APPENDIX F8

Culvert Crossing – Conveyance Capacity Assessment

Elfrida Subwatershed Study
Project Number: 160623199
Completed By: ZW
4/1/2026

Stantec Crossing ID	HEC-RAS Crossing ID	Creek	Crossing Type	Dimensions			Inverts		Length (m)	Slope (%)	Flow Direction	Design Storm	Check Storm	VO Model Node	Catchment Area		Flows[10]			Prorated Flows			Calculated Head[2]				Tailwater elevation [11]	Spill Point Elevation [12] (m)	Design Storm		Check Storm		Watercourse Crossings[6]				Relief Flow (Regional)[7]					
				Diameter of Pipe (m)	Span (Width) (m)	Rise (Height) (m)	U/S (m)	D/S (m)							SubCatchment Area (ha)	Prorated Catchment Area (ha)	Minor (m^3/s)	Major (m^3/s)	Regional (m^3/s)	Design	Check	Regional (m^3/s)	Design	Check	Model head were used from	HEC-RAS MAJOR RESULT	Regional (m)			Freeboard[4] (m)	Criteria Met	Freeboard[5] (m)	Criteria Met	Clearance (Erodable Bottom) (m)	HW/D (Non-Erodable Bottom) (m)	Criteria Met		Road Over-Topped	Flow Depth Over Road (m)	Overtopping Velocity (m/s)	Overtopping Velocity x Depth (m^2/s)	Criteria Met	
																				Minor (m^3/s)	Major (m^3/s)		Minor (m)	Major (m)											Clearance	HW/D						Flow Depth	V x D
HC 1		Hannon	Circular	0.50	-	-	208.25	208.16	12.0	0.8	Northwest	25	115% of 100 Year	510	12.7	12.7	0.378	0.518	1.442	0.378	0.596	-	209.39	210.56			-	208.46	209.88	0.49	Yes	-0.68	No	-	-	-	-	-	-	-	-	-	-
HC 2		Hannon	Circular	0.70	-	-	210.76	210.49	12.0	2.3	Northwest	10	100	500	7.6	7.6	0.183	0.339	0.957	0.183	0.339	-	211.21	211.40			-	210.91	211.59	0.38	Yes	0.19	Yes	-	-	-	-	-	-	-	-	-	-
20MC-W1		Twenty Mile West	Circular	0.60	-	-	214.55	214.41	12.0	1.2	Southeast	10	100	20	12.6	12.6	0.280	0.522	1.420	0.280	0.522	-	215.14	215.52			-	214.77	216.01	0.87	Yes	0.49	Yes	-	-	-	-	-	-	-	-	-	-
20MC-W2		Twenty Mile West	Circular	1.00	-	-	211.84	211.62	16.1	1.4	Southeast	25	115% of 100 Year	21	47.6	47.6	1.481	2.309	5.101	1.481	2.309	-	213.11	213.94	Culvert Master	Not in Model	-	212.22	213.72	0.61	No	-0.22	No	-	1.27	-	Yes	Yes	-	-	-	-	-
20MC-W3		Twenty Mile West	Circular	0.60	-	-	212.38	212.04	13.2	2.6	Northeast	10	100	22	3.4	1.1	0.090	0.163	0.479	0.028	0.051	-	212.55	212.61			-	212.40	213.30	0.75	Yes	0.69	Yes	-	-	-	-	-	-	-	-	-	-
20MC-W4		Twenty Mile West	Circular	0.60	-	-	211.80	211.58	13.9	1.6	Northeast	10	100	22	3.4	0.6	0.090	0.163	0.479	0.015	0.027	-	211.95	211.97			-	211.94	213.04	1.09	Yes	1.07	Yes	-	-	-	-	-	-	-	-	-	-
20MC-W5		Twenty Mile West	Circular	0.60	-	-	211.88	211.61	14.8	1.8	Northeast	10	100	22	3.4	1.0	0.090	0.163	0.479	0.027	0.049	-	212.05	212.11			-	211.97	213.23	1.18	Yes	1.12	Yes	-	-	-	-	-	-	-	-	-	-
20MC-W6		Twenty Mile West	Circular	0.60	-	-	212.03	212.10	13.9	-0.5	Northeast	10	100	22	3.4	0.8	0.090	0.163	0.479	0.020	0.036	-	212.46	212.47			-	212.46	213.58	1.12	Yes	1.11	Yes	-	-	-	-	-	-	-	-	-	-
20MC-W7		Twenty Mile West	Circular	0.50	-	-	207.98	207.96	10.7	0.2	Northeast	10	100	23	7.0	7.0	0.159	0.295	0.789	0.159	0.295	-	208.47	208.83			-	208.26	209.19	0.72	Yes	0.36	Yes	-	-	-	-	-	-	-	-	-	-
20MC-W8		Twenty Mile West	Circular	0.45	-	-	208.26	207.82	49.0	0.9	South	10	100	201	8.2	0.3	0.189	0.354	22.577	0.006	0.012	-	208.34	208.38			-	208.09	208.99	0.65	Yes	0.61	Yes	-	-	-	-	-	-	-	-	-	-
20MC-W9[3]		Twenty Mile West	Circular	0.60	-	-	207.55	207.25	14.1	2.1	Southeast	10	100	201	8.2	1.8	0.189	0.354	22.577	0.042	0.079	-	207.66	207.72			-	207.61	208.80	1.14	Yes	1.08	Yes	-	-	-	-	-	-	-	-	-	-
		Twenty Mile West	Circular	0.60	-	-	207.48	207.40	14.2	0.6	Southeast	10	100	201	8.2	1.8	0.189	0.354	22.577	0.042	0.079	-	207.66	207.72			-	207.76	208.80	1.14	Yes	1.08	Yes	-	-	-	-	-	-	-	-	-	-
20MC-W10	Fletcher Culvert	Twenty Mile West	Box		2.40	0.55	207.76	207.59	9.7	1.8	Southeast	25	115% of 100 Year	2010	216.5	216.5	6.260	9.810	22.577	6.260	9.810	-	208.85	208.92	Culvert Master	208.96	-	207.92	208.95	0.10	No	0.03	Yes	-0.54	1.98	No	No	No	-	-	-	-
20MC-W11		Twenty Mile West	Circular	0.60	-	-	210.16	210.08	10.3	0.8	Southwest	10	100	200	25.6	2.3	0.558	1.034	2.818	0.049	0.092	-	210.46	210.50			-	210.44	210.78	0.32	Yes	0.28	Yes	-	-	-	-	-	-	-	-	-	-
20MC-W12		Twenty Mile West	Circular	0.30	-	-	211.63	211.59	12.0	0.3	Southwest	10	100	230	24.7	6.3	0.552	1.014	2.705	0.141	0.260	-	212.54	212.56			-	211.77	212.53	-0.01	No	-0.03	No	-	-	-	-	-	-	-	-	-	-
20MC-W13	Golf Club Culvert	Twenty Mile West	Box		3.00	1.20	206.88	206.81	7.0	1.0	Southwest	25	115% of 100 Year	2000	242.1	242.1	6.984	10.938	25.119	6.984	10.938	-	208.32	208.59	Culvert Master	208.61	-	207.53	208.65	0.33	No	0.06	Yes	-0.24	1.20	No	Yes	No	-	-	-	-
20MC-W14		Twenty Mile East	Circular	0.60	-	-	207.76	207.64	11.8	1.0	Southwest	10	100	250	10.7	10.7	0.243	0.457	1.300	0.243	0.457	-	208.30	208.50			-	208.00	208.53	0.23	No	0.03	Yes	-	-	-	-	-	-	-	-	-	-
20MC-W15		Twenty Mile East	Circular	0.60	-	-	208.39	208.20	11.7	1.6	Southwest	10	100	260	7.0	7.0	0.178	0.324	0.910	0.178	0.324	-	208.86	209.04			-	208.56	209.35	0.49	Yes	0.31	Yes	-	-	-	-	-	-	-	-	-	-
20MC-W16		Twenty Mile East	Circular	0.60	-	-	210.10	209.86	11.5	2.1	Southwest	10	100	270	2.5	2.5	0.062	0.112	0.348	0.062	0.112	-	210.36	210.46			-	210.22	211.05	0.69	Yes	0.59	Yes	-	-	-	-	-	-	-	-	-	-
20MC-E3		Twenty Mile East	Box		1.50	1.00	206.69	206.68	21.2	0.1	Southeast	50	130% of 100 Year	3010	88.9	88.9	2.951	4.434	8.849	2.951	4.434	-	207.95	208.12	Culvert Master	208.24	-	207.28	208.07	0.12	No	-0.05	No	-0.26	1.26	No	Yes	Yes	-	-	-	-
20MC-E4		Twenty Mile East	Circular	0.50	-	-	212.79	212.67	12.0	1.0	Southwest	10	100	350	1.5	1.3	0.038	0.069	0.200	0.033	0.060	-	213.00	213.06			-	212.97	213.51	0.51	Yes	0.45	Yes	-	-	-	-	-	-	-	-	-	-
20MC-E5		Twenty Mile East	Circular	0.50	-	-	211.88	211.84	11.4	0.4	Southwest	10	100	350	1.5	0.2	0.038	0.069	0.200	0.005	0.009	-	212.14	212.14			-	212.14	212.80	0.66	Yes	0.66	Yes	-	-	-	-	-	-	-	-	-	-
20MC-E6		Twenty Mile East	Circular	0.60	-	-	206.71	206.65	17.1	0.4	Northeast	10	100	3200	29.5	29.5	0.663	1.194	3.132	0.663	1.194	-	207.62	207.71			-	207.01	207.72	0.10	No	0.01	Yes	-	-	-	-	-	-	-	-	-	-
20MC-E7		Twenty Mile East	Circular	0.30	-	-	207.18	206.89	14.7	2.0	Northeast	10	100	31	3.0	0.5	0.072	0.132	0.352	0.013	0.024	-	207.32	207.38			-	207.07	207.98	0.66	Yes	0.60	Yes	-	-	-	-	-	-	-	-	-	-
20MC-E8		Twenty Mile East	Circular	0.60	-	-	206.81	206.61	11.2	1.8	Northeast	10	100	31	3.0	2.5	0.072	0.132	0.352	0.059	0.108	-	207.07	207.16			-	206.97	207.99	0.92	Yes	0.83	Yes	-	-	-	-	-	-	-	-	-	-
20MC-E9	Golf Club Trib Culvert	Twenty Mile East	Box		3.50	0.90	204.15	204.35	10.9	-1.8	South	25	115% of 100 Year	3000	128.7	128.7	3.683	5.719	13.011	3.683	5.719	-	205.12	205.43	Culvert Master	205.79	-	204.89	205.90	0.78	No	0.47	Yes	-0.07	1.08	No	Yes	No	-	-	-	-
20MC-E10		Twenty Mile East	Circular	0.45	-	-	204.97	204.77	12.1	1.7	Southwest	10	100	320	11.7	10.6	0.287	0.528	1.500	0.260	0.478	-	205.71	205.79			-	205.04	205.70	-0.01	No	-0.09	No	-	-	-	-	-	-	-	-	-	-
20MC-E11		Twenty Mile East	Circular	0.20	-	-	207.08	207.04	12.7	0.3	Southwest	10	100	320	11.7	0.1	0.287	0.528	1.500	0.003	0.005	-	207.17	207.19			-	207.16	207.80	0.63	Yes	0.61	Yes	-	-	-	-	-	-	-	-	-	-
20MC-E12		Twenty Mile East	Circular	0.50	-	-	203.58	203.66	11.7	-0.7	South	10	100	330	22.3	22.3	0.505	0.949	2.637	0.505	0.949	-	204.93	204.97			-	203.96	204.83	-0.10	No	-0.14	No	-	-	-	-	-	-	-	-	-	-
20MC-E13		Twenty Mile East	Circular	0.70	-	-	204.48	204.59	11.9	-0.9	South	25	115% of 100 Year	3400	22.1	21.6	0.678	1.078	2.522	0.662	1.053	-	205.63	205.66	Culvert Master	Not in model	-	205.01	205.69	0.06	No	0.03	Yes	-	1.64	-	No	No	-	-	-	-
20MC-E14		Twenty Mile East	Circular	0.30	-	-	206.06	206.02	12.3	0.3	Southwest	10	100	3400	22.1	0.5	0.502	0.937	2.522	0.012	0.022	-	206.20	206.20			-	206.20	206.55	0.35	Yes	0.35	Yes	-	-	-	-	-	-	-	-	-	-
20MC-E15		Twenty Mile East	Circular	0.40	-	-	207.80	207.46	12.2	2.8	West	10	100	30	1.1	1.1	0.027	0.049	0.151	0.027	0.049	-	207.99	208.07			-	207.70	208.65	0.66	Yes	0.58	Yes	-	-	-	-	-	-	-	-	-	-

SHC 1		Sinkhole	Circular	0.50	-	-	215.11	215.06	11.0	0.5	Southeast	10	100	146	12.8	1.5	0.305	0.566	1.557	0.036	0.068	-	215.38	215.42			-	215.36	215.95	0.57	Yes	0.53	Yes	-	-	-	-	-	-	-	-	-	-				
SHC 2		Sinkhole	Circular	0.50	-	-	214.74	214.73	12.2	0.1	Southeast	10	100	146	12.8	11.3	0.305	0.566	1.557	0.269	0.498	-	215.50	215.56			-	215.03	215.62	0.12	No	0.06	Yes	-	-	-	-	-	-	-	-	-	-				
SHC 3		Sinkhole	Circular	0.80	-	-	209.66	209.26	26.4	1.5	East	10	100	113	13.5	13.5	0.295	0.540	1.456	0.295	0.540	-	210.22	210.44			-	209.74	210.98	0.76	Yes	0.54	Yes	-	-	-	-	-	-	-	-	-	-				
SHC 4	Trib 2 RS 560	Sinkhole	Circular	2.30	-	-	207.41	207.18	23.1	1.0	Southeast	25	115% of 100 Year	1510	74.1	74.1	2.088	3.251	7.367	2.088	3.251	-	208.66	208.80	Culvert Master	209.06	-	208.56	209.66	1.00	Yes	0.86	Yes	-	0.54	-	Yes	No	-	-	-	-	-				
SHC 5	Reach 5 RS 560	Sinkhole	Box - Closed		2.40	1.20	207.59	207.58	22.0	0.1	Southeast	25	115% of 100 Year	1420	108.8	108.8	3.117	4.835	10.783	3.117	4.835	-	208.56	208.86	Culvert Master	208.96	-	208.30	209.66	1.10	Yes	0.80	Yes	NA	0.81	NA	Yes	No	-	-	-	-	-				
SHC 6		Sinkhole	Box		3.66	1.22	208.12	207.93	22.0	0.9	Southeast	50	130% of 100 Year	1112	149.5	149.5	6.730	10.023	20.185	6.730	10.023	-	209.35	209.72	Culvert Master	Not in model	-	208.66	210.32	0.97	No	0.60	Yes	-0.01	1.00	No	Yes	No	-	-	-	-	-				
SHC 7		Sinkhole	Circular	0.80	-	-	208.42	208.20	28.2	0.8	Southeast	10	100	10	16.5	16.5	0.546	0.868	1.853	0.546	0.868	-	209.19	209.57			-	208.68	210.01	0.82	Yes	0.44	Yes	-	-	-	-	-	-	-	-	-	-				
SHC 8		Sinkhole	Circular	0.90	-	-	210.71	210.16	34.0	1.6	South	10	100	124	24.3	24.3	0.665	1.184	3.056	0.665	1.184	-	211.54	211.88			-	210.70	212.19	0.65	Yes	0.31	Yes	-	-	-	-	-	-	-	-	-	-				
SHC 9		Sinkhole	Circular	1.00	-	-	208.75	208.60	26.8	0.6	Southeast	10	100	123	24.6	24.6	0.544	0.984	2.616	0.544	0.984	-	209.45	209.74			-	209.20	211.18	1.73	Yes	1.44	Yes	-	-	-	-	-	-	-	-	-	-				
SHC 10		Sinkhole	Circular	1.10	-	-	207.17	207.12	11.7	0.4	Southeast	25	115% of 100 Year	1900	60.7	60.7	1.713	2.686	6.307	1.713	2.686	-	208.46	208.56	Culvert Master	208.62	-	207.78	208.60	0.14	No	0.04	Yes	-	1.17	-	Yes	No	-	-	-	-	-				
SHC 11		Sinkhole	Circular	0.30	-	-	208.08	208.13	15.0	-0.3	Southeast	10	100	185	2.0	1.4	0.045	0.084	0.264	0.031	0.058	-	208.40	208.59			-	208.31	208.86	0.46	Yes	0.27	Yes	-	-	-	-	-	-	-	-	-	-				
SHC 12		Sinkhole	Circular	0.50	-	-	207.82	207.90	13.1	-0.6	Southweat	10	100	185	2.0	0.6	0.045	0.084	0.264	0.014	0.026	-	208.20	208.21			-	208.20	208.83	0.63	Yes	0.62	Yes	-	-	-	-	-	-	-	-	-	-				
SHC 13		Sinkhole	Circular	0.80	-	-	205.05	205.12	12.0	-0.6	Southeast	25	115% of 100 Year	160	16.3	16.3	0.548	0.728	1.625	0.548	0.728	-	205.90	206.09			-	205.60	206.20	0.30	No	0.11	Yes	-	1.06	-	-	-	-	-	-	-	-				
SHC 14	Reach 2 RS 520	Sinkhole	Box		6.15	2.00	203.80	203.62	18.2	1.0	Southeast	25	115% of 100 Year	1000	695.6	695.6	18.802	29.286	62.321	18.802	29.286	-	205.52	205.92	Culvert Master	206.20	-	204.82	206.21	0.69	No	0.29	Yes	0.28	0.86	No	Yes	No	-	-	-	-	-				
SHC 15[3]		Sinkhole	Circular	0.50	-	-	207.64	207.57	14.3	0.5	East	10	100	180	6.8	6.8	0.149	0.272	0.737	0.149	0.272	-	208.10	208.43			-	207.87	208.69	0.59	Yes	0.26	Yes	-	-	-	-	-	-	-	-	-	-				
SHC 16[3]		Sinkhole	Circular	0.50	-	-	207.39	207.39	13.1	0.0	East	10	100	170	5.8	5.8	0.130	0.242	0.661	0.130	0.242	-	207.86	208.13			-	207.69	208.32	0.46	Yes	0.19	Yes	-	-	-	-	-	-	-	-	-	-				
SC 1		Stoney	Circular	0.90	-	-	208.30	208.27	39.6	0.1	Southeast	10	100	4345	24.2	24.2	0.685	1.210	3.161	0.685	1.210	-	209.23	209.92			-	208.81	211.32	2.09	Yes	1.40	Yes	-	-	-	-	-	-	-	-	-	-				
SC 2		Stoney	Box		2.35	0.90	205.22	205.19	29.4	0.1	Southeast	50	130% of 100 Year	44	29.4	26.6	1.66	2.453	4.232	1.502	2.218	3.826	205.86	206.00	Culvert Master	Not in model	206.34	205.73	206.80	0.94	No	0.80	Yes	0.26	0.71	No	Yes	No	-	-	-	-	-				
SC 3		Stoney	Circular	0.80	-	-	205.63	204.96	33.0	2.0	Southeast	10	100	44	29.4	2.8	1.138	1.887	4.232	0.109	0.181	-	204.95	206.05			-	205.44	206.32	1.37	Yes	0.27	Yes	-	-	-	-	-	-	-	-	-	-				
SC 4[9]		Stoney	Circular	0.60	-	-	203.66	203.63	17.7	0.2	Southeast	10	100	41	25.4	12.7	0.562	0.989	2.490	0.281	0.495	-	204.10	204.23			-	203.99	204.52	0.42	Yes	0.29	Yes	-	-	-	-	-	-	-	-	-	-				
		Stoney	Circular	0.75	-	-	203.72	203.64	17.7	0.5	Southeast	10	100	41	25.4	12.7	0.562	0.989	2.490	0.281	0.495	-	204.10	204.23			-	204.09	204.52	0.42	Yes	0.29	Yes	-	-	-	-	-	-	-	-	-	-				
SC 5	Reach 1 RS 1400.5	Stoney	Box		2.80	1.00	203.42	203.34	12.4	0.7	Southeast	25	115% of 100 Year	4110	148.5	148.5	4.681	7.208	15.385	4.681	7.208	15.385	204.57	204.84	HEC-RAS for major flow	N/A	205.01	203.94	204.74	0.17	No	-0.10	No	-0.15	1.15	No	Yes	Yes	0.27	0.67	0.18	Yes	Yes				
SC 6		Stoney	Box		1.00	0.80	203.19	203.21	10.0	-0.2	South	25	115% of 100 Year	4140	63.0	45.0	1.845	2.849	6.311	1.317	2.033	4.505	204.17	204.45	Culvert Master	N/A	204.54	203.69	204.51	0.34	No	0.06	Yes	-0.18	1.23	No	Yes	Yes	0.03	0.20	0.01	Yes	Yes				
SC 7		Stoney	Circular	0.30	-	-	204.23	204.21	11.7	0.2	Souht	10	100	40	37.5	18.0	0.866	1.546	3.953	0.416	0.743	-	205.02	205.04			-	204.39	205.02	0.00	No	-0.02	No	-	-	-	-	-	-	-	-	-	-				
SC 8		Stoney	Circular	0.60	-	-	203.40	203.49	11.8	-0.8	Southeast	25	115% of 100 Year	423	23.9	23.9	0.750	1.180	2.647	0.750	1.180	2.647	205.03	205.05	Culvert Master	N/A	205.08	203.85	205.00	-0.03	No	-0.05	No	-	2.72	-	No	Yes	0.08	0.30	0.02	Yes	Yes				
SC 9		Stoney	Circular	0.60	-	-	204.64	204.72	15.1	-0.5	East	10	100	422	6.9	1.1	0.165	0.305	2.600	0.027	0.050	-	205.08	205.09			-	205.08	205.90	0.82	Yes	0.81	Yes	-	-	-	-	-	-	-	-	-	-				
SC 10		Stoney	Circular	0.50	-	-	205.77	205.88	12.3	-0.9	East	10	100	422	6.9	5.8	0.165	0.305	2.600	0.138	0.255	-	206.33	206.65			-	206.18	206.64	0.31	Yes	-0.01	No	-	-	-	-	-	-	-	-	-	-				
SC 11[13]	Reach 3 RS 185 C#2	Stoney	Circular	0.80	-	-	207.49	207.29	15.1	1.3	North	25	115% of 100 Year	4411	57.8	57.8	1.280	1.976	7.099	1.280	1.976	7.099	208.23	208.25	HEC-RAS for major flow	208.33	208.33	207.77	208.52	0.29	No	0.27	Yes	-	0.92	-	Yes	No	-	-	-	-	-				
SC 12[13]	Reach 3 RS 185 C#9	Stoney	Circular	0.90	-	-	206.94	206.66	18.3	1.5	Northeast	25	115% of 100 Year	443	21.3	3.3	0.702	1.072	7.099	0.109	0.166	1.100	207.25	207.32	HEC-RAS for major flow	208.33	208.33	207.20	208.13	0.88	No	0.81	Yes	-	0.34	-	Yes	Yes	0.20	0.51	0.10	Yes	Yes				
SC 13		Stoney	Circular	0.60	-	-	211.66	211.52	12.8	1.1	Northeast	10	100	443	21.3	0.9	0.524	0.961	2.552	0.021	0.039	-	211.89	211.90			-	211.88	212.54	0.65	Yes	0.64	Yes	-	-	-	-	-	-	-	-	-	-				
SC 14		Stoney	Circular	0.50	-	-	212.47	211.72	32.4	2.3	Northeast	10	100	421	10.4	0.7	0.257	0.472	1.390	0.018	0.032	-	212.61	212.67			-	212.02	213.18	0.57	Yes	0.51	Yes	-	-	-	-	-	-	-	-	-	-				
SC 15		Stoney	Circular	0.40	-	-	212.57	212.51	16.0	0.4	East	10	100	443	21.3	0.7	0.524	0.961	2.552	0.017	0.032	-	212.77	212.80			-	212.75	213.31	0.54	Yes	0.51	Yes	-	-	-	-	-	-	-	-	-	-				
SC 16		Stoney	Circular	0.30	-	-	213.66	213.74	15.8	-0.5	East	10	100	443	21.3	1.1	0.524	0.961	2.552	0.027	0.049	-	213.99	214.14			-	213.92	214.60	0.61	Yes	0.46	Yes	-	-	-	-	-	-	-	-	-	-				
SC 17		Stoney	Circular	0.40	-	-	212.35	212.30	11.7	0.4	North	10	100	421	10.4	1.7	0.257	0.472	1.390	0.041	0.076	-	212.61	212.70			-	212.54	213.20	0.59	Yes	0.50	Yes	-	-	-	-	-	-	-	-	-	-				
SC 18		Stoney	Circular	0.40	-	-	212.30	212.10	10.9	1.8	North	10	100	421	10.4	2.8	0.257	0.472	1.390	0.069	0.127	-	212.63	212.76			-	212.34	213.26	0.63	Yes	0.50	Yes	-	-	-	-	-	-	-	-	-	-				
SC 19		Stoney	Circular	0.60	-	-	212.25	212.07	12.3	1.5	North	10	100	421	10.4	5.2	0.257	0.472	1.390	0.129	0.237	-	212.64	212.79			-	212.43	213.40	0.76	Yes	0.61	Yes	-	-	-	-	-	-	-	-	-	-				
SC 20		Stoney	Circular	0.50	-	-	212.67	212.31	11.7	3.1	North	10	100	400	27.6	1.6	0.635	1.149	2.987	0.037	0.067	-	212.88	212.96			-	212.61	213.11	0.23	No	0.15	Yes	-	-	-	-	-	-	-	-	-	-				
SC 21		Stoney	Circular	0.40	-	-	212.12	212.03	15.0	0.6	Northeast	10	100	400	27.6	0.1	0.635	1.149	2.987	0.002	0.003	-	212.27	212.27			-	212.27	212.91	0.64	Yes	0.64	Yes	-	-	-	-	-	-	-	-	-	-				
SC 22	Reach 1 RS 440.5	Stoney	Box		4.90	0.80	202.36	202.35	10.8	0.1	Southeast	25	115% of 100 Year	4000	337.5	337.5	10.183	15.698	33.591	10.183	15.698	33.591	203.71	203.89	HEC-RAS for major flow	N/A	204.23	202.83	203.87	0.16	No	-0.02	No	-0.55	1.69	No	No	Yes	0.36	0.78	0.28	No	Yes				
SC 23[14]	Reach 9 RS 260.5	Stoney	Circular	0.50			208.07	207.90	21.1	0.8	Northwest	25	115% of 100 Year	443	21.3	15.3	0.702	1.105	2.169	0.506	0.796	2.169	208.81	208.84	HEC-RAS for major flow	209.30	209.30	207.90	208.73	-0.08	No	-0.11	No	-	1.48	-	Yes	Yes	0.57	0.47	0.27	No	Yes				

Notes:

Shaded cells represent crossings situated on watercourses. All other crossings are surface drainage crossings.

[1] Design Storm criteria based on road classification. All existing roads classified as Rural Arterial.

[2] Calculated head is based on HEC-RAS output or CulvertMaster Output

[3] Size to be confirmed during Phase II

[4] Refer to criteria listed under SD-13 and WC-7.

[5] Refer to criteria listed under SD-1 & SD-9.

[6] Refer to criteria listed under WC-7.

[7] Refer to criteria listed under WC-13.

[8] Watercourse crossings determined from Aerial Mapping, CAD and field inspections

[9] Culvert crossing is a twin culvert crossing with two barrels.

[10] Calculated flows based on Visual OTTHYMO model.

[11] Tailwater elevation assumed to be 60% of the culvert diameter

[12] Elevations based on road profiles from Topographic Survey

[13] SC 11 and SC 12 were modelled independently for the minor flow in Culvert Master. While the Regional flows were modelled together in HEC-RAS.

[14] SC 23 minor and regional flows were prorated using the same technique but the difference in models results in variability in head.

Criteria:

Surface Drainage Criteria per MTO Highway Drainage Design Standards (2008)

SD-1 Design Flows for Surface Drainage Systems:

Minor System = 10-year

Major System = 100-year

Drainage system shall accommodate conveyance of the Major System Design Flow.

SD-13 Design Flows and Freeboards for Culverts not on a Watercourse:

Minimum Freeboard to top of Sub-Grade upstream of culvert = 0.3 m

Watercourse Crossings Criteria per MTO Highway Drainage Design Standards (2008)

WC-1 Design Flows (Bridges and Culverts):

Total Span ≤ 6.0 m: Design Flow = 25-year (Rural Arterial)

Total Span > 6.0 m: Design Flow = 50-year (Rural Arterial)

WC-7 Culvert Crossings on a Watercourse:

Minimum Freeboard is measured vertically from the High Water Level for the Design Flow to edge of travelled lane.

Freeboard ≥ 1.0 m

Open-Footing Culvert with erodable bottom: Minimum Clearance for straight soffit = 0.3 m

Closed-Footing Culvert & Open-Footing Culvert with non-erodable bottom:

Culvert with diameter/rise < 3.0 m: HW/D ≤ 1.5

Culvert with diameter/rise between 3.0 and 4.5 m: HW/D ≤ 4.5

WC-13 Relief Flow (Bridges and Culverts):

Relief Flow Criteria: Maximum depth over roadway < 0.3 m for Regulatory Storm

Velocity x Depth < 0.8 m^2/s for the Regional Storm

Culvert Design Report
HC 1

Peak Discharge Method: User-Specified					
Design Discharge	0.3780	m³/s	Check Discharge	0.5960	m³/s

Grades Model: Inverts					
Invert Upstream	208.25	m	Invert Downstream	208.16	m
Length	12.00	m	Slope	0.007500	m/m
Drop	0.09	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	208.46	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-500 mm Circular	0.3780 m³/s	209.39 m	2.16 m/s
	Trial-2	1-500 mm Circular	0.5960 m³/s	210.56 m	3.08 m/s

Culvert Design Report
HC 1

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	209.39	m	Discharge	0.3780	m³/s
Headwater Depth/Height	2.28		Tailwater Elevation	208.46	m
Inlet Control HW Elev.	209.19	m	Control Type	Outlet Control	
Outlet Control HW Elev.	209.39	m			

Grades					
Upstream Invert	208.25	m	Downstream Invert	208.16	m
Length	12.00	m	Constructed Slope	0.007500	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.42	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.42	m
Velocity Downstream	2.16	m/s	Critical Slope	0.033004	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	209.39	m	Upstream Velocity Head	0.19	m
Ke	0.90		Entrance Loss	0.17	m

Inlet Control Properties					
Inlet Control HW Elev.	209.19	m	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
HC 1

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	210.56	m	Discharge	0.5960	m³/s
Headwater Depth/Height	4.63		Tailwater Elevation	208.46	m
Inlet Control HW Elev.	210.19	m	Control Type	Outlet Control	
Outlet Control HW Elev.	210.56	m			

Grades					
Upstream Invert	208.25	m	Downstream Invert	208.16	m
Length	12.00	m	Constructed Slope	0.007500	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.48	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.48	m
Velocity Downstream	3.08	m/s	Critical Slope	0.073883	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	210.56	m	Upstream Velocity Head	0.47	m
Ke	0.90		Entrance Loss	0.42	m

Inlet Control Properties					
Inlet Control HW Elev.	210.19	m	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
HC 2

Peak Discharge Method: User-Specified					
Design Discharge	0.1830	m³/s	Check Discharge	0.3390	m³/s

Grades Model: Inverts					
Invert Upstream	210.76	m	Invert Downstream	210.49	m
Length	12.00	m	Slope	0.022500	m/m
Drop	0.27	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	210.91	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-700 mm Circular	0.1830 m³/s	211.21 m	0.76 m/s
	Trial-2	1-700 mm Circular	0.3390 m³/s	211.40 m	1.41 m/s

Culvert Design Report
HC 2

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	211.21	m	Discharge	0.1830	m³/s
Headwater Depth/Height	0.64		Tailwater Elevation	210.91	m
Inlet Control HW Elev.	211.14	m	Control Type	Entrance Control	
Outlet Control HW Elev.	211.21	m			

Grades					
Upstream Invert	210.76	m	Downstream Invert	210.49	m
Length	12.00	m	Constructed Slope	0.022500	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.42	m
Slope Type	Steep		Normal Depth	0.24	m
Flow Regime	N/A		Critical Depth	0.26	m
Velocity Downstream	0.76	m/s	Critical Slope	0.014716	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.70	m
Section Size	700 mm		Rise	0.70	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	211.21	m	Upstream Velocity Head	0.10	m
Ke	0.90		Entrance Loss	0.09	m

Inlet Control Properties					
Inlet Control HW Elev.	211.14	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.4	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
HC 2

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	211.40	m	Discharge	0.3390	m³/s
Headwater Depth/Height	0.91		Tailwater Elevation	210.91	m
Inlet Control HW Elev.	211.32	m	Control Type	Entrance Control	
Outlet Control HW Elev.	211.40	m			

Grades					
Upstream Invert	210.76	m	Downstream Invert	210.49	m
Length	12.00	m	Constructed Slope	0.022500	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.42	m
Slope Type	Steep		Normal Depth	0.33	m
Flow Regime	N/A		Critical Depth	0.36	m
Velocity Downstream	1.41	m/s	Critical Slope	0.016131	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.70	m
Section Size	700 mm		Rise	0.70	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	211.40	m	Upstream Velocity Head	0.14	m
Ke	0.90		Entrance Loss	0.13	m

Inlet Control Properties					
Inlet Control HW Elev.	211.32	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.4	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W1

Peak Discharge Method: User-Specified					
Design Discharge	0.2800	m³/s	Check Discharge	0.5220	m³/s

Grades Model: Inverts					
Invert Upstream	214.55	m	Invert Downstream	214.41	m
Length	12.00	m	Slope	0.011667	m/m
Drop	0.14	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	214.77	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-600 mm Circular	0.2800 m³/s	215.14 m	1.56 m/s
	Trial-2	1-600 mm Circular	0.5220 m³/s	215.52 m	2.16 m/s

Culvert Design Report
20MC-W1

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	215.14	m	Discharge	0.2800	m³/s
Headwater Depth/Height	0.96		Tailwater Elevation	214.77	m
Inlet Control HW Elev.	215.10	m	Control Type	Outlet Control	
Outlet Control HW Elev.	215.14	m			

Grades					
Upstream Invert	214.55	m	Downstream Invert	214.41	m
Length	12.00	m	Constructed Slope	0.011667	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	0.39	m
Flow Regime	Subcritical		Critical Depth	0.34	m
Velocity Downstream	1.56	m/s	Critical Slope	0.017665	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	215.14	m	Upstream Velocity Head	0.10	m
Ke	0.90		Entrance Loss	0.09	m

Inlet Control Properties					
Inlet Control HW Elev.	215.10	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W1

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	215.52	m	Discharge	0.5220	m³/s
Headwater Depth/Height	1.60		Tailwater Elevation	214.77	m
Inlet Control HW Elev.	215.46	m	Control Type	Outlet Control	
Outlet Control HW Elev.	215.52	m			

Grades					
Upstream Invert	214.55	m	Downstream Invert	214.41	m
Length	12.00	m	Constructed Slope	0.011667	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.47	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.47	m
Velocity Downstream	2.16	m/s	Critical Slope	0.025429	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	215.52	m	Upstream Velocity Head	0.16	m
Ke	0.90		Entrance Loss	0.15	m

Inlet Control Properties					
Inlet Control HW Elev.	215.46	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W2

Peak Discharge Method: User-Specified			
Design Discharge	1.4810 m³/s	Check Discharge	2.3092 m³/s

Grades Model: Inverts			
Invert Upstream	211.84 m	Invert Downstream	211.62 m
Length	16.10 m	Slope	0.013665 m/m
Drop	0.22 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	212.22 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-1000 mm Circular	1.4810 m³/s	213.11 m	2.51 m/s
	Trial-2	1-1000 mm Circular	2.3092 m³/s	213.94 m	3.20 m/s

Culvert Design Report
20MC-W2

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	213.11	m	Discharge	1.4810	m³/s
Headwater Depth/Height	1.27		Tailwater Elevation	212.22	m
Inlet Control HW Elev.	213.07	m	Control Type	Outlet Control	
Outlet Control HW Elev.	213.11	m			

Grades					
Upstream Invert	211.84	m	Downstream Invert	211.62	m
Length	16.10	m	Constructed Slope	0.013665	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.70	m
Slope Type	Mild		Normal Depth	0.80	m
Flow Regime	Subcritical		Critical Depth	0.70	m
Velocity Downstream	2.51	m/s	Critical Slope	0.018403	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	1.00	m
Section Size	1000 mm		Rise	1.00	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	213.11	m	Upstream Velocity Head	0.25	m
Ke	0.90		Entrance Loss	0.23	m

Inlet Control Properties					
Inlet Control HW Elev.	213.07	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.8	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W2

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	213.94	m	Discharge	2.3092	m³/s
Headwater Depth/Height	2.10		Tailwater Elevation	212.22	m
Inlet Control HW Elev.	213.94	m	Control Type	Inlet Control	
Outlet Control HW Elev.	213.90	m			

Grades					
Upstream Invert	211.84	m	Downstream Invert	211.62	m
Length	16.10	m	Constructed Slope	0.013665	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.86	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.86	m
Velocity Downstream	3.20	m/s	Critical Slope	0.029148	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	1.00	m
Section Size	1000 mm		Rise	1.00	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	213.90	m	Upstream Velocity Head	0.44	m
Ke	0.90		Entrance Loss	0.40	m

Inlet Control Properties					
Inlet Control HW Elev.	213.94	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.8	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W3

Peak Discharge Method: User-Specified			
Design Discharge	0.0281 m³/s	Check Discharge	0.0508 m³/s

Grades Model: Inverts			
Invert Upstream	212.38 m	Invert Downstream	212.04 m
Length	13.20 m	Slope	0.025758 m/m
Drop	0.34 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	212.40 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-600 mm Circular	0.0281 m³/s	212.55 m	0.16 m/s
	Trial-2	1-600 mm Circular	0.0508 m³/s	212.61 m	0.28 m/s

Culvert Design Report
20MC-W3

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	212.55	m	Discharge	0.0281	m³/s
Headwater Depth/Height	0.27		Tailwater Elevation	212.40	m
Inlet Control HW Elev.	212.53	m	Control Type	Entrance Control	
Outlet Control HW Elev.	212.55	m			

Grades					
Upstream Invert	212.38	m	Downstream Invert	212.04	m
Length	13.20	m	Constructed Slope	0.025758	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.36	m
Slope Type	Steep		Normal Depth	0.09	m
Flow Regime	N/A		Critical Depth	0.10	m
Velocity Downstream	0.16	m/s	Critical Slope	0.015953	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.55	m	Upstream Velocity Head	0.04	m
Ke	0.70		Entrance Loss	0.03	m

Inlet Control Properties					
Inlet Control HW Elev.	212.53	m	Flow Control	N/A	
Inlet Type	Mitered to slope		Area Full	0.3	m²
K	0.02100		HDS 5 Chart	2	
M	1.33000		HDS 5 Scale	2	
C	0.04630		Equation Form	1	
Y	0.75000				

Culvert Design Report
20MC-W3

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	212.61	m	Discharge	0.0508	m³/s
Headwater Depth/Height	0.37		Tailwater Elevation	212.40	m
Inlet Control HW Elev.	212.59	m	Control Type	Entrance Control	
Outlet Control HW Elev.	212.61	m			

Grades					
Upstream Invert	212.38	m	Downstream Invert	212.04	m
Length	13.20	m	Constructed Slope	0.025758	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.36	m
Slope Type	Steep		Normal Depth	0.12	m
Flow Regime	N/A		Critical Depth	0.14	m
Velocity Downstream	0.28	m/s	Critical Slope	0.015370	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.61	m	Upstream Velocity Head	0.05	m
Ke	0.70		Entrance Loss	0.03	m

Inlet Control Properties					
Inlet Control HW Elev.	212.59	m	Flow Control	N/A	
Inlet Type	Mitered to slope		Area Full	0.3	m²
K	0.02100		HDS 5 Chart	2	
M	1.33000		HDS 5 Scale	2	
C	0.04630		Equation Form	1	
Y	0.75000				

Culvert Design Report
20MC-W4

Peak Discharge Method: User-Specified					
Design Discharge	0.0148	m³/s	Check Discharge	0.0268	m³/s

Grades Model: Inverts					
Invert Upstream	211.80	m	Invert Downstream	211.58	m
Length	13.90	m	Slope	0.015827	m/m
Drop	0.22	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	211.94	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-600 mm Circular	0.0148 m³/s	211.95 m	0.08 m/s
	Trial-2	1-600 mm Circular	0.0268 m³/s	211.97 m	0.15 m/s

Culvert Design Report
20MC-W4

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	211.95	m	Discharge	0.0148	m³/s
Headwater Depth/Height	0.24		Tailwater Elevation	211.94	m
Inlet Control HW Elev.	211.94	m	Control Type	Outlet Control	
Outlet Control HW Elev.	211.95	m			

Grades					
Upstream Invert	211.80	m	Downstream Invert	211.58	m
Length	13.90	m	Constructed Slope	0.015827	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	0.08	m
Flow Regime	Subcritical		Critical Depth	0.08	m
Velocity Downstream	0.08	m/s	Critical Slope	0.017037	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	211.95	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	211.94	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W4

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	211.97	m	Discharge	0.0268	m³/s
Headwater Depth/Height	0.27		Tailwater Elevation	211.94	m
Inlet Control HW Elev.	211.94	m	Control Type	Outlet Control	
Outlet Control HW Elev.	211.97	m			

Grades					
Upstream Invert	211.80	m	Downstream Invert	211.58	m
Length	13.90	m	Constructed Slope	0.015827	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	0.10	m
Flow Regime	Subcritical		Critical Depth	0.10	m
Velocity Downstream	0.15	m/s	Critical Slope	0.016102	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	211.97	m	Upstream Velocity Head	0.01	m
Ke	0.90		Entrance Loss	0.01	m

Inlet Control Properties					
Inlet Control HW Elev.	211.94	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W5

Peak Discharge Method: User-Specified			
Design Discharge	0.0273 m³/s	Check Discharge	0.0494 m³/s

Grades Model: Inverts			
Invert Upstream	211.88 m	Invert Downstream	211.61 m
Length	14.80 m	Slope	0.018243 m/m
Drop	0.27 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	211.97 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-600 mm Circular	0.0273 m³/s	212.05 m	0.15 m/s
	Trial-2	1-600 mm Circular	0.0494 m³/s	212.11 m	0.28 m/s

Culvert Design Report
20MC-W5

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	212.05	m	Discharge	0.0273	m³/s
Headwater Depth/Height	0.28		Tailwater Elevation	211.97	m
Inlet Control HW Elev.	212.02	m	Control Type	Entrance Control	
Outlet Control HW Elev.	212.05	m			

Grades					
Upstream Invert	211.88	m	Downstream Invert	211.61	m
Length	14.80	m	Constructed Slope	0.018243	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.36	m
Slope Type	Steep		Normal Depth	0.10	m
Flow Regime	N/A		Critical Depth	0.10	m
Velocity Downstream	0.15	m/s	Critical Slope	0.016081	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.05	m	Upstream Velocity Head	0.04	m
Ke	0.90		Entrance Loss	0.03	m

Inlet Control Properties					
Inlet Control HW Elev.	212.02	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W5

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	212.11	m	Discharge	0.0494	m³/s
Headwater Depth/Height	0.38		Tailwater Elevation	211.97	m
Inlet Control HW Elev.	212.07	m	Control Type	Entrance Control	
Outlet Control HW Elev.	212.11	m			

Grades					
Upstream Invert	211.88	m	Downstream Invert	211.61	m
Length	14.80	m	Constructed Slope	0.018243	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.36	m
Slope Type	Steep		Normal Depth	0.13	m
Flow Regime	N/A		Critical Depth	0.14	m
Velocity Downstream	0.28	m/s	Critical Slope	0.015390	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.11	m	Upstream Velocity Head	0.05	m
Ke	0.90		Entrance Loss	0.04	m

Inlet Control Properties					
Inlet Control HW Elev.	212.07	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W6

Peak Discharge Method: User-Specified					
Design Discharge	0.0199	m³/s	Check Discharge	0.0360	m³/s

Grades Model: Inverts					
Invert Upstream	212.03	m	Invert Downstream	212.10	m
Length	13.90	m	Slope	-0.005036	m/m
Drop	-0.07	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	212.46	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-600 mm Circular	0.0199 m³/s	212.46 m	0.11 m/s
	Trial-2	1-600 mm Circular	0.0360 m³/s	212.47 m	0.20 m/s

Culvert Design Report
20MC-W6

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	212.46	m	Discharge	0.0199	m³/s
Headwater Depth/Height	0.71		Tailwater Elevation	212.46	m
Inlet Control HW Elev.	212.46	m	Control Type	Outlet Control	
Outlet Control HW Elev.	212.46	m			

Grades					
Upstream Invert	212.03	m	Downstream Invert	212.10	m
Length	13.90	m	Constructed Slope	-0.005036	m/m

Hydraulic Profile					
Profile	A2		Depth, Downstream	0.36	m
Slope Type	Adverse		Normal Depth	0.00	m
Flow Regime	Subcritical		Critical Depth	0.09	m
Velocity Downstream	0.11	m/s	Critical Slope	0.016518	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.46	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	212.46	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W6

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	212.47	m	Discharge	0.0360	m³/s
Headwater Depth/Height	0.72		Tailwater Elevation	212.46	m
Inlet Control HW Elev.	212.46	m	Control Type	Outlet Control	
Outlet Control HW Elev.	212.47	m			

Grades					
Upstream Invert	212.03	m	Downstream Invert	212.10	m
Length	13.90	m	Constructed Slope	-0.005036	m/m

Hydraulic Profile					
Profile	A2		Depth, Downstream	0.36	m
Slope Type	Adverse		Normal Depth	0.00	m
Flow Regime	Subcritical		Critical Depth	0.12	m
Velocity Downstream	0.20	m/s	Critical Slope	0.015685	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.47	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	212.46	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W7

Peak Discharge Method: User-Specified					
Design Discharge	0.1590	m³/s	Check Discharge	0.2950	m³/s

Grades Model: Inverts					
Invert Upstream	207.98	m	Invert Downstream	207.96	m
Length	10.70	m	Slope	0.001869	m/m
Drop	0.02	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	208.26	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-500 mm Circular	0.1590 m³/s	208.47 m	1.29 m/s
	Trial-2	1-500 mm Circular	0.2950 m³/s	208.83 m	1.88 m/s

Culvert Design Report
20MC-W7

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	208.47	m	Discharge	0.1590	m³/s
Headwater Depth/Height	0.98		Tailwater Elevation	208.26	m
Inlet Control HW Elev.	208.41	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.47	m			

Grades					
Upstream Invert	207.98	m	Downstream Invert	207.96	m
Length	10.70	m	Constructed Slope	0.001869	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.30	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.27	m
Velocity Downstream	1.29	m/s	Critical Slope	0.018463	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.47	m	Upstream Velocity Head	0.04	m
Ke	0.90		Entrance Loss	0.04	m

Inlet Control Properties					
Inlet Control HW Elev.	208.41	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W7

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	208.83	m	Discharge	0.2950	m³/s
Headwater Depth/Height	1.71		Tailwater Elevation	208.26	m
Inlet Control HW Elev.	208.67	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.83	m			

Grades					
Upstream Invert	207.98	m	Downstream Invert	207.96	m
Length	10.70	m	Constructed Slope	0.001869	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.37	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.37	m
Velocity Downstream	1.88	m/s	Critical Slope	0.025378	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.83	m	Upstream Velocity Head	0.12	m
Ke	0.90		Entrance Loss	0.10	m

Inlet Control Properties					
Inlet Control HW Elev.	208.67	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W8

Peak Discharge Method: User-Specified					
Design Discharge	0.0065	m³/s	Check Discharge	0.0121	m³/s

Grades Model: Inverts					
Invert Upstream	208.26	m	Invert Downstream	207.82	m
Length	49.00	m	Slope	0.008980	m/m
Drop	0.44	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	208.09	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-450 mm Circular	0.0065 m³/s	208.34 m	0.06 m/s
	Trial-2	1-450 mm Circular	0.0121 m³/s	208.38 m	0.12 m/s

Culvert Design Report
20MC-W8

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	208.34	m	Discharge	0.0065	m³/s
Headwater Depth/Height	0.19		Tailwater Elevation	208.09	m
Inlet Control HW Elev.	208.33	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.34	m			

Grades					
Upstream Invert	208.26	m	Downstream Invert	207.82	m
Length	49.00	m	Constructed Slope	0.008980	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.27	m
Slope Type	Mild		Normal Depth	0.06	m
Flow Regime	Subcritical		Critical Depth	0.05	m
Velocity Downstream	0.06	m/s	Critical Slope	0.019038	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.46	m
Section Size	450 mm		Rise	0.46	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.34	m	Upstream Velocity Head	0.01	m
Ke	0.90		Entrance Loss	0.01	m

Inlet Control Properties					
Inlet Control HW Elev.	208.33	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W8

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	208.38	m	Discharge	0.0121	m³/s
Headwater Depth/Height	0.26		Tailwater Elevation	208.09	m
Inlet Control HW Elev.	208.36	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.38	m			

Grades					
Upstream Invert	208.26	m	Downstream Invert	207.82	m
Length	49.00	m	Constructed Slope	0.008980	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.27	m
Slope Type	Mild		Normal Depth	0.09	m
Flow Regime	Subcritical		Critical Depth	0.07	m
Velocity Downstream	0.12	m/s	Critical Slope	0.017856	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.46	m
Section Size	450 mm		Rise	0.46	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.38	m	Upstream Velocity Head	0.02	m
Ke	0.90		Entrance Loss	0.01	m

Inlet Control Properties					
Inlet Control HW Elev.	208.36	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-W9

Analysis Component			
Storm Event	Design	Discharge	0.0419 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.0419 m³/s	Check Discharge	0.0786 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.61 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.0119 m³/s	207.66 m	0.07 m/s
Culvert-2	1-600 mm Circular	0.0300 m³/s	207.66 m	0.34 m/s
Weir	Not Considered	N/A	N/A	N/A
Total	----------	0.0419 m³/s	207.66 m	N/A

Culvert Analysis Report
20MC-W9

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	207.66	m	Discharge	0.0119	m³/s
Inlet Control HW Elev.	207.63	m	Tailwater Elevation	207.61	m
Outlet Control HW Elev.	207.66	m	Control Type	Outlet Control	
Headwater Depth/Height	0.18				

Grades					
Upstream Invert	207.55	m	Downstream Invert	207.25	m
Length	14.10	m	Constructed Slope	0.021277	m/m

Hydraulic Profile					
Profile	S1		Depth, Downstream	0.36	m
Slope Type	Steep		Normal Depth	0.06	m
Flow Regime	Subcritical		Critical Depth	0.07	m
Velocity Downstream	0.07	m/s	Critical Slope	0.017484	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.66	m	Upstream Velocity Head	0.02	m
Ke	0.90		Entrance Loss	0.02	m

Inlet Control Properties					
Inlet Control HW Elev.	207.63	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-W9

Component:Culvert-2

Culvert Summary					
Computed Headwater Elevation	207.66	m	Discharge	0.0300	m³/s
Inlet Control HW Elev.	207.63	m	Tailwater Elevation	207.61	m
Outlet Control HW Elev.	207.66	m	Control Type	Outlet Control	
Headwater Depth/Height	0.30				

Grades					
Upstream Invert	207.48	m	Downstream Invert	207.40	m
Length	14.20	m	Constructed Slope	0.005634	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.21	m
Slope Type	Mild		Normal Depth	0.14	m
Flow Regime	Subcritical		Critical Depth	0.11	m
Velocity Downstream	0.34	m/s	Critical Slope	0.015882	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.66	m	Upstream Velocity Head	0.01	m
Ke	0.90		Entrance Loss	0.01	m

Inlet Control Properties					
Inlet Control HW Elev.	207.63	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-W9

Analysis Component				
Storm Event	Check	Discharge	0.0786	m³/s

Peak Discharge Method: User-Specified				
Design Discharge	0.0419	m³/s	Check Discharge	0.0786 m³/s

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	207.61	m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.0256 m³/s	207.72 m	0.14 m/s
Culvert-2	1-600 mm Circular	0.0531 m³/s	207.72 m	0.60 m/s
Weir	Not Considered	N/A	N/A	N/A
Total	----------	0.0787 m³/s	207.72 m	N/A

Culvert Analysis Report
20MC-W9

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	207.72	m	Discharge	0.0256	m³/s
Inlet Control HW Elev.	207.68	m	Tailwater Elevation	207.61	m
Outlet Control HW Elev.	207.72	m	Control Type	Entrance Control	
Headwater Depth/Height	0.27				

Grades					
Upstream Invert	207.55	m	Downstream Invert	207.25	m
Length	14.10	m	Constructed Slope	0.021277	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.36	m
Slope Type	Steep		Normal Depth	0.09	m
Flow Regime	N/A		Critical Depth	0.10	m
Velocity Downstream	0.14	m/s	Critical Slope	0.016155	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.72	m	Upstream Velocity Head	0.03	m
Ke	0.90		Entrance Loss	0.03	m

Inlet Control Properties					
Inlet Control HW Elev.	207.68	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-W9

Component:Culvert-2

Culvert Summary					
Computed Headwater Elevation	207.72	m	Discharge	0.0531	m³/s
Inlet Control HW Elev.	207.68	m	Tailwater Elevation	207.61	m
Outlet Control HW Elev.	207.72	m	Control Type	Outlet Control	
Headwater Depth/Height	0.39				

Grades					
Upstream Invert	207.48	m	Downstream Invert	207.40	m
Length	14.20	m	Constructed Slope	0.005634	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.21	m
Slope Type	Mild		Normal Depth	0.19	m
Flow Regime	Subcritical		Critical Depth	0.14	m
Velocity Downstream	0.60	m/s	Critical Slope	0.015340	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.72	m	Upstream Velocity Head	0.02	m
Ke	0.90		Entrance Loss	0.02	m

Inlet Control Properties					
Inlet Control HW Elev.	207.68	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-W10

Analysis Component			
Storm Event	Design	Discharge	6.2600 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	6.2600 m³/s	Check Discharge	9.8095 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.92 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-2400 x 550 mm Box	3.3121 m³/s	208.85 m	3.41 m/s
Weir	Roadway	2.9513 m³/s	208.85 m	N/A
Total	----------	6.2634 m³/s	208.85 m	N/A

Culvert Analysis Report
20MC-W10

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.85	m	Discharge	3.3121	m³/s
Inlet Control HW Elev.	208.85	m	Tailwater Elevation	207.92	m
Outlet Control HW Elev.	208.79	m	Control Type	Inlet Control	
Headwater Depth/Height	1.99				

Grades					
Upstream Invert	207.76	m	Downstream Invert	207.56	m
Length	9.70	m	Constructed Slope	0.020619	m/m

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.40	m
Slope Type	Steep		Normal Depth	0.32	m
Flow Regime	Supercritical		Critical Depth	0.55	m
Velocity Downstream	3.41	m/s	Critical Slope	0.007834	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.40	m
Section Size	2400 x 550 mm		Rise	0.55	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.79	m	Upstream Velocity Head	0.32	m
Ke	0.50		Entrance Loss	0.16	m

Inlet Control Properties					
Inlet Control HW Elev.	208.85	m	Flow Control	Submerged	
Inlet Type	90° headwall w 45° bevels		Area Full	1.3	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
20MC-W10

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	2.9513	m³/s	Allowable HW Elevation	208.85	m
Roadway Width	7.50	m	Overtopping Coefficient	1.65	SI
Low Point	208.68	m	Headwater Elevation	208.85	m
Discharge Coefficient (Cr)	2.99		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.92	m			

Sta (m)	Elev. (m)
0.00	208.76
17.00	208.68
77.00	208.96

Culvert Analysis Report
20MC-W10

Analysis Component				
Storm Event	Check	Discharge	9.8095	m³/s

Peak Discharge Method: User-Specified				
Design Discharge	6.2600	m³/s	Check Discharge	9.8095 m³/s

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	207.92	m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-2400 x 550 mm Box	3.4867 m³/s	208.92 m	3.47 m/s
Weir	Roadway	6.3138 m³/s	208.92 m	N/A
Total	----------	9.8005 m³/s	208.92 m	N/A

Culvert Analysis Report
20MC-W10

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.92	m	Discharge	3.4867	m³/s
Inlet Control HW Elev.	208.92	m	Tailwater Elevation	207.92	m
Outlet Control HW Elev.	208.84	m	Control Type	Inlet Control	
Headwater Depth/Height	2.12				

Grades					
Upstream Invert	207.76	m	Downstream Invert	207.56	m
Length	9.70	m	Constructed Slope	0.020619	m/m

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.42	m
Slope Type	Steep		Normal Depth	0.33	m
Flow Regime	Supercritical		Critical Depth	0.55	m
Velocity Downstream	3.47	m/s	Critical Slope	0.008682	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.40	m
Section Size	2400 x 550 mm		Rise	0.55	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.84	m	Upstream Velocity Head	0.36	m
Ke	0.50		Entrance Loss	0.18	m

Inlet Control Properties					
Inlet Control HW Elev.	208.92	m	Flow Control	Submerged	
Inlet Type	90° headwall w 45° bevels		Area Full	1.3	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
20MC-W10

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	6.3138	m³/s	Allowable HW Elevation	208.92	m
Roadway Width	7.50	m	Overtopping Coefficient	1.66	SI
Low Point	208.68	m	Headwater Elevation	208.92	m
Discharge Coefficient (Cr)	3.01		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.92	m			

Sta (m)	Elev. (m)
0.00	208.76
17.00	208.68
77.00	208.96

Culvert Design Report
20MC-W11

Peak Discharge Method: User-Specified			
Design Discharge	0.0495 m³/s	Check Discharge	0.0917 m³/s

Grades Model: Inverts			
Invert Upstream	210.16 m	Invert Downstream	210.08 m
Length	10.30 m	Slope	0.007767 m/m
Drop	0.08 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	210.44 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-600 mm Circular	0.0495 m³/s	210.46 m	0.28 m/s
	Trial-2	1-600 mm Circular	0.0917 m³/s	210.50 m	0.51 m/s

Culvert Design Report
20MC-W11

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	210.46	m	Discharge	0.0495	m³/s
Headwater Depth/Height	0.49		Tailwater Elevation	210.44	m
Inlet Control HW Elev.	210.44	m	Control Type	Outlet Control	
Outlet Control HW Elev.	210.46	m			

Grades					
Upstream Invert	210.16	m	Downstream Invert	210.08	m
Length	10.30	m	Constructed Slope	0.007767	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	0.17	m
Flow Regime	Subcritical		Critical Depth	0.14	m
Velocity Downstream	0.28	m/s	Critical Slope	0.015388	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	210.46	m	Upstream Velocity Head	0.01	m
Ke	0.90		Entrance Loss	0.01	m

Inlet Control Properties					
Inlet Control HW Elev.	210.44	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W11

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	210.50	m	Discharge	0.0917	m³/s
Headwater Depth/Height	0.55		Tailwater Elevation	210.44	m
Inlet Control HW Elev.	210.44	m	Control Type	Outlet Control	
Outlet Control HW Elev.	210.50	m			

Grades					
Upstream Invert	210.16	m	Downstream Invert	210.08	m
Length	10.30	m	Constructed Slope	0.007767	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	0.23	m
Flow Regime	Subcritical		Critical Depth	0.19	m
Velocity Downstream	0.51	m/s	Critical Slope	0.015198	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	210.50	m	Upstream Velocity Head	0.02	m
Ke	0.90		Entrance Loss	0.02	m

Inlet Control Properties					
Inlet Control HW Elev.	210.44	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-W12

Analysis Component			
Storm Event	Design	Discharge	0.1415 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.1415 m³/s	Check Discharge	0.2599 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	211.77 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-300 mm Circular	0.1072 m³/s	212.54 m	1.66 m/s
Weir	Roadway	0.0350 m³/s	212.54 m	N/A
Total	----------	0.1421 m³/s	212.54 m	N/A

Culvert Analysis Report
20MC-W12

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	212.54	m	Discharge	0.1072	m³/s
Inlet Control HW Elev.	212.19	m	Tailwater Elevation	211.77	m
Outlet Control HW Elev.	212.54	m	Control Type	Outlet Control	
Headwater Depth/Height	2.99				

Grades					
Upstream Invert	211.63	m	Downstream Invert	211.59	m
Length	12.00	m	Constructed Slope	0.003333	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.25	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.25	m
Velocity Downstream	1.66	m/s	Critical Slope	0.037797	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.30	m
Section Size	300 mm		Rise	0.30	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.54	m	Upstream Velocity Head	0.11	m
Ke	0.90		Entrance Loss	0.10	m

Inlet Control Properties					
Inlet Control HW Elev.	212.19	m	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-W12

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0350	m³/s	Allowable HW Elevation	212.54	m
Roadway Width	8.00	m	Overtopping Coefficient	1.61	SI
Low Point	212.52	m	Headwater Elevation	212.54	m
Discharge Coefficient (Cr)	2.91		Submergence Factor (Kt)	1.00	
Tailwater Elevation	211.77	m			

Sta (m)	Elev. (m)
0.00	213.04
35.00	212.66
80.00	212.52
100.00	212.55
130.00	212.90

Culvert Analysis Report
20MC-W12

Analysis Component			
Storm Event	Check	Discharge	0.2599 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.1415 m³/s	Check Discharge	0.2599 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	211.77 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-300 mm Circular	0.1084 m³/s	212.56 m	1.67 m/s
Weir	Roadway	0.1525 m³/s	212.56 m	N/A
Total	----------	0.2609 m³/s	212.56 m	N/A

Culvert Analysis Report
20MC-W12

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	212.56	m	Discharge	0.1084	m³/s
Inlet Control HW Elev.	212.19	m	Tailwater Elevation	211.77	m
Outlet Control HW Elev.	212.56	m	Control Type	Outlet Control	
Headwater Depth/Height	3.04				

Grades					
Upstream Invert	211.63	m	Downstream Invert	211.59	m
Length	12.00	m	Constructed Slope	0.003333	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.25	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.25	m
Velocity Downstream	1.67	m/s	Critical Slope	0.038343	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.30	m
Section Size	300 mm		Rise	0.30	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.56	m	Upstream Velocity Head	0.11	m
Ke	0.90		Entrance Loss	0.10	m

Inlet Control Properties					
Inlet Control HW Elev.	212.19	m	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-W12

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.1525	m³/s	Allowable HW Elevation	212.56	m
Roadway Width	8.00	m	Overtopping Coefficient	1.61	SI
Low Point	212.52	m	Headwater Elevation	212.56	m
Discharge Coefficient (Cr)	2.91		Submergence Factor (Kt)	1.00	
Tailwater Elevation	211.77	m			

Sta (m)	Elev. (m)
0.00	213.04
35.00	212.66
80.00	212.52
100.00	212.55
130.00	212.90

Culvert Analysis Report
20MC-W13

Analysis Component			
Storm Event	Design	Discharge	6.9840 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	6.9840 m³/s	Check Discharge	10.9377 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.53 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-3000 x 1200 mm Box	6.9851 m³/s	208.32 m	3.37 m/s
Weir	Roadway	0.0000 m³/s	208.32 m	N/A
Total	----------	6.9851 m³/s	208.32 m	N/A

Culvert Analysis Report
20MC-W13

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.32	m	Discharge	6.9851	m³/s
Inlet Control HW Elev.	208.17	m	Tailwater Elevation	207.53	m
Outlet Control HW Elev.	208.32	m	Control Type	Entrance Control	
Headwater Depth/Height	1.20				

Grades					
Upstream Invert	206.88	m	Downstream Invert	206.81	m
Length	7.00	m	Constructed Slope	0.010000	m/m

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.69	m
Slope Type	Steep		Normal Depth	0.55	m
Flow Regime	Supercritical		Critical Depth	0.82	m
Velocity Downstream	3.37	m/s	Critical Slope	0.003168	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	m
Section Size	3000 x 1200 mm		Rise	1.20	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.32	m	Upstream Velocity Head	0.41	m
Ke	0.50		Entrance Loss	0.21	m

Inlet Control Properties					
Inlet Control HW Elev.	208.17	m	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	3.6	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
20MC-W13

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	208.32	m
Roadway Width	0.00	m	Overtopping Coefficient	1.71	SI
Low Point	208.39	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	3.09		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.53	m			

Sta (m)	Elev. (m)
0.00	208.39
20.00	208.54
25.00	208.50
35.00	208.67
40.00	208.55
60.00	208.62
80.00	208.58

Culvert Analysis Report
20MC-W13

Analysis Component			
Storm Event	Check	Discharge	10.9377 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	6.9840 m³/s	Check Discharge	10.9377 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.53 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-3000 x 1200 mm Box	9.0852 m³/s	208.59 m	3.63 m/s
Weir	Roadway	1.8573 m³/s	208.59 m	N/A
Total	----------	10.9424 m³/s	208.59 m	N/A

Culvert Analysis Report
20MC-W13

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.59	m	Discharge	9.0852	m³/s
Inlet Control HW Elev.	208.51	m	Tailwater Elevation	207.53	m
Outlet Control HW Elev.	208.59	m	Control Type	Entrance Control	
Headwater Depth/Height	1.43				

Grades					
Upstream Invert	206.88	m	Downstream Invert	206.81	m
Length	7.00	m	Constructed Slope	0.010000	m/m

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.83	m
Slope Type	Steep		Normal Depth	0.66	m
Flow Regime	Supercritical		Critical Depth	0.98	m
Velocity Downstream	3.63	m/s	Critical Slope	0.003261	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	m
Section Size	3000 x 1200 mm		Rise	1.20	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.59	m	Upstream Velocity Head	0.49	m
Ke	0.50		Entrance Loss	0.24	m

Inlet Control Properties					
Inlet Control HW Elev.	208.51	m	Flow Control	Submerged	
Inlet Type	90° headwall w 45° bevels		Area Full	3.6	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
20MC-W13

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	1.8573	m³/s	Allowable HW Elevation	208.59	m
Roadway Width	0.00	m	Overtopping Coefficient	1.71	SI
Low Point	208.39	m	Headwater Elevation	208.59	m
Discharge Coefficient (Cr)	3.09		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.53	m			

Sta (m)	Elev. (m)
0.00	208.39
20.00	208.54
25.00	208.50
35.00	208.67
40.00	208.55
60.00	208.62
80.00	208.58

Culvert Analysis Report
20MC-W14

Analysis Component			
Storm Event	Design	Discharge	0.2430 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.2430 m³/s	Check Discharge	0.4570 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	208.00 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.2431 m³/s	208.30 m	1.36 m/s
Weir	Roadway	0.0000 m³/s	208.30 m	N/A
Total	----------	0.2431 m³/s	208.30 m	N/A

Culvert Analysis Report
20MC-W14

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.30	m	Discharge	0.2431	m³/s
Inlet Control HW Elev.	208.26	m	Tailwater Elevation	208.00	m
Outlet Control HW Elev.	208.30	m	Control Type	Outlet Control	
Headwater Depth/Height	0.88				

Grades					
Upstream Invert	207.76	m	Downstream Invert	207.64	m
Length	11.80	m	Constructed Slope	0.010169	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	0.37	m
Flow Regime	Subcritical		Critical Depth	0.32	m
Velocity Downstream	1.36	m/s	Critical Slope	0.016949	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.30	m	Upstream Velocity Head	0.09	m
Ke	0.90		Entrance Loss	0.08	m

Inlet Control Properties					
Inlet Control HW Elev.	208.26	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-W14

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	208.30	m
Roadway Width	8.00	m	Overtopping Coefficient	1.60	SI
Low Point	208.46	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	208.00	m			

Sta (m)	Elev. (m)
0.00	208.56
15.00	208.46
25.00	208.52
35.00	208.47
45.00	208.58
50.00	208.51
55.00	208.61

Culvert Analysis Report
20MC-W14

Analysis Component				
Storm Event	Check	Discharge	0.4570	m³/s

Peak Discharge Method: User-Specified				
Design Discharge	0.2430	m³/s	Check Discharge	0.4570 m³/s

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	208.00	m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.3952 m³/s	208.50 m	1.89 m/s
Weir	Roadway	0.0625 m³/s	208.50 m	N/A
Total	----------	0.4577 m³/s	208.50 m	N/A

Culvert Analysis Report
20MC-W14

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.50	m	Discharge	0.3952	m³/s
Inlet Control HW Elev.	208.47	m	Tailwater Elevation	208.00	m
Outlet Control HW Elev.	208.50	m	Control Type	Outlet Control	
Headwater Depth/Height	1.21				

Grades					
Upstream Invert	207.76	m	Downstream Invert	207.64	m
Length	11.80	m	Constructed Slope	0.010169	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.41	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.41	m
Velocity Downstream	1.89	m/s	Critical Slope	0.020593	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.50	m	Upstream Velocity Head	0.11	m
Ke	0.90		Entrance Loss	0.10	m

Inlet Control Properties					
Inlet Control HW Elev.	208.47	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-W14

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0625	m³/s	Allowable HW Elevation	208.50	m
Roadway Width	8.00	m	Overtopping Coefficient	1.61	SI
Low Point	208.46	m	Headwater Elevation	208.50	m
Discharge Coefficient (Cr)	2.91		Submergence Factor (Kt)	1.00	
Tailwater Elevation	208.00	m			

Sta (m)	Elev. (m)
0.00	208.56
15.00	208.46
25.00	208.52
35.00	208.47
45.00	208.58
50.00	208.51
55.00	208.61

Culvert Design Report
20MC-W15

Peak Discharge Method: User-Specified					
Design Discharge	0.1780	m³/s	Check Discharge	0.3240	m³/s

Grades Model: Inverts					
Invert Upstream	208.39	m	Invert Downstream	208.20	m
Length	11.70	m	Slope	0.016239	m/m
Drop	0.19	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	208.56	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-600 mm Circular	0.1780 m³/s	208.86 m	0.99 m/s
	Trial-2	1-600 mm Circular	0.3240 m³/s	209.04 m	1.75 m/s

Culvert Design Report
20MC-W15

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	208.86	m	Discharge	0.1780	m³/s
Headwater Depth/Height	0.77		Tailwater Elevation	208.56	m
Inlet Control HW Elev.	208.79	m	Control Type	Entrance Control	
Outlet Control HW Elev.	208.86	m			

Grades					
Upstream Invert	208.39	m	Downstream Invert	208.20	m
Length	11.70	m	Constructed Slope	0.016239	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.36	m
Slope Type	Steep		Normal Depth	0.27	m
Flow Regime	N/A		Critical Depth	0.27	m
Velocity Downstream	0.99	m/s	Critical Slope	0.015951	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.86	m	Upstream Velocity Head	0.10	m
Ke	0.90		Entrance Loss	0.09	m

Inlet Control Properties					
Inlet Control HW Elev.	208.79	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W15

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	209.04	m	Discharge	0.3240	m³/s
Headwater Depth/Height	1.07		Tailwater Elevation	208.56	m
Inlet Control HW Elev.	209.00	m	Control Type	Outlet Control	
Outlet Control HW Elev.	209.04	m			

Grades					
Upstream Invert	208.39	m	Downstream Invert	208.20	m
Length	11.70	m	Constructed Slope	0.016239	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.37	m
Slope Type	Mild		Normal Depth	0.39	m
Flow Regime	Subcritical		Critical Depth	0.37	m
Velocity Downstream	1.75	m/s	Critical Slope	0.018652	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	209.04	m	Upstream Velocity Head	0.14	m
Ke	0.90		Entrance Loss	0.13	m

Inlet Control Properties					
Inlet Control HW Elev.	209.00	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W16

Peak Discharge Method: User-Specified					
Design Discharge	0.0620	m³/s	Check Discharge	0.1120	m³/s

Grades Model: Inverts					
Invert Upstream	210.10	m	Invert Downstream	209.86	m
Length	11.50	m	Slope	0.020870	m/m
Drop	0.24	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	210.22	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-600 mm Circular	0.0620 m³/s	210.36 m	0.35 m/s
	Trial-2	1-600 mm Circular	0.1120 m³/s	210.46 m	0.62 m/s

Culvert Design Report
20MC-W16

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	210.36	m	Discharge	0.0620	m³/s
Headwater Depth/Height	0.43		Tailwater Elevation	210.22	m
Inlet Control HW Elev.	210.31	m	Control Type	Entrance Control	
Outlet Control HW Elev.	210.36	m			

Grades					
Upstream Invert	210.10	m	Downstream Invert	209.86	m
Length	11.50	m	Constructed Slope	0.020870	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.36	m
Slope Type	Steep		Normal Depth	0.14	m
Flow Regime	N/A		Critical Depth	0.16	m
Velocity Downstream	0.35	m/s	Critical Slope	0.015261	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	210.36	m	Upstream Velocity Head	0.06	m
Ke	0.90		Entrance Loss	0.05	m

Inlet Control Properties					
Inlet Control HW Elev.	210.31	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-W16

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	210.46	m	Discharge	0.1120	m³/s
Headwater Depth/Height	0.59		Tailwater Elevation	210.22	m
Inlet Control HW Elev.	210.40	m	Control Type	Entrance Control	
Outlet Control HW Elev.	210.46	m			

Grades					
Upstream Invert	210.10	m	Downstream Invert	209.86	m
Length	11.50	m	Constructed Slope	0.020870	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.36	m
Slope Type	Steep		Normal Depth	0.20	m
Flow Regime	N/A		Critical Depth	0.21	m
Velocity Downstream	0.62	m/s	Critical Slope	0.015283	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	210.46	m	Upstream Velocity Head	0.08	m
Ke	0.90		Entrance Loss	0.07	m

Inlet Control Properties					
Inlet Control HW Elev.	210.40	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-E3

Analysis Component			
Storm Event	Design	Discharge	2.9510 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	2.9510 m³/s	Check Discharge	4.4340 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.28 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-1500 x 1050 mm Box	2.9189 m³/s	207.95 m	2.67 m/s
Weir	Roadway	0.0327 m³/s	207.95 m	N/A
Total	----------	2.9516 m³/s	207.95 m	N/A

Culvert Analysis Report
20MC-E3

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	207.95	m	Discharge	2.9189	m³/s
Inlet Control HW Elev.	207.84	m	Tailwater Elevation	207.28	m
Outlet Control HW Elev.	207.95	m	Control Type	Outlet Control	
Headwater Depth/Height	1.20				

Grades					
Upstream Invert	206.69	m	Downstream Invert	206.68	m
Length	21.20	m	Constructed Slope	0.000472	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.73	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.73	m
Velocity Downstream	2.67	m/s	Critical Slope	0.004552	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.50	m
Section Size	1500 x 1050 mm		Rise	1.05	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.95	m	Upstream Velocity Head	0.23	m
Ke	0.50		Entrance Loss	0.11	m

Inlet Control Properties					
Inlet Control HW Elev.	207.84	m	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	1.6	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
20MC-E3

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0327	m³/s	Allowable HW Elevation	207.95	m
Roadway Width	0.00	m	Overtopping Coefficient	1.71	SI
Low Point	207.89	m	Headwater Elevation	207.95	m
Discharge Coefficient (Cr)	3.09		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.28	m			

Sta (m)	Elev. (m)
0.00	208.33
26.00	208.27
45.00	208.15
60.00	207.89

Culvert Analysis Report
20MC-E3

Analysis Component			
Storm Event	Check	Discharge	4.4340 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	2.9510 m³/s	Check Discharge	4.4340 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.28 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-1500 x 1050 mm Box	3.5362 m³/s	208.12 m	2.85 m/s
Weir	Roadway	0.8996 m³/s	208.12 m	N/A
Total	----------	4.4358 m³/s	208.12 m	N/A

Culvert Analysis Report
20MC-E3

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.12	m	Discharge	3.5362	m³/s
Inlet Control HW Elev.	208.07	m	Tailwater Elevation	207.28	m
Outlet Control HW Elev.	208.12	m	Control Type	Outlet Control	
Headwater Depth/Height	1.36				

Grades					
Upstream Invert	206.69	m	Downstream Invert	206.68	m
Length	21.20	m	Constructed Slope	0.000472	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.83	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.83	m
Velocity Downstream	2.85	m/s	Critical Slope	0.004757	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.50	m
Section Size	1500 x 1050 mm		Rise	1.05	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.12	m	Upstream Velocity Head	0.26	m
Ke	0.50		Entrance Loss	0.13	m

Inlet Control Properties					
Inlet Control HW Elev.	208.07	m	Flow Control	Transition	
Inlet Type	90° headwall w 45° bevels		Area Full	1.6	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
20MC-E3

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.8996	m³/s	Allowable HW Elevation	208.12	m
Roadway Width	0.00	m	Overtopping Coefficient	1.71	SI
Low Point	207.89	m	Headwater Elevation	208.12	m
Discharge Coefficient (Cr)	3.09		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.28	m			

Sta (m)	Elev. (m)
0.00	208.33
26.00	208.27
45.00	208.15
60.00	207.89

Culvert Design Report
20MC-E4

Peak Discharge Method: User-Specified			
Design Discharge	0.0332 m³/s	Check Discharge	0.0603 m³/s

Grades Model: Inverts			
Invert Upstream	212.79 m	Invert Downstream	212.67 m
Length	12.00 m	Slope	0.010000 m/m
Drop	0.12 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	212.97 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-500 mm Circular	0.0332 m³/s	213.00 m	0.27 m/s
	Trial-2	1-500 mm Circular	0.0603 m³/s	213.06 m	0.49 m/s

Culvert Design Report
20MC-E4

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	213.00	m	Discharge	0.0332	m³/s
Headwater Depth/Height	0.42		Tailwater Elevation	212.97	m
Inlet Control HW Elev.	212.97	m	Control Type	Outlet Control	
Outlet Control HW Elev.	213.00	m			

Grades					
Upstream Invert	212.79	m	Downstream Invert	212.67	m
Length	12.00	m	Constructed Slope	0.010000	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.30	m
Slope Type	Mild		Normal Depth	0.14	m
Flow Regime	Subcritical		Critical Depth	0.12	m
Velocity Downstream	0.27	m/s	Critical Slope	0.016371	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	213.00	m	Upstream Velocity Head	0.01	m
Ke	0.90		Entrance Loss	0.01	m

Inlet Control Properties					
Inlet Control HW Elev.	212.97	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-E4

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	213.06	m	Discharge	0.0603	m³/s
Headwater Depth/Height	0.53		Tailwater Elevation	212.97	m
Inlet Control HW Elev.	213.02	m	Control Type	Outlet Control	
Outlet Control HW Elev.	213.06	m			

Grades					
Upstream Invert	212.79	m	Downstream Invert	212.67	m
Length	12.00	m	Constructed Slope	0.010000	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.30	m
Slope Type	Mild		Normal Depth	0.19	m
Flow Regime	Subcritical		Critical Depth	0.16	m
Velocity Downstream	0.49	m/s	Critical Slope	0.016259	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	213.06	m	Upstream Velocity Head	0.03	m
Ke	0.90		Entrance Loss	0.03	m

Inlet Control Properties					
Inlet Control HW Elev.	213.02	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-E5

Peak Discharge Method: User-Specified					
Design Discharge	0.0048	m³/s	Check Discharge	0.0087	m³/s

Grades Model: Inverts					
Invert Upstream	211.88	m	Invert Downstream	211.84	m
Length	11.40	m	Slope	0.003509	m/m
Drop	0.04	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	212.14	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-500 mm Circular	0.0048 m³/s	212.14 m	0.04 m/s
	Trial-2	1-500 mm Circular	0.0087 m³/s	212.14 m	0.07 m/s

Culvert Design Report
20MC-E5

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	212.14	m	Discharge	0.0048	m³/s
Headwater Depth/Height	0.52		Tailwater Elevation	212.14	m
Inlet Control HW Elev.	212.14	m	Control Type	Outlet Control	
Outlet Control HW Elev.	212.14	m			

Grades					
Upstream Invert	211.88	m	Downstream Invert	211.84	m
Length	11.40	m	Constructed Slope	0.003509	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.30	m
Slope Type	Mild		Normal Depth	0.07	m
Flow Regime	Subcritical		Critical Depth	0.04	m
Velocity Downstream	0.04	m/s	Critical Slope	0.019755	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.14	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	212.14	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-E5

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	212.14	m	Discharge	0.0087	m³/s
Headwater Depth/Height	0.52		Tailwater Elevation	212.14	m
Inlet Control HW Elev.	212.14	m	Control Type	Outlet Control	
Outlet Control HW Elev.	212.14	m			

Grades					
Upstream Invert	211.88	m	Downstream Invert	211.84	m
Length	11.40	m	Constructed Slope	0.003509	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.30	m
Slope Type	Mild		Normal Depth	0.09	m
Flow Regime	Subcritical		Critical Depth	0.06	m
Velocity Downstream	0.07	m/s	Critical Slope	0.018203	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.14	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	212.14	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-E6

Analysis Component			
Storm Event	Design	Discharge	0.6630 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.6630 m³/s	Check Discharge	1.1940 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.01 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.4276 m³/s	207.62 m	1.96 m/s
Weir	Roadway	0.2359 m³/s	207.62 m	N/A
Total	----------	0.6635 m³/s	207.62 m	N/A

Culvert Analysis Report
20MC-E6

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	207.62	m	Discharge	0.4276	m³/s
Inlet Control HW Elev.	207.46	m	Tailwater Elevation	207.01	m
Outlet Control HW Elev.	207.62	m	Control Type	Outlet Control	
Headwater Depth/Height	1.50				

Grades					
Upstream Invert	206.71	m	Downstream Invert	206.65	m
Length	17.10	m	Constructed Slope	0.003509	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.43	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.43	m
Velocity Downstream	1.96	m/s	Critical Slope	0.021633	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.62	m	Upstream Velocity Head	0.11	m
Ke	0.90		Entrance Loss	0.10	m

Inlet Control Properties					
Inlet Control HW Elev.	207.46	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-E6

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.2359	m³/s	Allowable HW Elevation	207.62	m
Roadway Width	0.00	m	Overtopping Coefficient	1.71	SI
Low Point	207.47	m	Headwater Elevation	207.62	m
Discharge Coefficient (Cr)	3.09		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.01	m			

Sta (m)	Elev. (m)
0.00	207.88
25.00	207.87
35.00	207.47
40.00	207.77
55.00	207.89
72.00	208.20

Culvert Analysis Report
20MC-E6

Analysis Component			
Storm Event	Check	Discharge	1.1940 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.6630 m³/s	Check Discharge	1.1940 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.01 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.4613 m³/s	207.71 m	2.03 m/s
Weir	Roadway	0.7327 m³/s	207.71 m	N/A
Total	----------	1.1940 m³/s	207.71 m	N/A

Culvert Analysis Report
20MC-E6

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	207.71	m	Discharge	0.4613	m³/s
Inlet Control HW Elev.	207.51	m	Tailwater Elevation	207.01	m
Outlet Control HW Elev.	207.71	m	Control Type	Outlet Control	
Headwater Depth/Height	1.65				

Grades					
Upstream Invert	206.71	m	Downstream Invert	206.65	m
Length	17.10	m	Constructed Slope	0.003509	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.44	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.44	m
Velocity Downstream	2.03	m/s	Critical Slope	0.022855	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.71	m	Upstream Velocity Head	0.13	m
Ke	0.90		Entrance Loss	0.11	m

Inlet Control Properties					
Inlet Control HW Elev.	207.51	m	Flow Control	Transition	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-E6

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.7327	m³/s	Allowable HW Elevation	207.71	m
Roadway Width	0.00	m	Overtopping Coefficient	1.71	SI
Low Point	207.47	m	Headwater Elevation	207.71	m
Discharge Coefficient (Cr)	3.09		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.01	m			

Sta (m)	Elev. (m)
0.00	207.88
25.00	207.87
35.00	207.47
40.00	207.77
55.00	207.89
72.00	208.20

Culvert Design Report
20MC-E7

Peak Discharge Method: User-Specified					
Design Discharge	0.0130	m³/s	Check Discharge	0.0238	m³/s

Grades Model: Inverts					
Invert Upstream	207.18	m	Invert Downstream	206.89	m
Length	14.70	m	Slope	0.019728	m/m
Drop	0.29	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	207.07	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-300 mm Circular	0.0130 m³/s	207.32 m	0.29 m/s
	Trial-2	1-300 mm Circular	0.0238 m³/s	207.38 m	0.53 m/s

Culvert Design Report
20MC-E7

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	207.32	m	Discharge	0.0130	m³/s
Headwater Depth/Height	0.47		Tailwater Elevation	207.07	m
Inlet Control HW Elev.	207.30	m	Control Type	Entrance Control	
Outlet Control HW Elev.	207.32	m			

Grades					
Upstream Invert	207.18	m	Downstream Invert	206.89	m
Length	14.70	m	Constructed Slope	0.019728	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.18	m
Slope Type	Steep		Normal Depth	0.08	m
Flow Regime	N/A		Critical Depth	0.09	m
Velocity Downstream	0.29	m/s	Critical Slope	0.019154	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.30	m
Section Size	300 mm		Rise	0.30	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.32	m	Upstream Velocity Head	0.03	m
Ke	0.90		Entrance Loss	0.03	m

Inlet Control Properties					
Inlet Control HW Elev.	207.30	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-E7

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	207.38	m	Discharge	0.0238	m³/s
Headwater Depth/Height	0.65		Tailwater Elevation	207.07	m
Inlet Control HW Elev.	207.35	m	Control Type	Entrance Control	
Outlet Control HW Elev.	207.38	m			

Grades					
Upstream Invert	207.18	m	Downstream Invert	206.89	m
Length	14.70	m	Constructed Slope	0.019728	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.18	m
Slope Type	Steep		Normal Depth	0.12	m
Flow Regime	N/A		Critical Depth	0.12	m
Velocity Downstream	0.53	m/s	Critical Slope	0.019471	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.30	m
Section Size	300 mm		Rise	0.30	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.38	m	Upstream Velocity Head	0.04	m
Ke	0.90		Entrance Loss	0.04	m

Inlet Control Properties					
Inlet Control HW Elev.	207.35	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-E8

Peak Discharge Method: User-Specified					
Design Discharge	0.0590	m³/s	Check Discharge	0.1082	m³/s

Grades Model: Inverts					
Invert Upstream	206.81	m	Invert Downstream	206.61	m
Length	11.20	m	Slope	0.017857	m/m
Drop	0.20	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	206.97	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-600 mm Circular	0.0590 m³/s	207.07 m	0.33 m/s
	Trial-2	1-600 mm Circular	0.1082 m³/s	207.16 m	0.60 m/s

Culvert Design Report
20MC-E8

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	207.07	m	Discharge	0.0590	m³/s
Headwater Depth/Height	0.42		Tailwater Elevation	206.97	m
Inlet Control HW Elev.	207.02	m	Control Type	Outlet Control	
Outlet Control HW Elev.	207.07	m			

Grades					
Upstream Invert	206.81	m	Downstream Invert	206.61	m
Length	11.20	m	Constructed Slope	0.017857	m/m

Hydraulic Profile					
Profile	S1		Depth, Downstream	0.36	m
Slope Type	Steep		Normal Depth	0.15	m
Flow Regime	Subcritical		Critical Depth	0.15	m
Velocity Downstream	0.33	m/s	Critical Slope	0.015282	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.07	m	Upstream Velocity Head	0.05	m
Ke	0.90		Entrance Loss	0.05	m

Inlet Control Properties					
Inlet Control HW Elev.	207.02	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-E8

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	207.16	m	Discharge	0.1082	m³/s
Headwater Depth/Height	0.58		Tailwater Elevation	206.97	m
Inlet Control HW Elev.	207.11	m	Control Type	Entrance Control	
Outlet Control HW Elev.	207.16	m			

Grades					
Upstream Invert	206.81	m	Downstream Invert	206.61	m
Length	11.20	m	Constructed Slope	0.017857	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.36	m
Slope Type	Steep		Normal Depth	0.20	m
Flow Regime	N/A		Critical Depth	0.21	m
Velocity Downstream	0.60	m/s	Critical Slope	0.015262	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.16	m	Upstream Velocity Head	0.08	m
Ke	0.90		Entrance Loss	0.07	m

Inlet Control Properties					
Inlet Control HW Elev.	207.11	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-E9

Analysis Component			
Storm Event	Design	Discharge	3.6830 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	3.6830 m³/s	Check Discharge	5.7190 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	204.62 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-3500 x 900 mm Box	3.6829 m³/s	205.12 m	2.18 m/s
Weir	Roadway	0.0000 m³/s	205.12 m	N/A
Total	----------	3.6829 m³/s	205.12 m	N/A

Culvert Analysis Report
20MC-E9

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	205.12	m	Discharge	3.6829	m³/s
Inlet Control HW Elev.	205.11	m	Tailwater Elevation	204.62	m
Outlet Control HW Elev.	205.12	m	Control Type	Outlet Control	
Headwater Depth/Height	1.08				

Grades					
Upstream Invert	204.15	m	Downstream Invert	204.35	m
Length	10.90	m	Constructed Slope	-0.018349	m/m

Hydraulic Profile					
Profile	A2		Depth, Downstream	0.48	m
Slope Type	Adverse		Normal Depth	0.00	m
Flow Regime	Subcritical		Critical Depth	0.48	m
Velocity Downstream	2.18	m/s	Critical Slope	0.002923	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.50	m
Section Size	3500 x 900 mm		Rise	0.90	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.12	m	Upstream Velocity Head	0.08	m
Ke	0.50		Entrance Loss	0.04	m

Inlet Control Properties					
Inlet Control HW Elev.	205.11	m	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	3.2	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
20MC-E9

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	205.12	m
Roadway Width	9.00	m	Overtopping Coefficient	1.60	SI
Low Point	205.77	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	204.62	m			

Sta (m)	Elev. (m)
0.00	205.95
50.00	205.83
75.00	205.95
81.00	205.87
85.00	205.90
121.00	205.82
127.00	205.77

Culvert Analysis Report
20MC-E9

Analysis Component			
Storm Event	Check	Discharge	5.7190 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	3.6830 m³/s	Check Discharge	5.7190 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	204.62 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-3500 x 900 mm Box	5.7180 m³/s	205.43 m	2.52 m/s
Weir	Roadway	0.0000 m³/s	205.43 m	N/A
Total	----------	5.7180 m³/s	205.43 m	N/A

Culvert Analysis Report
20MC-E9

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	205.43	m	Discharge	5.7180	m³/s
Inlet Control HW Elev.	205.37	m	Tailwater Elevation	204.62	m
Outlet Control HW Elev.	205.43	m	Control Type	Outlet Control	
Headwater Depth/Height	1.42				

Grades					
Upstream Invert	204.15	m	Downstream Invert	204.35	m
Length	10.90	m	Constructed Slope	-0.018349	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.65	m
Slope Type	Adverse		Normal Depth	0.00	m
Flow Regime	Subcritical		Critical Depth	0.65	m
Velocity Downstream	2.52	m/s	Critical Slope	0.002915	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.50	m
Section Size	3500 x 900 mm		Rise	0.90	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.43	m	Upstream Velocity Head	0.17	m
Ke	0.50		Entrance Loss	0.08	m

Inlet Control Properties					
Inlet Control HW Elev.	205.37	m	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	3.2	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
20MC-E9

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	205.43	m
Roadway Width	9.00	m	Overtopping Coefficient	1.60	SI
Low Point	205.77	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	204.62	m			

Sta (m)	Elev. (m)
0.00	205.95
50.00	205.83
75.00	205.95
81.00	205.87
85.00	205.90
121.00	205.82
127.00	205.77

Culvert Analysis Report
20MC-E10

Analysis Component			
Storm Event	Design	Discharge	0.2600 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.2600 m³/s	Check Discharge	0.4784 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	205.04 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-450 mm Circular	0.2579 m³/s	205.71 m	1.88 m/s
Weir	Roadway	0.0022 m³/s	205.71 m	N/A
Total	----------	0.2601 m³/s	205.71 m	N/A

Culvert Analysis Report
20MC-E10

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	205.71	m	Discharge	0.2579	m³/s
Inlet Control HW Elev.	205.66	m	Tailwater Elevation	205.04	m
Outlet Control HW Elev.	205.71	m	Control Type	Outlet Control	
Headwater Depth/Height	1.63				

Grades					
Upstream Invert	204.97	m	Downstream Invert	204.77	m
Length	12.10	m	Constructed Slope	0.016529	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.36	m
Velocity Downstream	1.88	m/s	Critical Slope	0.028374	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.46	m
Section Size	450 mm		Rise	0.46	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.71	m	Upstream Velocity Head	0.13	m
Ke	0.90		Entrance Loss	0.11	m

Inlet Control Properties					
Inlet Control HW Elev.	205.66	m	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-E10

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0022	m³/s	Allowable HW Elevation	205.71	m
Roadway Width	9.00	m	Overtopping Coefficient	1.61	SI
Low Point	205.70	m	Headwater Elevation	205.71	m
Discharge Coefficient (Cr)	2.91		Submergence Factor (Kt)	1.00	
Tailwater Elevation	205.04	m			

Sta (m)	Elev. (m)
0.00	205.89
20.00	205.70
35.00	205.94

Culvert Analysis Report
20MC-E10

Analysis Component			
Storm Event	Check	Discharge	0.4784 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.2600 m³/s	Check Discharge	0.4784 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	205.04 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-450 mm Circular	0.2721 m³/s	205.79 m	1.94 m/s
Weir	Roadway	0.2063 m³/s	205.79 m	N/A
Total	----------	0.4784 m³/s	205.79 m	N/A

Culvert Analysis Report
20MC-E10

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	205.79	m	Discharge	0.2721	m³/s
Inlet Control HW Elev.	205.71	m	Tailwater Elevation	205.04	m
Outlet Control HW Elev.	205.79	m	Control Type	Outlet Control	
Headwater Depth/Height	1.78				

Grades					
Upstream Invert	204.97	m	Downstream Invert	204.77	m
Length	12.10	m	Constructed Slope	0.016529	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.36	m
Velocity Downstream	1.94	m/s	Critical Slope	0.029996	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.46	m
Section Size	450 mm		Rise	0.46	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.79	m	Upstream Velocity Head	0.14	m
Ke	0.90		Entrance Loss	0.13	m

Inlet Control Properties					
Inlet Control HW Elev.	205.71	m	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-E10

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.2063	m³/s	Allowable HW Elevation	205.79	m
Roadway Width	9.00	m	Overtopping Coefficient	1.62	SI
Low Point	205.70	m	Headwater Elevation	205.79	m
Discharge Coefficient (Cr)	2.94		Submergence Factor (Kt)	1.00	
Tailwater Elevation	205.04	m			

Sta (m)	Elev. (m)
0.00	205.89
20.00	205.70
35.00	205.94

Culvert Design Report
20MC-E11

Peak Discharge Method: User-Specified			
Design Discharge	0.0027 m³/s	Check Discharge	0.0050 m³/s

Grades Model: Inverts			
Invert Upstream	207.08 m	Invert Downstream	207.04 m
Length	12.70 m	Slope	0.003150 m/m
Drop	0.04 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.16 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-200 mm Circular	0.0027 m³/s	207.17 m	0.14 m/s
	Trial-2	1-200 mm Circular	0.0050 m³/s	207.19 m	0.25 m/s

Culvert Design Report
20MC-E11

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	207.17	m	Discharge	0.0027	m³/s
Headwater Depth/Height	0.47		Tailwater Elevation	207.16	m
Inlet Control HW Elev.	207.16	m	Control Type	Outlet Control	
Outlet Control HW Elev.	207.17	m			

Grades					
Upstream Invert	207.08	m	Downstream Invert	207.04	m
Length	12.70	m	Constructed Slope	0.003150	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.12	m
Slope Type	Mild		Normal Depth	0.07	m
Flow Regime	Subcritical		Critical Depth	0.04	m
Velocity Downstream	0.14	m/s	Critical Slope	0.022446	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.20	m
Section Size	200 mm		Rise	0.20	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.17	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	207.16	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.0	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-E11

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	207.19	m	Discharge	0.0050	m³/s
Headwater Depth/Height	0.57		Tailwater Elevation	207.16	m
Inlet Control HW Elev.	207.16	m	Control Type	Outlet Control	
Outlet Control HW Elev.	207.19	m			

Grades					
Upstream Invert	207.08	m	Downstream Invert	207.04	m
Length	12.70	m	Constructed Slope	0.003150	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.12	m
Slope Type	Mild		Normal Depth	0.10	m
Flow Regime	Subcritical		Critical Depth	0.06	m
Velocity Downstream	0.25	m/s	Critical Slope	0.022023	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.20	m
Section Size	200 mm		Rise	0.20	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.19	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	207.16	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.0	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-E12

Analysis Component			
Storm Event	Design	Discharge	0.5050 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.5050 m³/s	Check Discharge	0.9490 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	203.96 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-500 mm Circular	0.3894 m³/s	204.93 m	2.20 m/s
Weir	Roadway	0.1164 m³/s	204.93 m	N/A
Total	----------	0.5057 m³/s	204.93 m	N/A

Culvert Analysis Report
20MC-E12

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	204.93	m	Discharge	0.3894	m³/s
Inlet Control HW Elev.	204.65	m	Tailwater Elevation	203.96	m
Outlet Control HW Elev.	204.93	m	Control Type	Outlet Control	
Headwater Depth/Height	2.70				

Grades					
Upstream Invert	203.58	m	Downstream Invert	203.66	m
Length	11.70	m	Constructed Slope	-0.006838	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.42	m
Slope Type	Adverse		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.42	m
Velocity Downstream	2.20	m/s	Critical Slope	0.034337	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	204.93	m	Upstream Velocity Head	0.20	m
Ke	0.90		Entrance Loss	0.18	m

Inlet Control Properties					
Inlet Control HW Elev.	204.65	m	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-E12

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.1164	m³/s	Allowable HW Elevation	204.93	m
Roadway Width	9.00	m	Overtopping Coefficient	1.62	SI
Low Point	204.88	m	Headwater Elevation	204.93	m
Discharge Coefficient (Cr)	2.93		Submergence Factor (Kt)	1.00	
Tailwater Elevation	203.96	m			

Sta (m)	Elev. (m)
0.00	205.55
90.00	204.88
105.00	204.95

Culvert Analysis Report
20MC-E12

Analysis Component			
Storm Event	Check	Discharge	0.9490 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.5050 m³/s	Check Discharge	0.9490 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	203.96 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-500 mm Circular	0.3990 m³/s	204.97 m	2.23 m/s
Weir	Roadway	0.5516 m³/s	204.97 m	N/A
Total	----------	0.9505 m³/s	204.97 m	N/A

Culvert Analysis Report
20MC-E12

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	204.97	m	Discharge	0.3990	m³/s
Inlet Control HW Elev.	204.68	m	Tailwater Elevation	203.96	m
Outlet Control HW Elev.	204.97	m	Control Type	Outlet Control	
Headwater Depth/Height	2.79				

Grades					
Upstream Invert	203.58	m	Downstream Invert	203.66	m
Length	11.70	m	Constructed Slope	-0.006838	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.43	m
Slope Type	Adverse		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.43	m
Velocity Downstream	2.23	m/s	Critical Slope	0.035526	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	204.97	m	Upstream Velocity Head	0.21	m
Ke	0.90		Entrance Loss	0.19	m

Inlet Control Properties					
Inlet Control HW Elev.	204.68	m	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-E12

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.5516	m³/s	Allowable HW Elevation	204.97	m
Roadway Width	9.00	m	Overtopping Coefficient	1.63	SI
Low Point	204.88	m	Headwater Elevation	204.97	m
Discharge Coefficient (Cr)	2.95		Submergence Factor (Kt)	1.00	
Tailwater Elevation	203.96	m			

Sta (m)	Elev. (m)
0.00	205.55
90.00	204.88
105.00	204.95

Culvert Analysis Report
20MC-E13

Analysis Component			
Storm Event	Design	Discharge	0.6624 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.6624 m³/s	Check Discharge	1.0527 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	204.90 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-700 mm Circular	0.6289 m³/s	205.63 m	2.14 m/s
Weir	Roadway	0.0340 m³/s	205.63 m	N/A
Total	----------	0.6629 m³/s	205.63 m	N/A

Culvert Analysis Report
20MC-E13

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	205.63	m	Discharge	0.6289	m³/s
Inlet Control HW Elev.	205.49	m	Tailwater Elevation	204.90	m
Outlet Control HW Elev.	205.63	m	Control Type	Outlet Control	
Headwater Depth/Height	1.64				

Grades					
Upstream Invert	204.48	m	Downstream Invert	204.59	m
Length	11.90	m	Constructed Slope	-0.009244	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.50	m
Slope Type	Adverse		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.50	m
Velocity Downstream	2.14	m/s	Critical Slope	0.021246	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.70	m
Section Size	700 mm		Rise	0.70	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.63	m	Upstream Velocity Head	0.14	m
Ke	0.90		Entrance Loss	0.12	m

Inlet Control Properties					
Inlet Control HW Elev.	205.49	m	Flow Control	Transition	
Inlet Type	Projecting		Area Full	0.4	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-E13

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0340	m³/s	Allowable HW Elevation	205.63	m
Roadway Width	9.00	m	Overtopping Coefficient	1.61	SI
Low Point	205.61	m	Headwater Elevation	205.63	m
Discharge Coefficient (Cr)	2.91		Submergence Factor (Kt)	1.00	
Tailwater Elevation	204.90	m			

Sta (m)	Elev. (m)
0.00	205.66
30.00	205.61
75.00	205.69
90.00	205.75

Culvert Analysis Report
20MC-E13

Analysis Component			
Storm Event	Check	Discharge	1.0527 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.6624 m³/s	Check Discharge	1.0527 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	204.90 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-700 mm Circular	0.6478 m³/s	205.66 m	2.17 m/s
Weir	Roadway	0.4082 m³/s	205.66 m	N/A
Total	----------	1.0560 m³/s	205.66 m	N/A

Culvert Analysis Report
20MC-E13

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	205.66	m	Discharge	0.6478	m³/s
Inlet Control HW Elev.	205.51	m	Tailwater Elevation	204.90	m
Outlet Control HW Elev.	205.66	m	Control Type	Outlet Control	
Headwater Depth/Height	1.69				

Grades					
Upstream Invert	204.48	m	Downstream Invert	204.59	m
Length	11.90	m	Constructed Slope	-0.009244	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.51	m
Slope Type	Adverse		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.51	m
Velocity Downstream	2.17	m/s	Critical Slope	0.021720	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.70	m
Section Size	700 mm		Rise	0.70	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.66	m	Upstream Velocity Head	0.14	m
Ke	0.90		Entrance Loss	0.13	m

Inlet Control Properties					
Inlet Control HW Elev.	205.51	m	Flow Control	Transition	
Inlet Type	Projecting		Area Full	0.4	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-E13

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.4082	m³/s	Allowable HW Elevation	205.66	m
Roadway Width	9.00	m	Overtopping Coefficient	1.61	SI
Low Point	205.61	m	Headwater Elevation	205.66	m
Discharge Coefficient (Cr)	2.92		Submergence Factor (Kt)	1.00	
Tailwater Elevation	204.90	m			

Sta (m)	Elev. (m)
0.00	205.66
30.00	205.61
75.00	205.69
90.00	205.75

Culvert Analysis Report
20MC-E14

Analysis Component			
Storm Event	Design	Discharge	0.0116 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.0116 m³/s	Check Discharge	0.0216 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	206.20 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-300 mm Circular	0.0117 m³/s	206.22 m	0.26 m/s
Weir	Roadway	0.0000 m³/s	206.22 m	N/A
Total	----------	0.0117 m³/s	206.22 m	N/A

Culvert Analysis Report
20MC-E14

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	206.22	m	Discharge	0.0117	m³/s
Inlet Control HW Elev.	206.20	m	Tailwater Elevation	206.20	m
Outlet Control HW Elev.	206.22	m	Control Type	Outlet Control	
Headwater Depth/Height	0.54				

Grades					
Upstream Invert	206.06	m	Downstream Invert	206.02	m
Length	12.30	m	Constructed Slope	0.003252	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.18	m
Slope Type	Mild		Normal Depth	0.13	m
Flow Regime	Subcritical		Critical Depth	0.08	m
Velocity Downstream	0.26	m/s	Critical Slope	0.019198	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.30	m
Section Size	300 mm		Rise	0.30	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	206.22	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	206.20	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-E14

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	206.22	m
Roadway Width	8.00	m	Overtopping Coefficient	1.60	SI
Low Point	206.50	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	206.20	m			

Sta (m)	Elev. (m)
0.00	206.61
80.00	206.50
90.00	206.53

Culvert Analysis Report
20MC-E14

Analysis Component				
Storm Event	Check	Discharge	0.0216	m³/s

Peak Discharge Method: User-Specified				
Design Discharge	0.0116	m³/s	Check Discharge	0.0216 m³/s

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	206.20	m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-300 mm Circular	0.0216 m³/s	206.27 m	0.48 m/s
Weir	Roadway	0.0000 m³/s	206.27 m	N/A
Total	----------	0.0216 m³/s	206.27 m	N/A

Culvert Analysis Report
20MC-E14

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	206.27	m	Discharge	0.0216	m³/s
Inlet Control HW Elev.	206.22	m	Tailwater Elevation	206.20	m
Outlet Control HW Elev.	206.27	m	Control Type	Outlet Control	
Headwater Depth/Height	0.67				

Grades					
Upstream Invert	206.06	m	Downstream Invert	206.02	m
Length	12.30	m	Constructed Slope	0.003252	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.18	m
Slope Type	Mild		Normal Depth	0.19	m
Flow Regime	Subcritical		Critical Depth	0.11	m
Velocity Downstream	0.48	m/s	Critical Slope	0.019342	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.30	m
Section Size	300 mm		Rise	0.30	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	206.27	m	Upstream Velocity Head	0.01	m
Ke	0.90		Entrance Loss	0.01	m

Inlet Control Properties					
Inlet Control HW Elev.	206.22	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
20MC-E14

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	206.27	m
Roadway Width	8.00	m	Overtopping Coefficient	1.60	SI
Low Point	206.50	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	206.20	m			

Sta (m)	Elev. (m)
0.00	206.61
80.00	206.50
90.00	206.53

Culvert Design Report
20MC-E15

Peak Discharge Method: User-Specified					
Design Discharge	0.0270	m³/s	Check Discharge	0.0490	m³/s

Grades Model: Inverts					
Invert Upstream	207.80	m	Invert Downstream	207.46	m
Length	12.20	m	Slope	0.027869	m/m
Drop	0.34	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	207.70	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-400 mm Circular	0.0270 m³/s	207.99 m	0.34 m/s
	Trial-2	1-400 mm Circular	0.0490 m³/s	208.07 m	0.62 m/s

Culvert Design Report
20MC-E15

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	207.99	m	Discharge	0.0270	m³/s
Headwater Depth/Height	0.48		Tailwater Elevation	207.70	m
Inlet Control HW Elev.	207.96	m	Control Type	Entrance Control	
Outlet Control HW Elev.	207.99	m			

Grades					
Upstream Invert	207.80	m	Downstream Invert	207.46	m
Length	12.20	m	Constructed Slope	0.027869	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.24	m
Slope Type	Steep		Normal Depth	0.10	m
Flow Regime	N/A		Critical Depth	0.12	m
Velocity Downstream	0.34	m/s	Critical Slope	0.017484	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.40	m
Section Size	400 mm		Rise	0.40	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.99	m	Upstream Velocity Head	0.04	m
Ke	0.90		Entrance Loss	0.04	m

Inlet Control Properties					
Inlet Control HW Elev.	207.96	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
20MC-E15

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	208.07	m	Discharge	0.0490	m³/s
Headwater Depth/Height	0.67		Tailwater Elevation	207.70	m
Inlet Control HW Elev.	208.03	m	Control Type	Entrance Control	
Outlet Control HW Elev.	208.07	m			

Grades					
Upstream Invert	207.80	m	Downstream Invert	207.46	m
Length	12.20	m	Constructed Slope	0.027869	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.24	m
Slope Type	Steep		Normal Depth	0.14	m
Flow Regime	N/A		Critical Depth	0.16	m
Velocity Downstream	0.62	m/s	Critical Slope	0.017847	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.40	m
Section Size	400 mm		Rise	0.40	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.07	m	Upstream Velocity Head	0.06	m
Ke	0.90		Entrance Loss	0.05	m

Inlet Control Properties					
Inlet Control HW Elev.	208.03	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC 1

Peak Discharge Method: User-Specified			
Design Discharge	0.0365 m³/s	Check Discharge	0.0677 m³/s

Grades Model: Inverts			
Invert Upstream	215.11 m	Invert Downstream	215.06 m
Length	11.00 m	Slope	0.004545 m/m
Drop	0.05 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	215.36 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-500 mm Circular	0.0365 m³/s	215.38 m	0.30 m/s
	Trial-2	1-500 mm Circular	0.0677 m³/s	215.42 m	0.55 m/s

Culvert Design Report
SHC 1

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	215.38	m	Discharge	0.0365	m³/s
Headwater Depth/Height	0.54		Tailwater Elevation	215.36	m
Inlet Control HW Elev.	215.36	m	Control Type	Outlet Control	
Outlet Control HW Elev.	215.38	m			

Grades					
Upstream Invert	215.11	m	Downstream Invert	215.06	m
Length	11.00	m	Constructed Slope	0.004545	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.30	m
Slope Type	Mild		Normal Depth	0.18	m
Flow Regime	Subcritical		Critical Depth	0.13	m
Velocity Downstream	0.30	m/s	Critical Slope	0.016319	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	215.38	m	Upstream Velocity Head	0.01	m
Ke	0.90		Entrance Loss	0.01	m

Inlet Control Properties					
Inlet Control HW Elev.	215.36	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC 1

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	215.42	m	Discharge	0.0677	m³/s
Headwater Depth/Height	0.63		Tailwater Elevation	215.36	m
Inlet Control HW Elev.	215.36	m	Control Type	Outlet Control	
Outlet Control HW Elev.	215.42	m			

Grades					
Upstream Invert	215.11	m	Downstream Invert	215.06	m
Length	11.00	m	Constructed Slope	0.004545	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.30	m
Slope Type	Mild		Normal Depth	0.25	m
Flow Regime	Subcritical		Critical Depth	0.17	m
Velocity Downstream	0.55	m/s	Critical Slope	0.016322	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	215.42	m	Upstream Velocity Head	0.02	m
Ke	0.90		Entrance Loss	0.02	m

Inlet Control Properties					
Inlet Control HW Elev.	215.36	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SHC 2

Analysis Component			
Storm Event	Design	Discharge	0.2685 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.2685 m³/s	Check Discharge	0.4983 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	215.03 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-500 mm Circular	0.2568 m³/s	215.50 m	1.76 m/s
Weir	Roadway	0.0119 m³/s	215.50 m	N/A
Total	----------	0.2687 m³/s	215.50 m	N/A

Culvert Analysis Report
SHC 2

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	215.50	m	Discharge	0.2568	m³/s
Inlet Control HW Elev.	215.35	m	Tailwater Elevation	215.03	m
Outlet Control HW Elev.	215.50	m	Control Type	Outlet Control	
Headwater Depth/Height	1.53				

Grades					
Upstream Invert	214.74	m	Downstream Invert	214.73	m
Length	12.20	m	Constructed Slope	0.000820	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.35	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.35	m
Velocity Downstream	1.76	m/s	Critical Slope	0.022891	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	215.50	m	Upstream Velocity Head	0.09	m
Ke	0.90		Entrance Loss	0.08	m

Inlet Control Properties					
Inlet Control HW Elev.	215.35	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SHC 2

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0119	m³/s	Allowable HW Elevation	215.50	m
Roadway Width	9.00	m	Overtopping Coefficient	1.61	SI
Low Point	215.48	m	Headwater Elevation	215.50	m
Discharge Coefficient (Cr)	2.91		Submergence Factor (Kt)	1.00	
Tailwater Elevation	215.03	m			

Sta (m)	Elev. (m)
0.00	216.21
60.00	215.62
85.00	215.48
130.00	216.07

Culvert Analysis Report
SHC 2

Analysis Component			
Storm Event	Check	Discharge	0.4983 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.2685 m³/s	Check Discharge	0.4983 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	215.03 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-500 mm Circular	0.2724 m³/s	215.56 m	1.81 m/s
Weir	Roadway	0.2271 m³/s	215.56 m	N/A
Total	----------	0.4994 m³/s	215.56 m	N/A

Culvert Analysis Report
SHC 2

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	215.56	m	Discharge	0.2724	m³/s
Inlet Control HW Elev.	215.38	m	Tailwater Elevation	215.03	m
Outlet Control HW Elev.	215.56	m	Control Type	Outlet Control	
Headwater Depth/Height	1.63				

Grades					
Upstream Invert	214.74	m	Downstream Invert	214.73	m
Length	12.20	m	Constructed Slope	0.000820	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.36	m
Velocity Downstream	1.81	m/s	Critical Slope	0.023844	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	215.56	m	Upstream Velocity Head	0.10	m
Ke	0.90		Entrance Loss	0.09	m

Inlet Control Properties					
Inlet Control HW Elev.	215.38	m	Flow Control	Transition	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SHC 2

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.2271	m³/s	Allowable HW Elevation	215.56	m
Roadway Width	9.00	m	Overtopping Coefficient	1.62	SI
Low Point	215.48	m	Headwater Elevation	215.56	m
Discharge Coefficient (Cr)	2.93		Submergence Factor (Kt)	1.00	
Tailwater Elevation	215.03	m			

Sta (m)	Elev. (m)
0.00	216.21
60.00	215.62
85.00	215.48
130.00	216.07

Culvert Design Report
SHC 3

Peak Discharge Method: User-Specified					
Design Discharge	0.2950	m³/s	Check Discharge	0.5400	m³/s

Grades Model: Inverts					
Invert Upstream	209.66	m	Invert Downstream	209.26	m
Length	26.40	m	Slope	0.015152	m/m
Drop	0.40	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	209.74	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-800 mm Circular	0.2950 m³/s	210.22 m	0.94 m/s
	Trial-2	1-800 mm Circular	0.5400 m³/s	210.44 m	1.71 m/s

Culvert Design Report
SHC 3

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	210.22	m	Discharge	0.2950	m³/s
Headwater Depth/Height	0.69		Tailwater Elevation	209.74	m
Inlet Control HW Elev.	210.13	m	Control Type	Entrance Control	
Outlet Control HW Elev.	210.22	m			

Grades					
Upstream Invert	209.66	m	Downstream Invert	209.26	m
Length	26.40	m	Constructed Slope	0.015152	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.48	m
Slope Type	Steep		Normal Depth	0.32	m
Flow Regime	N/A		Critical Depth	0.32	m
Velocity Downstream	0.94	m/s	Critical Slope	0.014248	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.80	m
Section Size	800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	210.22	m	Upstream Velocity Head	0.12	m
Ke	0.90		Entrance Loss	0.11	m

Inlet Control Properties					
Inlet Control HW Elev.	210.13	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.5	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC 3

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	210.44	m	Discharge	0.5400	m³/s
Headwater Depth/Height	0.98		Tailwater Elevation	209.74	m
Inlet Control HW Elev.	210.37	m	Control Type	Outlet Control	
Outlet Control HW Elev.	210.44	m			

Grades					
Upstream Invert	209.66	m	Downstream Invert	209.26	m
Length	26.40	m	Constructed Slope	0.015152	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.48	m
Slope Type	Mild		Normal Depth	0.45	m
Flow Regime	Subcritical		Critical Depth	0.44	m
Velocity Downstream	1.71	m/s	Critical Slope	0.016016	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.80	m
Section Size	800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	210.44	m	Upstream Velocity Head	0.17	m
Ke	0.90		Entrance Loss	0.16	m

Inlet Control Properties					
Inlet Control HW Elev.	210.37	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.5	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC 4

Peak Discharge Method: User-Specified					
Design Discharge	2.0880	m³/s	Check Discharge	3.2511	m³/s

Grades Model: Inverts					
Invert Upstream	207.41	m	Invert Downstream	207.18	m
Length	23.10	m	Slope	0.009957	m/m
Drop	0.23	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	208.56	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-2300 mm Circular	2.0880 m³/s	208.66 m	0.80 m/s
	Trial-2	1-2300 mm Circular	3.2511 m³/s	208.80 m	1.25 m/s

Culvert Design Report
SHC 4

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	208.66	m	Discharge	2.0880	m³/s
Headwater Depth/Height	0.54		Tailwater Elevation	208.56	m
Inlet Control HW Elev.	208.56	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.66	m			

Grades					
Upstream Invert	207.41	m	Downstream Invert	207.18	m
Length	23.10	m	Constructed Slope	0.009957	m/m

Hydraulic Profile					
Profile	S1		Depth, Downstream	1.38	m
Slope Type	Steep		Normal Depth	0.65	m
Flow Regime	Subcritical		Critical Depth	0.65	m
Velocity Downstream	0.80	m/s	Critical Slope	0.009753	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	2.30	m
Section Size	2300 mm		Rise	2.30	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.66	m	Upstream Velocity Head	0.05	m
Ke	0.90		Entrance Loss	0.05	m

Inlet Control Properties					
Inlet Control HW Elev.	208.56	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	4.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC 4

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	208.80	m	Discharge	3.2511	m³/s
Headwater Depth/Height	0.60		Tailwater Elevation	208.56	m
Inlet Control HW Elev.	208.59	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.80	m			

Grades					
Upstream Invert	207.41	m	Downstream Invert	207.18	m
Length	23.10	m	Constructed Slope	0.009957	m/m

Hydraulic Profile					
Profile	S1		Depth, Downstream	1.38	m
Slope Type	Steep		Normal Depth	0.82	m
Flow Regime	Subcritical		Critical Depth	0.82	m
Velocity Downstream	1.25	m/s	Critical Slope	0.009840	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	2.30	m
Section Size	2300 mm		Rise	2.30	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.80	m	Upstream Velocity Head	0.12	m
Ke	0.90		Entrance Loss	0.11	m

Inlet Control Properties					
Inlet Control HW Elev.	208.59	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	4.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC 5

Peak Discharge Method: User-Specified					
Design Discharge	3.1170	m³/s	Check Discharge	4.8346	m³/s

Grades Model: Inverts					
Invert Upstream	207.59	m	Invert Downstream	207.58	m
Length	22.00	m	Slope	0.000455	m/m
Drop	0.01	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	208.30	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-2440 x 1220 mm Box	3.1170 m³/s	208.56 m	1.78 m/s
	Trial-2	1-2440 x 1220 mm Box	4.8346 m³/s	208.86 m	2.69 m/s

Culvert Design Report
SHC 5

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	208.56	m	Discharge	3.1170	m³/s
Headwater Depth/Height	0.80		Tailwater Elevation	208.30	m
Inlet Control HW Elev.	208.46	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.56	m			

Grades					
Upstream Invert	207.59	m	Downstream Invert	207.58	m
Length	22.00	m	Constructed Slope	0.000455	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.72	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.55	m
Velocity Downstream	1.78	m/s	Critical Slope	0.003323	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.44	m
Section Size	2440 x 1220 mm		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.56	m	Upstream Velocity Head	0.15	m
Ke	0.50		Entrance Loss	0.07	m

Inlet Control Properties					
Inlet Control HW Elev.	208.46	m	Flow Control	N/A	
Inlet Type	90° headwall w 45° bevels		Area Full	3.0	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Design Report
SHC 5

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	208.86	m	Discharge	4.8346	m³/s
Headwater Depth/Height	1.04		Tailwater Elevation	208.30	m
Inlet Control HW Elev.	208.75	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.86	m			

Grades					
Upstream Invert	207.59	m	Downstream Invert	207.58	m
Length	22.00	m	Constructed Slope	0.000455	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.74	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.74	m
Velocity Downstream	2.69	m/s	Critical Slope	0.003447	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.44	m
Section Size	2440 x 1220 mm		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.86	m	Upstream Velocity Head	0.25	m
Ke	0.50		Entrance Loss	0.12	m

Inlet Control Properties					
Inlet Control HW Elev.	208.75	m	Flow Control	N/A	
Inlet Type	90° headwall w 45° bevels		Area Full	3.0	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Design Report
SHC 6

Peak Discharge Method: User-Specified					
Design Discharge	6.7300	m³/s	Check Discharge	10.0230	m³/s

Grades Model: Inverts					
Invert Upstream	208.12	m	Invert Downstream	207.93	m
Length	22.00	m	Slope	0.008636	m/m
Drop	0.19	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	208.53	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-3660 x 1220 mm Box	6.7300 m³/s	209.35 m	3.40 m/s
	Trial-2	1-3660 x 1220 mm Box	10.0230 m³/s	209.72 m	3.79 m/s

Culvert Design Report
SHC 6

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	209.35	m	Discharge	6.7300	m³/s
Headwater Depth/Height	1.01		Tailwater Elevation	208.53	m
Inlet Control HW Elev.	209.22	m	Control Type	Entrance Control	
Outlet Control HW Elev.	209.35	m			

Grades					
Upstream Invert	208.12	m	Downstream Invert	207.93	m
Length	22.00	m	Constructed Slope	0.008636	m/m

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.54	m
Slope Type	Steep		Normal Depth	0.49	m
Flow Regime	Supercritical		Critical Depth	0.70	m
Velocity Downstream	3.40	m/s	Critical Slope	0.002876	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.66	m
Section Size	3660 x 1220 mm		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	209.35	m	Upstream Velocity Head	0.35	m
Ke	0.50		Entrance Loss	0.18	m

Inlet Control Properties					
Inlet Control HW Elev.	209.22	m	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	4.5	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Design Report
SHC 6

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	209.72	m	Discharge	10.0230	m³/s
Headwater Depth/Height	1.31		Tailwater Elevation	208.53	m
Inlet Control HW Elev.	209.59	m	Control Type	Entrance Control	
Outlet Control HW Elev.	209.72	m			

Grades					
Upstream Invert	208.12	m	Downstream Invert	207.93	m
Length	22.00	m	Constructed Slope	0.008636	m/m

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.72	m
Slope Type	Steep		Normal Depth	0.63	m
Flow Regime	Supercritical		Critical Depth	0.91	m
Velocity Downstream	3.79	m/s	Critical Slope	0.002932	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.66	m
Section Size	3660 x 1220 mm		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	209.72	m	Upstream Velocity Head	0.46	m
Ke	0.50		Entrance Loss	0.23	m

Inlet Control Properties					
Inlet Control HW Elev.	209.59	m	Flow Control	Transition	
Inlet Type	90° headwall w 45° bevels		Area Full	4.5	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Design Report
SHC 7

Peak Discharge Method: User-Specified					
Design Discharge	0.5460	m³/s	Check Discharge	0.8680	m³/s

Grades Model: Inverts					
Invert Upstream	208.42	m	Invert Downstream	208.20	m
Length	28.20	m	Slope	0.007801	m/m
Drop	0.22	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	208.68	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-800 mm Circular	0.5460 m³/s	209.19 m	1.73 m/s
	Trial-2	1-800 mm Circular	0.8680 m³/s	209.57 m	2.27 m/s

Culvert Design Report
SHC 7

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	209.19	m	Discharge	0.5460	m³/s
Headwater Depth/Height	0.96		Tailwater Elevation	208.68	m
Inlet Control HW Elev.	209.13	m	Control Type	Outlet Control	
Outlet Control HW Elev.	209.19	m			

Grades					
Upstream Invert	208.42	m	Downstream Invert	208.20	m
Length	28.20	m	Constructed Slope	0.007801	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.48	m
Slope Type	Mild		Normal Depth	0.57	m
Flow Regime	Subcritical		Critical Depth	0.45	m
Velocity Downstream	1.73	m/s	Critical Slope	0.016073	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.80	m
Section Size	800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	209.19	m	Upstream Velocity Head	0.11	m
Ke	0.90		Entrance Loss	0.10	m

Inlet Control Properties					
Inlet Control HW Elev.	209.13	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.5	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC 7

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	209.57	m	Discharge	0.8680	m³/s
Headwater Depth/Height	1.43		Tailwater Elevation	208.68	m
Inlet Control HW Elev.	209.43	m	Control Type	Outlet Control	
Outlet Control HW Elev.	209.57	m			

Grades					
Upstream Invert	208.42	m	Downstream Invert	208.20	m
Length	28.20	m	Constructed Slope	0.007801	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.57	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.57	m
Velocity Downstream	2.27	m/s	Critical Slope	0.020152	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.80	m
Section Size	800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	209.57	m	Upstream Velocity Head	0.15	m
Ke	0.90		Entrance Loss	0.14	m

Inlet Control Properties					
Inlet Control HW Elev.	209.43	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.5	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC 8

Peak Discharge Method: User-Specified					
Design Discharge	0.6650	m³/s	Check Discharge	1.1840	m³/s

Grades Model: Inverts					
Invert Upstream	210.71	m	Invert Downstream	210.16	m
Length	34.00	m	Slope	0.016176	m/m
Drop	0.55	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	210.70	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-900 mm Circular	0.6650 m³/s	211.54 m	1.65 m/s
	Trial-2	1-900 mm Circular	1.1840 m³/s	211.88 m	2.40 m/s

Culvert Design Report
SHC 8

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	211.54	m	Discharge	0.6650	m³/s
Headwater Depth/Height	0.91		Tailwater Elevation	210.70	m
Inlet Control HW Elev.	211.45	m	Control Type	Entrance Control	
Outlet Control HW Elev.	211.54	m			

Grades					
Upstream Invert	210.71	m	Downstream Invert	210.16	m
Length	34.00	m	Constructed Slope	0.016176	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.54	m
Slope Type	Steep		Normal Depth	0.46	m
Flow Regime	N/A		Critical Depth	0.48	m
Velocity Downstream	1.65	m/s	Critical Slope	0.014778	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.91	m
Section Size	900 mm		Rise	0.91	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	211.54	m	Upstream Velocity Head	0.19	m
Ke	0.90		Entrance Loss	0.17	m

Inlet Control Properties					
Inlet Control HW Elev.	211.45	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.7	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC 8

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	211.88	m	Discharge	1.1840	m³/s
Headwater Depth/Height	1.28		Tailwater Elevation	210.70	m
Inlet Control HW Elev.	211.84	m	Control Type	Outlet Control	
Outlet Control HW Elev.	211.88	m			

Grades					
Upstream Invert	210.71	m	Downstream Invert	210.16	m
Length	34.00	m	Constructed Slope	0.016176	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.64	m
Slope Type	Mild		Normal Depth	0.68	m
Flow Regime	Subcritical		Critical Depth	0.64	m
Velocity Downstream	2.40	m/s	Critical Slope	0.018959	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.91	m
Section Size	900 mm		Rise	0.91	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	211.88	m	Upstream Velocity Head	0.26	m
Ke	0.90		Entrance Loss	0.23	m

Inlet Control Properties					
Inlet Control HW Elev.	211.84	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.7	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC 9

Peak Discharge Method: User-Specified					
Design Discharge	0.5440	m³/s	Check Discharge	0.9840	m³/s

Grades Model: Inverts					
Invert Upstream	208.75	m	Invert Downstream	208.60	m
Length	26.80	m	Slope	0.005597	m/m
Drop	0.15	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	209.20	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-1000 mm Circular	0.5440 m³/s	209.45 m	1.11 m/s
	Trial-2	1-1000 mm Circular	0.9840 m³/s	209.74 m	2.00 m/s

Culvert Design Report
SHC 9

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	209.45	m	Discharge	0.5440	m³/s
Headwater Depth/Height	0.70		Tailwater Elevation	209.20	m
Inlet Control HW Elev.	209.37	m	Control Type	Outlet Control	
Outlet Control HW Elev.	209.45	m			

Grades					
Upstream Invert	208.75	m	Downstream Invert	208.60	m
Length	26.80	m	Constructed Slope	0.005597	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.60	m
Slope Type	Mild		Normal Depth	0.54	m
Flow Regime	Subcritical		Critical Depth	0.42	m
Velocity Downstream	1.11	m/s	Critical Slope	0.013304	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	1.00	m
Section Size	1000 mm		Rise	1.00	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	209.45	m	Upstream Velocity Head	0.07	m
Ke	0.90		Entrance Loss	0.07	m

Inlet Control Properties					
Inlet Control HW Elev.	209.37	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.8	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC 9

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	209.74	m	Discharge	0.9840	m³/s
Headwater Depth/Height	0.99		Tailwater Elevation	209.20	m
Inlet Control HW Elev.	209.66	m	Control Type	Outlet Control	
Outlet Control HW Elev.	209.74	m			

Grades					
Upstream Invert	208.75	m	Downstream Invert	208.60	m
Length	26.80	m	Constructed Slope	0.005597	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.60	m
Slope Type	Mild		Normal Depth	0.83	m
Flow Regime	Subcritical		Critical Depth	0.57	m
Velocity Downstream	2.00	m/s	Critical Slope	0.015076	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	1.00	m
Section Size	1000 mm		Rise	1.00	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	209.74	m	Upstream Velocity Head	0.12	m
Ke	0.90		Entrance Loss	0.11	m

Inlet Control Properties					
Inlet Control HW Elev.	209.66	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.8	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SHC10

Analysis Component			
Storm Event	Design	Discharge	1.7130 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	1.7130 m³/s	Check Discharge	2.6864 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.78 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-1100 mm Circular	1.6618 m³/s	208.46 m	2.50 m/s
Weir	Roadway	0.0519 m³/s	208.46 m	N/A
Total	----------	1.7137 m³/s	208.46 m	N/A

Culvert Analysis Report
SHC10

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.46	m	Discharge	1.6618	m³/s
Inlet Control HW Elev.	208.41	m	Tailwater Elevation	207.78	m
Outlet Control HW Elev.	208.46	m	Control Type	Outlet Control	
Headwater Depth/Height	1.18				

Grades					
Upstream Invert	207.17	m	Downstream Invert	207.12	m
Length	11.60	m	Constructed Slope	0.004310	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.73	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.73	m
Velocity Downstream	2.50	m/s	Critical Slope	0.016531	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	1.10	m
Section Size	1100 mm		Rise	1.10	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.46	m	Upstream Velocity Head	0.19	m
Ke	0.90		Entrance Loss	0.17	m

Inlet Control Properties					
Inlet Control HW Elev.	208.41	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	1.0	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SHC10

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0519	m³/s	Allowable HW Elevation	208.46	m
Roadway Width	8.00	m	Overtopping Coefficient	1.62	SI
Low Point	208.42	m	Headwater Elevation	208.46	m
Discharge Coefficient (Cr)	2.93		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.78	m			

Sta (m)	Elev. (m)
0.00	208.88
82.00	208.42
120.00	209.38

Culvert Analysis Report
SHC10

Analysis Component				
Storm Event	Check	Discharge	2.6864	m³/s

Peak Discharge Method: User-Specified				
Design Discharge	1.7130	m³/s	Check Discharge	2.6864 m³/s

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	207.78	m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-1100 mm Circular	1.8264 m³/s	208.56 m	2.60 m/s
Weir	Roadway	0.8627 m³/s	208.56 m	N/A
Total	----------	2.6891 m³/s	208.56 m	N/A

Culvert Analysis Report
SHC10

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.56	m	Discharge	1.8264	m³/s
Inlet Control HW Elev.	208.50	m	Tailwater Elevation	207.78	m
Outlet Control HW Elev.	208.56	m	Control Type	Outlet Control	
Headwater Depth/Height	1.26				

Grades					
Upstream Invert	207.17	m	Downstream Invert	207.12	m
Length	11.60	m	Constructed Slope	0.004310	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.76	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.76	m
Velocity Downstream	2.60	m/s	Critical Slope	0.017492	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	1.10	m
Section Size	1100 mm		Rise	1.10	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.56	m	Upstream Velocity Head	0.21	m
Ke	0.90		Entrance Loss	0.19	m

Inlet Control Properties					
Inlet Control HW Elev.	208.50	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	1.0	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SHC10

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.8627	m³/s	Allowable HW Elevation	208.56	m
Roadway Width	8.00	m	Overtopping Coefficient	1.64	SI
Low Point	208.42	m	Headwater Elevation	208.56	m
Discharge Coefficient (Cr)	2.96		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.78	m			

Sta (m)	Elev. (m)
0.00	208.88
82.00	208.42
120.00	209.38

Culvert Design Report
SHC11

Peak Discharge Method: User-Specified			
Design Discharge	0.0311 m³/s	Check Discharge	0.0580 m³/s

Grades Model: Inverts			
Invert Upstream	208.08 m	Invert Downstream	208.13 m
Length	15.00 m	Slope	-0.003333 m/m
Drop	-0.05 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	208.31 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-300 mm Circular	0.0311 m³/s	208.40 m	0.69 m/s
	Trial-2	1-300 mm Circular	0.0580 m³/s	208.59 m	1.24 m/s

Culvert Design Report
SHC11

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	208.40	m	Discharge	0.0311	m³/s
Headwater Depth/Height	1.05		Tailwater Elevation	208.31	m
Inlet Control HW Elev.	208.33	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.40	m			

Grades					
Upstream Invert	208.08	m	Downstream Invert	208.13	m
Length	15.00	m	Constructed Slope	-0.003333	m/m

Hydraulic Profile					
Profile	A2		Depth, Downstream	0.18	m
Slope Type	Adverse		Normal Depth	0.00	m
Flow Regime	Subcritical		Critical Depth	0.13	m
Velocity Downstream	0.69	m/s	Critical Slope	0.020021	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.30	m
Section Size	300 mm		Rise	0.30	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.40	m	Upstream Velocity Head	0.01	m
Ke	0.90		Entrance Loss	0.01	m

Inlet Control Properties					
Inlet Control HW Elev.	208.33	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC11

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	208.59	m	Discharge	0.0580	m³/s
Headwater Depth/Height	1.69		Tailwater Elevation	208.31	m
Inlet Control HW Elev.	208.44	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.59	m			

Grades					
Upstream Invert	208.08	m	Downstream Invert	208.13	m
Length	15.00	m	Constructed Slope	-0.003333	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.19	m
Slope Type	Adverse		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.19	m
Velocity Downstream	1.24	m/s	Critical Slope	0.023626	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.30	m
Section Size	300 mm		Rise	0.30	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.59	m	Upstream Velocity Head	0.03	m
Ke	0.90		Entrance Loss	0.03	m

Inlet Control Properties					
Inlet Control HW Elev.	208.44	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC12

Peak Discharge Method: User-Specified					
Design Discharge	0.0140	m³/s	Check Discharge	0.0260	m³/s

Grades Model: Inverts					
Invert Upstream	207.82	m	Invert Downstream	207.90	m
Length	13.10	m	Slope	-0.006107	m/m
Drop	-0.08	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	208.20	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-500 mm Circular	0.0140 m³/s	208.20 m	0.11 m/s
	Trial-2	1-500 mm Circular	0.0260 m³/s	208.21 m	0.21 m/s

Culvert Design Report
SHC12

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	208.20	m	Discharge	0.0140	m³/s
Headwater Depth/Height	0.76		Tailwater Elevation	208.20	m
Inlet Control HW Elev.	208.20	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.20	m			

Grades					
Upstream Invert	207.82	m	Downstream Invert	207.90	m
Length	13.10	m	Constructed Slope	-0.006107	m/m

Hydraulic Profile					
Profile	A2		Depth, Downstream	0.30	m
Slope Type	Adverse		Normal Depth	0.00	m
Flow Regime	Subcritical		Critical Depth	0.08	m
Velocity Downstream	0.11	m/s	Critical Slope	0.017417	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.20	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	208.20	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC12

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	208.21	m	Discharge	0.0260	m³/s
Headwater Depth/Height	0.77		Tailwater Elevation	208.20	m
Inlet Control HW Elev.	208.20	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.21	m			

Grades					
Upstream Invert	207.82	m	Downstream Invert	207.90	m
Length	13.10	m	Constructed Slope	-0.006107	m/m

Hydraulic Profile					
Profile	A2		Depth, Downstream	0.30	m
Slope Type	Adverse		Normal Depth	0.00	m
Flow Regime	Subcritical		Critical Depth	0.11	m
Velocity Downstream	0.21	m/s	Critical Slope	0.016572	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.21	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	208.20	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC13

Peak Discharge Method: User-Specified					
Design Discharge	0.5480	m³/s	Check Discharge	0.7280	m³/s

Grades Model: Inverts					
Invert Upstream	205.05	m	Invert Downstream	205.12	m
Length	12.00	m	Slope	-0.005833	m/m
Drop	-0.07	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	205.60	m

	Name	Description	Discharge	HW Elev.	Velocity
	Trial-1	1-800 mm Circular	0.5480 m³/s	205.90 m	1.74 m/s
x	Trial-2	1-800 mm Circular	0.7280 m³/s	206.09 m	2.11 m/s

Culvert Design Report
SHC13

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	205.90	m	Discharge	0.5480	m³/s
Headwater Depth/Height	1.06		Tailwater Elevation	205.60	m
Inlet Control HW Elev.	205.84	m	Control Type	Outlet Control	
Outlet Control HW Elev.	205.90	m			

Grades					
Upstream Invert	205.05	m	Downstream Invert	205.12	m
Length	12.00	m	Constructed Slope	-0.005833	m/m

Hydraulic Profile					
Profile	A2		Depth, Downstream	0.48	m
Slope Type	Adverse		Normal Depth	0.00	m
Flow Regime	Subcritical		Critical Depth	0.45	m
Velocity Downstream	1.74	m/s	Critical Slope	0.016092	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.80	m
Section Size	800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.90	m	Upstream Velocity Head	0.07	m
Ke	0.90		Entrance Loss	0.06	m

Inlet Control Properties					
Inlet Control HW Elev.	205.84	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.5	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC13

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	206.09	m	Discharge	0.7280	m³/s
Headwater Depth/Height	1.30		Tailwater Elevation	205.60	m
Inlet Control HW Elev.	206.00	m	Control Type	Outlet Control	
Outlet Control HW Elev.	206.09	m			

Grades					
Upstream Invert	205.05	m	Downstream Invert	205.12	m
Length	12.00	m	Constructed Slope	-0.005833	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.52	m
Slope Type	Adverse		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.52	m
Velocity Downstream	2.11	m/s	Critical Slope	0.018092	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.80	m
Section Size	800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	206.09	m	Upstream Velocity Head	0.11	m
Ke	0.90		Entrance Loss	0.10	m

Inlet Control Properties					
Inlet Control HW Elev.	206.00	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.5	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SHC14

Analysis Component			
Storm Event	Design	Discharge	18.8020 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	18.8020 m³/s	Check Discharge	29.2859 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	204.82 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-6150 x 2000 mm Box	18.8045 m³/s	205.52 m	2.55 m/s
Weir	Roadway	0.0000 m³/s	205.52 m	N/A
Total	----------	18.8045 m³/s	205.52 m	N/A

Culvert Analysis Report
SHC14

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	205.52	m	Discharge	18.8045	m³/s
Inlet Control HW Elev.	205.35	m	Tailwater Elevation	204.82	m
Outlet Control HW Elev.	205.52	m	Control Type	Entrance Control	
Headwater Depth/Height	0.86				

Grades					
Upstream Invert	203.80	m	Downstream Invert	203.62	m
Length	18.20	m	Constructed Slope	0.009890	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	1.20	m
Slope Type	Steep		Normal Depth	0.62	m
Flow Regime	N/A		Critical Depth	0.98	m
Velocity Downstream	2.55	m/s	Critical Slope	0.002413	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	6.15	m
Section Size	6150 x 2000 mm		Rise	2.00	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.52	m	Upstream Velocity Head	0.49	m
Ke	0.50		Entrance Loss	0.25	m

Inlet Control Properties					
Inlet Control HW Elev.	205.35	m	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	12.3	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
SHC14

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	205.52	m
Roadway Width	9.00	m	Overtopping Coefficient	1.60	SI
Low Point	205.94	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	204.82	m			

Sta (m)	Elev. (m)
0.00	206.23
50.00	206.53
140.00	205.94
200.00	206.20

Culvert Analysis Report
SHC14

Analysis Component			
Storm Event	Check	Discharge	29.2859 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	18.8020 m³/s	Check Discharge	29.2859 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	204.82 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-6150 x 2000 mm Box	28.2321 m³/s	206.06 m	4.47 m/s
Weir	Roadway	1.0584 m³/s	206.06 m	N/A
Total	----------	29.2906 m³/s	206.06 m	N/A

Culvert Analysis Report
SHC14

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	206.06	m	Discharge	28.2321	m³/s
Inlet Control HW Elev.	205.83	m	Tailwater Elevation	204.82	m
Outlet Control HW Elev.	206.06	m	Control Type	Entrance Control	
Headwater Depth/Height	1.13				

Grades					
Upstream Invert	203.80	m	Downstream Invert	203.62	m
Length	18.20	m	Constructed Slope	0.009890	m/m

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.03	m
Slope Type	Steep		Normal Depth	0.81	m
Flow Regime	Supercritical		Critical Depth	1.29	m
Velocity Downstream	4.47	m/s	Critical Slope	0.002429	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	6.15	m
Section Size	6150 x 2000 mm		Rise	2.00	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	206.06	m	Upstream Velocity Head	0.65	m
Ke	0.50		Entrance Loss	0.32	m

Inlet Control Properties					
Inlet Control HW Elev.	205.83	m	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	12.3	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
SHC14

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	1.0584	m³/s	Allowable HW Elevation	206.06	m
Roadway Width	9.00	m	Overtopping Coefficient	1.62	SI
Low Point	205.94	m	Headwater Elevation	206.06	m
Discharge Coefficient (Cr)	2.94		Submergence Factor (Kt)	1.00	
Tailwater Elevation	204.82	m			

Sta (m)	Elev. (m)
0.00	206.23
50.00	206.53
140.00	205.94
200.00	206.20

Culvert Design Report
SHC15

Peak Discharge Method: User-Specified			
Design Discharge	0.1490 m³/s	Check Discharge	0.2720 m³/s

Grades Model: Inverts			
Invert Upstream	207.64 m	Invert Downstream	207.57 m
Length	14.30 m	Slope	0.004895 m/m
Drop	0.07 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.84 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-500 mm Circular	0.1490 m³/s	208.10 m	1.38 m/s
	Trial-2	1-500 mm Circular	0.2720 m³/s	208.43 m	1.81 m/s

Culvert Design Report
SHC15

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	208.10	m	Discharge	0.1490	m³/s
Headwater Depth/Height	0.92		Tailwater Elevation	207.84	m
Inlet Control HW Elev.	208.05	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.10	m			

Grades					
Upstream Invert	207.64	m	Downstream Invert	207.57	m
Length	14.30	m	Constructed Slope	0.004895	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.27	m
Slope Type	Mild		Normal Depth	0.43	m
Flow Regime	Subcritical		Critical Depth	0.26	m
Velocity Downstream	1.38	m/s	Critical Slope	0.018134	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.10	m	Upstream Velocity Head	0.05	m
Ke	0.90		Entrance Loss	0.04	m

Inlet Control Properties					
Inlet Control HW Elev.	208.05	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC15

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	208.43	m	Discharge	0.2720	m³/s
Headwater Depth/Height	1.58		Tailwater Elevation	207.84	m
Inlet Control HW Elev.	208.28	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.43	m			

Grades					
Upstream Invert	207.64	m	Downstream Invert	207.57	m
Length	14.30	m	Constructed Slope	0.004895	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.36	m
Velocity Downstream	1.81	m/s	Critical Slope	0.023820	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.43	m	Upstream Velocity Head	0.10	m
Ke	0.90		Entrance Loss	0.09	m

Inlet Control Properties					
Inlet Control HW Elev.	208.28	m	Flow Control	Transition	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC16

Peak Discharge Method: User-Specified					
Design Discharge	0.1300	m³/s	Check Discharge	0.2420	m³/s

Grades Model: Inverts					
Invert Upstream	207.39	m	Invert Downstream	207.39	m
Length	13.10	m	Slope	0.000000	m/m
Drop	0.00	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	207.74	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-500 mm Circular	0.1300 m³/s	207.86 m	0.89 m/s
	Trial-2	1-500 mm Circular	0.2420 m³/s	208.13 m	1.65 m/s

Culvert Design Report
SHC16

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	207.86	m	Discharge	0.1300	m³/s
Headwater Depth/Height	0.95		Tailwater Elevation	207.74	m
Inlet Control HW Elev.	207.77	m	Control Type	Outlet Control	
Outlet Control HW Elev.	207.86	m			

Grades					
Upstream Invert	207.39	m	Downstream Invert	207.39	m
Length	13.10	m	Constructed Slope	0.000000	m/m

Hydraulic Profile					
Profile	H2		Depth, Downstream	0.35	m
Slope Type	Horizontal		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.24	m
Velocity Downstream	0.89	m/s	Critical Slope	0.017569	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.86	m	Upstream Velocity Head	0.03	m
Ke	0.90		Entrance Loss	0.02	m

Inlet Control Properties					
Inlet Control HW Elev.	207.77	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SHC16

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	208.13	m	Discharge	0.2420	m³/s
Headwater Depth/Height	1.48		Tailwater Elevation	207.74	m
Inlet Control HW Elev.	207.97	m	Control Type	Outlet Control	
Outlet Control HW Elev.	208.13	m			

Grades					
Upstream Invert	207.39	m	Downstream Invert	207.39	m
Length	13.10	m	Constructed Slope	0.000000	m/m

Hydraulic Profile					
Profile	CompositeH2PressureProfile		Depth, Downstream	0.35	m
Slope Type	Horizontal		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.34	m
Velocity Downstream	1.65	m/s	Critical Slope	0.022065	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.13	m	Upstream Velocity Head	0.08	m
Ke	0.90		Entrance Loss	0.07	m

Inlet Control Properties					
Inlet Control HW Elev.	207.97	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC 1

Peak Discharge Method: User-Specified					
Design Discharge	0.6850	m³/s	Check Discharge	1.2100	m³/s

Grades Model: Inverts					
Invert Upstream	208.30	m	Invert Downstream	208.27	m
Length	39.60	m	Slope	0.000758	m/m
Drop	0.03	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	208.81	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-900 mm Circular	0.6850 m³/s	209.23 m	1.70 m/s
	Trial-2	1-900 mm Circular	1.2100 m³/s	209.92 m	2.43 m/s

Culvert Design Report
SC 1

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	209.23	m	Discharge	0.6850	m³/s
Headwater Depth/Height	1.02		Tailwater Elevation	208.81	m
Inlet Control HW Elev.	209.06	m	Control Type	Outlet Control	
Outlet Control HW Elev.	209.23	m			

Grades					
Upstream Invert	208.30	m	Downstream Invert	208.27	m
Length	39.60	m	Constructed Slope	0.000758	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.54	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.48	m
Velocity Downstream	1.70	m/s	Critical Slope	0.014893	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.91	m
Section Size	900 mm		Rise	0.91	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	209.23	m	Upstream Velocity Head	0.06	m
Ke	0.90		Entrance Loss	0.06	m

Inlet Control Properties					
Inlet Control HW Elev.	209.06	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.7	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC 1

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	209.92	m	Discharge	1.2100	m³/s
Headwater Depth/Height	1.77		Tailwater Elevation	208.81	m
Inlet Control HW Elev.	209.45	m	Control Type	Outlet Control	
Outlet Control HW Elev.	209.92	m			

Grades					
Upstream Invert	208.30	m	Downstream Invert	208.27	m
Length	39.60	m	Constructed Slope	0.000758	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.65	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.65	m
Velocity Downstream	2.43	m/s	Critical Slope	0.019248	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.91	m
Section Size	900 mm		Rise	0.91	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	209.92	m	Upstream Velocity Head	0.17	m
Ke	0.90		Entrance Loss	0.16	m

Inlet Control Properties					
Inlet Control HW Elev.	209.45	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.7	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC 2 Check

Analysis Component			
Storm Event	Design	Discharge	1.5020 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	1.5020 m³/s	Check Discharge	2.2180 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	205.73 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-2350 x 900 mm Box	1.5011 m³/s	205.86 m	1.18 m/s
Weir	Roadway	0.0000 m³/s	205.86 m	N/A
Total	----------	1.5011 m³/s	205.86 m	N/A

Culvert Analysis Report
SC 2 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	205.86	m	Discharge	1.5011	m³/s
Inlet Control HW Elev.	205.77	m	Tailwater Elevation	205.73	m
Outlet Control HW Elev.	205.86	m	Control Type	Outlet Control	
Headwater Depth/Height	0.72				

Grades					
Upstream Invert	205.22	m	Downstream Invert	205.19	m
Length	29.40	m	Constructed Slope	0.001020	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.54	m
Slope Type	Mild		Normal Depth	0.52	m
Flow Regime	Subcritical		Critical Depth	0.35	m
Velocity Downstream	1.18	m/s	Critical Slope	0.003330	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.35	m
Section Size	2350 x 900 mm		Rise	0.90	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.86	m	Upstream Velocity Head	0.07	m
Ke	0.50		Entrance Loss	0.04	m

Inlet Control Properties					
Inlet Control HW Elev.	205.77	m	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	2.1	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
SC 2 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	205.86	m
Roadway Width	26.00	m	Overtopping Coefficient	1.60	SI
Low Point	206.37	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	205.73	m			

Sta (m)	Elev. (m)
0.00	206.37
60.00	206.85
70.00	206.90
130.00	206.78

Culvert Analysis Report
SC 2 Check

Analysis Component			
Storm Event	Check	Discharge	2.2180 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	1.5020 m³/s	Check Discharge	2.2180 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	205.73 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-2350 x 900 mm Box	2.2180 m³/s	206.00 m	1.75 m/s
Weir	Roadway	0.0000 m³/s	206.00 m	N/A
Total	----------	2.2180 m³/s	206.00 m	N/A

Culvert Analysis Report
SC 2 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	206.00	m	Discharge	2.2180	m³/s
Inlet Control HW Elev.	205.93	m	Tailwater Elevation	205.73	m
Outlet Control HW Elev.	206.00	m	Control Type	Outlet Control	
Headwater Depth/Height	0.87				

Grades					
Upstream Invert	205.22	m	Downstream Invert	205.19	m
Length	29.40	m	Constructed Slope	0.001020	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.54	m
Slope Type	Mild		Normal Depth	0.68	m
Flow Regime	Subcritical		Critical Depth	0.45	m
Velocity Downstream	1.75	m/s	Critical Slope	0.003332	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.35	m
Section Size	2350 x 900 mm		Rise	0.90	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	206.00	m	Upstream Velocity Head	0.13	m
Ke	0.50		Entrance Loss	0.07	m

Inlet Control Properties					
Inlet Control HW Elev.	205.93	m	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	2.1	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
SC 2 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	206.00	m
Roadway Width	26.00	m	Overtopping Coefficient	1.60	SI
Low Point	206.37	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	205.73	m			

Sta (m)	Elev. (m)
0.00	206.37
60.00	206.85
70.00	206.90
130.00	206.78

Culvert Analysis Report
SC 2 Regional

Analysis Component				
Storm Event	Check	Discharge	3.8261	m³/s

Peak Discharge Method: User-Specified				
Design Discharge	1.3055	m³/s	Check Discharge	3.8261 m³/s

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	205.73	m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-2350 x 900 mm Box	3.8269 m³/s	206.34 m	2.52 m/s
Weir	Roadway	0.0000 m³/s	206.34 m	N/A
Total	----------	3.8269 m³/s	206.34 m	N/A

Culvert Analysis Report
SC 2 Regional

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	206.34	m	Discharge	3.8269	m³/s
Inlet Control HW Elev.	206.24	m	Tailwater Elevation	205.73	m
Outlet Control HW Elev.	206.34	m	Control Type	Outlet Control	
Headwater Depth/Height	1.24				

Grades					
Upstream Invert	205.22	m	Downstream Invert	205.19	m
Length	29.40	m	Constructed Slope	0.001020	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.65	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.65	m
Velocity Downstream	2.52	m/s	Critical Slope	0.003439	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.35	m
Section Size	2350 x 900 mm		Rise	0.90	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	206.34	m	Upstream Velocity Head	0.21	m
Ke	0.50		Entrance Loss	0.11	m

Inlet Control Properties					
Inlet Control HW Elev.	206.24	m	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	2.1	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
SC 2 Regional

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	206.34	m
Roadway Width	26.00	m	Overtopping Coefficient	1.60	SI
Low Point	206.37	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	205.73	m			

Sta (m)	Elev. (m)
0.00	206.37
60.00	206.85
70.00	206.90
130.00	206.78

Culvert Design Report
SC 3

Peak Discharge Method: User-Specified					
Design Discharge	0.1090	m³/s	Check Discharge	0.1810	m³/s

Grades Model: Inverts					
Invert Upstream	205.63	m	Invert Downstream	204.96	m
Length	33.00	m	Slope	0.020303	m/m
Drop	0.67	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	205.44	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-800 mm Circular	0.1090 m³/s	205.95 m	0.35 m/s
	Trial-2	1-800 mm Circular	0.1810 m³/s	206.05 m	0.57 m/s

Culvert Design Report
SC 3

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	205.95	m	Discharge	0.1090	m³/s
Headwater Depth/Height	0.41		Tailwater Elevation	205.44	m
Inlet Control HW Elev.	205.89	m	Control Type	Entrance Control	
Outlet Control HW Elev.	205.95	m			

Grades					
Upstream Invert	205.63	m	Downstream Invert	204.96	m
Length	33.00	m	Constructed Slope	0.020303	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.48	m
Slope Type	Steep		Normal Depth	0.18	m
Flow Regime	N/A		Critical Depth	0.19	m
Velocity Downstream	0.35	m/s	Critical Slope	0.013990	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.80	m
Section Size	800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.95	m	Upstream Velocity Head	0.07	m
Ke	0.90		Entrance Loss	0.06	m

Inlet Control Properties					
Inlet Control HW Elev.	205.89	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.5	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC 3

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	206.05	m	Discharge	0.1810	m³/s
Headwater Depth/Height	0.53		Tailwater Elevation	205.44	m
Inlet Control HW Elev.	205.98	m	Control Type	Entrance Control	
Outlet Control HW Elev.	206.05	m			

Grades					
Upstream Invert	205.63	m	Downstream Invert	204.96	m
Length	33.00	m	Constructed Slope	0.020303	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.48	m
Slope Type	Steep		Normal Depth	0.23	m
Flow Regime	N/A		Critical Depth	0.25	m
Velocity Downstream	0.57	m/s	Critical Slope	0.013882	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.80	m
Section Size	800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	206.05	m	Upstream Velocity Head	0.09	m
Ke	0.90		Entrance Loss	0.08	m

Inlet Control Properties					
Inlet Control HW Elev.	205.98	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.5	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC 5 Check

Analysis Component			
Storm Event	Design	Discharge	4.6810 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	4.6810 m³/s	Check Discharge	7.2080 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	203.94 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-2800 x 1000 mm Box	4.6813 m³/s	204.57 m	2.97 m/s
Weir	Roadway	0.0000 m³/s	204.57 m	N/A
Total	----------	4.6813 m³/s	204.57 m	N/A

Culvert Analysis Report
SC 5 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	204.57	m	Discharge	4.6813	m³/s
Inlet Control HW Elev.	204.46	m	Tailwater Elevation	203.94	m
Outlet Control HW Elev.	204.57	m	Control Type	Entrance Control	
Headwater Depth/Height	1.15				

Grades					
Upstream Invert	203.42	m	Downstream Invert	203.34	m
Length	12.40	m	Constructed Slope	0.006452	m/m

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.56	m
Slope Type	Steep		Normal Depth	0.52	m
Flow Regime	Supercritical		Critical Depth	0.66	m
Velocity Downstream	2.97	m/s	Critical Slope	0.003185	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.80	m
Section Size	2800 x 1000 mm		Rise	1.00	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	204.57	m	Upstream Velocity Head	0.33	m
Ke	0.50		Entrance Loss	0.16	m

Inlet Control Properties					
Inlet Control HW Elev.	204.46	m	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	2.8	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
SC 5 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	204.57	m
Roadway Width	13.00	m	Overtopping Coefficient	1.60	SI
Low Point	204.72	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	203.94	m			

Sta (m)	Elev. (m)
0.00	204.72
86.00	205.02

Culvert Analysis Report
SC 5 Check

Analysis Component			
Storm Event	Check	Discharge	7.2080 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	4.6810 m³/s	Check Discharge	7.2080 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	203.94 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-2800 x 1000 mm Box	6.4017 m³/s	204.84 m	3.25 m/s
Weir	Roadway	0.8065 m³/s	204.84 m	N/A
Total	----------	7.2081 m³/s	204.84 m	N/A

Culvert Analysis Report
SC 5 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	204.84	m	Discharge	6.4017	m³/s
Inlet Control HW Elev.	204.78	m	Tailwater Elevation	203.94	m
Outlet Control HW Elev.	204.84	m	Control Type	Entrance Control	
Headwater Depth/Height	1.42				

Grades					
Upstream Invert	203.42	m	Downstream Invert	203.34	m
Length	12.40	m	Constructed Slope	0.006452	m/m

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.70	m
Slope Type	Steep		Normal Depth	0.64	m
Flow Regime	Supercritical		Critical Depth	0.81	m
Velocity Downstream	3.25	m/s	Critical Slope	0.003268	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.80	m
Section Size	2800 x 1000 mm		Rise	1.00	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	204.84	m	Upstream Velocity Head	0.41	m
Ke	0.50		Entrance Loss	0.20	m

Inlet Control Properties					
Inlet Control HW Elev.	204.78	m	Flow Control	Submerged	
Inlet Type	90° headwall w 45° bevels		Area Full	2.8	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
SC 5 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.8065	m³/s	Allowable HW Elevation	204.84	m
Roadway Width	13.00	m	Overtopping Coefficient	1.63	SI
Low Point	204.72	m	Headwater Elevation	204.84	m
Discharge Coefficient (Cr)	2.96		Submergence Factor (Kt)	1.00	
Tailwater Elevation	203.94	m			

Sta (m)	Elev. (m)
0.00	204.72
86.00	205.02

Culvert Analysis Report
SC 5 Regional

Analysis Component			
Storm Event	Check	Discharge	15.3850 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	4.6810 m³/s	Check Discharge	15.3850 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	203.94 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-2800 x 1000 mm Box	7.6118 m³/s	205.01 m	3.42 m/s
Weir	Roadway	7.7816 m³/s	205.01 m	N/A
Total	----------	15.3934 m³/s	205.01 m	N/A

Culvert Analysis Report
SC 5 Regional

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	205.01	m	Discharge	7.6118	m³/s
Inlet Control HW Elev.	205.00	m	Tailwater Elevation	203.94	m
Outlet Control HW Elev.	205.01	m	Control Type	Entrance Control	
Headwater Depth/Height	1.59				

Grades					
Upstream Invert	203.42	m	Downstream Invert	203.34	m
Length	12.40	m	Constructed Slope	0.006452	m/m

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.80	m
Slope Type	Steep		Normal Depth	0.72	m
Flow Regime	Supercritical		Critical Depth	0.91	m
Velocity Downstream	3.42	m/s	Critical Slope	0.003335	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	2.80	m
Section Size	2800 x 1000 mm		Rise	1.00	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.01	m	Upstream Velocity Head	0.46	m
Ke	0.50		Entrance Loss	0.23	m

Inlet Control Properties					
Inlet Control HW Elev.	205.00	m	Flow Control	Submerged	
Inlet Type	90° headwall w 45° bevels		Area Full	2.8	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
SC 5 Regional

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	7.7816	m³/s	Allowable HW Elevation	205.01	m
Roadway Width	13.00	m	Overtopping Coefficient	1.66	SI
Low Point	204.72	m	Headwater Elevation	205.01	m
Discharge Coefficient (Cr)	3.01		Submergence Factor (Kt)	1.00	
Tailwater Elevation	203.94	m			

Sta (m)	Elev. (m)
0.00	204.72
86.00	205.02

Culvert Analysis Report
SC 6 Check

Analysis Component			
Storm Event	Design	Discharge	1.3170 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	1.3170 m³/s	Check Discharge	2.0330 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	203.69 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-1000 x 800 mm Box	1.3168 m³/s	204.17 m	2.35 m/s
Weir	Roadway	0.0000 m³/s	204.17 m	N/A
Total	----------	1.3168 m³/s	204.17 m	N/A

Culvert Analysis Report
SC 6 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	204.17	m	Discharge	1.3168	m³/s
Inlet Control HW Elev.	204.09	m	Tailwater Elevation	203.69	m
Outlet Control HW Elev.	204.17	m	Control Type	Outlet Control	
Headwater Depth/Height	1.22				

Grades					
Upstream Invert	203.19	m	Downstream Invert	203.21	m
Length	10.00	m	Constructed Slope	-0.002000	m/m

Hydraulic Profile					
Profile	A2		Depth, Downstream	0.56	m
Slope Type	Adverse		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.56	m
Velocity Downstream	2.35	m/s	Critical Slope	0.005481	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.00	m
Section Size	1000 x 800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	204.17	m	Upstream Velocity Head	0.17	m
Ke	0.50		Entrance Loss	0.08	m

Inlet Control Properties					
Inlet Control HW Elev.	204.09	m	Flow Control	Unsubmerged	
Inlet Type	90° headwall w 45° bevels		Area Full	0.8	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
SC 6 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	204.17	m
Roadway Width	10.00	m	Overtopping Coefficient	1.60	SI
Low Point	204.41	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	203.69	m			

Sta (m)	Elev. (m)
0.19	204.55
1.14	204.54
2.42	204.53
4.92	204.52
5.34	204.52
5.83	204.52
7.50	204.51
7.98	204.51
9.40	204.51
9.97	204.50
10.39	204.50
11.65	204.50
12.02	204.49
13.02	204.49
13.34	204.49
14.98	204.48
15.36	204.48
17.93	204.48
18.28	204.48
18.80	204.47
19.25	204.47
20.80	204.47
23.32	204.45
23.85	204.45
24.90	204.44
27.82	204.42
30.37	204.41
33.29	204.41
34.15	204.41
34.64	204.41
35.18	204.41
35.67	204.41
36.15	204.41
37.12	204.41
37.62	204.42
37.98	204.42
38.36	204.42
38.85	204.42
40.83	204.43
41.33	204.43
42.67	204.43
43.09	204.43
43.60	204.44
44.17	204.44
45.44	204.44
45.91	204.44

Culvert Analysis Report
SC 6 Check

Sta (m)	Elev. (m)
46.39	204.44
47.42	204.45
47.90	204.45
48.30	204.45
48.77	204.45
49.29	204.45
50.72	204.45
51.41	204.45
51.87	204.46
52.34	204.46
53.29	204.46
53.71	204.46
54.09	204.46
54.45	204.47
54.93	204.47
56.34	204.47
56.71	204.47
57.10	204.47
57.66	204.48
58.88	204.48
59.39	204.48
60.44	204.49
61.73	204.50
62.66	204.51
64.43	204.52
65.44	204.53
66.54	204.54
67.48	204.54
67.88	204.55
68.54	204.55
69.33	204.56
69.82	204.56
71.34	204.57
72.66	204.58
73.69	204.59
75.05	204.60
76.10	204.61
76.94	204.63
78.24	204.64
79.80	204.66
81.15	204.66
81.55	204.67
82.20	204.68
83.14	204.69
84.52	204.70
85.78	204.71
86.34	204.72
86.98	204.73
87.67	204.73
88.53	204.74
88.62	204.74
88.77	204.74
88.90	204.74

Culvert Analysis Report
SC 6 Check

Analysis Component			
Storm Event	Check	Discharge	2.0330 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	1.3170 m³/s	Check Discharge	2.0330 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	203.69 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-1000 x 800 mm Box	1.8291 m³/s	204.45 m	2.62 m/s
Weir	Roadway	0.2037 m³/s	204.45 m	N/A
Total	----------	2.0328 m³/s	204.45 m	N/A

Culvert Analysis Report
SC 6 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	204.45	m	Discharge	1.8291	m³/s
Inlet Control HW Elev.	204.41	m	Tailwater Elevation	203.69	m
Outlet Control HW Elev.	204.45	m	Control Type	Outlet Control	
Headwater Depth/Height	1.58				

Grades					
Upstream Invert	203.19	m	Downstream Invert	203.21	m
Length	10.00	m	Constructed Slope	-0.002000	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.70	m
Slope Type	Adverse		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.70	m
Velocity Downstream	2.62	m/s	Critical Slope	0.005993	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.00	m
Section Size	1000 x 800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	204.45	m	Upstream Velocity Head	0.27	m
Ke	0.50		Entrance Loss	0.13	m

Inlet Control Properties					
Inlet Control HW Elev.	204.41	m	Flow Control	Submerged	
Inlet Type	90° headwall w 45° bevels		Area Full	0.8	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
SC 6 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.2037	m³/s	Allowable HW Elevation	204.45	m
Roadway Width	10.00	m	Overtopping Coefficient	1.61	SI
Low Point	204.41	m	Headwater Elevation	204.45	m
Discharge Coefficient (Cr)	2.91		Submergence Factor (Kt)	1.00	
Tailwater Elevation	203.69	m			

Sta (m)	Elev. (m)
0.19	204.55
1.14	204.54
2.42	204.53
4.92	204.52
5.34	204.52
5.83	204.52
7.50	204.51
7.98	204.51
9.40	204.51
9.97	204.50
10.39	204.50
11.65	204.50
12.02	204.49
13.02	204.49
13.34	204.49
14.98	204.48
15.36	204.48
17.93	204.48
18.28	204.48
18.80	204.47
19.25	204.47
20.80	204.47
23.32	204.45
23.85	204.45
24.90	204.44
27.82	204.42
30.37	204.41
33.29	204.41
34.15	204.41
34.64	204.41
35.18	204.41
35.67	204.41
36.15	204.41
37.12	204.41
37.62	204.42
37.98	204.42
38.36	204.42
38.85	204.42
40.83	204.43
41.33	204.43
42.67	204.43
43.09	204.43
43.60	204.44
44.17	204.44
45.44	204.44
45.91	204.44

Culvert Analysis Report
SC 6 Check

Sta (m)	Elev. (m)
46.39	204.44
47.42	204.45
47.90	204.45
48.30	204.45
48.77	204.45
49.29	204.45
50.72	204.45
51.41	204.45
51.87	204.46
52.34	204.46
53.29	204.46
53.71	204.46
54.09	204.46
54.45	204.47
54.93	204.47
56.34	204.47
56.71	204.47
57.10	204.47
57.66	204.48
58.88	204.48
59.39	204.48
60.44	204.49
61.73	204.50
62.66	204.51
64.43	204.52
65.44	204.53
66.54	204.54
67.48	204.54
67.88	204.55
68.54	204.55
69.33	204.56
69.82	204.56
71.34	204.57
72.66	204.58
73.69	204.59
75.05	204.60
76.10	204.61
76.94	204.63
78.24	204.64
79.80	204.66
81.15	204.66
81.55	204.67
82.20	204.68
83.14	204.69
84.52	204.70
85.78	204.71
86.34	204.72
86.98	204.73
87.67	204.73
88.53	204.74
88.62	204.74
88.77	204.74
88.90	204.74

Culvert Analysis Report
SC 6 Regional

Analysis Component			
Storm Event	Check	Discharge	4.5050 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	1.3170 m³/s	Check Discharge	4.5050 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	203.69 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-1000 x 800 mm Box	1.9736 m³/s	204.54 m	2.68 m/s
Weir	Roadway	2.5245 m³/s	204.54 m	N/A
Total	----------	4.4982 m³/s	204.54 m	N/A

Culvert Analysis Report
SC 6 Regional

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	204.54	m	Discharge	1.9736	m³/s
Inlet Control HW Elev.	204.49	m	Tailwater Elevation	203.69	m
Outlet Control HW Elev.	204.54	m	Control Type	Outlet Control	
Headwater Depth/Height	1.69				

Grades					
Upstream Invert	203.19	m	Downstream Invert	203.21	m
Length	10.00	m	Constructed Slope	-0.002000	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.74	m
Slope Type	Adverse		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.74	m
Velocity Downstream	2.68	m/s	Critical Slope	0.006132	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.00	m
Section Size	1000 x 800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	204.54	m	Upstream Velocity Head	0.31	m
Ke	0.50		Entrance Loss	0.16	m

Inlet Control Properties					
Inlet Control HW Elev.	204.49	m	Flow Control	N/A	
Inlet Type	90° headwall w 45° bevels		Area Full	0.8	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
SC 6 Regional

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	2.5245	m³/s	Allowable HW Elevation	204.54	m
Roadway Width	10.00	m	Overtopping Coefficient	1.63	SI
Low Point	204.41	m	Headwater Elevation	204.54	m
Discharge Coefficient (Cr)	2.95		Submergence Factor (Kt)	1.00	
Tailwater Elevation	203.69	m			

Sta (m)	Elev. (m)
0.19	204.55
1.14	204.54
2.42	204.53
4.92	204.52
5.34	204.52
5.83	204.52
7.50	204.51
7.98	204.51
9.40	204.51
9.97	204.50
10.39	204.50
11.65	204.50
12.02	204.49
13.02	204.49
13.34	204.49
14.98	204.48
15.36	204.48
17.93	204.48
18.28	204.48
18.80	204.47
19.25	204.47
20.80	204.47
23.32	204.45
23.85	204.45
24.90	204.44
27.82	204.42
30.37	204.41
33.29	204.41
34.15	204.41
34.64	204.41
35.18	204.41
35.67	204.41
36.15	204.41
37.12	204.41
37.62	204.42
37.98	204.42
38.36	204.42
38.85	204.42
40.83	204.43
41.33	204.43
42.67	204.43
43.09	204.43
43.60	204.44
44.17	204.44
45.44	204.44
45.91	204.44

Culvert Analysis Report
SC 6 Regional

Sta (m)	Elev. (m)
46.39	204.44
47.42	204.45
47.90	204.45
48.30	204.45
48.77	204.45
49.29	204.45
50.72	204.45
51.41	204.45
51.87	204.46
52.34	204.46
53.29	204.46
53.71	204.46
54.09	204.46
54.45	204.47
54.93	204.47
56.34	204.47
56.71	204.47
57.10	204.47
57.66	204.48
58.88	204.48
59.39	204.48
60.44	204.49
61.73	204.50
62.66	204.51
64.43	204.52
65.44	204.53
66.54	204.54
67.48	204.54
67.88	204.55
68.54	204.55
69.33	204.56
69.82	204.56
71.34	204.57
72.66	204.58
73.69	204.59
75.05	204.60
76.10	204.61
76.94	204.63
78.24	204.64
79.80	204.66
81.15	204.66
81.55	204.67
82.20	204.68
83.14	204.69
84.52	204.70
85.78	204.71
86.34	204.72
86.98	204.73
87.67	204.73
88.53	204.74
88.62	204.74
88.77	204.74
88.90	204.74

Culvert Analysis Report
SC 7

Analysis Component			
Storm Event	Check	Discharge	0.7432 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.4163 m³/s	Check Discharge	0.7432 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	204.39 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-300 mm Circular	0.0984 m³/s	205.04 m	1.58 m/s
Weir	Roadway	0.6461 m³/s	205.04 m	N/A
Total	----------	0.7445 m³/s	205.04 m	N/A

Culvert Analysis Report
SC 7

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	205.04	m	Discharge	0.0984	m³/s
Inlet Control HW Elev.	204.72	m	Tailwater Elevation	204.39	m
Outlet Control HW Elev.	205.04	m	Control Type	Outlet Control	
Headwater Depth/Height	2.66				

Grades					
Upstream Invert	204.23	m	Downstream Invert	204.21	m
Length	11.70	m	Constructed Slope	0.001709	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.24	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.24	m
Velocity Downstream	1.58	m/s	Critical Slope	0.034215	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.30	m
Section Size	300 mm		Rise	0.30	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.04	m	Upstream Velocity Head	0.09	m
Ke	0.90		Entrance Loss	0.08	m

Inlet Control Properties					
Inlet Control HW Elev.	204.72	m	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC 7

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.6461	m³/s	Allowable HW Elevation	205.04	m
Roadway Width	10.00	m	Overtopping Coefficient	1.61	SI
Low Point	204.95	m	Headwater Elevation	205.04	m
Discharge Coefficient (Cr)	2.92		Submergence Factor (Kt)	1.00	
Tailwater Elevation	204.39	m			

Sta (m)	Elev. (m)
0.00	205.16
80.00	205.06
100.00	205.10
130.00	204.95
170.00	205.10
200.00	205.17

Culvert Analysis Report
SC 7

Analysis Component			
Storm Event	Design	Discharge	0.4163 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.4163 m³/s	Check Discharge	0.7432 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	204.39 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-300 mm Circular	0.0966 m³/s	205.02 m	1.56 m/s
Weir	Roadway	0.3215 m³/s	205.02 m	N/A
Total	----------	0.4181 m³/s	205.02 m	N/A

Culvert Analysis Report
SC 7

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	205.02	m	Discharge	0.0966	m³/s
Inlet Control HW Elev.	204.71	m	Tailwater Elevation	204.39	m
Outlet Control HW Elev.	205.02	m	Control Type	Outlet Control	
Headwater Depth/Height	2.59				

Grades					
Upstream Invert	204.23	m	Downstream Invert	204.21	m
Length	11.70	m	Constructed Slope	0.001709	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.24	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.24	m
Velocity Downstream	1.56	m/s	Critical Slope	0.033538	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.30	m
Section Size	300 mm		Rise	0.30	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.02	m	Upstream Velocity Head	0.09	m
Ke	0.90		Entrance Loss	0.08	m

Inlet Control Properties					
Inlet Control HW Elev.	204.71	m	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC 7

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.3215	m³/s	Allowable HW Elevation	205.02	m
Roadway Width	10.00	m	Overtopping Coefficient	1.61	SI
Low Point	204.95	m	Headwater Elevation	205.02	m
Discharge Coefficient (Cr)	2.92		Submergence Factor (Kt)	1.00	
Tailwater Elevation	204.39	m			

Sta (m)	Elev. (m)
0.00	205.16
80.00	205.06
100.00	205.10
130.00	204.95
170.00	205.10
200.00	205.17

Culvert Analysis Report
SC 8 Check

Analysis Component			
Storm Event	Design	Discharge	0.7500 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.7500 m³/s	Check Discharge	1.1800 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	203.76 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.6741 m³/s	205.03 m	2.51 m/s
Weir	Roadway	0.0745 m³/s	205.03 m	N/A
Total	----------	0.7486 m³/s	205.03 m	N/A

Culvert Analysis Report
SC 8 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	205.03	m	Discharge	0.6741	m³/s
Inlet Control HW Elev.	204.79	m	Tailwater Elevation	203.76	m
Outlet Control HW Elev.	205.03	m	Control Type	Outlet Control	
Headwater Depth/Height	2.67				

Grades					
Upstream Invert	203.40	m	Downstream Invert	203.49	m
Length	11.80	m	Constructed Slope	-0.007627	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.53	m
Slope Type	Adverse		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.53	m
Velocity Downstream	2.51	m/s	Critical Slope	0.034690	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.03	m	Upstream Velocity Head	0.27	m
Ke	0.90		Entrance Loss	0.24	m

Inlet Control Properties					
Inlet Control HW Elev.	204.79	m	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC 8 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0745	m³/s	Allowable HW Elevation	205.03	m
Roadway Width	10.00	m	Overtopping Coefficient	1.60	SI
Low Point	205.01	m	Headwater Elevation	205.03	m
Discharge Coefficient (Cr)	2.91		Submergence Factor (Kt)	1.00	
Tailwater Elevation	203.76	m			

Sta (m)	Elev. (m)
0.00	205.23
31.95	205.04
55.90	205.01
83.88	205.02
105.08	205.04
124.83	205.08
144.21	205.05
164.50	205.04
186.37	205.12
208.08	205.19

Culvert Analysis Report
SC 8 Check

Analysis Component			
Storm Event	Check	Discharge	1.1800 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.7500 m³/s	Check Discharge	1.1800 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	203.76 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.6813 m³/s	205.05 m	2.53 m/s
Weir	Roadway	0.5032 m³/s	205.05 m	N/A
Total	----------	1.1845 m³/s	205.05 m	N/A

Culvert Analysis Report
SC 8 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	205.05	m	Discharge	0.6813	m³/s
Inlet Control HW Elev.	204.81	m	Tailwater Elevation	203.76	m
Outlet Control HW Elev.	205.05	m	Control Type	Outlet Control	
Headwater Depth/Height	2.70				

Grades					
Upstream Invert	203.40	m	Downstream Invert	203.49	m
Length	11.80	m	Constructed Slope	-0.007627	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.53	m
Slope Type	Adverse		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.53	m
Velocity Downstream	2.53	m/s	Critical Slope	0.035246	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.05	m	Upstream Velocity Head	0.28	m
Ke	0.90		Entrance Loss	0.25	m

Inlet Control Properties					
Inlet Control HW Elev.	204.81	m	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC 8 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.5032	m³/s	Allowable HW Elevation	205.05	m
Roadway Width	10.00	m	Overtopping Coefficient	1.61	SI
Low Point	205.01	m	Headwater Elevation	205.05	m
Discharge Coefficient (Cr)	2.91		Submergence Factor (Kt)	1.00	
Tailwater Elevation	203.76	m			

Sta (m)	Elev. (m)
0.00	205.23
31.95	205.04
55.90	205.01
83.88	205.02
105.08	205.04
124.83	205.08
144.21	205.05
164.50	205.04
186.37	205.12
208.08	205.19

Culvert Analysis Report
SC 8 Regional

Analysis Component				
Storm Event	Check	Discharge	2.6470	m³/s

Peak Discharge Method: User-Specified				
Design Discharge	0.7500	m³/s	Check Discharge	2.6470 m³/s

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	203.76	m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-600 mm Circular	0.6912 m³/s	205.08 m	2.56 m/s
Weir	Roadway	1.9656 m³/s	205.08 m	N/A
Total	----------	2.6569 m³/s	205.08 m	N/A

Culvert Analysis Report
SC 8 Regional

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	205.08	m	Discharge	0.6912	m³/s
Inlet Control HW Elev.	204.84	m	Tailwater Elevation	203.76	m
Outlet Control HW Elev.	205.08	m	Control Type	Outlet Control	
Headwater Depth/Height	2.75				

Grades					
Upstream Invert	203.40	m	Downstream Invert	203.49	m
Length	11.80	m	Constructed Slope	-0.007627	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.53	m
Slope Type	Adverse		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.53	m
Velocity Downstream	2.56	m/s	Critical Slope	0.036036	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.08	m	Upstream Velocity Head	0.29	m
Ke	0.90		Entrance Loss	0.26	m

Inlet Control Properties					
Inlet Control HW Elev.	204.84	m	Flow Control	Submerged	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC 8 Regional

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	1.9656	m³/s	Allowable HW Elevation	205.08	m
Roadway Width	10.00	m	Overtopping Coefficient	1.62	SI
Low Point	205.01	m	Headwater Elevation	205.08	m
Discharge Coefficient (Cr)	2.93		Submergence Factor (Kt)	1.00	
Tailwater Elevation	203.76	m			

Sta (m)	Elev. (m)
0.00	205.23
31.95	205.04
55.90	205.01
83.88	205.02
105.08	205.04
124.83	205.08
144.21	205.05
164.50	205.04
186.37	205.12
208.08	205.19

Culvert Design Report
SC 9

Peak Discharge Method: User-Specified			
Design Discharge	0.0272 m³/s	Check Discharge	0.0503 m³/s

Grades Model: Inverts			
Invert Upstream	204.64 m	Invert Downstream	204.72 m
Length	15.10 m	Slope	-0.005298 m/m
Drop	-0.08 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	205.08 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-600 mm Circular	0.0272 m³/s	205.08 m	0.15 m/s
	Trial-2	1-600 mm Circular	0.0503 m³/s	205.09 m	0.28 m/s

Culvert Design Report
SC 9

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	205.08	m	Discharge	0.0272	m³/s
Headwater Depth/Height	0.73		Tailwater Elevation	205.08	m
Inlet Control HW Elev.	205.08	m	Control Type	Outlet Control	
Outlet Control HW Elev.	205.08	m			

Grades					
Upstream Invert	204.64	m	Downstream Invert	204.72	m
Length	15.10	m	Constructed Slope	-0.005298	m/m

Hydraulic Profile					
Profile	A2		Depth, Downstream	0.36	m
Slope Type	Adverse		Normal Depth	0.00	m
Flow Regime	Subcritical		Critical Depth	0.10	m
Velocity Downstream	0.15	m/s	Critical Slope	0.016085	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.08	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	205.08	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC 9

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	205.09	m	Discharge	0.0503	m³/s
Headwater Depth/Height	0.74		Tailwater Elevation	205.08	m
Inlet Control HW Elev.	205.08	m	Control Type	Outlet Control	
Outlet Control HW Elev.	205.09	m			

Grades					
Upstream Invert	204.64	m	Downstream Invert	204.72	m
Length	15.10	m	Constructed Slope	-0.005298	m/m

Hydraulic Profile					
Profile	A2		Depth, Downstream	0.36	m
Slope Type	Adverse		Normal Depth	0.00	m
Flow Regime	Subcritical		Critical Depth	0.14	m
Velocity Downstream	0.28	m/s	Critical Slope	0.015377	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	205.09	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	205.08	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC10

Peak Discharge Method: User-Specified			
Design Discharge	0.1378 m³/s	Check Discharge	0.2547 m³/s

Grades Model: Inverts			
Invert Upstream	205.77 m	Invert Downstream	205.88 m
Length	12.30 m	Slope	-0.008943 m/m
Drop	-0.11 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	206.18 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-500 mm Circular	0.1378 m³/s	206.33 m	1.12 m/s
	Trial-2	1-500 mm Circular	0.2547 m³/s	206.65 m	1.76 m/s

Culvert Design Report
SC10

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	206.33	m	Discharge	0.1378	m³/s
Headwater Depth/Height	1.12		Tailwater Elevation	206.18	m
Inlet Control HW Elev.	206.27	m	Control Type	Outlet Control	
Outlet Control HW Elev.	206.33	m			

Grades					
Upstream Invert	205.77	m	Downstream Invert	205.88	m
Length	12.30	m	Constructed Slope	-0.008943	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.30	m
Slope Type	Adverse		Normal Depth	0.00	m
Flow Regime	Subcritical		Critical Depth	0.25	m
Velocity Downstream	1.12	m/s	Critical Slope	0.017792	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	206.33	m	Upstream Velocity Head	0.03	m
Ke	0.90		Entrance Loss	0.02	m

Inlet Control Properties					
Inlet Control HW Elev.	206.27	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC10

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	206.65	m	Discharge	0.2547	m³/s
Headwater Depth/Height	1.76		Tailwater Elevation	206.18	m
Inlet Control HW Elev.	206.49	m	Control Type	Outlet Control	
Outlet Control HW Elev.	206.65	m			

Grades					
Upstream Invert	205.77	m	Downstream Invert	205.88	m
Length	12.30	m	Constructed Slope	-0.008943	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.35	m
Slope Type	Adverse		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.35	m
Velocity Downstream	1.76	m/s	Critical Slope	0.022766	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	206.65	m	Upstream Velocity Head	0.09	m
Ke	0.90		Entrance Loss	0.08	m

Inlet Control Properties					
Inlet Control HW Elev.	206.49	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC11 Check

Analysis Component			
Storm Event	Design	Discharge	1.2800 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	1.2800 m³/s	Check Discharge	1.9760 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.77 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-800 mm Circular	0.5044 m³/s	208.23 m	1.60 m/s
Weir	Roadway	0.7779 m³/s	208.23 m	N/A
Total	----------	1.2822 m³/s	208.23 m	N/A

Culvert Analysis Report
SC11 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.23	m	Discharge	0.5044	m³/s
Inlet Control HW Elev.	208.16	m	Tailwater Elevation	207.77	m
Outlet Control HW Elev.	208.23	m	Control Type	Outlet Control	
Headwater Depth/Height	0.92				

Grades					
Upstream Invert	207.49	m	Downstream Invert	207.29	m
Length	15.10	m	Constructed Slope	0.013245	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.48	m
Slope Type	Mild		Normal Depth	0.45	m
Flow Regime	Subcritical		Critical Depth	0.43	m
Velocity Downstream	1.60	m/s	Critical Slope	0.015693	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.80	m
Section Size	800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.23	m	Upstream Velocity Head	0.15	m
Ke	0.90		Entrance Loss	0.14	m

Inlet Control Properties					
Inlet Control HW Elev.	208.16	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.5	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC11 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.7779	m³/s	Allowable HW Elevation	208.23	m
Roadway Width	10.00	m	Overtopping Coefficient	1.61	SI
Low Point	208.17	m	Headwater Elevation	208.23	m
Discharge Coefficient (Cr)	2.92		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.77	m			

Sta (m)	Elev. (m)
0.00	209.10
26.36	208.81
45.66	208.57
66.51	208.41
91.46	208.28
110.65	208.23
129.75	208.17
148.28	208.18
167.07	208.20
187.28	208.33

Culvert Analysis Report
SC11 Check

Analysis Component			
Storm Event	Check	Discharge	1.9760 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	1.2800 m³/s	Check Discharge	1.9760 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.77 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-800 mm Circular	0.5289 m³/s	208.25 m	1.68 m/s
Weir	Roadway	1.4474 m³/s	208.25 m	N/A
Total	----------	1.9763 m³/s	208.25 m	N/A

Culvert Analysis Report
SC11 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.25	m	Discharge	0.5289	m³/s
Inlet Control HW Elev.	208.19	m	Tailwater Elevation	207.77	m
Outlet Control HW Elev.	208.25	m	Control Type	Outlet Control	
Headwater Depth/Height	0.95				

Grades					
Upstream Invert	207.49	m	Downstream Invert	207.29	m
Length	15.10	m	Constructed Slope	0.013245	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.48	m
Slope Type	Mild		Normal Depth	0.47	m
Flow Regime	Subcritical		Critical Depth	0.44	m
Velocity Downstream	1.68	m/s	Critical Slope	0.015913	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.80	m
Section Size	800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.25	m	Upstream Velocity Head	0.15	m
Ke	0.90		Entrance Loss	0.14	m

Inlet Control Properties					
Inlet Control HW Elev.	208.19	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.5	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC11 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	1.4474	m³/s	Allowable HW Elevation	208.25	m
Roadway Width	10.00	m	Overtopping Coefficient	1.62	SI
Low Point	208.17	m	Headwater Elevation	208.25	m
Discharge Coefficient (Cr)	2.93		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.77	m			

Sta (m)	Elev. (m)
0.00	209.10
26.36	208.81
45.66	208.57
66.51	208.41
91.46	208.28
110.65	208.23
129.75	208.17
148.28	208.18
167.07	208.20
187.28	208.33

Culvert Analysis Report
SC11 Regional

Analysis Component			
Storm Event	Check	Discharge	7.0990 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	1.2800 m³/s	Check Discharge	7.0990 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.77 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-800 mm Circular	0.6349 m³/s	208.33 m	2.00 m/s
Weir	Roadway	6.4769 m³/s	208.33 m	N/A
Total	----------	7.1118 m³/s	208.33 m	N/A

Culvert Analysis Report
SC11 Regional

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.33	m	Discharge	0.6349	m³/s
Inlet Control HW Elev.	208.28	m	Tailwater Elevation	207.77	m
Outlet Control HW Elev.	208.33	m	Control Type	Outlet Control	
Headwater Depth/Height	1.05				

Grades					
Upstream Invert	207.49	m	Downstream Invert	207.29	m
Length	15.10	m	Constructed Slope	0.013245	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.48	m
Slope Type	Mild		Normal Depth	0.53	m
Flow Regime	Subcritical		Critical Depth	0.48	m
Velocity Downstream	2.00	m/s	Critical Slope	0.016972	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.80	m
Section Size	800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.33	m	Upstream Velocity Head	0.17	m
Ke	0.90		Entrance Loss	0.15	m

Inlet Control Properties					
Inlet Control HW Elev.	208.28	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.5	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC11 Regional

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	6.4769	m³/s	Allowable HW Elevation	208.33	m
Roadway Width	10.00	m	Overtopping Coefficient	1.64	SI
Low Point	208.17	m	Headwater Elevation	208.33	m
Discharge Coefficient (Cr)	2.96		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.77	m			

Sta (m)	Elev. (m)
0.00	209.10
26.36	208.81
45.66	208.57
66.51	208.41
91.46	208.28
110.65	208.23
129.75	208.17
148.28	208.18
167.07	208.20
187.28	208.33

Culvert Analysis Report
SC12 Check

Analysis Component			
Storm Event	Design	Discharge	0.1088 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.1088 m³/s	Check Discharge	0.1710 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.20 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-900 mm Circular	0.1088 m³/s	207.25 m	0.27 m/s
Weir	Roadway	0.0000 m³/s	207.25 m	N/A
Total	----------	0.1088 m³/s	207.25 m	N/A

Culvert Analysis Report
SC12 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	207.25	m	Discharge	0.1088	m³/s
Inlet Control HW Elev.	207.20	m	Tailwater Elevation	207.20	m
Outlet Control HW Elev.	207.25	m	Control Type	Outlet Control	
Headwater Depth/Height	0.34				

Grades					
Upstream Invert	206.94	m	Downstream Invert	206.66	m
Length	18.30	m	Constructed Slope	0.015301	m/m

Hydraulic Profile					
Profile	S1		Depth, Downstream	0.54	m
Slope Type	Steep		Normal Depth	0.18	m
Flow Regime	Subcritical		Critical Depth	0.19	m
Velocity Downstream	0.27	m/s	Critical Slope	0.013634	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.91	m
Section Size	900 mm		Rise	0.91	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.25	m	Upstream Velocity Head	0.03	m
Ke	0.90		Entrance Loss	0.02	m

Inlet Control Properties					
Inlet Control HW Elev.	207.20	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.7	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC12 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	207.25	m
Roadway Width	9.00	m	Overtopping Coefficient	1.60	SI
Low Point	208.17	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.20	m			

Sta (m)	Elev. (m)
0.00	208.27
34.00	208.17
55.00	208.17
100.00	208.36

Culvert Analysis Report
SC12 Check

Analysis Component			
Storm Event	Check	Discharge	0.1710 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.1088 m³/s	Check Discharge	0.1710 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.20 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-900 mm Circular	0.1709 m³/s	207.32 m	0.42 m/s
Weir	Roadway	0.0000 m³/s	207.32 m	N/A
Total	----------	0.1709 m³/s	207.32 m	N/A

Culvert Analysis Report
SC12 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	207.32	m	Discharge	0.1709	m³/s
Inlet Control HW Elev.	207.26	m	Tailwater Elevation	207.20	m
Outlet Control HW Elev.	207.32	m	Control Type	Outlet Control	
Headwater Depth/Height	0.42				

Grades					
Upstream Invert	206.94	m	Downstream Invert	206.66	m
Length	18.30	m	Constructed Slope	0.015301	m/m

Hydraulic Profile					
Profile	S1		Depth, Downstream	0.54	m
Slope Type	Steep		Normal Depth	0.23	m
Flow Regime	Subcritical		Critical Depth	0.24	m
Velocity Downstream	0.42	m/s	Critical Slope	0.013332	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.91	m
Section Size	900 mm		Rise	0.91	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	207.32	m	Upstream Velocity Head	0.07	m
Ke	0.90		Entrance Loss	0.06	m

Inlet Control Properties					
Inlet Control HW Elev.	207.26	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.7	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC12 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	207.32	m
Roadway Width	9.00	m	Overtopping Coefficient	1.60	SI
Low Point	208.17	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.20	m			

Sta (m)	Elev. (m)
0.00	208.27
34.00	208.17
55.00	208.17
100.00	208.36

Culvert Analysis Report
SC12 Regional

Analysis Component				
Storm Event	Check	Discharge	1.0998	m³/s

Peak Discharge Method: User-Specified				
Design Discharge	0.1088	m³/s	Check Discharge	1.0998 m³/s

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	207.20	m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-900 mm Circular	1.0995 m³/s	208.06 m	2.33 m/s
Weir	Roadway	0.0000 m³/s	208.06 m	N/A
Total	----------	1.0995 m³/s	208.06 m	N/A

Culvert Analysis Report
SC12 Regional

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.06	m	Discharge	1.0995	m³/s
Inlet Control HW Elev.	208.00	m	Tailwater Elevation	207.20	m
Outlet Control HW Elev.	208.06	m	Control Type	Outlet Control	
Headwater Depth/Height	1.22				

Grades					
Upstream Invert	206.94	m	Downstream Invert	206.66	m
Length	18.30	m	Constructed Slope	0.015301	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.62	m
Slope Type	Mild		Normal Depth	0.66	m
Flow Regime	Subcritical		Critical Depth	0.62	m
Velocity Downstream	2.33	m/s	Critical Slope	0.018080	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.91	m
Section Size	900 mm		Rise	0.91	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.06	m	Upstream Velocity Head	0.24	m
Ke	0.90		Entrance Loss	0.22	m

Inlet Control Properties					
Inlet Control HW Elev.	208.00	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.7	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC12 Regional

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	208.06	m
Roadway Width	9.00	m	Overtopping Coefficient	1.60	SI
Low Point	208.17	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.20	m			

Sta (m)	Elev. (m)
0.00	208.27
34.00	208.17
55.00	208.17
100.00	208.36

Culvert Design Report
SC13

Peak Discharge Method: User-Specified			
Design Discharge	0.0212 m³/s	Check Discharge	0.0388 m³/s

Grades Model: Inverts			
Invert Upstream	211.66 m	Invert Downstream	211.52 m
Length	12.80 m	Slope	0.010937 m/m
Drop	0.14 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	211.88 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-600 mm Circular	0.0212 m³/s	211.89 m	0.12 m/s
	Trial-2	1-600 mm Circular	0.0388 m³/s	211.90 m	0.22 m/s

Culvert Design Report
SC13

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	211.89	m	Discharge	0.0212	m³/s
Headwater Depth/Height	0.37		Tailwater Elevation	211.88	m
Inlet Control HW Elev.	211.88	m	Control Type	Outlet Control	
Outlet Control HW Elev.	211.89	m			

Grades					
Upstream Invert	211.66	m	Downstream Invert	211.52	m
Length	12.80	m	Constructed Slope	0.010937	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	0.10	m
Flow Regime	Subcritical		Critical Depth	0.09	m
Velocity Downstream	0.12	m/s	Critical Slope	0.016403	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	211.89	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	211.88	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC13

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	211.90	m	Discharge	0.0388	m³/s
Headwater Depth/Height	0.39		Tailwater Elevation	211.88	m
Inlet Control HW Elev.	211.88	m	Control Type	Outlet Control	
Outlet Control HW Elev.	211.90	m			

Grades					
Upstream Invert	211.66	m	Downstream Invert	211.52	m
Length	12.80	m	Constructed Slope	0.010937	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	0.13	m
Flow Regime	Subcritical		Critical Depth	0.12	m
Velocity Downstream	0.22	m/s	Critical Slope	0.015635	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	211.90	m	Upstream Velocity Head	0.01	m
Ke	0.90		Entrance Loss	0.01	m

Inlet Control Properties					
Inlet Control HW Elev.	211.88	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC14

Peak Discharge Method: User-Specified			
Design Discharge	0.0175 m³/s	Check Discharge	0.0322 m³/s

Grades Model: Inverts			
Invert Upstream	212.47 m	Invert Downstream	211.72 m
Length	32.40 m	Slope	0.023148 m/m
Drop	0.75 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	212.02 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-500 mm Circular	0.0175 m³/s	212.61 m	0.14 m/s
	Trial-2	1-500 mm Circular	0.0322 m³/s	212.67 m	0.26 m/s

Culvert Design Report
SC14

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	212.61	m	Discharge	0.0175	m³/s
Headwater Depth/Height	0.29		Tailwater Elevation	212.02	m
Inlet Control HW Elev.	212.58	m	Control Type	Entrance Control	
Outlet Control HW Elev.	212.61	m			

Grades					
Upstream Invert	212.47	m	Downstream Invert	211.72	m
Length	32.40	m	Constructed Slope	0.023148	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.30	m
Slope Type	Steep		Normal Depth	0.08	m
Flow Regime	N/A		Critical Depth	0.09	m
Velocity Downstream	0.14	m/s	Critical Slope	0.017017	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.61	m	Upstream Velocity Head	0.03	m
Ke	0.90		Entrance Loss	0.03	m

Inlet Control Properties					
Inlet Control HW Elev.	212.58	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC14

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	212.67	m	Discharge	0.0322	m³/s
Headwater Depth/Height	0.40		Tailwater Elevation	212.02	m
Inlet Control HW Elev.	212.63	m	Control Type	Entrance Control	
Outlet Control HW Elev.	212.67	m			

Grades					
Upstream Invert	212.47	m	Downstream Invert	211.72	m
Length	32.40	m	Constructed Slope	0.023148	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.30	m
Slope Type	Steep		Normal Depth	0.11	m
Flow Regime	N/A		Critical Depth	0.12	m
Velocity Downstream	0.26	m/s	Critical Slope	0.016391	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.67	m	Upstream Velocity Head	0.04	m
Ke	0.90		Entrance Loss	0.04	m

Inlet Control Properties					
Inlet Control HW Elev.	212.63	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC15

Peak Discharge Method: User-Specified			
Design Discharge	0.0175 m³/s	Check Discharge	0.0320 m³/s

Grades Model: Inverts			
Invert Upstream	212.57 m	Invert Downstream	212.51 m
Length	16.00 m	Slope	0.003750 m/m
Drop	0.06 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	212.75 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-400 mm Circular	0.0175 m³/s	212.77 m	0.22 m/s
	Trial-2	1-400 mm Circular	0.0320 m³/s	212.80 m	0.41 m/s

Culvert Design Report
SC15

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	212.77	m	Discharge	0.0175	m³/s
Headwater Depth/Height	0.50		Tailwater Elevation	212.75	m
Inlet Control HW Elev.	212.75	m	Control Type	Outlet Control	
Outlet Control HW Elev.	212.77	m			

Grades					
Upstream Invert	212.57	m	Downstream Invert	212.51	m
Length	16.00	m	Constructed Slope	0.003750	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.24	m
Slope Type	Mild		Normal Depth	0.14	m
Flow Regime	Subcritical		Critical Depth	0.09	m
Velocity Downstream	0.22	m/s	Critical Slope	0.017697	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.40	m
Section Size	400 mm		Rise	0.40	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.77	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	212.75	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC15

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	212.80	m	Discharge	0.0320	m³/s
Headwater Depth/Height	0.58		Tailwater Elevation	212.75	m
Inlet Control HW Elev.	212.75	m	Control Type	Outlet Control	
Outlet Control HW Elev.	212.80	m			

Grades					
Upstream Invert	212.57	m	Downstream Invert	212.51	m
Length	16.00	m	Constructed Slope	0.003750	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.24	m
Slope Type	Mild		Normal Depth	0.19	m
Flow Regime	Subcritical		Critical Depth	0.13	m
Velocity Downstream	0.41	m/s	Critical Slope	0.017490	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.40	m
Section Size	400 mm		Rise	0.40	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.80	m	Upstream Velocity Head	0.01	m
Ke	0.90		Entrance Loss	0.01	m

Inlet Control Properties					
Inlet Control HW Elev.	212.75	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC16

Peak Discharge Method: User-Specified					
Design Discharge	0.0268	m³/s	Check Discharge	0.0492	m³/s

Grades Model: Inverts					
Invert Upstream	213.66	m	Invert Downstream	213.74	m
Length	15.80	m	Slope	-0.005063	m/m
Drop	-0.08	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	213.92	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-300 mm Circular	0.0268 m³/s	213.99 m	0.60 m/s
	Trial-2	1-300 mm Circular	0.0492 m³/s	214.14 m	1.10 m/s

Culvert Design Report
SC16

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	213.99	m	Discharge	0.0268	m³/s
Headwater Depth/Height	1.08		Tailwater Elevation	213.92	m
Inlet Control HW Elev.	213.93	m	Control Type	Outlet Control	
Outlet Control HW Elev.	213.99	m			

Grades					
Upstream Invert	213.66	m	Downstream Invert	213.74	m
Length	15.80	m	Constructed Slope	-0.005063	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.18	m
Slope Type	Adverse		Normal Depth	0.00	m
Flow Regime	Subcritical		Critical Depth	0.12	m
Velocity Downstream	0.60	m/s	Critical Slope	0.019705	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.30	m
Section Size	300 mm		Rise	0.30	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	213.99	m	Upstream Velocity Head	0.01	m
Ke	0.90		Entrance Loss	0.01	m

Inlet Control Properties					
Inlet Control HW Elev.	213.93	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC16

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	214.14	m	Discharge	0.0492	m³/s
Headwater Depth/Height	1.56		Tailwater Elevation	213.92	m
Inlet Control HW Elev.	214.02	m	Control Type	Outlet Control	
Outlet Control HW Elev.	214.14	m			

Grades					
Upstream Invert	213.66	m	Downstream Invert	213.74	m
Length	15.80	m	Constructed Slope	-0.005063	m/m

Hydraulic Profile					
Profile	CompositeA2PressureProfile		Depth, Downstream	0.18	m
Slope Type	Adverse		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.17	m
Velocity Downstream	1.10	m/s	Critical Slope	0.022212	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.30	m
Section Size	300 mm		Rise	0.30	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	214.14	m	Upstream Velocity Head	0.02	m
Ke	0.90		Entrance Loss	0.02	m

Inlet Control Properties					
Inlet Control HW Elev.	214.02	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC17

Peak Discharge Method: User-Specified			
Design Discharge	0.0413 m³/s	Check Discharge	0.0758 m³/s

Grades Model: Inverts			
Invert Upstream	212.35 m	Invert Downstream	212.30 m
Length	11.70 m	Slope	0.004274 m/m
Drop	0.05 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	212.54 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-400 mm Circular	0.0413 m³/s	212.61 m	0.52 m/s
	Trial-2	1-400 mm Circular	0.0758 m³/s	212.70 m	0.96 m/s

Culvert Design Report
SC17

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	212.61	m	Discharge	0.0413	m³/s
Headwater Depth/Height	0.64		Tailwater Elevation	212.54	m
Inlet Control HW Elev.	212.56	m	Control Type	Outlet Control	
Outlet Control HW Elev.	212.61	m			

Grades					
Upstream Invert	212.35	m	Downstream Invert	212.30	m
Length	11.70	m	Constructed Slope	0.004274	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.24	m
Slope Type	Mild		Normal Depth	0.21	m
Flow Regime	Subcritical		Critical Depth	0.14	m
Velocity Downstream	0.52	m/s	Critical Slope	0.017636	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.40	m
Section Size	400 mm		Rise	0.40	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.61	m	Upstream Velocity Head	0.02	m
Ke	0.90		Entrance Loss	0.01	m

Inlet Control Properties					
Inlet Control HW Elev.	212.56	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC17

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	212.70	m	Discharge	0.0758	m³/s
Headwater Depth/Height	0.87		Tailwater Elevation	212.54	m
Inlet Control HW Elev.	212.65	m	Control Type	Outlet Control	
Outlet Control HW Elev.	212.70	m			

Grades					
Upstream Invert	212.35	m	Downstream Invert	212.30	m
Length	11.70	m	Constructed Slope	0.004274	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.24	m
Slope Type	Mild		Normal Depth	0.34	m
Flow Regime	Subcritical		Critical Depth	0.20	m
Velocity Downstream	0.96	m/s	Critical Slope	0.018993	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.40	m
Section Size	400 mm		Rise	0.40	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.70	m	Upstream Velocity Head	0.03	m
Ke	0.90		Entrance Loss	0.03	m

Inlet Control Properties					
Inlet Control HW Elev.	212.65	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC18

Peak Discharge Method: User-Specified			
Design Discharge	0.0692 m³/s	Check Discharge	0.1271 m³/s

Grades Model: Inverts			
Invert Upstream	212.30 m	Invert Downstream	212.10 m
Length	10.90 m	Slope	0.018349 m/m
Drop	0.20 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	212.34 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-400 mm Circular	0.0692 m³/s	212.63 m	0.88 m/s
	Trial-2	1-400 mm Circular	0.1271 m³/s	212.76 m	1.48 m/s

Culvert Design Report
SC18

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	212.63	m	Discharge	0.0692	m³/s
Headwater Depth/Height	0.81		Tailwater Elevation	212.34	m
Inlet Control HW Elev.	212.58	m	Control Type	Outlet Control	
Outlet Control HW Elev.	212.63	m			

Grades					
Upstream Invert	212.30	m	Downstream Invert	212.10	m
Length	10.90	m	Constructed Slope	0.018349	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.24	m
Slope Type	Mild		Normal Depth	0.19	m
Flow Regime	Subcritical		Critical Depth	0.19	m
Velocity Downstream	0.88	m/s	Critical Slope	0.018660	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.40	m
Section Size	400 mm		Rise	0.40	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.63	m	Upstream Velocity Head	0.07	m
Ke	0.90		Entrance Loss	0.06	m

Inlet Control Properties					
Inlet Control HW Elev.	212.58	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC18

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	212.76	m	Discharge	0.1271	m³/s
Headwater Depth/Height	1.14		Tailwater Elevation	212.34	m
Inlet Control HW Elev.	212.73	m	Control Type	Outlet Control	
Outlet Control HW Elev.	212.76	m			

Grades					
Upstream Invert	212.30	m	Downstream Invert	212.10	m
Length	10.90	m	Constructed Slope	0.018349	m/m

Hydraulic Profile					
Profile	M2		Depth, Downstream	0.26	m
Slope Type	Mild		Normal Depth	0.28	m
Flow Regime	Subcritical		Critical Depth	0.26	m
Velocity Downstream	1.48	m/s	Critical Slope	0.022668	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.40	m
Section Size	400 mm		Rise	0.40	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.76	m	Upstream Velocity Head	0.09	m
Ke	0.90		Entrance Loss	0.08	m

Inlet Control Properties					
Inlet Control HW Elev.	212.73	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC19

Peak Discharge Method: User-Specified					
Design Discharge	0.1290	m³/s	Check Discharge	0.2369	m³/s

Grades Model: Inverts					
Invert Upstream	212.25	m	Invert Downstream	212.07	m
Length	12.30	m	Slope	0.014634	m/m
Drop	0.18	m			

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	212.43	m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-600 mm Circular	0.1290 m³/s	212.64 m	0.72 m/s
	Trial-2	1-600 mm Circular	0.2369 m³/s	212.79 m	1.32 m/s

Culvert Design Report
SC19

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	212.64	m	Discharge	0.1290	m³/s
Headwater Depth/Height	0.63		Tailwater Elevation	212.43	m
Inlet Control HW Elev.	212.58	m	Control Type	Outlet Control	
Outlet Control HW Elev.	212.64	m			

Grades					
Upstream Invert	212.25	m	Downstream Invert	212.07	m
Length	12.30	m	Constructed Slope	0.014634	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	0.23	m
Flow Regime	Subcritical		Critical Depth	0.23	m
Velocity Downstream	0.72	m/s	Critical Slope	0.015405	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.64	m	Upstream Velocity Head	0.08	m
Ke	0.90		Entrance Loss	0.07	m

Inlet Control Properties					
Inlet Control HW Elev.	212.58	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC19

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	212.79	m	Discharge	0.2369	m³/s
Headwater Depth/Height	0.89		Tailwater Elevation	212.43	m
Inlet Control HW Elev.	212.74	m	Control Type	Outlet Control	
Outlet Control HW Elev.	212.79	m			

Grades					
Upstream Invert	212.25	m	Downstream Invert	212.07	m
Length	12.30	m	Constructed Slope	0.014634	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	0.33	m
Flow Regime	Subcritical		Critical Depth	0.31	m
Velocity Downstream	1.32	m/s	Critical Slope	0.016838	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.61	m
Section Size	600 mm		Rise	0.61	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.79	m	Upstream Velocity Head	0.11	m
Ke	0.90		Entrance Loss	0.10	m

Inlet Control Properties					
Inlet Control HW Elev.	212.74	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.3	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC20

Analysis Component			
Storm Event	Design	Discharge	0.0368 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.0368 m³/s	Check Discharge	0.0666 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	212.61 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-500 mm Circular	0.0368 m³/s	212.88 m	0.30 m/s
Weir	Roadway	0.0000 m³/s	212.88 m	N/A
Total	----------	0.0368 m³/s	212.88 m	N/A

Culvert Analysis Report
SC20

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	212.88	m	Discharge	0.0368	m³/s
Inlet Control HW Elev.	212.84	m	Tailwater Elevation	212.61	m
Outlet Control HW Elev.	212.88	m	Control Type	Entrance Control	
Headwater Depth/Height	0.42				

Grades					
Upstream Invert	212.67	m	Downstream Invert	212.31	m
Length	11.70	m	Constructed Slope	0.030769	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.30	m
Slope Type	Steep		Normal Depth	0.11	m
Flow Regime	N/A		Critical Depth	0.13	m
Velocity Downstream	0.30	m/s	Critical Slope	0.016314	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.88	m	Upstream Velocity Head	0.05	m
Ke	0.90		Entrance Loss	0.04	m

Inlet Control Properties					
Inlet Control HW Elev.	212.84	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC20

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	212.88	m
Roadway Width	10.00	m	Overtopping Coefficient	1.60	SI
Low Point	213.00	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	212.61	m			

Sta (m)	Elev. (m)
0.00	214.23
100.00	213.00

Culvert Analysis Report
SC20

Analysis Component				
Storm Event	Check	Discharge	0.0666	m³/s

Peak Discharge Method: User-Specified				
Design Discharge	0.0368	m³/s	Check Discharge	0.0666 m³/s

Tailwater Conditions: Constant Tailwater		
Tailwater Elevation	212.61	m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-500 mm Circular	0.0666 m³/s	212.96 m	0.54 m/s
Weir	Roadway	0.0000 m³/s	212.96 m	N/A
Total	----------	0.0666 m³/s	212.96 m	N/A

Culvert Analysis Report
SC20

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	212.96	m	Discharge	0.0666	m³/s
Inlet Control HW Elev.	212.91	m	Tailwater Elevation	212.61	m
Outlet Control HW Elev.	212.96	m	Control Type	Entrance Control	
Headwater Depth/Height	0.58				

Grades					
Upstream Invert	212.67	m	Downstream Invert	212.31	m
Length	11.70	m	Constructed Slope	0.030769	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.30	m
Slope Type	Steep		Normal Depth	0.15	m
Flow Regime	N/A		Critical Depth	0.17	m
Velocity Downstream	0.54	m/s	Critical Slope	0.016311	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.96	m	Upstream Velocity Head	0.06	m
Ke	0.90		Entrance Loss	0.06	m

Inlet Control Properties					
Inlet Control HW Elev.	212.91	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC20

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0000	m³/s	Allowable HW Elevation	212.96	m
Roadway Width	10.00	m	Overtopping Coefficient	1.60	SI
Low Point	213.00	m	Headwater Elevation	N/A	m
Discharge Coefficient (Cr)	2.90		Submergence Factor (Kt)	1.00	
Tailwater Elevation	212.61	m			

Sta (m)	Elev. (m)
0.00	214.23
100.00	213.00

Culvert Design Report
SC21

Peak Discharge Method: User-Specified			
Design Discharge	0.0018 m³/s	Check Discharge	0.0033 m³/s

Grades Model: Inverts			
Invert Upstream	212.12 m	Invert Downstream	212.03 m
Length	15.00 m	Slope	0.006000 m/m
Drop	0.09 m		

Headwater Model: Unspecified

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	212.27 m

	Name	Description	Discharge	HW Elev.	Velocity
x	Trial-1	1-400 mm Circular	0.0018 m³/s	212.27 m	0.02 m/s
	Trial-2	1-400 mm Circular	0.0033 m³/s	212.27 m	0.04 m/s

Culvert Design Report
SC21

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Design	
Computed Headwater Elevation	212.27	m	Discharge	0.0018	m³/s
Headwater Depth/Height	0.38		Tailwater Elevation	212.27	m
Inlet Control HW Elev.	212.27	m	Control Type	Outlet Control	
Outlet Control HW Elev.	212.27	m			

Grades					
Upstream Invert	212.12	m	Downstream Invert	212.03	m
Length	15.00	m	Constructed Slope	0.006000	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.24	m
Slope Type	Mild		Normal Depth	0.04	m
Flow Regime	Subcritical		Critical Depth	0.03	m
Velocity Downstream	0.02	m/s	Critical Slope	0.022406	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.40	m
Section Size	400 mm		Rise	0.40	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.27	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	212.27	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Design Report
SC21

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	N/A	m	Storm Event	Check	
Computed Headwater Elevation	212.27	m	Discharge	0.0033	m³/s
Headwater Depth/Height	0.38		Tailwater Elevation	212.27	m
Inlet Control HW Elev.	212.27	m	Control Type	Outlet Control	
Outlet Control HW Elev.	212.27	m			

Grades					
Upstream Invert	212.12	m	Downstream Invert	212.03	m
Length	15.00	m	Constructed Slope	0.006000	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.24	m
Slope Type	Mild		Normal Depth	0.05	m
Flow Regime	Subcritical		Critical Depth	0.04	m
Velocity Downstream	0.04	m/s	Critical Slope	0.020563	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.40	m
Section Size	400 mm		Rise	0.40	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	212.27	m	Upstream Velocity Head	0.00	m
Ke	0.90		Entrance Loss	0.00	m

Inlet Control Properties					
Inlet Control HW Elev.	212.27	m	Flow Control	N/A	
Inlet Type	Projecting		Area Full	0.1	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC22 Check

Analysis Component			
Storm Event	Design	Discharge	10.1830 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	10.1830 m³/s	Check Discharge	15.6980 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	202.83 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-4900 x 800 mm Box	10.1757 m³/s	203.71 m	2.73 m/s
Weir	Roadway	0.0087 m³/s	203.71 m	N/A
Total	----------	10.1844 m³/s	203.71 m	N/A

Culvert Analysis Report
SC22 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	203.71	m	Discharge	10.1757	m³/s
Inlet Control HW Elev.	203.71	m	Tailwater Elevation	202.83	m
Outlet Control HW Elev.	203.71	m	Control Type	Outlet Control	
Headwater Depth/Height	1.69				

Grades					
Upstream Invert	202.36	m	Downstream Invert	202.35	m
Length	10.80	m	Constructed Slope	0.000926	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.76	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.76	m
Velocity Downstream	2.73	m/s	Critical Slope	0.002604	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	4.90	m
Section Size	4900 x 800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	203.71	m	Upstream Velocity Head	0.34	m
Ke	0.50		Entrance Loss	0.17	m

Inlet Control Properties					
Inlet Control HW Elev.	203.71	m	Flow Control	Submerged	
Inlet Type	90° headwall w 45° bevels		Area Full	3.9	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
SC22 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.0087	m³/s	Allowable HW Elevation	203.71	m
Roadway Width	8.00	m	Overtopping Coefficient	1.61	SI
Low Point	203.70	m	Headwater Elevation	203.71	m
Discharge Coefficient (Cr)	2.91		Submergence Factor (Kt)	1.00	
Tailwater Elevation	202.83	m			

Sta (m)	Elev. (m)
0.00	203.87
36.00	203.70
40.00	203.70
110.00	204.13

Culvert Analysis Report
SC22 Check

Analysis Component			
Storm Event	Check	Discharge	15.6980 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	10.1830 m³/s	Check Discharge	15.6980 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	202.83 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-4900 x 800 mm Box	11.4421 m³/s	203.89 m	2.92 m/s
Weir	Roadway	4.2559 m³/s	203.89 m	N/A
Total	----------	15.6980 m³/s	203.89 m	N/A

Culvert Analysis Report
SC22 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	203.89	m	Discharge	11.4421	m³/s
Inlet Control HW Elev.	203.89	m	Tailwater Elevation	202.83	m
Outlet Control HW Elev.	203.87	m	Control Type	Inlet Control	
Headwater Depth/Height	1.92				

Grades					
Upstream Invert	202.36	m	Downstream Invert	202.35	m
Length	10.80	m	Constructed Slope	0.000926	m/m

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	0.80	m
Slope Type	N/A		Normal Depth	N/A	m
Flow Regime	N/A		Critical Depth	0.80	m
Velocity Downstream	2.92	m/s	Critical Slope	0.005977	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	4.90	m
Section Size	4900 x 800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	203.87	m	Upstream Velocity Head	0.43	m
Ke	0.50		Entrance Loss	0.22	m

Inlet Control Properties					
Inlet Control HW Elev.	203.89	m	Flow Control	Submerged	
Inlet Type	90° headwall w 45° bevels		Area Full	3.9	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
SC22 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	4.2559	m³/s	Allowable HW Elevation	203.89	m
Roadway Width	8.00	m	Overtopping Coefficient	1.66	SI
Low Point	203.70	m	Headwater Elevation	203.89	m
Discharge Coefficient (Cr)	3.00		Submergence Factor (Kt)	1.00	
Tailwater Elevation	202.83	m			

Sta (m)	Elev. (m)
0.00	203.87
36.00	203.70
40.00	203.70
110.00	204.13

Culvert Analysis Report
SC22 Regional

Analysis Component			
Storm Event	Check	Discharge	33.5910 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	10.1830 m³/s	Check Discharge	33.5910 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	202.83 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-4900 x 800 mm Box	12.6567 m³/s	204.09 m	3.23 m/s
Weir	Roadway	20.9159 m³/s	204.09 m	N/A
Total	----------	33.5726 m³/s	204.09 m	N/A

Culvert Analysis Report
SC22 Regional

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	204.09	m	Discharge	12.6567	m³/s
Inlet Control HW Elev.	204.09	m	Tailwater Elevation	202.83	m
Outlet Control HW Elev.	204.03	m	Control Type	Inlet Control	
Headwater Depth/Height	2.16				

Grades					
Upstream Invert	202.36	m	Downstream Invert	202.35	m
Length	10.80	m	Constructed Slope	0.000926	m/m

Hydraulic Profile					
Profile	PressureProfile		Depth, Downstream	0.80	m
Slope Type	N/A		Normal Depth	N/A	m
Flow Regime	N/A		Critical Depth	0.80	m
Velocity Downstream	3.23	m/s	Critical Slope	0.007313	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	4.90	m
Section Size	4900 x 800 mm		Rise	0.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	204.03	m	Upstream Velocity Head	0.53	m
Ke	0.50		Entrance Loss	0.27	m

Inlet Control Properties					
Inlet Control HW Elev.	204.09	m	Flow Control	N/A	
Inlet Type	90° headwall w 45° bevels		Area Full	3.9	m²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
SC22 Regional

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	20.9159	m³/s	Allowable HW Elevation	204.09	m
Roadway Width	8.00	m	Overtopping Coefficient	1.68	SI
Low Point	203.70	m	Headwater Elevation	204.09	m
Discharge Coefficient (Cr)	3.04		Submergence Factor (Kt)	1.00	
Tailwater Elevation	202.83	m			

Sta (m)	Elev. (m)
0.00	203.87
36.00	203.70
40.00	203.70
110.00	204.13

Culvert Analysis Report
SC 23 Check

Analysis Component			
Storm Event	Design	Discharge	0.5056 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.5056 m³/s	Check Discharge	0.7960 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.90 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-500 mm Circular	0.2580 m³/s	208.81 m	1.77 m/s
Weir	Roadway	0.2479 m³/s	208.81 m	N/A
Total	----------	0.5059 m³/s	208.81 m	N/A

Culvert Analysis Report
SC 23 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.81	m	Discharge	0.2580	m³/s
Inlet Control HW Elev.	208.68	m	Tailwater Elevation	207.90	m
Outlet Control HW Elev.	208.81	m	Control Type	Outlet Control	
Headwater Depth/Height	1.49				

Grades					
Upstream Invert	208.07	m	Downstream Invert	207.90	m
Length	21.10	m	Constructed Slope	0.008057	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.35	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.35	m
Velocity Downstream	1.77	m/s	Critical Slope	0.022958	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.81	m	Upstream Velocity Head	0.09	m
Ke	0.90		Entrance Loss	0.08	m

Inlet Control Properties					
Inlet Control HW Elev.	208.68	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC 23 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.2479	m³/s	Allowable HW Elevation	208.81	m
Roadway Width	10.00	m	Overtopping Coefficient	1.62	SI
Low Point	208.73	m	Headwater Elevation	208.81	m
Discharge Coefficient (Cr)	2.93		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.90	m			

Sta (m)	Elev. (m)
0.00	208.89
10.00	208.73
50.00	208.99
100.00	209.29

Culvert Analysis Report
SC 23 Check

Analysis Component			
Storm Event	Check	Discharge	0.7960 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.5056 m³/s	Check Discharge	0.7960 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.90 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-500 mm Circular	0.2645 m³/s	208.84 m	1.79 m/s
Weir	Roadway	0.5297 m³/s	208.84 m	N/A
Total	----------	0.7942 m³/s	208.84 m	N/A

Culvert Analysis Report
SC 23 Check

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.84	m	Discharge	0.2645	m³/s
Inlet Control HW Elev.	208.69	m	Tailwater Elevation	207.90	m
Outlet Control HW Elev.	208.84	m	Control Type	Outlet Control	
Headwater Depth/Height	1.55				

Grades					
Upstream Invert	208.07	m	Downstream Invert	207.90	m
Length	21.10	m	Constructed Slope	0.008057	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.35	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.35	m
Velocity Downstream	1.79	m/s	Critical Slope	0.023352	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.84	m	Upstream Velocity Head	0.09	m
Ke	0.90		Entrance Loss	0.08	m

Inlet Control Properties					
Inlet Control HW Elev.	208.69	m	Flow Control	Unsubmerged	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC 23 Check

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	0.5297	m³/s	Allowable HW Elevation	208.84	m
Roadway Width	10.00	m	Overtopping Coefficient	1.62	SI
Low Point	208.73	m	Headwater Elevation	208.84	m
Discharge Coefficient (Cr)	2.94		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.90	m			

Sta (m)	Elev. (m)
0.00	208.89
10.00	208.73
50.00	208.99
100.00	209.29

Culvert Analysis Report
SC 23 Regional

Analysis Component			
Storm Event	Check	Discharge	2.1690 m³/s

Peak Discharge Method: User-Specified			
Design Discharge	0.5056 m³/s	Check Discharge	2.1690 m³/s

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	207.90 m

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-500 mm Circular	0.2803 m³/s	208.92 m	1.83 m/s
Weir	Roadway	1.8926 m³/s	208.92 m	N/A
Total	----------	2.1730 m³/s	208.92 m	N/A

Culvert Analysis Report
SC 23 Regional

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	208.92	m	Discharge	0.2803	m³/s
Inlet Control HW Elev.	208.72	m	Tailwater Elevation	207.90	m
Outlet Control HW Elev.	208.92	m	Control Type	Outlet Control	
Headwater Depth/Height	1.69				

Grades					
Upstream Invert	208.07	m	Downstream Invert	207.90	m
Length	21.10	m	Constructed Slope	0.008057	m/m

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	0.36	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	0.36	m
Velocity Downstream	1.83	m/s	Critical Slope	0.024370	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.024	
Section Material	CMP		Span	0.50	m
Section Size	500 mm		Rise	0.50	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	208.92	m	Upstream Velocity Head	0.10	m
Ke	0.90		Entrance Loss	0.09	m

Inlet Control Properties					
Inlet Control HW Elev.	208.72	m	Flow Control	Transition	
Inlet Type	Projecting		Area Full	0.2	m²
K	0.03400		HDS 5 Chart	2	
M	1.50000		HDS 5 Scale	3	
C	0.05530		Equation Form	1	
Y	0.54000				

Culvert Analysis Report
SC 23 Regional

Component:Weir

Hydraulic Component(s): Roadway					
Discharge	1.8926	m³/s	Allowable HW Elevation	208.92	m
Roadway Width	10.00	m	Overtopping Coefficient	1.63	SI
Low Point	208.73	m	Headwater Elevation	208.92	m
Discharge Coefficient (Cr)	2.96		Submergence Factor (Kt)	1.00	
Tailwater Elevation	207.90	m			

Sta (m)	Elev. (m)
0.00	208.89
10.00	208.73
50.00	208.99
100.00	209.29

Photo 1: 20MC-W 10 – Facing upstream of culvert.

Photo 2: 20MC-W 10 – Upstream facing downstream inside culvert.

Photo 3: 20MC-W 10 – Facing downstream of culvert.

Photo 4: 20MC-W 10 – Downstream facing upstream towards culvert.

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Photographic Record	**Elfrida Community Builders Group Inc.**

Photo 5: 20MC-W 10 – Downstream facing upstream into culvert.

Photo 6: 20MC-W 12 – Downstream facing upstream towards culvert.

Photo 7: 20MC-W 12 – Facing downstream of culvert.

Photo 8: 20MC-W 12 – Downstream facing upstream inside culvert.

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Photographic Record	**Elfrida Community Builders Group Inc.**

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Photo 9: 20MC-W 12 – Facing upstream of culvert.

Photo 10: 20MC-W 12 – Upstream facing downstream towards culvert.

Photo 11: 20MC-W 12 – Upstream facing downstream inside culvert.

Photo 12: 20MC-W 1 – Facing downstream of culvert.

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Photographic Record	**Elfrida Community Builders Group Inc.**

Photo 13: 20MC-W 1 – Downstream facing upstream towards culvert.

Photo 14: 20MC-W 1 – Downstream facing upstream inside culvert.

Photo 15: 20MC-W 1 – Facing upstream of culvert.

Photo 16: 20MC-W 1 – Upstream facing downstream towards culvert.

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Photographic Record	**Elfrida Community Builders Group Inc.**

Photo 17: 20MC-W 1 – Upstream facing downstream towards culvert.

Photo 18: 20MC-W 2 – Facing downstream of culvert.

Photo 19: 20MC-W 2 – Downstream facing upstream towards culvert.

Photo 20: 20MC-W 2 – Downstream facing upstream inside culvert.

TITLE

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Photo 21: 20MC-W 2 – Upstream facing Downstream towards culvert.

Photo 22: 20MC-W 2 – Facing downstream of culvert.

Photo 23: 20MC-W 2 – Upstream facing downstream inside culvert.

Photo 24: 20MC-W 3 – Facing downstream of culvert.

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Photo 25: 20MC-W 3 – Downstream facing upstream towards culvert.

Photo 26: 20MC-W 3 – Downstream facing upstream inside culvert.

Photo 27: 20MC-W 3 – Facing upstream of culvert.

Photo 28: 20MC-W 3 – Upstream facing downstream towards culvert.

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Photo 29: 20MC-W 3 – Upstream facing downstream inside culvert.

Photo 30: 20MC-W 4 – Facing Downstream of culvert.

Photo 31: 20MC-W 4 – Downstream facing Upstream towards culvert.

Photo 32: 20MC-W 4 – Downstream facing upstream inside culvert.

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Photo 33: 20MC-W 4 – Facing upstream of culvert.

Photo 34: 20MC-W 4 – Upstream facing downstream towards culvert.

Photo 35: 20MC-W 4 – Upstream facing downstream inside culvert.

Photo 36: 20MC-E 3 – Facing downstream of culvert.

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Photo 37: 20MC-E 3 – Downstream facing upstream towards culvert

Photo 38: 20MC-E 3 – downstream facing upstream inside culvert.

Photo 39: 20MC-E 3 – Facing upstream of culvert.

Photo 40: 20MC-E 3 – Upstream facing downstream towards culvert.

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Photo 41: 20MC-E 3 – Upstream facing downstream inside culvert.

Photo 42: 20MC-E 9 – Facing downstream of culvert.

Photo 43: 20MC-E 9 – Downstream facing upstream towards culvert.

Photo 44: 20MC-E 9 – Downstream facing upstream inside culvert.

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Photo 45: 20MC-E 9 – Facing upstream of culvert.

Photo 46: 20MC-E 9 – Upstream facing downstream towards culvert.

Photo 47: 20MC-E 9 – Upstream facing downstream inside culvert.

Photo 48: 20MC-E 15 – Facing downstream of culvert.

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Photo 49: 20MC-E 15 – Downstream facing upstream towards culvert.

Photo 50: 20MC-E 15 – Downstream facing upstream inside culvert.

Photo 51: 20MC-E 15 – Facing upstream of culvert.

Photo 52: 20MC-E 15 – Upstream facing downstream towards culvert.

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Photo 53: 20MC-E 15 – Upstream facing downstream inside culvert.

Photo 54: 20MC-W 13 – Facing downstream of culvert.

Photo 55: 20MC-W 13 – Downstream facing upstream towards culvert.

Photo 56: 20MC-W 13 – Downstream facing upstream inside culvert.

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Photo 57: 20MC-W 13 – Facing upstream of culvert.

Photo 58: 20MC-W 13 – Upstream facing downstream towards culvert.

Photo 59: 20MC-W 13 – Upstream facing downstream inside culvert.

Photo 60: HC 1 – Facing downstream of culvert.

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Photo 61: HC 1 – Downstream facing upstream towards culvert.

Photo 62: HC 1 – Downstream facing upstream inside culvert.

Photo 63: HC 1 – Facing upstream of culvert.

Photo 64: HC 1 – Upstream facing downstream towards culvert.

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Photo 65: HC 2 – Facing downstream of culvert.

Photo 66: HC 2 – Downstream facing upstream towards culvert.

Photo 67: HC 2 – Downstream facing upstream inside culvert.

Photo 68: HC 2 – Facing upstream of culvert.

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Photo 69: HC 2 – Upstream facing downstream towards culvert.

Photo 70: HC 2 – Upstream facing downstream inside culvert.

Photo 71: SHC 2 – Facing downstream of culvert.

Photo 72: SHC 2 – Downstream facing upstream towards culvert.

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Photo 73: SHC 2 – Downstream facing upstream inside culvert.

Photo 74: SHC 2 – Facing upstream of culvert.

Photo 75: SHC 2 – Upstream facing downstream towards culvert.

Photo 76: SHC 2 – Upstream facing downstream inside culvert.

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Photo 77: SHC 4 – Facing downstream of culvert.

Photo 78: SHC 4 – Downstream facing upstream towards culvert.

Photo 79: SHC 4 – Downstream facing upstream inside culvert.

Photo 80: SHC 4 – Facing upstream of culvert.

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Photo 81: SHC 4 – Upstream facing downstream towards culvert.

Photo 82: SHC 4 – Upstream facing downstream inside culvert.

Photo 83: SHC 5 – Facing downstream of culvert.

Photo 84: SHC 5 – Downstream facing upstream towards culvert.

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Photo 85: SHC 5 – Downstream facing upstream inside culvert.

Photo 86: SHC 5 – Facing Upstream of culvert.

Photo 87: SHC 5 – Upstream facing downstream towards culvert.

Photo 88: SHC 5 – Upstream facing downstream inside culvert.

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Photo 89: SHC 6 – Facing downstream of culvert.

Photo 90: SHC 6 – Facing downstream with additional culvert in view.

Photo 91: SHC 6 – Downstream facing upstream towards culvert.

Photo 92: SHC 6 – Downstream facing upstream inside culvert.

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Photo 93: SHC 6 – Additional downstream culvert.

Photo 94: SHC 6 – Facing upstream of culvert.

Photo 95: SHC 6 – Upstream facing downstream towards culvert.

Photo 96: SHC 6 – Upstream facing downstream inside culvert.

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Photo 97: SHC 7 – Facing downstream of culvert.

Photo 98: SHC 7 – Downstream facing upstream towards culvert.

Photo 99: SHC 7 – Downstream facing upstream inside culvert.

Photo 100: SHC 7 – Facing upstream of culvert.

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Photo 101: SHC 7 – Upstream facing downstream towards culvert.

Photo 102: SHC 7 – Upstream facing downstream inside culvert.

Photo 103: SHC 8 – Facing downstream of culvert.

Photo 104: SHC 8 – Downstream facing upstream towards culvert.

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Photo 105: SHC 8 – Downstream facing upstream inside culvert.

Photo 106: SHC 8 – Facing upstream of culvert.

Photo 107: SHC 8 – Upstream facing downstream towards culvert.

Photo 108: SHC 8 – Upstream facing downstream inside culvert.

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Photo 109: SHC 9 – Facing downstream of culvert.

Photo 110: SHC 9 – Downstream facing upstream towards culvert.

Photo 111: SHC 9 – Downstream facing upstream inside culvert.

Photo 112: SHC 9 – Facing upstream of culvert.

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Photo 113: SHC 9 – Upstream facing downstream towards culvert.

Photo 114: SHC 9 – Upstream facing downstream inside culvert.

Photo 115: SHC 10 – Facing downstream of culvert.

Photo 116: SHC 10 – Downstream facing upstream towards culvert.

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Photo 117: SHC 10 – Downstream facing upstream inside culvert.

Photo 118: SHC 10 – Facing upstream of culvert.

Photo 119: SHC 10 – Upstream facing downstream towards culvert.

Photo 120: SHC 10 – Upstream facing downstream inside culvert.

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Photo 121: SHC 15 – Facing downstream of culvert.

Photo 122: SHC 15 – Downstream facing upstream towards culvert.

Photo 123: SHC 15 – Downstream facing upstream inside culvert.

Photo 124: SHC 15 – Facing upstream of culvert.

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Photo 125: SHC 15 – Upstream facing downstream towards culvert.

Photo 126: SHC 15 – Upstream facing downstream inside culvert.

Photo 127: SHC 16 – Facing downstream of culvert.

Photo 128: SHC 16 – Downstream facing upstream towards culvert.

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Photo 129: SHC 16 – Downstream facing upstream inside culvert.

Photo 130: SHC 16 – Facing upstream of culvert.

Photo 131: SHC 16 – Upstream facing downstream towards culvert.

Photo 132: SHC 16 – Upstream facing downstream inside culvert.

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Photo 133: SHC 13 – Facing downstream of culvert.

Photo 134: SHC 13 – Downstream facing upstream towards culvert.

Photo 135: SHC 13 – Downstream facing upstream inside culvert.

Photo 136: SHC 13 – Facing upstream of culvert.

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Photo 137: SHC 13 – Upstream facing downstream towards culvert.

Photo 138: SHC 13 – Upstream facing downstream inside culvert.

Photo 139: SHC 14 – Facing downstream of culvert.

Photo 140: SHC 14 – Downstream facing upstream towards culvert.

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Photo 141: SHC 14 – Downstream facing upstream inside culvert.

Photo 142: SHC 14 – Facing upstream of culvert.

Photo 143: SHC 14 – Upstream facing downstream towards culvert.

Photo 144: SHC 14 – Upstream facing downstream inside culvert.

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Photo 145: SC 7 – Facing downstream of culvert.

Photo 146: SC 7 – Downstream facing upstream towards culvert.

Photo 147: SC 7 – Facing upstream of culvert.

Photo 148: SC 7 – Upstream facing downstream towards culvert.

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Photo 149: SC 7 – Upstream inlet crushed.

Photo 150: SC 7 – Upstream facing downstream inside culvert.

Photo 151: SC 8 – Facing downstream of culvert.

Photo 152: SC 8 – Downstream facing upstream towards culvert.

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Photo 153: SC 8 – Downstream facing upstream inside culvert.

Photo 154: SC 8 – Facing upstream of culvert.

Photo 155: SC 8 – Upstream facing downstream towards culvert.

Photo 156: SC 8 – Upstream facing downstream inside culvert.

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Photo 157: SC 5 – Facing downstream of culvert.

Photo 158: SC 5 – Downstream facing upstream towards culvert.

Photo 159: SC 5 – Downstream facing upstream inside culvert.

Photo 160: SC 5 – Facing upstream of culvert.

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Photo 161: SC 5 – Upstream facing downstream towards culvert.

Photo 162: SC 5 – Upstream facing downstream inside culvert.

Photo 163: SC 2 – Facing downstream of culvert.

Photo 164: SC 2 – Downstream facing upstream towards culvert.

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Photo 165: SC 2 – Downstream facing upstream inside culvert.

Photo 166: SC 2 – Facing upstream of culvert.

Photo 167: SC 2 – Upstream facing downstream towards culvert.

Photo 168: SC 2 – Upstream facing downstream inside culvert.

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Photo 169: SC 11 – Facing downstream of culvert.

Photo 170: SC 11 – Downstream facing upstream towards culvert.

Photo 171: SC 11 – Downstream facing upstream inside culvert.

Photo 172: SC 11 – Facing upstream of culvert.

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Photo 173: SC 11 – Upstream facing downstream towards culvert.

Photo 174: SC 11 – Upstream facing downstream inside culvert.

Photo 175: SC 12 – Facing downstream of culvert.

Photo 176: SC 12 – Downstream facing upstream towards culvert.

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Photo 177: SC 12 – Downstream facing upstream inside culvert.

Photo 178: SC 12 – Facing upstream of culvert.

Photo 179: SC 12 – Upstream facing downstream towards culvert.

Photo 180: SC 12 – Upstream facing downstream inside culvert.

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Photo 181: SC 23 – Facing downstream of culvert (outlet not found).

Photo 182: SC 23 – Facing downstream of culvert (outlet not found).

Photo 183: SC 23 – Upstream of culvert facing west.

Photo 184: SC 23 – Upstream of culvert facing east.

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Photo 185: SC 23 –Upstream facing downstream towards culvert.

Photo 186: SC 23 – Upstream facing downstream inside culvert.

Photo 187: SC 18 – Facing downstream of culvert.

Photo 188: SC 18 – Downstream facing upstream towards culvert.

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Photo 189: SC 18 – Downstream facing upstream inside culvert.

Photo 190: SC 18 – Facing upstream of culvert.

Photo 191: SC 18 – Upstream facing downstream towards culvert.

Photo 192: SC 18 – Facing upstream of culvert.

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Photo 193: SC 19 – Facing downstream of culvert.

Photo 194: SC 19 – Downstream facing upstream towards culvert.

Photo 195: SC 19 – Downstream facing upstream inside culvert.

Photo 196: SC 19 – Facing upstream of culvert.

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Photo 197: SC 19 – Upstream facing downstream towards culvert.

Photo 198: SC 19 – Upstream facing downstream inside culvert.

Photo 199: SC 22 – Facing downstream of culvert.

Photo 200: SC 22 – Downstream facing upstream towards culvert.

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Photo 201: SC 22 – Downstream facing upstream inside culvert.

Photo 202: SC 22 – Facing upstream of culvert.

Photo 203: SC 22 – Upstream facing downstream towards culvert.

Photo 204: SC 22 – Upstream facing downstream inside culvert.

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