERE DEVELOPED FROM INFORMATION COLLECTED DURING THE UTILITY SYSTEM MASTER PLAN. PROPERTY LINES SHOWN ARE FROM THE RAPID CITY GIS SYSTEM.



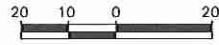
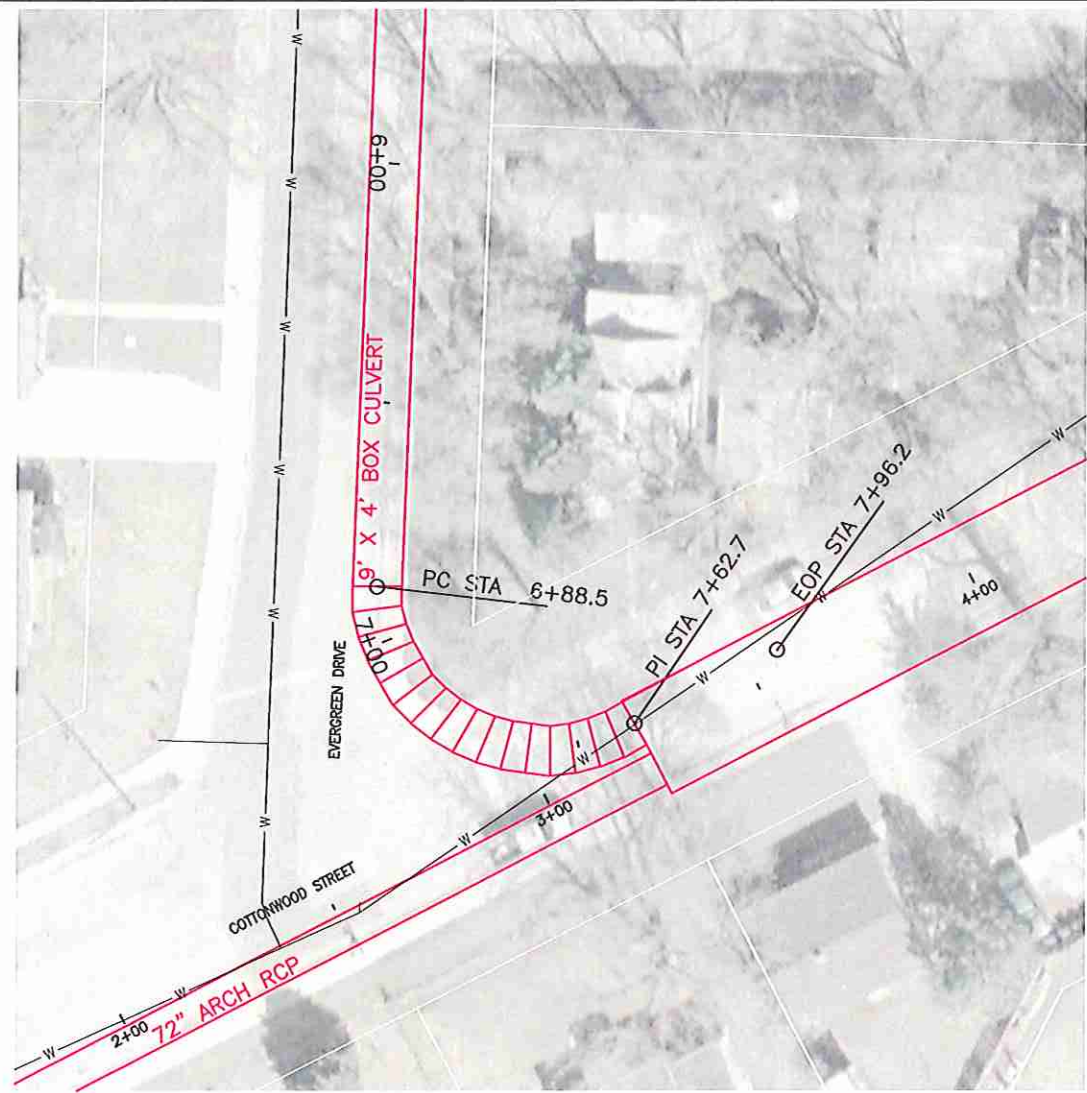
Scale: AS SHOWN

Designed By: DAL	Drawn By: DRS
Design Date: JUNE 2009	Plot Date: 07-9-09
Internal Job No: J09-101	
Surveyed By: SLAJUB	Survey Date: FEB 2009
Revisions:	

DOVER STREET DRAINAGE IMPROVEMENTS
PHASE III - CONCEPTUAL DESIGN

Sheet Title:
EVERGREEN DRIVE
PLAN AND PROFILE
STA 1+00 TO 6+60

P:\09-101\AUTOCAD\PHASE2\EVERGREEN P&P.DWG



NOTE:
NO FIELD SURVEY IS REPRESENTED ON THIS PLAN SHEET. THE EXISTING GROUND PROFILE IS BASED ON THE RAPID CITY 2008 AERIAL TOPOGRAPHY. THE EXISTING SANITARY SEWER PLAN AND PROFILES WERE DEVELOPED FROM INFORMATION COLLECTED DURING THE UTILITY SYSTEM MASTER PLAN. PROPERTY LINES SHOWN ARE FROM THE RAPID CITY GIS SYSTEM.



NOT FOR CONSTRUCTION

Scale:	AS SHOWN
Designed By:	DAL
Drawn By:	DRS
Design Date:	JUNE 2009
Print Date:	06-22-09
Internal Job No:	J09-101
Surveyed By:	SLAJUB
Survey Date:	FEB 2009
Revisions:	

DOVER STREET DRAINAGE IMPROVEMENTS
PHASE III - CONCEPTUAL DESIGN

Sheet Title:
EVERGREEN DRIVE
PLAN AND PROFILE
STA 6+60 TO 10+00

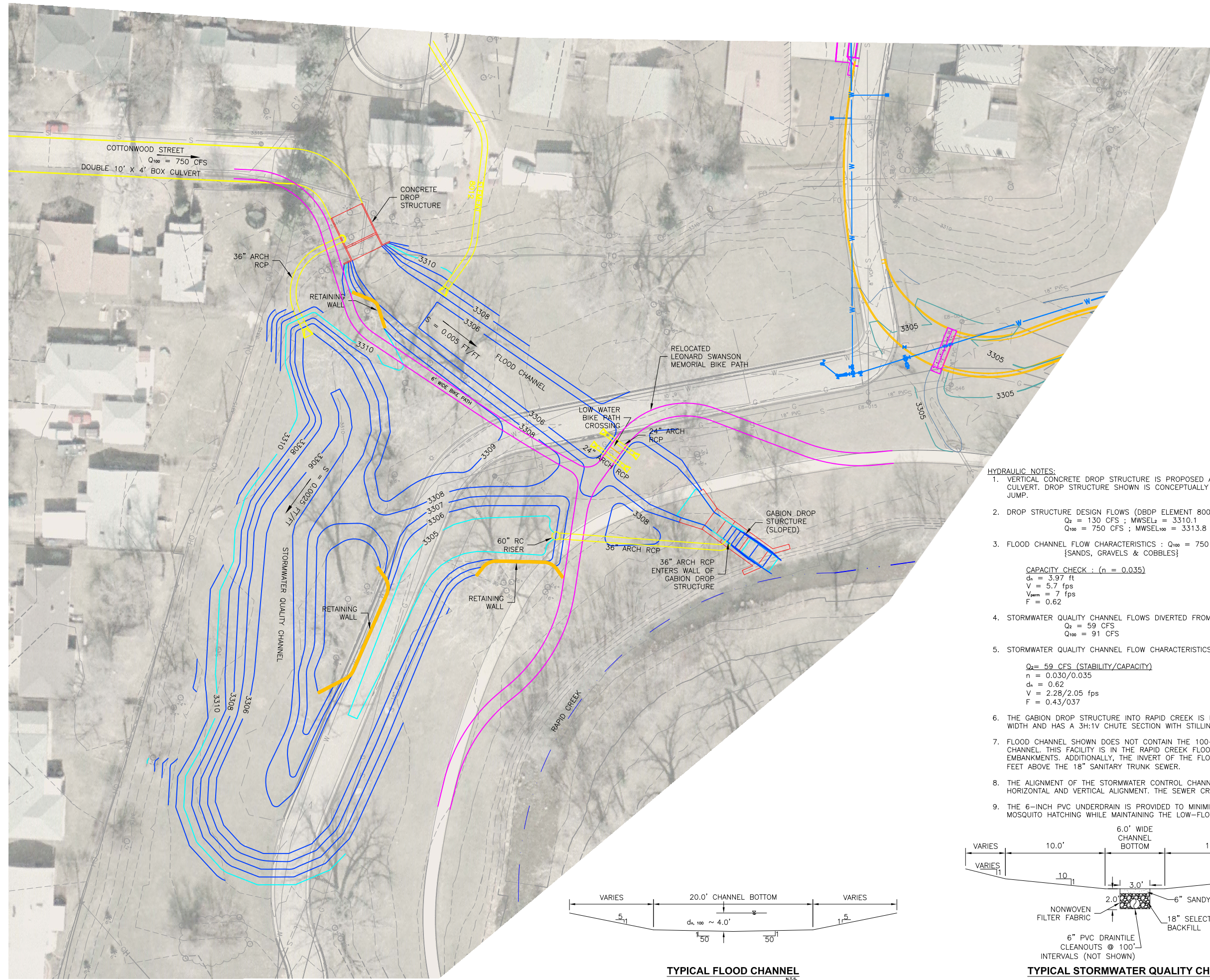


Ferber
Engineering
Company, Inc.

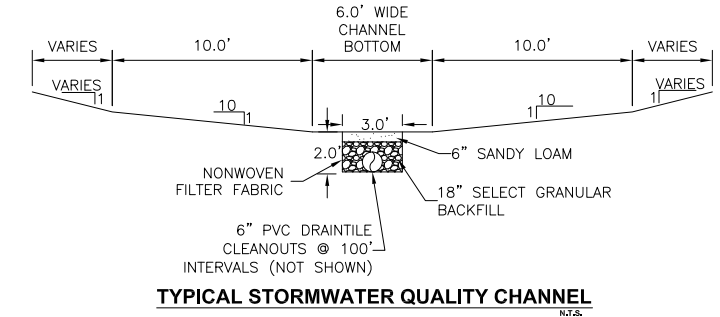
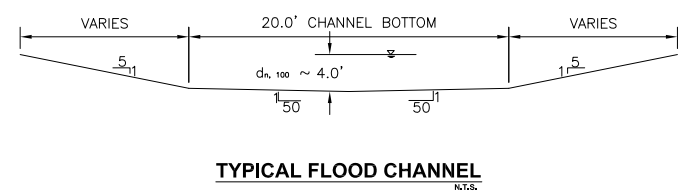
APPENDIX D

Hartland Storm Water Quality Facility

7/23/2009 P:\09-101\AUTOCAD\FIGURES\1452-PLAN-CONCEPTUAL STORM LAYOUT.DWG



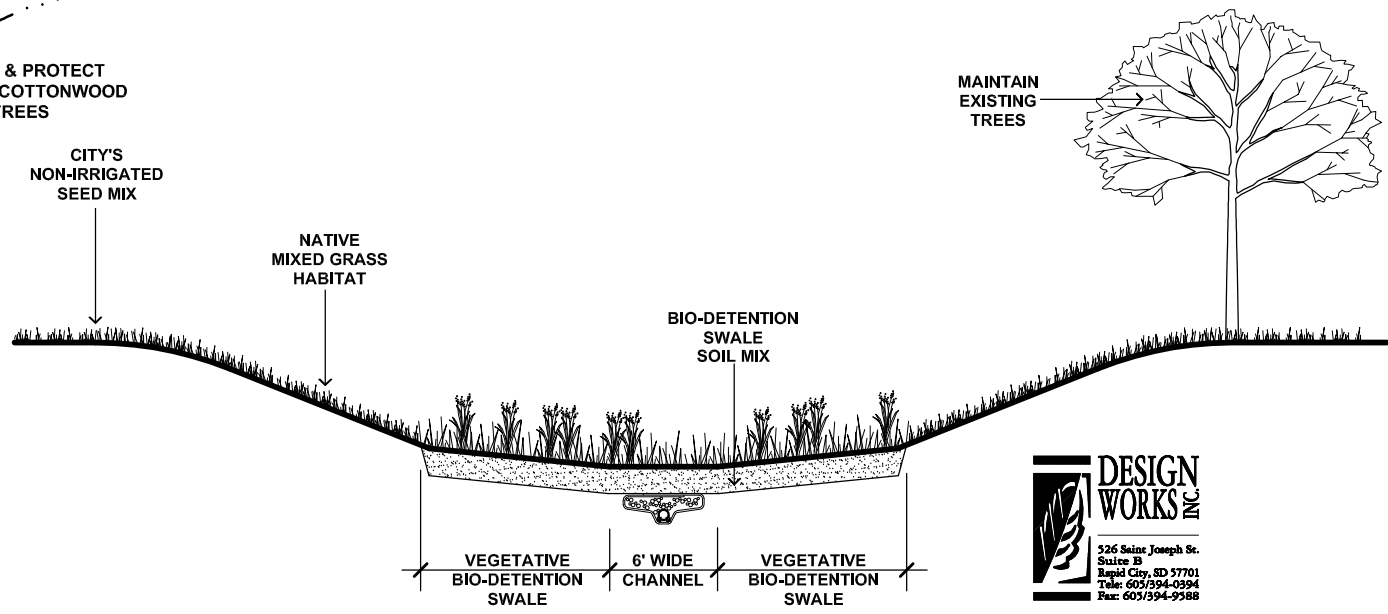
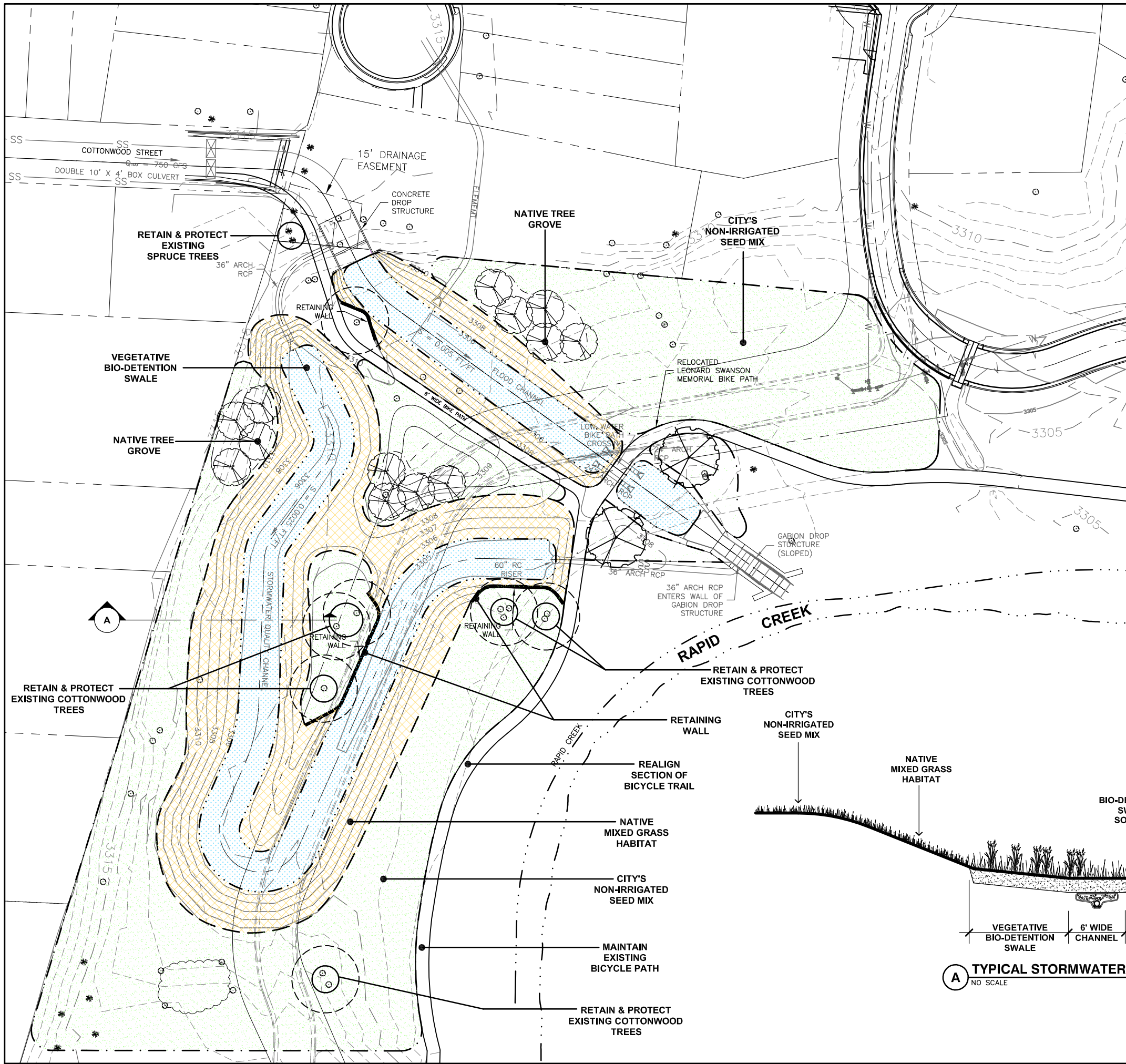
- HYDRAULIC NOTES:**
- VERTICAL CONCRETE DROP STRUCTURE IS PROPOSED AT OUTLET OF COTTONWOOD STREET BOX CULVERT. DROP STRUCTURE SHOWN IS CONCEPTUALLY DESIGNED TO CONTAIN 100-YR HYDRAULIC JUMP.
 - DROP STRUCTURE DESIGN FLOWS (DBDP ELEMENT 8004)
 $Q_2 = 130 \text{ CFS}$; $MWSEL_2 = 3310.1$
 $Q_{100} = 750 \text{ CFS}$; $MWSEL_{100} = 3313.8$
 - FLOOD CHANNEL FLOW CHARACTERISTICS : $Q_{100} = 750 \text{ CFS}$.
 {SANDS, GRAVELS & COBBLES}
- | | |
|-------------------------------------|------------------------------------|
| <u>CAPACITY CHECK</u> : (n = 0.035) | <u>STABILITY CHECK</u> (n = 0.030) |
| $d_n = 3.97 \text{ ft}$ | $d_n = 3.68 \text{ FT}$ |
| $V = 5.7 \text{ fps}$ | $V = 6.37 \text{ fps}$ |
| $V_{perm} = 7 \text{ fps}$ | $V_{perm} = 7 \text{ fps}$ |
| $F = 0.62$ | $F = 0.62$ |
- STORMWATER QUALITY CHANNEL FLOWS DIVERTED FROM DROP STRUCTURE:
 $Q_2 = 59 \text{ CFS}$
 $Q_{100} = 91 \text{ CFS}$
 - STORMWATER QUALITY CHANNEL FLOW CHARACTERISTICS
- | | |
|---|---|
| <u>$Q_2 = 59 \text{ CFS}$ (STABILITY/CAPACITY)</u> | <u>$Q_{100} = 91 \text{ CFS}$ (STABILITY/CAPACITY)</u> |
| n = 0.030/0.035 | n = 0.030/0.035 |
| $d_n = 0.62$ | $d_n = 1.65/1.77$ |
| $V = 2.28/2.05 \text{ fps}$ | $V = 2.61/2.35 \text{ fps}$ |
| $F = 0.43/0.37$ | $F = 0.44/0.30$ |
- THE GABION DROP STRUCTURE INTO RAPID CREEK IS PROPOSED TO HAVE A 10 - FOOT BOTTOM WIDTH AND HAS A 3H:1V CHUTE SECTION WITH STILLING BASIN.
 - FLOOD CHANNEL SHOWN DOES NOT CONTAIN THE 100-YR FLOW IN THE EAST HALF OF THE CHANNEL. THIS FACILITY IS IN THE RAPID CREEK FLOODWAY, WHICH LIMITS THE OPTION TO CREATE EMBANKMENTS. ADDITIONALLY, THE INVERT OF THE FLOOD CHANNEL MUST BE A MINIMUM OF FOUR FEET ABOVE THE 18" SANITARY TRUNK SEWER.
 - THE ALIGNMENT OF THE STORMWATER CONTROL CHANNEL IS DICTATED BY THE SANITARY SEWER HORIZONTAL AND VERTICAL ALIGNMENT. THE SEWER CROSSING WILL REQUIRE INSULATION.
 - THE 6-INCH PVC UNDERDRAIN IS PROVIDED TO MINIMIZE STANDING WATER WHICH WILL DISCOURAGE MOSQUITO HATCHING WHILE MAINTAINING THE LOW-FLOW WATER QUALITY ASPECT OF THE FACILITY.



NOT FOR CONSTRUCTION

Scale: AS SHOWN	
Designed By: DAL	Drawn By: DRS
Design Date: FEB 2009	Print Date: 7/23/2009
Internal Job No: J09-101	
Surveyed By: SLA/JUB	Survey Date: FEB 2009
Revisions:	

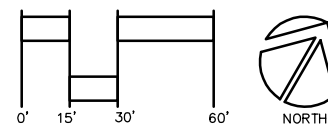
**DOVER STREET DRAINAGE IMPROVEMENTS
PHASE II - STORM WATER QUALITY FACILITY**



A TYPICAL STORMWATER QUALITY CHANNEL
NO SCALE



LANDSCAPE CONCEPT



NOT FOR CONSTRUCTION

Scale:	SCALE
Designed By:	Drawn By:
RJF	TJD
Design Date:	Print Date:
AUG 2009	08-05-09
Internal Job No:	
J09-101	
Surveyed By:	Survey Date:
SLAJUB	FEB 2009
Revisions:	

**DOVER STREET DRAINAGE IMPROVEMENTS
PHASE II - STORM WATER QUALITY FACILITY**



Ferber
Engineering
Company, Inc.

APPENDIX E

22"x34" Existing / DBDP Exhibits

**Red Dale Drainage Basin Design Plan Amendment
DR05-1452 / CIP 50025**

22"x34" exhibits included only in hardcopy documents.



**Ferber
Engineering
Company, Inc.**

APPENDIX F

Digital Information

Red Dale Drainage Basin Design Plan Amendment
DR05-1452 / CIP 50025

Digital information available from Public Works Department upon request.