BACKWATER CALCULATIONS

(KCSWDM FIG. 4.2.1.1 using King County 25-Yr Storm and 100-year Floodwater Elev. 12.31)

Pipe Segment CB to CB		1 Q (CFS)	2 Length (FT)	3 Pipe Size (FT)	4 "n" Value	5 Outlet Elevation	6 Inlet Elevation	7 Barrel Area (SF)	8 Barrel Velocity (FT/S)	9 Barrel Velocity Head (FT)	10 TW Elevation (FT)	11 Friction Loss (FT)	12 Entrance HGL Elevation (FT)	13 Entrance Head Loss (FT)	14 Exit Head Loss (FT)	15 Outlet Control Elevation (FT)	16 Inlet Control Elevation* (FT)	17 Approximate Velocity Head (FT)	18 Bend Head Loss (FT)	19 Junction Head Loss (FT)	20 HW Elevation (FT)	21 RIM Elevation (FT)	22 RIM Elevation - HW (FT)	Comments
NORTH BASIN																								
Outfall	DR03-5	3.294	50.00	2.00	0.014	8.64	8.75	3.140	1.049	0.017	12.31	0.005	12.315	0.009	0.017	12.340	12.132	0.017	0.005	0.000	12.33	16.33	4.00	*Inlet Control Assuming Fully Submerged Conditons.
DR03-5	DR04-2	3.294	105.12	2.00	0.014	8.75	8.97	3.140	1.049	0.017	12.33	0.010	12.338	0.009	0.017	12.364	12.352	0.015	0.019	0.012	12.38	16.58	4.20	*Inlet Control Assuming Fully Submerged Conditons.
DR04-2	DR04-3	3.051	11.51	2.00	0.014	8.97	9.00	3.140	0.972	0.015	12.38	0.001	12.382	0.007	0.015	12.404	12.375	0.015	0.019	0.000	12.41	16.55	4.14	*Inlet Control Assuming Fully Submerged Conditons.
DR04-3	DR04-4	3.051	86.00	2.00	0.014	9.00	9.18	3.140	0.972	0.015	12.41	0.007	12.416	0.007	0.015	12.438	12.555	0.015	0.019	0.000	12.44	16.55	4.11	*Inlet Control Assuming Fully Submerged Conditons.
DR04-4	DR04-5	3.051	14.32	2.00	0.014	9.18	9.21	3.140	0.972	0.015	12.44	0.001	12.444	0.007	0.015	12.466	12.585	0.015	0.019	0.000	12.47	16.55	4.08	*Inlet Control Assuming Fully Submerged Conditons.
DR04-5	DR04-6	3.051	144.50	2.00	0.014	9.21	9.60	3.140	0.972	0.015	12.47	0.012	12.482	0.007	0.015	12.504	12.975	0.037	0.001	0.000	12.47	16.55	4.08	*Inlet Control Assuming Fully Submerged Conditons.
DR04-6	DR05-1	4.860	193.61	2.00	0.014	9.60	10.10	3.140	1.548	0.037	12.47	0.041	12.509	0.019	0.037	12.565	13.533	0.118	0.156	0.000	12.60	17.75	5.15	*Inlet Control Assuming Fully Submerged Conditons.
DR05-1	DR05-2	4.860	22.50	1.50	0.014	10.10	10.20	1.766	2.752	0.118	12.60	0.022	12.626	0.059	0.118	12.802	13.003	0.039	0.053	0.038	12.85	17.75	4.90	*Inlet Control Assuming Fully Submerged Conditons.
DR05-2	DR05-3	1.252	29.16	1.00	0.014	10.60	10.75	0.785	1.595	0.039	12.85	0.016	12.869	0.020	0.039	12.928	12.519	0.035	0.047	0.000	12.94	17.65	4.71	*Inlet Control Assuming Fully Submerged Conditons.
DR05-3	DR05-4	1.181	25.50	1.00	0.014	10.75	10.90	0.785	1.505	0.035	12.94	0.013	12.953	0.018	0.035	13.005	12.657	0.032	0.001	0.001	12.98	18.24	5.26	*Inlet Control Assuming Fully Submerged Conditons.
DR05-4	DR05-5	1.120	40.03	1.00	0.014	10.90	11.20	0.785	1.426	0.032	12.98	0.018	12.994	0.016	0.032	13.041	12.947	0.032	0.042	0.000	13.05	18.16	5.11	*Inlet Control Assuming Fully Submerged Conditons.
DR05-5	DR05-6	1.120	59.91	1.00	0.014	11.20	11.90	0.785	1.426	0.032	13.05	0.027	13.079	0.016	0.032	13.126	13.645	0.008	0.000	0.004	13.12	18.04	4.92	*Inlet Control Assuming Fully Submerged Conditons.
DR05-6	DR05-7	0.571	97.16	1.00	0.014	11.90	12.90	0.785	0.727	0.008	13.12	0.011	13.134	0.004	0.008	13.146	14.586	0.000	0.000	0.000	13.15	17.71	4.56	*Inlet Control Assuming Fully Submerged Conditons.
NORTH BASIN (BYPASS)																								
Outfall	DR04-27	8.64	120.00	1.50	0.014	6.04	6.95	1.766	4.892	0.372	12.31	0.372	12.682	0.186	0.372	13.239	10.402	0.110	0.146	0.006	13.28	16.15	2.87	*Inlet Control Assuming Fully Submerged Conditons.
DR04-27	DR04-28	8.35	44.91	2.00	0.014	6.95	7.15	3.140	2.659	0.110	13.28	0.028	13.310	0.055	0.110	13.474	10.767	0.088	0.002	0.012	13.40	16.25	2.85	*Inlet Control Assuming Fully Submerged Conditons.
DR04-28	DR04-29	7.49	32.00	2.00	0.014	7.15	7.25	3.140	2.387	0.088	13.40	0.016	13.416	0.044	0.088	13.549	10.814	0.087	0.116	0.000	13.58	16.32	2.74	*Inlet Control Assuming Fully Submerged Conditons.
DR04-29	DR04-30	7.45	300.00	2.00	0.014	7.25	8.50	3.140	2.371	0.087	13.58	0.149	13.727	0.044	0.087	13.858	12.060	0.068	0.001	0.000	13.79	16.89	3.10	*Inlet Control Assuming Fully Submerged Conditons.
DR04-30	DR04-31	6.55	91.00	2.00	0.014	8.50	9.00	3.140	2.085	0.068	13.79	0.035	13.827	0.034	0.068	13.928	12.508	0.067	0.001	0.000	13.86	17.10	3.24	*Inlet Control Assuming Fully Submerged Conditons.
DR04-31	DR05-19	6.53	119.73	2.00	0.014	9.00	9.46	3.140	2.081	0.067	13.86	0.046	13.908	0.034	0.067	14.009	12.969	0.070	0.001	0.000	13.94	17.75	3.81	*Inlet Control Assuming Fully Submerged Conditons.
DR05-19	DR05-11	6.66	143.06	2.00	0.014	9.46	10.00	3.140	2.121	0.070	13.94	0.057	13.997	0.035	0.070	14.102	13.515	0.012	0.000	0.000	14.09	17.35	3.26	*Inlet Control Assuming Fully Submerged Conditons.
DR05-11	DR05-12	1.54	209.75	1.50	0.014	10.00	11.10	1.766	0.870	0.012	14.09	0.021	14.111	0.006	0.012	14.129	13.631	0.013	0.017	0.000	14.13	17.44	3.31	*Inlet Control Assuming Fully Submerged Conditons.
DR05-12	DR05-13	1.62	24.92	1.50	0.014	11.10	11.20	1.766	0.918	0.013	14.13	0.003	14.136	0.007	0.013	14.155	13.736	0.000	0.000	0.000	14.16	15.18	1.02	*Inlet Control Assuming Fully Submerged Conditons.
SOUTH BASIN																								
Outfall	DR02-26	9.658	35.00	2.00	0.014	8.64	9.15	3.140	3.076	0.147	12.31	0.029	12.339	0.073	0.147	12.560	12.852	0.147	0.003	0.075	12.49	15.00	2.51	*Inlet Control Assuming Fully Submerged Conditons.
DR02-26	DR02-27	9.658	28.09	2.00	0.014	9.15	9.60	3.140	3.076	0.147	12.49	0.023	12.514	0.073	0.147	12.734	12.924	0.010	0.001	0.349	13.07	15.07	2.00	*Inlet Control Assuming Fully Submerged Conditons.
DR02-27	DR02-25	1.388	87.25	1.50	0.014	9.60	9.90	1.766	0.786	0.010	13.07	0.007	13.082	0.005	0.010	13.096	12.427	0.008	0.000	0.000	13.09	15.21	2.12	*Inlet Control Assuming Fully Submerged Conditons.
DR02-25	DR02-24	1.272	80.00	1.50	0.014	9.90	10.15	1.766	0.720	0.008	13.09	0.005	13.094	0.004	0.008	13.106	12.673	0.076	0.101	0.000	13.13	15.37	2.24	*Inlet Control Assuming Fully Submerged Conditons.
DR02-24	DR02-23	0.781	23.46	0.67	0.009	10.15	10.27	0.352	2.216	0.076	13.13	0.018	13.149	0.038	0.076	13.263	11.583	0.076	0.101	0.000	13.29	15.25	1.96	*Inlet Control Assuming Fully Submerged Conditons.
DR02-23	DR02-22	0.781	100	0.67	0.009	10.27	10.77	0.352	2.216	0.076	13.29	0.077	13.365	0.038	0.076	13.480	12.083	0.000	0.000	0.000	13.48	15.25	1.77	*Inlet Control Assuming Fully Submerged Conditons.
Outfall	DR02-26	9.658	35.00	2.00	0.014	8.64	9.15	3.140	3.076	0.147	12.31	0.029	12.339	0.073	0.147	12.560	12.852	0.147	0.003	0.075	12.49	15.00	2.51	*Inlet Control Assuming Fully Submerged Conditons.
DR02-26	DR02-27	9.658	28.09	2.00	0.014	9.15	9.60	3.140	3.076	0.147	12.49	0.023	12.514	0.073	0.147	12.734	13.300	0.107	0.073	0.020	12.72	15.07	2.35	*Inlet Control Assuming Fully Submerged Conditons.
DR02-27	DR02-29	8.245	32.26	2.00	0.014	9.60	10.00	3.140	2.626	0.107	12.72	0.020	12.740	0.054	0.107	12.901	13.602	0.071	0.008	0.128	12.97	15.25	2.28	*Inlet Control Assuming Fully Submerged Conditons.
DR02-29	DR02-30	6.733	13.50	2.00	0.014	10.00	10.10	3.140	2.144	0.071	12.97	0.005	12.970	0.036	0.071	13.078	13.616	0.058	0.022	0.000	13.04	14.00	0.96	*(EMERGENCY OVERFLOW).
DR02-30	DR02-31	1.512	38.94	1.00	0.014	10.50	14.14	0.785	1.926	0.058	13.04	0.032	13.074	0.029	0.058	13.160	15.911	0.000	0.000	0.000	13.16	15.25	2.09	*Inlet Control Assuming Fully Submerged Conditons.
SOUTH BASIN INLET TO RAIN																								
Inlet	DR01-27	7.514	70.00	1.50	0.014	9.00	9.65	1.766	4.254	0.281	14.13	0.164	14.294	0.141	0.281	14.716	12.868	0.102	0.002	0.107	14.72	19.92	5.20	*Inlet Control Assuming Fully Submerged Conditons.
DR01-27	DR01-9	4.525	12.00	1.50	0.014	9.65	9.70	1.766	2.562	0.102	14.72	0.010	14.733	0.051	0.102	14.886	12.463	0.064	0.059	0.023	14.90	19.70	4.80	*Inlet Control Assuming Fully Submerged Conditons.
DR01-9	DR01-8	3.581	31.35	1.50	0.014	9.70	10.10	1.766	2.028	0.064	14.90	0.017	14.920	0.032	0.064	15.016	12.759	0.065	0.021	0.157	15.13	19.73	4.60	*Inlet Control Assuming Fully Submerged Conditons.
DR01-8	DR01-7	1.604	12.54	1.00	0.014	10.10	10.50	0.785	2.043	0.065	15.13	0.012	15.140	0.032	0.065	15.237	12.320	0.065	0.001	0.000	15.17	19.67	4.50	*Inlet Control Assuming Fully Submerged Conditons.
DR01-7	DR01-6	1.604	51.69	1.00	0.014	10.50	12.40	0.785	2.043	0.065	15.17	0.048	15.222	0.032	0.065	15.319	14.218	0.051	0.013	0.008	15.29	19.30	4.01	*Inlet Control Assuming Fully Submerged Conditons.
DR01-6	DR01-5	1.428	161.84	1.00	0.014	12.40	13.34	0.785	1.819	0.051	15.29	0.119	15.408	0.026	0.051	15.485	15.139	0.000	0.000	0.000	15.48	19.05	3.57	*Inlet Control Assuming Fully Submerged Conditons.
Inlet	DR01-27	7.514	70.00	1.50	0.014	9.00	9.65	1.766	4.254	0.281	14.13	0.164	14.294	0.141	0.281	14.716	12.868	0.102	0.002	0.107	14.72	19.92	5.20	*Inlet Control Assuming Fully Submerged Conditons.
DR01-27	DR01-9	4.525	12.00	1.50	0.014	9.65	9.70	1.766	2.562	0.102	14.72	0.010	14.733	0.051	0.102	14.886	12.463	0.064	0.059	0.023	14.90	19.70	4.80	*Inlet Control Assuming Fully Submerged Conditons.
DR01-9	DR01-8	3.581	31.35	1.50	0.014	9.70	10.10	1.766	2.028	0.064	14.90	0.017	14.920	0.032	0.064	15.016	12.759	0.019	0.006	0.047	15.05	19.73	4.68	*Inlet Control Assuming Fully Submerged Conditons.
DR01-8	DR06-8	1.978	179.52	1.50	0.014	10.10	10.95	1.766	1.120	0.019	15.05	0.029	15.079	0.010	0.019	15.108	13.501	0.006	0.007	0.008	15.12	17.05	1.93	*Inlet Control Assuming Fully Submerged Conditons.
DR06-8	DR06-9	1.055	59.84	1.50	0.014	10.95	11.30	1.766	0.598	0.006	15.12	0.003	15.121	0.003	0.006	15.129	13.815	0.001	0.001	0.001	15.13	16.37	1.24	*Inlet Control Assuming Fully Submerged Conditons.
DR06-9	DR06-10	0.176	26.16	1.00	0.014	11.30	12.05	0.785	0.224	0.001	15.13	0.000	15.130	0.000	0.001	15.132	13.708	0.000	0.000	0.000	15.13	16.20	1.07	*Inlet Control Assuming Fully Submerged Conditons.

BACKWATER CALCULATIONS

(KCSWDM FIG. 4.2.1.1 using King County 100-Yr Storm and 100-year Floodwater Elev. 12.31)

Pipe Segment CB to CB		1 Q (CFS)	2 Length (FT)	3 Pipe Size (FT)	4 "n" Value	5 Outlet Elevation	6 Inlet Elevation	7 Barrel Area (SF)	8 Barrel Velocity (FT/S)	9 Barrel Velocity Head (FT)	10 TW Elevation (FT)	11 Friction Loss (FT)	12 Entrance HGL Elevation (FT)	13 Entrance Head Loss (FT)	14 Exit Head Loss (FT)	15 Outlet Control Elevation (FT)	16 Inlet Control Elevation* (FT)	17 Approximate Velocity Head (FT)	18 Bend Head Loss (FT)	19 Junction Head Loss (FT)	20 HW Elevation (FT)	21 RIM Elevation (FT)	22 RIM Elevation - HW (FT)	Comments
NORTH BASIN																								
Outfall	DR03-5	3.961	50.00	2.00	0.014	8.64	8.75	3.140	1.261	0.025	12.31	0.007	12.317	0.012	0.025	12.354	12.151	0.025	0.007	0.000	12.34	16.33	3.99	*Inlet Control Assuming Fully Submerged Conditons.
DR03-5	DR04-2	3.961	105.12	2.00	0.014	8.75	8.97	3.140	1.261	0.025	12.34	0.015	12.351	0.012	0.025	12.388	12.371	0.022	0.029	0.018	12.41	16.58	4.17	*Inlet Control Assuming Fully Submerged Conditons.
DR04-2	DR04-3	3.718	11.51	2.00	0.014	8.97	9.00	3.140	1.184	0.022	12.41	0.001	12.414	0.011	0.022	12.447	12.393	0.022	0.029	0.000	12.45	16.55	4.10	*Inlet Control Assuming Fully Submerged Conditons.
DR04-3	DR04-4	3.718	86.00	2.00	0.014	9.00	9.18	3.140	1.184	0.022	12.45	0.011	12.465	0.011	0.022	12.497	12.574	0.022	0.029	0.000	12.50	16.55	4.05	*Inlet Control Assuming Fully Submerged Conditons.
DR04-4	DR04-5	3.718	14.32	2.00	0.014	9.18	9.21	3.140	1.184	0.022	12.50	0.002	12.506	0.011	0.022	12.539	12.604	0.022	0.029	0.000	12.55	16.55	4.00	*Inlet Control Assuming Fully Submerged Conditons.
DR04-5	DR04-6	3.718	144.50	2.00	0.014	9.21	9.60	3.140	1.184	0.022	12.55	0.018	12.564	0.011	0.022	12.597	12.993	0.055	0.001	0.000	12.54	16.55	4.01	*Inlet Control Assuming Fully Submerged Conditons.
DR04-6	DR05-1	5.923	193.61	2.00	0.014	9.60	10.10	3.140	1.886	0.055	12.54	0.061	12.603	0.028	0.055	12.686	13.579	0.175	0.232	0.000	12.74	17.75	5.01	*Inlet Control Assuming Fully Submerged Conditons.
DR05-1	DR05-2	5.923	22.50	1.50	0.014	10.10	10.20	1.766	3.353	0.175	12.74	0.033	12.777	0.087	0.175	13.038	13.149	0.059	0.078	0.056	13.11	17.75	4.64	*Inlet Control Assuming Fully Submerged Conditons.
DR05-2	DR05-3	1.526	29.16	1.00	0.014	10.60	10.75	0.785	1.943	0.059	13.11	0.024	13.138	0.029	0.059	13.226	12.568	0.052	0.069	0.000	13.24	17.65	4.41	*Inlet Control Assuming Fully Submerged Conditons.
DR05-3	DR05-4	1.439	25.50	1.00	0.014	10.75	10.90	0.785	1.834	0.052	13.24	0.019	13.262	0.026	0.052	13.341	12.701	0.047	0.001	0.002	13.30	18.24	4.94	*Inlet Control Assuming Fully Submerged Conditons.
DR05-4	DR05-5	1.364	40.03	1.00	0.014	10.90	11.20	0.785	1.738	0.047	13.30	0.027	13.323	0.023	0.047	13.394	12.986	0.047	0.062	0.000	13.41	18.16	4.75	*Inlet Control Assuming Fully Submerged Conditons.
DR05-5	DR05-6	1.364	59.91	1.00	0.014	11.20	11.90	0.785	1.738	0.047	13.41	0.040	13.450	0.023	0.047	13.520	13.684	0.012	0.000	0.007	13.51	18.04	4.53	*Inlet Control Assuming Fully Submerged Conditons.
DR05-6	DR05-7	0.696	97.16	1.00	0.014	11.90	12.90	0.785	0.886	0.012	13.51	0.017	13.531	0.006	0.012	13.550	14.596	0.000	0.000	0.000	13.55	17.71	4.16	*Inlet Control Assuming Fully Submerged Conditons.
NORTH BASIN (BYPASS)																								
Outfall	DR04-27	10.69	120.00	1.50	0.014	6.04	6.95	1.766	6.054	0.569	12.31	0.569	12.879	0.285	0.569	13.733	10.908	0.168	0.223	0.010	13.80	16.15	2.35	*Inlet Control Assuming Fully Submerged Conditons.
DR04-27	DR04-28	10.33	44.91	2.00	0.014	6.95	7.15	3.140	3.290	0.168	13.80	0.043	13.841	0.084	0.168	14.093	10.916	0.135	0.003	0.019	13.98	16.25	2.27	*Inlet Control Assuming Fully Submerged Conditons.
DR04-28	DR04-29	9.27	32.00	2.00	0.014	7.15	7.25	3.140	2.952	0.135	13.98	0.025	14.004	0.068	0.135	14.207	10.934	0.133	0.178	0.000	14.25	16.32	2.07	*Inlet Control Assuming Fully Submerged Conditons.
DR04-29	DR04-30	9.21	300.00	2.00	0.014	7.25	8.50	3.140	2.932	0.133	14.25	0.228	14.479	0.067	0.133	14.679	12.178	0.103	0.002	0.001	14.58	16.89	2.31	*Inlet Control Assuming Fully Submerged Conditons.
DR04-30	DR04-31	8.08	91.00	2.00	0.014	8.50	9.00	3.140	2.573	0.103	14.58	0.053	14.632	0.051	0.103	14.786	12.598	0.103	0.002	0.000	14.69	17.10	2.41	*Inlet Control Assuming Fully Submerged Conditons.
DR04-31	DR05-19	8.07	119.73	2.00	0.014	9.00	9.46	3.140	2.569	0.103	14.69	0.070	14.756	0.051	0.103	14.910	13.059	0.106	0.002	0.000	14.81	17.75	2.94	*Inlet Control Assuming Fully Submerged Conditons.
DR05-19	DR05-11	8.21	143.06	2.00	0.014	9.46	10.00	3.140	2.616	0.106	14.81	0.086	14.892	0.053	0.106	15.051	13.609	0.018	0.000	0.000	15.03	17.35	2.32	*Inlet Control Assuming Fully Submerged Conditons.
DR05-11	DR05-12	1.89	209.75	1.50	0.014	10.00	11.10	1.766	1.072	0.018	15.03	0.031	15.065	0.009	0.018	15.092	13.647	0.020	0.026	0.000	15.10	17.44	2.34	*Inlet Control Assuming Fully Submerged Conditons.
DR05-12	DR05-13	1.99	24.92	1.50	0.014	11.10	11.20	1.766	1.129	0.020	15.10	0.004	15.102	0.010	0.020	15.132	13.753	0.000	0.000	0.000	15.13	15.18	0.05	*Inlet Control Assuming Fully Submerged Conditons.
SOUTH BASIN																								
Outfall	DR02-26	11.769	35.00	2.00	0.014	8.64	9.15	3.140	3.748	0.218	12.31	0.043	12.353	0.109	0.218	12.681	13.035	0.218	0.004	0.111	12.58	15.00	2.42	*Inlet Control Assuming Fully Submerged Conditons.
DR02-26	DR02-27	11.769	28.09	2.00	0.014	9.15	9.60	3.140	3.748	0.218	12.58	0.035	12.613	0.109	0.218	12.940	12.924	0.012	0.001	0.419	13.35	15.07	1.72	*Inlet Control Assuming Fully Submerged Conditons.
DR02-27	DR02-25	1.520	87.25	1.50	0.014	9.60	9.90	1.766	0.861	0.012	13.35	0.008	13.357	0.006	0.012	13.375	12.432	0.009	0.000	0.000	13.37	15.21	1.84	*Inlet Control Assuming Fully Submerged Conditons.
DR02-25	DR02-24	1.379	80.00	1.50	0.014	9.90	10.15	1.766	0.781	0.009	13.37	0.006	13.372	0.005	0.009	13.386	12.677	0.076	0.101	0.000	13.41	15.37	1.96	*Inlet Control Assuming Fully Submerged Conditons.
DR02-24	DR02-23	0.781	23.46	0.67	0.009	10.15	10.27	0.352	2.216	0.076	13.41	0.018	13.429	0.038	0.076	13.543	11.583	0.076	0.101	0.000	13.57	15.25	1.68	*Inlet Control Assuming Fully Submerged Conditons.
DR02-23	DR02-22	0.781	100	0.67	0.009	10.27	10.77	0.352	2.216	0.076	13.57	0.077	13.645	0.038	0.076	13.760	12.083	0.000	0.000	0.000	13.76	15.25	1.49	*Inlet Control Assuming Fully Submerged Conditons.
Outfall	DR02-26	11.769	35.00	2.00	0.014	8.64	9.15	3.140	3.748	0.218	12.31	0.043	12.353	0.109	0.218	12.681	13.035	0.218	0.004	0.111	12.58	15.00	2.42	*Inlet Control Assuming Fully Submerged Conditons.
DR02-26	DR02-27	11.769	28.09	2.00	0.014	9.15	9.60	3.140	3.748	0.218	12.58	0.035	12.613	0.109	0.218	12.940	13.483	0.164	0.112	0.031	12.92	15.07	2.15	*Inlet Control Assuming Fully Submerged Conditons.
DR02-27	DR02-29	10.218	32.26	2.00	0.014	9.60	10.00	3.140	3.254	0.164	12.92	0.030	12.949	0.082	0.164	13.196	13.749	0.110	0.012	0.198	13.30	15.25	1.95	*Inlet Control Assuming Fully Submerged Conditons.
DR02-29	DR02-30	8.376	13.50	2.00	0.014	10.00	10.10	3.140	2.667	0.110	13.30	0.008	13.304	0.055	0.110	13.469	13.716	0.086	0.033	0.000	13.42	14.00	0.58	*(EMERGENCY OVERFLOW).
DR02-30	DR02-31	1.843	38.94	1.00	0.014	10.50	14.14	0.785	2.347	0.086	13.42	0.048	13.464	0.043	0.086	13.592	15.983	0.000	0.000	0.000	13.59	15.25	1.66	*Inlet Control Assuming Fully Submerged Conditons.
SOUTH BASIN INLET TO RAIN																								
Inlet	DR01-27	9.157	70.00	1.50	0.014	9.00	9.65	1.766	5.184	0.417	14.13	0.244	14.374	0.209	0.417	15.000	13.218	0.151	0.003	0.159	15.01	19.92	4.91	*Inlet Control Assuming Fully Submerged Conditons.
DR01-27	DR01-9	5.514	12.00	1.50	0.014	9.65	9.70	1.766	3.122	0.151	15.01	0.015	15.025	0.076	0.151	15.252	12.590	0.095	0.087	0.033	15.28	19.70	4.42	*Inlet Control Assuming Fully Submerged Conditons.
DR01-9	DR01-8	4.364	31.35	1.50	0.014	9.70	10.10	1.766	2.471	0.095	15.28	0.025	15.303	0.047	0.095	15.445	12.838	0.096	0.031	0.233	15.61	19.73	4.12	*Inlet Control Assuming Fully Submerged Conditons.
DR01-8	DR01-7	1.955	12.54	1.00	0.014	10.10	10.50	0.785	2.490	0.096	15.61	0.017	15.630	0.048	0.096	15.774	12.401	0.096	0.002	0.000	15.68	19.67	3.99	*Inlet Control Assuming Fully Submerged Conditons.
DR01-7	DR01-6	1.955	51.69	1.00	0.014	10.50	12.40	0.785	2.490	0.096	15.68	0.071	15.751	0.048	0.096	15.895	14.298	0.076	0.020	0.012	15.85	19.30	3.45	*Inlet Control Assuming Fully Submerged Conditons.
DR01-6	DR01-5	1.740	161.84	1.00	0.014	12.40	13.34	0.785	2.217	0.076	15.85	0.176	16.028	0.038	0.076	16.142	15.203	0.000	0.000	0.000	16.14	19.05	2.91	*Inlet Control Assuming Fully Submerged Conditons.
Inlet	DR01-27	9.157	70.00	1.50	0.014	9.00	9.65	1.766	5.184	0.417	14.13	0.244	14.374	0.209	0.417	15.000	13.218	0.151	0.003	0.159	15.01	19.92	4.91	*Inlet Control Assuming Fully Submerged Conditons.
DR01-27	DR01-9	5.514	12.00	1.50	0.014	9.65	9.70	1.766	3.122	0.151	15.01	0.015	15.025	0.076	0.151	15.252	12.590	0.095	0.087	0.033	15.28	19.70	4.42	*Inlet Control Assuming Fully Submerged Conditons.
DR01-9	DR01-8	4.364	31.35	1.50	0.014	9.70	10.10	1.766	2.471	0.095	15.28	0.025	15.303	0.047	0.095	15.445	12.838	0.029	0.009	0.070	15.50	19.73	4.23	*Inlet Control Assuming Fully Submerged Conditons.
DR01-8	DR06-8	2.410	179.52	1.50	0.014	10.10	10.95	1.766	1.364	0.029	15.50	0.043	15.539	0.014	0.029	15.582	13.526	0.008	0.011	0.012	15.60	17.05	1.45	*Inlet Control Assuming Fully Submerged Conditons.
DR06-8	DR06-9	1.286	59.84	1.50	0.014	10.95	11.30	1.766	0.728	0.008	15.60	0.004	15.601	0.004	0.008	15.614	13.822	0.001	0.002	0.001	15.62	16.37	0.75	*Inlet Control Assuming Fully Submerged Conditons.
DR06-9	DR06-10	0.215	26.16	1.00	0.014	11.30	12.05	0.785	0.273	0.001	15.62	0.000	15.616	0.001	0.001	15.617	13.709	0.000	0.000	0.000	15.62	16.20	0.58	*Inlet Control Assuming Fully Submerged Conditons.

Comanor, Kyle

To: Bleifuhs, Steve

Cc: Stypula, Jeanne; Levesque, Andy

Subject: South Park Bridge Replacement - Zero Rise Analysis

Steve-

I've looked over the Analysis of Hydraulic Effects and Riverbed Scour report and consulted with Jeanne on how our code is applied in this situation. There are some issues with the approach that ultimately don't affect the needed course of action, but that I'll include here for completeness.

- Zero-rise is not an absolute standard. A rise is allowed if impacted property owners consent to the increase in base flood elevation. In this case it looks like the rise is within the King County right-of-way for the old bridge. The County can grant a flood easement to the County.
- However, the model results show a local rise on what is tidal slack water. This appears to be technically incorrect. The old (and new, see next bullet) FIS show flat water surface elevations extending up and downstream of the bridge. A local rise would indicate water is flowing both up and downstream from the local rise, which is clearly not the case. Showing the current and proposed water surface elevations in profile would have revealed this - or more likely revealed that the modeled water surface elevations were not in fact the regulatory base flood elevations. Profile plots should be included in the report in addition to the tables of 100-year flood water surface rise.
- Note that there is a new flood study (3/2008) that will be published later this year with revised flood elevations. This best available information has the 1% annual chance flood elevation at the bridge as 12.31 feet - an increase of 0.53 feet over the value used of 11.78 feet. The value of 12.31 feet should also be used for design purposes.
- The high water at this project site is not due to riverine flooding. The 1% annual chance flood elevation is due to backwater tidal effects from Elliot Bay, and the proposed bridge has no impact on the water surface elevations. There is no zero-rise issue with the proposed bridge.

I've photocopied the sections of the new flood study that are relevant to this bridge: the floodway data table referencing the tidal source of high water at the current and proposed bridge, the flood profiles for the lower Green/Duwamish River, and the cover sheet of the report. These will placed on your desk along with a copy of this e-mail.

Please let me know if you have any questions.

Cheers,
Kyle

Kyle Comanor, P.E.

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K.C. Roads Engineering Services

Floodplain Mapping Study
for
Lower Green River

River Mile 3.85 to
State Highway 18 (RM 33.25)

King County, WA

Prepared for:
King County River and Floodplain Management
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Prepared by:
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16300 Christensen Road, Suite 350
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March 2008

Table 3: Lower Green River Floodway Data Table

Flooding Source		Floodway			Base Flood Water Surface Elevation			
Cross Section	Distance (feet from Mouth)	Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Regulatory[1] (ft)	Without Floodway[2] (ft)	With Floodway[3] (ft)	Increase[4] (ft)
LG - A	20,207	477	8354	1.55	12.31[5]	9.00	9.00	0.00
LG - B	20,401	531	10276	1.26	12.31[5]	9.02	9.02	0.00
LG - C	20,543	577	10009	1.30	12.31[5]	9.02	9.02	0.00
LG - D	22,539	385	7384	1.76	12.31[5]	9.08	9.08	0.00
LG - E	25,439	606	9509	1.37	12.31[5]	9.24	9.24	0.00
LG - F	27,373	772	11015	1.18	12.31[5]	9.31	9.31	0.00
LG - G	28,163	374	5531	2.35	12.31[5]	9.31	9.31	0.00
LG - H	28,246	401	5501	2.36	12.31[5]	9.32	9.32	0.00
LG - I	29,117	286	4348	2.99	12.31[5]	9.44	9.44	0.00
LG - J	29,209	275	3819	3.40	12.31[5]	9.48	9.48	0.00
LG - K	30,000	254	3638	3.57	12.31[5]	9.70	9.70	0.00
LG - L	30,815	230	3262	3.98	12.31[5]	9.95	9.95	0.00
LG - M	31,659	250	3141	4.13	12.31[5]	10.29	10.29	0.00
LG - N	33,138	207	2403	5.41	12.31[5]	11.06	11.06	0.00
LG - O	33,180	214	2610	4.97	12.31[5]	11.20	11.20	0.00
LG - P	34,510	196	2767	4.69	12.31[5]	12.08	12.08	0.00
LG - Q	34,655	221	3164	4.38	12.37	12.20	12.20	0.00
LG - R	35,436	219	2993	4.34	12.75	12.57	12.58	0.01
LG - S	36,119	214	2832	4.58	13.09	12.90	12.90	0.00
LG - T	36,227	205	3024	4.29	13.20	13.01	13.01	0.00
LG - U	37,262	184	2890	4.49	13.67	13.47	13.47	0.00
LG - V	38,342	191	2882	4.50	14.20	13.98	13.99	0.01
LG - W	39,013	198	3039	4.27	14.55	14.33	14.33	0.00
LG - X	39,076	197	2932	4.43	14.59	14.37	14.37	0.00
LG - Y	40,402	223	3249	4.00	15.22	14.98	14.98	0.00
LG - Z	41,506	266	2504	5.18	15.68	15.43	15.44	0.01
LG - AA	41,601	238	2915	4.45	15.89	15.64	15.64	0.00
LG - AB	42,557	227	3045	4.26	16.39	16.13	16.14	0.01
LG - AC	43,324	271	3587	3.62	16.79	16.53	16.54	0.01
LG - AD	44,030	188	2988	4.34	17.01	16.75	16.75	0.00
LG - AE	44,823	312	3884	3.34	17.43	17.15	17.16	0.01
LG - AF	45,650	179	2565	5.06	17.62	17.35	17.35	0.00
LG - AG	46,470	194	2833	4.58	18.16	17.88	17.89	0.01
LG - AH	47,583	244	3064	4.24	18.69	18.41	18.41	0.00

Flooding Source		Floodway			Base Flood Water Surface Elevation			
Cross Section	Distance (feet from Mouth)	Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Regulatory[1] (ft)	Without Floodway[2] (ft)	With Floodway[3] (ft)	Increase[4] (ft)
LG - HB	166,009	166	1916	6.69	68.37	68.35	68.37	0.02
LG - HC	166,774	167	1937	6.62	68.78	68.77	68.79	0.02
LG - HD	167,559	274	2421	5.29	69.36	69.34	69.36	0.02
LG - HE	168,451	160	1806	7.10	69.62	69.60	69.60	0.00
LG - HF	169,353	667	4667	2.75	70.51	70.51	70.54	0.03
LG - HG	170,280	167	1831	7.00	70.42	70.42	70.47	0.05
LG - HH	170,699	188	2109	6.08	71.01	71.00	71.04	0.04
LG - HI	170,876	347	2780	4.61	71.24	71.24	71.28	0.04
LG - HJ	171,210	1,217	4137	3.10	71.53	71.52	71.56	0.04
LG - HK	171,743	1,116	6448	1.99	72.11	72.11	72.13	0.02
LG - HL	172,540	680	1830	7.01	71.91	71.92	71.91	-0.01
LG - HM	173,355	932	3651	3.51	75.18	75.18	75.19	0.01
LG - HN	174,460	506	2428	5.28	76.78	76.78	76.78	0.00
LG - HO	175,554	209	1658	7.73	78.35	78.35	78.35	0.00

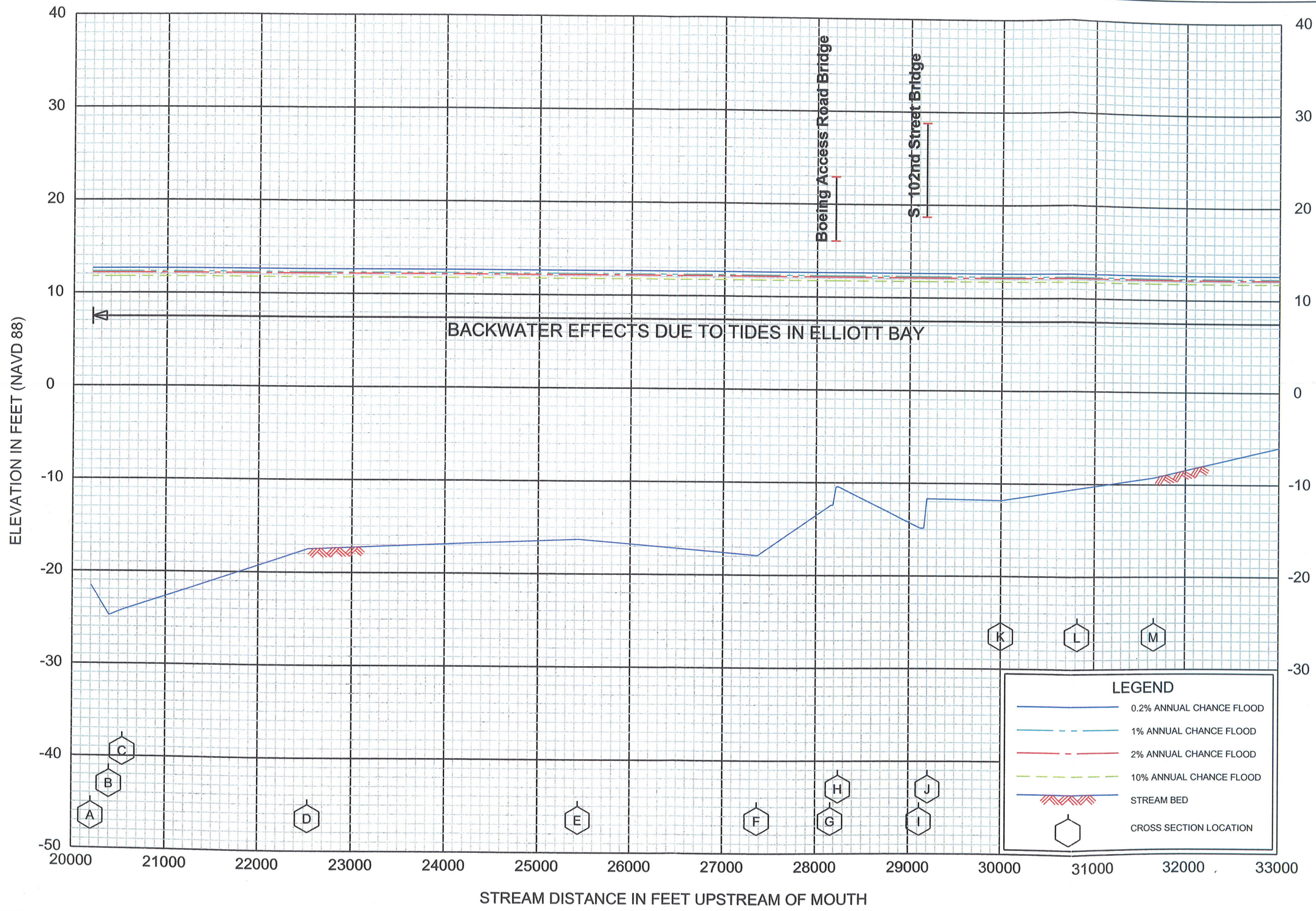
Notes: [1] Regulatory (in-channel) Base Flood Elevations computed using HEC-RAS with baseline geometry and flows as shown in Table 1.

[2] Without Floodway elevations computed using HEC-RAS with flows as extracted from FLO-2D Model for "Fail- all" levee scenario

[3] With Floodway elevations computed using HEC-RAS with flows as extracted from FLO-2D Model for floodway run

[4] Increase computed as the difference between the simulated water levels for the "with" and "without" floodway scenarios (e.g. the "fail-all" levee scenario versus the floodway run)

[5] Regulatory Base Flood Elevations below cross section LG-P were set based on 100-year tidal elevation at Seattle Station as computed by Seattle District USACE



FLOOD PROFILES

LOWER GREEN RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

KING COUNTY, WA
& INCORPORATED AREAS

2.1